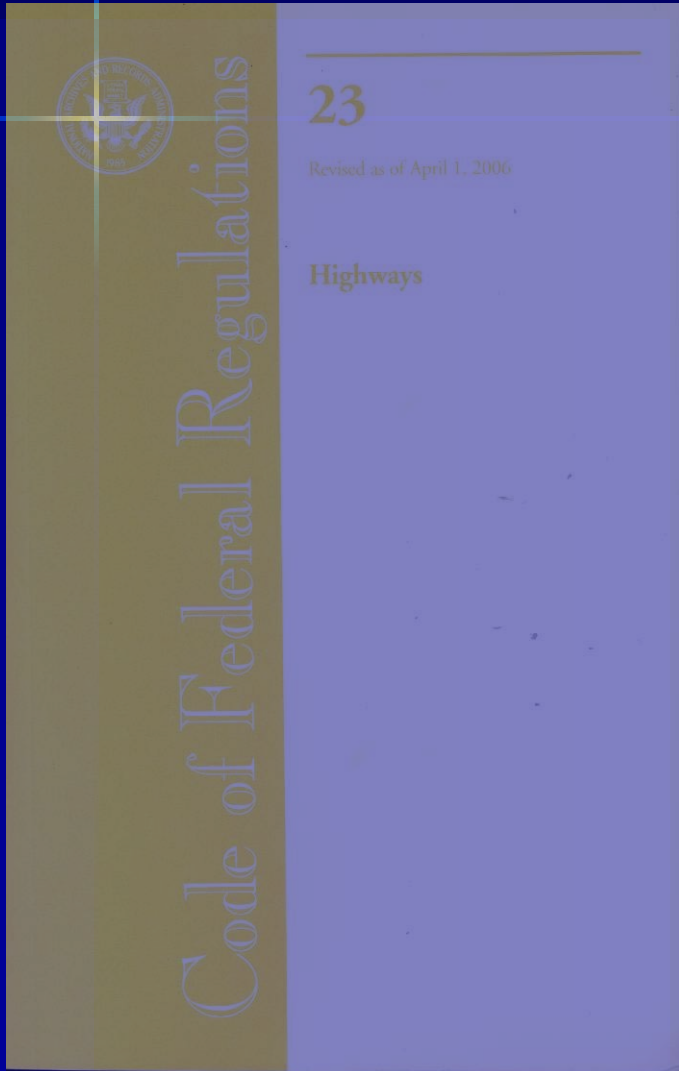


What Makes a Successful Hot Mix Asphalt Warranties

Ohio Asphalt Paving Conference
Columbus, Ohio

Lee Gallivan, HIPT
Federal Highway Administration

Federal Regulations



- Warranties Covered in Title 23: Highways
- Code of Federal Regulations (CFR)
 - § 635.413 Guaranty and warranty clauses
- Interim Final Rule
 - August 25, 1995
- Amended December 2002 (Design-Build)

MYTHS: 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

Warranties **Are...**



- Guaranty of better performance
- Incentive for quality construction
- Quality based initiative
- Another contracting option
- Incentive for innovation

First: Establish Baseline

Webster's Definitions

- **What is a Warranty?**

A written assurance that some product or service will be provided or will meet certain specifications.

- **What is Success?**

An event that accomplishes its intended purpose



Three types of HMA warranties

- Materials and workmanship
2 – 4 yrs
- Short-term performance
5 - 10 yrs
- Long-term performance
10 - 20 yrs

There are pluses and minus of each

Materials & Workmanship

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



Performance Warranties



“Performance warranties are defined as a **guarantee of the integrity** of a product and the maker’s responsibility for the repair or replacement of the deficiencies. A warranty is used to specify the **desired performance** characteristics of a particular product over a **specified period of time** and to define who is **responsible** for the product.”

Performance Warranties

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



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**

Short-Term Performance Warranties

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

Long-Term Performance Warranties

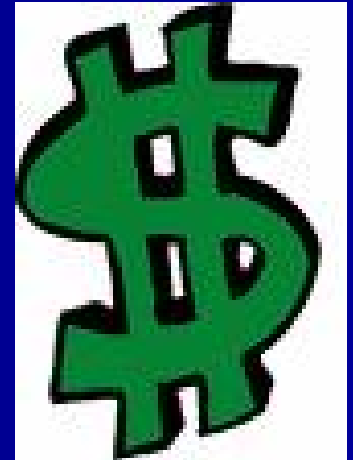
- Agency provides
 - Traffic characteristics
 - Geometrics
 - Quantities for payment (e.g., sq.yd., lane-mile)
 - Performance threshold values
- Contractor provides
 - Structural design and typical section
 - Quality management plans
 - Project phasing
 - Pavement Performance

Performance Warranty Components

1. **Contract Administrative requirements**
2. **Distress identifiers' and applicable thresholds.**
3. **Distress remediation**
4. **Quality programs for Binders, aggregate, production and laydown**
5. **Restrictions, traffic Monitoring and evaluation of the pavement/project**
6. **Bonding/guarantees**

Pavement Warranties

- Do they cost more???
- Are there any benefits??



It DEPENDS!

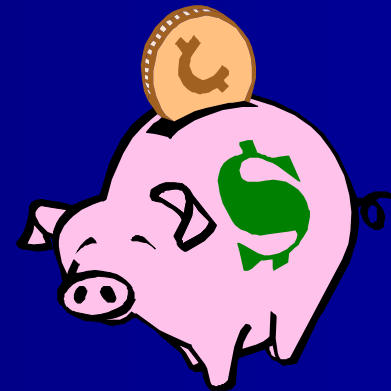
...how are the rules written???

Cost Effectiveness

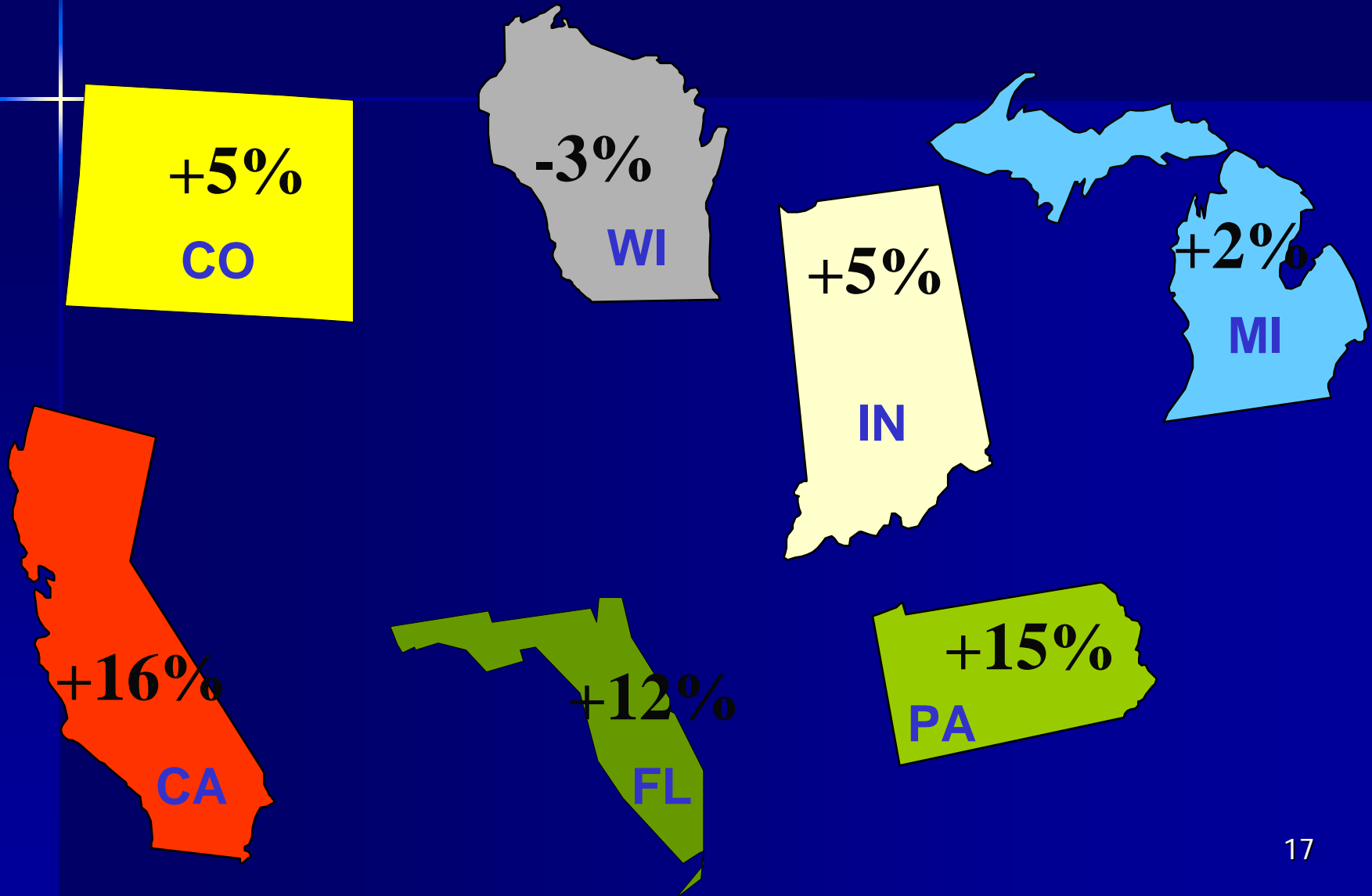
- Some agency reports very favorable experiences and some agency's not. Va, Oh, In, Wi, Ca., all have reported variable results depending on the types of Warranties, M/W or STPW. Limited results are available on LTPW.
- European results on all three types of warranties are all favorable. Most all use M/W or STPW in all projects.

What Affects Warranty Costs

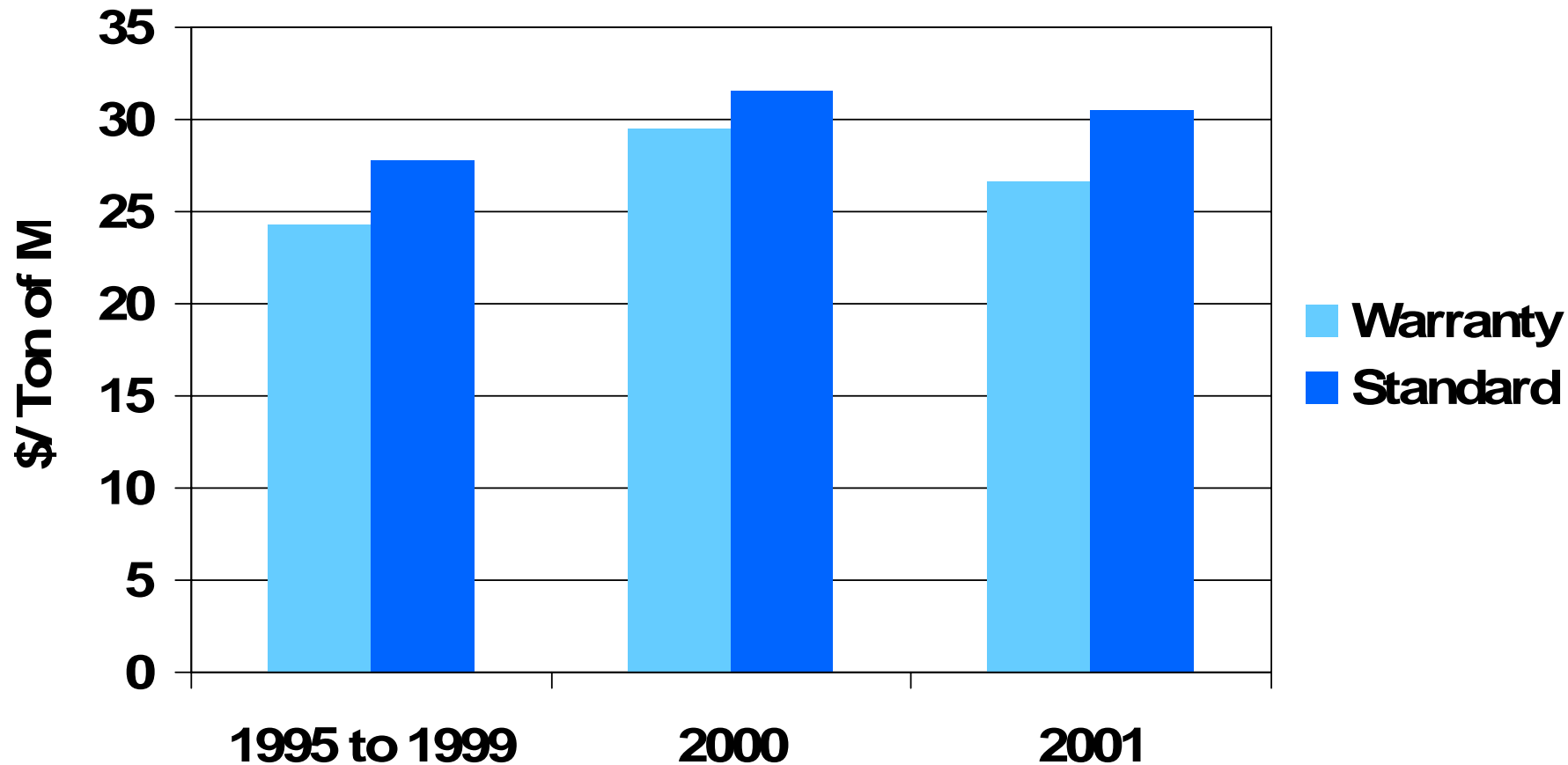
- More restrictions = higher costs
- More contractor risk = higher costs
- Learning curve impacts costs



Cost of Warranties



Cost Comparison of HMA (Wisconsin)



Cost of Warranties

- Related to the perceived risk by the contractor
- Unknowns, traffic, agency restrictions, contractor's past performance, production/processing, quality programs.
- Bonding/Guarantee's
- **Number One reason for higher cost, is the clarity of the specifications**

Core Elements

Performance Warranty Specifications

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**
7. **Agency Maintenance Responsibilities**
8. **Method of Measurement**
9. **Basis of Payment**
10. **Quality Control Plans**
11. **Verification and Evaluation**
12. **Final Warranty Acceptance**

Quality Characteristics

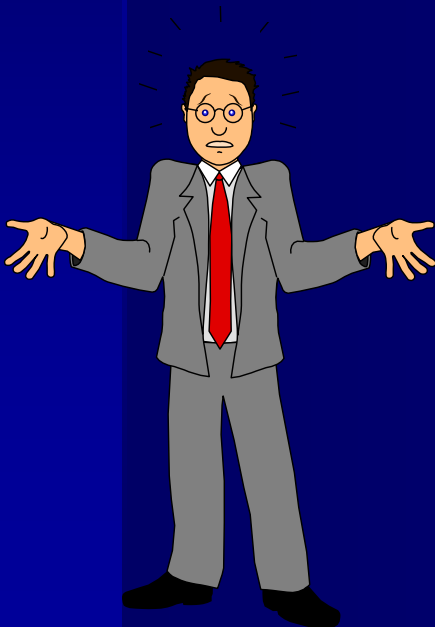
- Quality Characteristics used for acceptance should be objective measurements and tied to the PMS systems.
- **For HMA**, Smoothness, cracking, friction, rutting
- **For PCC**, Smoothness, cracking, friction, and faulting

Example: HMA Warranty Items

Materials & Workmanship

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

Performance



Setting Performance Criteria

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

1. Pavements of Target Age

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



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
- Proper Segment Length reduces the risk to the agency and the contractor and reduces the cost of the warranty

3. Performance Data

Image/Location Data

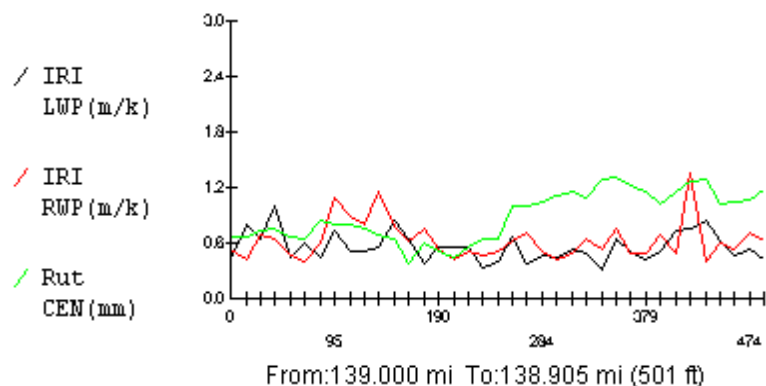
01:33:07:05 1 Rec 25 Set 101
 Dist 5099.1 ft 139.034 mi Sp 0 m/h
 Lat +41.5105934 Lon -85.0550766
 End-Imag 01:33:07:15 Road-Nail69
 Road---Fr139.000 Road-----138.000
 Len 5280.0 SvyLenq 5440.2
 IRI L e 34 IRI R e 41
 HRI e 28 RutAvg(ir0.04

Digital Video



Sensor Data Graph

Road:I69 Co:1 D:N Ln:1



Road/Surface Condition Information

File	Edit	Options	Image	Samples	Distress	Sensor	Map	Signs/Inv	Help							
Num	Road	From(mi)	To(mi)	Dir	Len(ft)	SvyLen	P	Set	Start-Image	End-Image	SurveyDate	Time	IRI L e	IRI R e	RutAvg(in)	
26	169	139.000	138.000	D	5280.0	5440.2	A	101	01:33:07:15	01:34:10:17	05/05/98	11:40	34	41	0.04	
27	169	138.000	137.000	D	5280.0	5275.4	A	101	01:34:10:21	01:35:09:08	05/05/98	11:41	41	51	0.04	
28	169	137.000	136.000	D	5280.0	5304.2	A	101	01:35:09:08	01:36:05:21	05/05/98	11:42	35	44	0.05	
29	169	136.000	135.000	D	5280.0	5278.1	A	101	01:36:05:21	01:37:02:09	05/05/98	11:43	37	45	0.04	
30	169	135.000	134.000	D	5280.0	5267.6	A	101	01:37:02:09	01:38:09:04	05/05/98	11:44	56	59	0.03	
31	169	134.000	133.000	D	5280.0	5268.1	A	101	01:38:09:04	01:39:10:12	05/05/98	11:45	65	65	0.03	
32	169	133.000	132.000	D	5280.0	5275.6	A	101	01:39:10:12	01:40:06:26	05/05/98	11:46	40	46	0.03	
33	169	132.000	131.000	D	5280.0	5304.5	A	101	01:40:06:26	01:41:03:26	05/05/98	11:47	39	44	0.02	
34	169	131.000	130.000	D	5280.0	5280.9	A	101	01:41:03:26	01:42:00:17	05/05/98	11:48	42	65	0.11	
35	165	75.000	76.000	I	5280.0	5295.1	A	101	00:49:55:28	00:50:52:16	05/04/98	19:23	55	58	0.12	
36	165	76.000	77.000	I	5280.0	5257.1	A	101	00:50:52:16	00:51:48:20	05/04/98	19:24	48	51	0.11	
37	165	77.000	78.000	I	5280.0	5503.9	A	101	00:51:48:20	00:52:47:14	05/04/98	19:25	29	36	0.11	
38	165	78.000	79.000	I	5280.0	5137.1	A	101	00:52:47:14	00:53:42:10	05/04/98	19:26	30	38	0.17	
39	165	79.000	80.000	I	5280.0	5281.1	A	101	00:53:42:10	00:54:38:26	05/04/98	19:26	32	40	0.14	
40	165	80.000	81.000	I	5280.0	5265.1	A	101	00:54:38:26	00:55:35:02	05/04/98	19:27	42	48	0.10	

PMS Data Evaluation

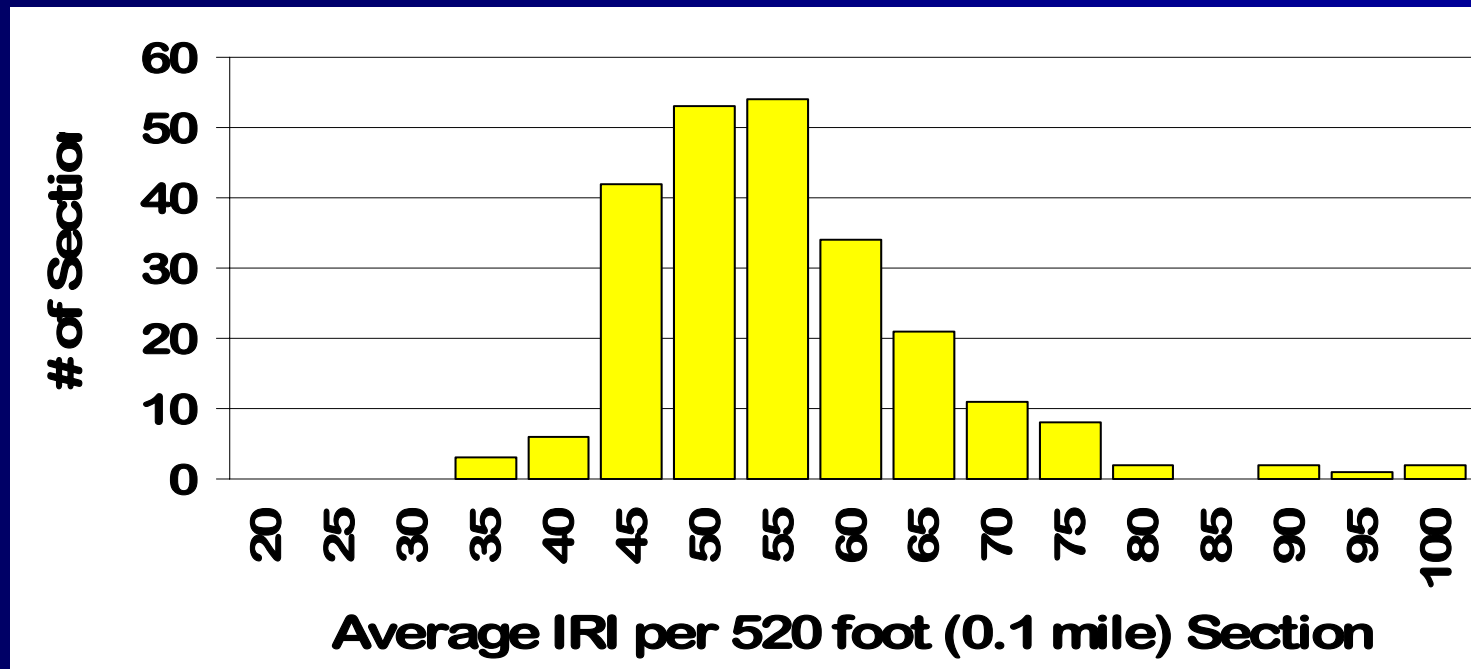
- Evaluate each of the distresses utilizing PMS data to determine thresholds.
- Evaluate each scenario at 5, 7, and 10 years.
- Determine mean, SD and use 2 SD's above the mean as target value

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

Performance Indicator: Ride Example

- 5-7 year old pavements



Objective vs. Subjective

- Acknowledge that there are distresses like raveling on HMA or joint deterioration on PCC is subjective.
- Subjective distresses should be limited
- Subjective determinations by the agency increases the cost (risk) to the contactor and results in higher costs of the warranty

Establishment of the warranty period

- M/W should be 2-4
- STPW should be 5-10
- LTPW should be >10 years

- New warranties should start at 5 years and go to 7 and 10 as experience grows

Recommended Distress Thresholds - HMA

Example*

Ride (IRI)	80 in/mile
------------	------------

Rut	0.25 in
-----	---------

Friction	35
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Cracking

Longitudinal	0 ft
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Transverse	0 ft
------------	------

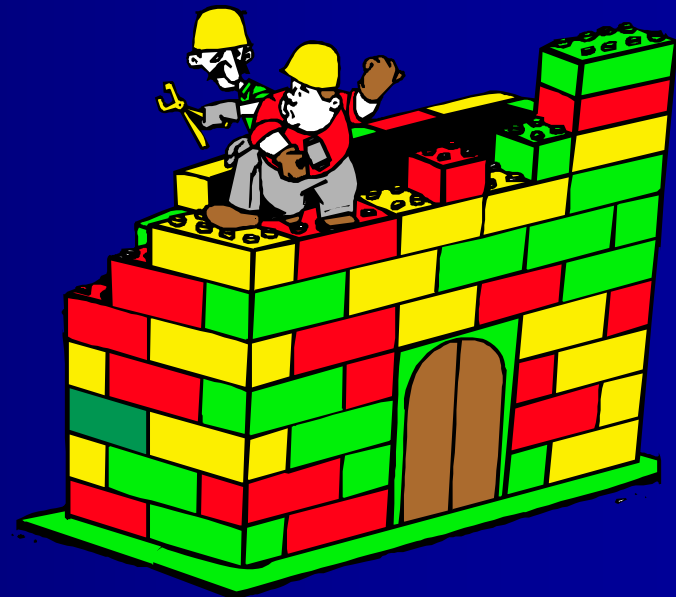
** based on 520 feet (0.1 mile)
evaluation sections for 5-7 yr projects*

Material Selection

- **M/W** – Standard Specifications
- **STPW** - Agency Minimums, and does not include Structural design in warranty
- **LTPW** – Contractor establishes material requirements and determines the structural design to meet contract requirements

Material Requirement Recommendations (MIN)

- LA Abrasion <40 dense / <30 SMA
- Deleterious
- Crushed faces
- Soundness
- Grade of Binder
- Etc.



RISK, RISK, RISK

- Materials selection is one of the critical elements in a successful warranty and is directly related to the cost of the warranty.
- **M/W** – No risk, as standard specifications are use,
- **STPW** – Moderate risk, depends on clarity of the specifications and Contractor's experience with available materials,
- **LTPW** – Higher risk, Contractor has total control and assumes the resulting risk.

Contractor Quality Control Plans

- QCP are critical elements to a successful warranty project/program.
- For HMA, they should include aggregates, binders, production and laydown for HMA projects.
- For PCC, aggregates, production and placement of PCC pavements.
- Laboratory and field personnel need to be certified or qualified in accordance with agency normal requirements.

Qualified or certified programs should be required in the specifications for STPW or LTPW programs.

Dispute Resolution

- Generally fewer disputes than on non-warranty projects
- Assembled to address disputes for warranty period. Example:
 - Agency selects two representatives
 - Contractor selects two representatives
 - Both parties jointly select one independent representative

Agency Evaluation

- At a minimum, the agency needs to evaluate the project to determine its status at time zero, and a full evaluation at the end of the project.
- Depending on the agency & contractor experiences, specified frequency of yearly or by yearly could be utilized.
- Risk is directly related to the contractor and cost of the warranty.
- Starting with more inspections will improve agency and contractor confidence in the program.

Materials and Workmanship Acceptance Program

- Standard contract requirements apply
- Standard inspection occurs
- Standard project acceptance occurs
 - Specified items under warranty



Materials and Workmanship Verification Program

- Monitor project performance
 - Informal
 - Formal
- Formal inspection at close-out
- Investigate deficiencies
- If material or workmanship is the cause, contractor responsible
- Agency formally accepts the project at close-out

Performance Warranty Acceptance Program

- **Non-Warranted Items**
 - Standard contract requirements apply
 - Standard inspection occurs
- **Warranted items**
 - Contractor
 - Submits material documentation
 - Agency
 - Determines quantities
 - Inspection and sampling is optional (does not imply acceptance)
 - Evaluates performance indicators (need to be measurable)

Performance Warranty Verification Program

- Monitor project performance
 - Informal
 - Formal
- Formal inspection at close-out
- Contractor responsible for performance deficiencies
- Agency formally accepts the project at close-out

Monitoring Performance

- Informal

- Drive-by inspections by agency personnel
- Routine pavement management data collection

- Formal

- Objective Determinations
- Project broken down into evaluation sections (PMS)
- All lanes (shoulders) evaluated



Performance Warranty Verification Program

Example Performance Indicator

Ride: International Roughness Index
(IRI)

- Pavement roughness determined using profile measurement that meets the current Highway Performance Monitoring System (HPMS) manual.

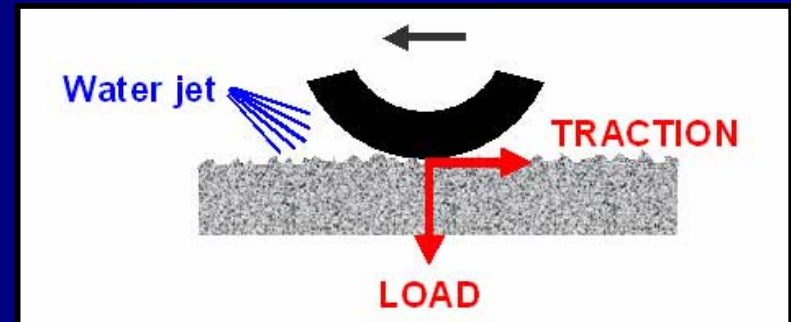


Performance Warranty Verification Program

Example Performance Indicator

Friction Testing

- Locked Wheel Trailer as defined by ASTM E274 with a smooth tire in accordance with ASTM E524.



Performance Warranty Verification Program

Example Performance Indicator

Rutting

- Measure rutting during Pavement Management System condition survey.



What makes a successful Warranty????

- The development of the specification jointly with industry is critical to ensure knowledge of the program by all parties
- Inclusion of the 12 basic key elements
- Agency ensures that required performance period reviews are completed in a timely period and results issued to allow contactor remediation within the same year.
- Agency establish and follow up with an open review and evaluation of the program.

FHWA Perspective on Warranties

- Supports warranty program
- Encourage as a contracting option
- Ensure shared risk by Agency and Contractor
- Contractor responsible for items they control
- Cannot participate in items defined as maintenance

Successful Implementation

- New way of doing business (Change)
- Buy-in from the top
 - Agency
 - Contractor/Industry
 - FHWA
- Early involvement by all parties in program development
- Consider lessons learned



FHWA Basic Warranty Workshop



- 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
or Dennis Dvorak, RC, 708-283-3542
@ Dennis.dvorak@fhwa.dot.gov

Thank you