Driving Indiana's Economic Growth

Pavement Evaluation Resources Supporting PMS Program

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INDOT System Information

Route System	Lane Miles
All Routes	27,217
Interstates	4,261
Non – Interstates – NHS	5,154
Non – NHS	17, 802

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Contracted Resources

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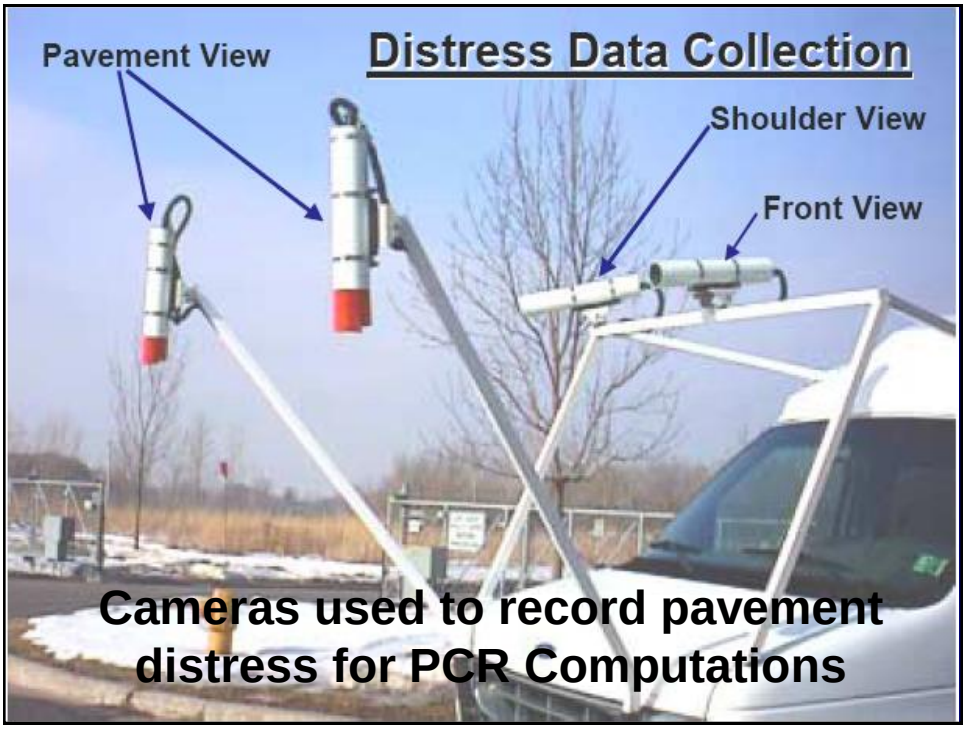


Lasers used to measure roughness, rutting and/or faulting
1
2
3
4
5
5 Lasers Measure the Distance to Pavement
(Accelerometers in each Wheelpath)


In-House Resources – INDOT R&D
Pavement Skid Resistance/ Friction
6. 23. 2000 08:04

Pavement Surface Skid Resistance

- 40 mph, Smooth Tire, Wet Pavement Surface

Condition	Friction Number
Excellent	>40
Very Good	35 – 40
Good	25 – 35
Fair	20 – 25
Poor	< 20

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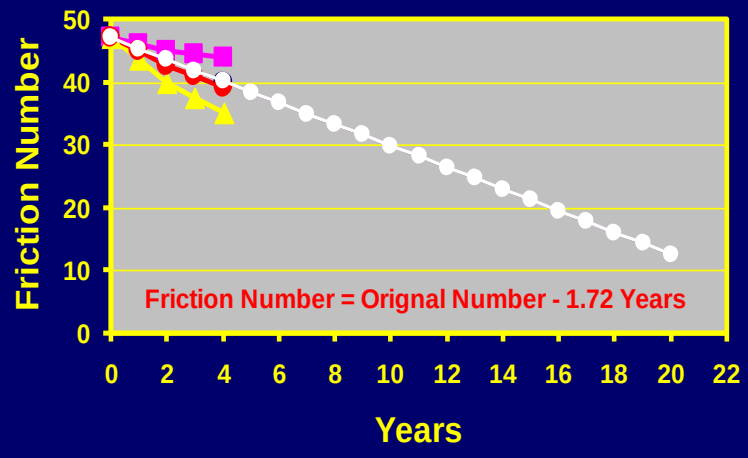
Friction Performance



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Friction Performance

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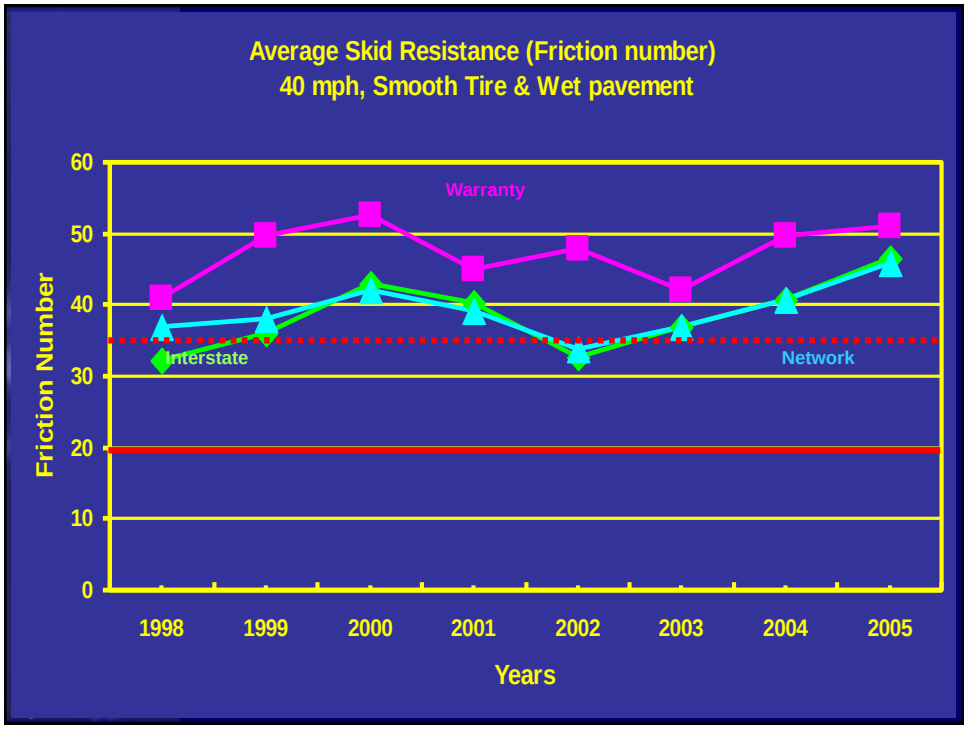

Decisions Driven by Friction Data

- Initially was used just to report the pavement surface condition
- Preservation at Locations of Low Friction Values – Saved Lives and Properties
- Planning for preservation needs
- Warranty Contract Compliance
- Special Tests (What Materials best suited to provide acceptable values)

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Ground Penetrating Radar- GPR

- Air Coupled Antenna
  - Highway Speed
- Ground Coupled Antenna
  - Traffic Control

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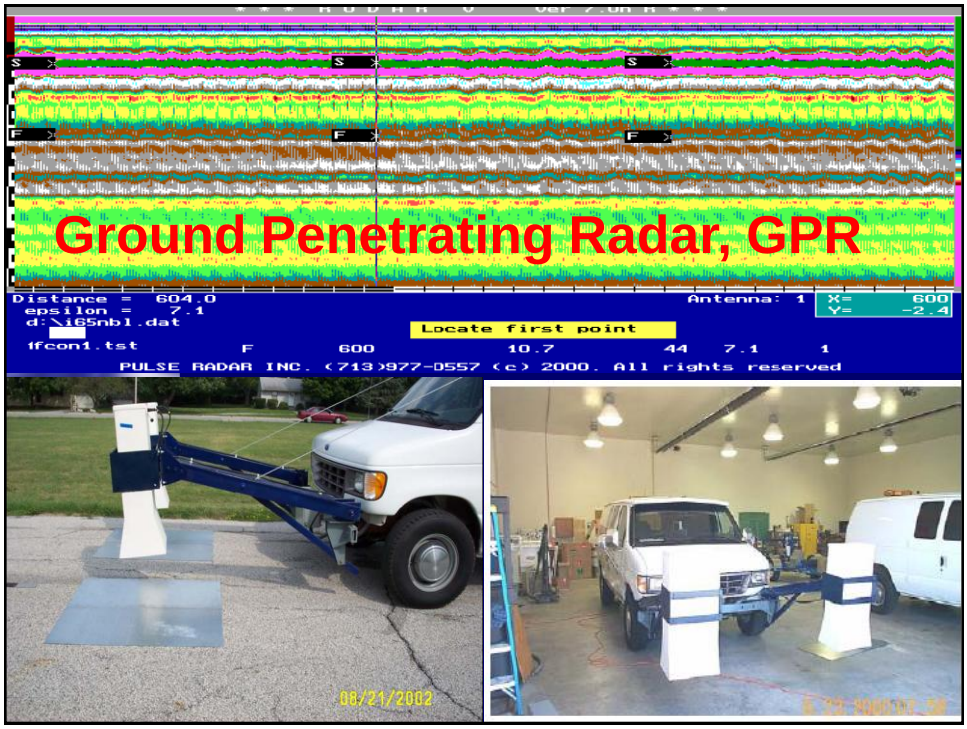
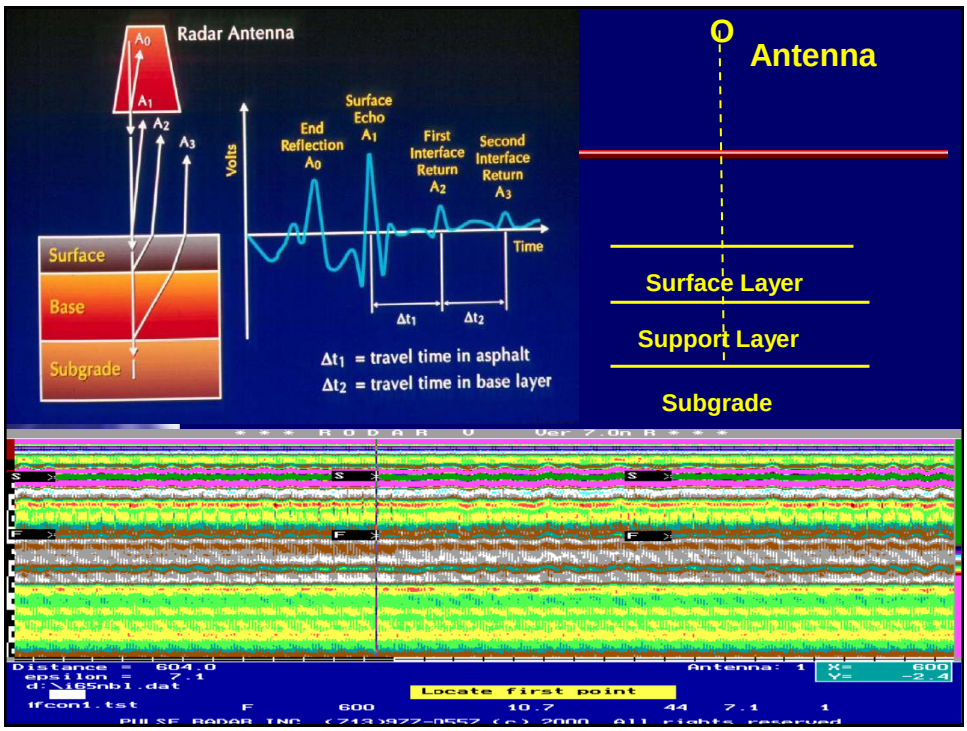

Ground Penetrating Radar, GPR
Distance = 604.0
epsilon = 7.1
d:\i65nb1.dat
Antenna: 1
X= 600
Y= -2.4
Locate first point
1fcon1.tst F 600 10.7 44 7.1 1
PULSE RADAR INC. (713)977-0557 (c) 2000. All rights reserved
08/21/2002


Radar Antenna
A0
A1
A2
A3
Surface
Base
Subgrade
Volts
End Reflection A0
Surface Echo A1
First Interface Return A2
Second Interface Return A3
Time
Δt1
Δt2
Δt1 = travel time in asphalt
Δt2 = travel time in base layer
O
Antenna
Surface Layer
Support Layer
Subgrade
Distance = 604.0
epsilon = 7.1
d:\i65nb1.dat
Antenna: 1
X= 600
Y= -2.4
Locate first point
1fcon1.tst F 600 10.7 44 7.1 1

Material	Mean	Range
Portland Cement Concrete	9	6 – 12
Asphalt Concrete and Dry Sand	5	3 – 7
Rock	9	6 - 12
Dry Aggregate Base/ Subbase	7	5 – 9
Wet Aggregate Base/Subbase	15	10 – 20*
Subgrade	15	5 – 25*
Air	1	
Water	80	

Ground Penetrating Radar- GPR

- Thickness Evaluation
- Moisture Entrapment Causing Stripping or Disintegration
- Water Infiltrations at Joints and cracks and Subsurface Drainage effectiveness
- Utility Location
- Bridge Deck Evaluation

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Ride Quality, IRI, and Texture Depth Measurements

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Ride Quality, IRI, and Texture Depth Measurements

- IRI: Warranty Contracts - Now
- IRI: Smoothness Award - Now
- IRI: Network Data Quality Cross Check and Calibration - Planned
- IRI: Construction specifications Planned – Research
- Texture Depth: Preservation Needs Planned – Research
- Texture Depth: Evaluation of Materials used in preservation – Planned – Research

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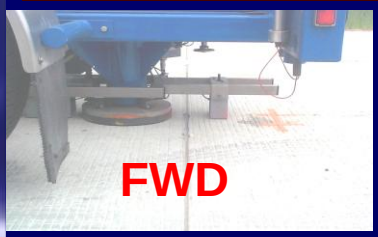
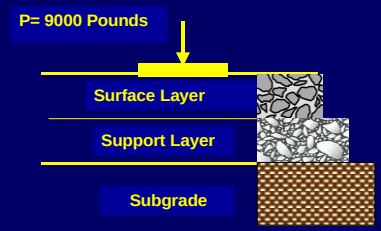
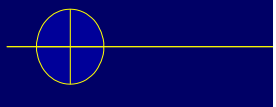
Project Level Pavement Deflection

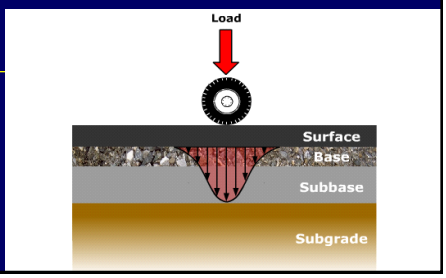




D2	D1	D3	D4	D5	D6	D7	D8	D9
-12	0	8	12	18	24	36	48	60



Network Level?



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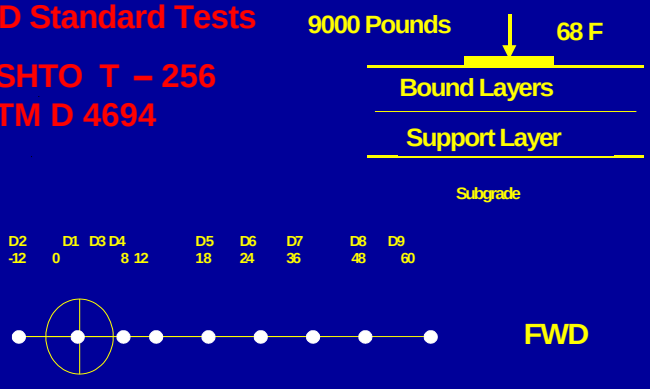
Project Level Pavement Deflection

FWD Standard Tests

AASHTO T – 256
ASTM D 4694



Deflection Basin is Dependent Upon Thickness & Material Properties

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Pavement Deflection
Falling Weight Deflectometer, FWD

- Pavement and/or Shoulder Structural Evaluation
- Remaining Life Calculations
- Overlay Design
- Joints and Cracks Evaluation
- Pavement Layers Moduli Backcalculation
- Undersealing Requirements
- Subgrade Evaluation

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Project Level Pavement Deflection

Pavement Deflection

Center Deflection in mils , 9000 Pounds (40 KN), 68 F (20 C)

	Interstates	Heavy Traffic	Medium Traffic	Light Traffic
Excellent	< 4	< 5	< 6	< 8
Very Good	4 – 6	5 – 7	6 – 8	8 – 10
Good	6 – 8	7 – 9	8 – 10	10 – 12
Fair	8 – 10	9 – 11	10 – 12	12 – 14
Poor	>10	>11	>12	>14
ESALs, Millions	> 30	10 – 30	3 – 10	< 3

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Undersealing
Concrete and Composite Pavements

Center Deflection	Outer Deflection	Extent	Underseal
Low	Low	The Majority of the Pavement Segment	No
High	High	Localized	Yes
Low	High	Localized	Yes
High	High	The Majority of the Pavement Segment	No

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