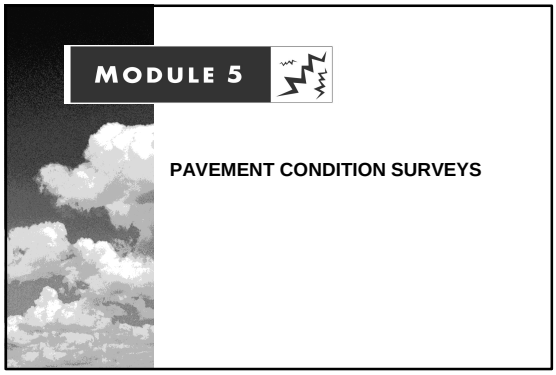

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Instructional Objectives

- Need for condition surveys
- Collection methodologies
- Four basic types of condition surveys
- AASHTO Draft Protocols
- Different procedures and equipment available

5

Need for Condition Surveys

- Evaluate current condition of pavement
- Determine rates of deterioration
- Project future conditions
- Determine maintenance & rehabilitation needs
- Determine costs of repairs
- Prepare plans for repairs

5

Collection Methodologies

- Costs of collecting condition data
  - Accuracy
  - Precision
  - Resolution

5

Types of Surveys

- Distress Surveys
- Structural Capacity
- Roughness (Ride Quality)
- Skid Resistance (Surface Friction)

5

Distress Surveys

- Type of distress
- Severity
- Quantity of distress present on the pavement

5

AASHTO Distress Survey Protocols

- **Cracking protocols for:**
  - **Asphalt pavements**
  - **Jointed concrete pavements**
  - **Continuously reinforced concrete pavements**
- **Faulting protocols for concrete pavements**
- **Rut depth protocols for asphalt pavements**
- **Roughness protocols**

5

PAVEMENT MANAGEMENT CONDITION DATA PROTOCOLS

Stuart W. Hudson, President
Texas Research and Development Incorporated

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VISION STATEMENT

- **Consistent and effective condition data for** Network Level Pavement Management
- **Effective state pavement management with coordinated technology and communication**
- **Synergize and standardize network level PMS data collection and reporting nationwide**

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GOALS AND OBJECTIVES

- **Goal is effective and accepted PMS data collection protocols**
- **Objectives Include:**
  - **Synthesize state PMS data methodologies**
  - **Determine appropriate data guidelines**
  - **Develop protocols with state input**
  - **Ensure acceptance**

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PROTOCOL DEFINITION

A procedure for the objective measurement of a pavement characteristic which defines a minimum standard and a set of parameters regarding the type, precision, quantity, location, reporting, and quality of a measurement to be made

5

PROTOCOLS DEVELOPED

- **Six Protocols developed**
  - **Roughness (Automated only)**
  - **Rut Depth (Automated only)**
  - **Faulting (Automated & Manual)**
  - **Automated & Manual Cracking Protocols**
    - Asphalt (Automated & Manual)
    - CRCP (Automated & Manual)
    - JCP (Automated & Manual)

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PROTOCOLS

- **Roughness**
  - **Profile 2 WPs 150 mm (6") spacing**
  - **Report average of two wheelpath IRI**
- **Rut Depth -**
  - **Three point measurement every 15 meters**
- **Faulting**
  - **Each transverse joint (Automated)**
  - **10% Sample of joints (Manual)**

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IRI ROUGHNESS PROTOCOL

IRI is calculated from longitudinal profile measured with a road profiler in both wheelpaths. The average IRI of the two wheelpaths is reported as the roughness of the pavement section.

5

ROUGHNESS SURVEY

- **Survey the outside lane.**
- **For undivided highways survey one direction.**
- **For divided highways survey the outside lane in both directions.**
- **For each survey cycle use the same direction(s) of travel and survey lane(s).**

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IRI CALCULATION

International Roughness Index (IRI) **- The IRI is computed from a single longitudinal profile using a quarter-car simulation as described in the report, "On the Calculation of IRI from Longitudinal Road Profile." [Sayers 95]**

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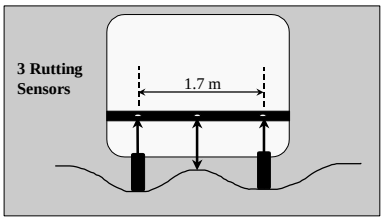
RUT DEPTH MEASUREMENT



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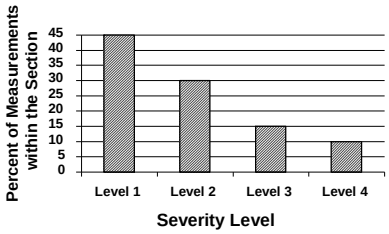
WHAT IS REPORTED?

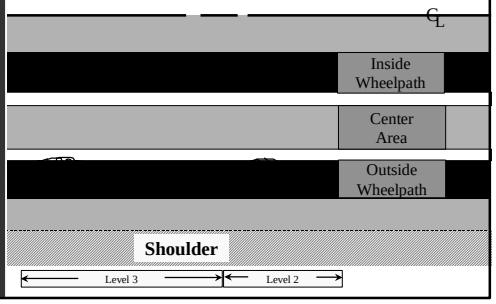
SAMPLE DATA AGGREGATION



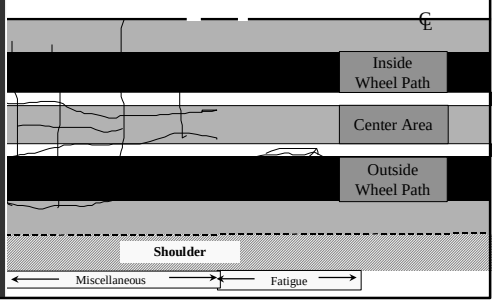
ASPHALT CRACKING PROTOCOL

- **Fatigue Cracking**
  - **in outside wheel path (WP)**
- **Miscellaneous Cracking**
  - **in center area between WP's**
- **Transverse Cracking**
  - **cracks crossing outside half of lane**

FATIGUE CRACKING



MISCELLANEOUS CRACKING



CRCP CRACKING PROTOCOL

- **Transverse Cracking**
- **Longitudinal Cracking**
- **Punchouts**

JCP CRACKING PROTOCOL

- **Slab Distresses**
  - **Shattered Slab**
  - **Longitudinal and Transverse Cracking**
  - **Corner Breaks**
  - **Surface Disintegration & Asphalt Patches**
- **Joint Distresses**
  - **Spalling**
  - **"D" Cracking**

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WHAT THE PROTOCOLS DO

- **Assist you in the implementation of data collection procedures**
- **Accommodate and assess many of your current procedures**
- **Facilitate data collection training and reduce data variability**

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WHAT THE PROTOCOLS DO (cont.)

- **Gauge the accuracy of data collection procedures and equipment**
- **Provide a framework by which states' data and results will be compatible**
- **Improve the exchange of pavement information, experience, and results**

5

PROTOCOL CONTENT

- **Purpose**
  - **Applies to Network Level Surveys on NHS**
- **Scope**
  - **Specifications for equipment not included**
- **Condition Measurements**
  - **Distresses defined**
    - Measurement (Severity and Extent)

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PROTOCOL CONTENT (cont.)

- **Recording of Data**
  - **Aggregation, Units, and Format**
  - **Section length between 0.15 and 1 km**
- **Quality Assurance**
  - **Survey crew training SHA procedures**
  - **Daily and periodic equipment calibration according to manufacturer's specifications**

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PROTOCOL CONVENTIONS

- **Down the Road**
  - **Stable Measurement Definition in SI units**
  - **Uniform Data Collection Sections**
    - Uniform Lengths
    - Uniform aggregation of measurements
  - **Standard Aggregation per PM Section**
- **Across the Road**
  - **Collection in either outside lane**
  - **Collection in portion of lane (WP/Mid)**

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Structural Capacity

- **Not routinely collected for pavement monitoring**
- **Mainly used for selecting and designing rehabilitation strategies**
- **Can reduce maintenance and rehabilitation costs**

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Structural Evaluation
Destructive Testing

- Coring
- Laboratory testing
- Excavation of pits
- Field CBR

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Structural Evaluation
Non-Destructive Testing

- Benkelman Beam
- Dynaflect
- Road Rater
- FWD
- Rolling Deflectometer
- GPR

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Rolling Weight Deflectometer

- In development through an SBIR
- Primary objectives are:
  - Develop an RWD suitable for network level analysis
  - Collect data at speeds of 50 mph
  - Output will be a structural index
  - Measure maximum deflection, pavement temperature, station numbers, and day and time of test

5

Rolling Weight Deflectometer

- Phase I
  - Identified deflection measurements
- Phase II
  - Highway speeds
  - Deflection response converted to a structural index

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Rolling Weight Deflectometer

- Objective is to compare relative structural strengths
- Identify weak links
- Deflection basins, magnitudes, loads and temperatures
- Processed in real time
- Continuously measured at 1 foot intervals

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Automated Distress Surveys

- Increase speed and ease of data collection
- Reduce transcription errors
- Increase consistency between classification and quantification
- Increase safety of field crews

5

Classes of Automated Data Collection

- Distress images collected on film or high resolution video and:
  - analyzed while the vehicle collects data
  - analyzed in the office after data collection
  - analyzed after data collection by viewing the images
- Lasers are used to determine changes in surface texture

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Automated Condition Survey Equipment

- Used by most states to collect:
  - Pavement friction
  - Roughness
  - Profile
  - Rut depth
  - Deflection data

5

Distress Data Collection

- Visual survey
- Laser technology
- Film-based systems
- Video systems

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Drainage Surveys

- Poor drainage causes poor pavement performance
- Water on a pavement can:
  - create a hazard to motorists
  - saturate the subgrade soil
  - deteriorate the pavement

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Pavement failure is caused by:

- Load
  - Load capacity can be increased by an overlay
- Moisture
  - If proper drainage is not provided during rehabilitation, the same moisture related distress will recur

5

Signs of Deficient Drainage

- Standing water in ditchlines
- Concentrated weed growth in ditchline or edge of pavement
- Evidence of water ponding on shoulder
- Deteriorated joint or crack sealants
- Any evidence of pumping

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How Much Data to Collect?

- To support network-level analysis
  - Sampling processes
- Two sampling procedures:
  - Network sampling
  - Section sampling

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Network Sampling

- Less samples needed when total number in the whole increases
- To determine average condition:
  - Sample 2 - 5%
- To predict the distribution of condition:
  - Sample 10 - 25%
- To predict cost of repairs, restorations:
  - Sample 30 - 35%
- Most states survey 10%

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Section Sampling

- To identify sections of pavement in a selected condition level, the condition of each section must be defined
- If a windshield survey is used:
  - entire section should be inspected
- If a walking or automated survey is used:
  - a portion of the section is adequate

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Frequency of Surveys

- Not all sections need to be inspected every year
- Interstates and more important sections can be inspected every year
- Sections with lower usage can be inspected every second or third year
- Use of a condition project method to utilize a common period for analysis

5

Summary

- Appendix 5A
  - Sample of distress evaluation charts used in New Mexico
- Appendix 5B
  - Reproduction of the draft AASHTO protocols for pavement condition data collection

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Instructional Objectives

- Need for condition surveys
- Collection methodologies
- Four basic types of condition surveys
- AASHTO Draft Protocols
- Different procedures and equipment available