Pavement Management Program
Maintenance Division
Local Assistance Division

Local Government Workgroup Meeting
January 10th, 2012
Presentation Topics

• Pavement data collection program at VDOT
  • Scope and how the data is collected
  • What distresses are collected
  • How data is summarized
  • QA of the data

• Brief discussion on the Pavement Management System

• Uses of pavement condition data in VDOT

• Demonstration of the data viewing software (Ivision)
Scope of VDOT Pavement Data Collection

- Data collection is contracted out to Fugro-Roadware
- Automated data collection using digital images and automated crack detection methodology since 2006
- Total yearly collection: approx. 20,400 directional miles
  - Interstate: approx. 2,200 directional miles (100% of IS system)
  - Primary: approx. 10,500 directional miles (100% of PR system)
  - Secondary: approx. 7,700 directional miles (~20% of SC system)
    - Secondary system is on a 5-year collection cycle
Data Collection Vehicle
Automatic Road Analyzer (ARAN)

Photolog
- Single view
- Panoramic view
- 1300 x 1030 pixel
- 1920 x 1080 (HDTV)
- Direct-to-digital
- Custom angles

Geometry & Spatial
- Inertial measurement unit
- HPMS curve type
- Long. Grade
- Cross slope
- Centerline mapping
- Spatial referencing for GIS integration

Pavement
- Image recognition software
- Strobe-lit pavement video
- Roughness
- Texture
- Rutting
- Surface Distress
- Ground Penetrating Radar

Assets
- Inventory from imagery
- Location determined
- Offset measured
- Height and width measured
- Sign code recorded
- Condition assessment
Distance Measuring Instrument (DMI)

- DMI utilizes a precision optical shaft encoder that is mounted on the left rear driving wheel.
- The DMI records 2,000 pulses per revolution.
- Accuracy is ±0.02% of the linear distance traveled.
- Ensures accurate low speed roughness measurements down to 20 km/h (12.5 mph).
Pavement Images

- Rear downward facing cameras
- Continuous pavement images of full lane width
- Renders pavement distresses down to 2mm (0.08 inches) in width
Pavement Distress Marking
Laser Rut Measuring System

• Pair of rear mounted INO Lasers
• Measure full transverse profile of the road surface to over 1,200 points
• Transverse profile is evaluated to determine the depths of ruts
International Roughness Index (IRI)

- Laser SDP System
- 16 kHz laser in each wheelpath
- Measures continuous longitudinal profile of the roadway
High Definition Right of Way Images

- True High Definition 1920 x 1080 CCD Camera
- Wide angle High Definition images
- A single image every 21 feet (variable)
GPS Data

• Real Time GPS Data Collection to ensure proper collection and referencing.
• Inertial referencing system allows for fill in of missing GPS data.
Production Data: Data Collection Schedule

• **VDOT’s Data Delivery Schedule**
  – **Collection Begins: November**
    • End of the paving season:
      – Condition data reflects recent paving work
      – Lane closures/deviations associated with construction are avoided
  – **Delivery of Condition Data**
    • Interstate: April 15th
    • Primary: May 15th
    • Secondary: June 15th

• **Challenges**
  – **Weather Delays**
    • Data collection in NOVA and western Virginia difficult during winter months
      – Sand/salt application; damp pavement; excessive rain
  – **GIS Network Definition**
    • Accuracy of network data is critical for processing
Distress Data Collected

• **Asphalt Surfaced pavement**
  • Alligator Cracking
  • Longitudinal Cracking
  • Transverse Cracking
  • Patching
  • Potholes
  • Delaminations
  • Bleeding
  • Rutting

• **Rigid Pavement**
  • Jointed concrete pavement
  • Continuously reinforced concrete pavements
Example of Alligator Cracking
Example of Transverse Cracking

Transverse Cracking—Severity Level 2
Example of Longitudinal Cracking

Longitudinal Cracking - Severity Level 2
Example of Patching

Patching—No Severity Levels Defined
Example of Rutting

An Example of Rutting
Data Summarization: Data Delivery Formats

- **Summarization of Production Data**
  - Split by road system
  - Split by pavement type
    - Asphalt Concrete Pavements (ACP)
      - Bituminous
      - Bituminous over Continuously Reinforced Concrete
      - Bituminous over Jointed Reinforced Concrete
    - Continuously Reinforced Concrete Pavement (CRCP)
    - Jointed Concrete Pavement (JRCP)
  - Delivered in 0.10 Mile and Summary Homogeneous Sections
Data Summarization: Pavement Condition Indices

Flexible Pavement
  – **Load Related Distress Rating (LDR)**
    • Alligator (Fatigue) Cracking, Wheel Path Patching, Rutting
  – **Non-load Related Distress Rating (NDR)**
    • Longitudinal and Transverse Cracking, Non-Wheel Path Patching, Bleeding

The lower of the two index values is the Critical Condition Index (CCI)
Pavement Condition by CCI Index

- Pavement Condition Category based on CCI
  - Excellent ($\geq 90$)
  - Good (Between 70 and 89)
  - Fair (Between 60 and 69)
  - Poor (Between 50 and 59)
  - Very Poor ($\leq 49$)

- Poor and Very Poor pavements are termed as “deficient”
Control Site Preliminary Data Collection

• **14 control sites**
  – Distributed across each system and pavement type
  – Wide range of pavement conditions between sites

• **Review of results from control sites by third party consultant—Quality Engineering Solutions (QES):**
  – Establish precision and bias values for roughness and rutting measurements
  – Calibrate the pavement distress rating process
    • QES reviews against reference values based on average rating from four experienced raters

• **Comparison of Individual Data Collection Vehicles to Reference Values**
  – At least 3 runs per site per truck
  – Single truck results are reviewed for reasonableness and repeatability
QA, QC and IV&V of Production Data

- Roadware’s Internal QA/QC
  - Initial QA/QC (Control Sites)
  - Daily QA/QC
  - On-Going QA/QC

- QES IV&V
  - Review of homogeneous pavement sections

- VDOT QA
  - Year-to-Year Comparison
  - Reasonableness Check
Final Acceptance of Production Data

- Data is accepted as QES IV&V and VDOT year-to-year comparison are completed
- Data is not delivered (or accepted) all at once
  - Interstate (statewide)
  - Primary (district by district)
  - Secondary (district by district)
QA, QC and IV&V of Production Data

Project Quality Process Flow Diagram

Start Up Process
- Control Sites

Control Site Acceptance (VDOT)

Production Data Collection
- Verification Sites
- Image Quality
- Field QC
- SOP

Data Processing
- D-Rate
- WiseCrax
- QA

Batch Acceptance (VDOT)

Internal QA (RWG)

A

Pass IV&V ? (QES)

Independent Verification & Validation by QES
- 5% Data Review
- Data Completeness
- Index Limits

Delivery to VDOT
- Deliverable Files via ftp Site
- Images via Portable Hard Drive

Delivery to VDOT
- QA & IV&V Reports
- 0.10 mile DeliveryTbl
- Homogenous Section DeliveryTbl

PMS Database Video Database

A

No

No

No

No

No

No

No

No

No

No

No
Pavement Management System (PMS)

- A tool to store, analyze, summarize and report data
- Serves as a repository of inventory, history and condition data
- Used to identify M&R needs
- Used to develop budget requirements
- Used to answer where, when and what treatments are needed
- Used to export files for displaying maps in GIS
Data Reporting and Use

- State of the Pavement Report and GIS maps
- Legislative reports on Infrastructure System Condition
- Report to CTB by the Commissioner
- HPMS data reporting to FHWA
- Report to the Dashboard
- Prepare yearly paving schedule
- Performance measure for districts
Pavement Condition – Interstate (2011)

<table>
<thead>
<tr>
<th>Condition</th>
<th>% Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>35.3%</td>
</tr>
<tr>
<td>Good</td>
<td>35.4%</td>
</tr>
<tr>
<td>Fair</td>
<td>9.6%</td>
</tr>
<tr>
<td>Poor</td>
<td>11.4%</td>
</tr>
<tr>
<td>Very Poor</td>
<td>8.3%</td>
</tr>
</tbody>
</table>
Interstate Asphalt Pavement – Alligator Cracking (% of total area)
Percent Sufficient by District – Interstate (2011)

% Sufficient Network

<table>
<thead>
<tr>
<th>District</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/BR</td>
<td>78.6%</td>
</tr>
<tr>
<td>2/SA</td>
<td>83.0%</td>
</tr>
<tr>
<td>4/RI</td>
<td>73.5%</td>
</tr>
<tr>
<td>5/HR</td>
<td>76.5%</td>
</tr>
<tr>
<td>6/FR</td>
<td>93.0%</td>
</tr>
<tr>
<td>7/CU</td>
<td>88.6%</td>
</tr>
<tr>
<td>8/ST</td>
<td>92.3%</td>
</tr>
<tr>
<td>9/NO</td>
<td>71.2%</td>
</tr>
</tbody>
</table>

% Sufficient Condition: 80.3%
Statewide Target > 82%
Percent Sufficient by District – Primary (2011)

- 1/BR: 81.2%
- 2/3A: 76.2%
- 3/LY: 88.6%
- 4/RI: 72.3%
- 5/HR: 81.1%
- 6/FR: 68.8%
- 7/CU: 89.2%
- 8/ST: 78.6%
- 9/NO: 58.3%

% Sufficient Condition: 77.6%
Statewide Target: 82%
Statewide Percent Sufficient Pavement by System

<table>
<thead>
<tr>
<th>Year</th>
<th>IS</th>
<th>PR</th>
<th>SC</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>79.9%</td>
<td>75.7%</td>
<td>68.9%</td>
</tr>
<tr>
<td>2010</td>
<td>78.4%</td>
<td>73.3%</td>
<td>65.8%</td>
</tr>
<tr>
<td>2011</td>
<td>80.5%</td>
<td>77.6%</td>
<td>64.2%</td>
</tr>
<tr>
<td>Est. 2012</td>
<td>82.0%</td>
<td>Est. 80.0%</td>
<td>Est. 64.6%</td>
</tr>
<tr>
<td>Est. 2013</td>
<td>82.0%</td>
<td>Est. 82.0%</td>
<td>Est. 65.0%</td>
</tr>
</tbody>
</table>

Performance Target (I & P) ≥ 82%
Data Viewing Software

Data Viewing Software: IVision

http://ivision