Urban Arterial Roads
Pavement Data Collection

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Presentation Topics

- **Background Information:**
  - CTB Subcommittee & Local Government Workgroup
- **Pavement data collection program**
  - Scope and how the data is collected
  - Collection vehicle and detection mechanisms
  - 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**
- **Data Collection Schedule**
- **Questions**
The CTB meeting on July 20, 2011 established a subcommittee of the Board, which consists of all at-large members to:

- evaluate the issues surrounding equalization of maintenance fund allocations
- and to consider options which could be addressed administratively and legislatively
- to develop recommendations for the effective and equitable distribution of maintenance funds
- to present those recommendations to the Board on or before December 31, 2011

Resolution of the CTB in December 2011:

- An analysis and comparison of needs across systems is desired before recommending legislative changes
  - Lack of available data on local system condition and performance limits further analysis
- The most equitable approach to distribution of scarce maintenance funding may be a formula that incorporates a prioritized needs-based factor along with a commitment to maintain our statewide assets, regardless of maintenance responsibility
- Reconvene the local government working group (in partnership with the Virginia Municipal League and Virginia First Cities Coalition) to advance the collection and analysis of system condition and performance data on the locally maintained system
Local Government Workgroup

• General Information:
  • Was comprised of 13 different localities, VDOT, the VA Municipal League, and the VA First Cities Coalition
  • Met 4 times since January
  • Sent out a survey to all 83 localities that maintain their own systems

• Survey Data:
  • Included Questions Related to:
    • Pavement Data Collection and Management Systems
    • Traffic Signals
    • Drainage
    • Sidewalks
    • Other Assets Maintained by the 83 Localities
  • Compared the survey data to the annual Weldon Cooper Survey
  • The existence of collected data varied greatly across jurisdictions
  • Pavement was the top maintenance expense followed by traffic control operations and devices
  • Survey also showed that localities that maintain their own systems pay a substantial amount towards maintaining other transportation assets
Recommendations:

• Focus on pavements
• Evaluated the benefits and cost of using VDOT’s pavement data collection contract for preparing a snapshot of pavement data for arterial routes on the locally maintained system
  • Would provide a consistent standard/protocol that would be used statewide
  • The cost of the data collection is $250,000
• Currently the Cities of Hampton and Colonial Heights are using VDOT’s pavement data collection contract

• Schedule:
  • **Summer/Fall 2012:** Collect pavement data for arterial routes in all Cities/Towns
  • **Fall/Winter 2012:** Analyze and process the data
  • **Winter 2013:** Reconvene the Local Government Workgroup
  • **Spring 2013:** Report findings to the CTB

• In addition, the Local Government Workgroup will continue to evaluate other performance standards that can be utilized statewide in analyzing other transportation asset types
Scope of Pavement Data Collection Project

- Data collection is contracted out to Fugro-Roadware
- Automated data collection using digital images and automated crack detection methodology since 2006
- Total collection for the Urban Arterial System Collection:
  - Includes Principal and Minor Arterial Routes
  - Will collect approx. 2,795 directional miles
  - Cost: $250,000
  - Pavement data collection will be completed by February 2013
- Total yearly collection for VDOT systems:
  - 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 $\pm 0.02\%$ 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.
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

Alligator Cracking - Severity Level 3
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 and Challenges

• 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

• 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
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 (≥ 90)
- Good (Between 70 and 89)
- Fair (Between 60 and 69)
- Poor (Between 50 and 59)
- Very Poor (≤ 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

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

Internal QA (RWG)

Data Completeness
- Index Limits

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

Pass IV&V? (QES)

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

Batch Acceptance (VDOT)

PMS Database
- Video Database

QA Reports

QA & IV&V Reports
- 0.10 mile Delivery Tbl
- Homogeneous Section Delivery Tbl

Delivery Tbl

IV&V Report
- Deliverable Tables

IV&V

QC Reports

QA Reports

验收和验证 (IV&V) of Production Data

项目质量过程流程图

启动过程
- 控制站点

控制站点接受 (VDOT)

生产数据收集
- 验证站点
- 图像质量
- 野外 QC
- SOP

数据处理
- D-Rate
- WiseCraX
- QA

内部 QA (RWG)

数据完整性
- 索引限制

独立验证和验证由 QES
- 5% 数据审查
- 数据完整性
- 索引限制

通过 IV&V? (QES)

交付 VDOT
- 交付文件通过 ftp 站点
- 图像通过便携式硬盘

批接受 (VDOT)

PMS 数据库
- 视频数据库

QA 报告

QA & IV&V 报告
- 0.10 英里交付表
- 同质部分交付表

交付表

IV&V 报告
- 交付表

IV&V

QC 报告

QA 报告
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
VDOT Data Reporting and Use for Interstate, Primary, and Secondary Data

- 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
Fugro-Roadware’s Data Delivery Schedule

- **Collection Begins: October 15th**
  - End of the paving season (November):
    - Condition data reflects recent paving work
    - Lane closures/deviations associated with construction are avoided

- **Delivery of Condition Data**
  - VDOT:
    - Interstate: April 15th
    - Primary: May 15th
    - Secondary: June 15th
  - Urban:
    - February 28th