Data Collection, Management, and Modeling using GPS/GIS

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Outline

- Components of Pavement Management
- Data collection case
- Data Management case
- Data Modeling case
- Benefits of using GPS/GIS
Components in Pavement Management

Data Acquisition

Data Management

Decision Support

Knowledge Discovery
Data Collection Using GPS/GIS
– Fulton County Case
GPS/GIS-based Data Collection - 1

Fulton County
Computerized Pavement Condition Evaluation System

- Distress Identification
- Field Data Entry & Management
- PACES Manual
- Tutorial
GPS/GIS-based Data Collection - 3

- Can also collect the GPS/GIS data for new streets.
- Can integrate with aerial photo.
Data Management Using GIS – GDOT Case
GIS for Data Integration and Analysis

Click a route on the GIS map to visualize all the associated information.

Common Location Reference System (LRS)
### Pavement Thickness and Material

#### Fulton Dekalb

<table>
<thead>
<tr>
<th>County</th>
<th>Route Type</th>
<th>State Route</th>
<th>Route Number</th>
<th>Route Surface</th>
<th>Project</th>
<th>Pavement Thickness (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fulton</td>
<td>8012</td>
<td>100</td>
<td>200000</td>
<td>200</td>
<td>1224</td>
<td>1.5</td>
</tr>
</tbody>
</table>

#### Material Properties

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</thead>
<tbody>
<tr>
<td>01001</td>
<td>Asphalt</td>
<td>1.5</td>
<td>0.5</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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#### Additional Information

- The profile shown is dated 3/10/2002.
- Milepost Feat: 0
- Milepost To: 1
- Main Scale: 50
- Minor Scale: 25
Visualization and Identification of Project-level Pavement Information
Spatial Analysis for Visualizing and Quantifying Pavement Information for Different Jurisdictions

Total Miles for Projects with Rating Values Less Than and Equal to 80 in Each Congressional District
Network-level Pavement Condition
Data Modeling Using GIS – GDOT Case
Detailed System Information Flow

Central Oracle Database

Download latest pavement projects’ survey data

Set inputs:
1. Network analysis problem type
2. Budget Constraints and/or Performance Constraints
3. Analysis period: n years
4. Select pavement performance model
5. Select pavement distresses forecasting model

Start multi year analysis, set i=0

N

i <= n

Y

Final selection of individual projects with MR&R method and cost

GIS Visualization / Adjustment

Output Results

End

Network Level Analysis

Satisfy balance constraints and/or performance and cost requirements?

N

Y

Calculate network composite rating

Select a project, starting from highest cost effectiveness ratio

Project Level Analysis

Determine future project rating and distress deduct values

Determine MR&R Methods and Costs for all projects

Based on treatment methods, determine all projects’ performance after treatment

Determine all projects’ life cycle cost effectiveness ratios

Summarize network level results

Select a project, starting from highest cost effectiveness ratio

Feedback

Download latest pavement projects’ survey data

Historical Pavement Condition Data

Historical Maintenance Activity Data

MR&R Methods and Costs Data

Historical Traffic Data

Network Analysis Results

Download latest pavement projects’ survey data
Project-Level Results
Dynamic Analysis Using GIS

Impact on Network-Level – Cost

GDOT District-Level Need Analysis Results

Design View

Chart View

Table

Title: GDOT District-Level Need Analysis Results

X Axis: Fiscal Year

Y Axis: Yearly MR&R Cost ($1,000)

Data Range: GDOT District 1

Current: 0

2004: 1390.5
2005: 8595.8
2006: 10458.7
2007: 11652.2
2008: 12378

Adjust Select Project's Treatment(s)

Update Treatment(s)

Project ID: 125

Current Treatment(s):

[Choose necessary sections and updates]

Select a Fiscal Year: 2004

Select a Treatment: Micro Seal

[Options for selection and updates]
Benefits of GPS/GIS

- Improve data collection productivity and data quality.
- Support integration of different data based on their common location reference. This will lead to
  - Easier data access
  - Easier data correlation
  - More accurate performance forecasting
  - More reliable economic analysis
  - Prompter pavement management response
  - More effective cross-asset management
Benefits of GPS/GIS (Cont.)

- Visualize pavement condition such as historical and predicted pavement performance.
- Determine pavement performance at different jurisdiction levels using spatial analysis.
- Determine logic project termini based on pavement condition and network connectivity.
- Facilitate data management and decision making by clicking a route to access all roadway info.
- Integrate with “what-if” analysis and modeling based on different treatment scenarios and balancing constraints to facilitate decision making.
Benefits of using GPS/GIS

- Improve data collection productivity and data quality.
- Facilitate data management and decision making by clicking a route to access all roadway info.
- Integrate with “what-if” analysis and modeling based on different treatment scenarios and balancing constraints to facilitate decision making.
Questions
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