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Vecellio Professor

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VISION AND MISSION

CHAMPS

1. Independent party to assess the privatization of the interstate maintenance activities
2. Ongoing support to Virginia Department of Transportation (VDOT) on asset management practices
3. Research in maintenance contracting and asset management practices
Independent Party to Assess the Privatization of Highway Maintenance

Evaluating the Turnkey Asset Maintenance Services (TAMS)

Assessing the Baseline Condition of the Interstate

Assessing the Contractors’ Performance

Interstate Maintenance Outsourcing Contracts
Independent Party to Assess the Privatization of Highway Maintenance

Assessing the Baseline Condition of the Interstate:

1. Identification of the portion of the highway for which the contractor is going to be fully responsible

2. Identification of assets to be maintained.

3. Definition of performance standards (performance criteria and performance target) for each of these assets.

4. Sweeping the interstate to collect asset condition data within each 0.1 mile long segment using tablet pc and intelligent databases.
Independent Party to Assess the Privatization of Highway Maintenance

Assessing the Contractors’ Performance:

- Data Collection
- Data Analysis

Use of a stratified random sampling method to choose sites

Before conducting field inspections:
- Training sessions

During field inspections:
- Automated audit process
- Periodic meetings with inspection crew and other project members
- Follow-up inspections by QA/QC inspectors

During analysis:
- Comprehensive audit program to avoid any mistakes within reports

A report is submitted to VDOT and results are displayed in WebGIS

At the end of the inspections, the data is analyzed

Raw data is submitted to CHAMPS electronically

Data is processed and posted on the Web

NOTE: This cycle could be performed annually, semi-annually, or quarterly.
Ongoing Support to VDOT in Asset Management Practices

Random Condition Assessment (RCA) Process

- Establish a statewide inventory and condition assessment of a number of asset items
- Use such information to develop and optimize the maintenance budget for the following year

VDOT Districts and Inspected Sites

<table>
<thead>
<tr>
<th>Legend</th>
<th>District</th>
<th>Actual Sites Inspected</th>
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</thead>
<tbody>
<tr>
<td>2006 RCA actual inspected sites (10,811)</td>
<td>Bristol</td>
<td>1221, 1223, 1233</td>
</tr>
<tr>
<td>Interstates</td>
<td>Culpeper</td>
<td>1222</td>
</tr>
<tr>
<td>Primary Roads</td>
<td>Fredericksburg</td>
<td>1224, 1226</td>
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<td>Hampton Roads</td>
<td>Lyndhurst</td>
<td>1224, 1004</td>
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<td>Northern Virginia</td>
<td>Richmond</td>
<td>1222</td>
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<tr>
<td>Salem</td>
<td>Staunton</td>
<td>1221, 1222, 1236</td>
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</tbody>
</table>
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Developing an effectiveness framework to assess the level of service provided by highway maintenance contractors

Quality of Service (Agency/Users Satisfaction)

Level of Service

Timeliness of Response

Cost

Safety

Overall Performance
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Developing a framework to assess the **efficiency** with which the **effectiveness** of maintenance has been achieved.

**Component**

1. Develop the comprehensive list of Controllable Variables
2. Develop the comprehensive list of Uncontrollable Factors
3. Decide on the size of the DMU and the time unit of analysis
4. Refine the comprehensive lists of Controllable Variables and Uncontrollable Factors
5. Address the issue of Uncontrollable Factors

**Sub-Component**

- Prepare the data to be used in the DEA models
- Perform data mining
- Clean the data
- Allocate the data to the DMUs
- Perform data conversion and data rearrangement

The state DOTs should seek all possible ways to measure and improve their "**efficiency**" with which the "**effectiveness**" of road maintenance is being achieved...

- Choose the type of DEA models to be run
- Run the DEA models and obtain the efficiency score, targets and peer(s) for each DMU and the overall efficient frontiers
- Derive overall conclusions that would help the decision making process
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Incorporating customer input into the delivery of maintenance to assess the service quality

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Reliability Coefficients</th>
<th>Items</th>
<th>Factor Loadings</th>
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<td>Q1</td>
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<td></td>
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<td>Q2</td>
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<td>Q3</td>
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<td>Q4</td>
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<td>Q5</td>
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<td>Q6</td>
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<td>Q13</td>
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<td>Q22</td>
<td>68</td>
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</table>
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Developing a GPS-GIS framework to display the condition of the assets within the right-of-way fences

Condition of Paved Ditches on I-95, based on Inspections 2000-2007
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Developing a statistical procedure to inspect a minimal number of samples and generalize the findings to the whole population in an effort to save resources.

**Sampling Theory**

\[
n = \frac{Z^2 \cdot \alpha/2 \left\{ \left( \frac{N_1}{N} \right)^2 \frac{S^2_{PPS,1}}{w_1} + \left( \frac{N_2}{N} \right)^2 \frac{S^2_{PPS,2}}{w_2} \right\}}{e^2}
\]

where:

\[
S^2_{PPS,1} = \frac{1}{N_1 - 1} \sum_{i=1}^{N_1} \frac{a_i / a_T}{1/N_1} \left( Y_i \cdot \frac{1}{a_i / a_T} - \mu_1 \right)^2
\]

\[
S^2_{PPS,2} = \frac{1}{N_2 - 1} \sum_{i=1}^{N_2} \frac{a_i / a_T}{1/N_2} \left( Y_i \cdot \frac{1}{a_i / a_T} - \mu_2 \right)^2
\]

Example:

The condition of the assets within 100 miles of I-95 needs to be assessed.

0.1 mile long sample segments are defined (a total of 2000 segments both ways).

Only inspect 876 segments and generalize the findings to the whole population.
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Developing a Report Card similar to the American Society of Civil Engineer’s Infrastructure Report Card to depict the condition of the highways

### TAMS I-64 Spring 2007 Evaluation

**REPORT CARD for Maintenance Performance**

<table>
<thead>
<tr>
<th>Sections of Interstate</th>
<th>Pavement</th>
<th>Roadside</th>
<th>Drainage</th>
<th>Traffic</th>
<th>Bridge</th>
<th>All Groups</th>
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</thead>
<tbody>
<tr>
<td>I-64 Mainline (Section 1)</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>C</td>
<td>F</td>
<td>F</td>
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<tr>
<td>I-64 Ramps (Section 1)</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>B</td>
<td>A</td>
<td>F</td>
</tr>
</tbody>
</table>

**SCALE**

- **Grade**
  - A
  - B
  - C
  - F

- **Condition**
  - Actual Rating ≥ VDOT Requirement
  - 95% VDOT Req. ≤ Actual Rating < VDOT Req.
  - 90% VDOT Req. ≤ Actual Rating < 95% VDOT Req.
  - Actual Rating < 90% VDOT Requirement
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Using RFID tags to store condition of asset items on the mile marker posts

- **Radio Frequency Identification (RFID)**
- **Same type of technology used in E-ZPass for collecting tolls**
- **Test RFID systems on the Smart Road**
- **Goal:** Determine if RFID technology can store interstate asset information on milemarkers
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Optimizing the maintenance decision-making process

Pavement Condition Index

- **100** Excellent
- **Good**
- **Fair**
- **Poor**
- **20** Very Poor
- **Failed**

- 40% drop in quality
- 75% of life
- $1.00 for PM here
- 40% drop in quality
- 12% of life
- Will cost $4.00 to $5.00 here
QUESTIONS?