THE PROBLEM

Culvert pipes play a vital role in transportation infrastructure by facilitating safe drainage. The ramifications of culvert failures range from a temporary roadway closure to a catastrophic event with the attendant loss of human life. In that regard, the decision making process for preventative maintenance, i.e., to inspect, repair, replace, or no-action is key for both safety and cost savings considerations. However, the current inspection method is very expensive and time consuming. Hence, a new and properly developed Infrastructure Information Management System was developed to address these issues and to meet the Governmental Accounting Standards Bureau (GASB-34) requirements, as well as, saving tax payers’ money.

Collapse of New York State Thruway (I-88) due to culvert failure on June 28, 2006
(New York State Police Photo)
OUR SOLUTION

We analyzed the condition of culverts in NJ, and based on material type, age and expected life and cost of replacement or repair, we can make recommendations to NJDOT for the decision process. The Culvert Information Management System (CIMS) provides fast and accurate information for NJDOT to make decisions on when and how to rehabilitate them.

OUR RESEARCH

The following information was used to make recommendations to Repair, Rehabilitate, Replace or to Do-Nothing at Project as well as Network levels.

- Number of pipes in the network
- Age or date of installation
- Fiscal year to be considered
- Condition State of some of the pipes based on prior inspection
- Expected life and variance for each pipe.
- Current value of the pipe after do-nothing/rehabilitation/replacement
- Cost of additional travel due to road closing
- Cost of inspection for each pipe
- Cost of pipe replacement
- Maximum rehabilitation for each, which includes user cost of failure, new construction cost plus damages associated with pipe failure
- Expected user cost for each pipe

We also enhanced the CIMS by adding the following modules:

*The Culvert Assessment Module*, a module developed to perform financial analysis by summarizing the pipe’s material type, current condition, treatment cost, and relevant date. The Culvert Assessment Module also allows users to modify/update data at any time and automatically make a judgment to save the data by comparing the old and new information.

*Optimization Module*. After determining the treatment techniques for the culvert/pipe
segments under consideration, the user can define project groups and search for the optimal or near optimal solutions for budget allocation. This will be done by the CIMS optimization module.

Additional Screen Shot of CIMS

Other components of CIMS:
- Determination of Critical Sections of the Culvert
- Inspection Frequency
- Inspection
- Condition State
- Prediction of Remaining Service Life
- Rehabilitation options and determining service life of the rehabilitated pipes
- Financial Analysis
FOR MORE INFORMATION CONTACT:

<table>
<thead>
<tr>
<th><strong>NJDOT PROJECT MANAGER:</strong></th>
<th>Stefanie Potapa</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PHONE NO.</strong></td>
<td>(609) 530-2861</td>
</tr>
<tr>
<td><strong>e-mail</strong></td>
<td><a href="mailto:Stefanie.Potapa@dot.state.nj.us">Stefanie.Potapa@dot.state.nj.us</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>PRINCIPAL INVESTIGATOR:</strong></th>
<th>Dr. Jay N. Meegoda</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UNIVERSITY:</strong></td>
<td>New Jersey Institute of Technology</td>
</tr>
<tr>
<td><strong>PHONE NO.</strong></td>
<td>973-596-2464</td>
</tr>
<tr>
<td><strong>e-mail</strong></td>
<td><a href="mailto:Meegoda@NJIT.edu">Meegoda@NJIT.edu</a></td>
</tr>
</tbody>
</table>

A final report is available online at [http://www.state.nj.us/transportation/refdata/research/](http://www.state.nj.us/transportation/refdata/research/)

If you would like a copy of the full report, please call the NJDOT, Bureau of Research at (609) 530-5637 or send an e-mail to Research.Bureau@dot.state.nj.us and ask for: Culvert Information Management System – Demonstration Project

NJDOT Research Report No: FHWA-NJ-2009-017