Meeting the Needs of Today and the Challenges of Tomorrow

NATIONAL PAVEMENT MANAGEMENT CONFERENCE
MAY 6-9, 2007
SHERATON NORFOLK WATERSIDE HOTEL, NORFOLK, VA

FUTURE OF PAVEMENT MANAGEMENT SYSTEMS
By
Ralph Haas
Why the future is important

Is the past relevant to the future?

Future prospects (likely, uncertain and wishful thinking) – Examples

Ideal PMS of the future
WHY IS THE FUTURE IMPORTANT

..... have to build, renew, maintain and manage an infrastructure which can support economic development ..... preserve our quality of life ..... requires search for new and better technologies and processes ..... can be realized in large part by creative individuals, innovation and adequate resources.
### 2005 Report Card for America’s Infrastructure

<table>
<thead>
<tr>
<th>Category</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aviation</td>
<td>D+</td>
</tr>
<tr>
<td>Bridges</td>
<td>C</td>
</tr>
<tr>
<td>Dams</td>
<td>D</td>
</tr>
<tr>
<td>Drinking Water</td>
<td>D-</td>
</tr>
<tr>
<td>Energy</td>
<td>D</td>
</tr>
<tr>
<td>Hazardous Waste</td>
<td>D</td>
</tr>
<tr>
<td>Navigable Waterways</td>
<td>D-</td>
</tr>
<tr>
<td>Public Parks and Recreation</td>
<td>C-</td>
</tr>
<tr>
<td>Rail</td>
<td>C-</td>
</tr>
<tr>
<td>Roads</td>
<td>D</td>
</tr>
<tr>
<td>Schools</td>
<td>D</td>
</tr>
<tr>
<td>Security</td>
<td>I</td>
</tr>
<tr>
<td>Solid Waste</td>
<td>C+</td>
</tr>
<tr>
<td>Transit</td>
<td>D+</td>
</tr>
<tr>
<td>Wastewater</td>
<td>D-</td>
</tr>
</tbody>
</table>

**America’s Infrastructure GPA = D**

**Total Investment Needs = $1.6 Trillion (estimated 5 year need)**

### WE NEED
- Adequate Financing
- Good Management
- Best Technologies
- Security
- Environmental Protection
- Succession Planning

**AND**

Relevant Teaching, Training and Research
TIME HORIZON FOR THE FUTURE

Short Term (10 to 30 Years)

Medium Term (30 to 70 Years)

Long Term (70 to 100 Years+)


## Civil Infrastructure Prospects

<table>
<thead>
<tr>
<th>FUTURE</th>
<th>REASONABLE CERTAINTY</th>
<th>UNCERTAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Term</td>
<td>- Need for clean water</td>
<td>- Use of quantum computing?</td>
</tr>
<tr>
<td></td>
<td>- Continued urban growth</td>
<td>- Population growth levels off?</td>
</tr>
<tr>
<td></td>
<td>- Continued need for effective waste treatment / disposal</td>
<td>- Start of infr. on Mars?</td>
</tr>
<tr>
<td></td>
<td>- Globalization of technology</td>
<td>- Widespread telecommuting?</td>
</tr>
<tr>
<td></td>
<td>- Continued need to transport materials and goods</td>
<td>- Less transport of people?</td>
</tr>
<tr>
<td></td>
<td>- &quot;Super materials&quot;</td>
<td>- Decreased use of petroleum?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Glob. of water market?</td>
</tr>
</tbody>
</table>
FUTURE OF PAVEMENT MANAGEMENT

Does it Have a Future?

Overridden By Asset Management?

Distinct System But Integrated and Continuing Improvements

What Will It Look Like??
DRIVING FORCES
BEHIND THE
FUTURE OF
PAVEMENT
MANAGEMENT
SYSTEMS
1970's ...... Pavement Management
1980's ...... Bridge Management
1990's ...... Asset Management

Why! Why!

Private sector business principles for managing public assets

But: Private sector <-> profit motive
     Public sector <-> many objectives and demands

Result: Adjustments are not simple or straightforward
Today

Asset Management Systems Inc.

BMS  SMS

PMS  TMS
Asset Management Systems Inc.

Who Drives Now?
PAVEMENT MANAGEMENT
SUCCESSSES?

Depend On

Commitment
Understanding the Technology
Application Levels
Succession Planning
Resources
Data
Serving Users
1. Institutional

- Succession Planning
- Integrating PMS with Asset Management
- Adapting PMS to Privatization
2. Technical

- Interfacing Network and Project Levels

- Longer Lasting, Better Quality Pavements

- Performance Models Which Separate Traffic and Environment Effects
3. Economic and Life Cycle

- Quantifying Benefits
- Incentive Programs
- Very Long Term Life Cycle Analysis Protocols

PMS IMPROVEMENT NEEDS (Circa 2000)
FUTURE OF PAVEMENT MANAGEMENT?

INSTITUTE FOR ADVANCED FORESIGHT

Short Term (10 to 30 Years)

Medium Term (30 to 70 Years)

Long Term (70 to 100 Years+)
### Short Term Future Prospects

<table>
<thead>
<tr>
<th>Prospect</th>
<th>Likely</th>
<th>Uncertain</th>
<th>Wishful Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extensive web-based availability of data and information</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Explicit requirements for reporting asset value</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Explicit policy objectives tied to measurable performance indicators and implementation targets</td>
<td>?</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
### SHORT TERM FUTURE PROSPECTS

<table>
<thead>
<tr>
<th>Prospect</th>
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<th>Wishful Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Comprehensive integration platform tying “silos” together</td>
<td>?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>● More P3’s in long term network contracts</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>● Incorp. climate change, resource conservation, noise, etc. into PMS</td>
<td>?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>● Substantive tech. advances (“Smart” pavements, nanotech. application, etc.)</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
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### SHORT TERM FUTURE PROSPECTS

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<th>Prospect</th>
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<th>Uncertain</th>
<th>Wishful Thinking</th>
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</thead>
<tbody>
<tr>
<td>● Widespread protocols for valuing PMS’s, data bases, risk exposure, etc.</td>
<td>No</td>
<td>Yes</td>
<td>?</td>
</tr>
<tr>
<td>● Comprehensive succession planning (people, knowledge and technology)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>● Adequate research funding to advance PMS</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>● Clear recognition and encouragement of the leaders of tomorrow</td>
<td>No</td>
<td>Yes</td>
<td>?</td>
</tr>
</tbody>
</table>
Welcome to the 7th International Conference on Managing Pavement Assets!

The Conference Will Include “THE CHALLENGE”

Investment Analysis and Communication Challenge for Road Assets
Introduction and Scope (demonstration of good practices; emphasis on communication)

Network Description (1293 pavement sections in 2 road classes, 161 bridges, 356 culverts, 45 major signs) and Data Files

Treatments, Service, Lives, Unit Costs, Vehicle Types and Volumes, IRI models, VOC’s, etc.
Policy Objectives

- Quality of Service to Users
- Safety Goals
- Preservation of Investment
- Productivity and Efficiency
- Cost Recovery
- Research and Training
- Communication With Stakeholders
- Resource Conservation and Environmental Protection

With Measureable Performance Indicators and Quantified Implementation Targets
<table>
<thead>
<tr>
<th>Policy Objective</th>
<th>Performance Indicator</th>
<th>Implementation Target</th>
</tr>
</thead>
</table>
| Quality of Service to Users            | ● Network smoothness (% good, fair or poor)  
● Annual user costs ($/km)  
● Provision of mobility (ave. speed by road class) | ● 90% + fair or better  
● Increase ≤ CPI  
● > 50% speed limit |
| Safety Goals                           | ● Accident reductions (%)                                                              | ● Fatalities and injuries by ≥ 1% annually             |
| Preservation of Investment             | ● Asset value of road network ($)                                                     | ● Increase of ≥ 0.5% annually                          |
INTERURBAN NETWORK
(The “Challenge”)

Interurban

<table>
<thead>
<tr>
<th>IRI</th>
<th>Percent of km</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;=1</td>
<td>40.00%</td>
</tr>
<tr>
<td>1&gt;</td>
<td>35.00%</td>
</tr>
<tr>
<td>1.5&gt;</td>
<td>30.00%</td>
</tr>
<tr>
<td>2&gt;</td>
<td>25.00%</td>
</tr>
</tbody>
</table>

Legend:
- Series1

IRI: International Roughness Index

Note: The chart shows the distribution of IRI values across different categories.
RURAL NETWORK
(The “Challenge”)

Rural

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percent of km</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRI &lt;= 1</td>
<td>30.00%</td>
</tr>
<tr>
<td>1 &gt; IRI &lt;= 1.5</td>
<td>35.00%</td>
</tr>
<tr>
<td>1.5 &gt; IRI &lt;= 2</td>
<td>25.00%</td>
</tr>
<tr>
<td>IRI &gt; 2</td>
<td>15.00%</td>
</tr>
</tbody>
</table>

Series 1

[Bar chart showing the distribution of kilometers for different IRI categories in rural networks.]
Financial Accounting: (Book value, based on depreciated as-built cost)

Management Accounting: (Current value, based on written down replacement cost)
KEY ELEMENTS OF AN INTEGRATION PLATFORM

INTEGRATION PLATFORM

CORPORATE DATA BASE AND EXECUTIVE INFORMATION SYSTEM

Location Reference (GIS Base) → Asset Valuation → Level of Service → Risk Exposure
Numerous examples and variations

Some success stories

Some disasters

Not simple; proper structuring, financing, performance requirements, etc. are essential!
buy-in at all levels to policy objectives and implementation targets

leadership with commitment to excellence

extensive data base (long term, reliable, used)

provision of resource needs

seamless implementation at all levels

effectively integrated with AMS

effective communication with all stakeholders

explicit incorporation into agency business plan

“culture” of innovation and advancements
Dr. Susan Tighe, P.Eng, Canada Research Chair and Associate Professor of Civil Engineering, University of Waterloo

Dr. Susan Tighe is currently a Canada Research Chair in Pavement and Infrastructure Management and an Associate Professor of Civil Engineering at the University of Waterloo. She recently received the Young Engineer Award from the Professional Engineers of Ontario. She is an author of over 80 technical publications in pavements and infrastructure and is involved in a number of research projects. She is a member of various Transportation Research Board activities including the LTPP Expert Task Group on Data Analysis, and the Chair of the Subcommittee on Airport Pavement Management Systems. She is the Chair of the Transportation Association of Canada’s, (TAC) Standing Committee on Soils and Materials, and a member of their Standing Committee on Pavements. Susan worked four years for the Ministry of Transportation of Ontario and most recently spent five months in Australia working for a contractor as a senior technical advisor.
Dr. Haas is the Norman W. McLeod Engineering Professor and Distinguished Professor Emeritus at the University of Waterloo. He has lectured and consulted worldwide and authored 10 books and 400 technical papers in the areas of infrastructure, pavements and transportation. Dr. Haas is Founding Director of the University’s Centre for Pavement and Transportation Technology (CPATT). His contributions have been recognized by various honours and awards including the Order of Canada, Fellow of the Royal Society of Canada, Fellow of the Canadian Academy of Engineering and recipient of the Canadian Society for Civil Engineering’s Sandford Fleming Award for “outstanding contributions to research and education in the field of transportation engineering”.