The Big Picture

- PMS Fits into Asset Management
- Funds Shift to Asset Management
- Congestion & Freight
- Cost & Revenue
- Criticality:
  - Superpave
  - Materials
  - Quality
  - Pavement Management
  - Mechanistic Design
Synergy:

1. Asset Management
2. Congestion & Freight
3. Cost & Revenues
Synergy => Premise

A. Asset Management
B. Congestion & Freight
C. Cost & Revenues

A + B + C = \textit{The Perfect Storm}
<table>
<thead>
<tr>
<th>Premise  =&gt; Analogy</th>
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</table>

<table>
<thead>
<tr>
<th>Transportation</th>
<th>Weather</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 40 years</td>
<td>• 6 Days</td>
</tr>
<tr>
<td>• Historic</td>
<td>• Epic</td>
</tr>
<tr>
<td>• 3 Energy Cells</td>
<td>• 3 Energy Cells</td>
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</table>
Transportation

1980  Middle  2020
3 Energy Cells:

Transportation:
A. Asset Management
B. Congestion & Freight
C. Cost & Revenues

Perfect Storm:
A. Hurricane Grace
B. Cyclone
C. Cold Front

A + B + C = THE PERFECT STORM
Hurricane Grace
Extratropical Low
Cyclone

Cold Front

October 28, 1991
Hurricane, Cold Front & Cyclone Converge

Middle of the Storm

October 29, 1991

Hurricane, Cold Front & Cyclone Converge
Storm Drifts West, Strengthening
November 1, 1991

Storm At Maximum Intensity
Superimpose Big Picture

• **PMS Fits into Asset Management**
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    • Mechanistic Design
Hurricane Grace
Asset Management
PMS Definition:

“A set of tools or methods that can assist decision-makers in finding cost-effective strategies for providing, evaluating and maintaining pavements in a serviceable condition”

Source: AASHTO Guidelines for Pavement Management Systems, 1990
Board or Commission

Program Approval

Program Development

Information Processing

Information Gathering
Transportation Asset Management Guide

final report

prepared for
National Cooperative Highway Research Program (NCHRP) Project 20-24(11)

prepared by
Cambridge Systematics, Inc.
with
Parsons Brinckerhoff Quade & Douglas, Inc.
Roy Jorgensen Associates, Inc.
Paul D. Thompson, Consultant

November 2002
Asset Management:

“Transportation Asset Management is a strategic approach to the optimal allocation and utilization of resources for the management, operation, preservation, and expansion of transportation infrastructure.”
Asset Management Framework

Policy Goals and Objectives, Performance Measures
Examples: Transportation System Performance (including Customer perceptions), Economic, Social/Environment

Planning and Programming
*Options, Project Evaluation, and Tradeoff Analyses Across (Examples)*

<table>
<thead>
<tr>
<th>Asset Classes</th>
<th>Investment Categories</th>
<th>Funding Types</th>
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</thead>
<tbody>
<tr>
<td>Pavement</td>
<td>System Preservation</td>
<td>Capital</td>
</tr>
<tr>
<td>Bridge</td>
<td>Operating Efficiency</td>
<td>Operations</td>
</tr>
<tr>
<td>ITS</td>
<td>New Capacity</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Transit</td>
<td>Safety</td>
<td></td>
</tr>
<tr>
<td>Rail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port</td>
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</tbody>
</table>

Program Delivery
Examples: Intergovernmental Agreements, Outsourcing, Procurement Options

Systems Monitoring and Performance Results

Quality Information and Analysis
Examples: Inventory, Condition, Performance
PMS in Asset Management

Policy Goals and Objectives, Performance Measures
Examples: Transportation System Performance (including Customer perceptions), Economic, Social/Environment

Planning and Programming
Options, Project Evaluation, and Tradeoff Analyses Across (Examples)
Asset Classes
- Pavement
  - Bridge
  - ITS
  - Transit
  - Rail
  - Port
Investment Categories
- System Preservation
- Operating Efficiency
- New Capacity
- Safety
Funding Types
- Capital
- Operations
- Maintenance

Program Delivery
Examples: Intergovernmental Agreements, Outsourcing, Procurement Options

Systems Monitoring and Performance Results

Quality Information and Analysis
Examples: Inventory, Condition, Performance
### Historical Perspective

<table>
<thead>
<tr>
<th>1980</th>
<th>2000</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>React</td>
<td>Asset Management</td>
<td>Strategic</td>
</tr>
<tr>
<td>Tactical</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Pavements ‘Я’ Us Generation

1980 — 2000
‘R’ => Reactive Resurfacing Restoration Rehabilitation Reconstruction
Pavements ‘Я’ Us

- End of Structural Life
- Underestimated ADT, Truck Loads, Cost
- Marginal Designs and Materials
- Worst First
- Lowest Initial Cost
- Era:
  - Get In…
  - Stay In…
  - Keep Going Back…
Big Picture

• PMS Fits into Asset Management

• **Funds Shift to Asset Management**

• Congestion & Freight

• Cost & Revenue

• Criticality:
  • Superpave
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Widening

New Roads and Bridges

Asset Management

$ Billions (2000 Dollars)

1980 2000 2020
Combining Widening into New Roads & Bridges

- Asset Management
- New Roads and Bridges

$ Billions (2000 Dollars)

<table>
<thead>
<tr>
<th>Year</th>
<th>1980</th>
<th>2000</th>
<th>2020</th>
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</thead>
<tbody>
<tr>
<td>Value</td>
<td></td>
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</tbody>
</table>
Combining Widening into Asset Management

Asset Management

New Roads and Bridges
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Hurricane, Cold Front & Cyclone Converge

Middle of the Storm - 2000

Asset Management

Congestion

Hurricane, Cold Front & Cyclone Converge
VMT => Double 2020

- VMT (Vehicle Miles Traveled)
- Lane Miles

Graph showing the increase in VMT and Lane Miles from 1980 to 2020.
Congestion

Aver. Veh./Lane Mile/Day


0 200 400 600 800 1000 1200 1400 1600 1800
Congested Highways 2000

Source: U.S. DOT Freight Analysis Framework Project
Source: U.S. DOT Freight Analysis Framework Project
Virus

SARS $\Rightarrow$ CARS
Tonnage => Double 2020

- Freight Tonnage
Truck Volumes, 2020
Interstate and NHS
<table>
<thead>
<tr>
<th>Year</th>
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<th>Strategic</th>
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<tr>
<td>2020</td>
<td></td>
<td>Asset Management</td>
<td></td>
<td>Strategic</td>
</tr>
</tbody>
</table>
Maxed Out!

1. Vehicles /Lane Mile
2. Right-of-way
3. Rush Hours
4. HOV
5. ITS
6. Transit
7. Rail
Beltway Syndrome

Outer-Outer Beltway

Outer Beltway

Inner Beltway

City
Big Picture

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Storm Drifts West, Strengthening

Cold Front

Cost & Revenue
Driving Cost:

1. Congestion (People) Volume
2. Freight (Goods) Loads
Highway – Transit - Rail

1. Build New Capacity
2. Widen & Beef Up
3. Preserve & Optimize
### Cost Distribution

<table>
<thead>
<tr>
<th></th>
<th>Highway</th>
<th>Transit</th>
<th>Rail</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>New</strong></td>
<td>⭐️</td>
<td>⭐️</td>
<td>⭐️</td>
</tr>
<tr>
<td><strong>Widen</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Optimize &amp; Preserve</strong></td>
<td></td>
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</table>
Cost Coefficients

Preserve

Widen

Construct New

?
Revenue
3 Classic Scenarios
Revenue

Will: People
    Politicians
    Administrators

Economy: Bull vs. Bear

Sources: Taxes, etc.

Distribution: Apportionment (Formula)
    Earmarks
    Allocations
Steady State Cost Distribution

Sinusoidal Funding
Big Picture

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- Cost & Revenue

- **Criticality:**
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  - Mechanistic Design
2 Choices \{ \text{Sail into Storm} \quad \text{Avert Storm} \}
Choice #1
Repeat History: Sail into Storm
Choice #2
Avert the Storm:

1. Premium Pavements
2. Significantly Outperform Past Pavements
3. Strategically Plan => 20 Years
Avert Perfect Storm:

Asset Management => Strategic Principles

3 Primary Functions:
1. Where
2. When
3. How Much
1. Where?

Congestion
Loading}
Links

Aggregate by Link:
• Corridor
• Region
• State
• National
2. When?

Remaining Service Life (RSL)
3. How Much Cost?

Cost Distribution

\{ \text{Highways} \}
\text{Transit} \\
\text{Rail} \\

Cost Coefficients$^{1}$

\{ \text{New} \\
\text{Widen} \\
\text{Preserve} \}
3. How Much Cost?

Cost Coefficients$^2$ \{ Superpave Mechanistic Design Materials \}

Cost Coefficients$^3$ \{ Night Construction Accelerated Quality \}
Get In...
Stay In...
Keep Going Back...
Worst Case Scenario

• Engineering
• Asset Management
• Accountable
• Make Case
• Revenue
THE PERFECT STORM