

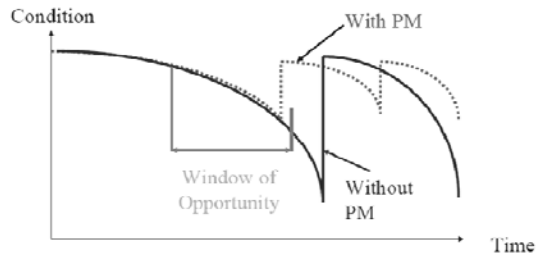
Pavement Preservation
Integrating
Pavement Preservation Practices
and
Pavement Management

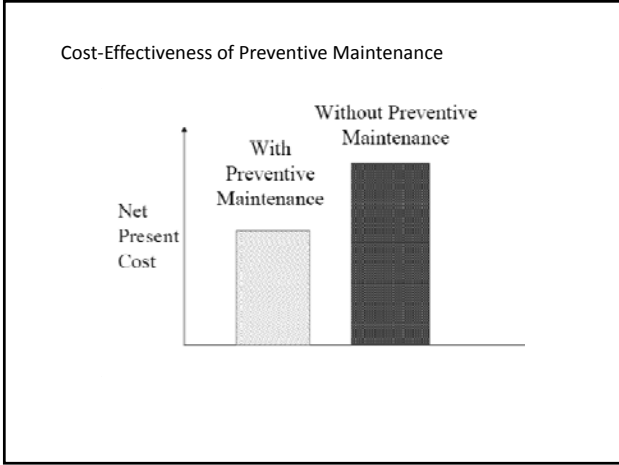
Importance of Integration

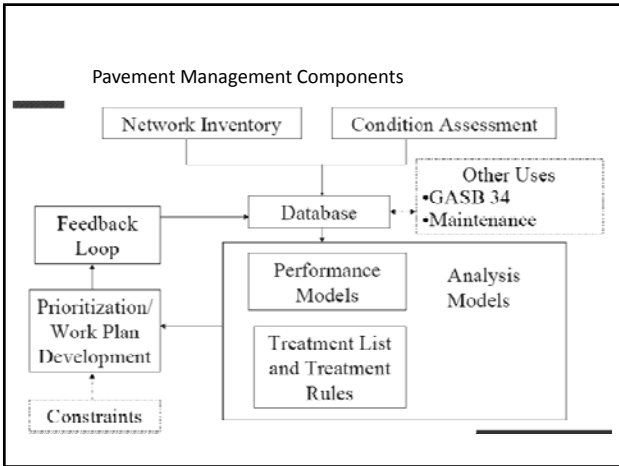
Key Concepts

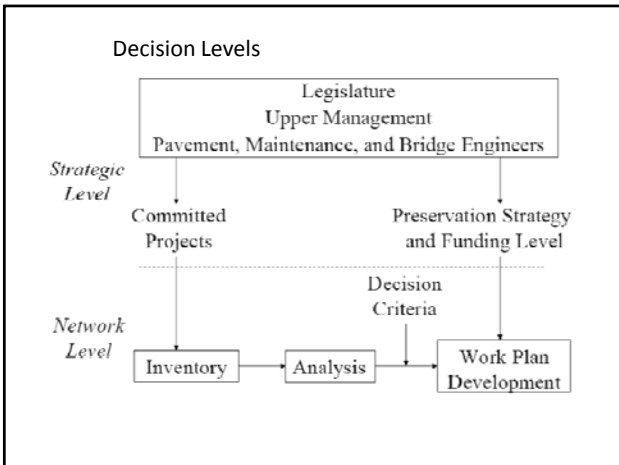
- Pavement Preservation
- Preventive Maintenance
- Pavement Management
- Pavement Management System
- Integration

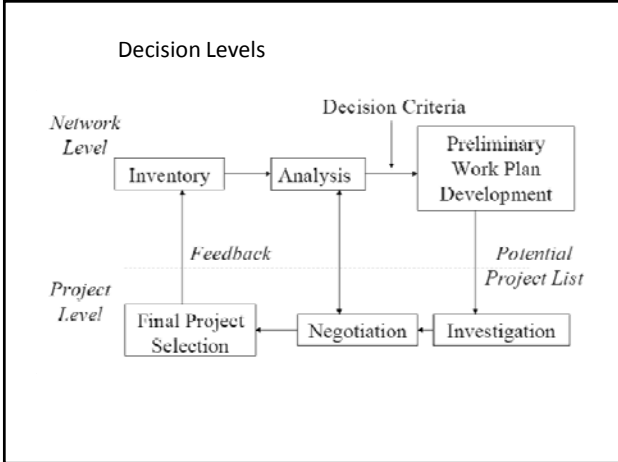
Importance of Preventive Maintenance









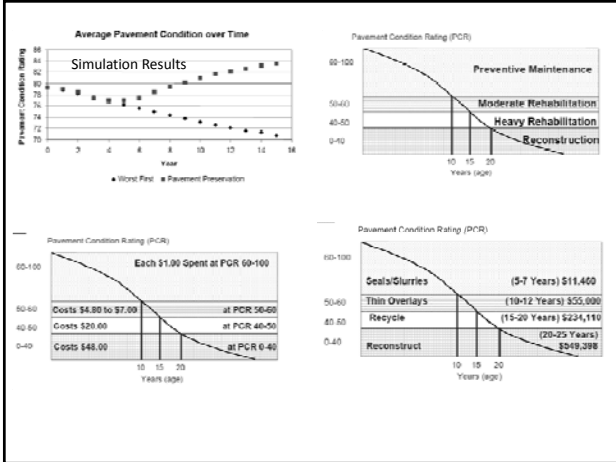


Decision Levels

- At what level is network condition information collected?
- At what level are funding levels established?
- At what level are candidate projects established?
- At what level are projects designed?
- Which level typically uses the most detailed information?

Use of Pavement Management to

- Support Preventive Maintenance
- Demonstrate the benefits associated with preventive maintenance
- Estimate funding needs to achieve specific targets or goals
- Allocate available funding cost-effectively Identify and prioritize treatment needs



Integration Requirements

- Method of identifying preventive maintenance needs
- Models that reflect future pavement performance with and without preventive maintenance treatments
- Prioritization process that considers preventive maintenance
- Analysis period long enough to display the impact of preventive maintenance

Integration Gaps

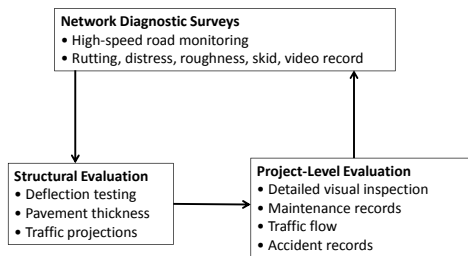
- Not tracking maintenance histories and performance
- Not collecting data to support preventive maintenance treatment selection and timing
- Maintaining independent databases
- Others?

Why Address Integration Issues?

- Develop a more coordinated work plan to accomplish agency goals
- Better demonstrate the benefits in using preventive maintenance treatments
- Keep the decisions at the appropriate level within the agency
- Make better informed decisions about treatment needs

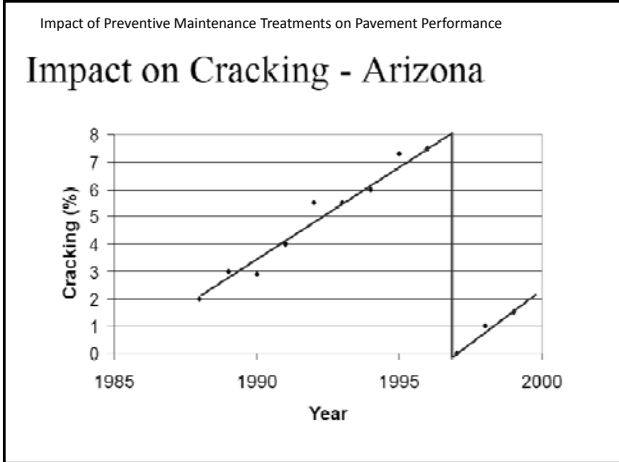
Project-Level Performance Issues

Level of Detail Comparisons



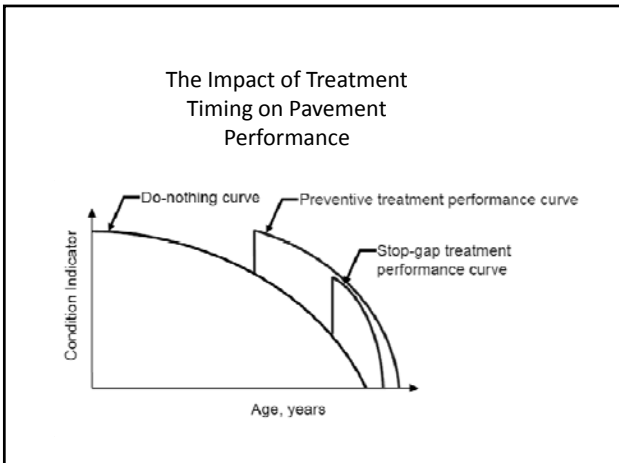
Questions to be Addressed

- Is it structurally adequate?**
- Is it functionally adequate?**
- Is the rate of deterioration normal?**
- Are the materials durable?**
- Is drainage adequate?**
- Has previous maintenance been normal?**
- What geometric factors are important?**

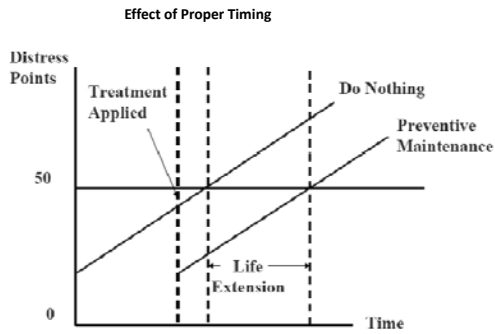


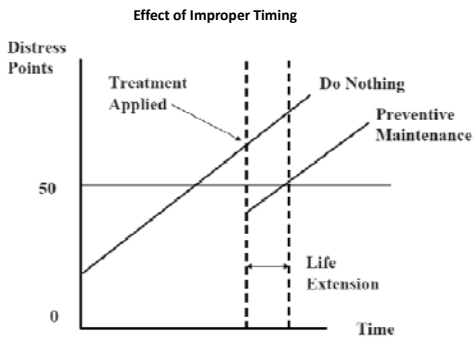
Reductions in IRI Rate of Change Due to Maintenance Expenditures

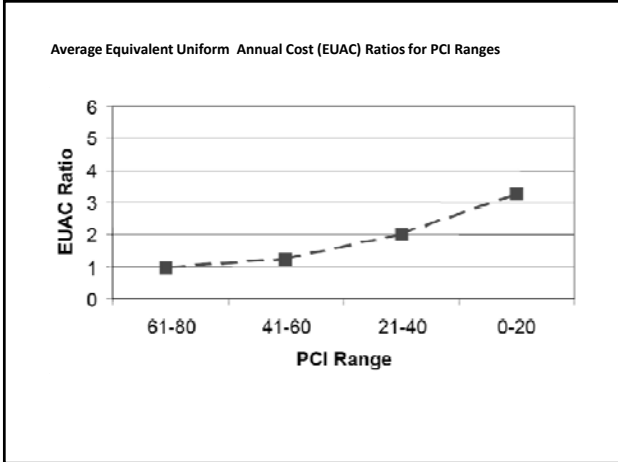
Increase in Expenditure Level (\$/lane mile/year)	Patching and Joint and Crack Sealing	
	North	South
\$50 to \$100	0.29	0.19
\$100 to \$150	0.17	0.11
\$150 to \$200	0.12	0.06
\$200 to \$250	0.10	0.05
\$250 to \$300	0.07	0.04



Suggested Optimal Timing
Fog seals, 1 to 3 years
Crack seals, 2 to 4 years
Chip seals, 5 to 7 years
Slurry seals, 5 to 7 years
Thin overlays, 5 to 10 years







Strategies to Assist With Timing
Earlier thresholds
Quick delivery contracts

Links to the Network-Level
Guidelines for using treatments
- Preventive maintenance manual
Compatible data collection efforts
- Frequency and timing of surveys
- Availability of desired information
- Accuracy of survey data

Network Modeling and Analysis Tools

Approaches to Integration -1
Establish treatment rules for rehabilitation and reconstruction
Pavement sections that are NOT candidates for rehabilitation or reconstruction are candidates for maintenance

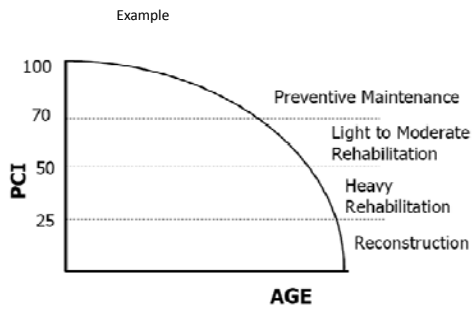
Rehabilitation and Reconstruction
OR
Preventive Maintenance Candidate

Approaches to Integration - 2

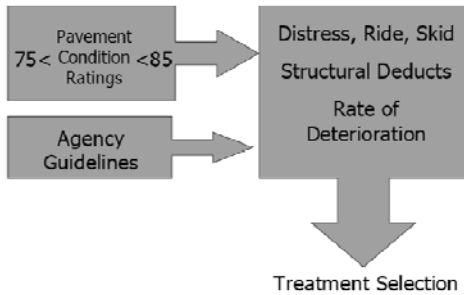
Preventive maintenance treatments are considered collectively as a treatment and the specific treatment is not identified

Treatments Considered

- Preventive Maintenance
- Thin Overlay
- Mill and Fill
- Structural Overlay
- Reconstruction



Ohio Department of Transportation



Treatment Rules Based on Timing

Rehabilitation and reconstruction activities are triggered based on condition information

Preventive maintenance treatments are triggered based on time since last activity

Approaches to Integration – 3

Specific preventive maintenance treatments are recommended based on information available in the pavement management system

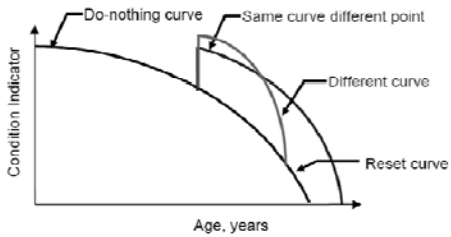
Improvements in Condition

Add points

- Change distress severity
- Medium and high severity cracks go to Low severity after crack sealing
- Corresponding changes to indexes are calculated and used to establish rules



Change in Rate of Deterioration



Pros and Cons to Approach 3

- Allows an agency to incorporate treatment selection with project identification
- Models can be more specific to the treatment
- Requires more supporting information in the pavement management system

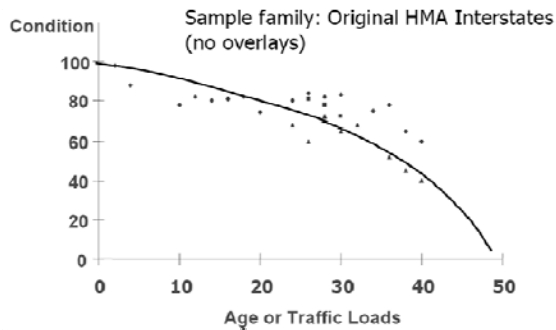
Condition Surveys and Condition Index Calculations

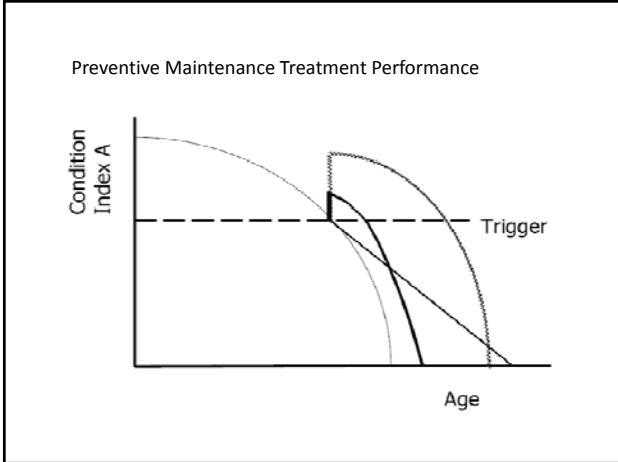
- Types of distress surveyed
- Use of individual versus composite indices
- Frequency of surveys
- Others?

Pavement Performance Models

- Ability to develop distinct curves for each treatment and condition index
- Availability of necessary information in the database

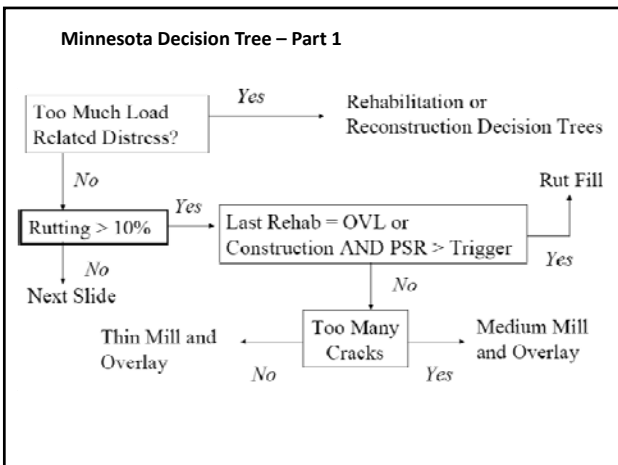
Family Modeling Approach



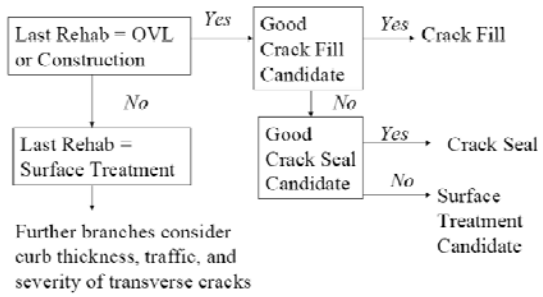


Treatment Rules

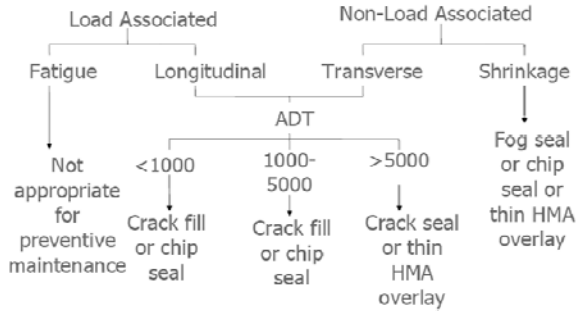
- Treatment Feasibility Rules
- Decision trees
- Treatment cycles
- Treatment Reset Rules
- Construction Cost Rules



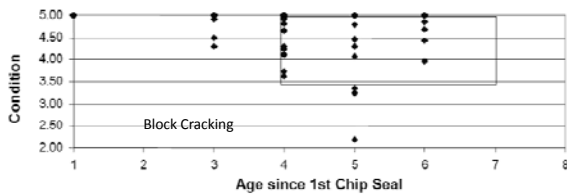
Minnesota Decision Tree – Part 2



Decision Tree for Cracking



Checking Treatment Triggers

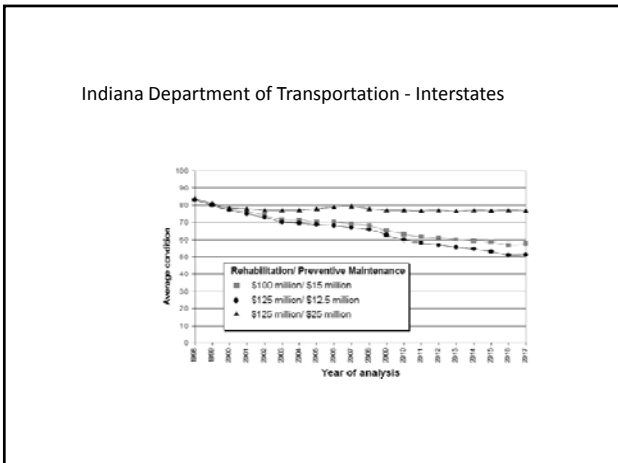


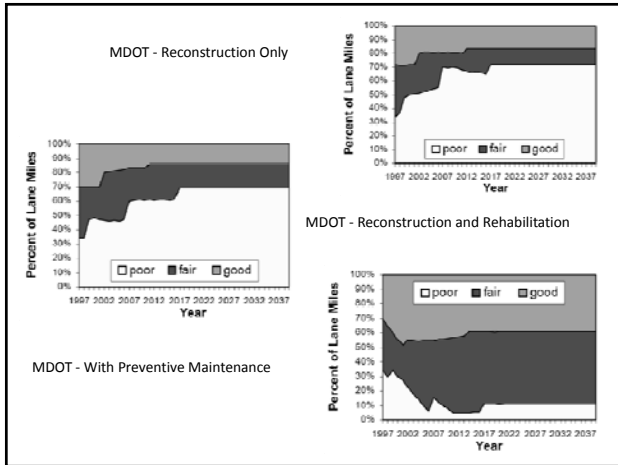
Impact of Maintenance on IRI

Activity	Mean Change in IRI	Adjusted Mean Change in IRI
Joint and crack filling	-0.294	-0.432
Joint and crack sealing	-0.225	-0.340
Full depth patching	-0.515	-0.570
Microsurfacing	-0.292	-0.324

Impact of Maintenance on a Condition Index

Description	Mean Observed Change in PCI	Mean Change in PCI After Correction
Full-depth patching ACC/PCC	1.08	3.50
ACC partial-depth patching	1.00	5.72
Microsurfacing	2.10	4.76
Pavement fog seal	1.00	6.47

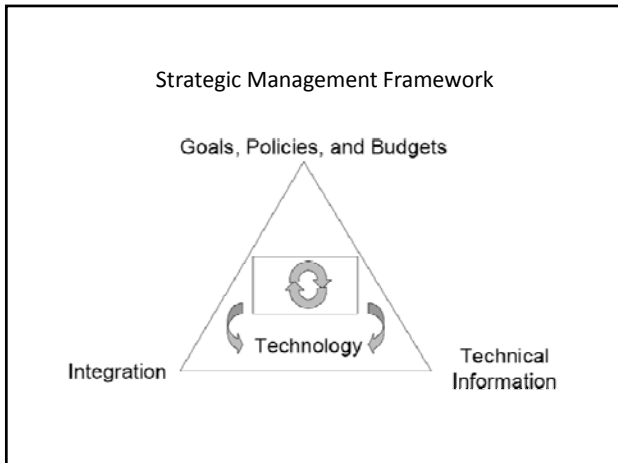


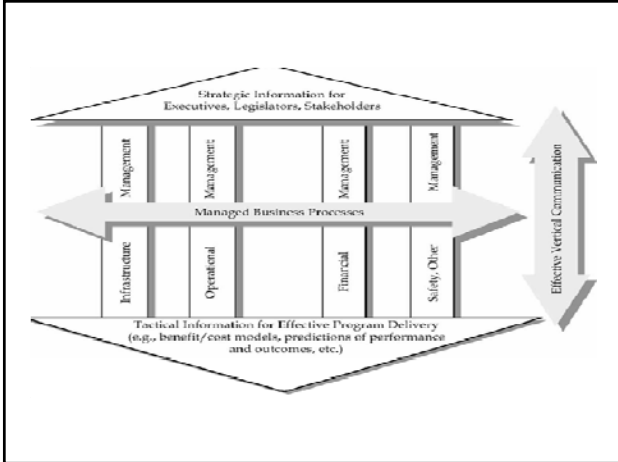


Incorporating Pavement Preservation into Strategic Decisions

Strategic-Level Issues

- The establishment of performance criteria for various road classifications
- The distribution of funding levels by district, including both targeted and actual funding levels
- The evaluation of trade-offs between the expansion of the network versus preservation of existing systems





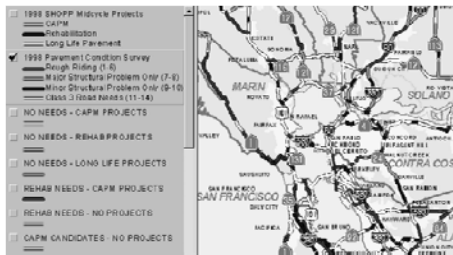
Legislative Involvement

Pennsylvania DOT: "...Governor now has a maintenance-first philosophy, and he is putting his money where his mouth is"
 North Carolina DOT: Requires reporting of conditions and costs
 California DOT: Reduce backlog from 14,300 lane miles to 5,500 lane miles

Establishing Goals and Budgets

Indicate the objective for the program in terms of what will be achieved and when it will be accomplished
 Example: Michigan set a 10-year goal for 95% of its expressways and 85% of its non-expressways to be in fair or good condition
 Monitor the progress towards the goal

CALTRANS GIS Map



NCDOT Maintenance Performance Measures - Primary

ELEMENT 1			Service Level					Acceptable Level of Service
Roadway Pavement			A	B	C	D	F	
Activities	Condition/Indicator	Performance Measure	Threshold	Threshold	Threshold	Threshold	Threshold	
Pavement Maintenance	Pavement Condition Rating	PCR	96	93	86	70	<70	C

ELEMENT 2			Service Level					Acceptable Level of Service
Unpaved Shoulders and Ditches			A	B	C	D	F	
Activities	Condition/Indicator	Performance Measure	Threshold	Threshold	Threshold	Threshold	Threshold	
Low Shoulder	Low_2inches	FT	1%	2%	8%	11%	>11%	C
High Shoulder	High_2inch	FT	1%	4%	8%	10%	>10%	C
Lateral Ditch	Blocked_50%not last redesigned	FT	2%	8%	9%	12%	>12%	C
Lateral Ditch Erosion	Erosion_11	FT	1%	2%	3%	4%	>4%	A

Statewide average

Maintenance Activity	Level of Service			
	A	B	C	D
Pavement				
Pavement				
Unpaved Shoulders and Ditches				
Low Shoulder				
High Shoulder				
Lateral Ditch				
Lateral Ditch Erosion				
Drainage				
Cross-drain Pipe				
Driveway Pipe				
Curb & Gutter				
Curb Basins & Drop Inlet				
Other Drainage Features				
Roadside				
Mowing				
Brush & Tree Control				
Leak & Ditch				
Slope				
Guardrail				
Traffic Control Devices				
Traffic Signs				
Pavement Striping				
Ways & Symbols				
Pavement Markers				
Environmental				
Turf Condition				
Misc. Vegetation Management				

Minnesota DOT

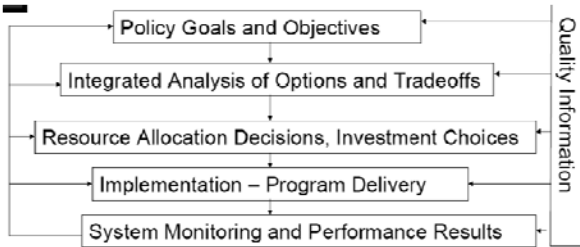
Set a funding goal of \$40 million based on information provided by the pavement management system
 Established procedures for distributing money to the districts and assisting the districts with project and treatment selection

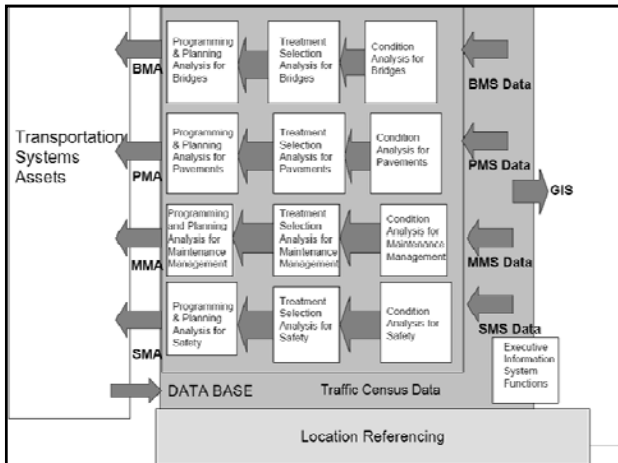
NY State Transportation Commissioner
 "The citizens and taxpayers that use our transportation system expect excellence, integrity, reliability, and sustainability to be reflected in the decisions public officials implement on their behalf. ...More use of technical tools to quantify the economic efficiency of proposed investment alternatives will help transportation executives meet these expectations."

Transportation Asset Management

Defined as a strategic approach to allocating resources for the preservation, operation, and management of our Nation's transportation infrastructure
FHWA emphasis on the use of asset management concepts for system preservation activities

Role of Management Systems in Supporting Asset Management Decisions





Implementation Concepts

Implementation Issues
Technical issues
Institutional issues
Organizational issues

Inability to Track Maintenance

Multiple Referencing Systems

Guidelines for Selecting a Common Reference System

- Pick a system that is attribute and application neutral
- Get help and do it quickly
- Leverage other efforts

Lack of Support for Early Intervention

- Shorten the time between project identification and construction
- Public perception issues

Lack of Performance Data

- Treatment histories
- Treatment objective
- Preventive
- Stop-gap
- Treatment cost
- Do-nothing performance curves

Observations on Pavement Management Databases

- A pavement management analysis limits the amount of data stored
- Subsurface pavement thickness and material information is often missing
- Traffic load data is missing
- Other useful information is missing

Lack of Integrated Databases

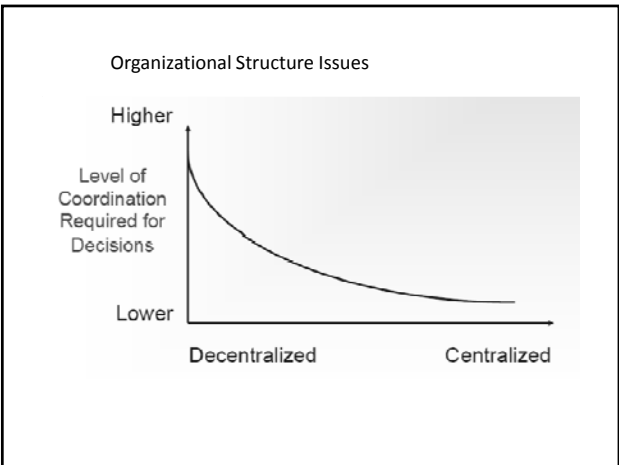
- Multiple sources of data within an agency
- Data integration
- Data warehousing
- Linking databases

Duplication of Effort

- Improve efficiency and consistency
- Example: Level of Service (LOS) and pavement condition surveys

understanding the Pavement Management System

- Understand the decision process
- Understand the impact maintenance activities have on treatment selection
- Be sure decisions are being made at the appropriate level



Developing an Action Plan

- Benchmark existing practices
- Identify steps needed to be taken
- Prioritize the steps
- Prepare the action plan

Benchmarking Practices

Strongly Disagree Strongly Agree

A1: Agency pavement preservation policies are supported through the use of pavement management activities

A2: The agency's capital maintenance funding allocations for roads are based on an assessment of pavement needs

Identify and Prioritize Actions

- Where do gaps exist between good practice and agency practice?
- What steps can the agency take to reduce the gaps?
- Which issues are organizational issues and which are local issues?
- Which actions will have the greatest immediate benefit to the agency?

Guidelines

- Start small and build gradually
- Involve as many stakeholders as possible
- Recognize change doesn't happen immediately
- Promote the plan and build acceptance
- Document and promote progress

Long-Term Research

- Performance studies
- Technology transfer/sharing results
- Data integration issues

Maintaining an Integrated Approach

- Develop a feedback loop
- Link Manuals of Practice to pavement management treatment selection
- Develop a steering committee
- Diagram relationships between sources of data and users
- Other ideas?

Key Points

- Importance of preventive maintenance
- Role of pavement management in supporting a preventive maintenance program at the project, network, and strategic levels
- Integration is a key to developing coordinated pavement preservation plans