Pavement Management Systems (PMS)

Topics to be Covered

- **Introduction: Why Pavement Management?**
- **What is a Pavement Management System?**
- **How PMS Works**
- **Repair Strategies and Repair Alternatives**
- **Preventive Maintenance**
- **Cost of Delaying Maintenance**
- **PMS Software Components**

Why Pavement Management?

$$$$ It's all about money $$$$$

Problem Statement

- **Existing pavements are aging**
- **New pavements are being added**
- **Increased use/degradation**
- **As pavements degrade, repair/ replacement costs increase exponentially**
- **Money Trees don't exist**

Budgets can't keep up

Pay Now or Pay Later

Now, we are faced with the choice of:

- **Preserving these valuable assets at reasonable cost,**

OR

- **Deferring maintenance and have to prematurely replace these assets at a much higher cost**

Typical Management Practices

- **Standard Program**
- **Squeaky Wheel**
- **Worst First**
- **Political Pressure**
- **Gut Feel**

Shortfalls

- Two major problems with these methods:
  1. Focuses on the Roads in Bad Shape
  2. Subjective
- Does not maximize the investment

Pavement Management

The Solution: *System Preservation*
- A rational, systematic approach
- A Maintenance Management System

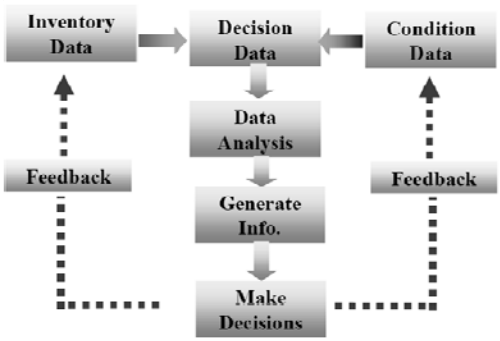
Most Commonly called:
Pavement Management System

Pavement Management
- Planning tool
- Collects and monitors information on current pavement conditions
- Evaluates alternative repair strategies
- Prioritizes selected repairs

Pavement Management

- When properly implemented, it provides:
  – Necessary information for decision-makers to be well informed
  – Understand the long-term consequences of short-term budgeting decisions.
- With this planning tool, decision makers can act to preserve road assets

PMS Flow Chart

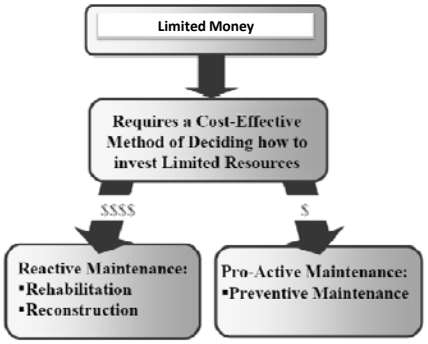


What can PM do?

Answer questions such as:

- What is the current condition of the roadway network?
- Which roads should be repaired first?
- What techniques should be used for best results?
- What are the projected long-term consequences if we delay or defer repairs?

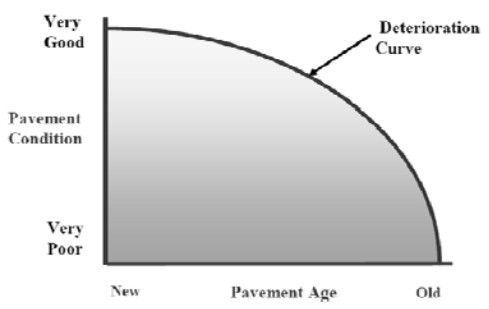
Investing Wisely



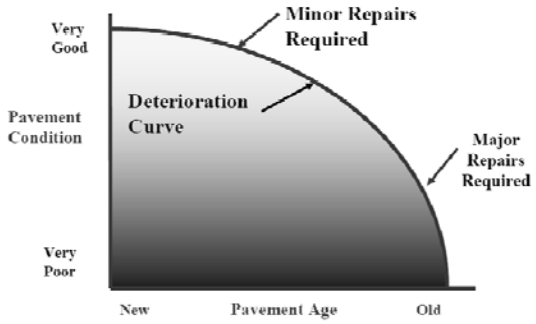
How PMS Works

- **One of the main goals:**
  - **Select the type of repair that is most cost effective for the condition of each pavement.**
- **Selection is based upon the current condition of the pavement.**
  - **This is best illustrated using the deterioration curve.**

Deterioration Curve



Minor vs. Major Repairs

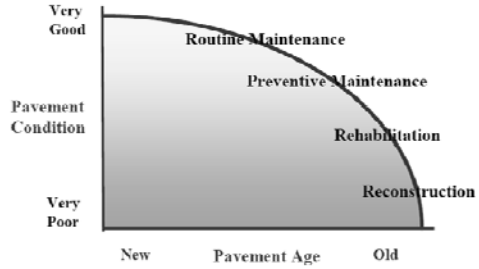


Repair Strategies

Repair Alternatives can be grouped:

- **Routine Maintenance**
- **Preventive Maintenance**
- **Rehabilitation**
- **Reconstruction**
- **Defer Maintenance**

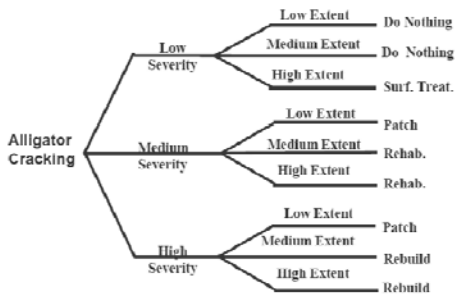
Strategies vs. Condition



Decision Trees

- **Used to select the Appropriate Repair Strategy**
  - **Relates the different levels of severity and extent of each distress with the appropriate repair strategy**

Typical Decision Tree



Decision Trees

Example:

Severity/Extent	Repair Strategy
High Severity/Low Extent:	Patching
High Severity/High Extent:	Rebuild

Repair Strategies

As stated earlier, Repair Alternatives can be grouped:

- **Routine Maintenance**
- **Preventive Maintenance**
- **Rehabilitation**
- **Reconstruction**
- **Defer Maintenance**

Routine Maintenance

- **Localized repairs**
  - **Used to prevent further distress**
- **Usually applied as needed or yearly**
- **Techniques include:**
  - **Crack Sealing**
  - **Patching**

Preventive Maintenance

- **Surface Treatments**
  - **EXTEND SERVICE LIFE**
  - **Any treatment less than 1 (1 1/2) inch thick**
- **Intended to provide 1 or more of the following:**
  - **Long lasting, economical surface**
  - **Prevent water infiltration**
  - **Slow down oxidation/raveling**
  - **Restore skid resistance**

Types of Surface Treatments

In order of Cost & Life Expectancy:
- **Fog Seal**
- **Sand Seal**
- **Chip Seal (Oil & Chip)**
- **Slurry Seal**
- **Micro-Surfacing**
- **Thin Overlay**

Surface Treatments

- **Most Cost-Effective when used as a Preventive Maintenance Technique**
  - **Slow down the aging process**
- **"Seal in the freshness"**
  - **When applied to a properly designed and constructed road, surface treatments can significantly extend the life of pavements**

Rehabilitation

- **Used to:**
  - **Increase structural capacity**
  - **Structural deficiencies**
- **Rutting**
- **Fatigue cracking**
- **Added Benefit - Restores the surface**
  - **Seals cracks**
  - **Retards oxidation/raveling**
  - **Restores skid resistance**

Rehabilitation

- **Types:**
  - **Thick overlays**
  - **Milling and overlay**
  - **Hot in-place recycling**
- **Recycles only the surface**
- **All weak spots must be repaired**
  - **Same as surface treatments**

Deferred Maintenance

- **These roads are typically beyond the point where preventive maintenance will be effective, but not yet to the point of needing rehabilitation.**

Reconstruction

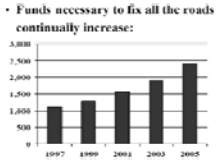
- **Pavement with severe deterioration**
  - **Overlays and surface treatments are not cost-effective**
- **All deficiencies must be improved:**
  - **Weak soils**
  - **Contaminated aggregate base courses**
  - **Poor Drainage**
  - **Soils susceptible to capillary action or freeze/thaw**

Reconstruction

Three main types :
- **Traditional reconstruction**
- **Cold in-place Recycling**
- **Full-depth reclamation**

Preventive Maintenance

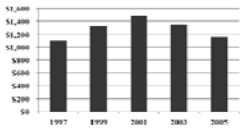
Worst First policy
- **Focusing on roads in the worst shape quickly deplete a maintenance/repair budget**
  - **Expensive repairs leaves little or no money for routine/preventive maintenance**
  - **This allows many streets to deteriorate for the sake of fixing a few**



Best-First Policy

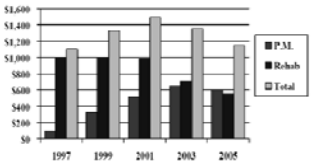
- **Why extend Pavement Life?**
  - **Because it Maximizes the Return on the Taxpayers Investment**
- **Pavements represent a multi-million dollar investment to every agency**
  - **WE MUST PROTECT IT!**
- **Extends pavement life in a Cost-Effective Manner**
- **Benefits**
  - **Extend Service Life**
  - **Enhance Safety**
  - **Improve Ride Quality**
  - **Low Cost Treatments**

- **Over time, if roads are properly maintained, the overall maintenance/rehab costs should reduce:**



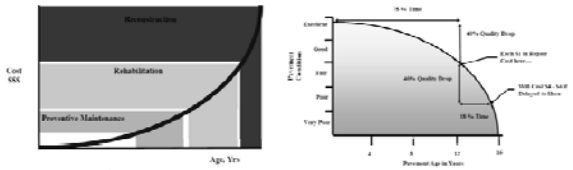
Balanced Approach

- **In the real world, it is acknowledged that not all of the budget can be spent on the roads in "good condition."**
- **However, in order to reduce the long-term maintenance/repair backlog, agencies must start a maintenance program and continue to increase funding over time.**
- **Otherwise, the maintenance/repair backlog will continue to increase rapidly**

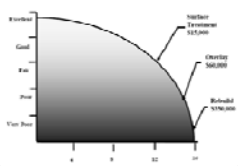


Timing is critical.

Relationship of Condition vs. Repair Costs

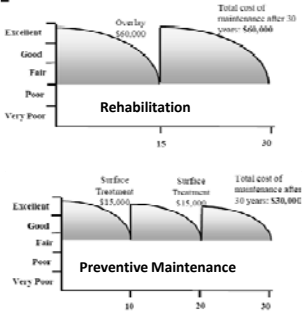


Cost of Delaying Maintenance



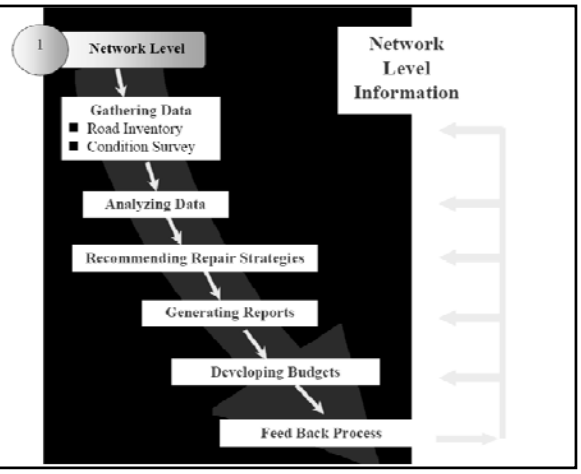
Example

• The following is a "simple" illustration intended to show the concept of saving money by using less costly, properly-timed preventive maintenance techniques.



Network-Level Management

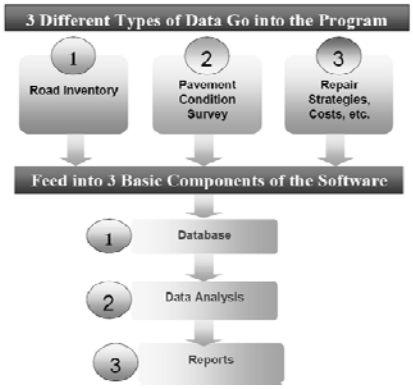
• Overall road system
• Approximate Costs
– Average values : actual costs depend on many factors including project size
• Scope of Work
– Based on Windshield Survey
– Requires Project-Level Analysis to finalize
• Scope of Work
• Budget
• Network Level Planning Information



Project-Level Management

Once Candidate Roads are selected through Prioritization:
- **Examined more closely to determine:**
  - **Exact scope of work**
  - **More accurate cost estimate**
- **With more accurate information:**
  - **The number of roads to be repaired may need to be revised**

PMS Software Components



Road Inventory

- Defines the physical characteristics for each road.
  - Stored in road inventory files in the PMS database.
  - Each road is divided into manageable sections called "road segments."
- The data for each road segment includes such information as:
  - Segment Identification
  - Starting Point & Stopping Points
  - Width
  - Length
  - Surface Type
  - Traffic data

Condition Survey

- A windshield survey of each segment
- Visually looking for indications of distresses, including:
  - Cracking
  - Distortion
  - Disintegration
  - Skid Hazard
  - Drainage Problems
- Common Asphalt Concrete Pavement Distresses include:
  - Alligator (Fatigue Cracking)
  - Block Cracking
  - Environmental (Transverse) Cracking
  - Potholes/Patches
  - Raveling

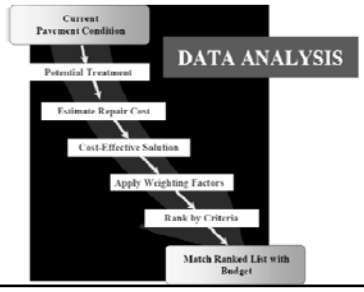
Decision Making Info

In addition to inventory and condition data, decision making info is required, including:

- Repair Strategies
- Repair Alternatives
- Repair Costs
- Decision Trees

Data Analysis

- The Pavement Management System software contains analysis tools that will:
  - Identify potential repair alternatives for each segment
  - Calculate the associated estimated repair costs
  - Select the most cost-effective solution for each road segment
  - Prioritize potential projects for budgeting



Reports

- **Variety of Formats:**
  - **Pie Charts**
  - **Bar Graphs**
  - **Tables**
- **Querying Capabilities**
  - **Districts**
  - **Type of Pavement**
  - **Age or Condition of Pavement**

Pie Chart

Graphs