

Pavement Management for Local Agencies

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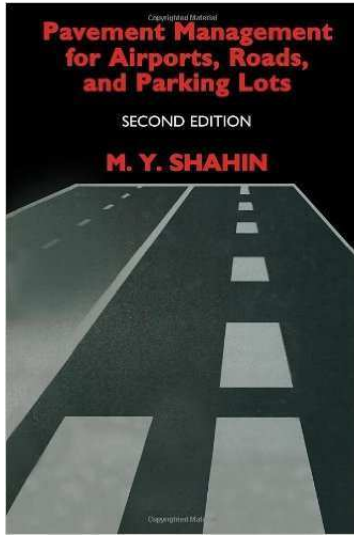
Overview

- Pavement Management Concepts
- Benefits of a Pavement Management System
- PMS Components
- Intro to the PCI Method
- PMS Data Analysis
- PMS Output
 - Project Prioritization
 - Maps

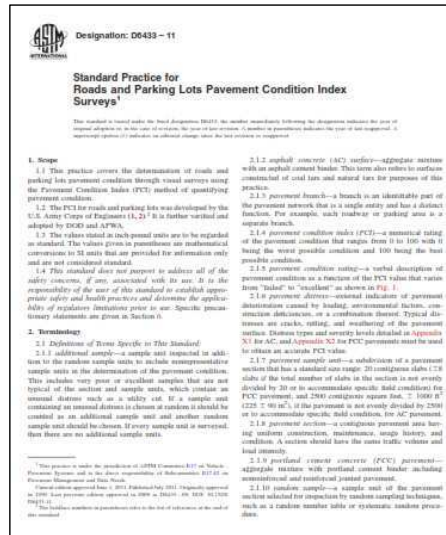


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References

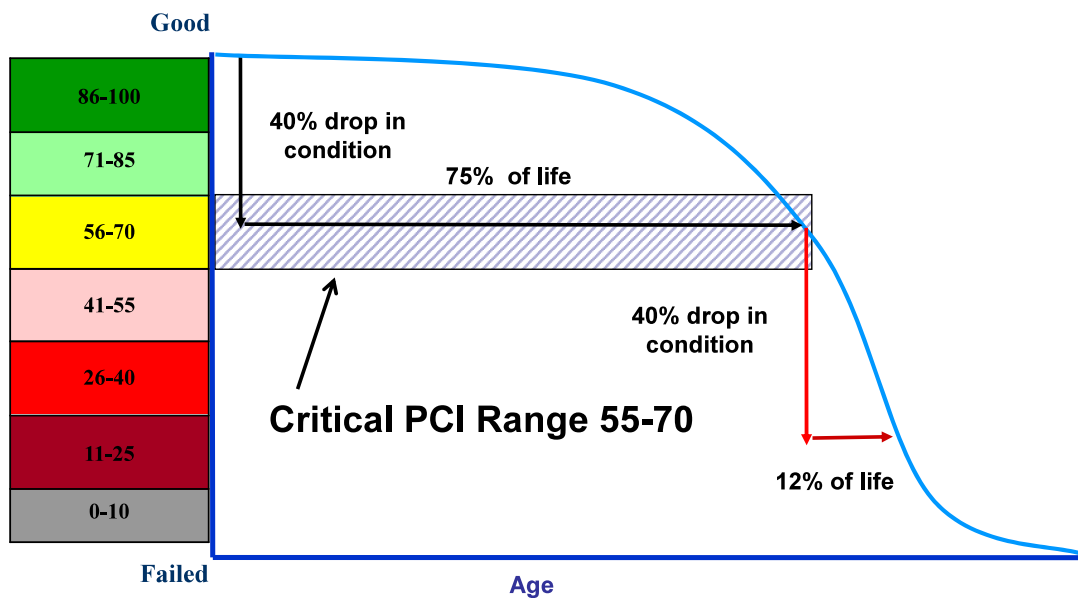


Pavement Management for Airports,
Roads and Parking Lots
M.Y. Shahin

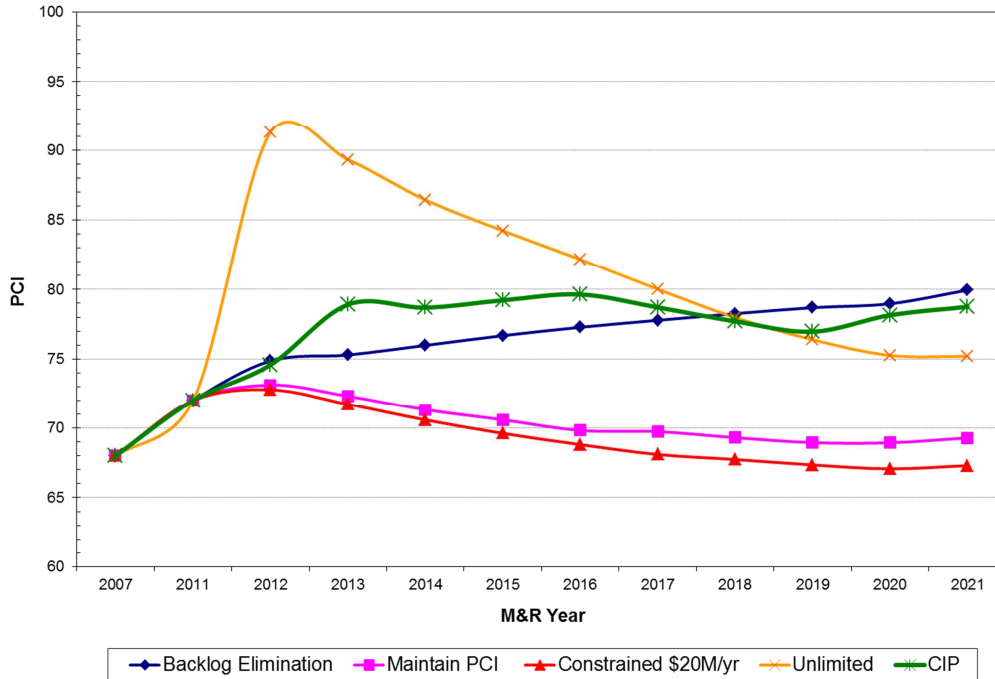


ASTM D6433

Typical Pavement Life Cycle

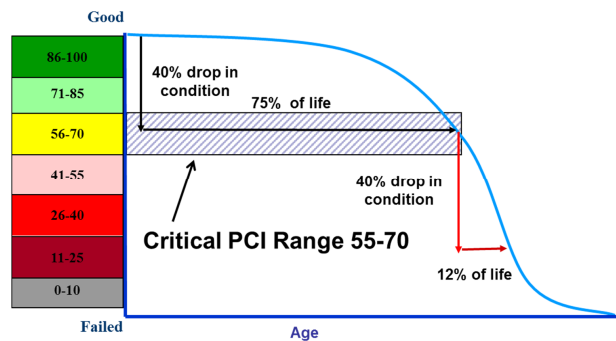


Analysis of Budget Scenarios



Benefits of Pavement Management

1. Process That Increases Pavement Useful Life
2. Objective and Consistent Condition Assessment
3. Documentation of Current and Future Condition
4. Engineering Basis for Repair Types and Timing



Benefits of Pavement Management

5. Life Cycle Cost Analysis for Several Repair Options
6. Budget Development for Performance Objectives
7. Performance Consequences for Doing Nothing



Pavement Management Objectives

- Identify Pavement Preservation Types & Timing
- Identify Rehabilitation Types & Timing for 5 to 10 Years
 - Project future conditions
 - Identify feasible repair alternatives
 - Develop budget scenarios
 - Select best repair alternative
 - Build multi-year rehabilitation program



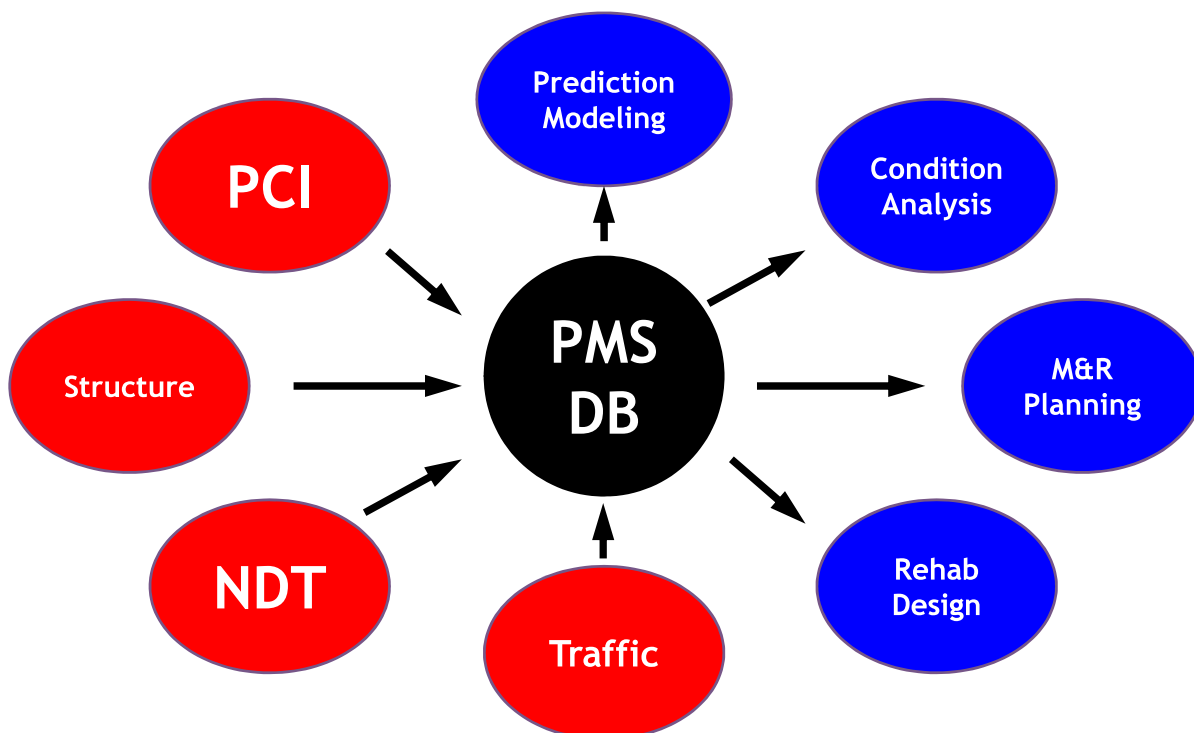
Pavement Management Objectives

- Justify Preservation and Rehabilitation Expenditures
 - Optimize use of limited funds
 - Maximize Return On Investment
 - Minimize disruptions to traffic
 - Minimize pavement repairs costs with construction efficiency
 - Maximize pavement condition improvement
 - Minimize rate of annual pavement deterioration



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Pavement Management System



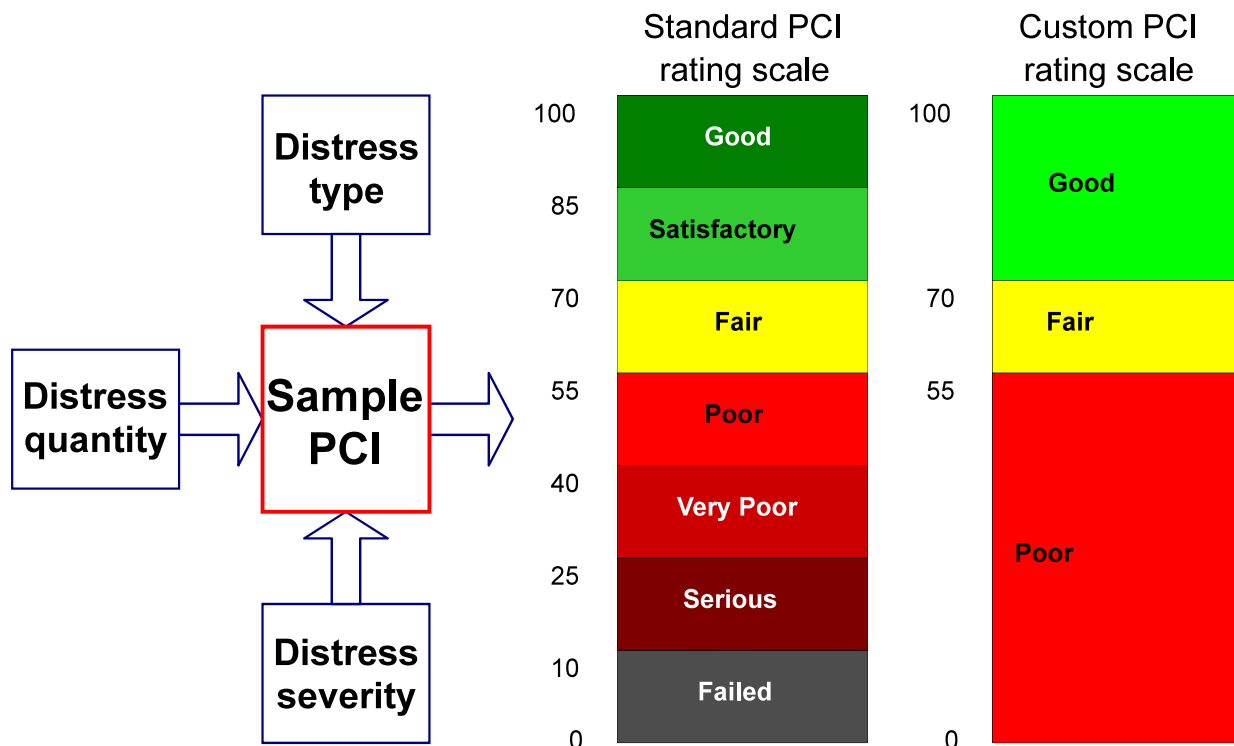
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Introduction to PCI



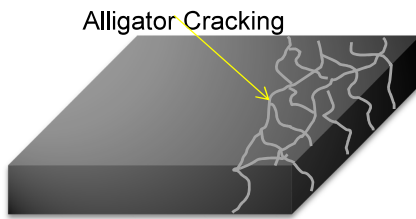
- Pavement Rating is the method of determining the pavement condition through visual observations.
 - Specifically, the type of distress/defect, the severity, and the quantity are recorded.
 - Method to consistently characterize the condition of the pavement surface.
- **Pavement Condition Index (PCI) Method**
 - *ASTM D6433 - Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys*
 - 20 AC and 19 PCC Distress Types

Pavement Condition Index (PCI) - Overview

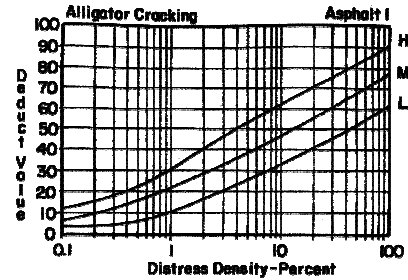


Pavement Condition Index (PCI) - Overview

Step 1: Determine Distress Type, Severity & Quantity

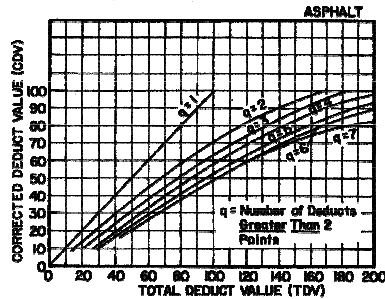


Step 2: Determine Deduct Values



Step 3: Compute the Total Deduct Value

Step 4: Adjust Total Deduct Value, CDV



Step 5: Compute Pavement Condition Index

$$PCI = 100 - CDV$$

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Benefits of Pavement Condition Index (PCI)

- What It Provides: The PCI tells public works officials
 - The current condition of the road network
 - The rate of deterioration of the road network over time
- Benefits of PCI within Pavement Management System:
 - Identify immediate maintenance and rehabilitation needs
 - Monitor pavement condition over time
 - Develop a network preventive maintenance strategy
 - Develop road maintenance budgets
 - Evaluate pavement materials and designs

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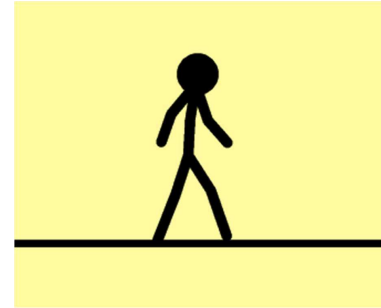
Rating Considerations

Survey Method

- Manual
 - Walking
 - Windshield

- Automated/ Semi-Automated

- Hybrid
 - Combination



Rating Considerations

- **Manual Survey Method**
 - Walking
 - Provides a higher level of detail.
 - Traffic control often not required.
 - Method prescribed by ASTM D6433
 - Time intensive.
 - Uses multiple inspection teams
 - One identifies distress type, severity, and quantity
 - One records data and watches for traffic

Rating Considerations

- Manual Survey Method
 - Windshield
 - Lowest cost
 - Least time intensive
 - Provides the lowest level of detail
 - Low distress severities are often not visible/recorded
 - Distress and severity levels are easily misjudged or not observed
 - Will result in greater error in rating
 - Does Not Conform to ASTM D6433

Rating Considerations

- Automated/ Semi-Automated Survey Method
 - Rating vehicles equipped with sensors take images/laser scans of the pavement
 - Data interpreted for Distress Types, Severity & Quantity
 - Manually by people
 - Automatically by software
 - Safest Method
 - Does not conform to ASTM D6433
- Big Question – Does distress data collected from automated/windshield methods match data from walking surveys?
 - Largely, No

PCI Inspection

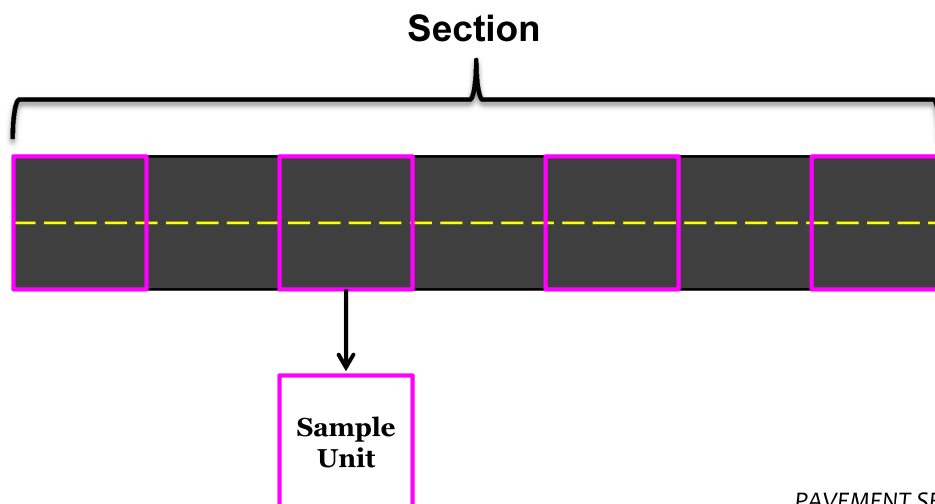
HOW DO WE CONDUCT A PCI SURVEY?

Sample Unit Method

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Sample Unit Definition

Sample Units are portions of the pavement section, designated only for the purpose of a pavement inspection.



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Sample Unit Definition

Sample Unit Sizes

- **Asphalt Pavements**
 - **2,500 SF** ± 1,000 Square Feet (1,500 – 3,500 SF)
- **Concrete Pavements**
 - **20 Slabs** ± 8 Slabs (12 – 28 Slabs)
 - Slab size less than or equal to 25 x 25 Ft

Source: ASTM D6433

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Number of Sample Units to Survey

- **Network Level Inspection:**
 - Used for budget planning
 - Limit number of sample units surveyed per section to minimize needed resources.
- **Project Level Inspection**
 - Used to estimate work for plans and contracts
 - Higher number of sample units surveyed per section to achieve higher PCI and distress quantity accuracy.

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Network Level Inspection

No. of Sample Units in Section (N)	No. of Units to be Inspected (n)
1 to 5	1
6 to 10	2
11 to 15	3
16 to 40	4
over 40	10%

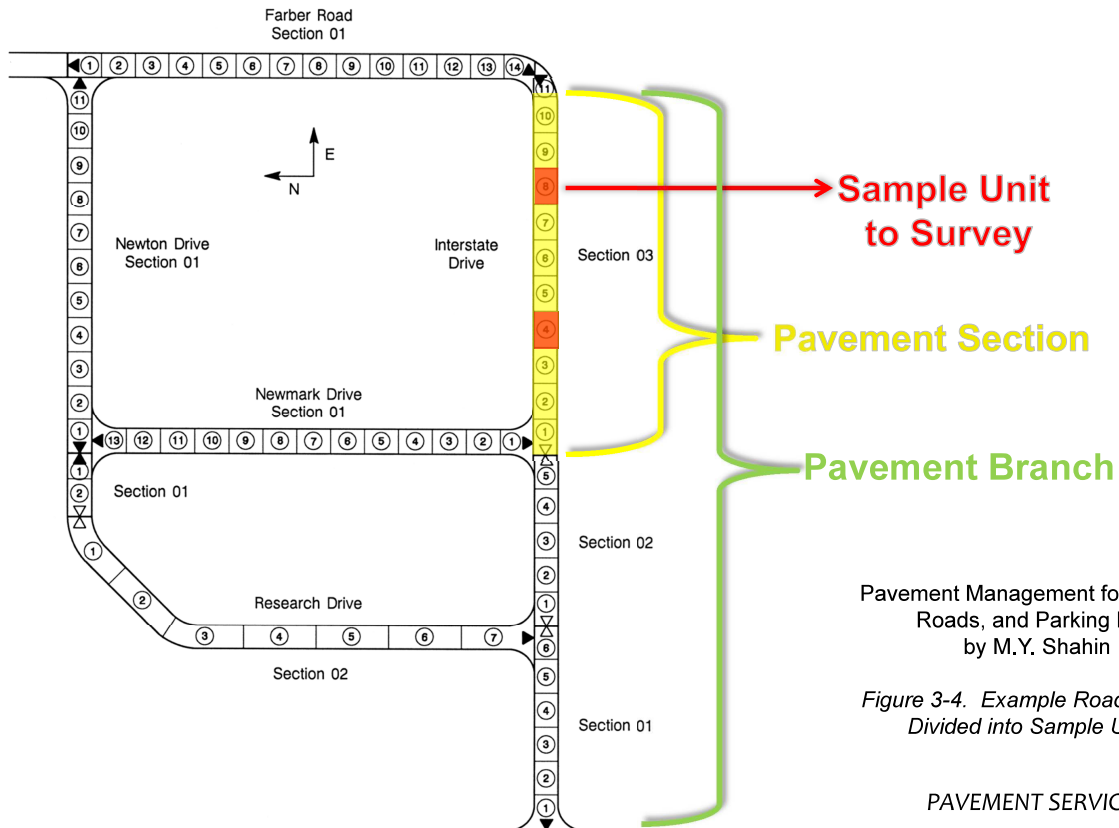
(round up to next whole sample unit)

Figure 3-10. Example of Network Level Sampling Criteria Used by Some Agencies.

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by M.Y. Shahin

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Roadway Divided Into Sample Units



Pavement Management for Airports, Roads, and Parking Lots
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Figure 3-4. Example Road Network Divided into Sample Units.

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Distress Identification

ASTM D6433-11: Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys -- ASPHALT DISTRESSES

- Alligator Cracking
- Bleeding
- Block Cracking
- Bumps and Sags
- Corrugation
- Depression
- Edge Cracking
- Joint Reflection Cracking
- Lane Shoulder Drop Off
- Longitudinal/ Transverse Cracking
- Patching/ Utility Cut Patching
- Polished Aggregate
- Pothole
- Railroad Crossing
- Rutting
- Shoving
- Slippage Cracking
- Swelling
- Raveling
- Weathering

Distress Identification

ASTM D6433-11: Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys -- PORTLAND CEMENT CONCRETE DISTRESSES

- Blow-up
- Corner Break
- Divided Slab
- Durability Cracking
- Faulting
- Joint Seal Damage
- Lane Shoulder Drop Off
- Linear Crack
- Small Patch
- Large Patch
- Polished Aggregate
- Popouts
- Pumping
- Punchout
- Railroad Crossing
- Scaling
- Shrinkage Cracking
- Corner Spall
- Joint Spall

Field Distress Manuals



Quality Management Program

- Verify Qualified Raters are Used
- Establish a Quality Control Plan Prior to Rating
- Agency and Consultant should both Verify Collected Data
- Quality Management Programs Minimizes “Garbage In-Garbage Out”

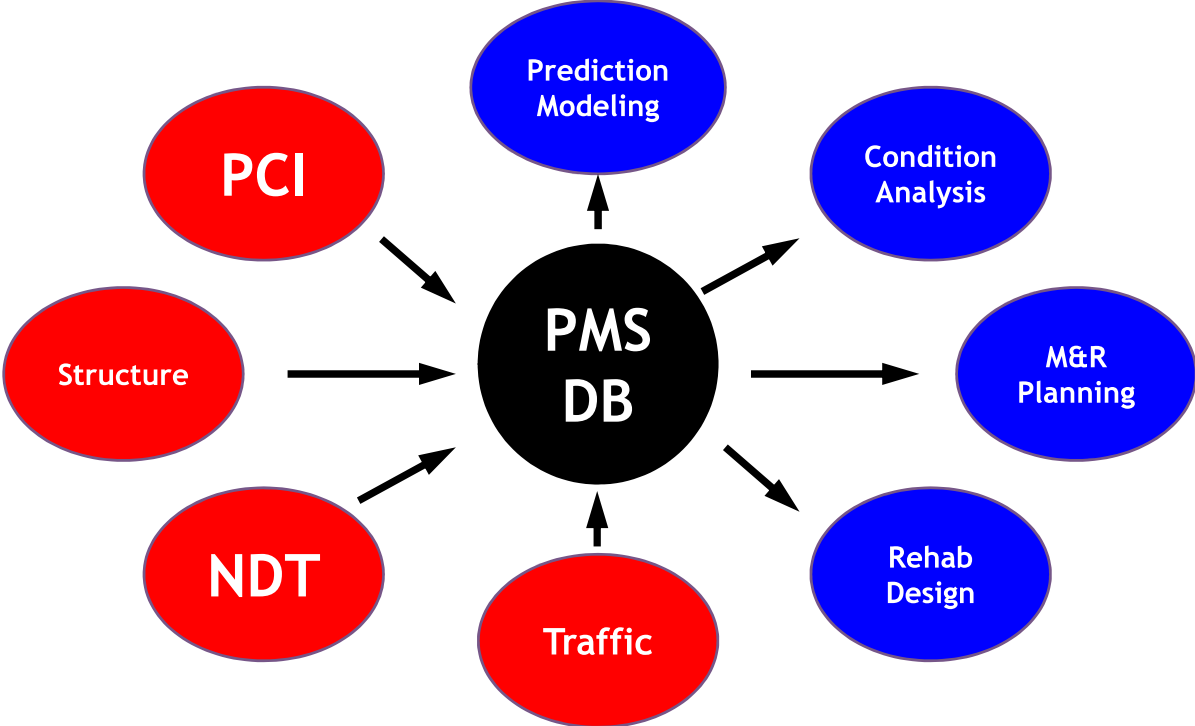


PCI Safety Hazard!



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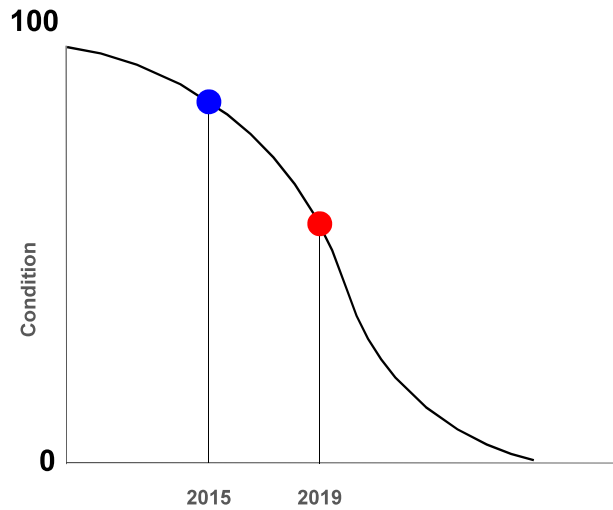
Pavement Management System



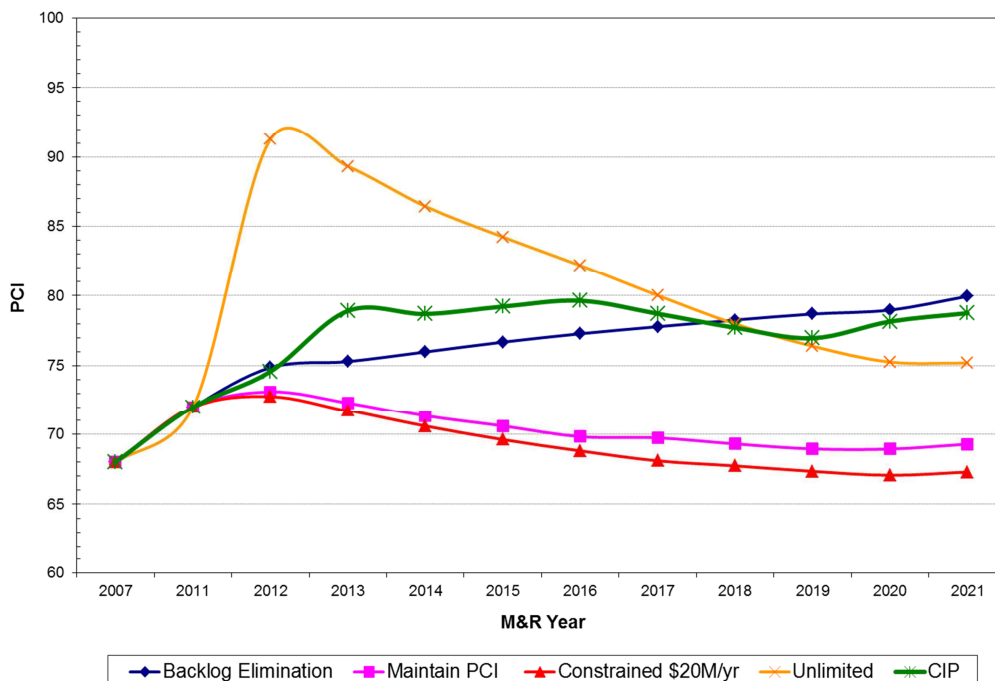
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PMS Data Analysis

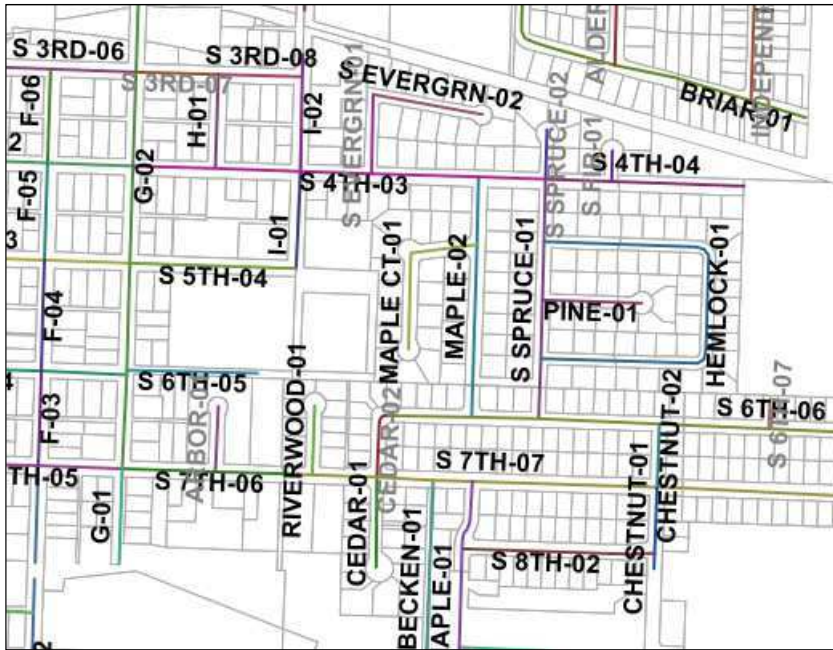
- Compute Current Pavement Condition
- Predict Future Pavement Condition
- Select Feasible Repair Types
- Select Optimal Repair Types & Timing
- Prioritize Repair Projects
- Develop Localized Repair and Preservation Plans
- Develop Multi-Year Capital Improvement Program



Analysis of Budget Scenarios



Prioritized Project Plan

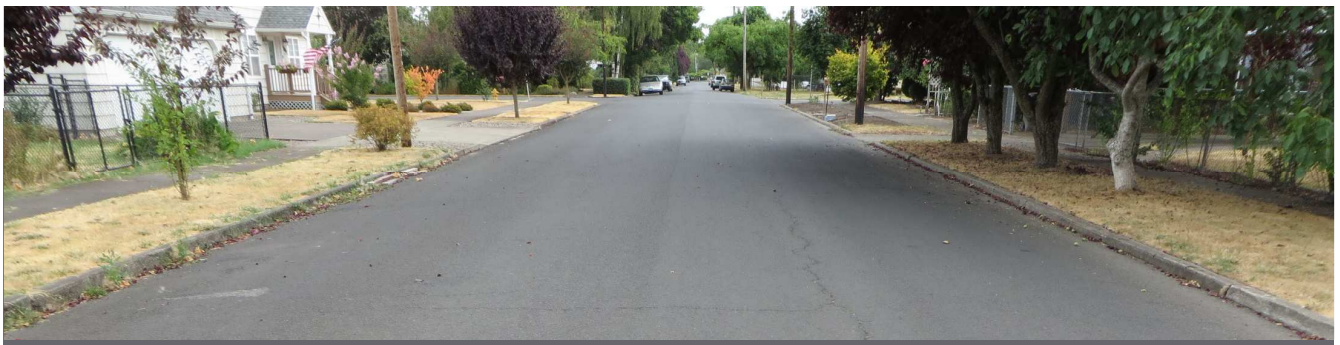


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Prioritized 10-Year M&R Plan

Project	Construction Year	PMP Sections	Total Project Area (sf)	Area Weighted PCI at Construction Year	Total Project Cost (2012 Dollars)	Cost with Escalation
12-01 TW C and RW 28 Deice Mill and OL-Structural	2012	2	246,941	55	\$4,009,122	\$4,009,122
12-02 TW G, TW R Mill and OL-Functional	2012	4	292,879	56	\$2,652,429	\$2,652,429
12-03 TW P Mill and OL-Structural	2012	1	35,821	59	\$581,559	\$581,559
12-04 TW A Mill and OL-Structural	2012	3	114,407	55	\$1,857,414	\$1,857,414
12-05 TL at Ramp AB Mill and Overlay-Functional	2012	2	80,108	66	\$725,490	\$725,490
12-06 B Gates Concrete Pavement Restoration	2012	3	254,453	52	\$4,501,543	\$4,501,543
12-07 RW 15L-33R Mill and OL-Functional	2012	7	501,399	71	\$4,540,869	\$4,540,869
12-08 TW J, K, Q Mill and OL-Structural	2012	14	369,404	64	\$5,997,326	\$5,997,326
13-01 Runway 10-28 RSA Rehab	2013	18	2,222,343	54	\$20,126,425	\$20,629,586
13-02 TWF and TWR (at RW 10) Mill and OL-Functional	2013	3	117,560	62	\$1,064,670	\$1,091,287

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Thank you!

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