

**The Fork in the Road;  
The diverging paths of roadway maintenance**



**Lockwood, Andrews  
& Newnam, Inc.**  
A LEO A DALY COMPANY



**Don Olivetti  
Jeff Roberts, PE**

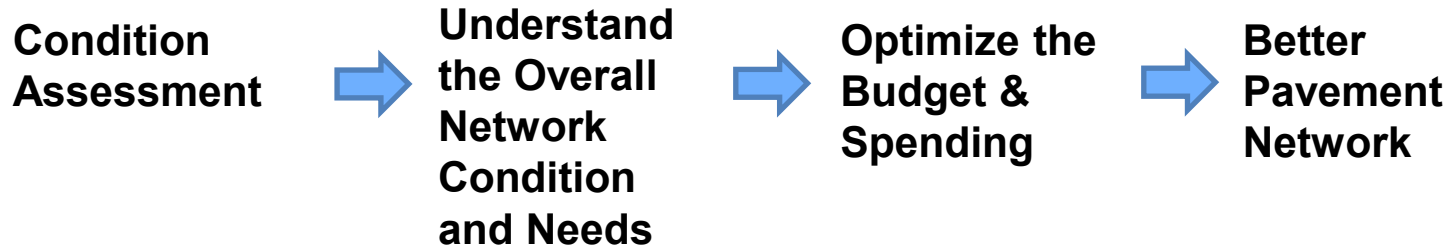
**June 2023**

# Pavement Management System

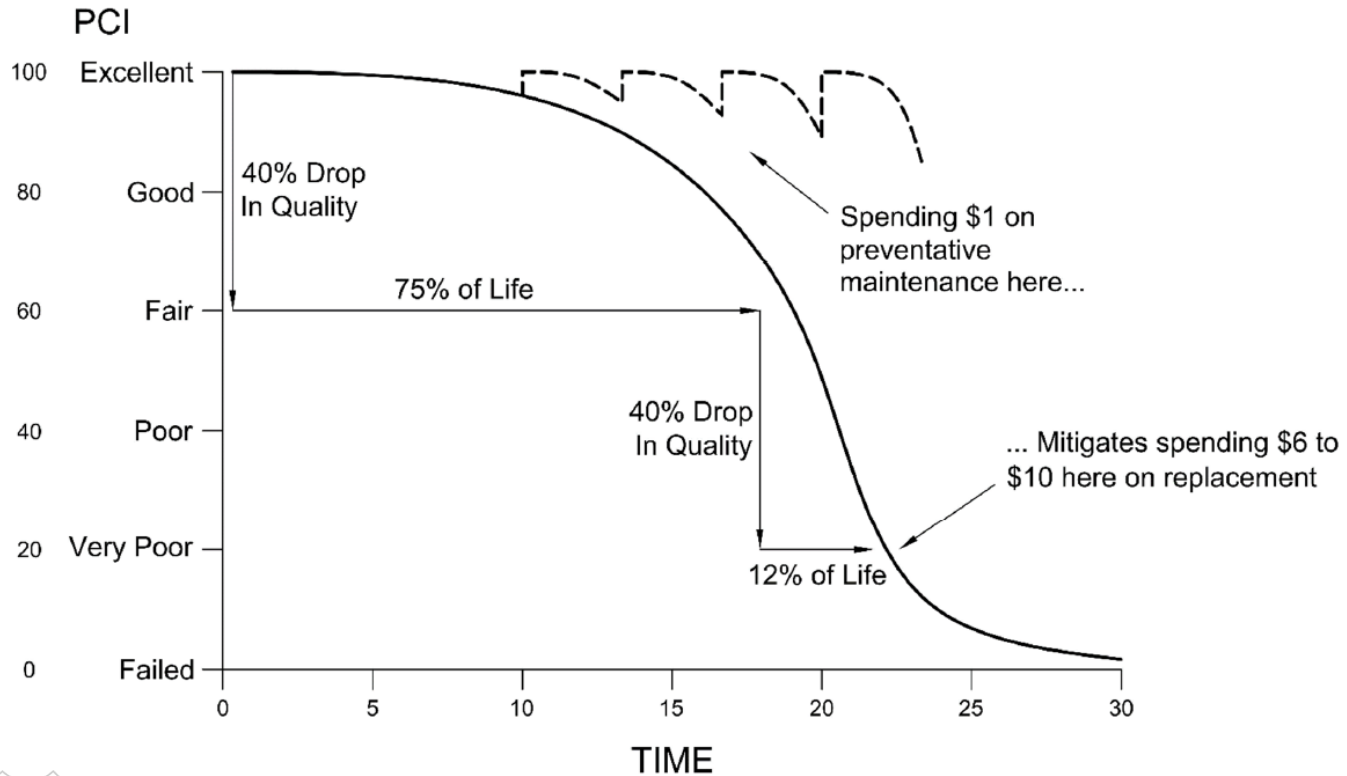
**Pavement Management System (PMS)** is a comprehensive system including:

- Inspections, surveys and data collection
- Models for analysis and forecasting of infrastructure condition
- Maintenance & operational standards
- Prioritization of repair works based on their cost-effectiveness

# Pavement Management Objectives



PCI is a tool to preliminarily determine the condition of pavement and the type of maintenance application.

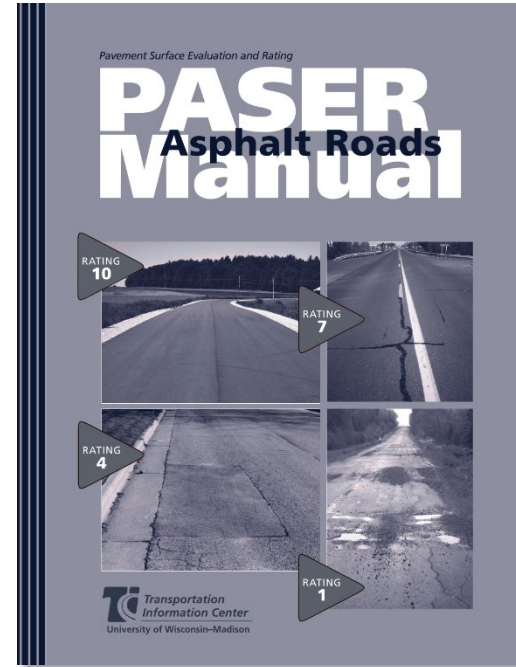
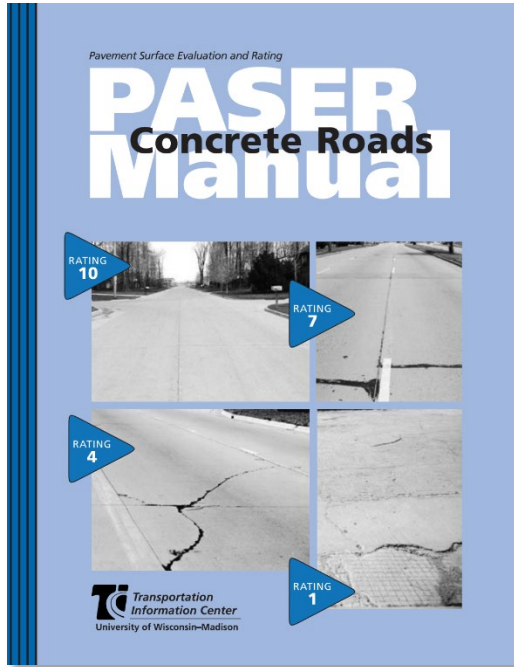


Typical Pavement Life Cycle

# Condition Assessments



# Visual Assessment



# Visual Assessment

## Concrete PASER

Modified for Michigan TAMC Data Collection  
 • Denotes Priority Distress

	Concrete 10	Concrete 9	Concrete 8
Good	New construction No defects Less than 1 year old Only a "10" for 1 year <u>Recent reconstruction</u> No action required	• Joint rehabilitation, only if no other defects are present Like NEW Slight traffic wear in wheel path Slight map cracking Few pop outs <u>Recent concrete overlay</u> No maintenance required	• Joints all in good condition • Partial loss of joint sealant • No transverse cracks Minor surface defects - pop outs, map cracking or slight scaling Isolated meander cracks (cracks are well-sealed or light) Slight surface wear Isolated cracks at manholes (cracks are well-sealed or light) Little or no maintenance required
Fair	Concrete 7 • Isolated transverse cracks • Full depth repairs all in excellent condition Minor surface scaling Some open joints Some manhole cracks Isolated settlement or heave areas Pop outs could be extensive but sound Suggested Action Seal open joints <u>Spot repair surface defects</u>	Concrete 6 • Meander and transverse cracks "1" open • Transverse joints open "1" • Longitudinal joints open "1" Moderate surface scaling <25% of surface Several corner cracks light or well-sealed Multiple corner cracks Suggested Action Seal open joints and cracks <u>Overlay surface ravelling areas</u>	Concrete 5 • First signs of cracks/joints faulting up to "1" • First signs of joint or crack spalling Moderate to severe scaling or polishing Between 25% to 50% of surface Spalling from shallow reinforcement Multiple corner cracks Suggested Action Grind and repair surface defects Some <u>partial depth joint repairs</u> or patching may be needed
Poor	Concrete 4 • Crack or joint faulting up to "1" • Severe spalling on joints and cracks • Multiple transverse or meander cracks Severe scaling, pocking, map cracking or spalling >50% of surface Corner cracks missing pieces or patches Pavement blowups Suggested Action <u>Some full depth repairs</u> Asphalt overlay or extensive surface resurfacing	Concrete 3 • Severe crack or joint faulting up to "1" • D cracking evident • Many joints, transverse and meander cracks open and severely spalled Extensive patching in "1" or poor condition Suggested Action <u>Extensive full depth repairs</u> Some full slab replacements	Concrete 2 Extensive and severely spalled slab cracks Extensive failed patches Severe and extensive settlement & heaves Suggested Action <u>Reseal or rebuild pavement</u> Concrete 1 <u>Restrictive speeds</u> Extensive potholes Total loss of pavement integrity Suggested Action Total reconstruction

### Contact Information

ReadSoft & LDC Technical Support: 906-487-2122  
 TAMC Coordinator: Roger Balknap, 517-373-2249  
 e-mail: rbalknap@tamc.mig.gov  
 TAMC Website: tamc.mig.state.mi.us

Center for Shared Solutions (CSS) Framework Issues:  
 517-373-3710, ask for Josh Ross  
 PASER Data Submission via the CSS SIT web site  
<https://mlonginfo.michigan.gov>



2017 Michigan PASER Check Sheet V1.0

## Asphalt PASER

Modified for Michigan TAMC Data Collection  
 • Denotes Priority Distress

	Asphalt 10	Asphalt 9	Asphalt 8
Good	New construction No defects Less than 1 year old Only a "10" for 1 year <u>Recent pavement improvement</u> No action required	Like new condition No defects More than 1 year old <u>Recent overlay with or without a smooth place</u> No action required	• Occasional transverse crack >40' apart No defects Few if any longitudinal cracks on joints <u>Recent seal coat or slurry seal (1 year below)</u> Little or no maintenance required
Fair	Asphalt 7 • Trans. cracks 10'-40' apart • Cracks open <"1" Little or no crack erosion Little or no raveling Few if any patches in good condition First signs of wear Suggested Action Maintain with crack seal	Asphalt 6 • Trans. cracks less than 10' apart • Initial block cracking (5'-10' blocks) • Cracks open 1/4" - 1/2" Blocks are large and stable Slight to moderate polishing or flushing No patches or few in good condition Slight raveling <u>Sound structural condition</u> Suggested Action Maintain with sealcoat	Asphalt 5 • Secondary cracks (crack raveling) • Moderate block cracking (1' - 5' blocks) • First sign of longitudinal cracks at edge • Cracks open 1/2" Patching/grading in good condition Moderate raveling Fairness to severe flushing & polishing <u>Sound structural condition</u> Suggested Action Maintain with sealcoat or thin overlay
Poor	Asphalt 4 • Longitudinal cracking in the wheel paths • Rutting 1/2" - 1" deep • Severe block cracking <1' blocks Severe surface raveling Multiple longitudinal & transverse cracks with slight crack erosion Occasional potholes Patches in fair/poor condition Suggested Action <u>Structural overlay &gt;2"</u> Patching & repair prior to a major overlay Milling would exceed overlay life Suggested Action Structural overlay >2"	Asphalt 3 • < 25% alligator cracking (first signs) • Moderate rutting 1" - 2" deep • Severe block cracking (Alligator) Longitudinal & transverse cracks showing extensive crack erosion Frequent potholes Extensive patches in poor condition Suggested Action <u>Structural overlay &gt;2"</u> Patching & repair prior to a major overlay Milling would exceed overlay life	Asphalt 2 • > 25% alligator cracking • Severe rutting or distortion >2" Closely spaced cracks with erosion Frequent potholes Extensive patches in poor condition Suggested Action Reconstruction with base repair Crush and shape possible Asphalt 1 Loss of surface integrity Extensive surface distress Suggested Action Reconstruction with base repair

### General TAMC PASER Rating Tips

**Rate surface distress, not ride quality.** In severe of cracks in the wheel path, they can be hard to see and don't affect the ride.  
**Disregard the shoulder.** Rate only the drivable pavement, edge line to edge line.  
**Do not give reflective credit.** Look them by assessing the type of crack they are (transverse, longitudinal, alligator...)  
**Rate the current surface condition.** If construction is progress work is active, but you are riding on the old surface, get ahead and rate the new surface. Some barriers sitting on the side of the road is good construction in progress.  
**Rate what you see, not what drivers see.** That might happen in the future.  
**Rate roads with the same severity regardless of their use, ownership or functional class.**  
**Rate the lane with the worst condition** when lanes have differing conditions, for visible surface eyes, rate the worst lane, and select it as the Surface Subtype.  
**Crack & Shape** - An inspection is considered a reconstruct only if the base material is replaced or rehabilitated.  
**Rutting** - Look for visual cues such as flow scars. Get out and measure using a straight edge and tape measure. Use the chart.  
**Rutting Revisions** - See page 8 of the TAMC PASER Training Manual for rating measurement changes.  
**Complete Pavement** - When a concrete pavement has been overlaid with asphalt (compare pavement) rate it based on the upper most surface, in this case, asphalt, but rate the surface subtype as concrete.  
**Concrete Joint Repair** - The highest rating a repaired concrete pavement can receive is a 5. No other defects are present and the condition is "like new." However, this is not what the Concrete PASER Manual says.  
**Sealcoat** - See pages 6-7 of the TAMC PASER Training Manual for rating postcoat pavements. Sealcoat applied over asphalt is a treatment. A sealcoat "wear" is simply a cosmetic over grade.  
**\*Practice Sealcoat treatments** - Do not downgrade an Asphalt PASER 9 or 10 for defects that are treated with PASER 8 because of the treatment. Rate it based on the distresses that are visible (see page 9 of TAMC PASER Training Manual).

2017 Michigan PASER Check Sheet V1.0

# Work Orders

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Work Order Email Print Save Close Delete

### Work Order

Description: Pavement Condition Inspection  
 Number: 359447  
 Entity Type: ROADINDEX  
 Category: Streets  
 Initiated By: OLIVETTI DONALD K Date: 03/14/2022 1:57 PM  
 Status: CLOSED Priority: MEDIUM  
 Requested By: Supervisor: ARGUELLO, ARMAND  
 Submitted: Date:  
 Projected Start: 03/14/2022 1:57 PM Projected Finish: 03/14/2022 1:57 PM  
 Closed By: OLIVETTI DONALD K Date: 9/9/2022 10:08:38 AM  
 Completed By:  
 Actual Start: Actual Finish: 09/9/2022 10:08 AM  
 Stage: Actual Expense Type: Maintenance  
 Comments: Add Comment Sort  
 Instructions:  
 Reactive?

### Location Information

WO Address: Rock Creek  
 Location Details:  
 Map Page: N098  
 Tile Number: 4th Wednesday  
 Facility Id: Level Id:  
 X Location: 2,470,444,824 Y Location: 7,092,987,588

### Custom Fields

Category: Pavement Condition Inspection  
 Street Name: Rock Creek  
 From: driveway  
 To: Lebanon  
 Direction: NB  
 Road Class: M  
 Safety Concern: NO  
 Severity: 80  
 Ride Quality: GOOD (PRETTY SMOOTH)  
 Risk/Consequence: LOW RISK  
 Internal Spot Repair: No  
 Internal Crackseal: Yes  
 Panel (Spot) Replacement: No  
 # of Panels to Replace:  
 Foam Inject: No  
 Joint Seal: No  
 PCC Reconstruction: No  
 Notes: S.I. 63  
 Range: E1 - 90  
 Work Completed?: No  
 Quadrant: SW - Quadrant

### Assets

Total Entities: 1

<input type="checkbox"/> Asset	Asset Id	Asset Uid	Location	Warranty Date	Work Completed
<input type="checkbox"/>	ROADINDEX	183809	183809		<input type="checkbox"/>

- Pink rows indicate inventory still under warranty.

Update Work Order XY when adding/removing assets?

### Map Layer Fields

Layer	Field	Value
ROADINDEX	SUBTYPE	4

### Reservations

Equipment ID	Employee	Start Date	End Date	Comments
No records to display.				

### Checked Out Equipment

Equipment ID	Employee	Check Out Date	Due Date	Comments
No records to display.				

### Work Cycle

Repeat: Never  
 Interval: 2 Months  
 From: Bracketed Start Date

### Details

Project: Account:

Contract: Contractor:  
 Legal Billable:  Contractor Billable:   
 Update Map:  Cancel Work Order:   
 Canceled By: Date:  
 Cancel Reason:  
 Units Accomplished: 0 Description:  
 Lock Units Desc:   
 Labor Cost: \$0.00 Material Cost: \$0.00  
 Equipment Cost: \$0.00 Permit Cost: \$0.00  
 Total WO Cost: \$0.00

### S.I. Value for Workorder 359447

Direction: NB  
 Ride Quality: GOOD (PRETTY SMOOTH)  
 Panel (Spot) Replacement: No  
 PCC Reconstruction: No  
 Work Completed?: No  
 Street Name: Rock Creek  
 Road Class: M  
 Risk/Consequence: LOW RISK  
 # of Panels to Replace:  
 Notes:  
 Quadrant: SW - Quadrant  
 From: driveway  
 Safety Concern: NO  
 Internal Spot Repair: No  
 Foam Inject: No  
 S.I.: 83  
 To: Lebanon  
 Severity: 80  
 Internal Crackseal: Yes  
 Joint Seal: No  
 Range: 81 - 90

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S.I. = 83.00





# Common Distresses & Mitigation

Asphalt	Concrete
Cracking	Surface Defects
Potholes	Spalling
Rutting	Cracking
Raveling	Pavement Faulting
Bleeding	

Asphalt	Concrete
Crack Seal	Surface Repairs/Patches
Sealcoat	Crack Seal
Thin Overlay	Partial Depth Joint Repairs
Structural Overlay	Joint Repairs
Partial Reconstruction and Base Repair	Panel Replacements
Full Depth Reclamation	Total Reconstruction
Reconstruction and Base Repair	

# Pavement Preventive Maintenance and Rehabilitation

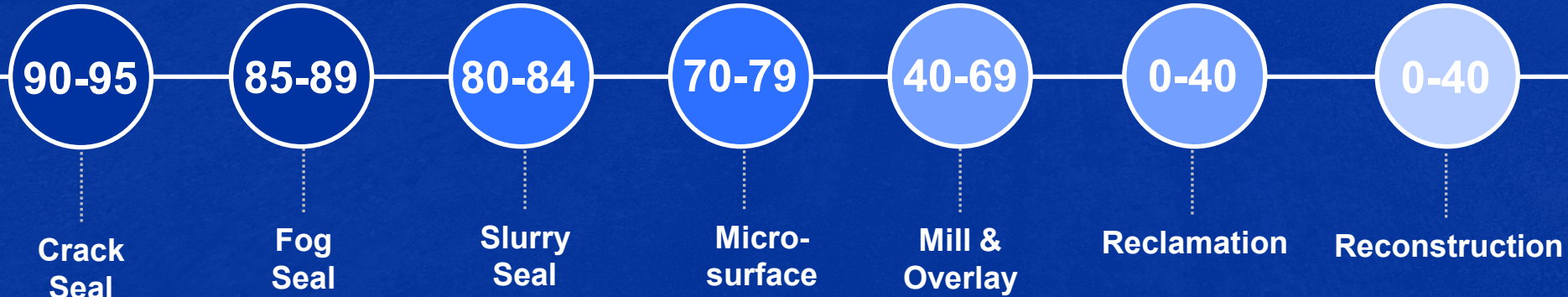
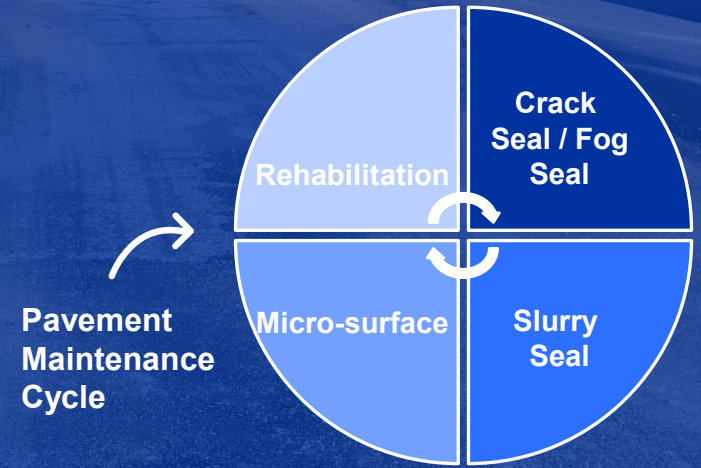
## Pavement Preventive Maintenance (Pavement Preservation):

A planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system (without significantly increasing the structural capacity).

## Pavement Rehabilitation:

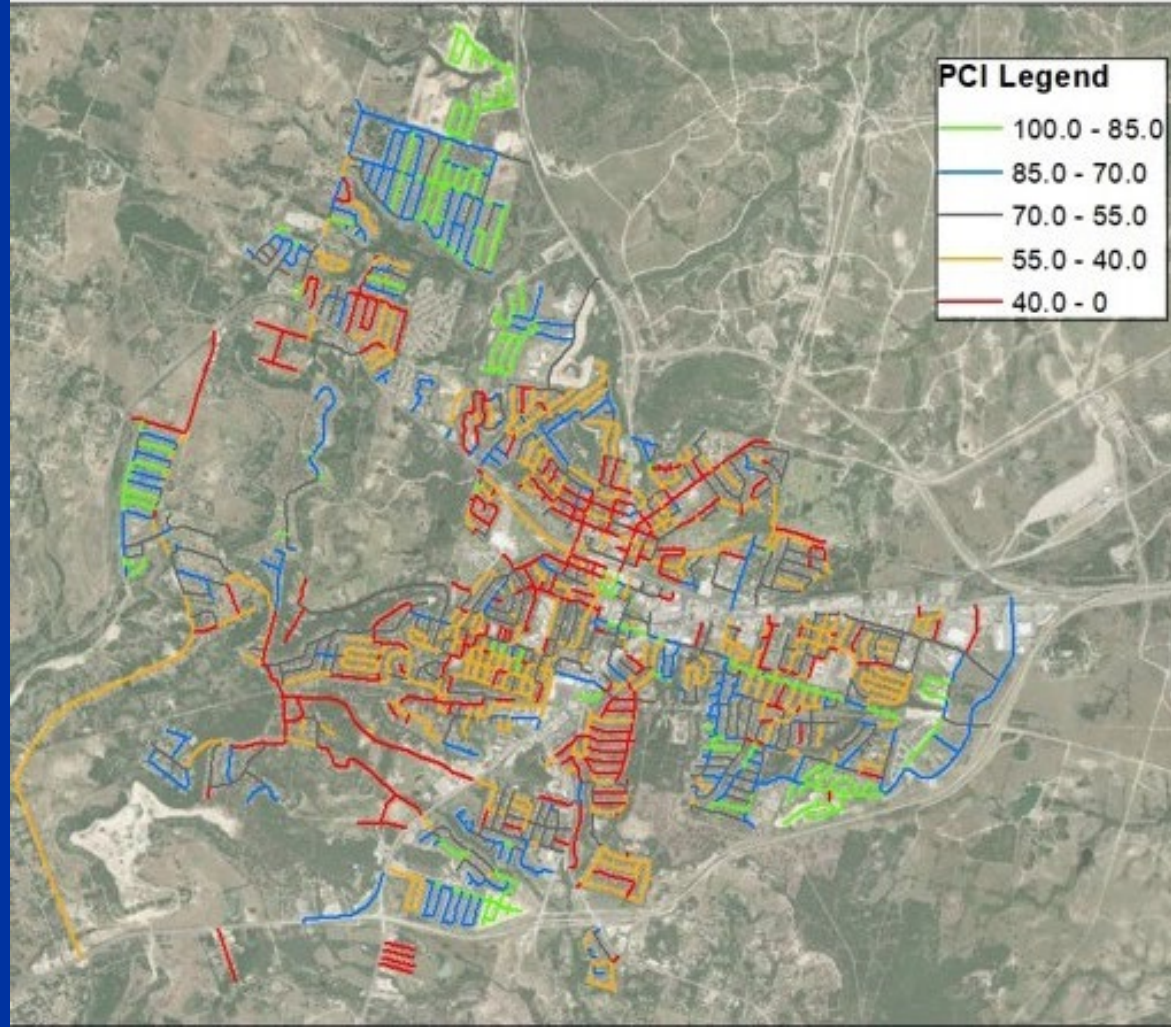
Resurfacing, restoration, and rehabilitation (3R) work consisting of structural enhancements that extend the service life of an existing pavement and/or improve its structural capacity. Rehabilitation techniques include restoration treatments and/or structural overlays.

# Pavement Maintenance Cycle



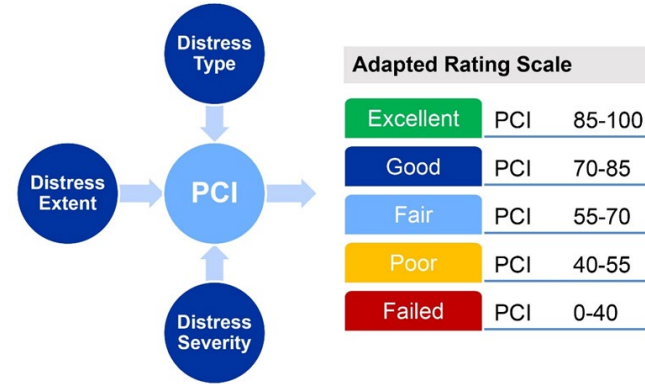
# Street Network Analysis for Budget Planning

PCI Index Map

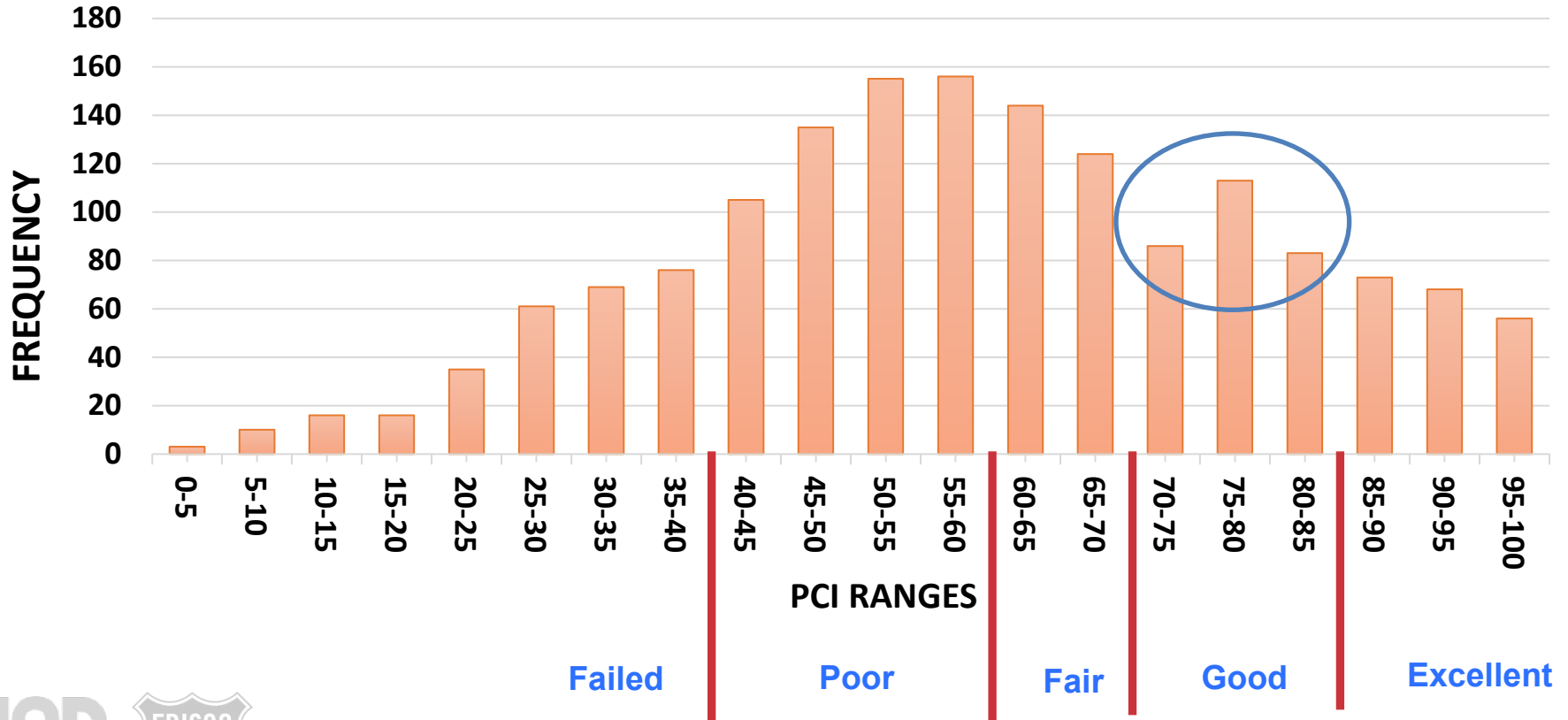


# Network Condition

- Conduct a comprehensive study and analysis using the **PCI** scores and areas of all pavement segments of the network.
- Classify pavement segments based on the **condition** of streets into five levels.
- Develop histograms and plots using outcomes of **data analysis**.



# Network's Histogram



# Preservation and Rehabilitation Applications with Associated Unit Costs

Application	Qualified PCI Range	Street Type	Unit Cost (\$/SY)
No application	95-100	Residential/Non-residential	\$0.00
Crack Sealing	85-95	Residential/Non-residential	\$1.50
Slurry Seal	75-85	Residential/Non-residential	\$11.40
Thin Overlay (1")	70-75	Residential/Non-residential	\$5.41
Patching (Residential)	65-70	Residential	\$34.60
Patching (Non-residential)	65-70	Non-residential	\$49.61
Mill & Overlay with 20% Base Repair	55-65	Residential	\$29.40
Mill & Overlay with 40% Base Repair	45-55	Residential	\$34.95
Mill & Overlay with 70% Base Repair	30-45	Residential	\$40.27
Mill & Overlay with 20% Base Repair	55-65	Non-residential	\$31.83
Mill & Overlay with 40% Base Repair	45-55	Non-residential	\$37.44
Mill & Overlay with 70% Base Repair	30-45	Non-residential	\$42.85
Mill & Overlay with 100% Base Repair	0-30	Residential	\$48.60
Reconstruction	0-30	Non-residential	\$125

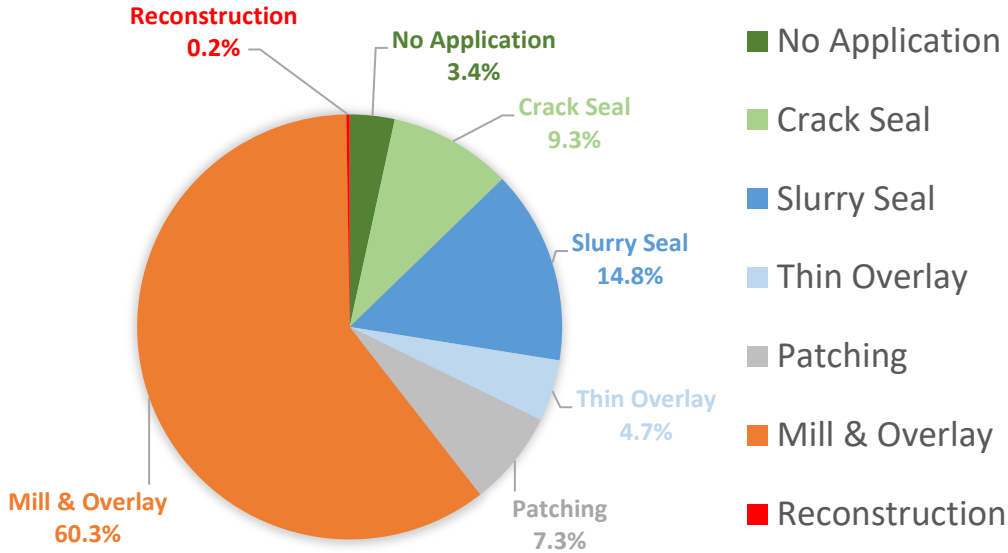
## Breakdown of Repair Costs for Pavement Applications

Qualified Applications	Area (SY)	Repair Cost
No Application	91,351	\$0
Crack Seal	250,089	\$162,558
Slurry Seal	395,509	\$1,265,628
Thin Overlay	125,433	\$678,592
Patching	194,312	\$7,074,096
Mill & Overlay with 20% BR	495,229	\$10,535,912
Mill & Overlay with 40% BR	482,903	\$11,866,623
Mill & Overlay with 70% BR	425,011	\$13,157,158
Mill & Overlay with 100% BR	211,162	\$7,305,803
Reconstruction	6,660	\$397,034
<b>TOTAL:</b>	<b>2,677,659</b>	<b>\$52,443,404</b>

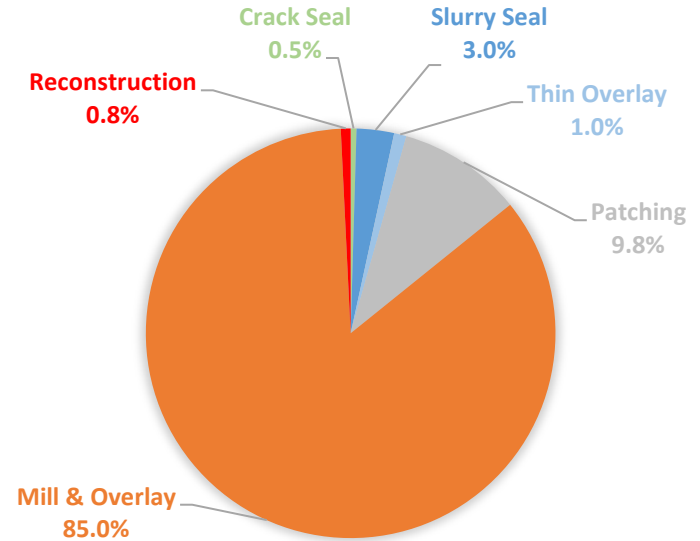


# Pavement Network Vs. Qualified Applications

## % NETWORK AREA BASED ON QUALIFIED APPLICATION



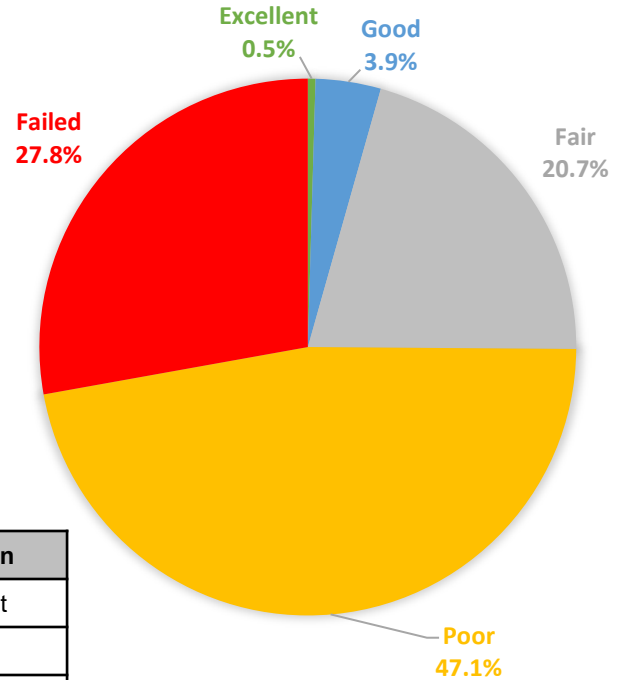
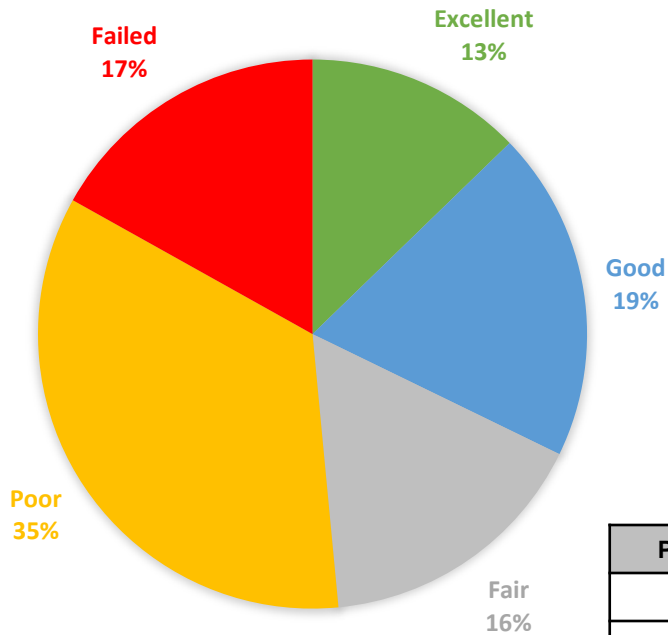
## % REPAIR COST BASED ON QUALIFIED APPLICATION



# Pavement Condition vs Network Area

% NETWORK AREA BASED ON PAVEMENT GRADE

REPAIR COST BASED ON PAVEMENT GRADE



- Excellent
- Good
- Fair
- Poor
- Failed

PCI Range	Condition
86 - 100	Excellent
71 - 85	Good
61 - 70	Fair
41 - 60	Poor
0 - 40	Failed



# Questions