



Pavement Management System

Mayor and City Council Work Session
Monday, December 12, 2016

Introduction

- ▶ In the past, the City used “*Worst First*” approach to select roadways for our Capital Improvement Program (CIP)
 - *“Worst First” results in higher capital costs over the life of the roadway network without predictable network improvement.*
- ▶ Why?
 - The City lacked good predictive capability on adequate funding level needed to maintain or improve the quality of its roadway network.

Treatments

- ▶ In the past, the City has limited its pavement improvement approach to three strategies:
 - Preservation treatments including crack sealing
 - Resurfacing (Full Depth Milling and Overlay)
 - Reconstruction

Other Treatment Options

- ▶ City limited its pavement improvement approach to these treatments – there are other more economical treatments, but their use requires a rational decision process to allow the city's program to become:

Proactive not Reactive



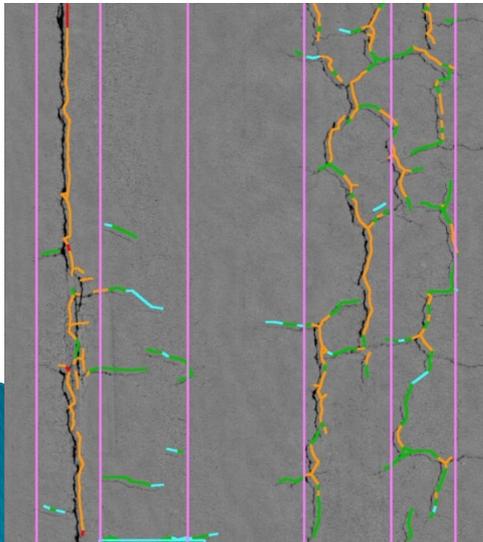
**How was this
addressed?**



Pavement Inventory Process via Automated Pavement Data Collection

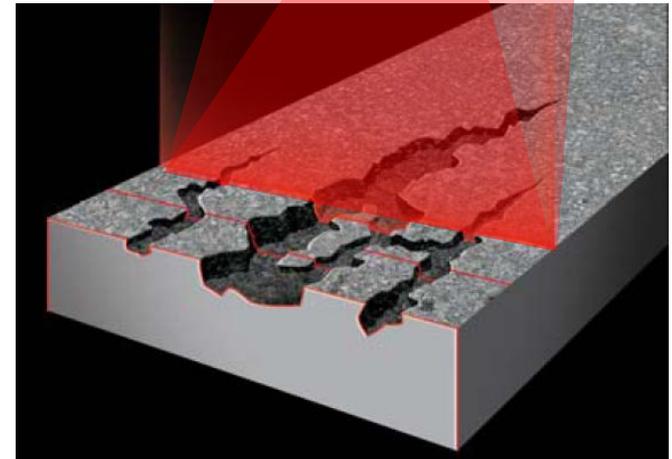
GPS/Distance

Cameras x 5
(up to 11MP)



3D Laser Pavement Data Collection System

- Longitudinal Cracking
- Transverse Cracking
- Block Cracking
- Fatigue/Alligator Cracking
- Roughness
- Rutting/Distortion
- Raveling
- Bumps and Dips





Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys¹

This standard is issued under the fixed designation D 6433; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

These results are used to develop a Pavement Condition Index (PCI) based on the methodologies detailed in ASTM D6433

1. Scope

1.1 This practice covers the determination of roads and parking lots pavement condition through visual surveys using the Pavement Condition Index (PCI) method of quantifying pavement condition.

1.2 The PCI for roads and parking lots was developed by the U.S. Army Corps of Engineers (1, 2).² It is further verified and adopted by DOD and APWA.

1.3 The values stated in inch-pound units are to be regarded as the standard. The SI units given in parentheses are for information only.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* Specific precautionary statements are given in Section 6.

2. Terminology

2.1 Definitions of Terms Specific to This Standard:

2.1.1 *additional sample*—a sample unit inspected in addition to the random sample units to include nonrepresentative sample units in the determination of the pavement condition. This includes very poor or excellent samples that are not typical of the section and sample units, which contain an unusual distress such as a utility cut. If a sample unit containing an unusual distress is chosen at random it should be counted as an additional sample unit and another random sample unit should be chosen. If every sample unit is surveyed, then there are no additional sample units.

2.1.2 *asphalt concrete (AC) surface*—aggregate mixture with an asphalt cement binder. This term also refers to surfaces constructed of coal tars and natural tars for purposes of this practice.

2.1.3 *pavement branch*—a branch is an identifiable part of the pavement network that is a single entity and has a distinct function. For example, each roadway or parking area is a separate branch.

2.1.4 *pavement condition index (PCI)*—a numerical rating of the pavement condition that ranges from 0 to 100 with 0 being the worst possible condition and 100 being the best possible condition.

2.1.5 *pavement condition rating*—a verbal description of pavement condition as a function of the PCI value that varies from “failed” to “excellent” as shown in Fig. 1.

2.1.6 *pavement distress*—external indicators of pavement deterioration caused by loading, environmental factors, construction deficiencies, or a combination thereof. Typical distresses are cracks, rutting, and weathering of the pavement surface. Distress types and severity levels detailed in Appendix X1 for AC, and Appendix X2 for PCC pavements must be used to obtain an accurate PCI value.

2.1.7 *pavement sample unit*—a subdivision of a pavement section that has a standard size range: 20 contiguous slabs (± 8 slabs if the total number of slabs in the section is not evenly divided by 20 or to accommodate specific field condition) for PCC pavement, and 2500 contiguous square feet, $\pm 1000 \text{ ft}^2$ ($225 \pm 90 \text{ m}^2$), if the pavement is not evenly divided by 2500 or to accommodate specific field condition, for AC pavement.

2.1.8 *pavement section*—a contiguous pavement area having uniform construction, maintenance, usage history, and condition. A section should have the same traffic volume and load intensity.

2.1.9 *portland cement concrete (PCC) pavement*—aggregate mixture with portland cement binder including nonreinforced and reinforced jointed pavement.

2.1.10 *random sample*—a sample unit of the pavement section selected for inspection by random sampling techniques, such as a random number table or systematic random procedure.

3. Summary of Practice

3.1 The pavement is divided into branches that are divided into sections. Each section is divided into sample units. The type and severity of pavement distress is assessed by visual

¹ This practice is under the jurisdiction of ASTM Committee E17 on Vehicle Pavement Systems and is the direct responsibility of Subcommittee E17.41 on Pavement Testing, Evaluation, and Management Methods.

Current edition approved Dec. 1, 2007. Published January 2008. Originally approved in 1999. Last previous edition approved in 2003 as D 6433 – 03.

² The boldface numbers in parentheses refer to the list of references at the end of this standard.

Pavement Condition Index (PCI)

- ▶ The Pavement Condition Index (PCI) is a numerical indicator that rates the surface condition of the pavement.
 - ▶ It begins to provide an objective and rational basis for determining maintenance and repair needs and priorities.
 - ▶ Continuous monitoring of the PCI is used by Pavement Managers to establish the rate of deterioration of the pavement.
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Pavement Condition Index (PCI) ASTM D6433

Many roadway owners have found that the ASTM PCI does not match their “business model” – *how they program funding for roadway improvement.*

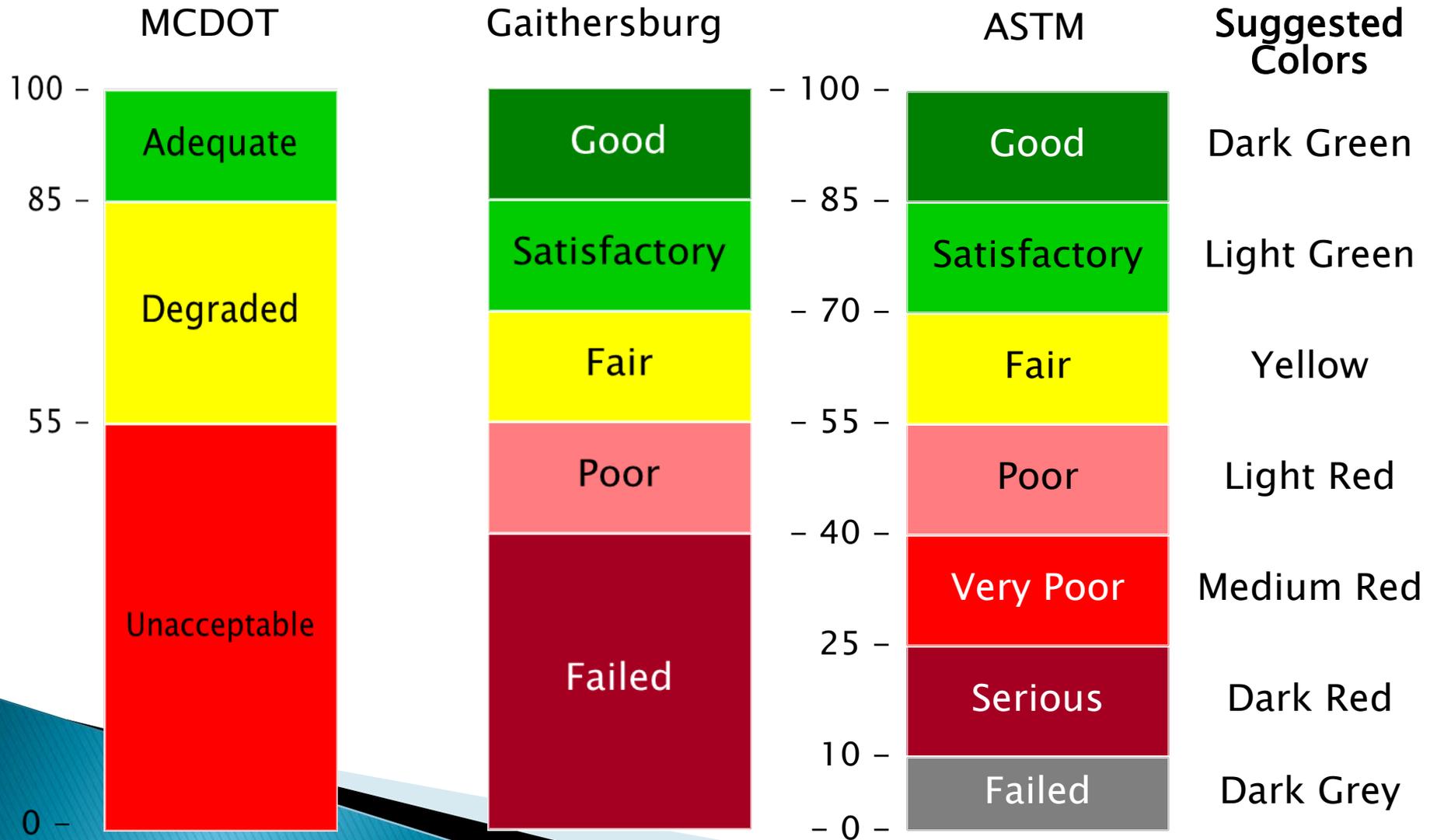
To compensate for this, they have adopted differing decision breakpoints.

	Standard PCI™ Rating Scale	Suggested Colors
100	Good	Dark Green
85	Satisfactory	Light Green
70	Fair	Yellow
55	Poor	Light Red
40	Very Poor	Medium Red
25	Serious	Dark Red
10	Failed	Dark Grey
0		

Proposed Gaithersburg Pavement Condition Rating System

- ▶ Based on a review of a number of different rating systems, staff proposes that the city adopt a modified version of the system detailed in ASTM D6433.
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Rating System Comparisons



City of Gaithersburg 2016 Pavement Condition Analyses

- ▶ 190 Lane Miles Citywide
- ▶ 40 Lane Miles of Collector/Arterial roads
 - 21% of network
- ▶ 150 Lane Miles of Residential roads
 - 79% of network
- ▶ **Citywide Average PCI is 76.85**
- ▶ **Collector/Arterial Average PCI is 77.0**
- ▶ **Residential Average PCI is 75.7**

Comparisons

Gaithersburg

- ▶ **Citywide Average PCI is 76.9**
- ▶ **Collector/Arterial Average PCI is 77.0**
- ▶ **Residential Average PCI is 75.7**

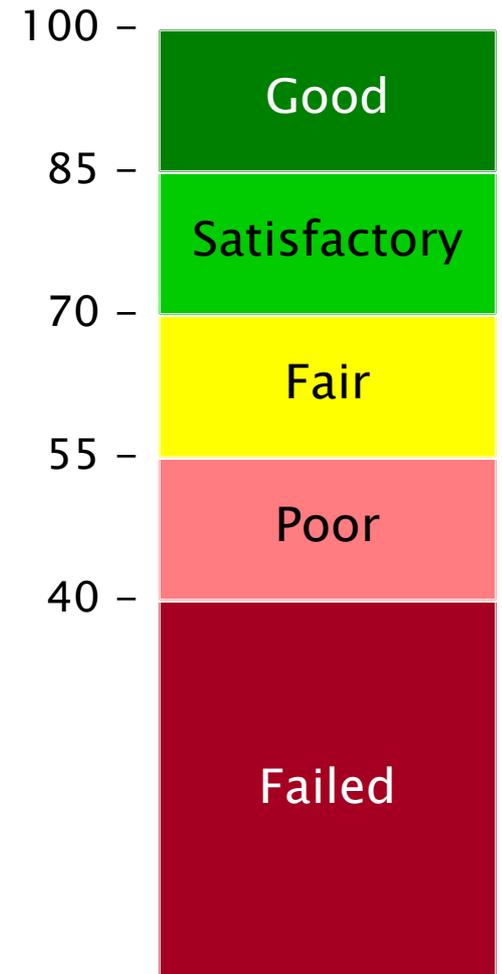
Montgomery County

- ▶ **Countywide Average PCI is 67**
- ▶ **Countywide Primary/Arterial Average PCI is 72.0**
- ▶ **Residential/Rural Average PCI is 66**

PCI Example 95 (Good)



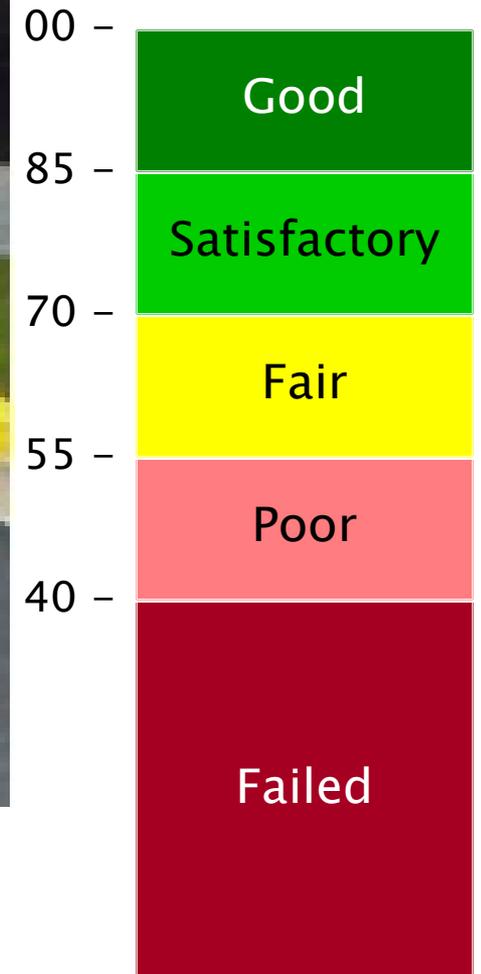
Gaithersburg
PCI Rating Scale



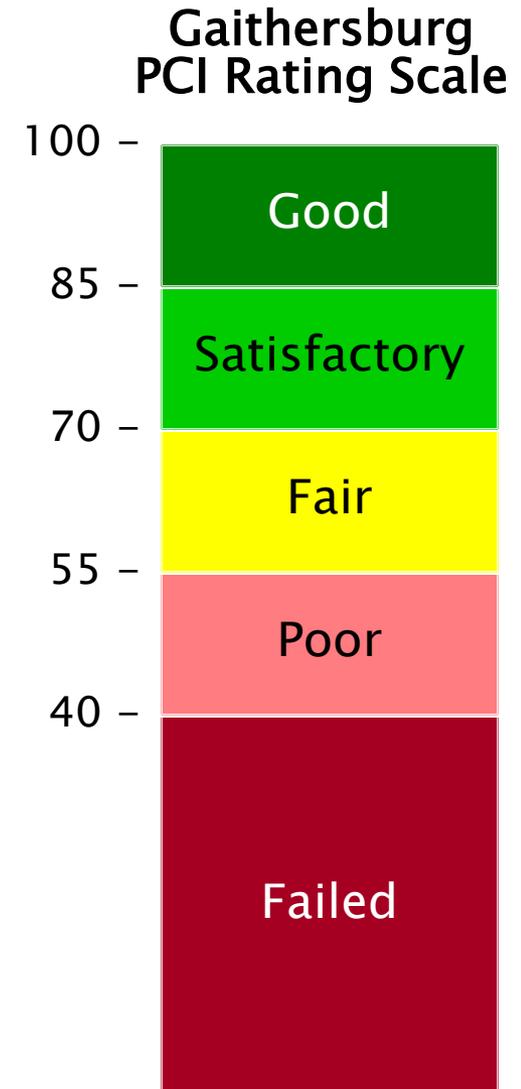
PCI Example 79 (Satisfactory)



Gaithersburg
PCI Rating Scale



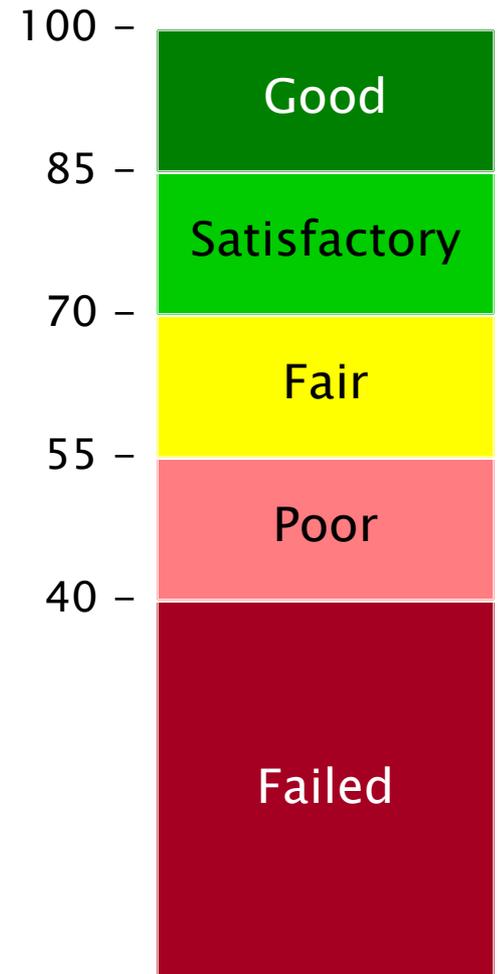
PCI Example 65 (Fair)



PCI Example 44 (Poor)



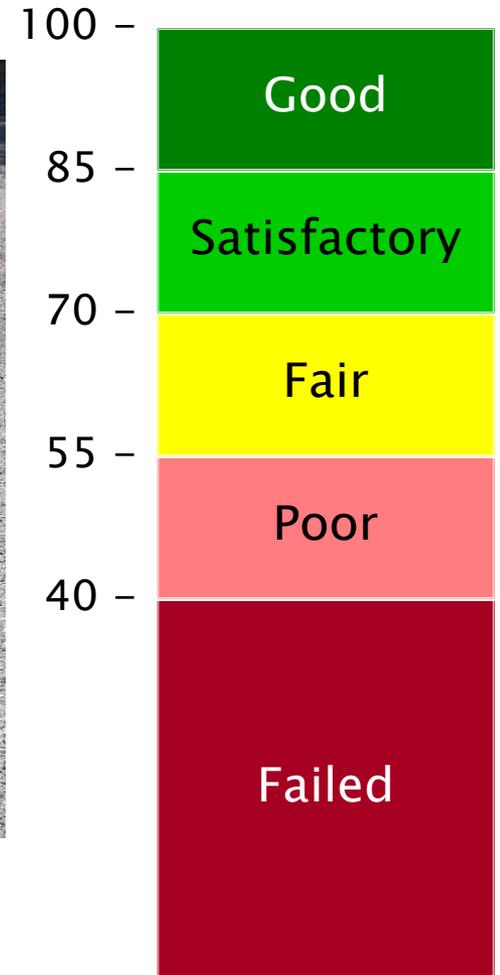
Gaithersburg
PCI Rating Scale



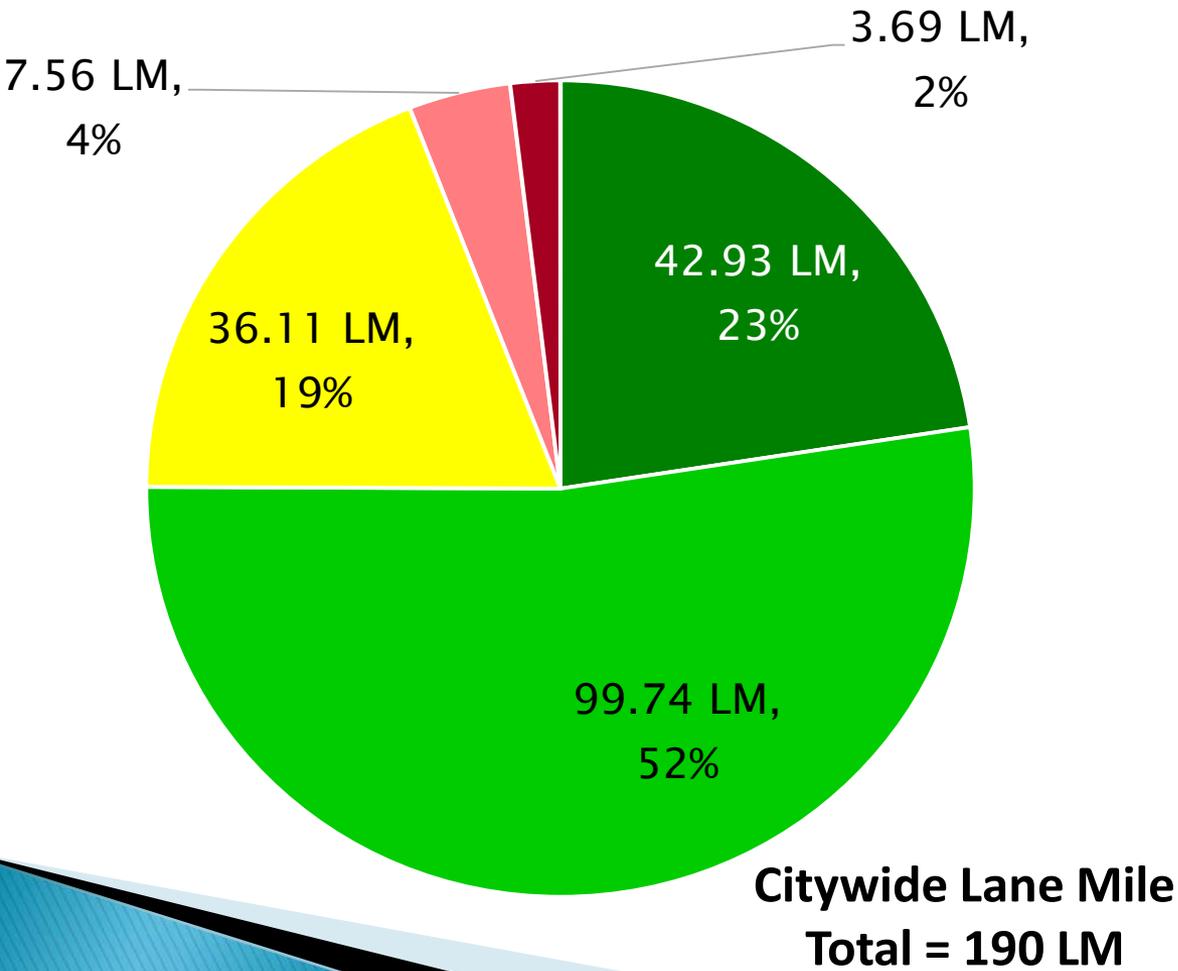
PCI Example 33(Failed)



Gaithersburg
PCI Rating Scale

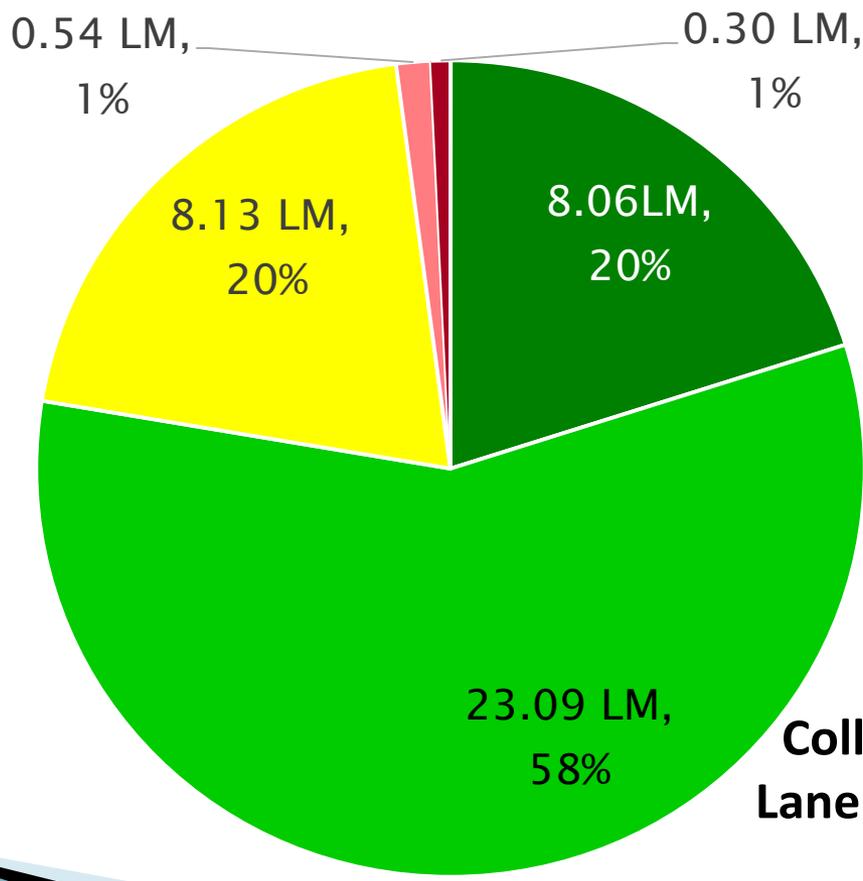


Citywide Lane Mile Breakdown by Gaithersburg PCI Rating Scale



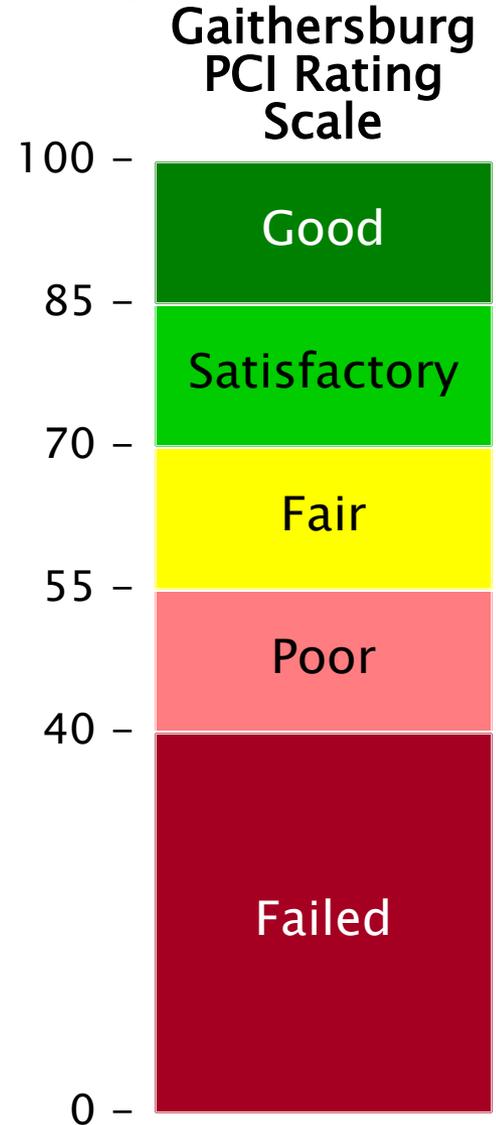
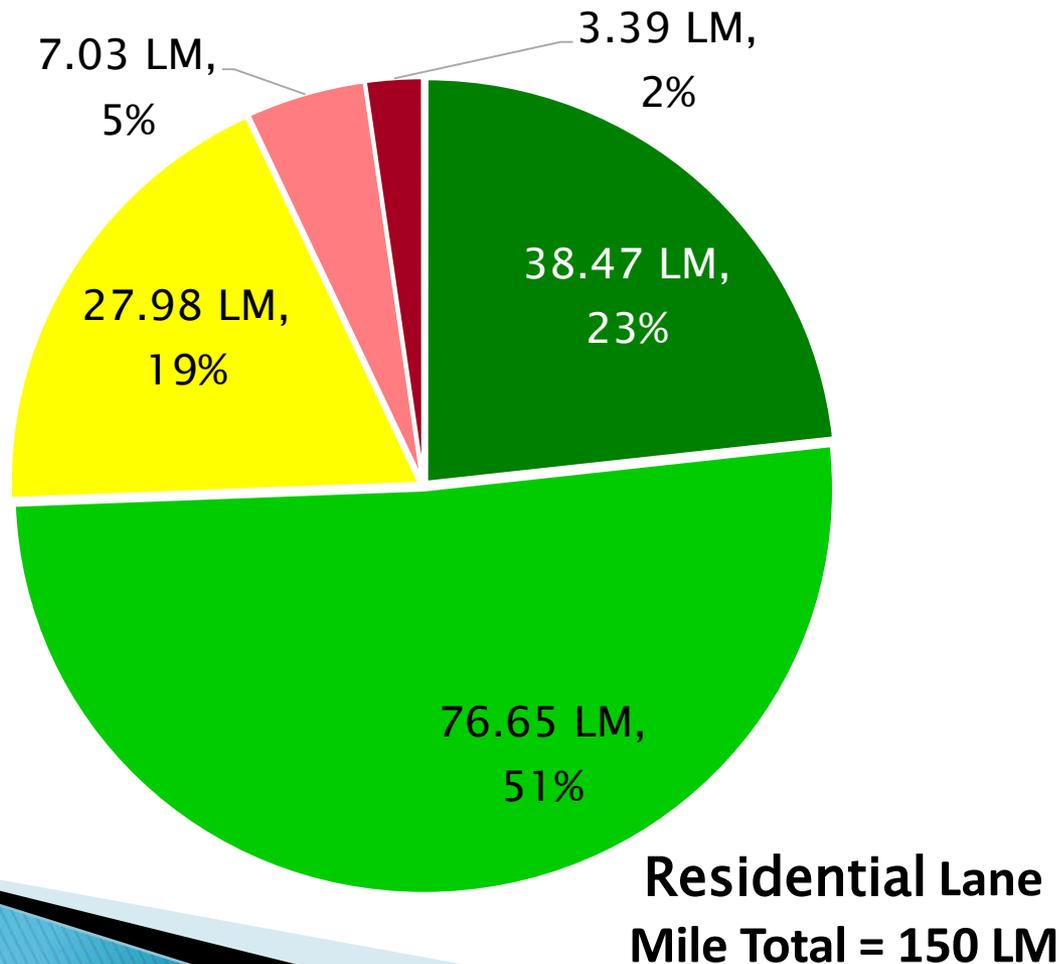
Collector/Arterial Lane Mile Breakdown

Gaithersburg PCI Rating Scale



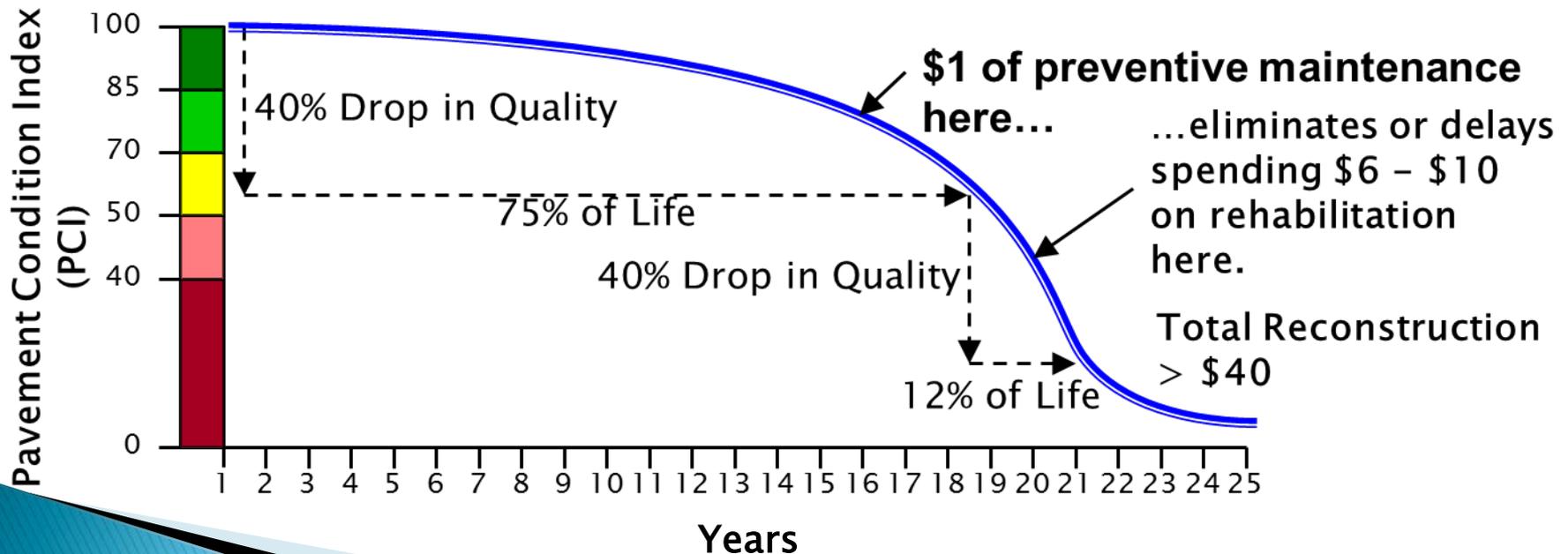
Residential Lane Mile Breakdown

Gaithersburg PCI Rating Scale



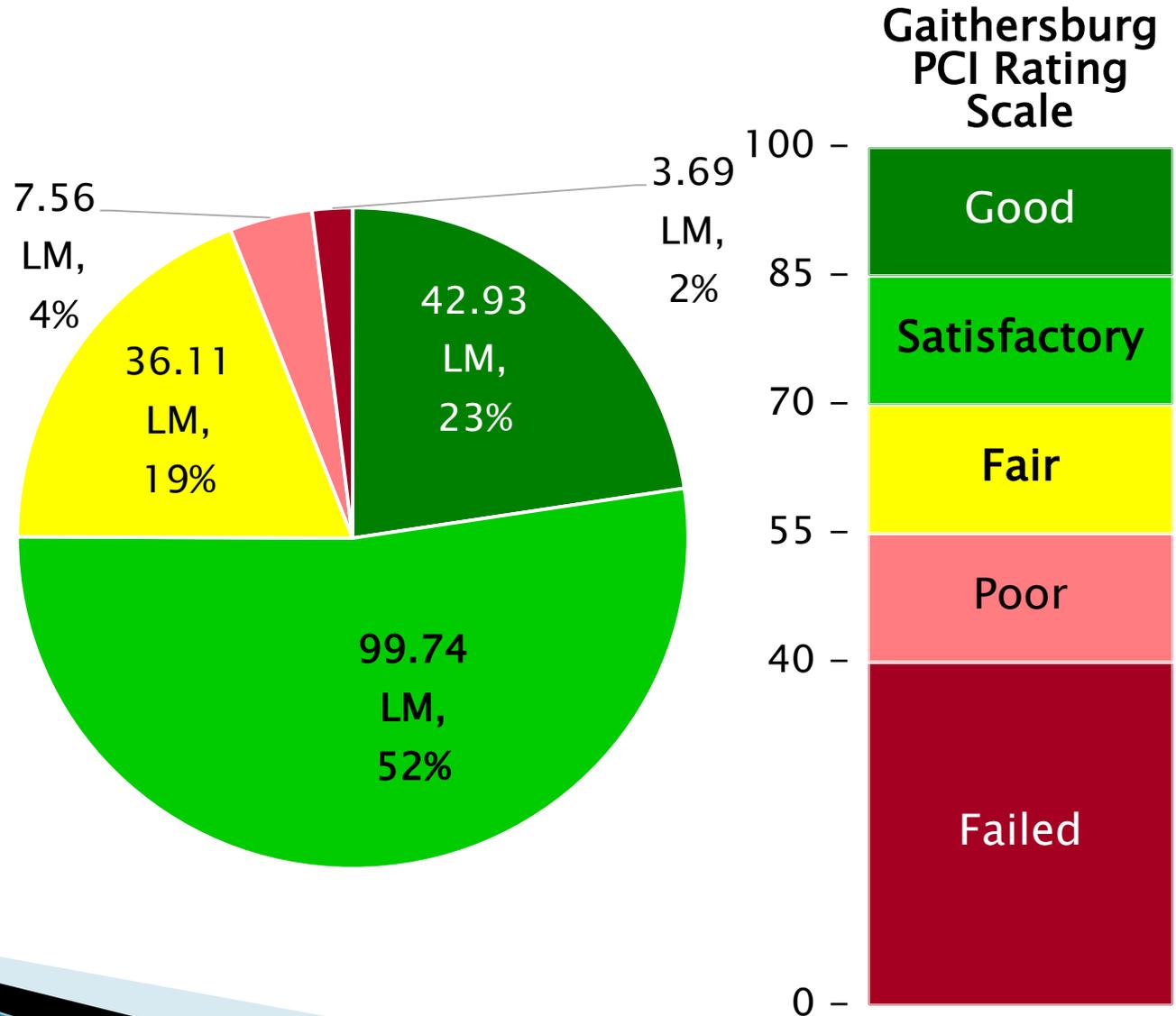
When Should We Fix It?

- ▶ Our objective is to perform restorative work on roads before they reach a condition level that would require a more costly treatment. How fast the road deteriorates depends on the following factors: (1) type of pavement, (2) thickness of the pavement structure, (3) traffic type and volume, and (4) subgrade strength.



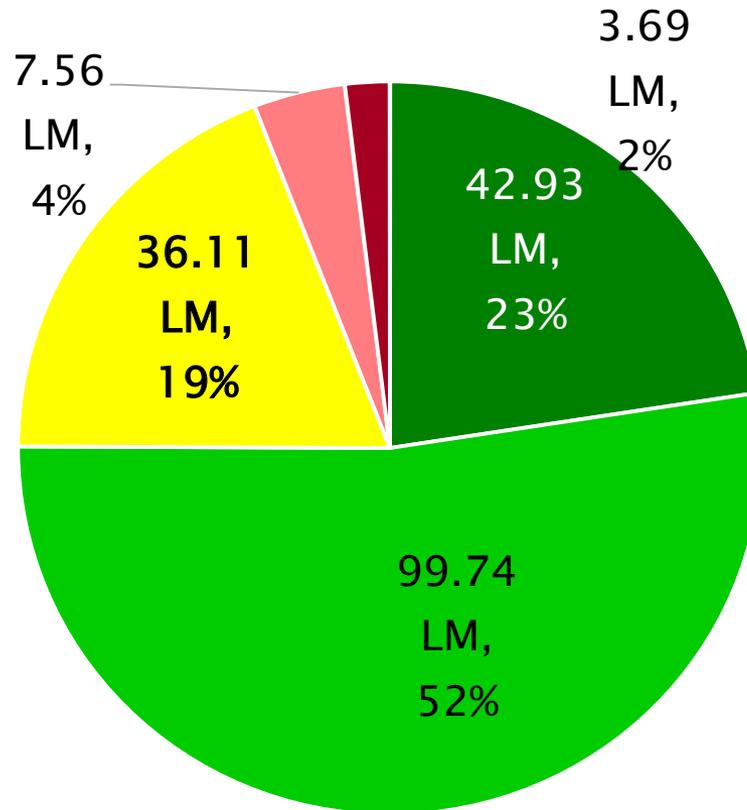
When Should We Fix the Road?

Apply pavement preservation treatments on streets that are rated as "Satisfactory." It is far less expensive to keep a street in good condition than to defer treatment and allowing it to deteriorate further.



When Do We Fix the Road?

Focus on treating the streets that are rated as "Fair."
This range is considered critical because treatment deferred beyond this point will increase the treatment cost many times over.



Once we know what condition the road is in and when we should fix it, the next question is:

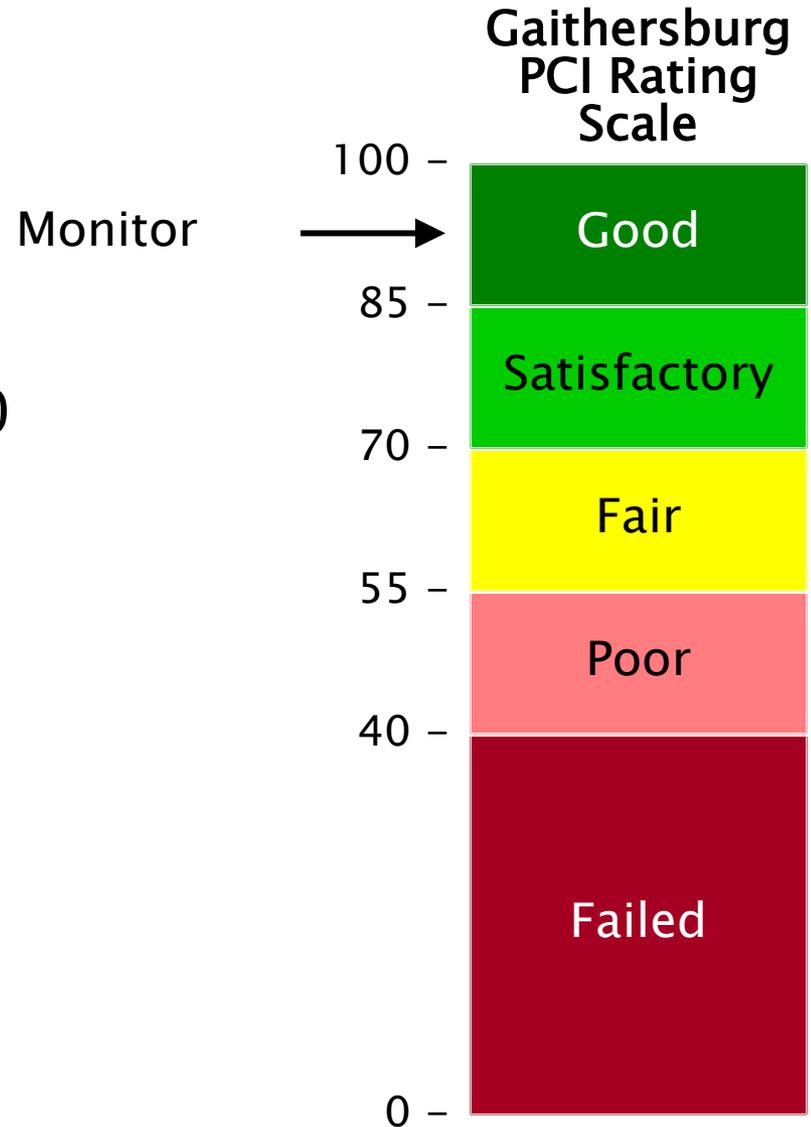
“What is the most economical manner in which to fix the road?”



How Do We Fix the Road?

Monitor

Roads with PCI's between 85-100 should be examined on a regular basis, and if needed, preventive maintenance measures could be considered.

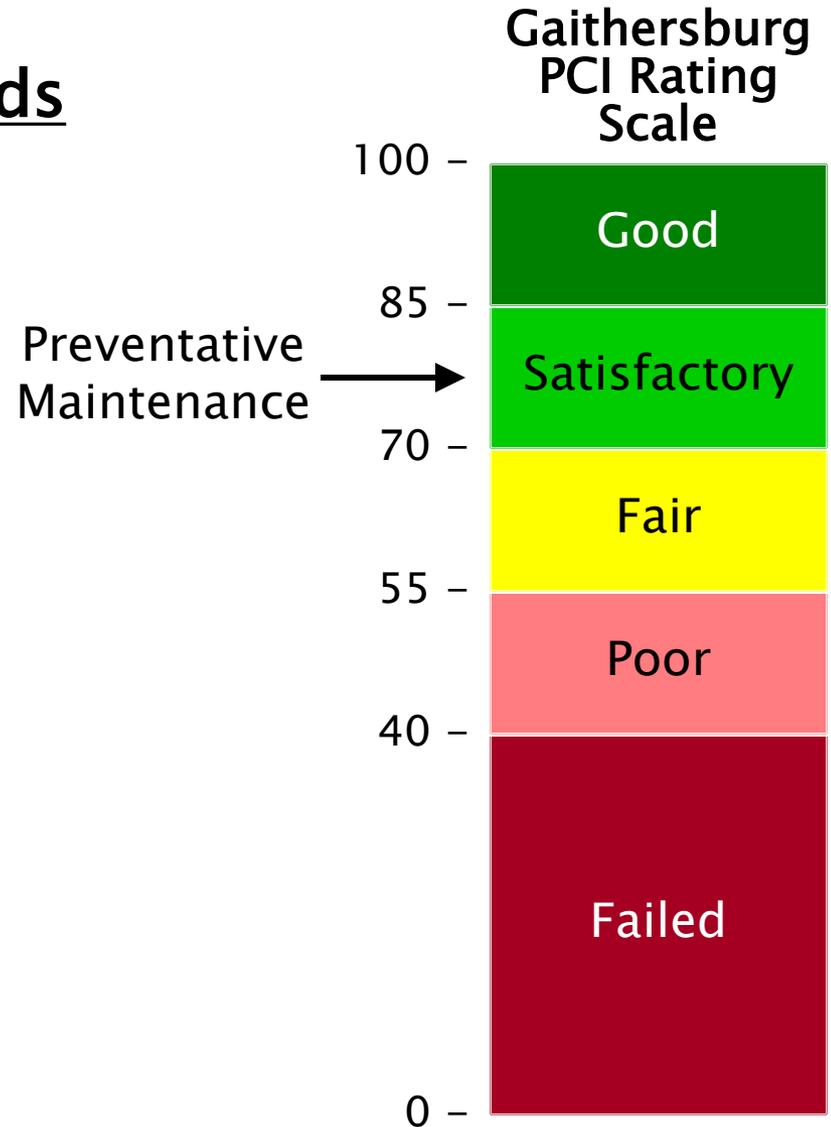


How Do We Fix the Road?

Preventive Maintenance for Roads with PCI's between 70-85

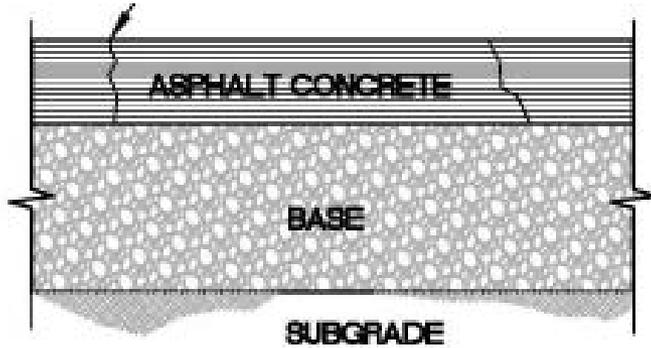
Possible treatment strategies could include:

- asphalt overlays,
- thin surface treatments, and
- crack sealing of existing surfaces.

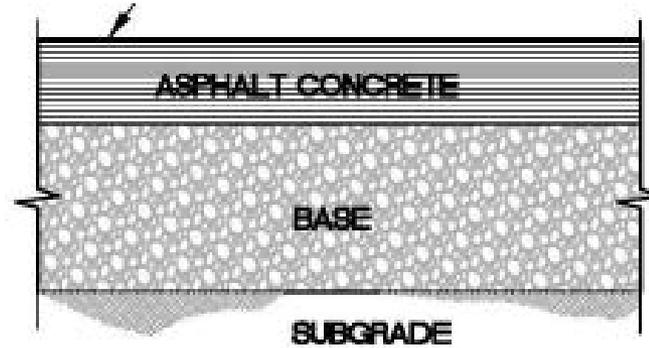


Preventive Maintenance

Crack Sealing



Surface Treatments



ROADWAY SECTIONS

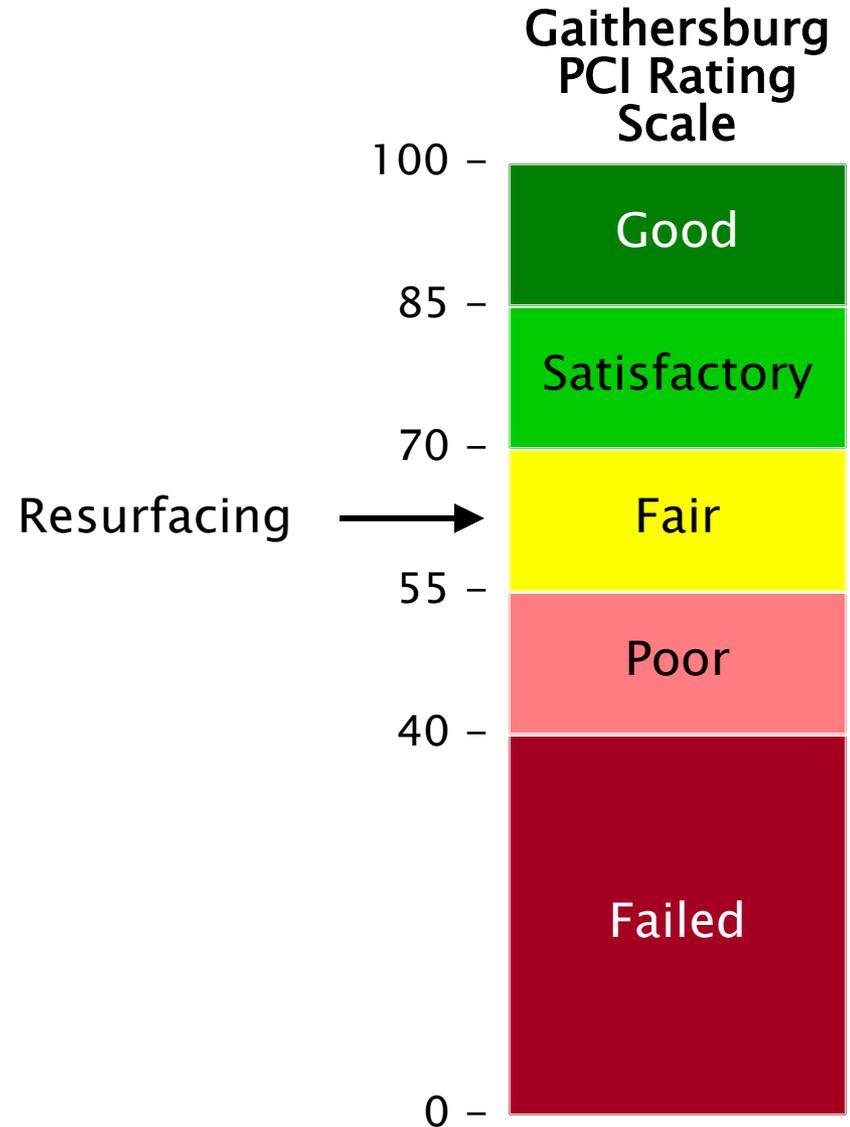


How Do We Fix the Road?

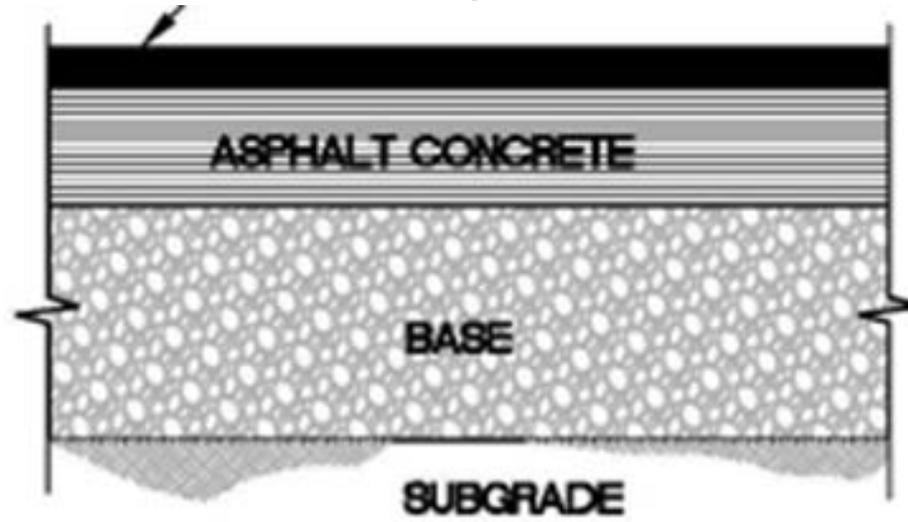
Resurfacing for Roads with PCI's between 55-70

Possible treatment strategies include:

- milling of the existing pavement,
- patching of problem areas, as needed, then
- overlaying of a new surface.



Mill & Overlay

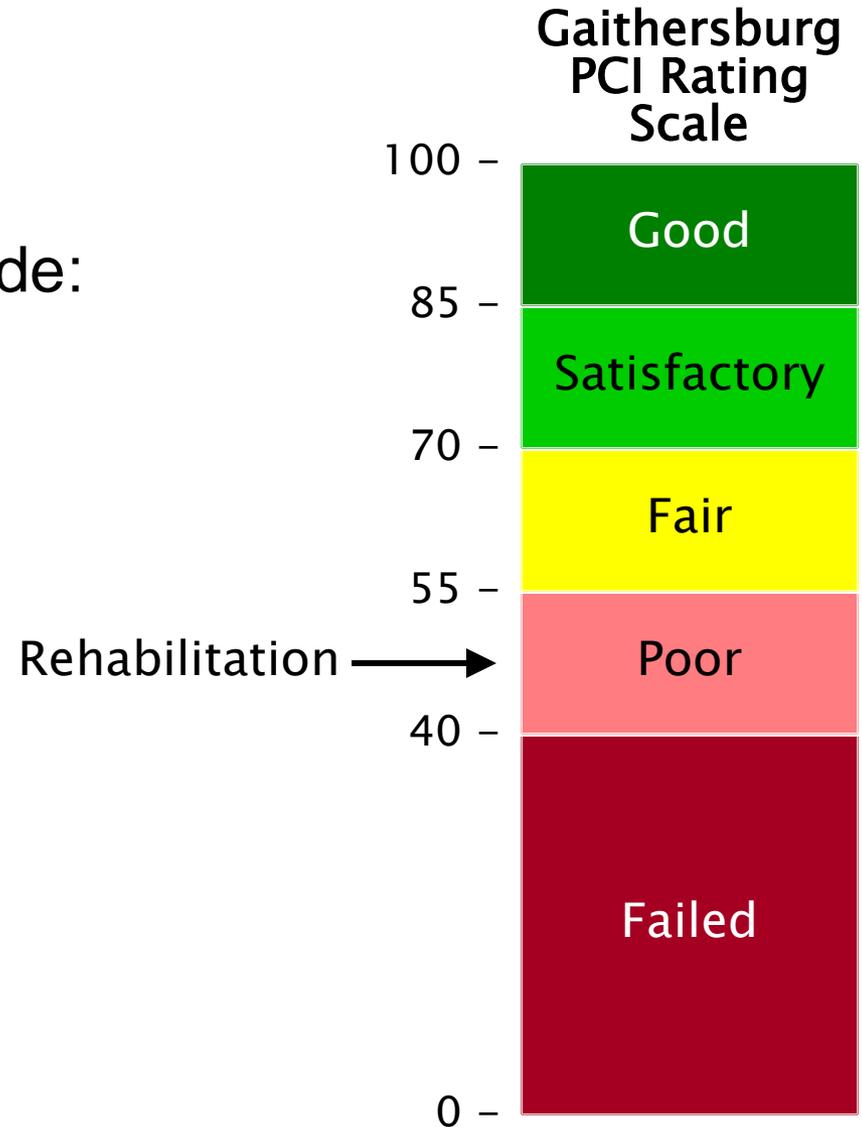


How Do We Fix the Road?

Rehabilitation for Roads with PCI's between 40-55

Possible treatment strategies include:

The City's current method of "Reconstruction" in which the roadway is patched and used as the new base, then a two inch overlay is added to the roadway. At the same time, all new curb and gutter is replaced and tied into the new road surface.



How Do We Fix the Road?

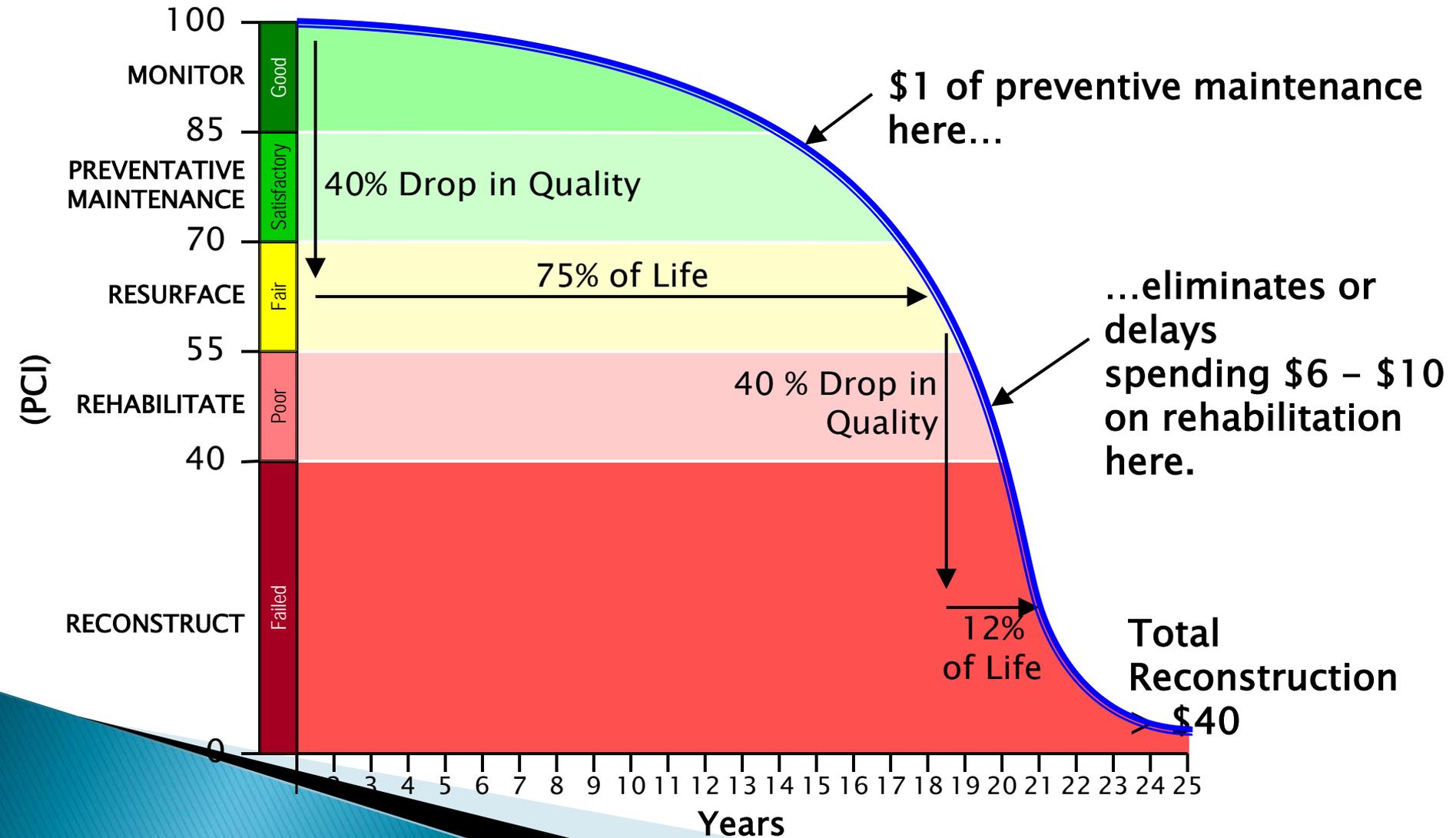
Reconstruction for roads with PCI's between 0- 40

Full reconstruction of streets provides long-term upgrades to the roadway and its underlying infrastructure. The work may include:

- New curbs and sidewalks.
- Additions or upgrades to bicycle facilities.
- Green streets or other innovative SWM treatments.
- Additions, upgrades or relocations of utilities, traffic controls, landscaping or street lights.
- Addressing ADA compliance issues.



Putting It All Together



Next Steps

- Seek guidance from the Mayor and City Council about expanding our menu of treatment options in a effort to optimize our program.
 - Determine target PCI Goal.
 - Establish budget optimization practices to reach goal.
 - Invest in infrastructure preventative maintenance.
 - Hold the line on pavement deterioration.
 - Determine when to re-survey.
 - Re-evaluate goals based on updated information.
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Questions?