

Frederick County Pavement Management Program Resilience in Uncertain Times

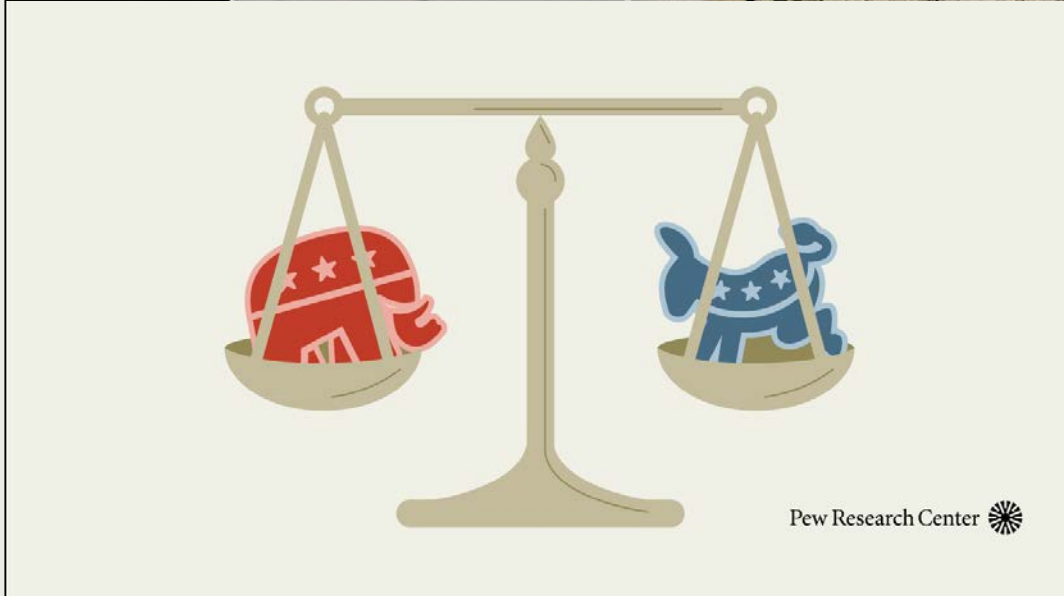
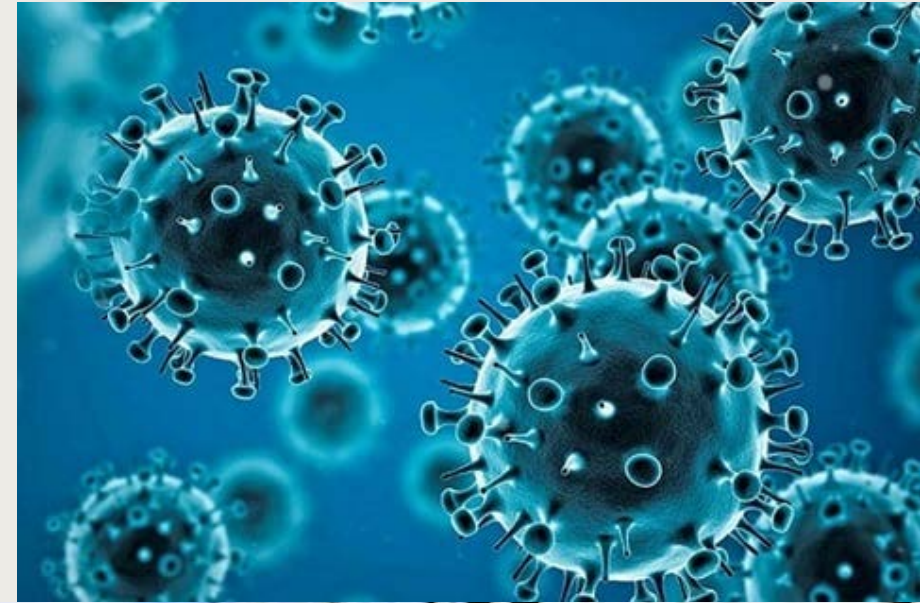
September 29, 2022

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Mott MacDonald



Resilience – The Ability to Bounce Back



Infrastructure Resilience: Vulnerability and Criticality



Gas House Pike flood – Frederick County
(Frederick News Post)



Shallmar Road Landslide – Garrett County
(Maryland Department of Environment)

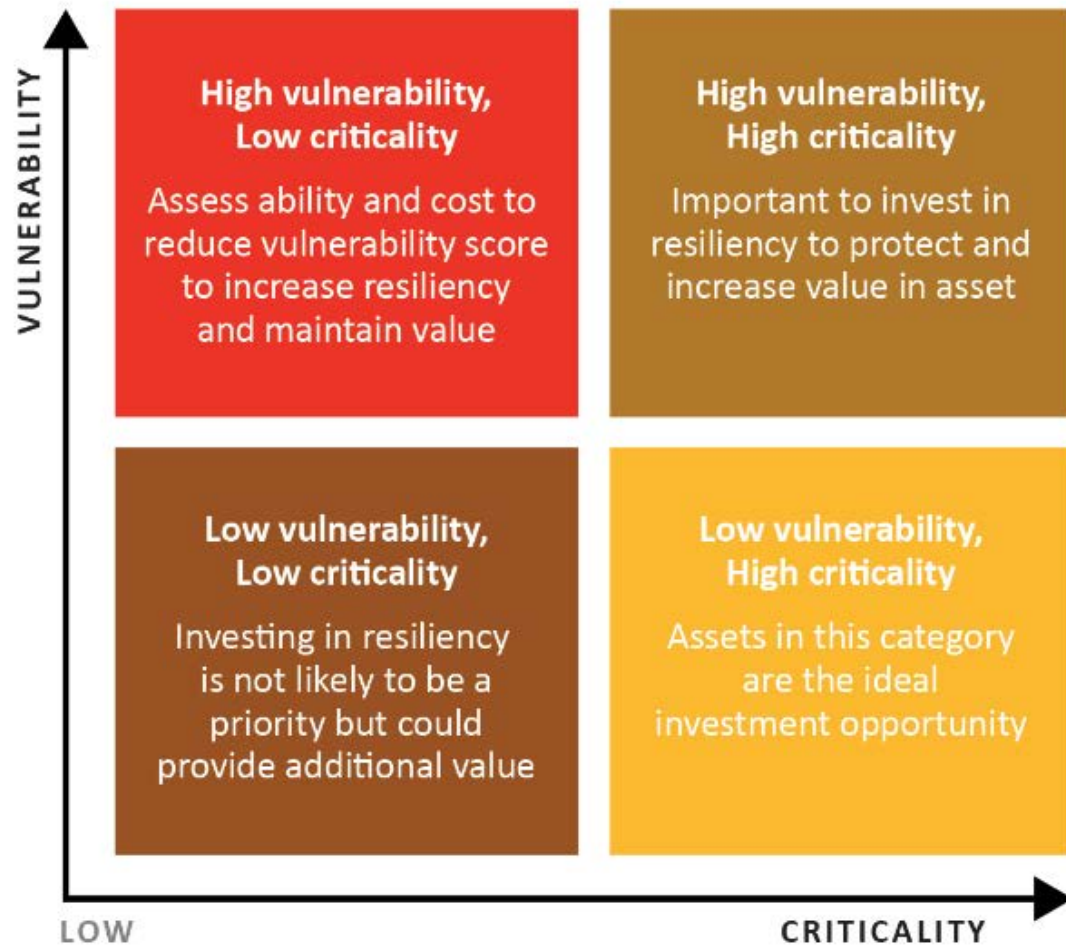


26th Street collapse – City of Baltimore
(Baltimore Sun)



Main Street flood – Ellicott City
(NPR.org)

Resilience is the Act of Minimizing/Mitigating Risk



Source: QIC

<https://www.qic.com.au/knowledge-centre/building-resilience-in-infrastructure-assets-20170205>

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		Likelihood				
		1 Rare	2 Unlikely	3 Possible	4 Likely	5 Almost Certain
Consequences	5 Catastrophic	5	10	15	20	25
	4 Major	4	8	12	16	20
	3 Moderate	3	6	9	12	15
	2 Minor	2	2	6	8	10
	1 Negligible	1	2	3	4	5

Risk = ■ Low ■ Moderate ■ High ■ Extreme

$$Risk = \underbrace{Threat \ Probability}_{Likelihood} * Vulnerability * Consequence$$

Likelihood



U.S. Department
of Transportation

**Federal Highway
Administration**

BIPARTISAN INFRASTRUCTURE LAW (BIL)*

Overview of Highway Provisions

- \$350.8 B (FY 22-26) for Highway programs
- Includes \$567.1 B (All DOT Modes) Over FY 22-26
- BIL Goes Beyond Transportation

*Also known as the “Infrastructure Investment and Jobs Act” (IIJA)



Funding Available to a Range of Recipients

Program Examples	State	PR*	MPO	Local	Tribe	PA**	Territory	FLMA**
Apportioned programs (formula)	✓	*						
Bridge Program (formula)	✓	✓			✓			
National Electric Vehicle Formula Program	✓	✓		✓				
Safe Streets and Roads for All program			✓	✓	✓			
PROTECT Grants (discretionary)	✓	✓	✓	✓	✓	✓	✓***	✓***
Charging and Fueling Infrastructure Program	✓	✓	✓	✓	✓	✓	✓	
Congestion Relief Program	✓	✓	✓	✓				
Bridge Investment Program (discretionary)	✓	✓	✓***	✓	✓	✓		✓
Reconnecting Communities Pilot Program	✓	✓	✓	✓	✓			
Rural Surface Transportation Grants	✓	✓		✓	✓			
INFRA	✓	✓	✓***	✓	✓	✓		✓
National Infrastructure Project Assistance	✓	✓	✓	✓	✓	✓	✓	
Local and Regional Project Assistance	✓	✓	✓	✓	✓	✓	✓	
Natl. Significant Fed. Lands & Tribal Projects	✓***	✓***	✓***	✓***	✓	✓***		✓
Tribal Transportation Program Safety Fund					✓			

PROTECT Program Grants (discretionary)

Promoting, Resilient Operations for Transformative, Efficient, and Cost-saving Transportation



Purpose	Planning, resilience improvements, community resilience and evacuation routes, and at-risk coastal infrastructure
Funding	\$1.4 B (FY 22-26) in Contract Authority from the HTF
Eligible entities	<ul style="list-style-type: none"> • State or political subdivision of a State (including Puerto Rico) • MPO • Local government • Special purpose district or public authority with a transportation function • Indian Tribe • Federal land management agency (applying jointly with State(s)) • <i>Different eligibilities apply for at-risk coastal infrastructure grants</i>
Eligible projects	<ul style="list-style-type: none"> • Highway, transit, intercity passenger rail, and port facilities • Resilience planning activities, including resilience improvement plans, evacuation planning and preparation, and capacity-building • Construction activities (oriented toward resilience) • Construction of (or improvement to) evacuation routes
Other key provisions	<ul style="list-style-type: none"> • Higher Federal share if the eligible entity develops a resilience improvement plan (or is in a State or area served by MPO that does) and the State or MPO incorporates it into its long-range transportation plan • May only use up to 40% of the grant for construction of new capacity



Asset Management – A Systematic Approach to Infrastructure Resilience

Can you answer these important questions about your infrastructure assets?

- ☐ Do I have a complete inventory of my assets?
- ☐ Do I know the condition of those assets?
- ☐ Do I have a structured approach of determining MPR&R on those assets?
- ☐ Do I know the performance life of those assets under typical conditions?
- ☐ Do I know how much funding it will take to maintain those assets in a state of good repair?
- ☐ Can I predict the consequences of losing funding and losing ground on condition?
- ☐ Do I have any assets that are critical to the economy, mobility, safety, environment, or social fabric of my community that require special consideration?



Frederick County Resilience Overview

- ☐ Gas House Pike Bridge
- ☐ Michaels Mill Road
- ☐ May 2018 flooding
- ☐ Pavement Management Program



Gas House Pike Bridge



Gas House Pike

Pipe culvert crossing prior to bridge install.

Legend

Google Earth

© 2022 Google

Mott MacDonald

4.48 ft



Gas House Pike Bridge





Gas House Pike Bridge





Gas House Pike Bridge





Michaels Mill Road





May of 2018 flooding





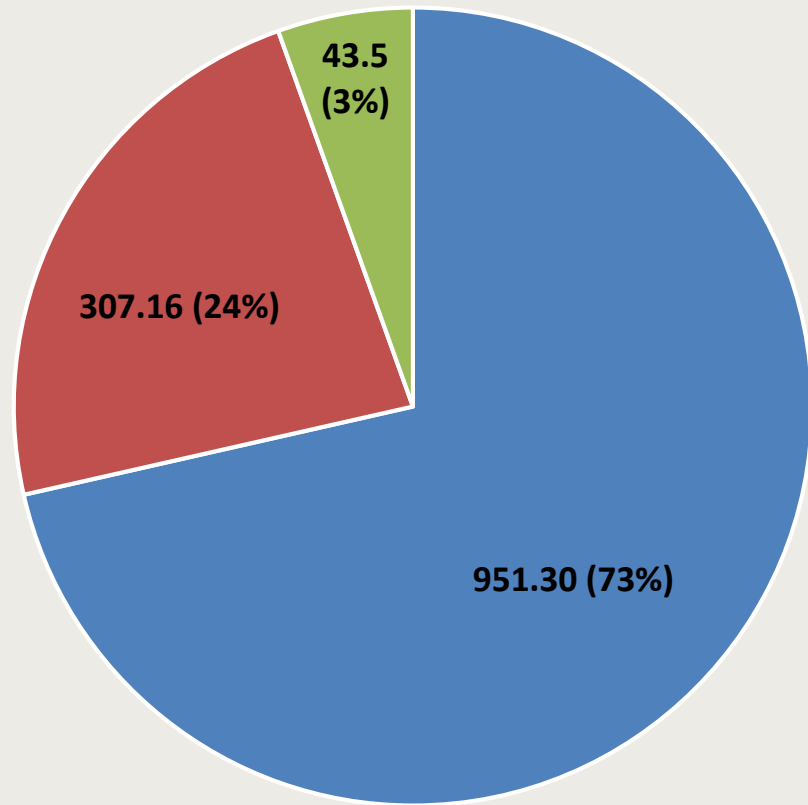
Pavement Management Program (PMP)

- ❑ Responsibilities of the Pavement Management Program (PMP).
- ❑ Program utilizes an optimized approach.
- ❑ Pioneer of County asset management programs.

Roadway Network Stats



Network Roadway Type
C/L Miles



■ Asphalt = ■ Tar and Chip = ■ Gravel =

Element	Asphalt	Tar & Chip	Total
Lane Miles	1897.2	586.9	2484.2
PCI	81.8	80.8	81.5
Total Square Yards	12,452,626	2,933,767	15,386,393
Replacement Value	\$512,051,963	\$120,636,518	\$632,688,481

Treatment Current Needs	Lane Miles	Treatment Cost
Maintenance	453.2	\$20,674,115
Preservation	694.5	\$21,719,715
Rehab-Thin	688.1	\$96,616,285
Rehab-Thick	50.9	\$7,038,653
Reconstruction	0.2	\$55,726
Grand Total	1886.8	\$146,104,494



AgileAssets Pavement Analyst Software



- ☐ Stores roadway information.
- ☐ Includes optimization tools for computerized outputs.
- ☐ Outputs are finalized and let.
- ☐ “Project-level decisions”
- ☐ Example of a project-level decision.



INVENTORY / GIS



CONDITION DATA



WORK PLANS



CONSTRUCTION HISTORY



TREATMENTS



DECISION TREES

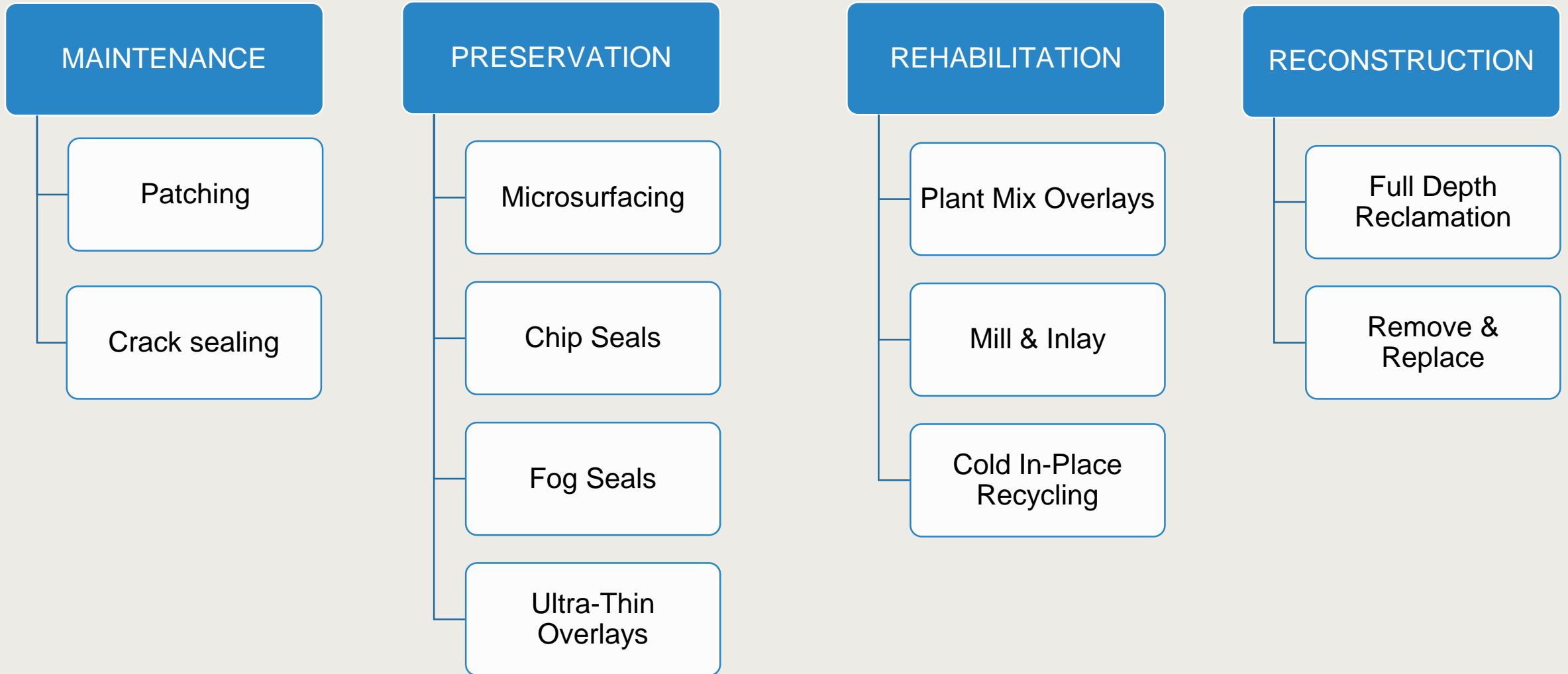


PERFORMANCE MODELS



ANALYSIS & REPORTING

PMP Construction Procedures



Steps of PMP Processes

Step 1

- Biennial Condition Evaluation Surveys Year 1 – Year 4
- HMA roads (Year 1 and Year 3)
- T&C roads (Year 2 and Year 4)
- Information captured by the surveys.
- Pavement Condition Index (PCI).

Step 2

- Analyze Unit Costs
- Update construction history.
- Develop Master Work Plan (MWP).
- Five-year plan for flexibility in design.

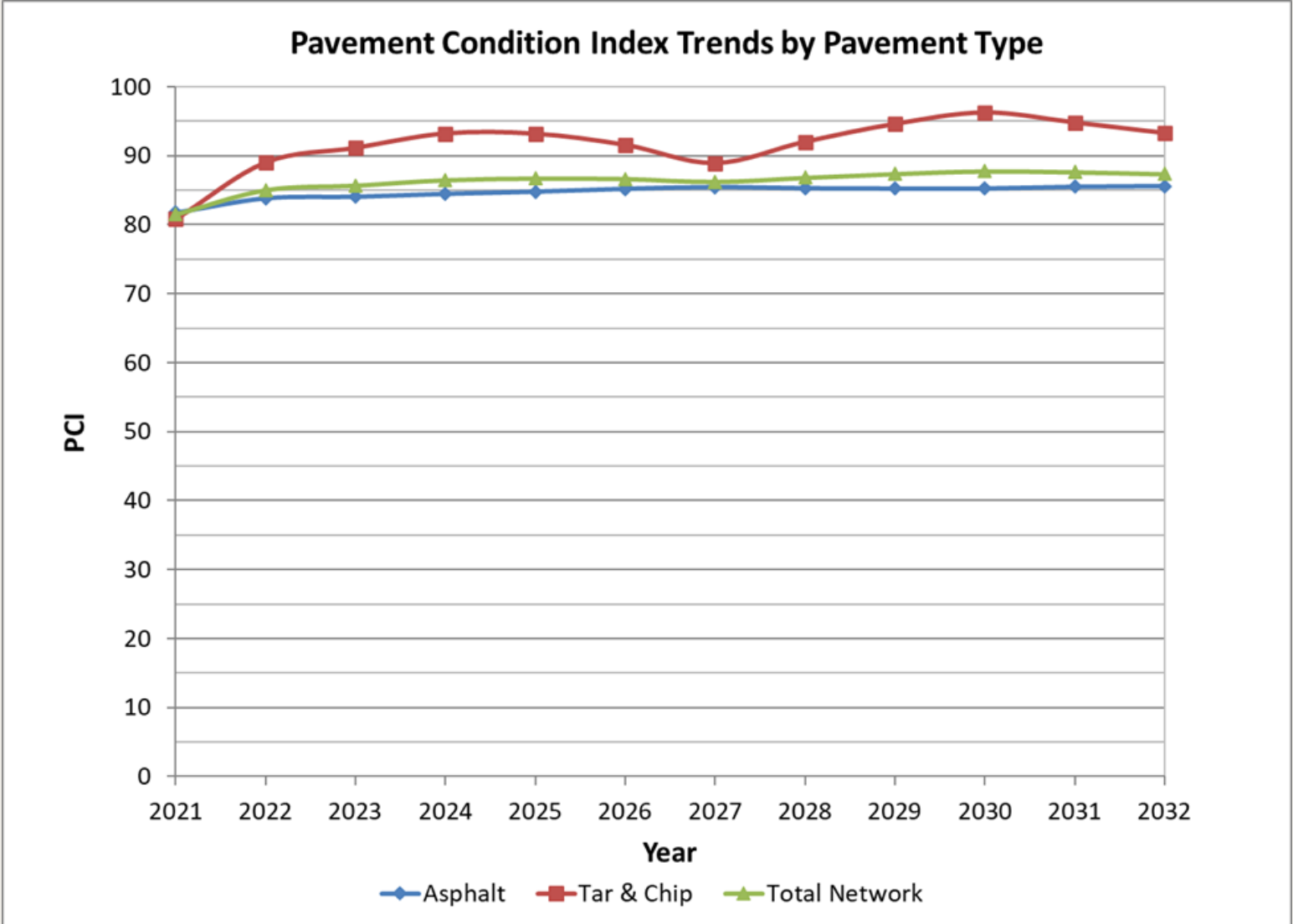
Step 3

- Fiscal Year projects are designed in-house.
- Advertise for bid.
- Three to five contracts per fiscal year.



Pavement Condition Index Thresholds

- 90-100 Excellent
- 80-90 Good
- 70-80 Satisfactory
- 60-70 Fair
- <60 Poor

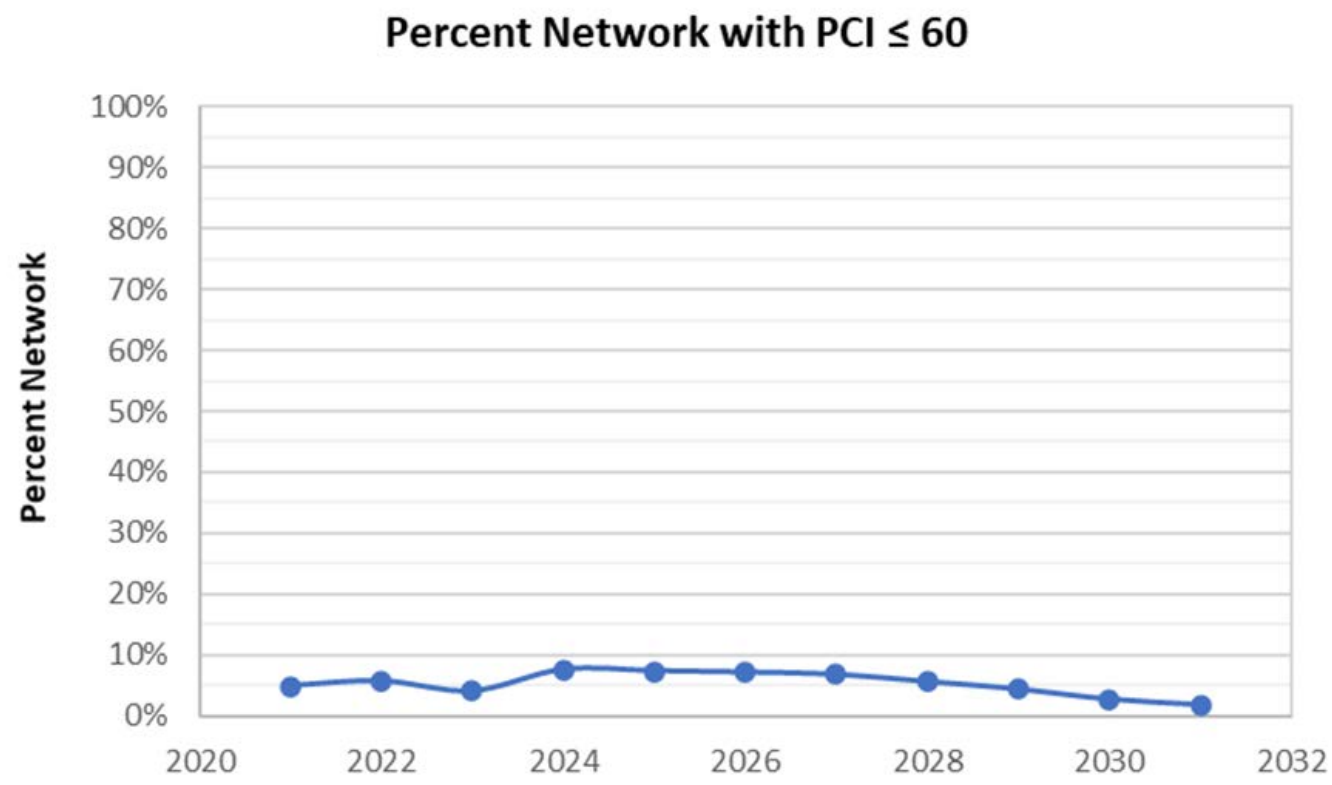
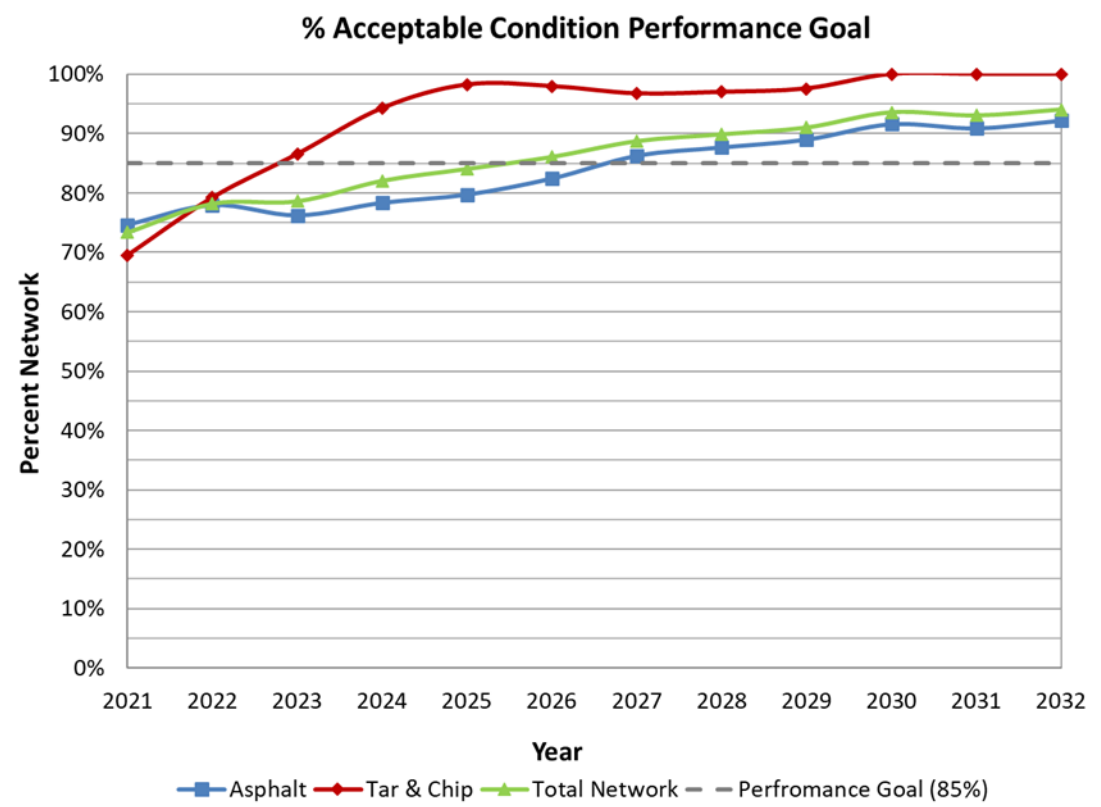




Program Goals

□ **Goals or key performance indicators:**

- 1. 85% of the network with PCI > 70.
- 2. < 10% of the total network with PCI < 60.

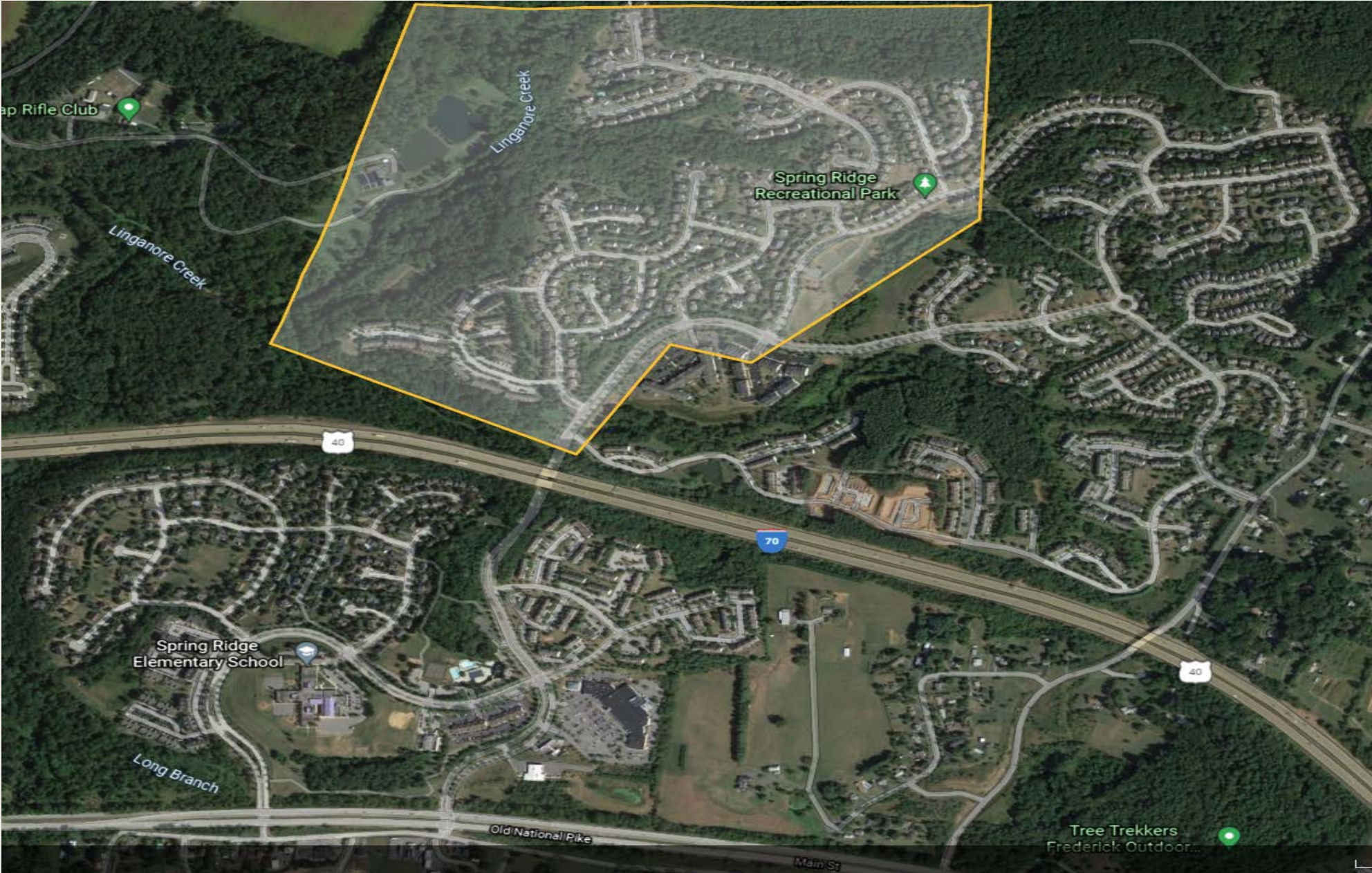




Neighborhood Grouping Analysis

- ☐ Tool was developed for Frederick County in 2018 as an enhancement to the pavement management system.
- ☐ First of its kind. Featured in presentations nationwide.
- ☐ A post process to the Optimization Analysis to group projects geographically by neighborhood to deliver as a single project.
- ☐ Takes advantage of Economies of Scale by minimizing mobilization and staging costs.
- ☐ Minimizes the impact of construction activities on adjacent routes to a neighborhood.
- ☐ Projects recommended provide same final surface appearance upon completion.

Neighborhood Grouping Analysis Example – Spring Ridge





PMP Road Map

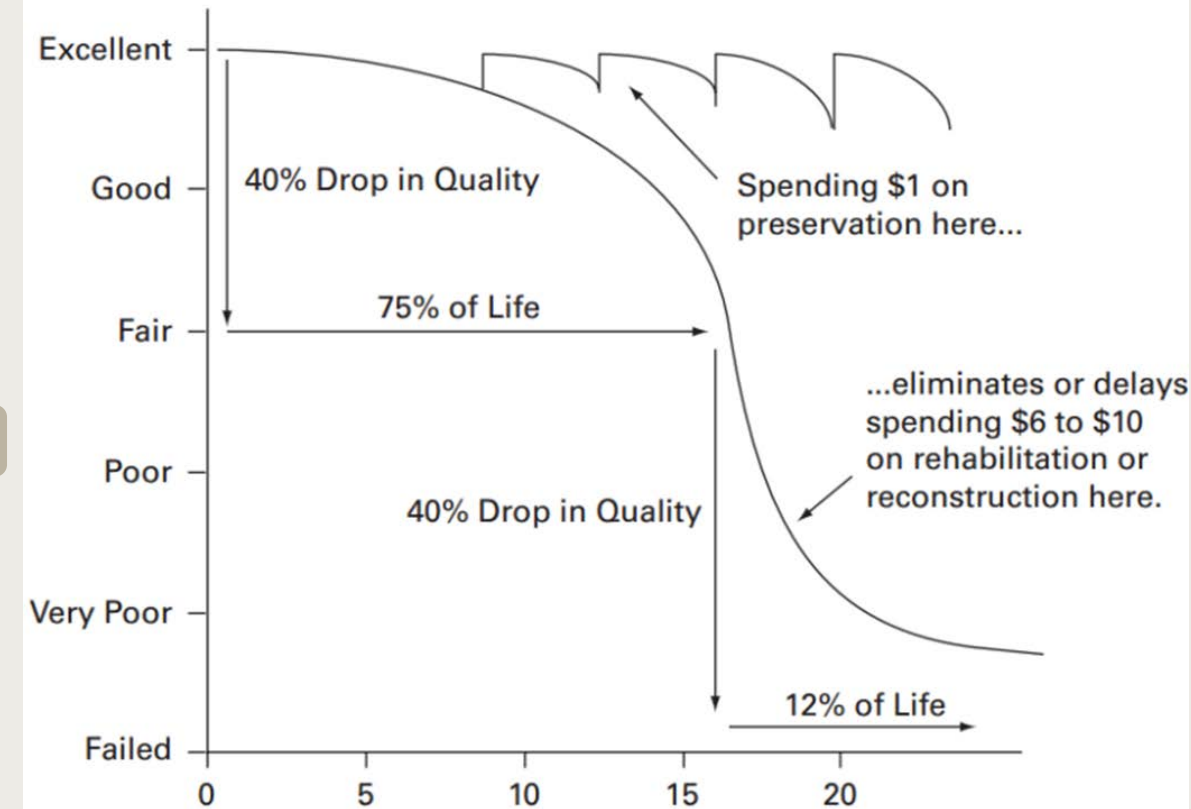
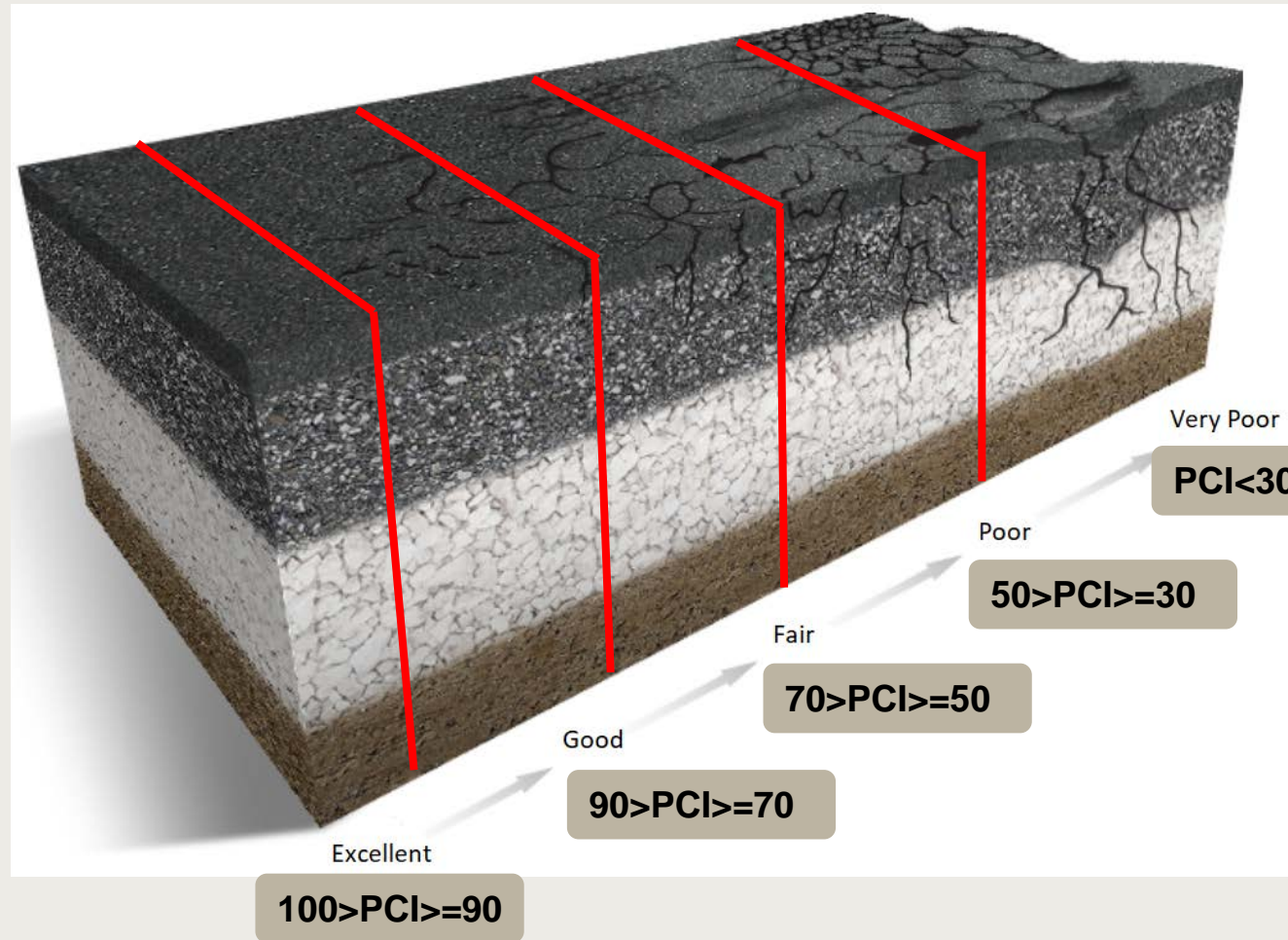
- ☐ Calibrated Performance Models (COMPLETE)
- ☐ Dashboards displaying real-time goals status. (COMPLETE)
- ☐ Interactive mapping. (IN PROGRESS)
- ☐ Evolving by piloting new products. (ONGOING)



Summary

- ☐ **Piloting Innovative Industry Technologies.**
- ☐ **Utilization of Asset Management.**
- ☐ **Pioneer of County Asset Management.**
- ☐ **Progressive Network Performance.**

Pavement Management Program – How does it work?

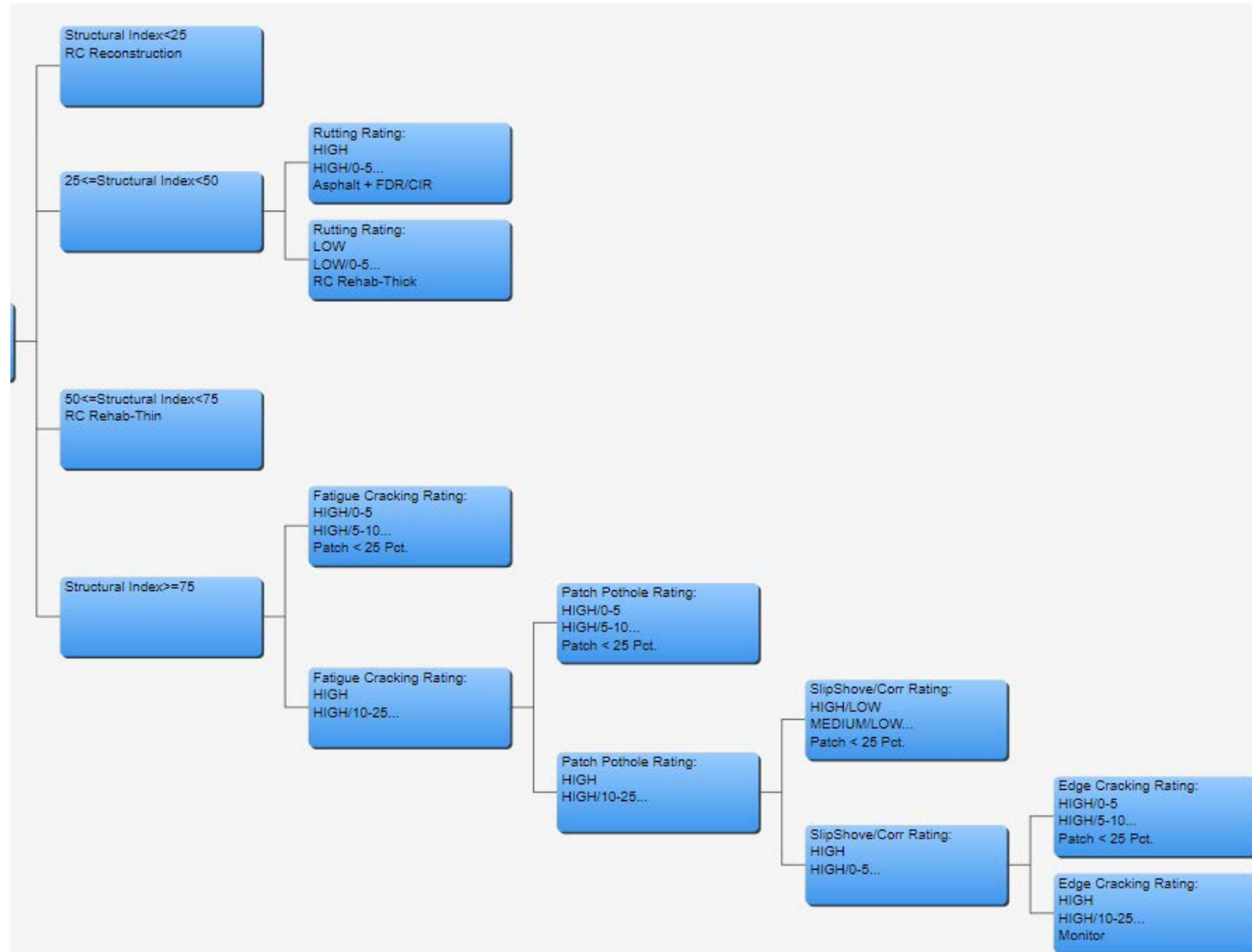


Objective: Maintain Network in Good Condition for as Long as Possible to Minimize Cost to Traveling Public!

<https://roadresource.org/>



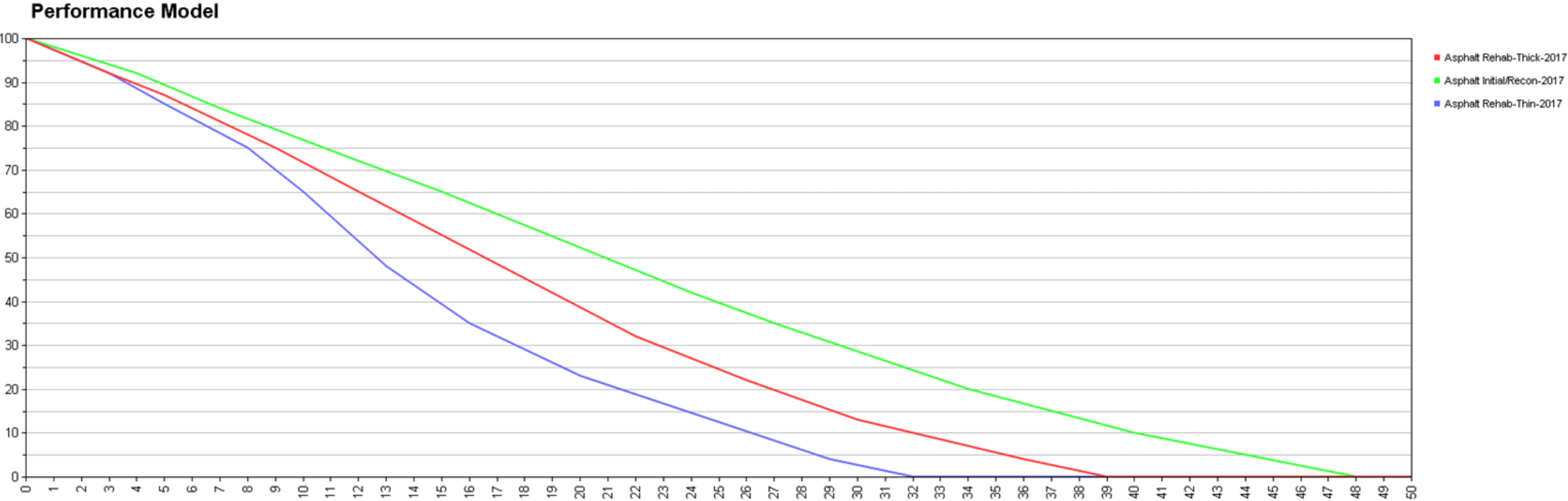
Frederick County Decision Trees





Frederick County Performance Models

Asphalt Pavements





Objective of Effective Pavement Management: Maximize Network Benefit Subject to Cost Constraints for All Roads in the Network

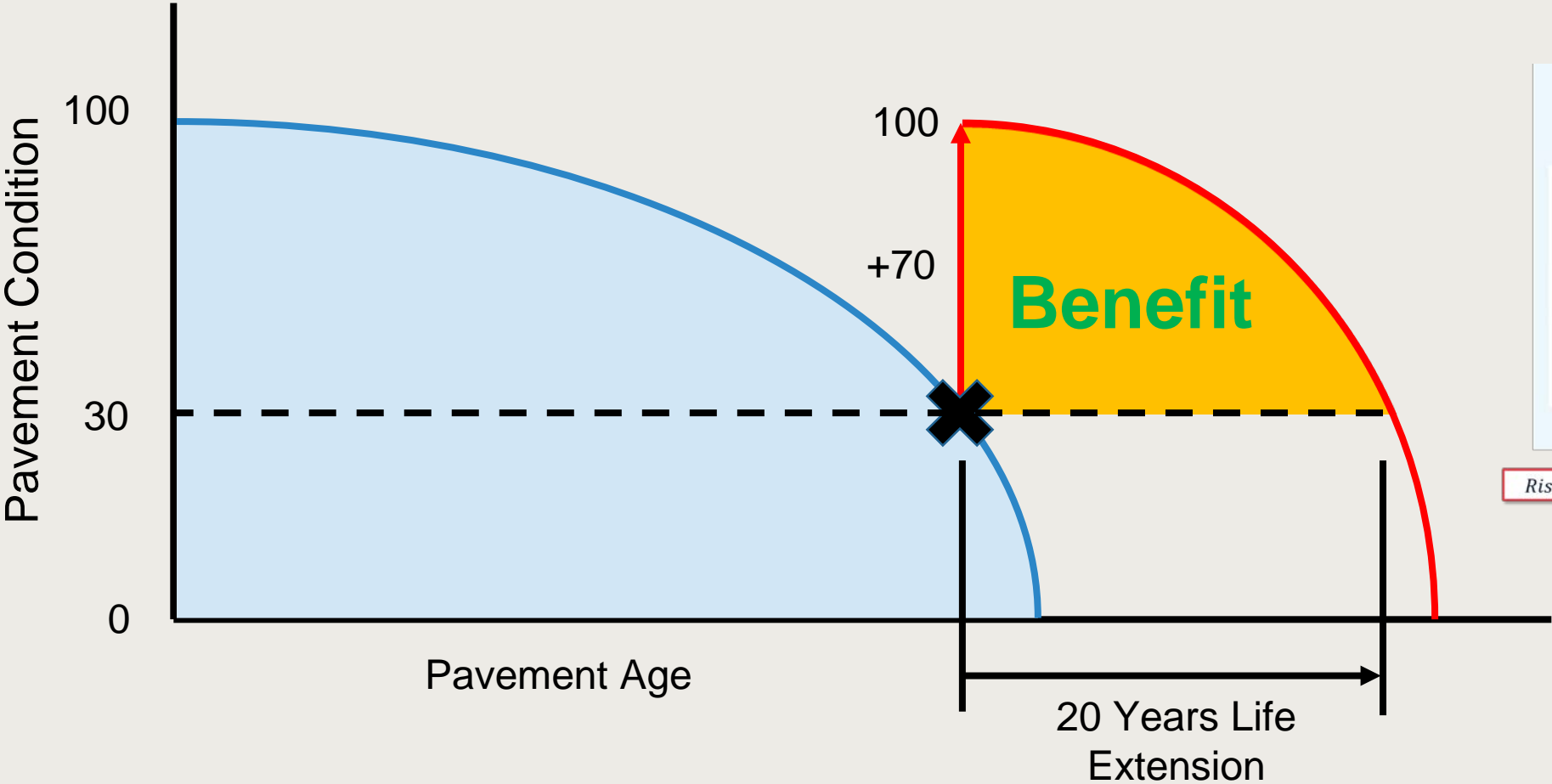


**Condition Improvement = 70 PCI Points (100-30)
Life Extension = 20 Years**

Benefit = Condition Improvement * Life Extension



Frederick County Pavement Management Program – Optimization Approach Incorporating Resilience



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Risk = ■ Low ■ Moderate ■ High ■ Extreme

*Risk = Threat Probability * Vulnerability * Consequence*

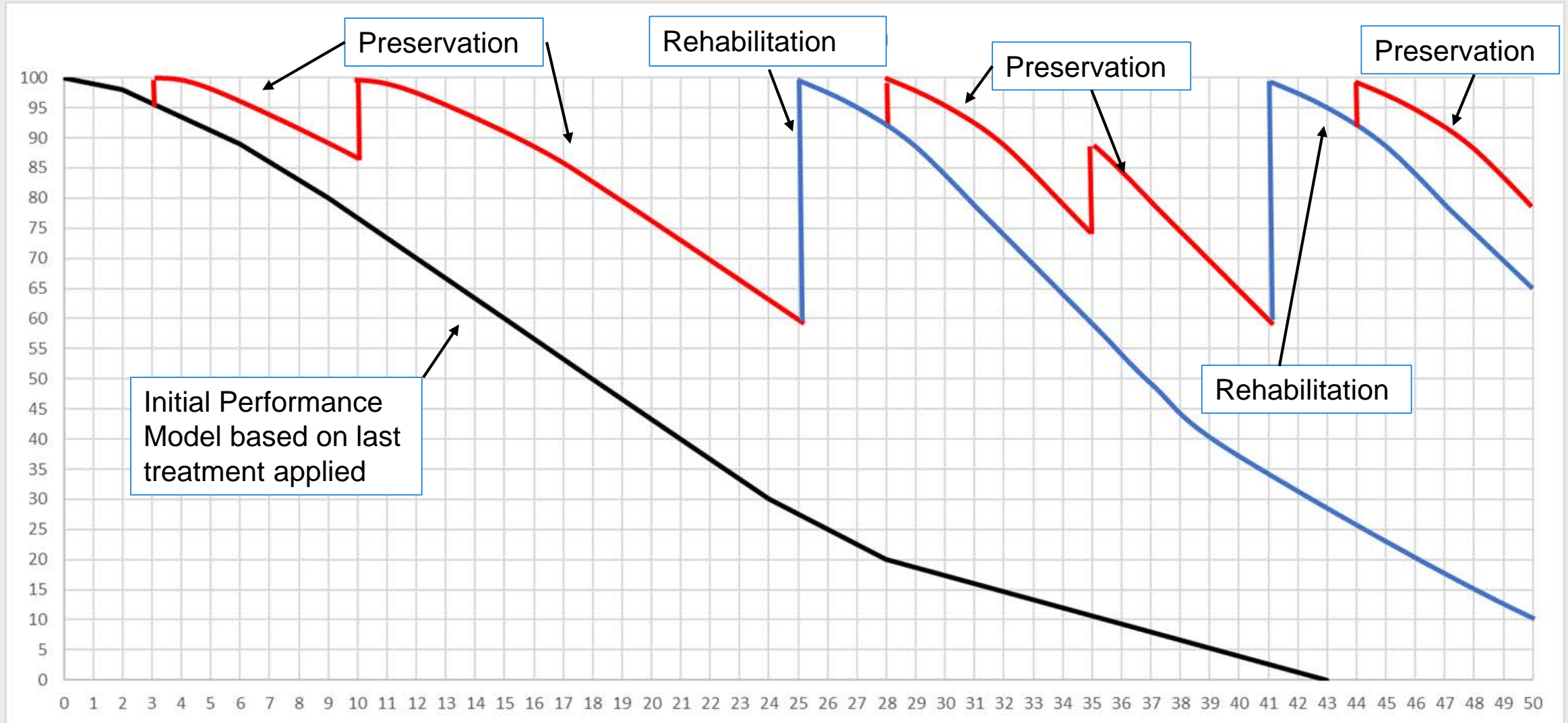
Likelihood

Benefit = Condition Improvement * Life Extension * Risk Factor



Life Cycle Cost Example

Optimized Treatment Timing





Goal of Optimization Analysis

Optimized
Work Plan
+ Priority of
Resiliency
Projects



PMP Performance Reports and Maps Generated Each Year



Frederick County, MD
Pavement Management Program
Support Services

Budget Optimization Analysis Results –
Requested Submission

Contract Services Agreement: #17-108



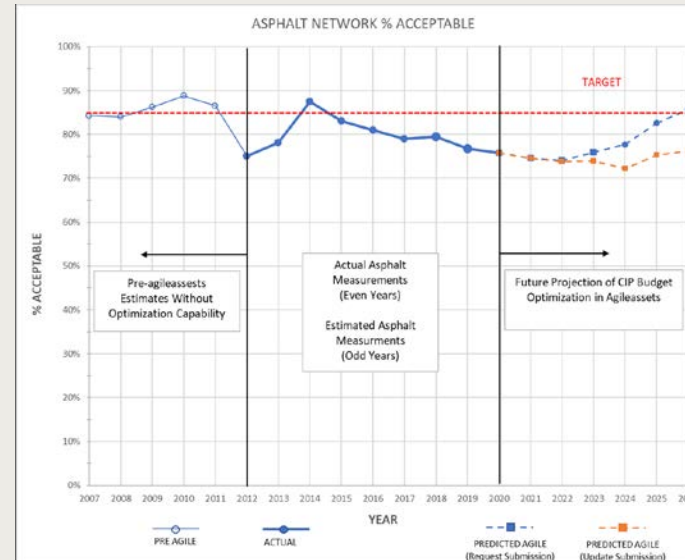
Table 1 - Current Condition and Inventory Summary

Element	Total	Asphalt	Tar & Chip
Length (CL Miles)	1,225.81	920.97	304.84
Lane Miles	2,421.44	1,840.3	581.14
PCI	77.8	80.4	78.2
Total Square Yards	134,102,654.4	107,798,169.6	26,304,484.8
Replacement Value	\$5,380,198,495	\$4,118,968,068.06	\$279,571,585.92

Table 15 - Requested Budgets for FY21-26 Analysis (CIP Period)

Fund	2020*	2021	2022	2023	2024	2025	2026
Bond Fund	\$12,783,400	\$14,609,898	\$10,364,147	\$13,220,180	\$13,668,767	\$16,111,967	\$16,652,603
Cash Fund	\$7,678,700	\$3,799,318	\$10,338,375	\$8,637,309	\$8,625,165	\$7,767,354	\$8,588,552
Total Budget	\$20,462,100	\$18,409,216	\$20,702,522	\$21,857,489	\$22,293,932	\$23,879,321	\$25,241,155

* Approved Budget

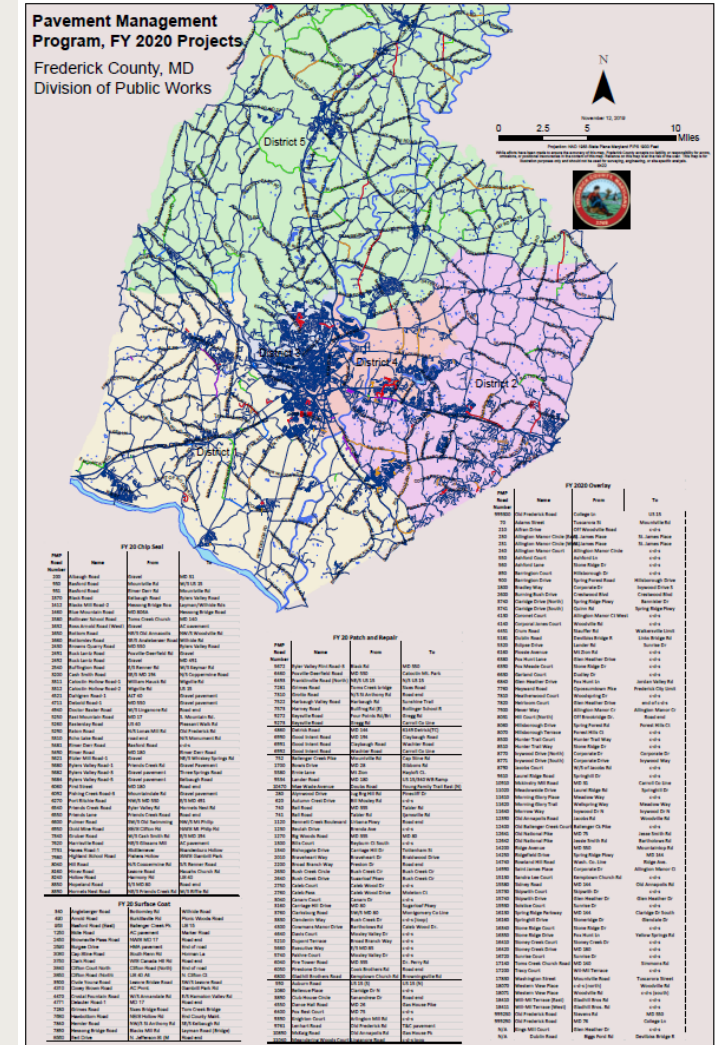


Submitted by:
The Kercher Group, Inc.

December 13, 2019



**Pavement Management
Program, FY 2020 Projects**
Frederick County, MD
Division of Public Works





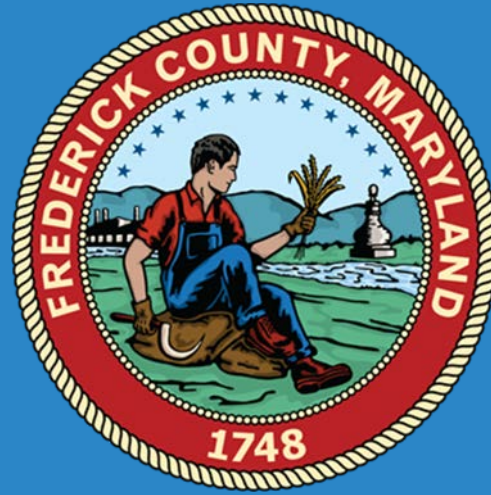


Final Thoughts

- ☐ There is a direct connection between the data and analysis process of PMP, the projects selected, and the ability to achieve performance goals and maintain funding.
- ☐ Get Started! Frederick County has 20 years of PMP history, with 11 years using an optimized approach to pavement management.
- ☐ Continuous process to manage, can't stop along the way.
- ☐ Public agency workers are continuously providing Resilience in the work you do, assessing the risks, and meeting the challenges.



Thank You



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