

Pavement Management: The Key to a Successful Road Maintenance Program

Session Agenda



- Introductions
- Getting to Know Your Roads
- Pavement Management Process & Components
- Options & Costs
- Benefits & Uses of a Pavement Management Plan
- Cost Benefit Value
- Remaining Service Life



Getting to Know Your Roads



What role do your roads play?

- Commuting
 - To and from work, school, doctors, stores
- Services
 - Police, fire, ambulance, mail, trash
- Commerce/Shipping
 - Merchandise, natural resources, food
- Tourism
 - Beaches, mountains, skiing, events
- Recreational
 - Walking, cycling



What happens when roads are...

- Snow covered or icy
- Flooded or washed out
- Closed by downed trees or powerlines
- Blocked by accidents
- Over-congested
- Deteriorated to an unsafe level



Your Most Valuable Asset



- Integral part of everyday life
- Largest financial asset in the community
- Can have significant impacts (positive and negative) on many aspects of town activities
- Is your network getting the attention it deserves?
- Do you have a plan for maintaining the network?



Simple Network Value Calculation



PRESENT DAY VALUE OF ROAD NETWORK																
MILEAGE: <table border="1"> <tr> <td>40</td> <td>Paved</td> </tr> <tr> <td>15</td> <td>Gravel</td> </tr> </table>			40	Paved	15	Gravel	UNIT COSTS: <table border="1"> <tr> <td>Pavement</td> <td>\$70</td> <td>/ ton</td> </tr> <tr> <td>Gravel</td> <td>\$25</td> <td>/ ton</td> </tr> </table>				Pavement	\$70	/ ton	Gravel	\$25	/ ton
40	Paved															
15	Gravel															
Pavement	\$70	/ ton														
Gravel	\$25	/ ton														
Depth (inches)	PAVED ROADS															
	Material	Cost/SY	Miles	Width (ft)	SY	Cost										
4	Pavement	\$ 15.68	40	24	563,200	\$ 8,830,976										
12	Gravel	\$ 11.31				\$ 6,371,200										
TOTAL VALUE PAVED ROADS						\$ 15,202,176										
Depth (inches)	GRAVEL ROADS															
	Material	Cost/SY	Miles	Width (ft)	SY	Cost										
12	Gravel	\$ 11.31	15	20	176,000	\$ 1,991,000										
TOTAL VALUE OF GRAVEL ROADS						\$ 1,991,000										
TOTAL VALUE OF THE NETWORK:						\$ 17,193,176										
ANNUALIZED DEPRECIATION AT 20 YEAR LIFE						\$ 859,659										



What causes Pavement Distress?

- Traffic volume
- Traffic loads
- Sunlight
- Water
- Trees/Vegetation
- Mix issues
- Construction issues
- Poor base



The Change in Road Maintenance

- Increased traffic volumes
- Increased heavy truck traffic
- Increased material costs
- Level or decreased budgets

*The Perfect Storm
for Road Maintenance*

- How do you do more with less?
- What are your alternative options?

Keeping Up in Today's World

- Asset / pavement management
 - What it is?
 - How to implement?
 - How to use it most effectively?
- New treatments in the toolbox
 - Many options to choose from
 - Matching the treatment to the road
- Working with your customers (residents)
 - Education & communication
 - Managing expectations



vs.



The Importance of Having a Plan



- Do you know all of your roads?
 - Length
 - Width
 - Construction
 - Condition
- Do you have a maintenance plan?
 - What treatment(s)
 - When
 - At what cost



***Pavement
Management***



Pavement Management Process & Components

Pavement Management



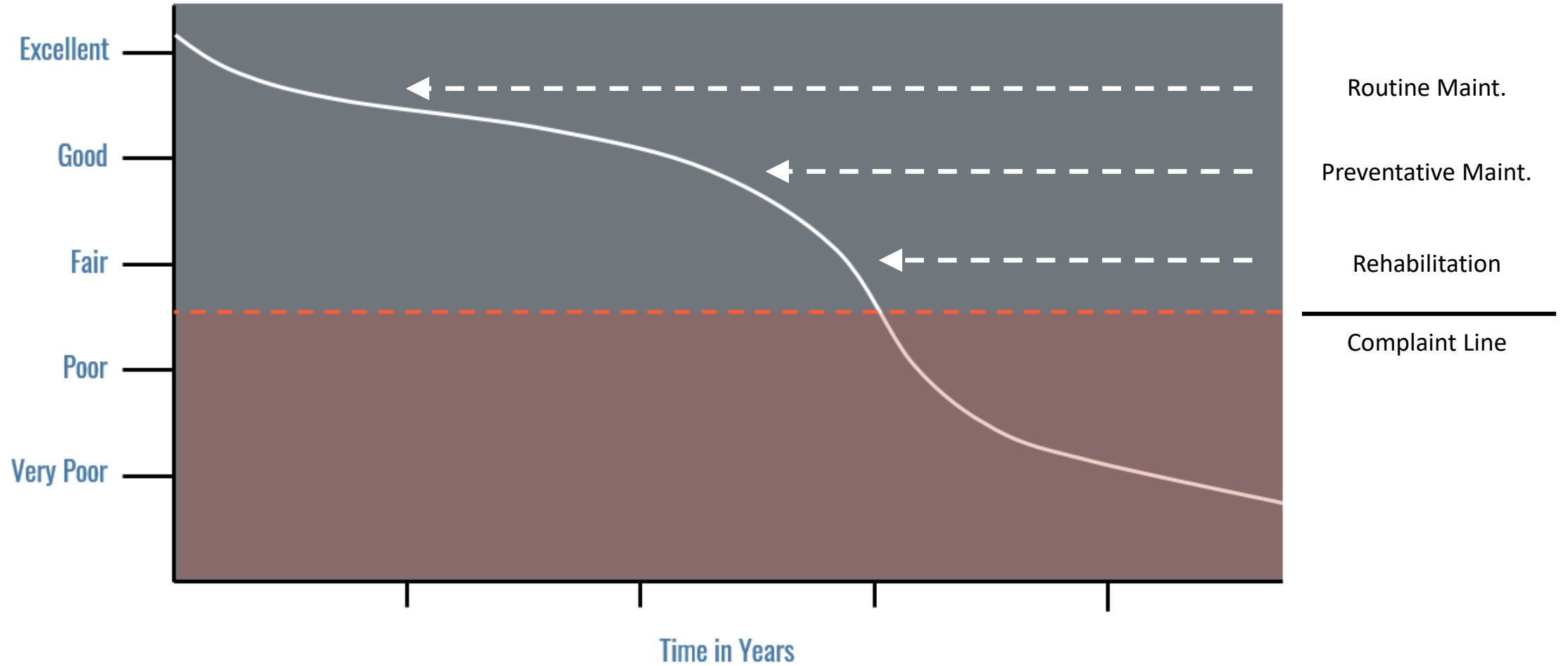
What is Pavement Management?

Pavement Management is the practice of planning pavement maintenance to maximize the value of the roadway network.

Enables you to perform the Right Repair at the Right Time on the Right Road!



Pavement Management



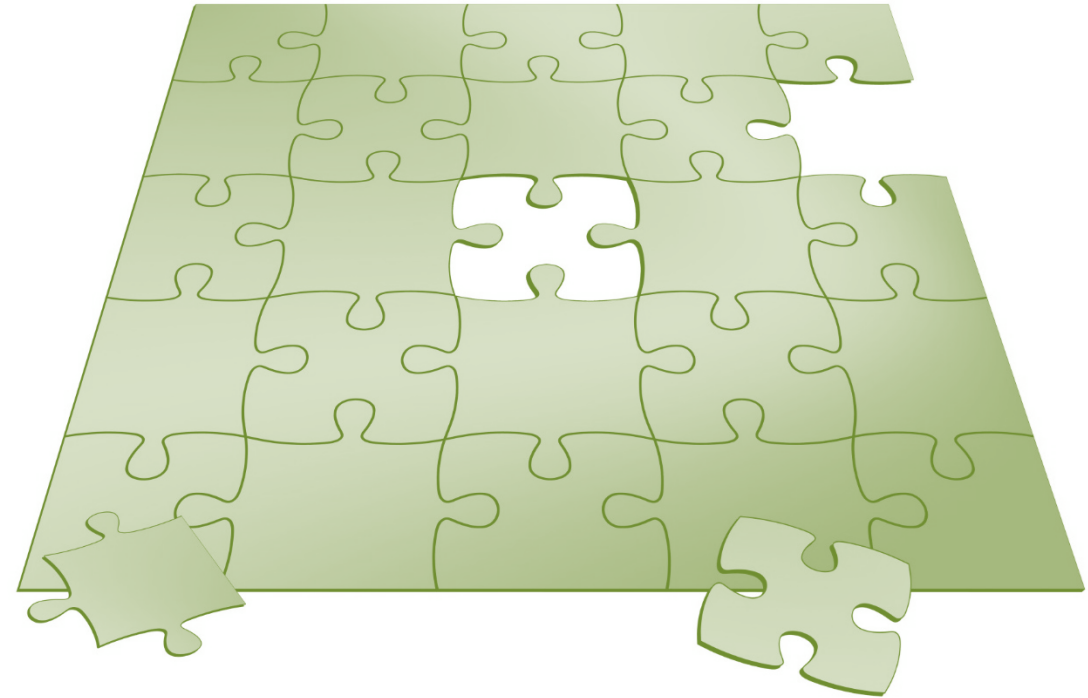
Life-Cycle Analysis



3-Step Approach



1. Network Inventory and Data Collection
2. Analysis and Reporting
3. Capital Planning and Action Planning

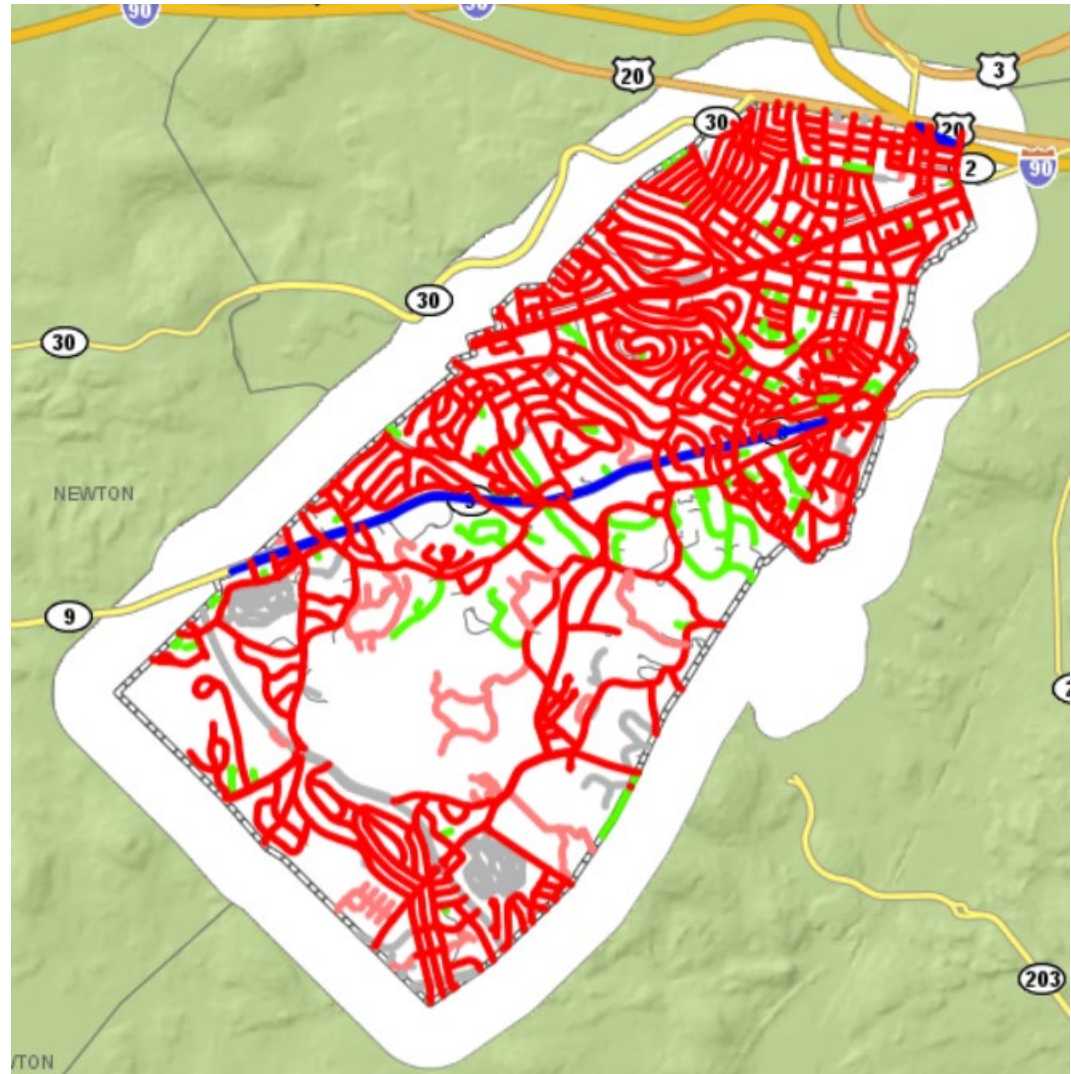


Network Inventory



Classification	Miles
Arterial	7.24
Collector	13.79
Local	60.98
Local – Low Volume	17.53
Total Miles	99.54

- Public vs Private vs State Maintained Roadways



Data Collection



Field Survey



Automated

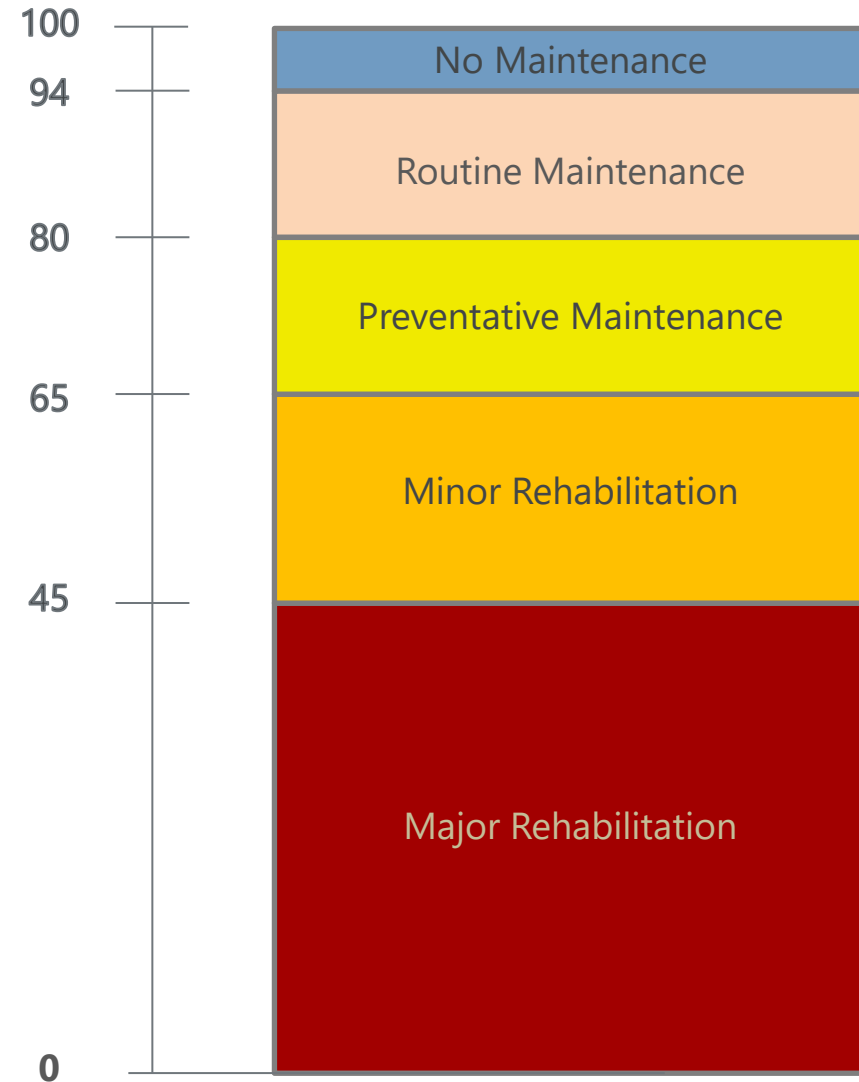


Artificial Intelligence (AI)

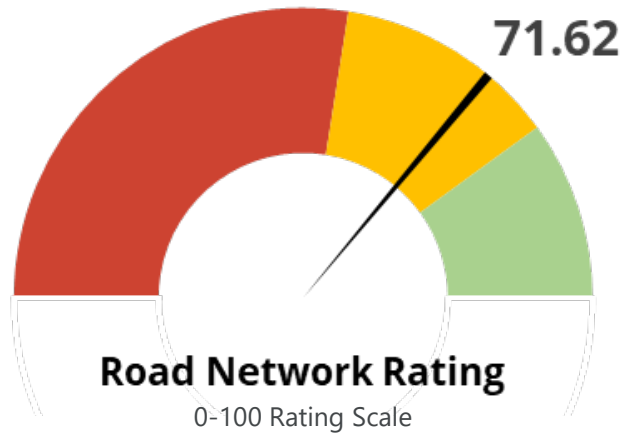
Maintenance Categories



- Routine Maintenance - \$0.50 - \$2.00
 - Fog Seal
 - Crack Seal
- Preventative Maintenance - \$2.50 - \$10.00
 - Chip Seal
 - Microsurfacing
 - Cape Seal
 - Bonded Wearing Course
 - Shim and Overlay
- Minor Rehabilitation - \$10.00 - \$15.00
 - Minor Mill and Overlay
 - Hot In-Place Recycling
 - Cold In-Place Recycling
- Major Rehabilitation - \$15.00 - \$40.00
 - Major Mill and Fill
 - Cold In-Place Recycling
 - Full Depth Reclamation
 - Reconstruction



Analysis and Reporting



Repair Category	Length (Miles)	Square Yardage	Estimated Costs
No Maintenance Required	9.10	167,052	\$0
Routine Maintenance	13.32	221,189	\$110,595
Preventative Maintenance	43.14	700,939	\$5,607,517
Minor Rehabilitation	30.65	523,712	\$7,331,968
Major Rehabilitation	3.33	57,941	\$2,317,622
Totals	99.54	1,670,833	\$15,367,702

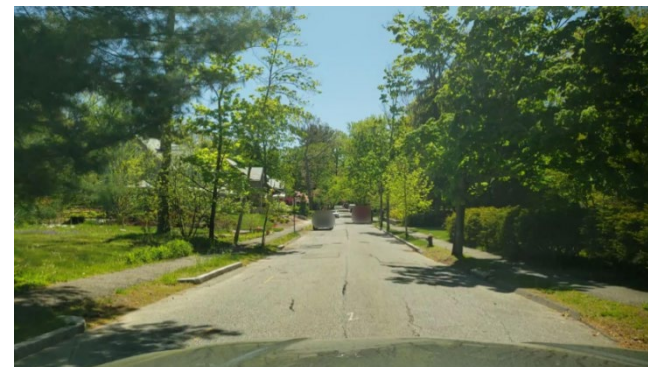
Existing Conditions – Backlog Report



ROUTINE MAINT.



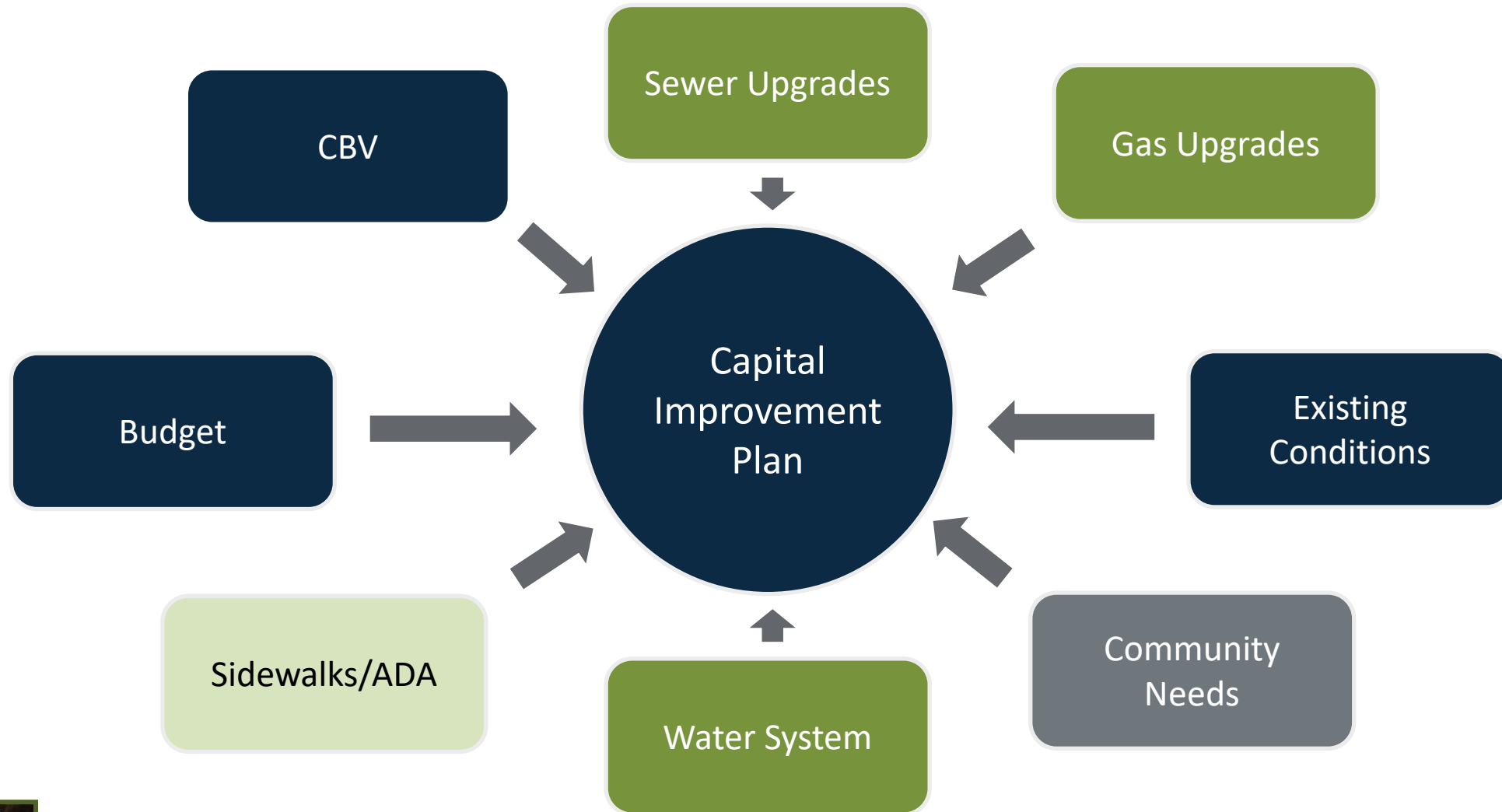
PREVENTATIVE MAINT.



MINOR REHABILITATION



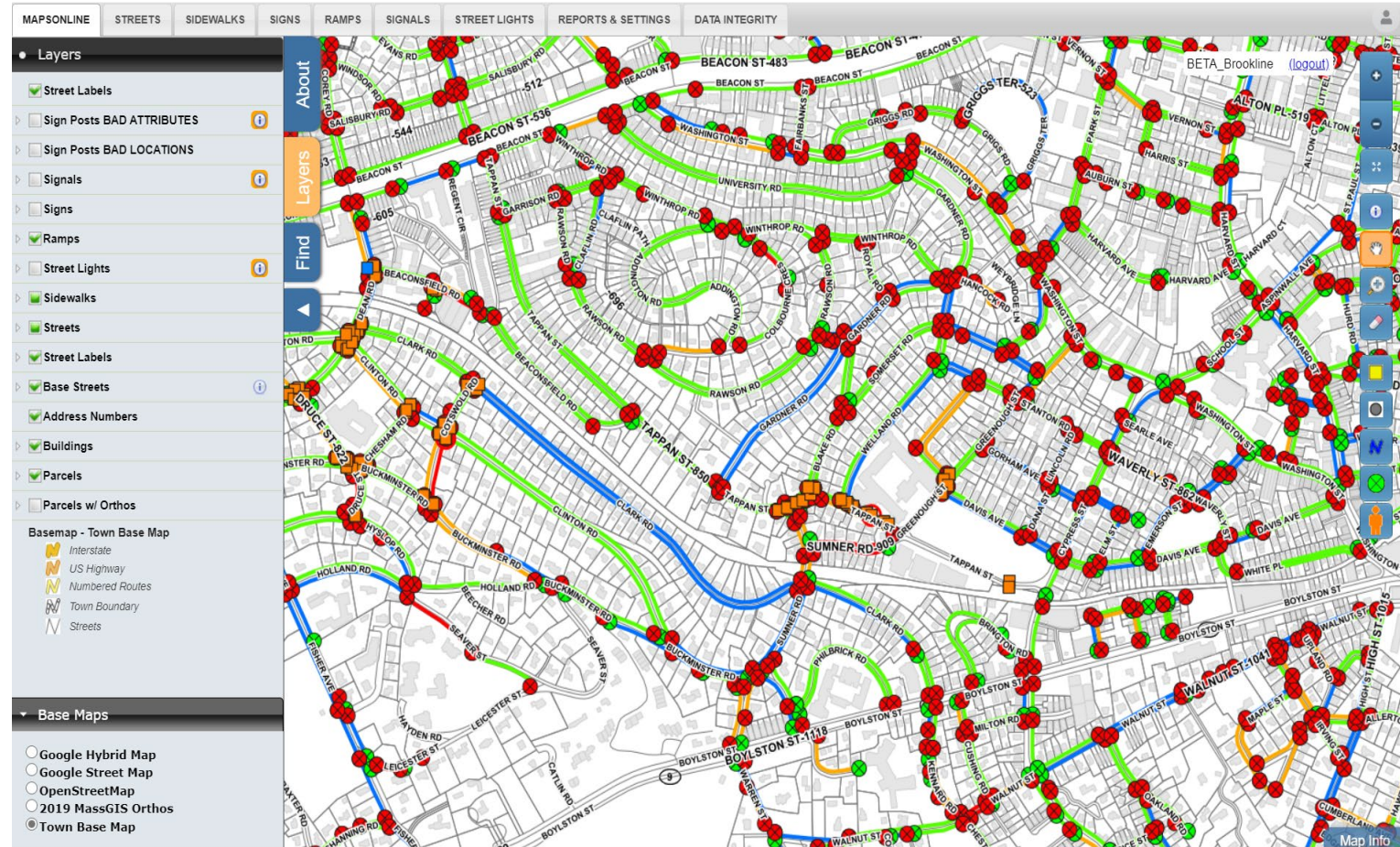
Capital Planning and Action Planning



Capture Critical Infrastructure Information



- Roadway Information
 - Length
 - Width
 - Square Yardage
 - Condition
 - Curbing
 - Drainage
 - Photographs
 - Construction History
- Sidewalks
 - Location
 - Condition
 - Material
 - Ramp Locations
- Signs
- Utility Information



Options & Costs

Considerations for PM Selection

- What information do you want included
- Linking to other systems/databases
- In-house database vs. Outsourced system (or a hybrid)
- Walking/windshield survey vs. Automated data collection
- Weighting/importance of different measured factors
- Treatment options and costing to be included
- How will the data be maintained/updated
- What services do you want included (consulting)

Every municipality is different...there is no one “right” choice

Potential Resources & Costs for PM Systems



- In-house staff
 - Local Universities / interns
 - Regional Planners
 - Engineering firms / consultants
-
- Typical costs can vary from \$0 (not including your staff's time) to \$25,000+



Benefits & Uses of a Pavement Management Plan

Why Pavement Management?



Allows users to become

PROACTIVE

rather than

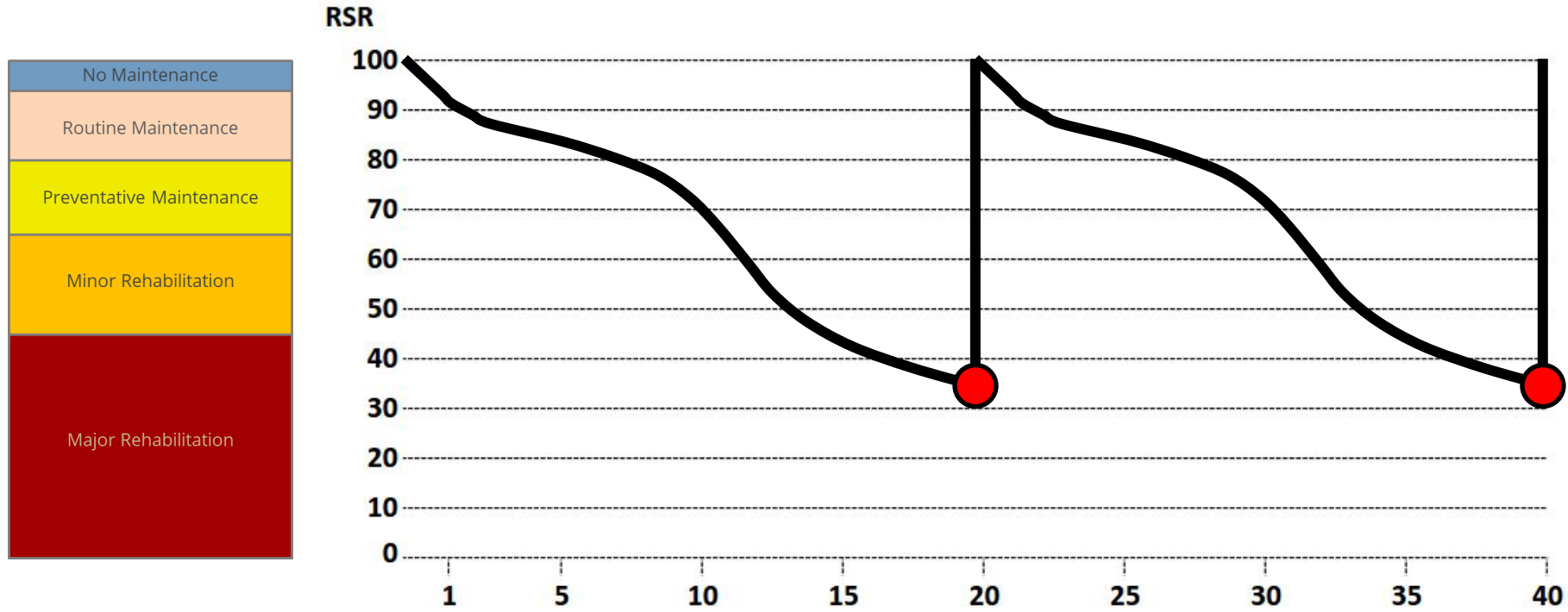
REACTIVE



Why Pavement Management?



PROACTIVE vs. **REACTIVE**



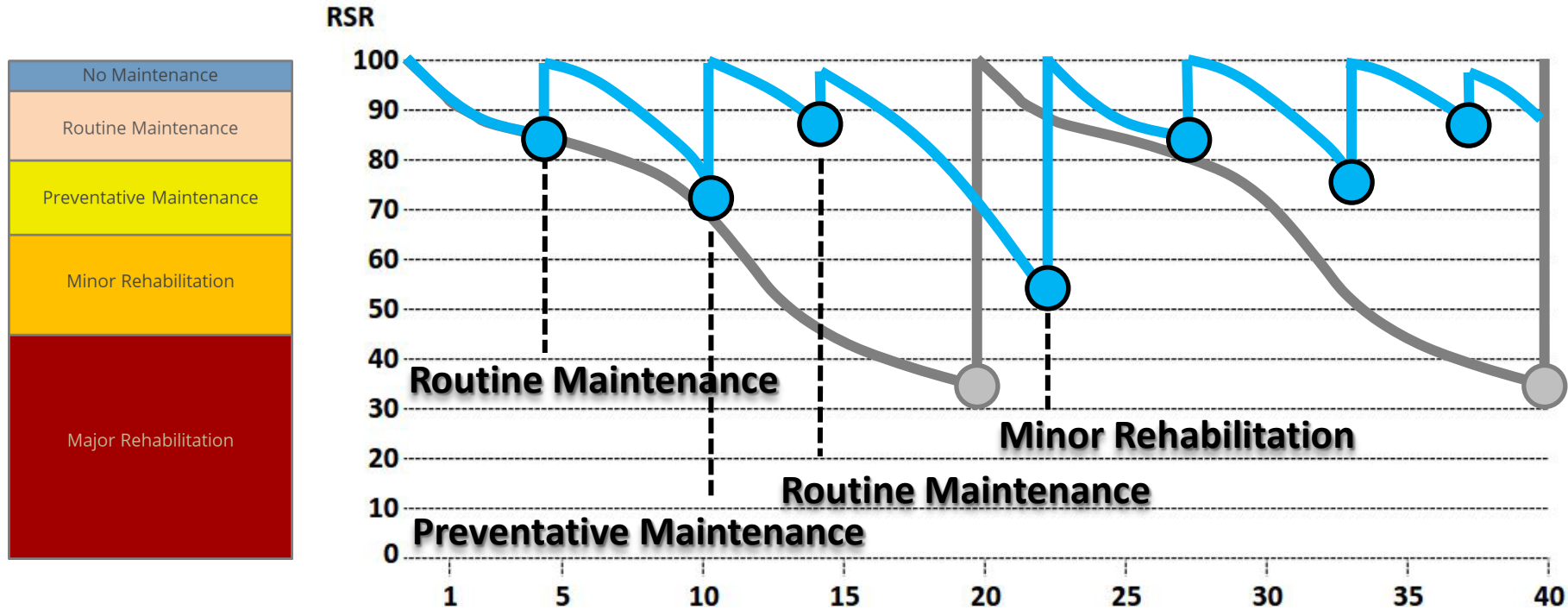
**Repairs performed twice over 40 years...
\$48 sy - \$60 sy over a 40 year period**



Why Pavement Management?



PROACTIVE vs. **REACTIVE**



**Maintenance and repairs 7 times over 40 years...
\$30 sy over the same 40-year period**



Justify Your Requests

Evaluate available funding...

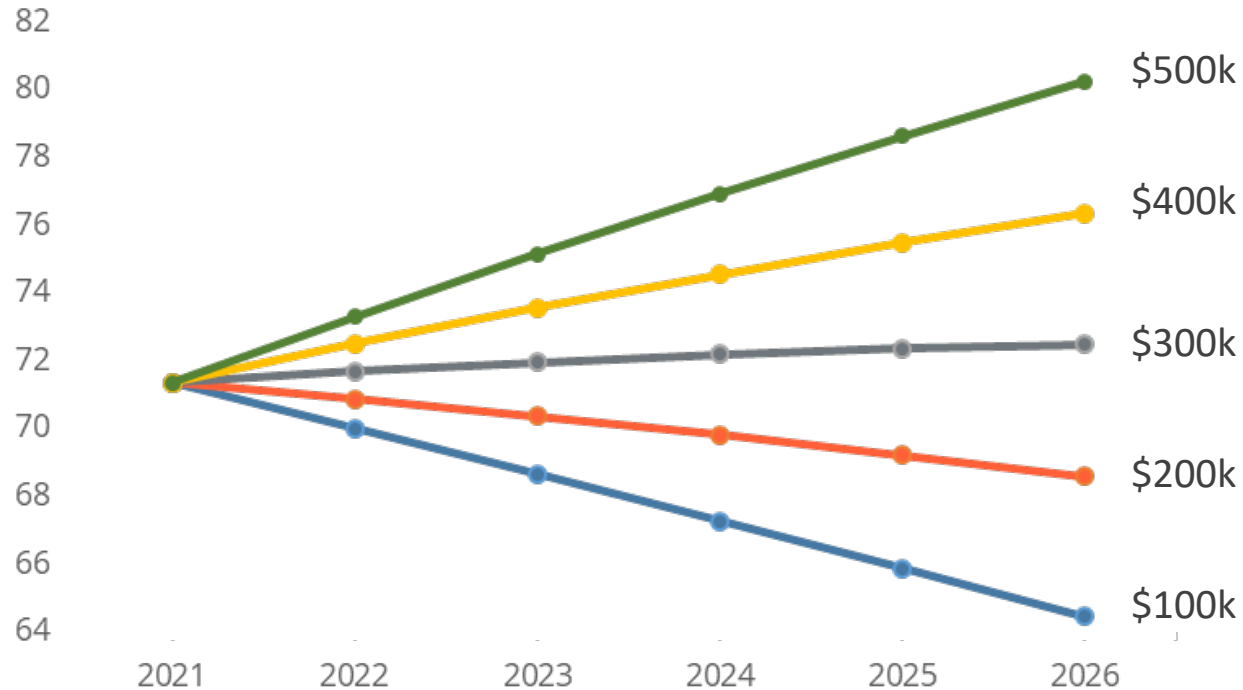
- City/Town Funding
- Grants
- State Funding Programs

Depending on Situation.....

- Bonds/Borrowing
- Additional Town/City Funding



Scenario Building



- Follow industry standards for justifying your requests
- Customize Scenarios
 - Funding Levels
 - Repair Costs
 - Planning Approach
 - Bottom First
 - Balanced Plan
 - Inflation rates
 - Lifecycle of roads



Track & Communicate Results



- Relay critical information
 - Without getting “into the weeds”
- Mapping progress
 - GIS
- Track your stats
 - Take credit for what you accomplish
- Coordinate with utilities
- Public Outreach



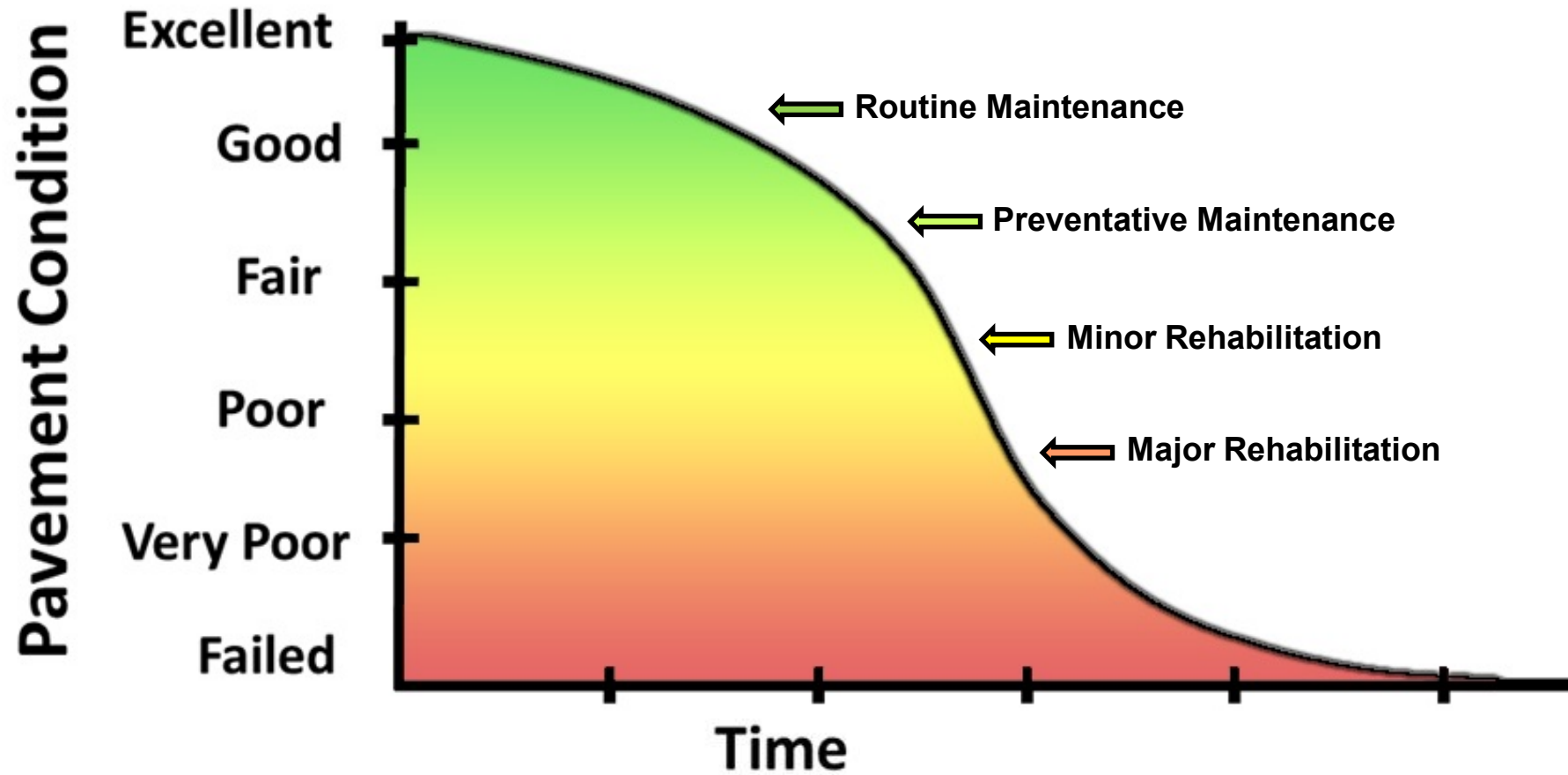
Pavement Management & Project Selection



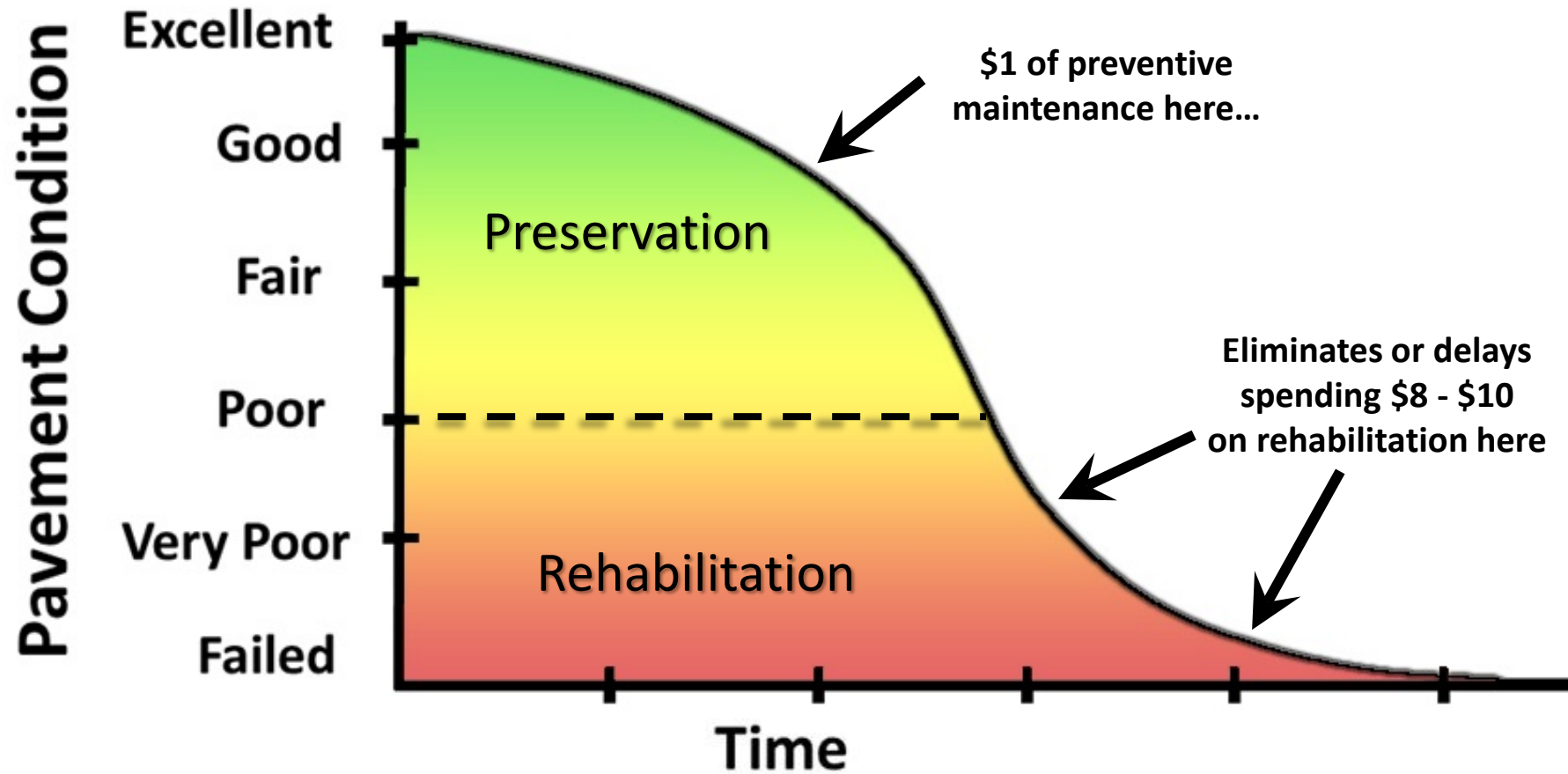
- Treatment timing is critical
- Need to continuously be planning several years in advance
- One or two winters can have a significant impact on treatment effectiveness and options
- Having a pavement management system helps to identify the “window of opportunity”
- ***“Right Treatment, Right Pavement, Right Time”***



Pavement Treatment Options



Life of Pavement



Summary of Pavement Management Benefits



- Helps you “sell” your program and plan to the community/stakeholders
- Unbiased information to an industry standard
- Allows you to run situational analysis and projections
- Establishes a baseline for where your network stands
- Improves decision making on what treatments should be used where and when
- Saves time (and money) when scoping and bidding your projects each year



Cost Benefit Value

Cost-Benefit Prioritization



$$\text{CBV} = \frac{(\text{Traffic}) \times (\text{Service Life})}{(\text{Unit \$}) \times (\text{Condition})}$$



Cost-Benefit Prioritization



Example #1

	Traffic (AADT)	Condition (PCI)	Required Treatment
Road #1	5000	30 (poor)	FDR
Road #2	5000	75 (good)	Single Seal

Which project has the highest CBV?



Cost-Benefit Prioritization



$$CBV = \frac{(AADT) \times (Life)}{(Unit \$) \times (PCI)}$$

Road #1 CBV = (FDR Candidate)	$\frac{(5000) \times (20)}{(25) \times (30)}$	= 133
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Road #2 CBV = (Single Seal Candidate)	$\frac{(5000) \times (5)}{(2) \times (75)}$	= 167
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For equal traffic, preservation should have the highest benefit



Cost-Benefit Prioritization



Example #2

- 8 road network
- 2 roads in each of 4 repair type categories:
 - **Major Rehabilitation**
 - **Minor Rehabilitation**
 - **Preventive Maintenance**
 - **Routine Maintenance**

Which roads should get done first?



“Worst First” Project Prioritization



Street Name	Condition (RSR)	Recommended Repair Type	Unit \$	AADT	Service Life of Repair (years)
South Road	30.2	Full-Depth Reclamation	\$25.00	300	20
Arthur Ave.	30.5	Full-Depth Reclamation	\$25.00	5000	20
Canal Street	59.7	Mill and Overlay	\$12.00	700	12
Beach Street	60.0	Mill and Overlay	\$12.00	4000	12
Williams Ave.	71.1	Double Surface Treatment	\$4.25	500	8
Adams Street	71.4	Double Surface Treatment	\$4.25	3500	8
Thom Avenue	87.9	Crack Seal	\$0.50	800	2
Midway Road	88.1	Crack Seal	\$0.50	5000	2



CBV Project Prioritization



Street Name	Condition (RSR)	Recommended Repair Type	Unit \$	AADT	Service Life of Repair (years)	CBV
Midway Road	88.1	Crack Seal	\$0.50	5000	2	227
Arthur Ave.	30.5	Full-Depth Reclamation	\$25.00	5000	20	131
Adams Street	71.4	Double Surface Treatment	\$4.25	3500	8	92
Beach Street	60.0	Mill and Overlay	\$12.00	4000	12	67
Thom Avenue	87.9	Crack Seal	\$0.50	800	2	36
Williams Ave.	71.1	Double Surface Treatment	\$4.25	500	8	13
Canal Street	59.7	Mill and Overlay	\$12.00	700	12	12
South Road	30.2	Full-Depth Reclamation	\$25.00	300	20	8



Cost-Benefit Prioritization



***CBV – Show some method to
your project selection process!***

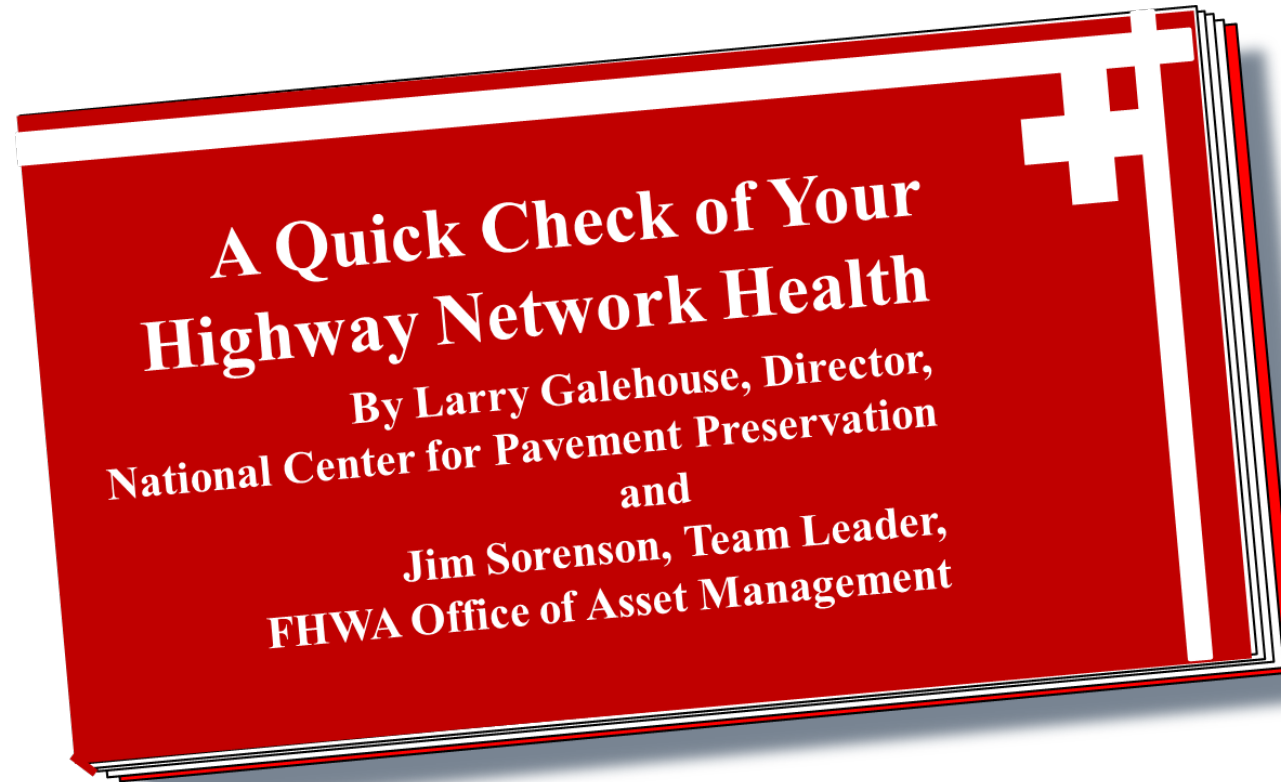


Remaining Service Life

Remaining Service Life



Simple (*but effective*) planning, education and communication tool:



Available at:

http://www.fhwa.dot.gov/pavement/pub_details.cfm?id=478



A Quick Check of Your Highway Network Health



Remaining Service Life (RSL) Concept

- Every road segment has a Remaining Service Life
- 100 miles with NO REPAIRS or MAINTENANCE in a given year, will lose 100 mile-years of Remaining Service Life
- Annual work plans should match condition goals (“outcome based budgeting”)



For Each Treatment Used:



Added Network Service Life =

$$\begin{array}{c} \text{Miles} \\ \text{of} \\ \text{Treatment} \end{array} \times \begin{array}{c} \text{Service} \\ \text{Life of} \\ \text{Treatment} \end{array} = \begin{array}{c} \text{Mile - Years} \end{array}$$



RSL Example



Network	=	100 miles
Budget=		\$1,000,000 (\$0.71/SY)

“Worst First” or Preservation?

**Which program will add
more service life?**



Pavement Network Evaluation Worksheet

Total Network Lane Miles =



Reconstruction					
Project	Design Life	Lane Miles	Lane Mile Years	Lane Mile Cost	Total Cost
FDR		X	=		
			Total =		Total =
Rehabilitation					
Project	Design Life	Lane Miles	Lane Mile Years	Lane Mile Cost	Total Cost
CIPR		X	=		
Mill & Fill		X	=		
			Total =		Total =
Pavement Preservation					
Project	Design Life	Lane Miles	Lane Mile Years	Lane Mile Cost	Total Cost
UTBO		X	=		
Micro surfacing		X	=		
Chip Seal		X	=		
Fog Seal		X	=		
Crack Seal		X	=		
			Total =		Total =

Publication No. FHWA-IF-07-006



Network Trend

Strategic Summary



"Worst First"

Programmed Activity	Miles	Mile Years	Total Cost
Reconstruction	1	20	\$352,000
Rehabilitation	4	50	\$661,760
Preservation	0	0	\$0
Totals:	5	70	\$1,013,760

Programmed Activity (Mile-Years) =	70
minus	
Total Network (Mile-Years) =	100
Gain (+) / Deficit (-) =	-30

Preservation

Programmed Activity	Miles	Mile Years	Total Cost
Reconstruction	0.5	10	\$176,000
Rehabilitation	2	25	\$330,880
Preservation	21	86	\$492,800
Totals:	23.5	123	\$999,680

Programmed Activity (Mile-Years) =	123
minus	
Total Network (Mile-Years) =	100
Gain (+) / Deficit (-) =	23



How much
newly added
network service life
did Town X
achieve last year?

Shim & Overlay



0.6 Miles Shim & Overlay =

$$\begin{array}{|c|} \hline \mathbf{0.6 \text{ Miles} \\ \text{of} \\ \text{Treatment}} \\ \hline \end{array} \times \begin{array}{|c|} \hline \mathbf{10 \text{ Years} \\ \text{of Service} \\ \text{Life}} \\ \hline \end{array} = \begin{array}{|c|} \hline \mathbf{6 \\ \text{Mile-Years}} \\ \hline \end{array}$$



Full Depth Reclamation



1.0 Miles Full Depth Reclamation =

$$\begin{array}{|c|} \hline \mathbf{1.0 \text{ Miles}} \\ \mathbf{\text{of}} \\ \mathbf{\text{Treatment}} \\ \hline \end{array} \times \begin{array}{|c|} \hline \mathbf{20 \text{ Years}} \\ \mathbf{\text{of Service}} \\ \mathbf{\text{Life}} \\ \hline \end{array} = \begin{array}{|c|} \hline \mathbf{20} \\ \mathbf{\text{Mile-Years}} \\ \hline \end{array}$$



Example Agency



New Service Life

Based on 60 Network Miles

- Shim & Overlay Paving = 6 Mile-Years
- Full Depth Reclamation = 20 Mile-Years

New Service Life Added = 26 Mile-Years

Pavement Life Lost = (60) Mile-Years

2020 Program Shortfall = 34 Mile-Years



Shim & Overlay – Optimized Program



0.3 Miles Shim & Overlay =

$$\begin{array}{|c|} \hline \mathbf{0.3 \text{ Miles} \\ \text{of} \\ \text{Treatment}} \\ \hline \end{array} \times \begin{array}{|c|} \hline \mathbf{10 \text{ Years} \\ \text{of Service} \\ \text{Life}} \\ \hline \end{array} = \begin{array}{|c|} \hline \mathbf{3} \\ \mathbf{\text{Mile-Years}} \\ \hline \end{array}$$



Full Depth Reclamation – optimized program



0.5 Miles Full Depth Reclamation =

$$\begin{array}{|c|} \hline \mathbf{0.5 \text{ Miles}} \\ \mathbf{\text{of}} \\ \mathbf{\text{Treatment}} \\ \hline \end{array} \times \begin{array}{|c|} \hline \mathbf{20 \text{ Years}} \\ \mathbf{\text{of Service}} \\ \mathbf{\text{Life}} \\ \hline \end{array} = \begin{array}{|c|} \hline \mathbf{10} \\ \mathbf{\text{Mile-Years}} \\ \hline \end{array}$$



Crack Seal – Optimized Program



6.0 Miles Crack Seal=

$$\begin{array}{|c|} \hline \mathbf{6.0 \text{ Miles}} \\ \mathbf{\text{of}} \\ \mathbf{\text{Treatment}} \\ \hline \end{array} \times \begin{array}{|c|} \hline \mathbf{3 \text{ Years}} \\ \mathbf{\text{of Service}} \\ \mathbf{\text{Life}} \\ \hline \end{array} = \begin{array}{|c|} \hline \mathbf{18} \\ \mathbf{\text{Mile-Years}} \\ \hline \end{array}$$



Single Seal – optimized program



6.0 Miles Single Seal=

$$\begin{array}{|c|} \hline \mathbf{6.0\ Miles} \\ \mathbf{of} \\ \mathbf{Treatment} \\ \hline \end{array} \times \begin{array}{|c|} \hline \mathbf{5\ Years} \\ \mathbf{of\ Service} \\ \mathbf{Life} \\ \hline \end{array} = \begin{array}{|c|} \hline \mathbf{30} \\ \mathbf{Mile-Years} \\ \hline \end{array}$$



Example Agency



New Service Life

Based on 60 Network Miles

- Shim & Overlay Paving = 3 Mile-Years
- Full Depth Reclamation = 10 Mile-Years
- Crack Seal = 18 Mile-Years
- Single Seal = 30 Mile-Years

New Service Life Added = 61 Mile-Years

Pavement Life Lost = (60) Mile-Years

2021 Program Gained = 1 Mile-Years



Summary / Key Takeaways



- Understand the value of your roads
- Having a plan is the key to a successful program
- Each community is different – no “one size fits all” approach
- Process does not have to be complex
- Once completed, communicate your results and plan
- Continuously update the information and plan
- Use the data to help make critical decisions

