Stretching Your Budget with Pavement Preservation

March 2021

Presentation Outline

- About Your Roads
- Pavement Maintenance Strategies
- Pavement Maintenance Treatments
- Budgeting & Network Approach

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

Your Most Valuable Asset

- Integral part of everyday life
- Community's largest financial asset
- Can have significant impacts (positive and negative) on many aspects of municipal activities
- Is your network getting the attention it deserves?

Average Road Network Value

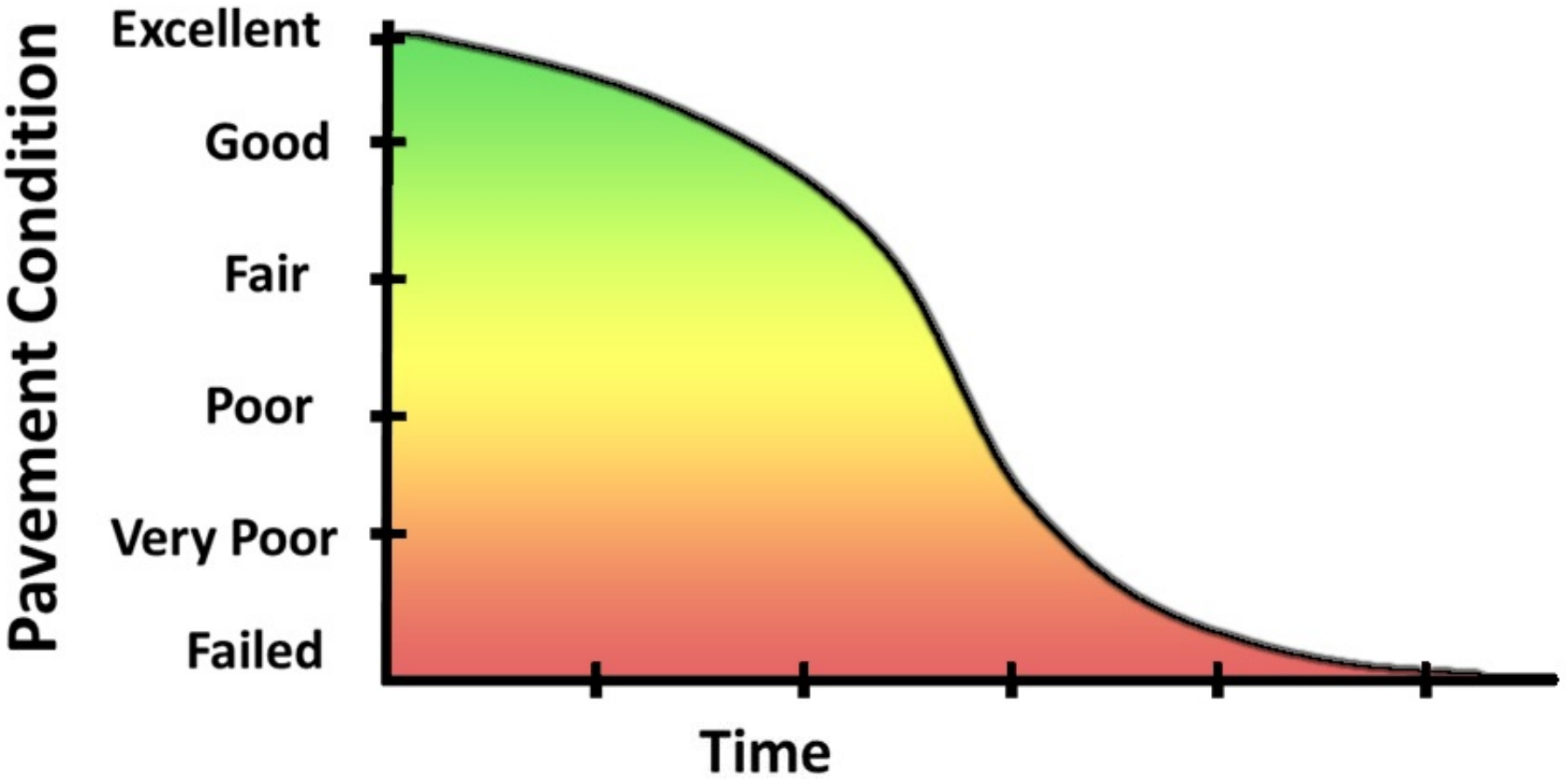
PRESENT DAY VALUE OF ROAD NETWORK							
MILEAGE:				**UNIT COSTS:**			
35	Paved			Pavement	$80	/ ton	
5	Gravel			Gravel	$30	/ ton	
Depth (inches)	**PAVED ROADS**						
	Material	**Cost/SY**	**Miles**	**Width (ft)**	**SY**	**Cost**	
3.5	Pavement	$ 15.68	35	21	431,200	$ 6,761,216	
18	Gravel	$ 20.36				$ 8,780,310	
TOTAL VALUE PAVED ROADS						**$ 15,541,526**	
Depth (inches)	**GRAVEL ROADS**						
	Material	**Cost/SY**	**Miles**	**Width (ft)**	**SY**	**Cost**	
12	Gravel	$ 13.58	5	20	58,667	$ 796,400	
TOTAL VALUE OF GRAVEL ROADS						**$ 796,400**	
TOTAL VALUE OF THE NETWORK:						**$ 16,337,926**	
ANNUALIZED DEPRECIATION AT 20 YEAR LIFE						**$ 816,896**	

Average Road Network by the Numbers

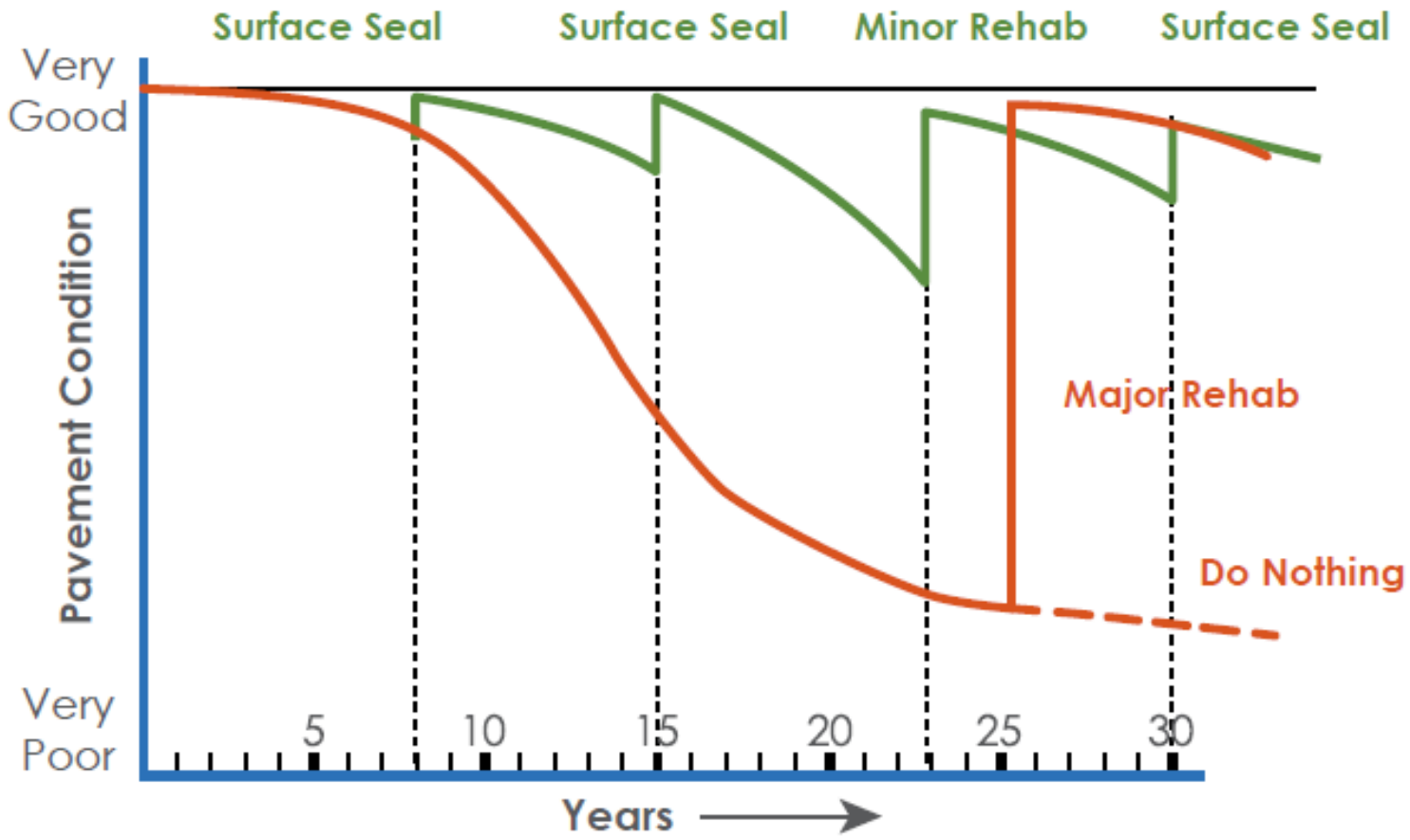
- 35 miles of paved road ≈ $15.5M replacement value
- 5 miles of gravel road ≈ $800k replacement value
- **TOTAL Road Network ≈ $16.3M replacement value**

- Using an average 20 year lifespan of a road…
  - Annual depreciation of the network ≈ $816,000

Life of Pavement



Strategy Comparison



Source: FHWA Every Day Counts

“Worst First”- “Fix it First” Not Best Fiscal Policy

- Fixing the worst roads first means rebuilding, which has the highest cost
- Maintenance on other roads is neglected and their conditions worsen
- Each year adds more miles to the list of “worst” that need rebuilding
- Agencies dig themselves into a deeper financial hole with the “Worst First” strategy

Barns

Pavement Preservation "Definition"

Pavement preservation is a program employing a network level, **long-term strategy** that enhances pavement performance by using an integrated, cost-effective **set of practices** that **extend pavement life**, improve safety and meet motorist expectations.

Source: FHWA-2005

Pavement Preservation "Definition"

Work that is planned and performed to improve or sustain the condition of the transportation facility in a state of good repair.

"Keeping good roads good"

Source: FHWA Guidance on Highway Preservation and Maintenance memo dated February 25, 2016

Philosophy

Pavement Preservation is…

RIGHT TREATMENT

RIGHT PAVEMENT

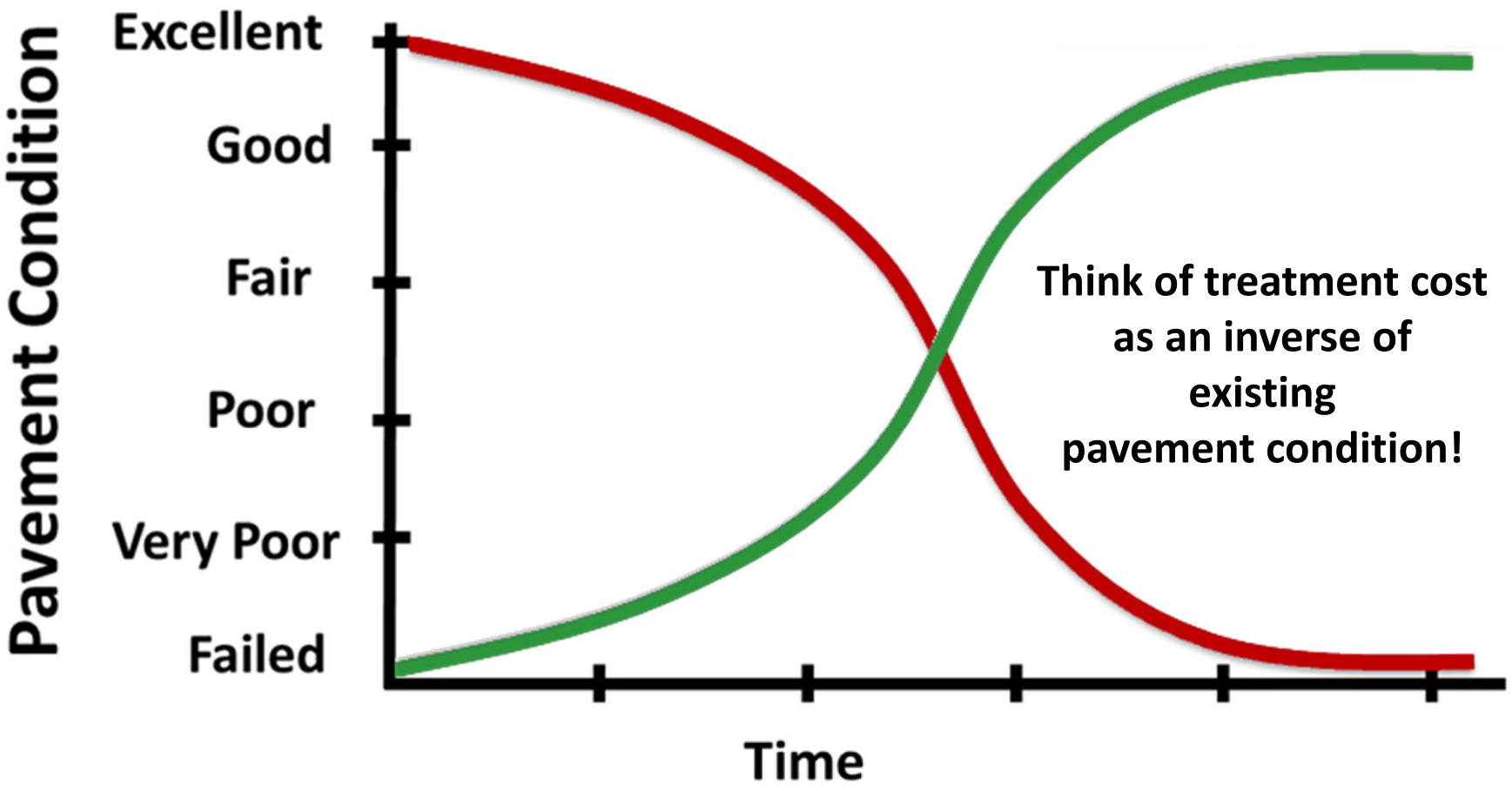
RIGHT TIME

BE ***PROACTIVE*** ‘NOT’ REACTIVE!

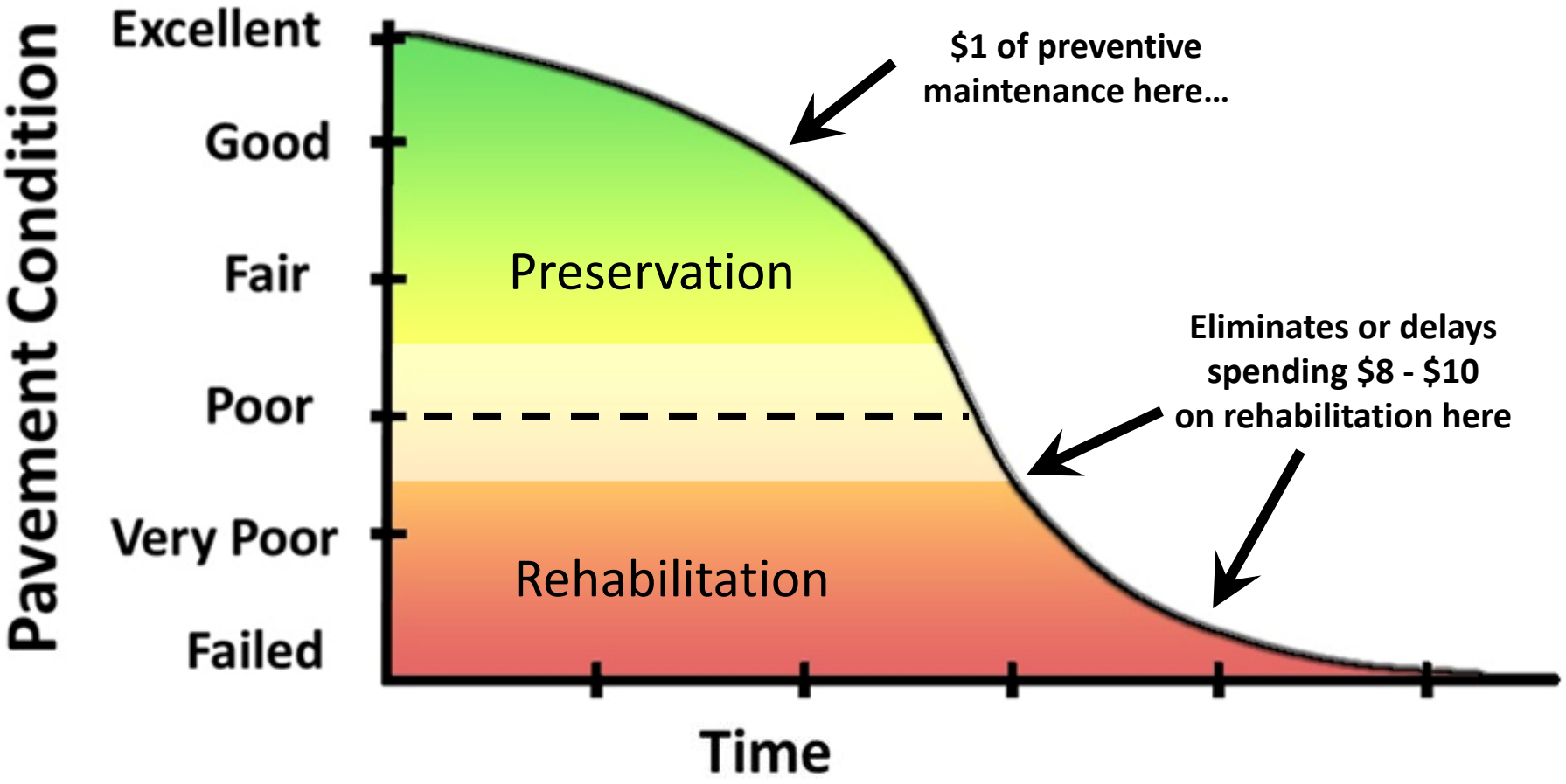
Strategies versus Treatments

- Reduced $$ and deteriorating conditions should lead to a focus on preservation
- Is that happening?
- Agencies moving to treatments with lower unit cost to **s t r e t c h** $$$
- Using treatments as Band-Aids is not pavement preservation

Treatment Timing vs. Cost



Life of Pavement



Importance of Good Prep Work

- Assure proper drainage, ditching, etc. exists
- Trim overhanging brush, branches, and grass
- Seal cracks greater than 1/4”
- Shim/leveling of rutting/surface irregularities
- Address trouble spots (potholes, utility trenches, spot failures)
- Mill joints, intersecting roads, or high spots *(if needed)*
- Adjust utility structures *(if needed)*
- Clean pavement surface of mud, dirt, sand, etc.

Pavement Maintenance Techniques

- Crack Seal
- Conventional Chip Seal
- Asphalt Rubber SAMs
- Microsurfacing
- Bonded Wearing Course
- (Hot & Cold) In-Place Recycling
- Cold Mix Asphalt
- HMA Overlays w/ or w/out Milling
- Full Depth Reclamation

Crack Seal

Existing Road Condition

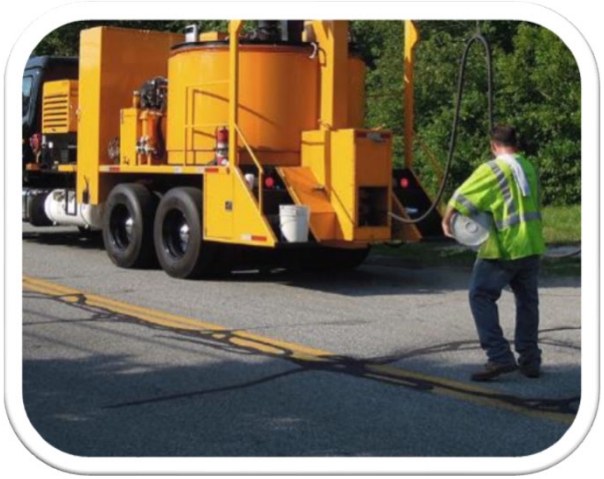
- Low to high volume roads
- Sound structural pavement with good drainage
- Minor to moderate surface cracking
- Often applied before other surface treatments

Process

- Routing or sawing, cleaning, and drying existing cracks (as needed)
- Application of highly flexible polymer modified asphalt into/over cracks

Benefits

- Seals moisture out of existing pavement and base materials
- Helps to prevent additional cracking and pavement distress caused by moisture damage



Conventional Chip Seal

Existing Road Condition

- Low volume roads
- Sound structural pavement with a good profile
- Minor to moderate surface distress (cracking, bleeding, raveling, oxidation)
- Can be applied in a double application, or covered by a fog seal or microsurfacing

Process

- Shim/leveling course and crack sealing (as needed)
- Sweeping of surface immediately before application
- Spray application of asphalt emulsion (~0.42 gal/SY) followed by a layer of cover aggregate (~20-25 lbs/SY)
- Immediately rolled and can be swept in 2-5 days

Benefits

- Waterproofs and seals pavement, including small cracks and imperfections
- Protects existing surface from traffic wear and improves skid resistance
- Quick construction process allows for minimal traffic disruption
- Thin profile minimizes impact to driveway and intersecting road aprons

Asphalt-Rubber SAM

Existing Road Condition

- Low to medium volume roads
- Sound structural pavement with a good profile
- Minor to moderate surface distress (cracking, bleeding, raveling, oxidation)
- Can be used as an interlayer (SAMI) with HMA overlay

Process

- Shim/leveling course and crack sealing (as needed)
- Sweeping of surface immediately before application
- Spray application of 20% asphalt rubber (~0.60 gal/SY) followed by a layer of heated and treated cover aggregate (~35 lbs/SY)
- Immediately rolled and swept leaving no loose aggregate

Benefits

- Waterproofs and seals pavement, including small cracks and imperfections
- Highly resistant to reflective cracking
- Protects existing surface from traffic wear and improves skid resistance
- Quick construction process allows for minimal traffic disruption
- Thin profile minimizes impact to driveway and intersecting road aprons

Microsurfacing

Existing Road Condition

- Low to high volume roads
- Sound structural pavement with a good profile
- Minor surface distress (cracking, raveling, oxidation, and minor rutting)
- Can be placed over a chip seal to form a cape seal

Process

- Crack sealing (as needed)
- Sweeping of surface immediately before application
- Mixture of asphalt emulsion, fine aggregate, mineral filler, water, and additives applied through a box spreader (18-32 lbs/SY)
- Utilizes a polymer modified emulsion and can be applied up to 1½" thick (typically applied at 3/8")

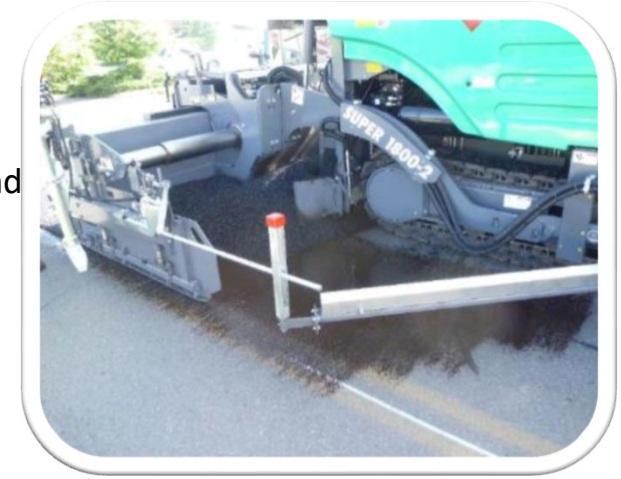
Benefits

- Waterproofs and seals pavement, including small cracks, minor rutting, and surface imperfections
- Provides new wearing surface with improved skid resistance
- Minimal changes to grade (maintains curb reveal and structures do not need to be adjusted)

Bonded Wearing Course

Existing Road Condition

- Low to high volume roads
- Sound structural pavement with a good profile
- Minor to moderate surface distress (cracking, raveling, oxidation, and minor rutting)



Process

- Shim/leveling course and crack sealing (as needed)
- Spray paver application of polymer modified emulsion and ultrathin (5/8” - 3/4”) gap graded HMA overlay (~85 lbs/SY)
- Immediate rolling and return to traffic

Benefits

- Waterproofs and seals pavement, including small cracks, minor rutting, and surface imperfections
- Superior bonding allows for thin application that preserves curb reveals, driveways, and intersecting roads
- High skid resistant wearing surface that will not de-laminate
- Quick construction and curing process allows for minimal traffic impact

Hot In-Place Recycling

Existing Road Condition

- Low to high volume roads
- Sound structural pavement base with good drainage
- Moderate to severe surface distress (cracking, raveling, oxidation, and minor rutting)

Process

- Continuous equipment train heats existing pavement to 250-300°F before scarifying and milling to ¾ - 2”
- Material is mixed with rejuvenating asphalt binder and repaved to roadway
- Immediate compaction and open to traffic
- Must be finished with surface treatment or HMA overlay

Benefits

- Restores profile of roadway
- Provides improved base course utilizing existing materials

Cold In-Place Recycling

Existing Road Condition

- Low to high volume roads
- Sound structural pavement base with good drainage
- Moderate to severe surface distress (cracking, raveling, oxidation, and minor rutting)

Process

- Continuous equipment train that mills, grinds, and resizes 3-5” of pavement (RAP)
- Asphalt emulsion or foamed asphalt mixed with RAP onboard and placed back on roadway
- Immediate compaction and open to traffic
- Must be finished with surface treatment or HMA overlay

Benefits

- Restores profile of roadway
- Eliminates rutting, cracking, and patch issues in pavement layer
- Recycles existing materials in place

Cold Mix Asphalt

Existing Road Condition

- Low volume roads
- Minor to moderate surface distress (cracking, raveling, oxidation, and minor rutting)

Process

- Cold mix asphalt paving between 2-4 inches in thickness
- Immediate compaction and open to traffic
- Should be covered with a final wearing surface

Benefits

- Cost-effective paving for upgrading non-engineered rural roads
- Can be produced at central plant or on-site to minimize transportation and material costs
- Flexible but strong pavement materials resistant to rutting, cracking, and moisture damage
- Surplus material can be stockpiled and used for patching at a later date

HMA Paving w/ or w/out Milling

Existing Road Condition

- Low to high volume roads
- Sound structural pavement with a good profile
- Minor to moderate surface distress (cracking, raveling, oxidation, and minor rutting)

Process

- Milling and/or crack sealing (as needed)
- Hot mix asphalt paving (~112 lbs/SY per inch of thickness)
- Immediate compaction and open to traffic

Benefits

- Waterproofs and seals pavement, including small cracks, minor rutting, and surface imperfections
- Provides new wearing surface with improved rideability

Full Depth Reclamation

Existing Road Condition

- Low to high volume roads
- Unstable pavement base and poor profile
- Moderate to severe distress (cracking, raveling, oxidation, rutting)

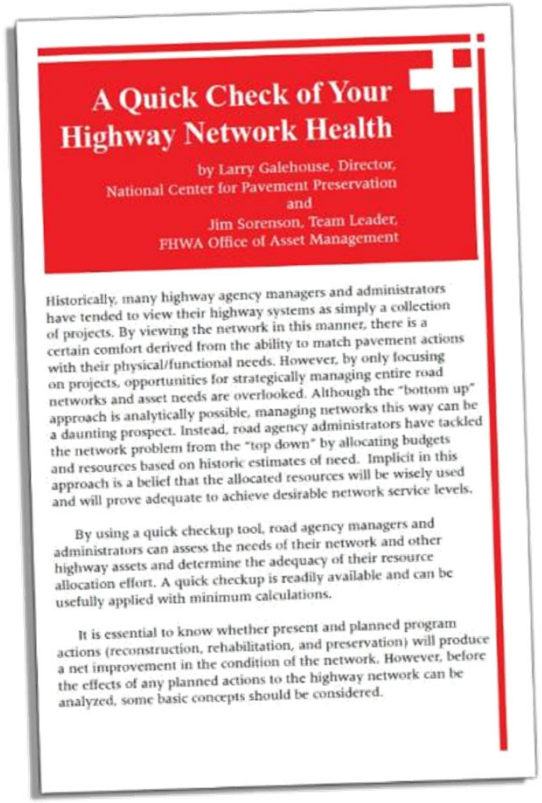
Process

- Sample and test existing pavement and base materials
- Pulverize existing roadway
- Grade and roll
- Second pass with stabilization (if needed)
- Fine grade and compact treated material
- Must be finished with HMA, CMA or surface treatment

Benefits

- Strengthens the base, adding traffic bearing capacity
- Breaks the crack pattern of the road
- Creates a uniform base across the road cross-section
- Uses existing materials in-place in a true recycling process

Pavement Network Evaluation



A Quick Check of Your Highway Network Health

by Larry Galehouse, Director, National Center for Pavement Preservation
and
Jim Sorenson, Team Leader, FHWA Office of Asset Management

Historically, many highway agency managers and administrators have tended to view their highway systems as simply a collection of projects. By viewing the network in this manner, there is a certain comfort derived from the ability to match pavement actions with their physical/functional needs. However, by only focusing on projects, opportunities for strategically managing entire road networks and asset needs are overlooked. Although the "bottom up" approach is analytically possible, managing networks this way can be a daunting prospect. Instead, road agency administrators have tackled the network problem from the "top down" by allocating budgets and resources based on historic estimates of need. Implicit in this approach is a belief that the allocated resources will be wisely used and will prove adequate to achieve desirable network service levels.

By using a quick checkup tool, road agency managers and administrators can assess the needs of their network and other highway assets and determine the adequacy of their resource allocation effort. A quick checkup is readily available and can be usefully applied with minimum calculations.

It is essential to know whether present and planned program actions (reconstruction, rehabilitation, and preservation) will produce a net improvement in the condition of the network. However, before the effects of any planned actions to the highway network can be analyzed, some basic concepts should be considered.

A Quick Check of Your Highway Network Health

- By Larry Galehouse, Director, National Center for Pavement Preservation
- And Jim Sorenson, Team Leader, FHWA Office of Asset Management
- Available at pavementpreservation.org

Network Approach Concept

- Every mile of road ages (deteriorates) by 1 year each year (a “mile-year”)
- For every mile of road in your network, you must preserve/extend the network life by one mile-year through treatments each year

- **Example:** For an average 25 mile (paved) network, you must gain at least 25 mile-years of life through work each year to maintain the current network condition

Every Treatment Has…

- Unit cost
- Estimated life extension
  (number of years until the road returns to it's prior condition)

- Using these values, we calculate the **E**quivalent **A**nnual **C**ost

EAC = Unit Cost / Estimated Life Extension

Estimated Treatment Costs

- **Surface Seal** — $0.50 - $1.50 / SY
  (Crack Seal, Fog Seal)
- **Single Seal** — $1.75 - $3.00 / SY
  (Single Chip, Single Micro)
- **Double / High Performance Seal** — $3.50 - $6.00 / SY
  (Double Chip, Double Micro, Asphalt Rubber SAM)
- **Combination Seals / Thin Overlays** — $6.00 - $8.00 / SY
  (Cape Seal, Shim & Single Seal, Thin HMA, Bonded Wearing Course)
- **Shim & Overlay / Mill & Fill** — $8.00 - $12.00 / SY
- **In-Place Recycling & Overlay** — $12.00 - $18.00 / SY
  (Hot In-Place Recycling, Cold In-Place Recycling)
- **Reclaim & Pave** — $15.00 - $20.00 / SY

Treatment Life Extensions

Treatment	Good Condition (PCI=80)	Fair Condition (PCI=60)	Poor Condition (PCI=40)
Crack Fill / Crack Seal	1 - 3	0 - 2	0
Single Seal	4 - 8	3 - 5	0 - 3
Double or High Performance Seal	6 - 12	3 - 8	2 - 4
Thin Overlay or Combo	8 - 14	4 - 10	3 - 6
FDR & HMA	12 - 18	12 - 18	12 - 18

Applying treatments at the right time yields the best return on your investment!

What Does This Mean For YOU???

- 1 mile of road, 22 feet wide
- Comparing 6 treatment options
  - Reclaim & Repave
  - Cold Mix & Single Seal
  - Crack Seal & Overlay
  - Shim & Single Seal
  - Crack Seal & Single Seal
  - Crack Seal

Example Treatment Options

Treatment	Total Cost	Life Extension
Reclaim & Repave	$202,541	15
Cold Mix & Single Seal	$130,764	10
Crack Seal & Overlay	$87,790	8
HMA Shim & Single Seal	$59,013	8
Crack Seal & Single Seal	$36,416	6
Crack Seal	$5,000	3

Rehab Strategy

Strategy 1						
Rehab Strategy						
Item #	**Process**	**Miles**	**Life Extension**	**Years Gained**	**Cost Per Mile**	**Subtotal**
1	Reclaim & Repave	2.50	15	38	$202,541	$506,352
2	Cold Mix & Single Seal	0.00	10		$130,764	
3	Crack Seal & Overlay	0.00	8		$87,790	
4	HMA Shim & Single Seal	0.00	8		$59,013	
5	Crack Seal & Single Seal	0.00	6		$36,416	
6	Crack Seal	0.00	3		$5,000	
TOTAL		**2.50**	**n/a**	**38**	**n/a**	**$506,352**

Rehab & Repair Strategy

Strategy 2						
Repair Strategy						
Item #	**Process**	**Miles**	**Life Extension**	**Years Gained**	**Cost Per Mile**	**Subtotal**
1	Reclaim & Repave	1.00	15	15	$202,541	$202,541
2	Cold Mix & Single Seal	1.50	10	15	$130,764	$196,147
3	Crack Seal & Overlay	1.00	8	8	$87,790	$87,790
4	HMA Shim & Single Seal	0.00	8		$59,013	
5	Crack Seal & Single Seal	0.00	6		$36,416	
6	Crack Seal	0.00	3		$5,000	
TOTAL		**3.50**	**n/a**	**38**	**n/a**	**$486,478**

Preservation Strategy

Strategy 3						
Hybrid-Preservation Strategy						
Item #	**Process**	**Miles**	**Life Extension**	**Years Gained**	**Cost Per Mile**	**Subtotal**
1	Reclaim & Repave	0.75	15	11	$202,541	$151,906
2	Cold Mix & Single Seal	0.75	10	8	$130,764	$98,073
3	Crack Seal & Overlay	0.00	8		$87,790	
4	HMA Shim & Single Seal	1.00	8	8	$59,013	$59,013
5	Crack Seal & Single Seal	2.00	6	12	$36,416	$72,832
6	Crack Seal	0.00	3		$5,000	
TOTAL		**4.50**	**n/a**	**39**	**n/a**	**$381,824**

Strategy Comparison

Strategy	Miles Treated	Total Cost	Years Gained	Equivalent Annual Cost
Rehabilitation	2.5	$506,352	38	$1.10
Repair	3.5	$486,478	38	$1.03
Hybrid-Preservation	4.5	$381,824	39	$0.80

Summary & Take-aways

- Network asset value and the annual depreciation value provide a baseline for funding
- A Rehabilitation (and repair to an extent) strategy limits the roadway miles a municipality can maintain annually
- A Preservation strategy provides the greatest return on investment and maximizes the miles maintained
- Higher funding levels or a Repair & Preserve strategy are needed in order to “maintain” or “improve” the overall network condition

Thank you!

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