Build a Balanced Road Network with Pavement Preservation

Rex W. Eberly
National Center for Pavement Preservation

MICHIGAN STATE UNIVERSITY

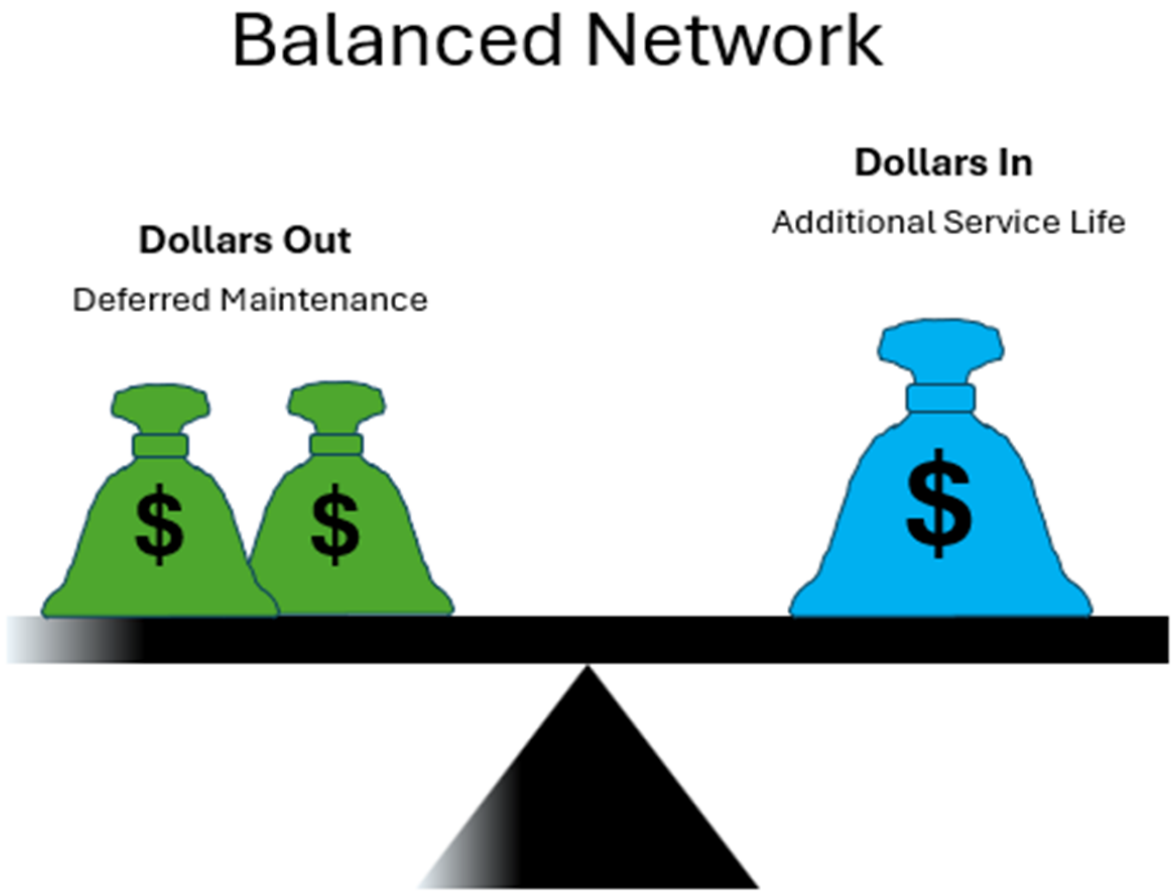
CHALLENGES FOR ROAD MANAGERS

- Bid prices are rising
- Asphalt Pavements have a shorter life span
- Traffic counts are increasing
- Truck traffic is increasing
- Road users expect sustainable solutions

WHILE

- Budgets aren't keeping up

THE SOLUTION IS BUILDING A BALANCED ROAD NETWORK



Pavement Preservation Is…

- "Programs and activities 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 improve motorist satisfaction while saving public tax dollars".

  - The treatment must:
    - Address pavements while they are still in good condition
    - Reduce aging
    - Extend Pavement Life
    - Restore Serviceability**

Define the Definition

- **Network Level**
  - All Pavements (Urban, Rural, Airports)
    - Asphalt and Concrete
- **Long-Term Strategy**
  - Budgeted Expense
- **Integrated**
  - Department Wide
  - All Stakeholders
- **Cost-Effective**
  - Right Treatment, Right Road, Right Time
- **Improve Road User Satisfaction**

Why Develop a Preservation Mindset?

- Budgets
  - Few agencies can afford a strategy of Build It, Rehab It, Build it Again
- Material Changes
  - Pavements don't seem to be lasting as long. Preservation stretches the service life of your pavements
- Sustainability
  - Carbon Reduction Act
  - Environmental Product Declarations (EPD's)
  - Material Availability

THE BEST REASON IS – IT WORKS!

Why Don't We Just Mill and Fill Everything?

What Happens When We Mill and Fill Everything!

Michigan DOT Example

The FY 2023 Highway Program approximately $1.6 billion for roadway preservation activities.

The MDOT estimates for their FY 2023 Repair and Rebuild Roads program (roadway preservation) will include approximately: 1,111 lane miles of reconstruction and improvements, 821 lane miles of capital preventive maintenance, and 206 lane miles of freeway and non-freeway resurfacing.

2138 L.M. / 32,045 L.M = 6.7% of the network

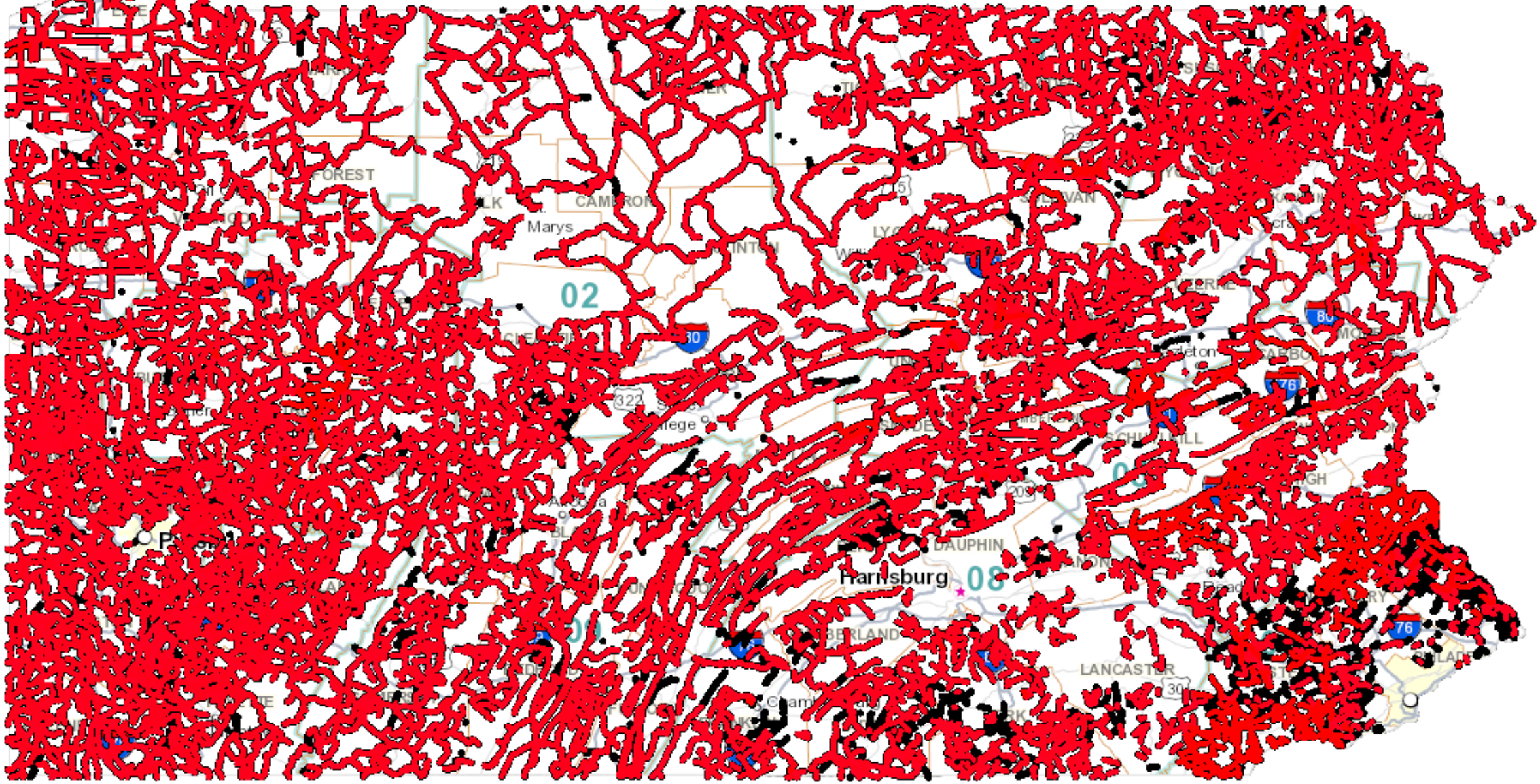
32,045 L.M / 2138 L.M = 15 Year Cycle

1.6 Billion / 2138 L.M = $ 748,363 / LM

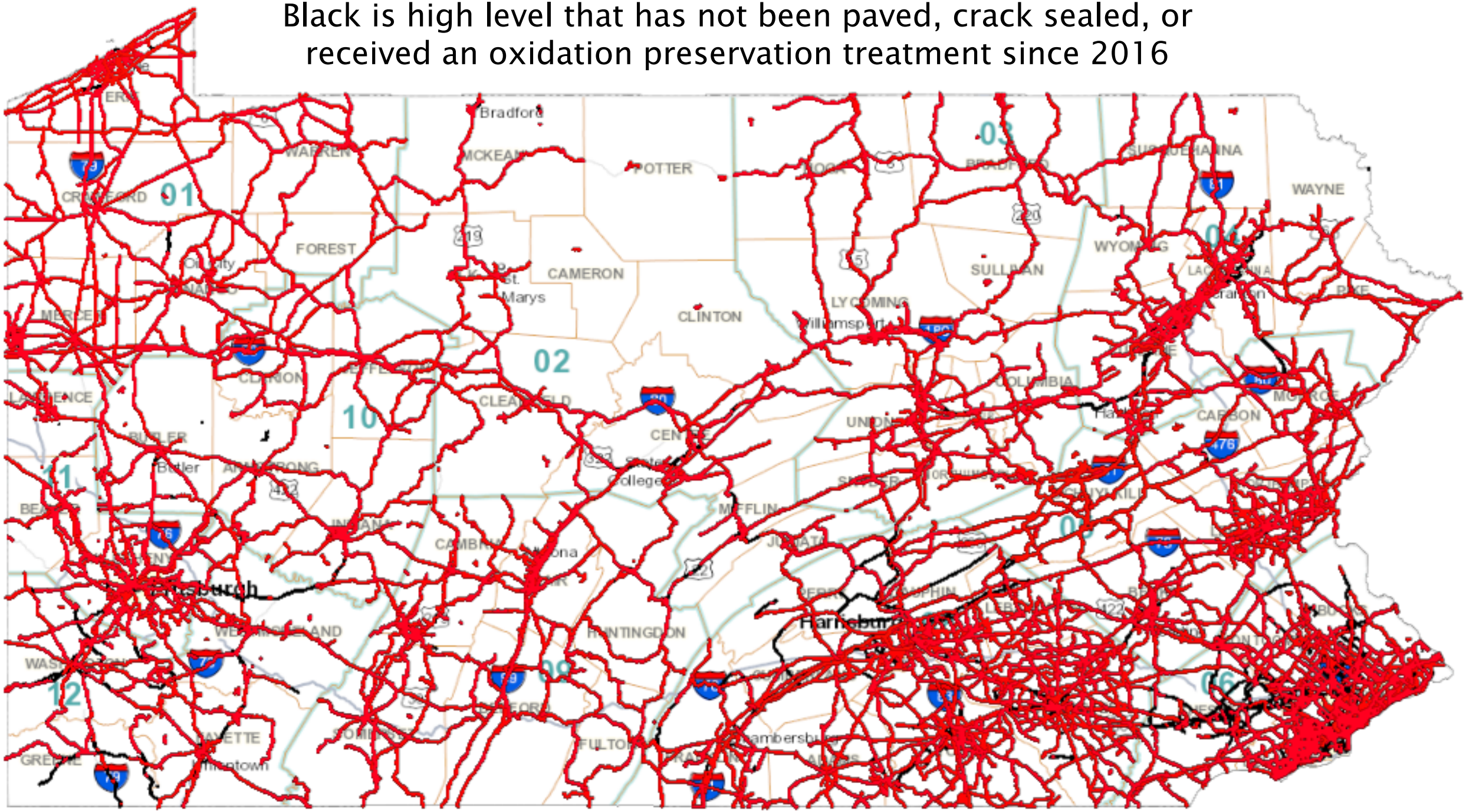
A Better Strategy Pennsylvania DOT

- PennDOT improved 7,102 miles of pavement in fiscal year 2023.
- Improvement includes Seal Coat, Micro surfacing, Thin Lift and Regular HMA Paving
- 7,102 miles / 35,776 miles = 20% of the network or a 5-year cycle.
  - Mix of treatments
    - Seal Coat – 60%
    - Paving – 20%
    - Other – 20%

Black is low level that has not been paved or received an oxidation preservation treatment since 2016



Black is high level that has not been paved, crack sealed, or received an oxidation preservation treatment since 2016



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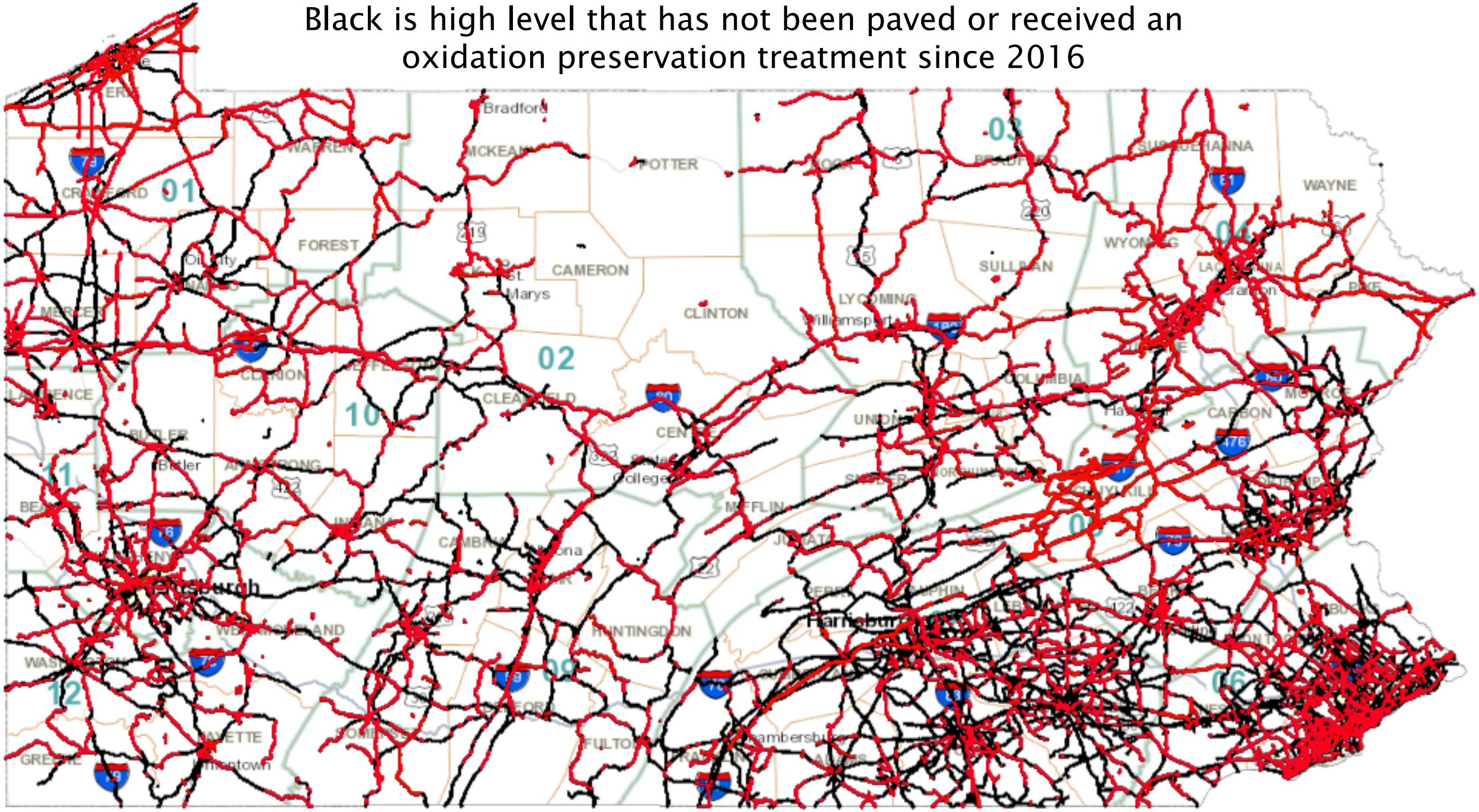
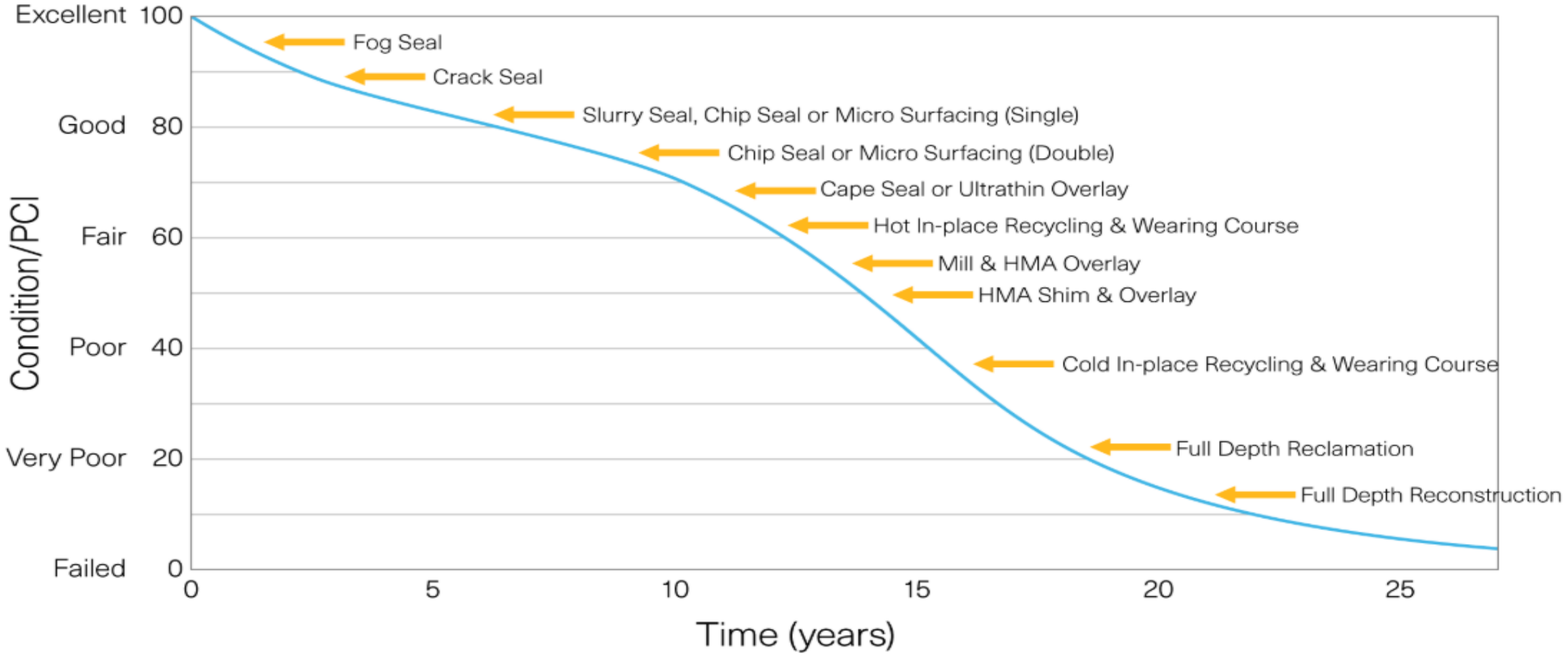


Deterioration Curve



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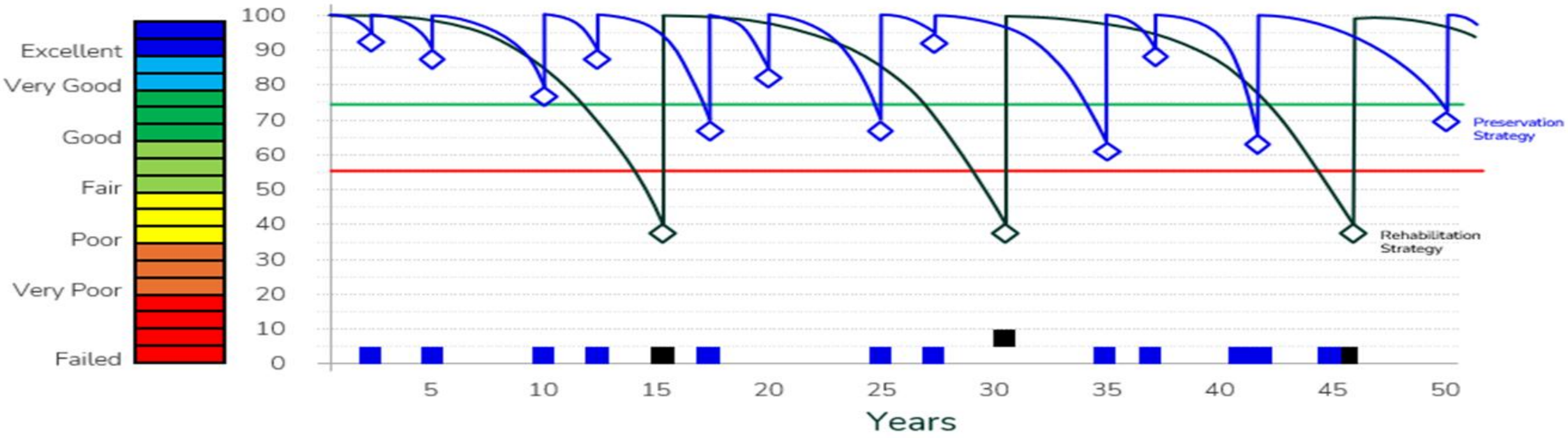
Preservation vs. Rehabilitation



Preservation Strategy

Years 2, 12, 27, 37 ›	Fog Seal w/ Crack Seal
Year 5, 45 ›	Bituminous Seal Coat w/ Crack Seal
Years 10 ›	Micro surfacing (double) w/ crack seal
Years 17, 35 ›	Cape Seal (Bit. Seal w/ Micro)
Year 25 ›	Ultra Thin Bonded Wearing Course.

TOTAL COST / SY OVER 50 YEARS › $72.00

Rehabilitation Strategy

Years 15 ›	FDR plus 4" Hot Mix Overlay
Years 30 ›	FDR plus 4" Hot Mix Overlay
Years 45 ›	FDR plus 4" Hot Mix Overlay

TOTAL COST / SY OVER 50 YEARS › $120.00

Simple
Equivalent Annual Costs Example

Roadway Network = 100 centerline miles
Average Paved Width = 26 feet
Total Paved Area = 1,525,300 SY

	Preservation Approach (Chip Seal)	"Worst First" Approach (FDR w/overlay)
Network Area	1,525,300 SY	1,525,300 SY
Avg. EAC	**X** $ 0.45/SY/Year	**X** $ 1.30/SY/Year
Required Annual Budget	**$ 686,400 305,000 S.Y. / YR 20% of Network**	**$1,980,000 101,000 S.Y. / Yr 6% of Network**

Developing Preservation Strategies

- One of the keys to maintaining balance in your network is to use several tools (treatments) in your toolbox and then find a data driven way to choose the best tool for each pavement section.

  - Crack Treatments
  - Surface Treatments
  - Heavy Surface Treatments
  - Recycling
  - Rehabilitation

What Deteriorates Your Pavements?

- Oxidation
- Moisture Intrusion
- Traffic Load

Oxidation and Moisture Intrusion Kill Pavements

- Oxidation
  - "Because asphalt is a natural organic end product of ancient living organisms, it is subject to chemical oxidation by reaction with atmospheric oxygen. Asphalt oxidation is of pragmatic importance because it leads to the hardening of the asphalt, resulting in a deterioration of desirable physical properties…. eventually resulting in excessive pavement cracking." TRB –TRANSPORTATION RESEARCH CIRCULAR E-C140 – J. Claine Petersen

- Moisture Intrusion
  - "Moisture damage is one of the most important and common factors affecting durability of asphalt pavement. Moisture intrusion into asphalt mixture seriously weakens the adhesion of asphalt and aggregate and then leads to the debonding of asphalt-aggregate interface." Influence of moisture on the migration of asphalt components – Peilang Cong

EFFECTS OF OXIDATION AND MOISTURE

Preservation Treatments Protect Pavements From Oxidation and Moisture Intrusion

- Crack Treatments
  - Crack Sealing
  - Mastic
- Fog Seals
  - Rejuvenating
  - Standard
- Seal Coats (Chip Seals)
  - Scrub Seals
  - Cape Seals
- Preservation Overlays
  - Slurry and Micro surfacing
  - Ultra Thin Bonded Wearing Course (NovaChip)
  - Thin HMA

When Should We Not Use Thin Surface Treatments? Structural Defects Vs. Functional Distress

- Chip Seal or Micro surfacing should **NOT** be placed on a Pavement with Structural Defects.
- A Structural Defect means either the Pavement or the Base has failed.
  - Pavement Failure
    - Stripping – the asphalt no longer adheres to the rock
    - Potholes – if not repaired
    - Rutting – if continuing to rut
    - Longitudinal and Transverse Cracking – Heavy
  - Base Failure
    - Alligator Cracking – the base or sub-base has failed and no longer supports traffic loading.
    - Water and / or fines pumping – the base is failing, and Alligator Cracks will soon appear

- Chip Seal or Micro surfacing can be used to treat **moderate** Functional Distresses.
- A Functional Defect, if not treated may become a Structural Defect.
- A Functional Defect is often caused by environmental or traffic conditions.
  - Rutting – if rutting has stopped
  - Bleeding
  - Longitudinal and Transverse Cracks – Light to Moderate
  - Polishing
  - Raveling

Structural

Functional (Surface)

Final Thoughts

- **Pavement Preservation** is a Mindset
- The Goal is to “Touch” about 20% of your network every year with some sort of **Life Extending Treatment**.
- Schedule **Early Preservation Treatments** when the pavement is first built.
- Have a **Toolbox** full of treatments so you can always use the **Right Treatment** on the **Right Road** at the **Right Time**.
- **Pavement Preservation** Saves **Money**, **Time**, **Resources** and satisfies the **Public** and **Politicians**.

Questions?