Pavement Preservation

The Who, What, When, Where, Why, and How

Ben Statler

RUSSELL STANDARD

The Who

The What

Pavement Preservation

pre·serve (pri-zērv’) verb

1. to keep in good condition
2. to keep safe from harm
3. to prevent decay
4. maintain

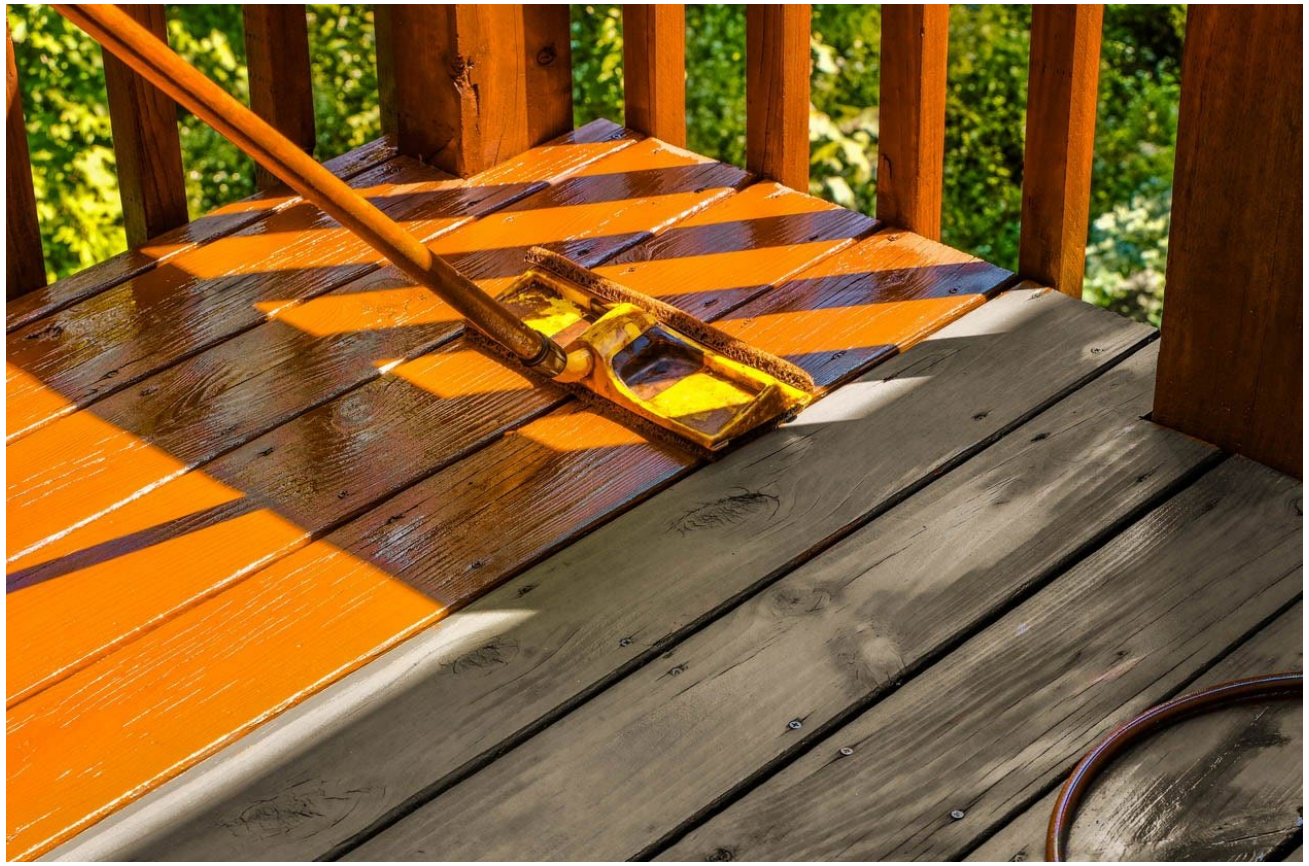
Source: Merriam Webster

Building a Deck

Let’s imagine you’ve just finished building a deck on the back of your house. What’s next?

Protecting it from the elements

You stain the deck or paint it. Why? To preserve it! Rain, snow, even the oxygen in the air is going to eat away at that wood unless you preserve it.



"Worst First"

- Worst first is the concept of addressing the worst, most complained about roads. While ignoring roads that are still in good condition.
- This is a political trap
- Worst first is not sustainable.

Reconstruction Candidate

Preservation Candidate

PCI-Pavement Condition Index

- A grading system used to quantify the condition of the road
- 0 to 100
- 100 being a road in perfect condition
- 0 being…well……this…..

Some Pavement Preservation Applications

- Crack Seal
- Scrub Seal
- Fog Seal
- Chip Seal
- Fibermat

The Where

Maryland

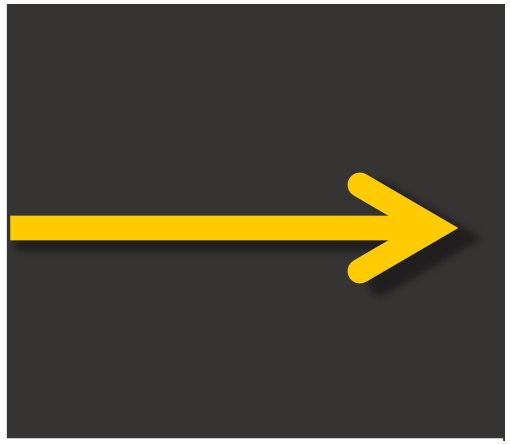
The When

The Why

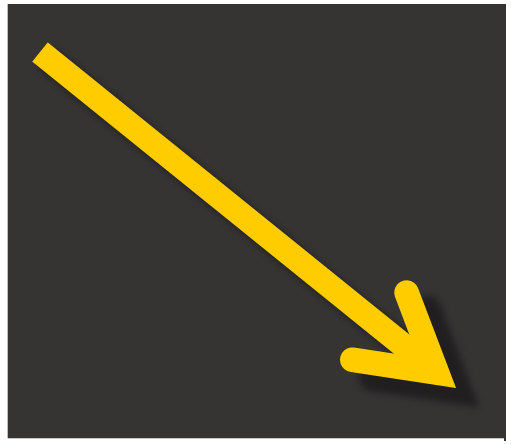
- **December 2023**
- **Governor Wes Moore and Transportation Secretary Paul Wiedefeld announce 3.3 billion in cuts over six years to Maryland's Consolidated Transportation Program.**

Why Do We Need Pavement Preservation?

Asphalt Cost

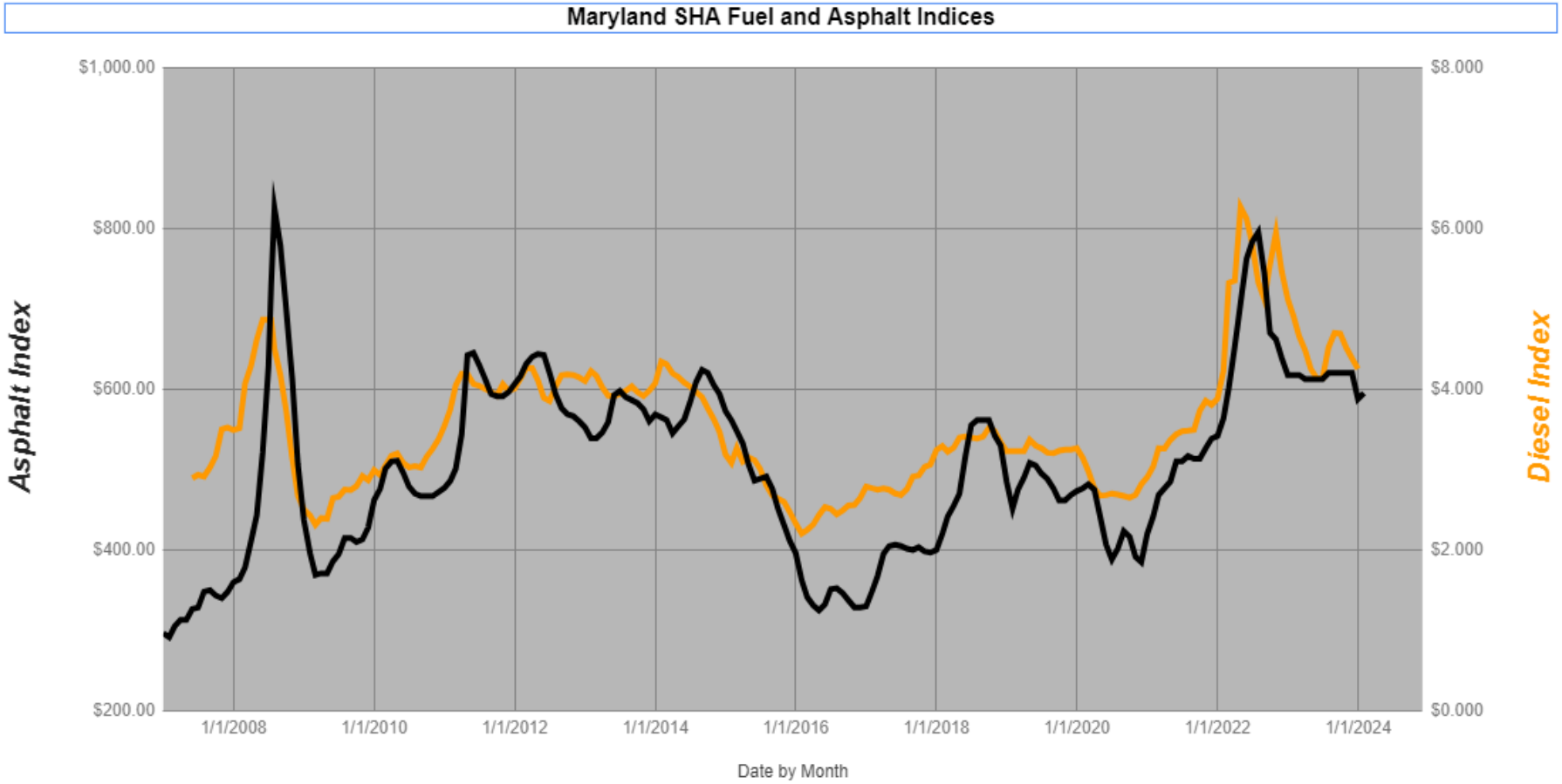


Road Budgets

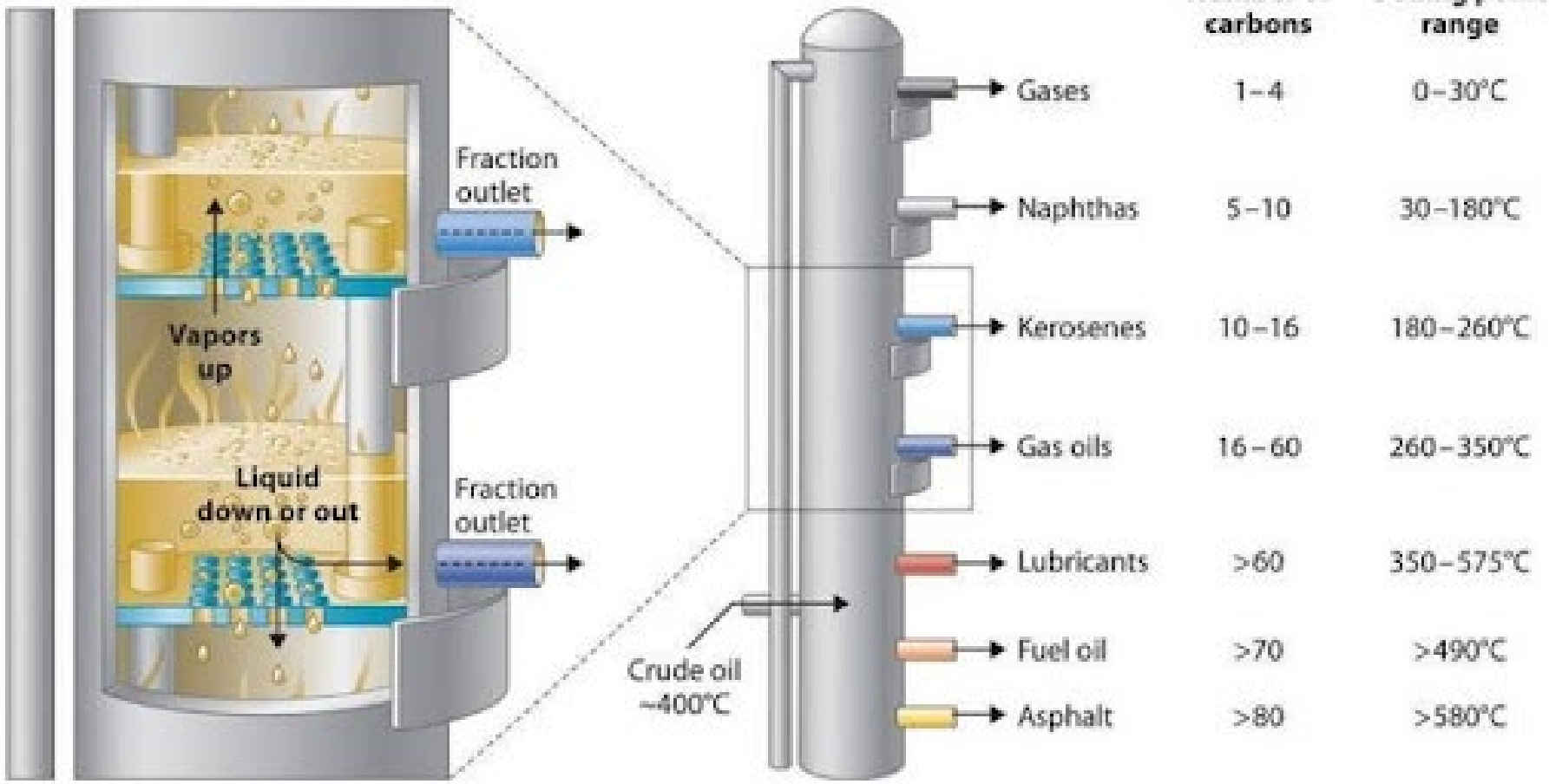


HMA Life Expectancy

Maryland Asphalt Index as of February 2024



Refiners are getting more for the lighter products, and leaving less in the asphalt



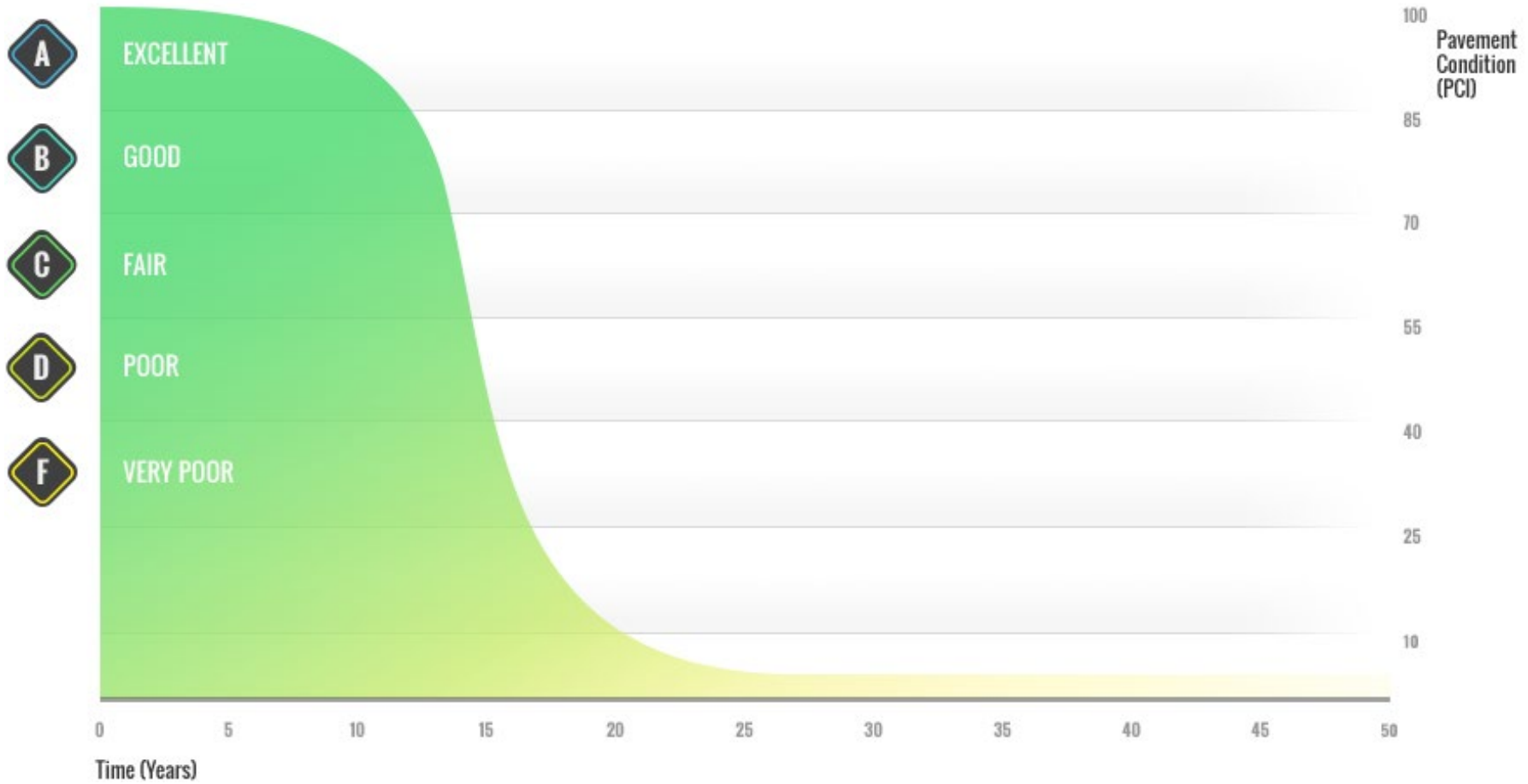
(a) Petroleum distillation tower

(b) Petroleum fractions

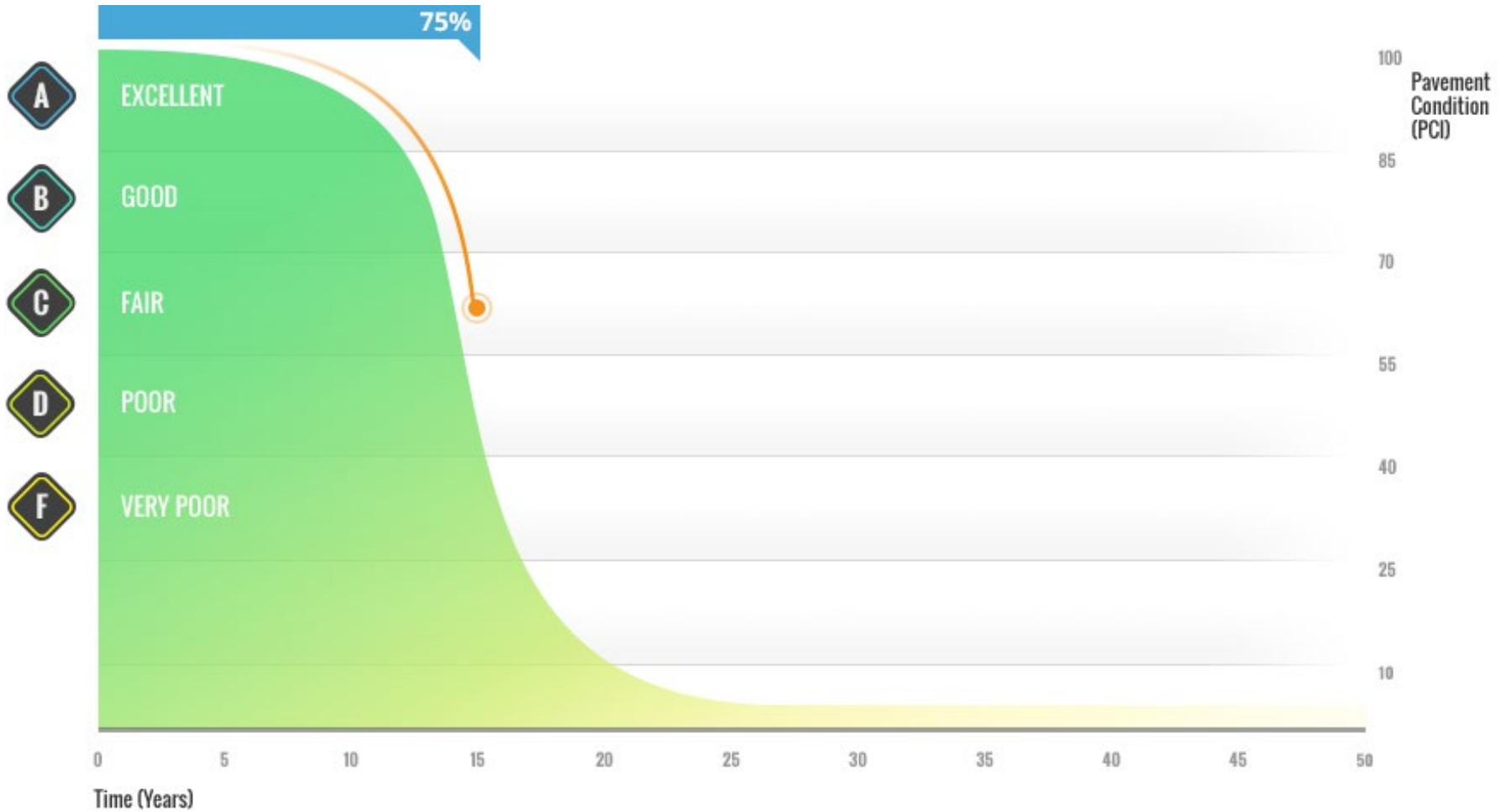
Common Pavement Preservation Treatments including, but limited to

- Crack Seal
- Fog Seal
- Chip Seal (Single, Double, Triple)
- Micro Surfacing (Single and Double)
- Cape Seal (chip seal w/ micro)
- Hot Mix Asphalt (HMA) Overlay
- In-Place Recycling

The typical life of an untreated road is **20 years**

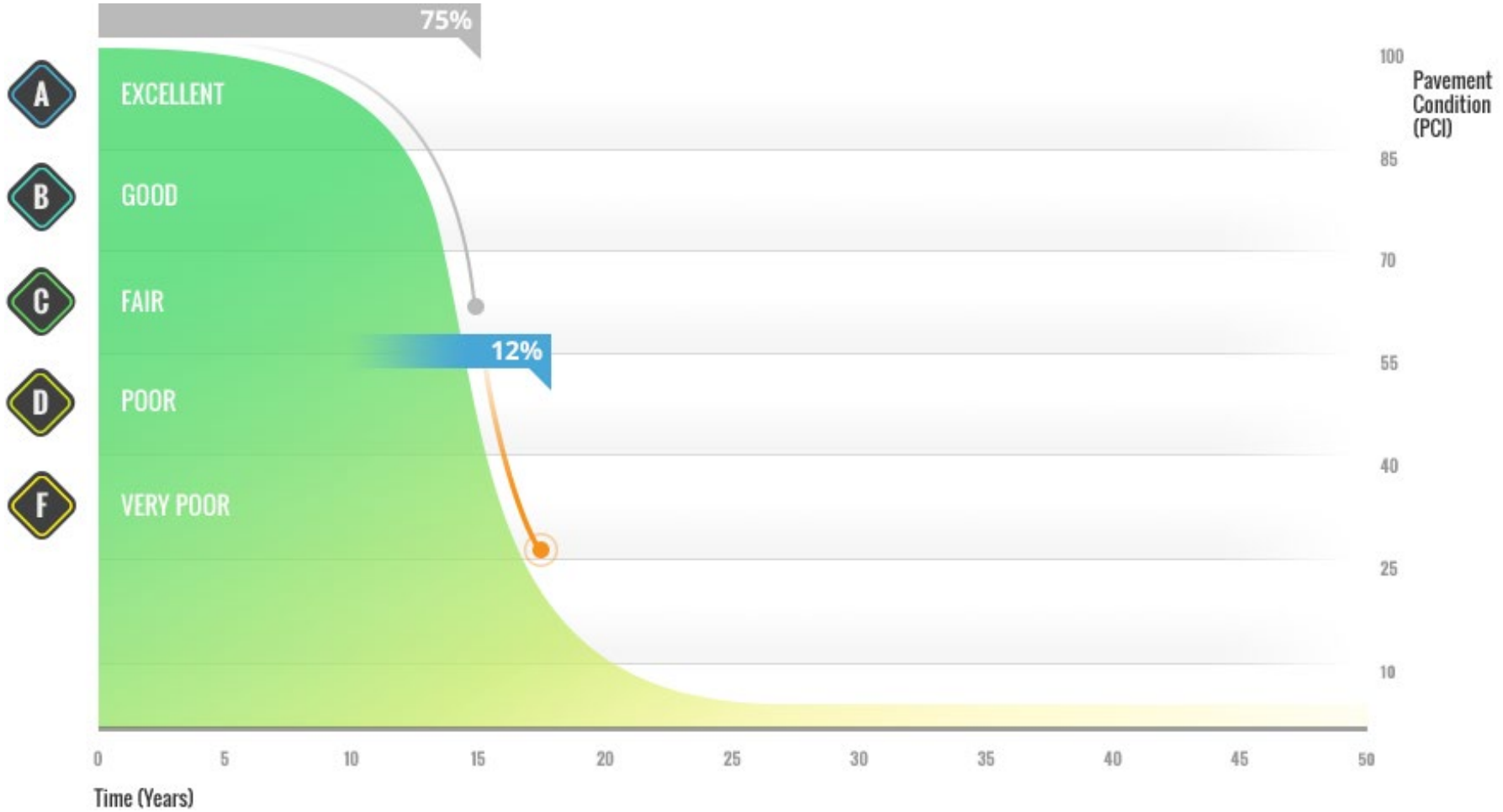


Over the **first 75%** of a road's life, it will **drop 40%** in quality.

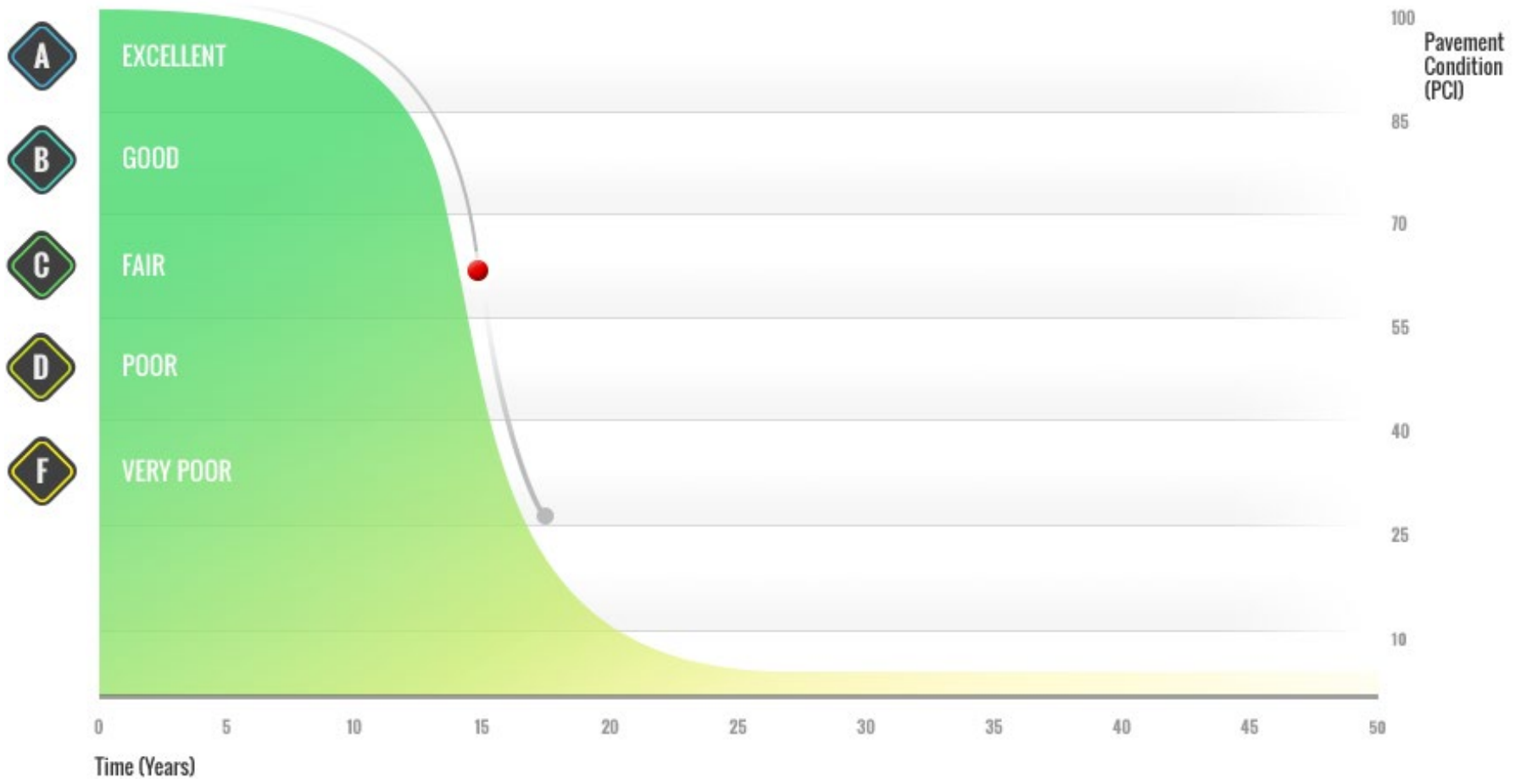


Over the first 75% of a road's life, it will drop 40% in quality.

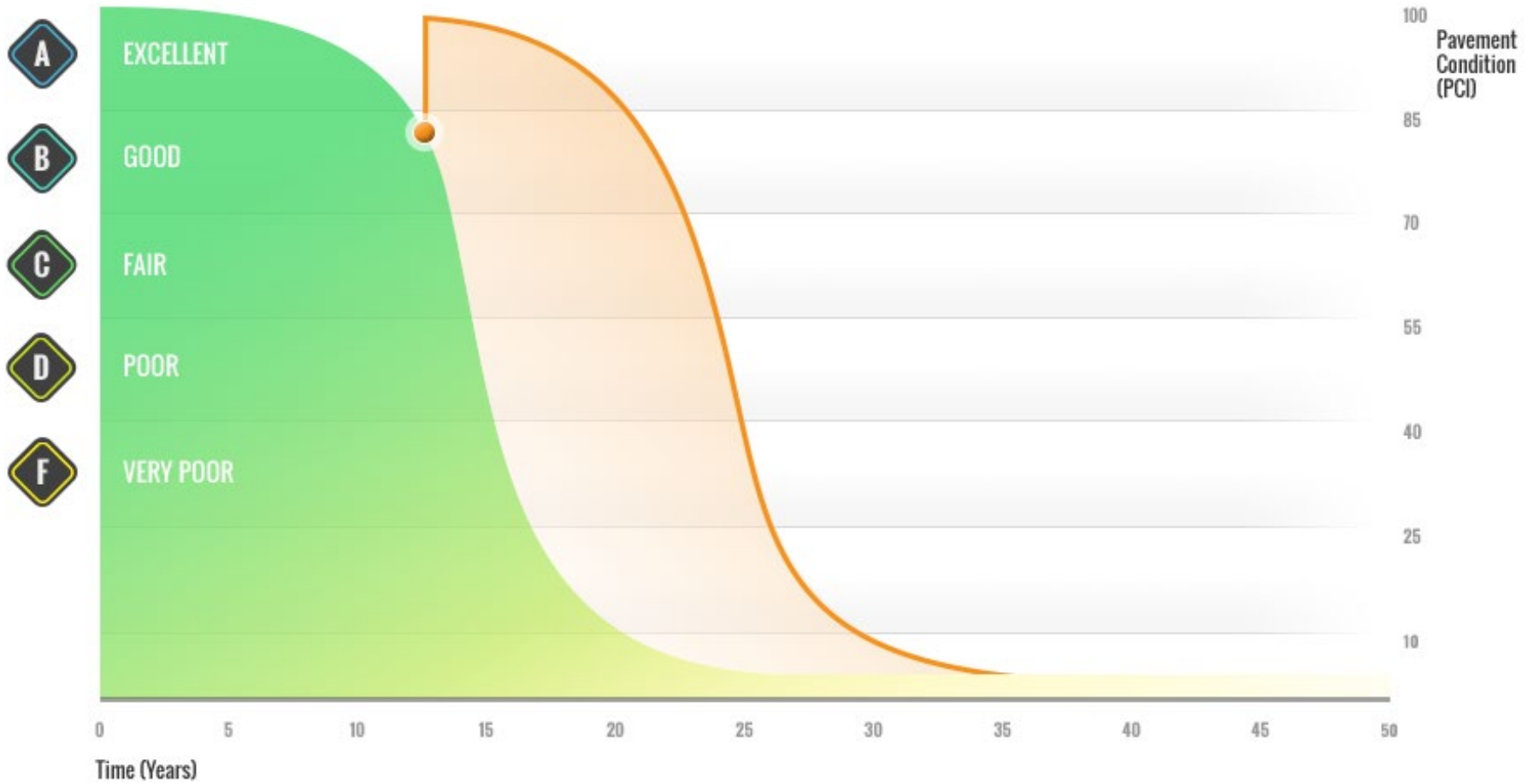
Over the **next 12%** of its life, it will drop **another 40%** in quality.

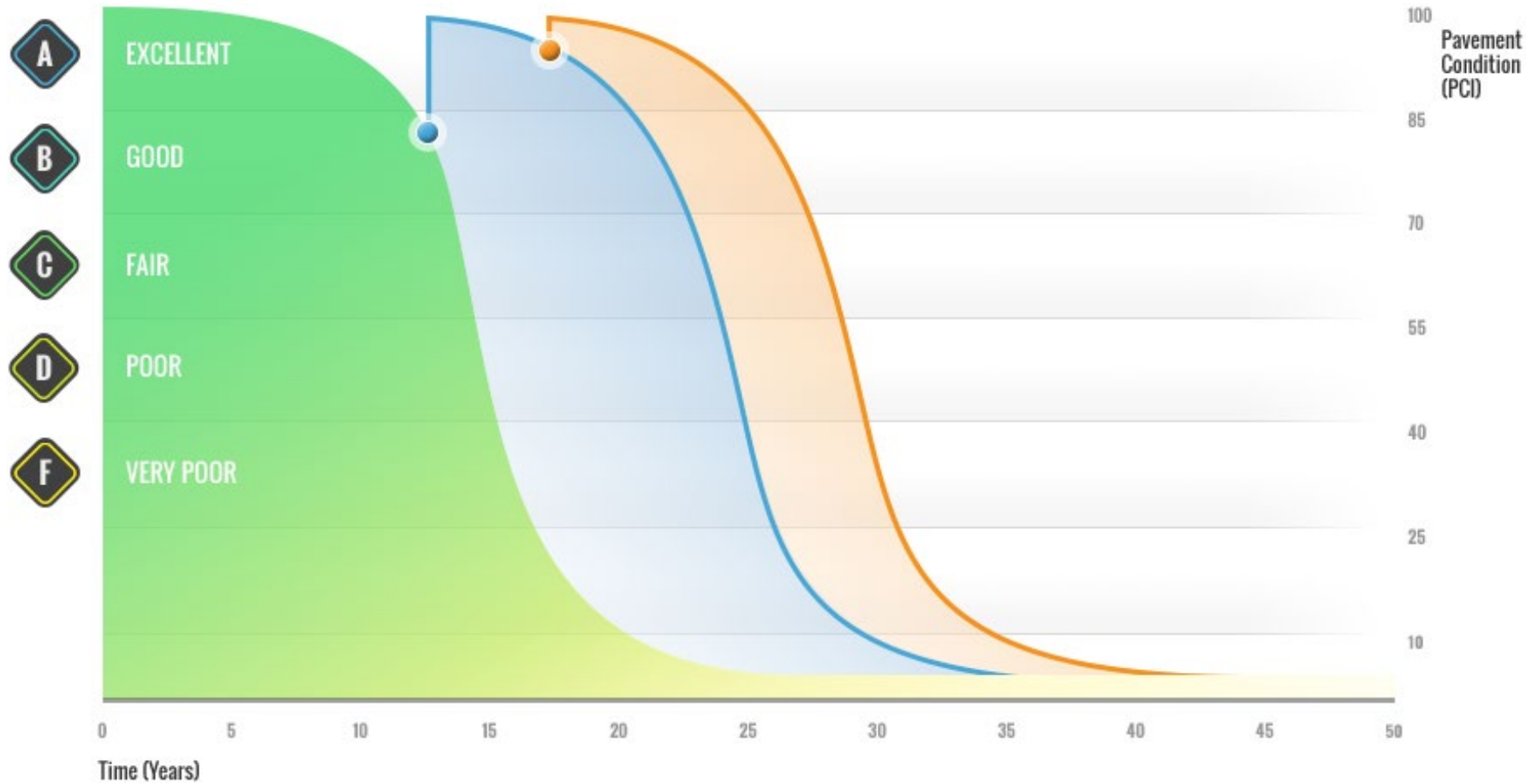


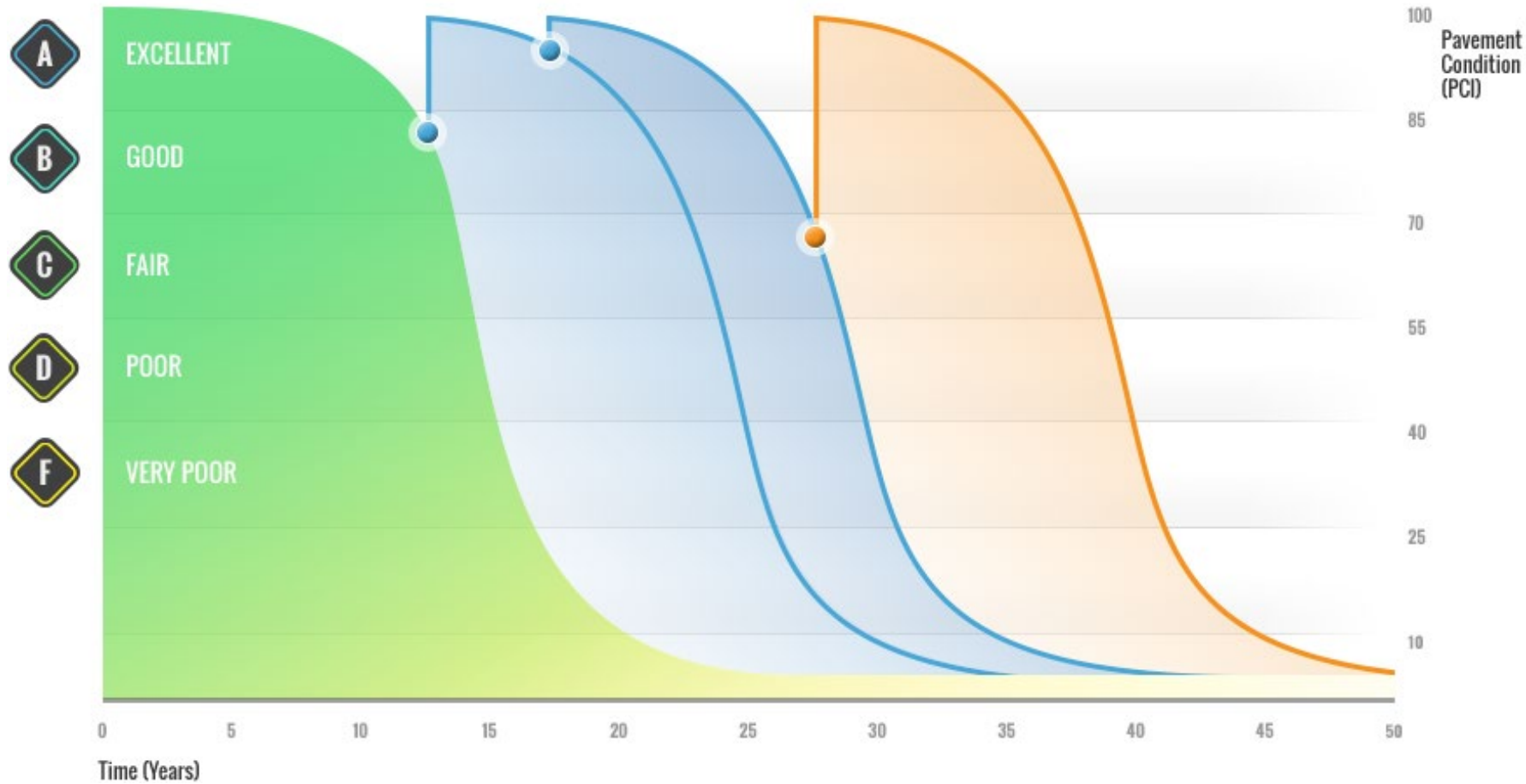
All roads pass a **point of accelerated deterioration** – past this point, costly rehab and reconstruction are the only options.



By investing in **preventative treatments**, pavement owners can inexpensively add life to their pavement.




A
EXCELLENT
B
GOOD
C
FAIR
D
POOR
F
VERY POOR
100
85
70
55
40
25
10
Pavement Condition (PCI)
0
5
10
15
20
25
30
35
40
45
50
Time (Years)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70
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40
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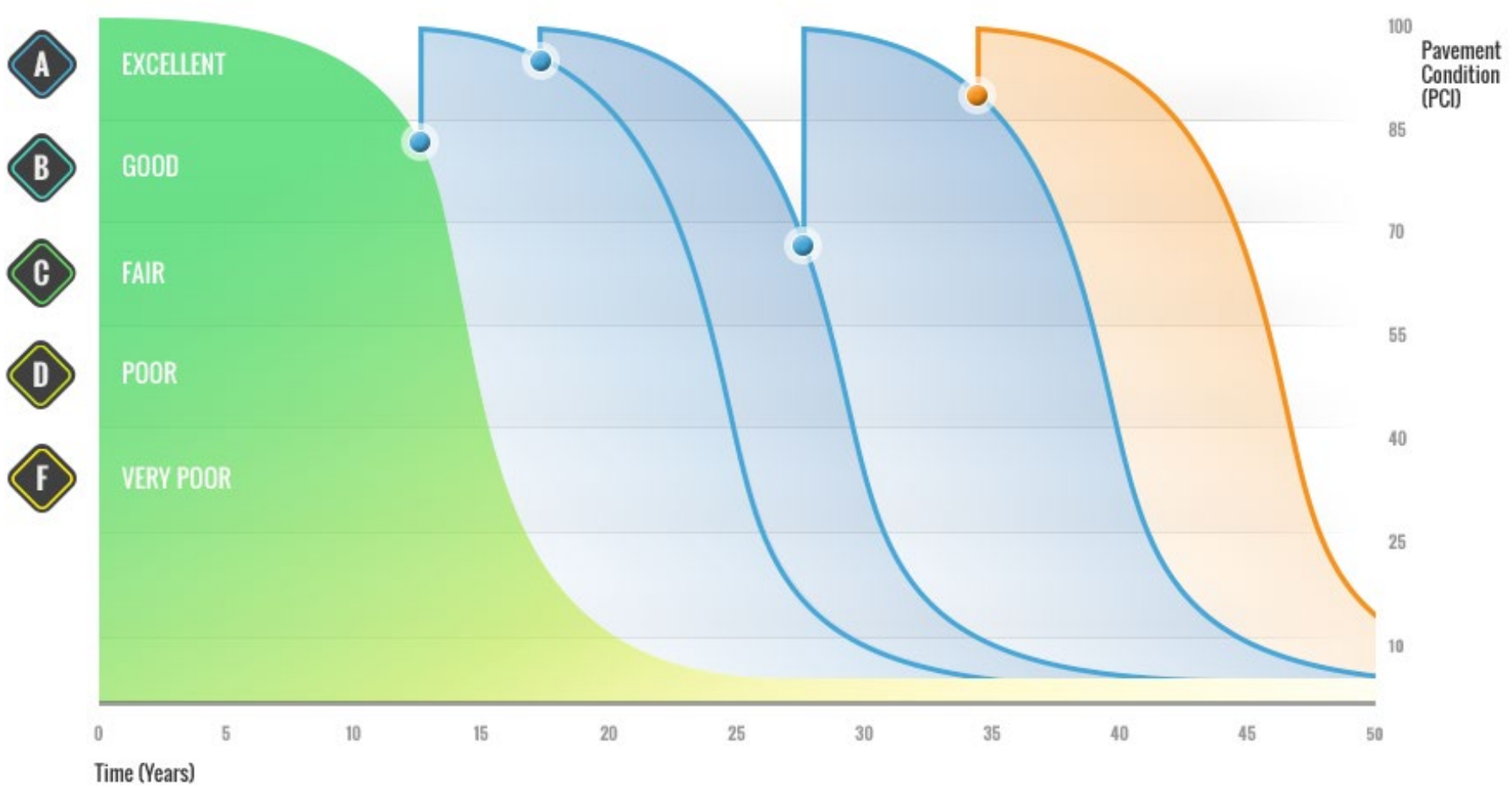
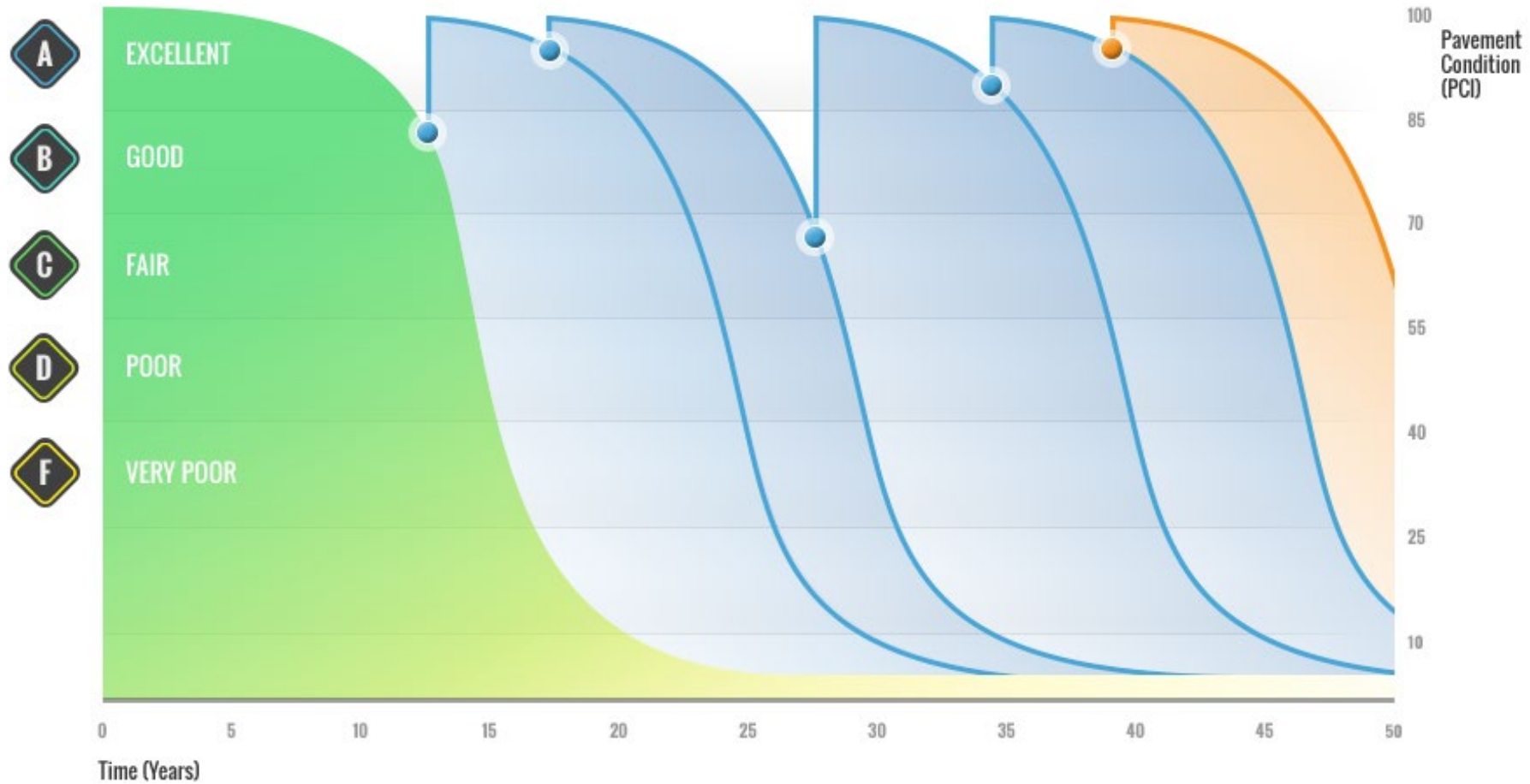
10
Pavement Condition (PCI)
0
5
10
15
20
25
30
35
40
45
50
Time (Years)

By performing the right treatments over time, pavement owners can get **40 years or more** of life from their roads.




A
EXCELLENT
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GOOD
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FAIR
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VERY POOR
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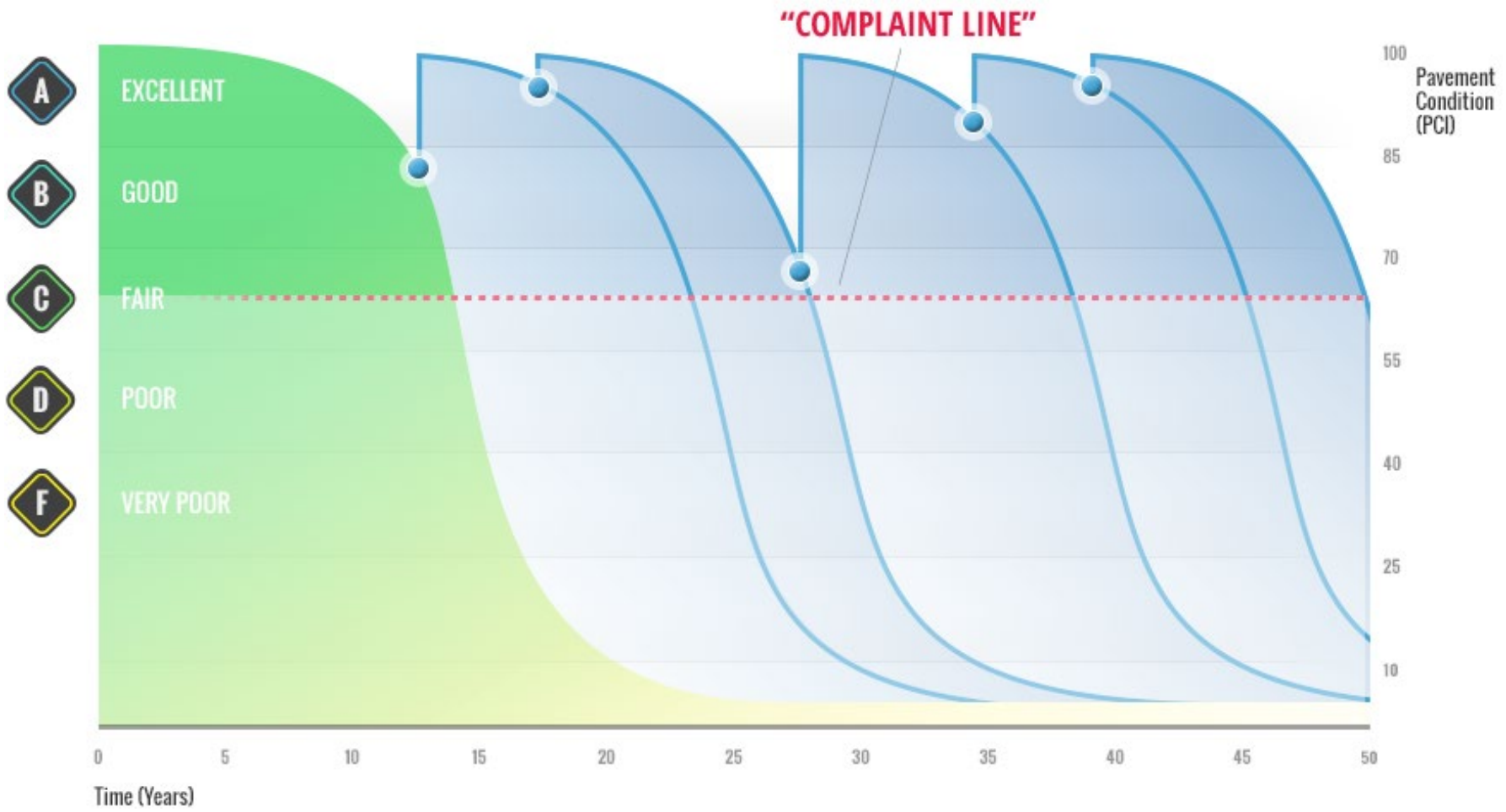
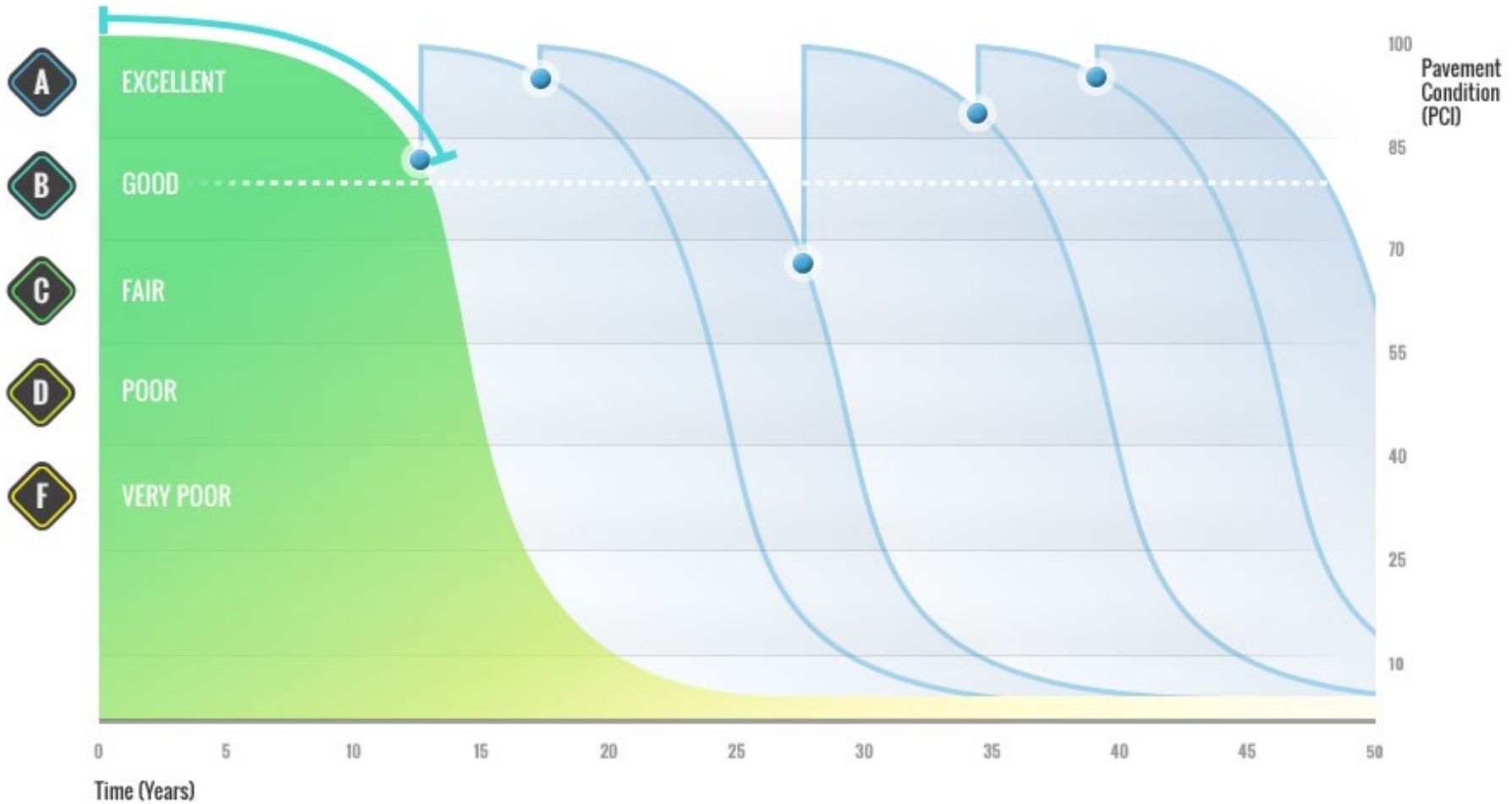
85
70
55
40
25
10
Pavement Condition (PCI)
0
5
10
15
20
25
30
35
40
45
50
Time (Years)

Plus, when good roads stay good, they spend **more time above the** "**complaint line**" – reducing maintenance, decreasing user costs, and leading to happier residents, businesses, and taxpayers.



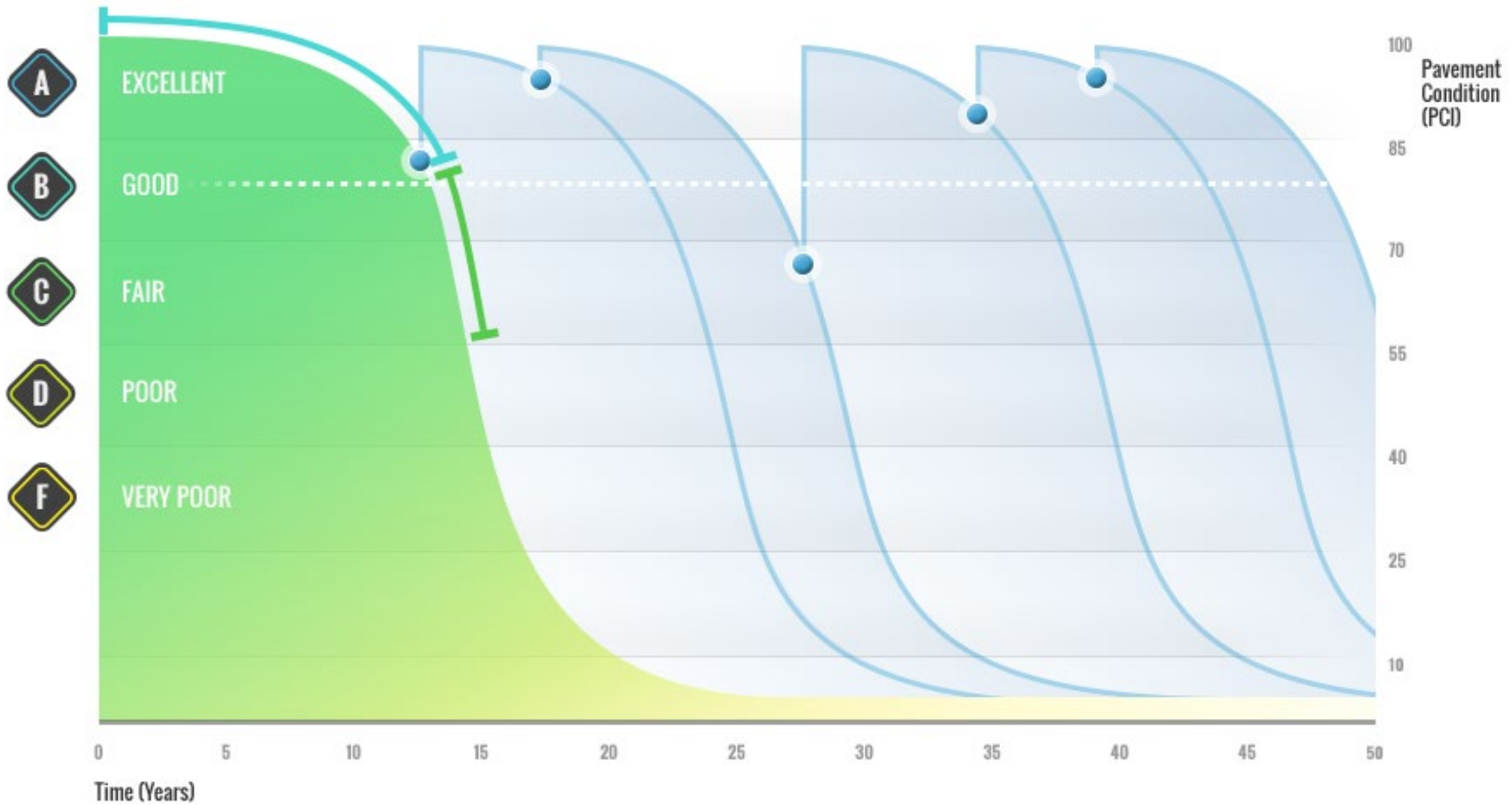
A investment in preservation pays off.

Every $2 here…



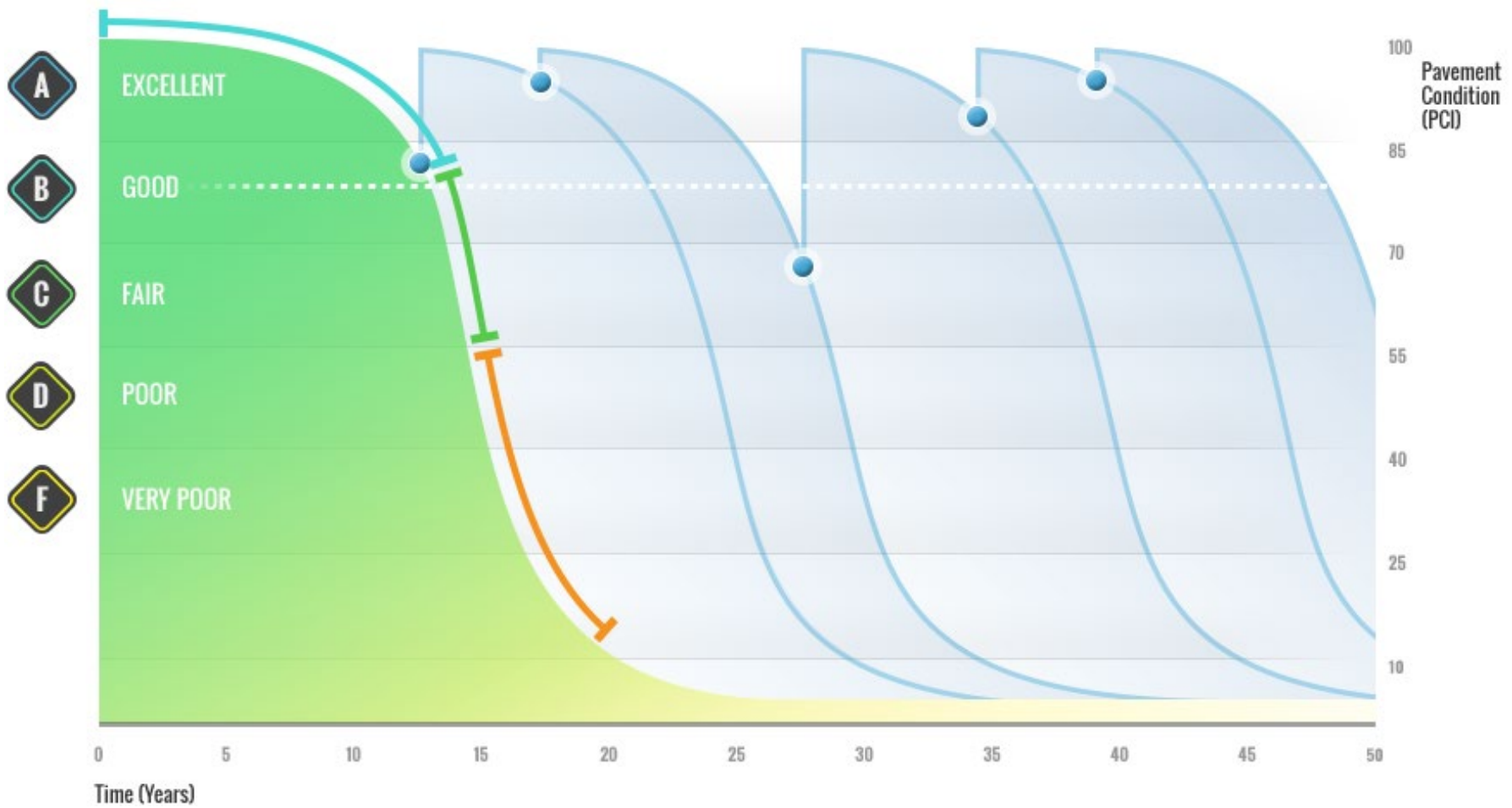
A investment in preservation pays off.

Every $2 here...
or **$4-8 here**

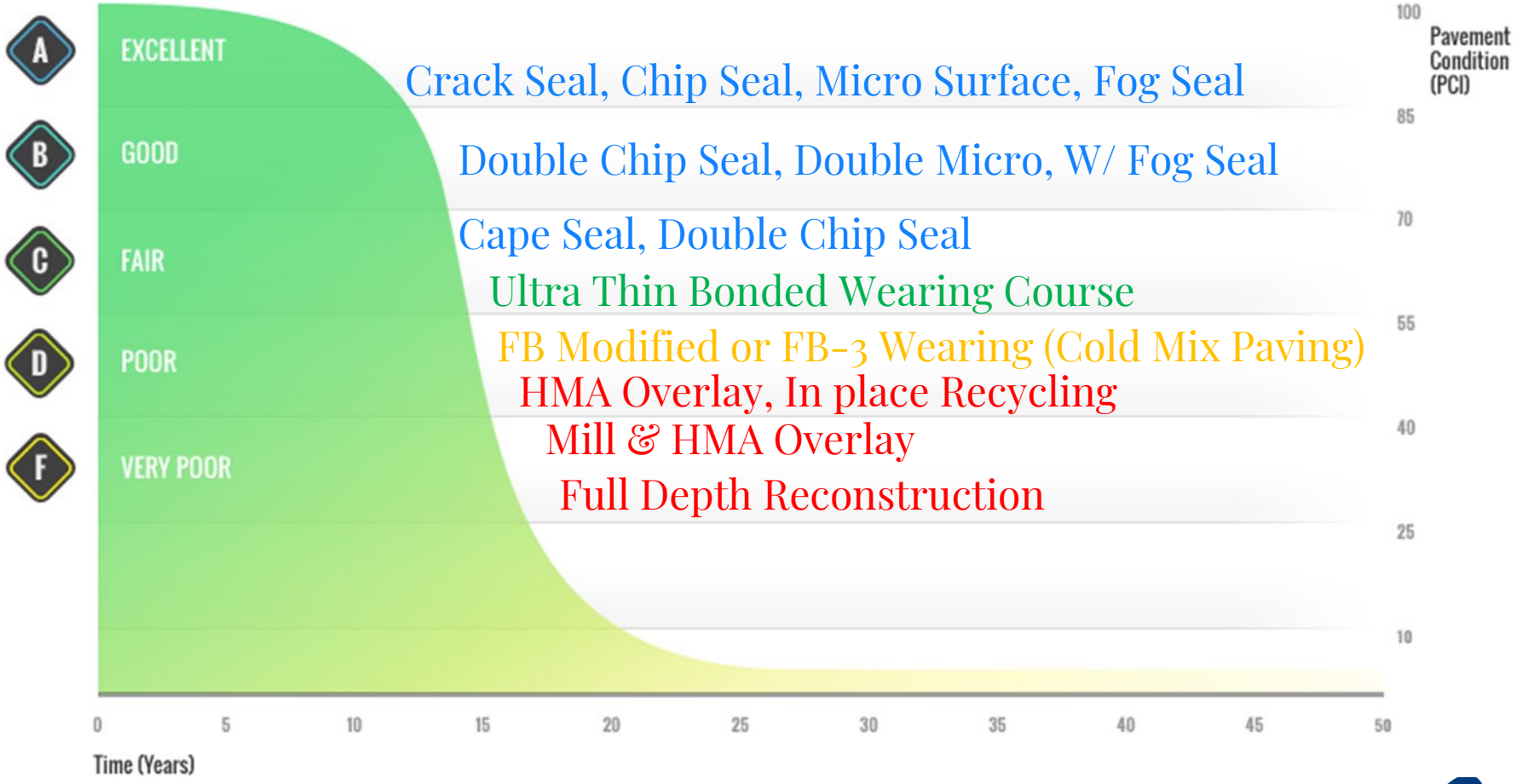


A investment in preservation pays off.

Every $2 here...
or **$4-8 here**
saves **$12-18 here**



The How


A
EXCELLENT
B
GOOD
C
FAIR
D
POOR
F
VERY POOR
Crack Seal, Chip Seal, Micro Surface, Fog Seal
Double Chip Seal, Double Micro, W/ Fog Seal
Cape Seal, Double Chip Seal
Ultra Thin Bonded Wearing Course
FB Modified or FB-3 Wearing (Cold Mix Paving)
HMA Overlay, In place Recycling
Mill & HMA Overlay
Full Depth Reconstruction
100
85
70
55
40
25
10
Pavement Condition (PCI)
0
5
10
15
20
25
30
35
40
45
50
Time (Years)

Pavement Condition Index
A (85 – 100)

Fatigue Cracking - Low

Oxidation and Raveling – Low

Preventive Maintenance Candidate

TREATMENT OPTIONS

Crack Seal, Chip Seal, Micro Surface, Fog Seal, Cape Seal

Pavement Condition Index
B (70 – 84)

Fatigue Cracking - Low

Oxidation and Raveling – Moderate

Longitudinal & Transverse Cracking - Low

TREATMENT OPTIONS

Crack Seal, Chip Seal (Single or Double), Micro Surface (Single or Double),
High Performance Chip Seal with Fog Seal
Cape Seal, Ultra Thin Bonded Wearing

Pavement Condition Index
C (55 – 69)

Fatigue, Longitudinal & Transverse Cracking – Moderate

Oxidation and Raveling – High

Longitudinal & Transverse Cracking Moderate

TREATMENT OPTIONS

Crack Seal, Double Chip Seal, Cape Seal, Ultra Thin Bonded Wearing

Pavement Condition Index
D (40 – 54)

Fatigue Cracking – High
Potholes
Longitudinal & Transverse Cracking - Moderate

Base Failure

Oxidation and Raveling - High

TREATMENT OPTIONS

FB-Modified or FB-3 Wearing

Pavement Condition Index
F (0 – 39)

Fatigue Cracking – High
With High Traffic Volume

Rutting – High
With High Traffic Volume

Fatigue Cracking with Rutting – High
With High Traffic Volume

TREATMENT OPTIONS

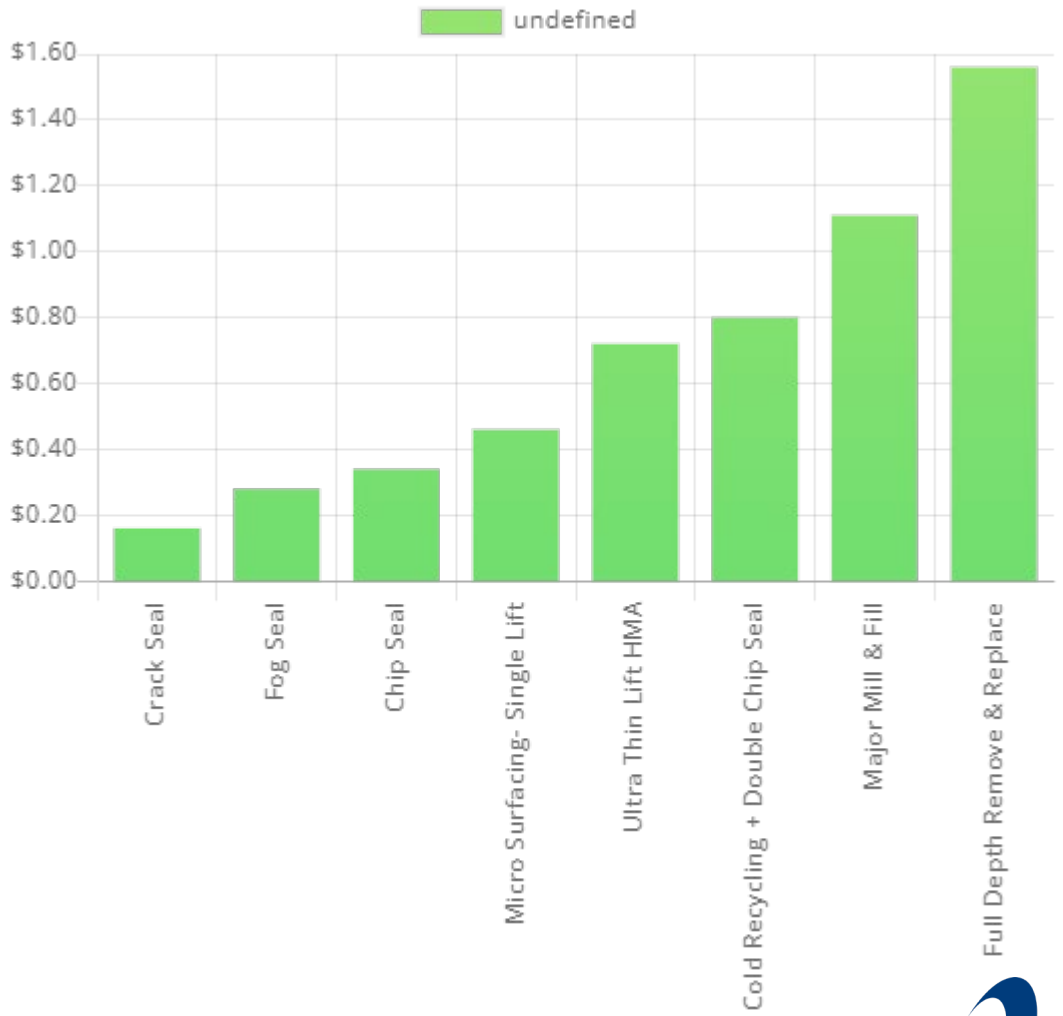
Reconstruction or Full Depth Reclamation with Hot or Cold Mix Overlay

Management Concepts to Optimize Limited Funding

- EAC – Equivalent Annual Costs
- RSL – Remaining Service Life

Road Treatment Alternatives Equivalent Annual Cost

Treatment	Cost ($ Mile) *	Cost ($ SY)	Years of Estimated Service Life	EAC $/SY/Year
Crack Seal	$ 77.76	$ 0.48	3	$ 0.16
Fog Seal	$ 92.34	$ 0.57	2	$ 0.28
Chip Seal	$ 333.72	$ 2.06	6	$ 0.34
Micro Surface	$ 448.74	$ 2.77	6	$ 0.46
Thin Lift HMA	$ 934.74	$ 5.77	8	$ 0.72
Cold Recycling + Double Chipseal	$ 1,678.32	$ 10.36	13	$ 0.80
Mill and Fill	$ 2,695.68	$ 16.64	15	$ 1.11
Reconstruction	$ 6,319.62	$ 39.01	25	$ 1.56
* Based on 18' wide roads				

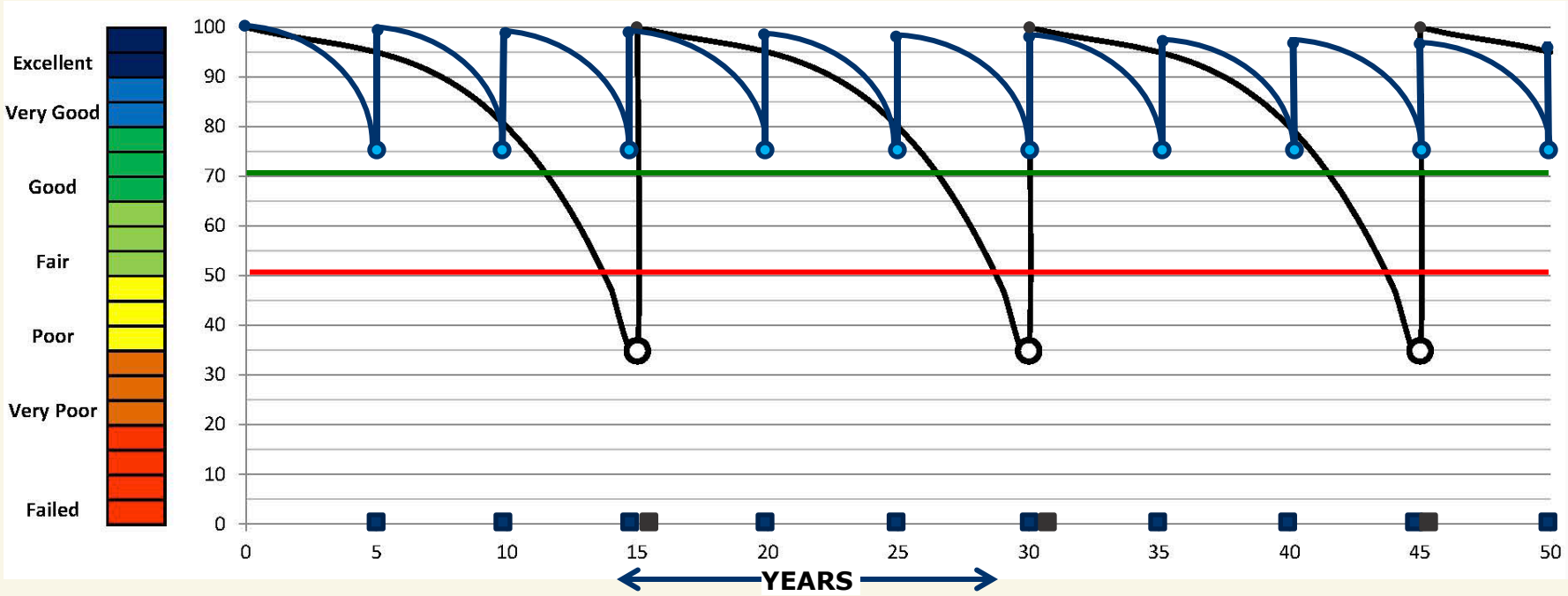


EAC Example

Roadway Network	= 100 miles
Average Paved Width	= 26 feet
Total Paved Area	**= 1,525,000 SY**

	Preservation Approach (Chip Seal)	"Worst First" Approach (Mill & Fill)
Network Area	1,525,000 SY	1,525,000 SY
Avg. EAC	**X** $2.06/SY/Year	**X** $16.64/SY/Year
Required Annual Budget	**$3,141,500**	**$25,376,000**

Progressive Pavement Management Preservation vs. Rehabilitation



PRESERVATION STRATEGY:

(Chip Seal) $2.40 X 1,525,000 X 10 = $36,600,000 For 50 years

REHABILITATION STRATEGY:

(Mill and Fill) $16.64 X 1,525,000 X 3 = $76,128,000 Over the same 50 years

Preservation Strategy

Rehabilitation Strategy

***Savings*= $39,528,000**

Inflation/CPI	Interest Rate	Total Paved Area
5 %	2.5 %	1525000 SY

CONVENTIONAL PLAN

yd Export

Year	Treatment Type	Cost in Constant Dollars	Future Cost	Present Value
25	Full Depth Remove & Replac	39.01	132.10	71.25
	Select...		0.00	0.00
	Select...		0.00	0.00
	Select...		0.00	0.00
	Select...		0.00	0.00
ADD ROW		$39.01	$132.10	$71.25

Net Present Value: **$71.25 / SY**

Total Life Cycle Cost: **$108,656,250**

OPTIMIZED PLAN

yd

Year	Treatment Type	Cost in Constant Dollars	Future Cost	Present Value
5	Chip Seal	2.06	2.63	2.32
10	Chip Seal	2.06	3.36	2.62
15	Chip Seal	2.06	4.28	2.96
20	Chip Seal	2.06	5.47	3.34
25	Chip Seal	2.06	6.98	3.76
ADD ROW		$10.30	$22.72	$15.00

Net Present Value: **$15.00 / SY**

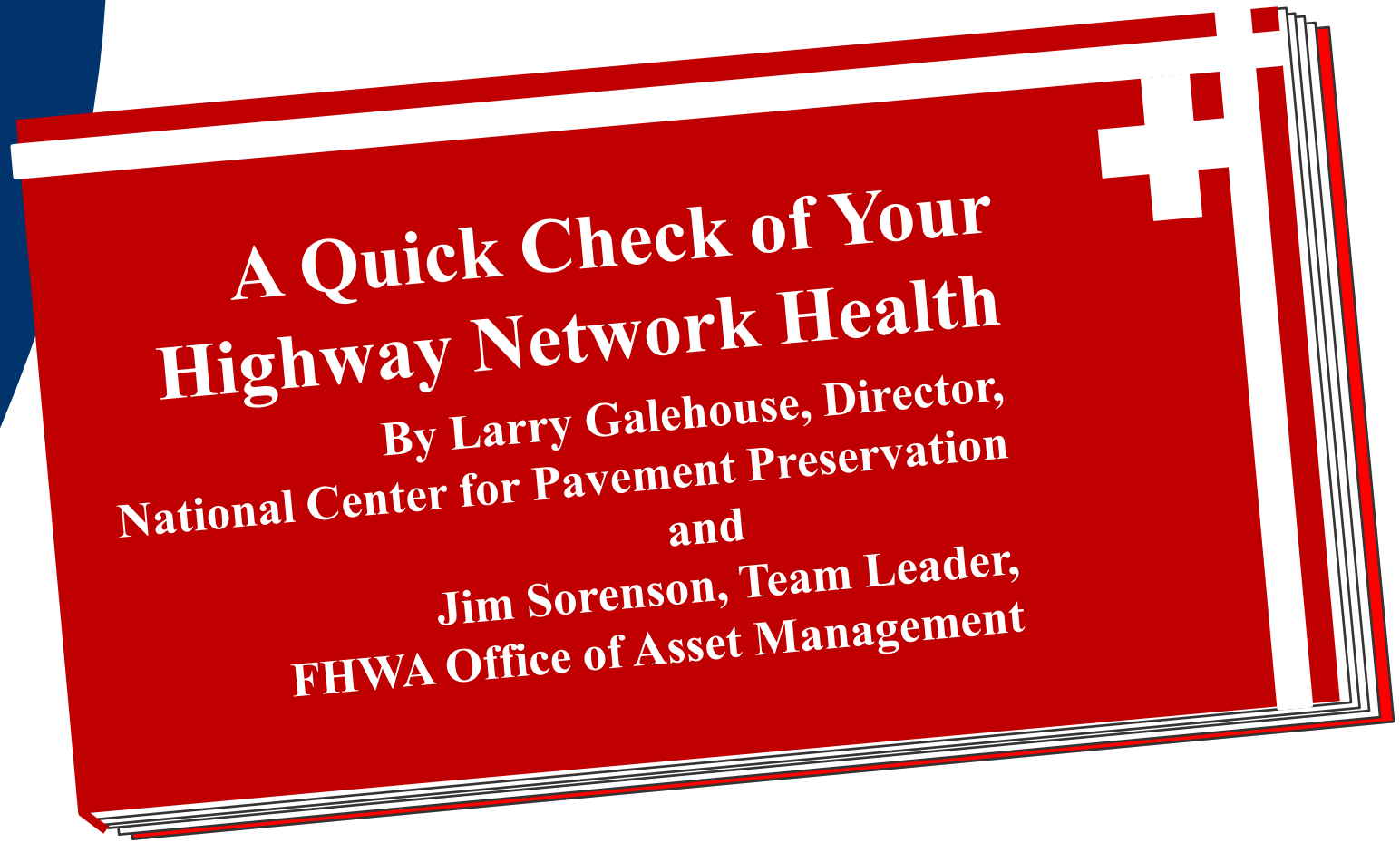
Total Life Cycle Cost: **$22,875,000**

Management Concepts to Optimize Limited Funding

- EAC – Equivalent Annual Costs
- RSL – 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**
- 200 lane-miles with NO REPAIRS or MAINTENANCE in a given year, will **lose 200 lane-mile-years of Remaining Service Life**

For Each Treatment Used:

Added Network Service Life =

Miles of Treatment X **Service Life of Treatment** = **Mile - Years**

1 Mile X 6 years of service life (Chip Seal) = 6 mile years

Total Network Lane-Miles	Average Lane Width (ft)	Total Budget	Remaining Budget
202	12	$ 950000	$950,000

Treatment Type	Category	Life Extension	Lane-Miles Treated	Lane-Mile-Years	Unit Cost	Total Cost
Full Depth Reclamation & Polymer	Reconstruction	25.0	2	50	$9,000	$0
Select...				0		$0
Select...				0		$0
Select...				0		$0
Select...				0		$0
Select...				0		$0
Select...				0		$0
Select...				0		$0

Add Row

Total Lane-Miles Treated	Total Lane-Mile-Years	Total Cost
0	0	$0

Total Network Impact

Preservation	Rehabilitation	Reconstruction
$0	$0	$0
0 Lane-Miles 0 Lane-Mile-Years	0 Lane-Miles 0 Lane-Mile-Years	0 Lane-Miles 0 Lane-Mile-Years

Worst First Approach

Total Network Lane-Miles	Average Lane Width (ft)	Total Budget	Remaining Budget
200	12	$ 950000	$1,430

yd Export

Treatment Type	Category	Life Extension	Lane-Miles* Treated	Lane-Mile-Years	Unit Cost	Total Cost
Full Depth Remove & Replace	Reconstruction	25.0	2	50	39.01	$549,261
Major Mill & Fill	Rehabilitation	15.0	2	30	16.64	$234,291
Minor Mill & Fill	Rehabilitation	11.0	2	22	9.80	$137,984
Crack Seal	Preservation	3.0	8	24	0.48	$27,034
Select...				0		$0
Select...				0		$0
Select...				0		$0
Select...				0		$0

ADD ROW

Total Lane-Miles Treated	Total Lane-Mile-Years	Total Cost
14	126	$948,570

Worst First Approach

Total Network Impact

Preservation	Rehabilitation	Reconstruction
$27,034	$372,275	$549,261
8 Lane-Miles 24 Lane-Mile-Years	4 Lane-Miles 52 Lane-Mile-Years	2 Lane-Miles 50 Lane-Mile-Years

Ouch!

YOU ONLY ADDED
126 LANE-MILE-YEARS OF LIFE

74
LANE-MILE-YEAR
NET LOSS

7%
OF ROADS ADDRESSED

Preservation Approach

Total Network Lane-Miles	Average Lane Width (ft)	Total Budget	Remaining Budget
200	12	$ 950000	$22

yd Export

Treatment Type	Category	Life Extension	Lane-Miles* Treated	Lane-Mile-Years	Unit Cost	Total Cost
Full Depth Reclamation + 4" HMA	Reconstruction	25.0	2	50	28.54	$401,843
Cold Recycling + Double Chip Seal	Rehabilitation	13.0	2	26	10.36	$145,869
Cape Seal	Preservation	10.0	2	20	5.20	$73,216
Crack Seal	Preservation	3.0	33	99	0.48	$111,514
Chip Seal	Preservation	6.0	15	90	2.06	$217,536
Select...				0		$0
Select...				0		$0
Select...				0		$0

ADD ROW

Total Lane-Miles Treated	Total Lane-Mile-Years	Total Cost
54	285	$949,978

Preservation Approach

Total Network Impact

Preservation	Rehabilitation	Reconstruction
$402,266	$145,869	$401,843
50 Lane-Miles 209 Lane-Mile-Years	2 Lane-Miles 26 Lane-Mile-Years	2 Lane-Miles 50 Lane-Mile-Years

Congratulations

Park Avenue – August 1, 2014

Bridgeport, CT

2004: 2” Mill & Fill

Fairfield, CT

2004: 2” Mill & Fill

2010: Crack Seal & Microsurfacing

Thank you

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