RAS
Roadway Asset Services

PAVEMENT CONDITION EVALUATION RESULTS
DURHAM, NC

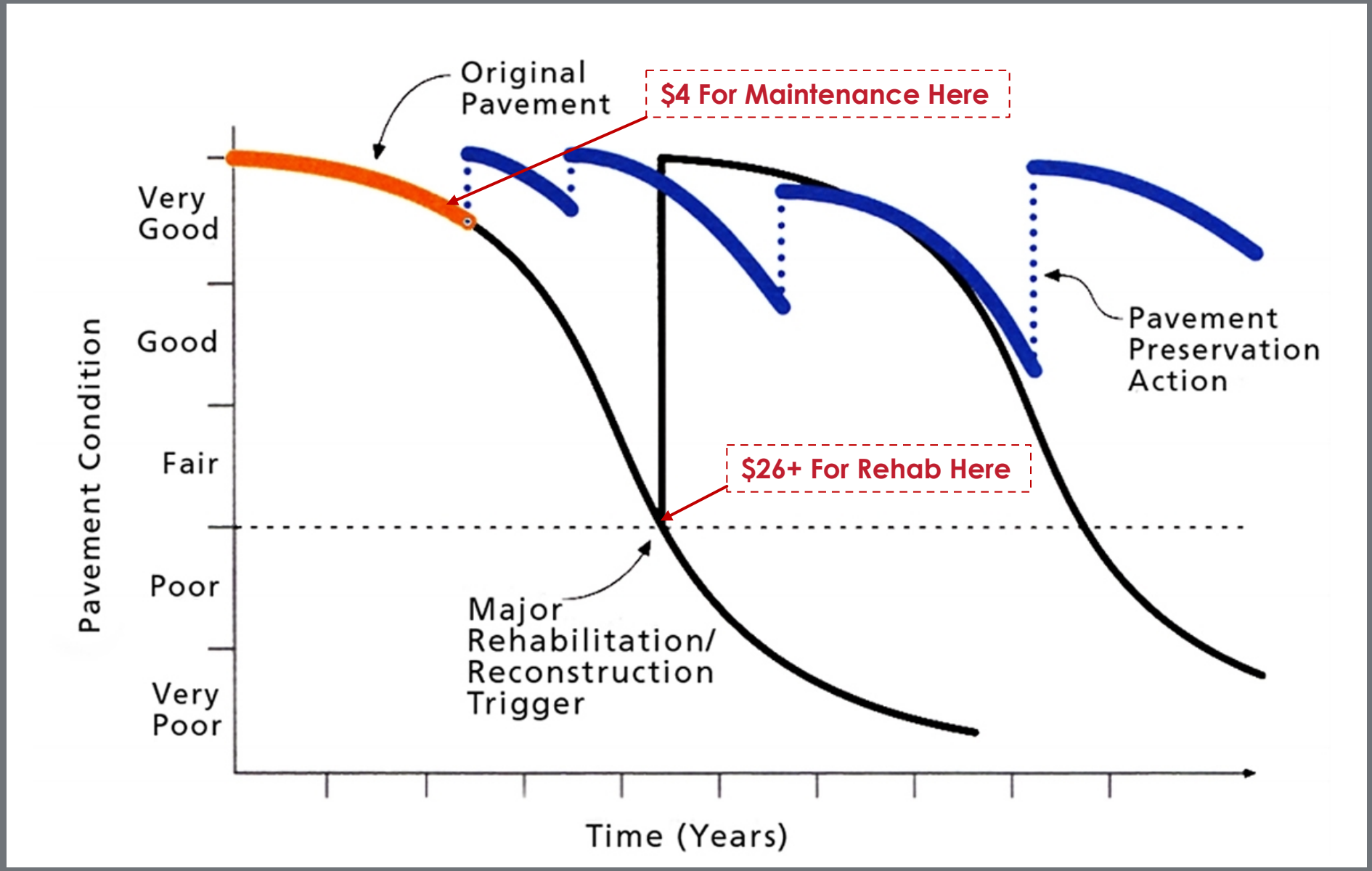
CITY OF DURHAM

- **Centerline Miles** – City maintains 770 linear miles of roadway
- **Paved Area** – Over 13.5M SQYDS of pavement or enough material to pave a two-lane road from Durham to Dallas
- **Network Replacement Value** – Over a $1 Billion Dollar Asset
- **Lane mile (LM)** – 5,280 ft long x 12 ft wide
- **Pavement condition index (pci)** – score 0 to 100
- **Preservation** – Light weight and cost-effective treatment to extend design life
- **ASTM D 6433** – National guideline for evaluation of pavements

Terminology

Pavement Condition Index (PCI)	Condition Description
86 – 100	GOOD
71 – 85	SATISFACTORY
56 – 70	FAIR
41 – 55	POOR
26-40	VERY POOR
11-25	SERIOUS
0 – 10	FAILED

Purpose of Pavement Management



Benefits of Active Maintenance

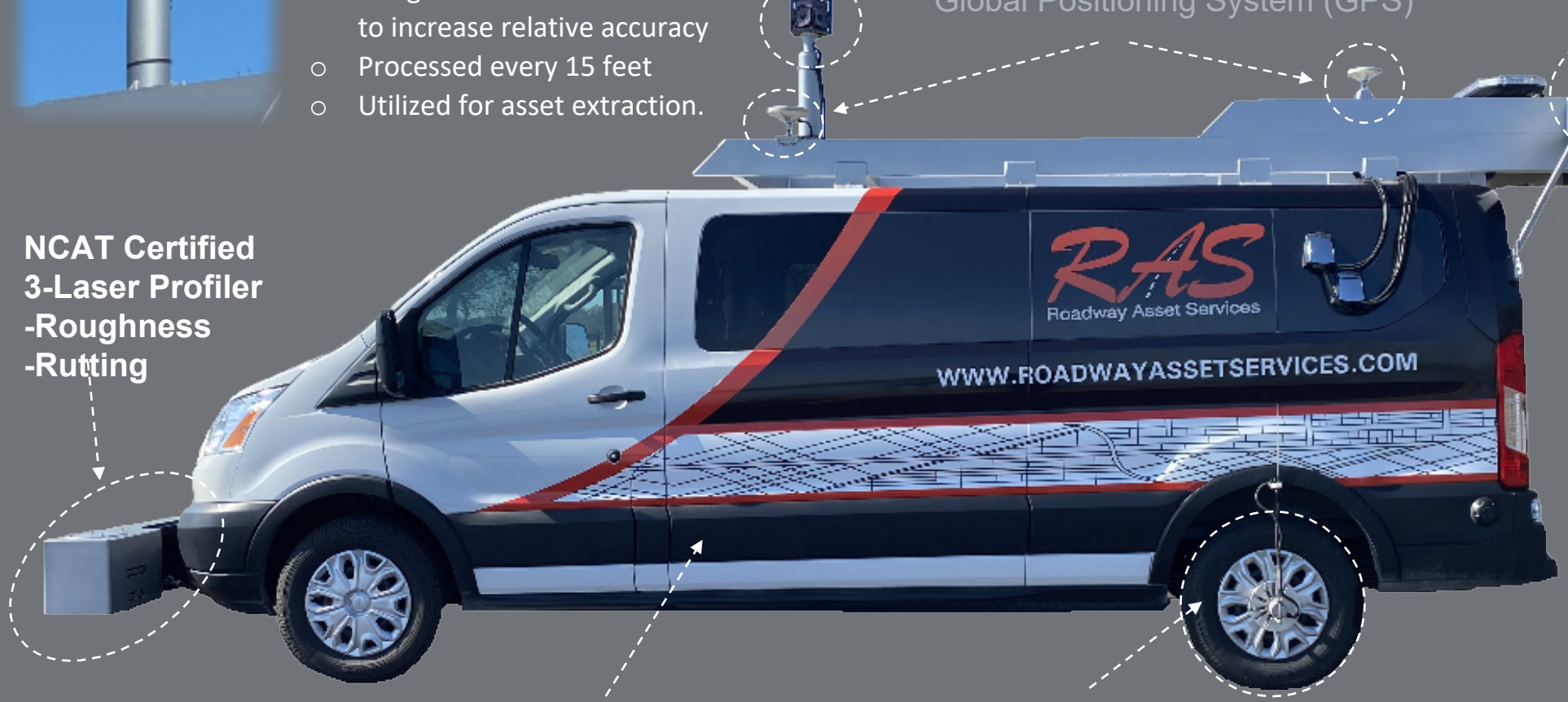
- Extend pavement design life at lowest possible cost
- Reduce the cost of roadway ownership
- Improve the level of service over the roadway's life
- Delay costly rehabilitation for as long as possible

Roadway Asset Collection Van

Ladybug 360º Right-of-Way Camera

- Panoramic 360 degree video
- proven Ladybug camera technology
- 32 mega pixel resolution.
- Integrated with onboard DMI to increase relative accuracy
- Processed every 15 feet
- Utilized for asset extraction.

Global Positioning System (GPS)



NCAT Certified 3-Laser Profiler
-Roughness
-Rutting

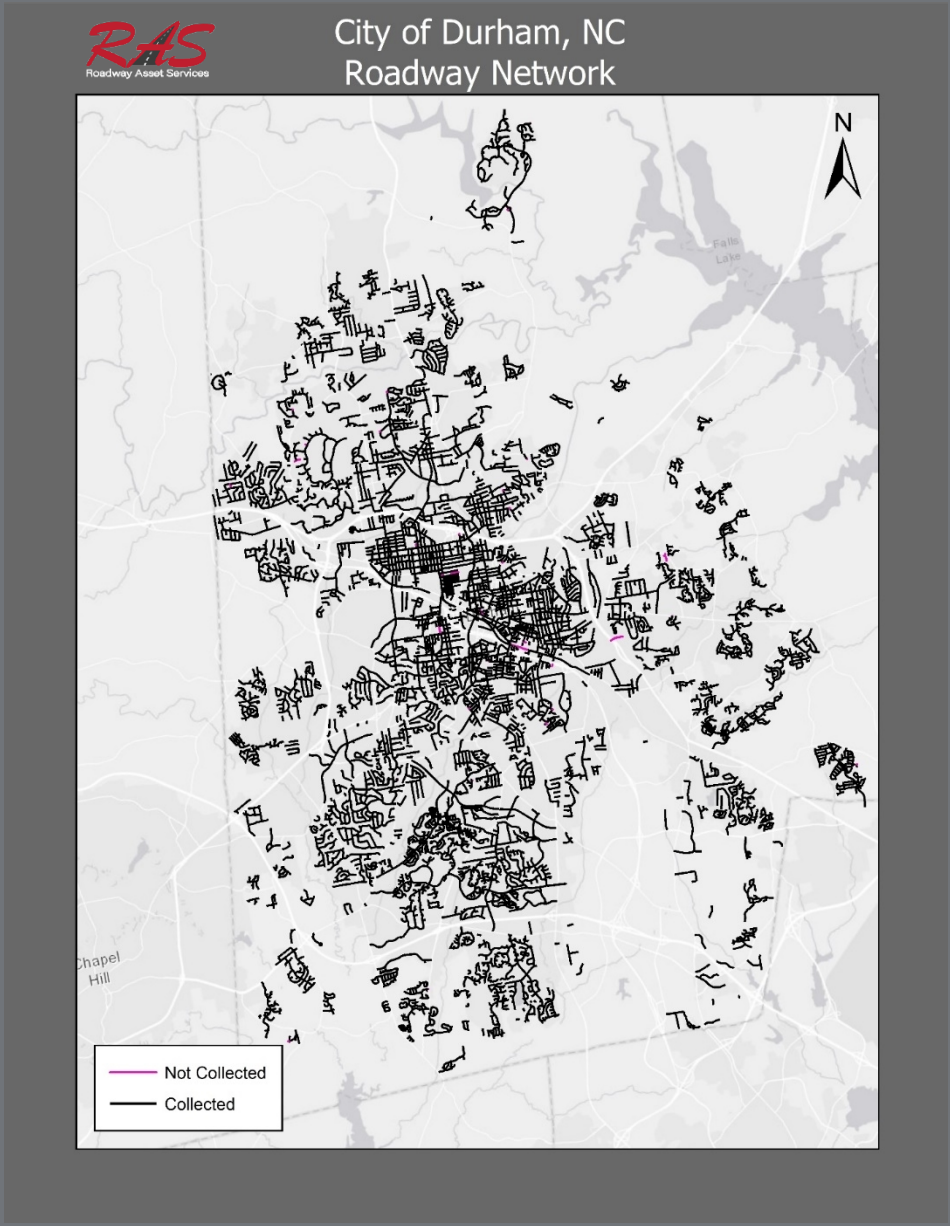
Laser Crack Measuring System (LCMS-2)

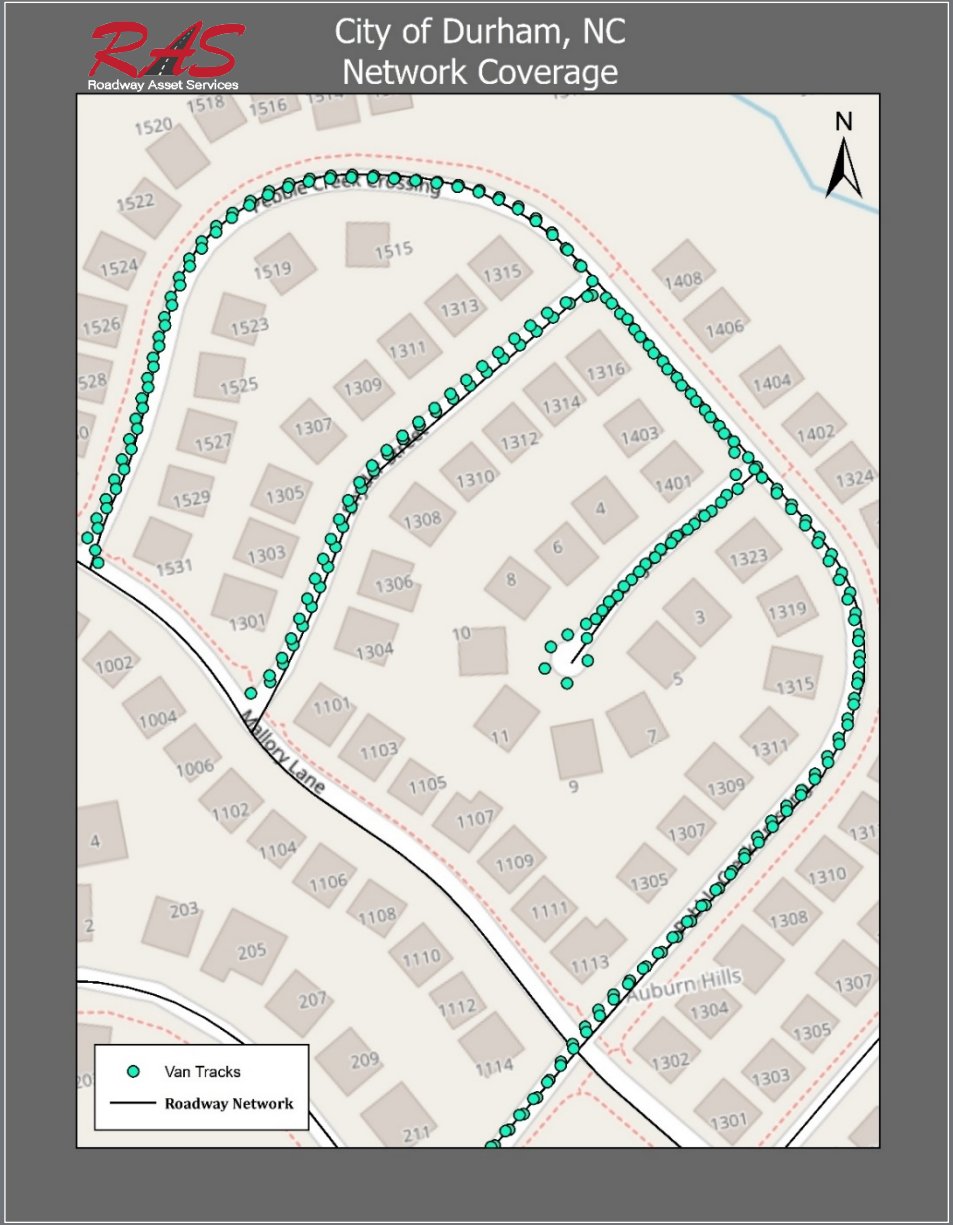
- two 1-millimeter resolution line scan cameras.
- 1mm resolution is equivalent to over 4,000 dedicated laser points.
- 32MP HD imagery
- 100% contiguous survey & processing
- Objective ASTM D6433 assessment

Internal Inertial Measuring Unit (IMU)

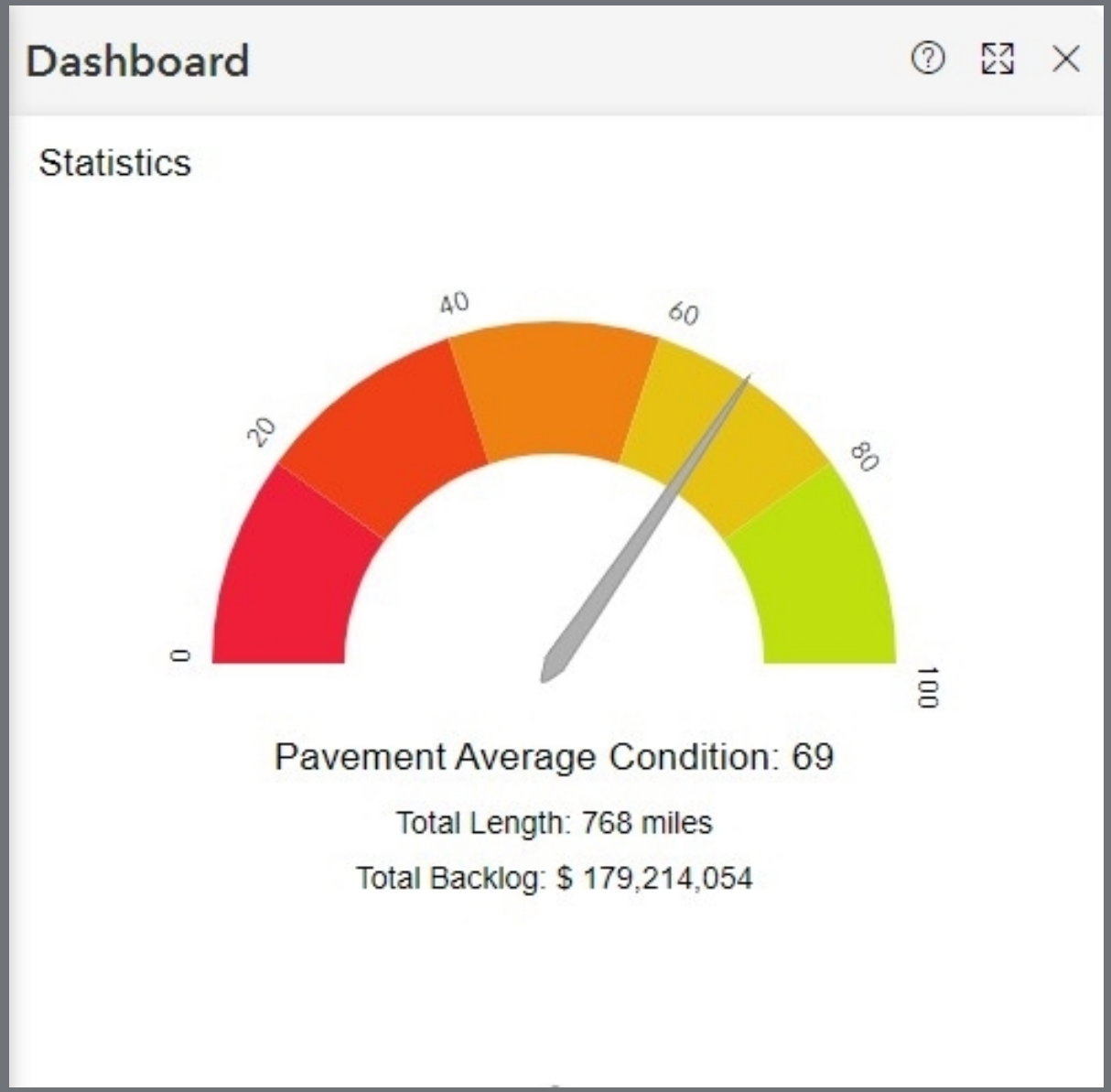
Distance Measuring Instrument (DMI)

Centerline File Verification

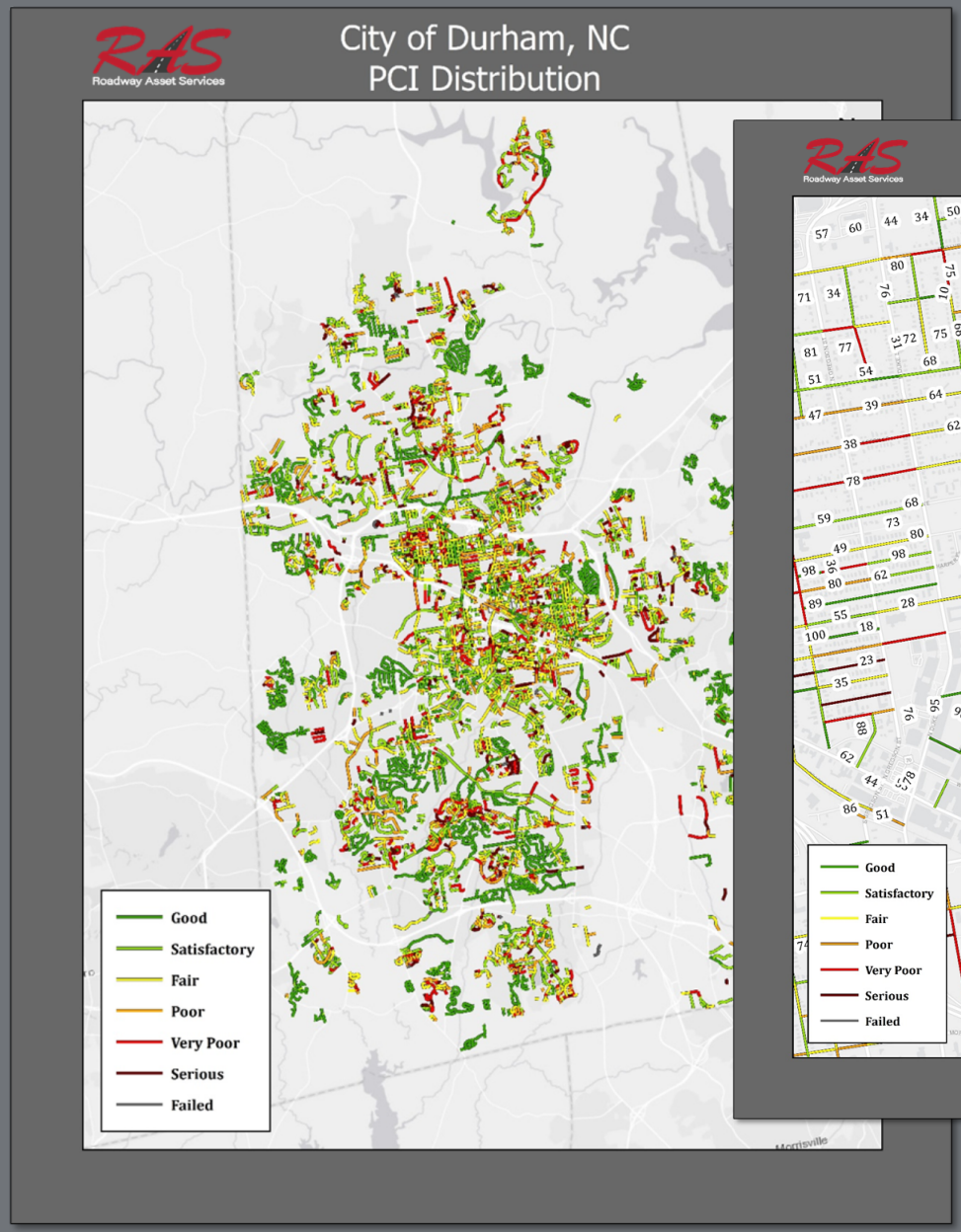




Network Average Condition Results

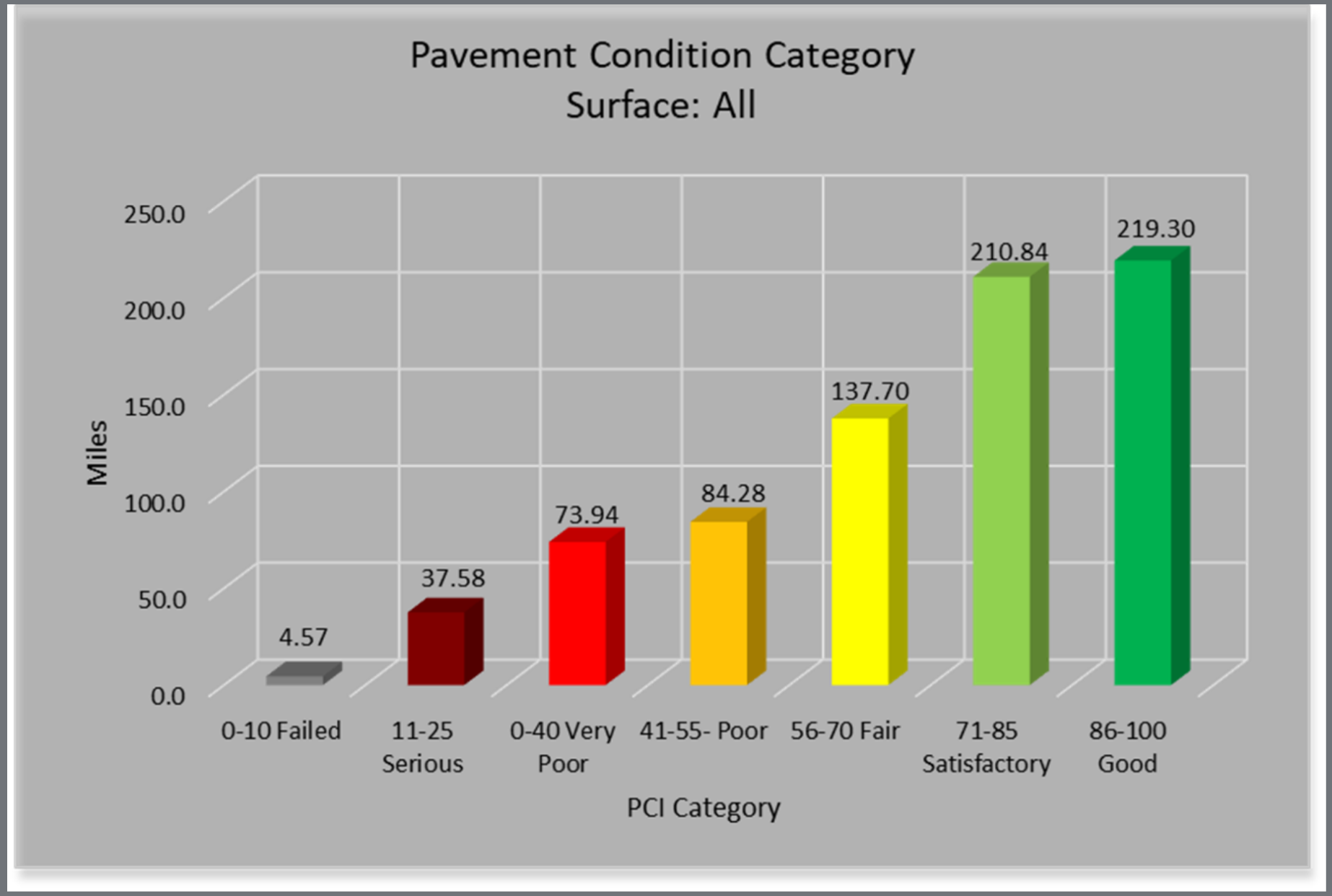


Pavement Condition Results



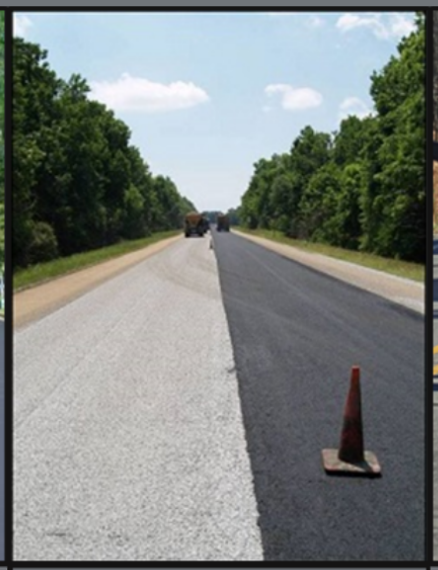
Pavement Condition Index (PCI) Range	Condition Description	2018 Percent of Network	2021 Percent of Network
86 - 100	Good	30.89%	28.5%
71 - 85	Satisfactory	25.11%	27.4%
56 - 70	Fair	15.37%	17.9%
41 - 55	Poor	25.60%	11.0%
26 - 40	Very Poor		9.6%
25 - 11	Serious	3.03%	4.9%
0 - 10	Failed		0.6%
Total of Rated Streets		100%	100%

Pavement Condition Results



Maintenance & Rehabilitation Treatment Options

Microsurfacing



Cape Seal

Crack Seal

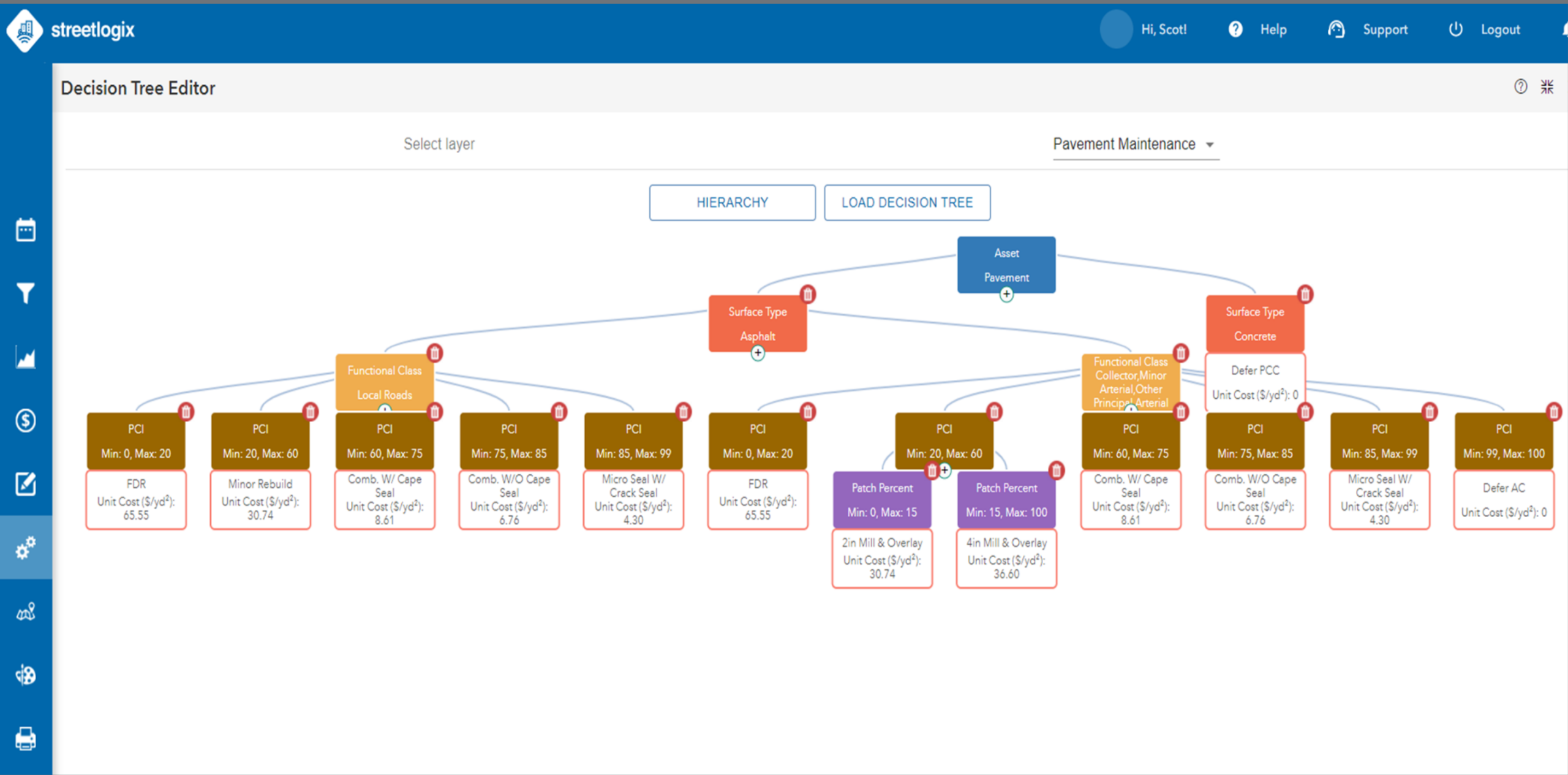
Rejuvenation

Mill & Overlay

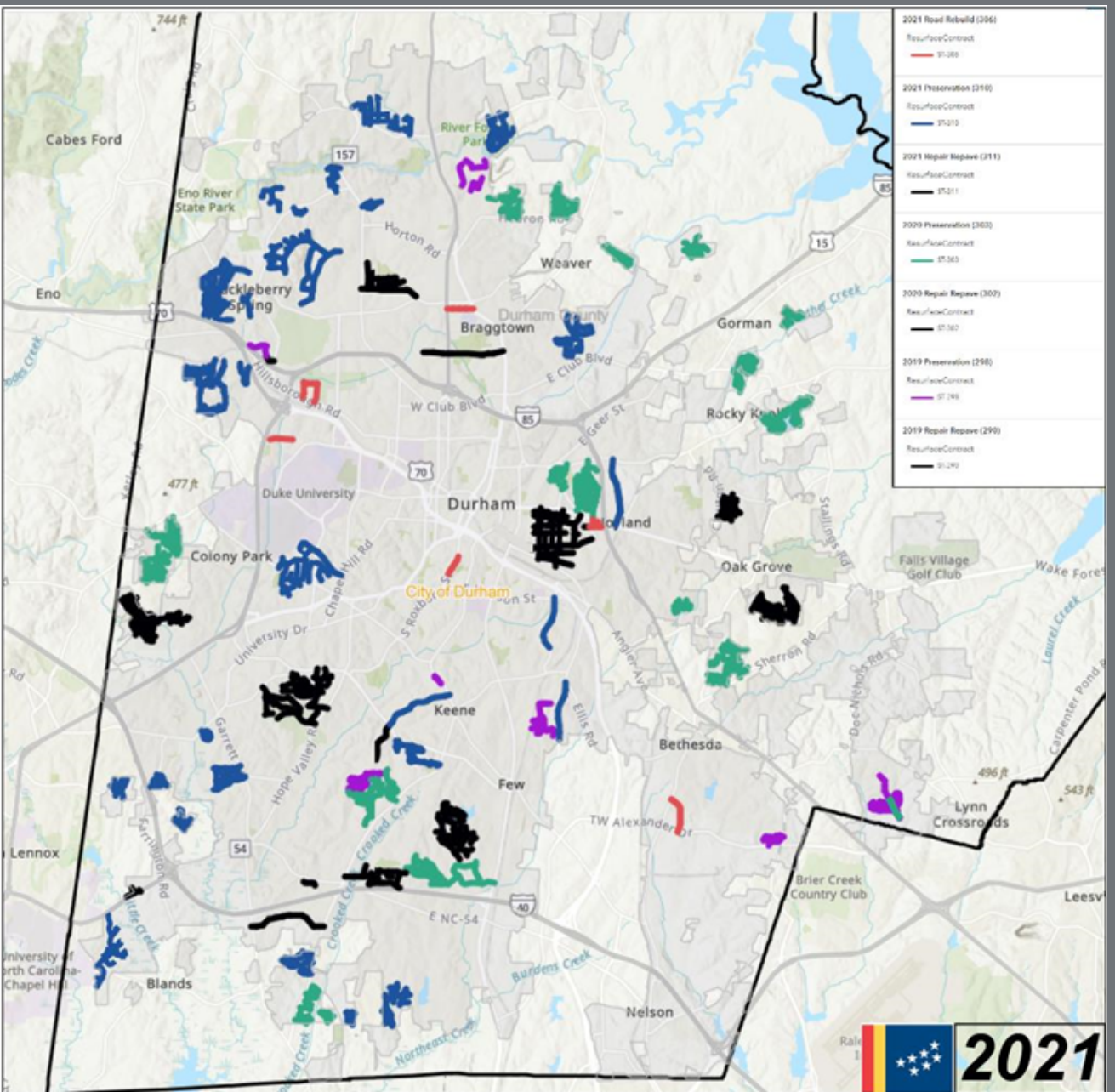
Full Recon

Maintenance Category	Work Description	Work Units	Unit Cost	PCI Impact	PCI Range
Preserve	Rejuvenation	SqYd	$1.53	+5	95-99
Preserve / Prevent	Micro W/ Crack Seal	SqYd	$5.33	+12	86-94
Preserve / Correct	Combination W/O Cape seal	SqYd	$8.38	+15	75-85
Preserve / Restore	Combination W/ Cape seal	SqYd	$10.68	+18	61-74
Rehabilitation	Minor Rebuild (Local)	SqYd	$38.12	99 Fixed	20-60
Rehabilitation	Minor Rebuild (Arterial/Collector)	SqYd	$45.38	99 Fixed	20-60
Reconstruct	Full Depth Rebuild	SqYd	$81.28	100 Fixed	0-20

Maintenance Decision Tree



City Paving Program



	TOTAL COST	SY	LN.MI	$ / LN.MII	$ / SY
2021 REPAIR REPAVE	$4,681,192.70	235,981	33.52	$139,653.60	*$19.84*
2021 PRESERVATION	$4,831,319.18	854,139	121.33	$39,820.79	*$5.66*
MICRO	*$1,627,372.95*	*614,103*	*87.23*	*$18,656.00*	*$2.65*
CAPE SEAL	*$1,162,177.70*	*240,036*	*34.10*	*$34,085.43*	*$4.84*
2021 REJUVENATOR	$540,218.58	539,396	76.62	$7,050.74	*$1.00*

- Repaving Contract
- 2019 Preservation Contract
- 2020 Preservation Contract
- 2021 Preservation Contract
- 2021 Road Rebuild Contract

Don’t Forget About ADA Compliance

Ignoring ADA is not an Option

As of 2016, Cape Seals & Microsurfacing were considered an alteration that triggers ADA compliance requirements

Not cheap, each pedestrian curb ramp could cost $2,500 - $4,500

Conducting an inventory or at the very least burdening your unit rates to accommodate for alterations is key!

Why This Road And Not That One???

Let's define selection criteria commonly used:

Prioritization = Order of Priority
Arrange from highest to lowest

Optimization = Maximum Benefit
Arrange from maximum to minimum

Financial Optimization = Maximum Financial Benefit
Arrange from maximum to minimum

Prioritization = Order of Priority

Arrange from highest to lowest

PCI / Condition – Typical uses in prioritization are "Worst First" or "Best First"

Traffic/Classification – Higher volume roadways have higher priority

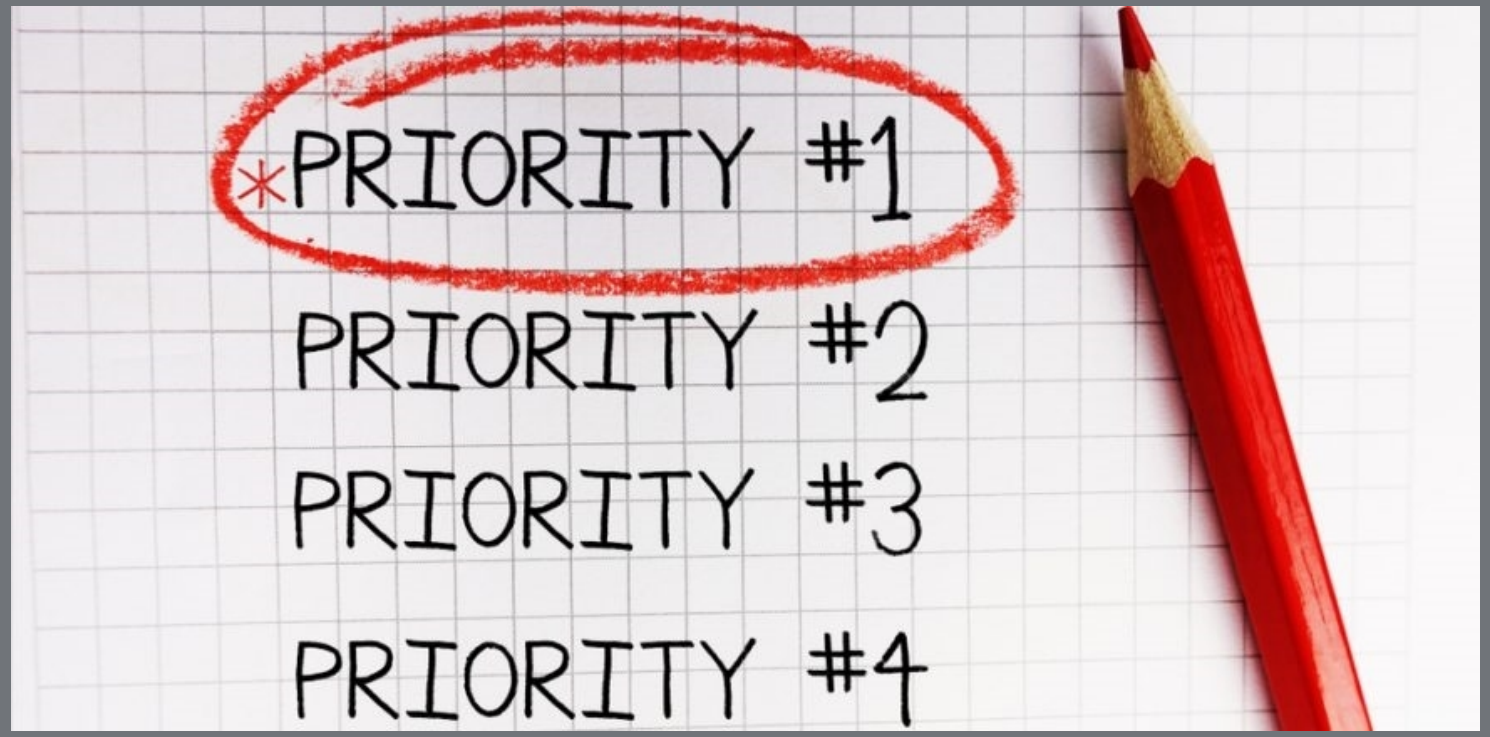
Pavement Type – Asphalt typically a higher priority as it deteriorates more rapidly

High Commerce / Geographics – High commerce, tourist areas, bike routes, school districts, or special districts

Equity Lens – Use of local demographics such as annual household income

Optimization = Maximum Benefit

Arrange from maximum to minimum



Financial Efficacy (PCI condition)– 70%

Uses cost of deferral to identify financially critical roads to ensure sound financial management and selection

Traffic/Classification – 15%

Higher volume roads have higher priority as they deteriorate at a more rapid rate, serve commerce, and more residents

Equity Lens – 15%

Lower household income areas have a higher priority and is used to ensure equity when there is a financial benefit tie

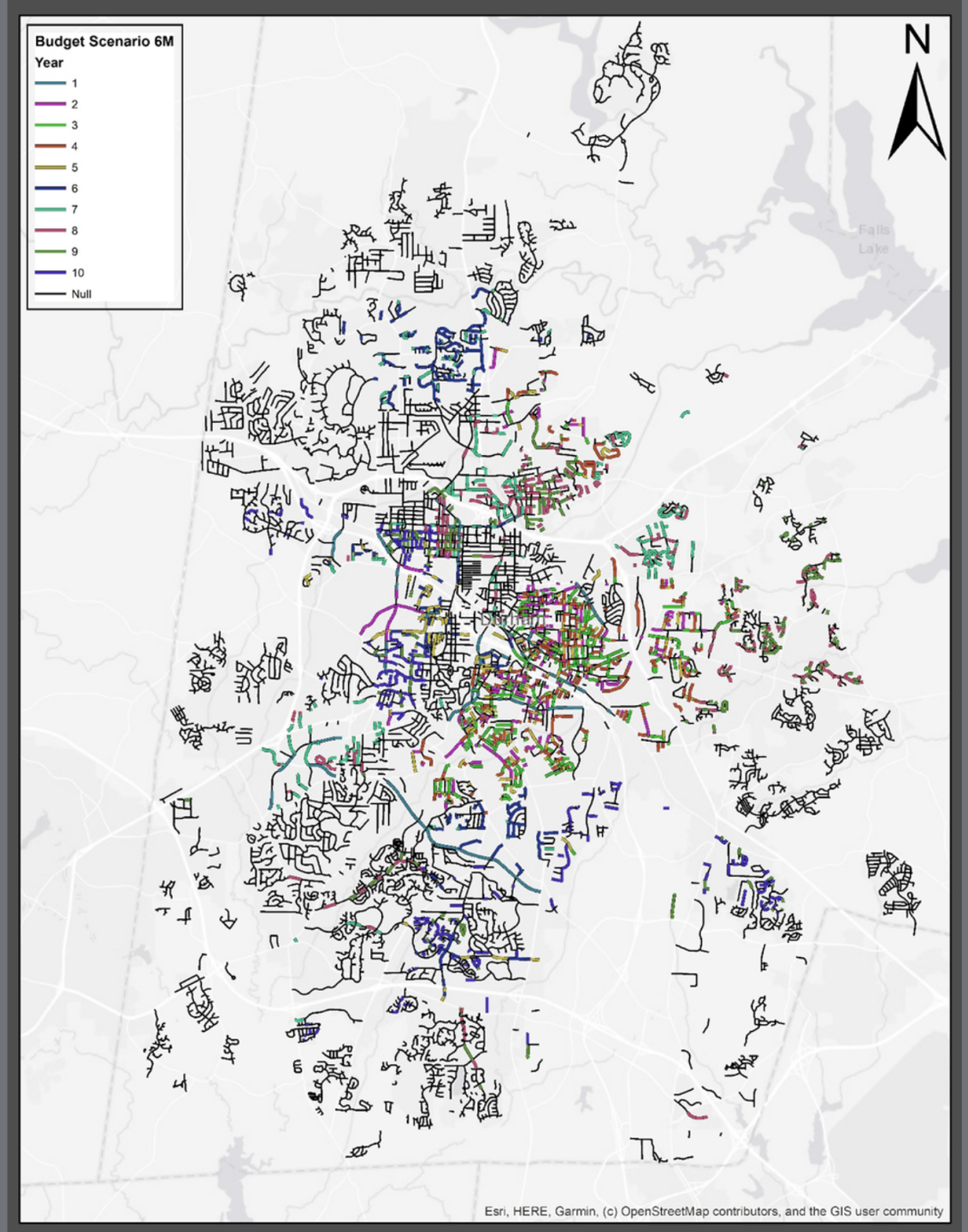
Cost Of Deferral Explained

Cost of Deferral = $27.44 SQYD

Critical roadways in this category (2-4 points from dropping into next rehab activity), represent the 2nd highest priority from a financial perspective. This particular road was in the low 60's and critical.

Non-critical roadways have more life in their current rehab zone. While currently non-critical, once this road does become critical it will have the highest priority from a financial perspective.

Budget Scenario Activity Coverage



$20M Budget Model

$15M Budget Model

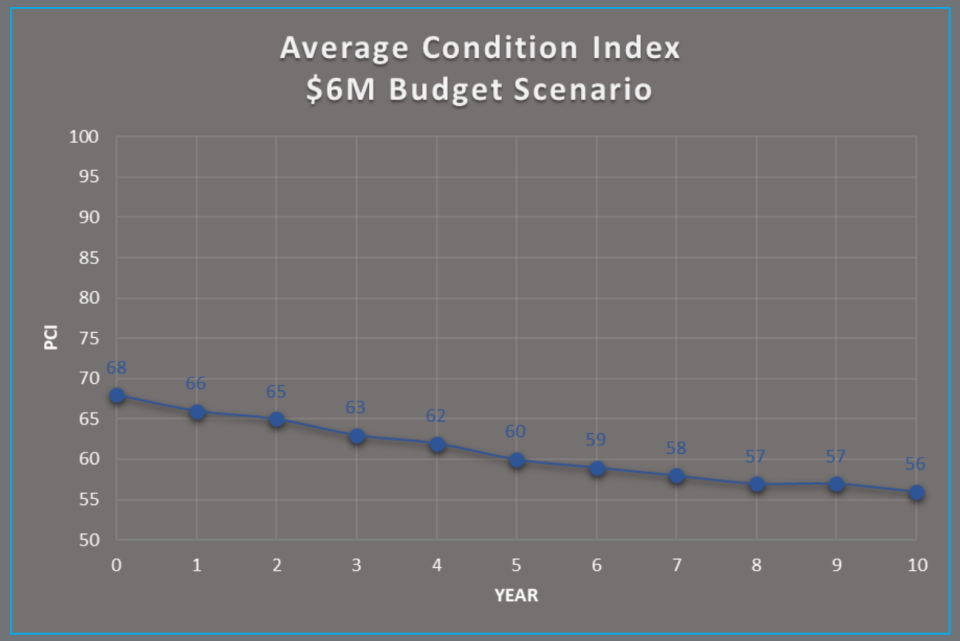
$10M Budget Model

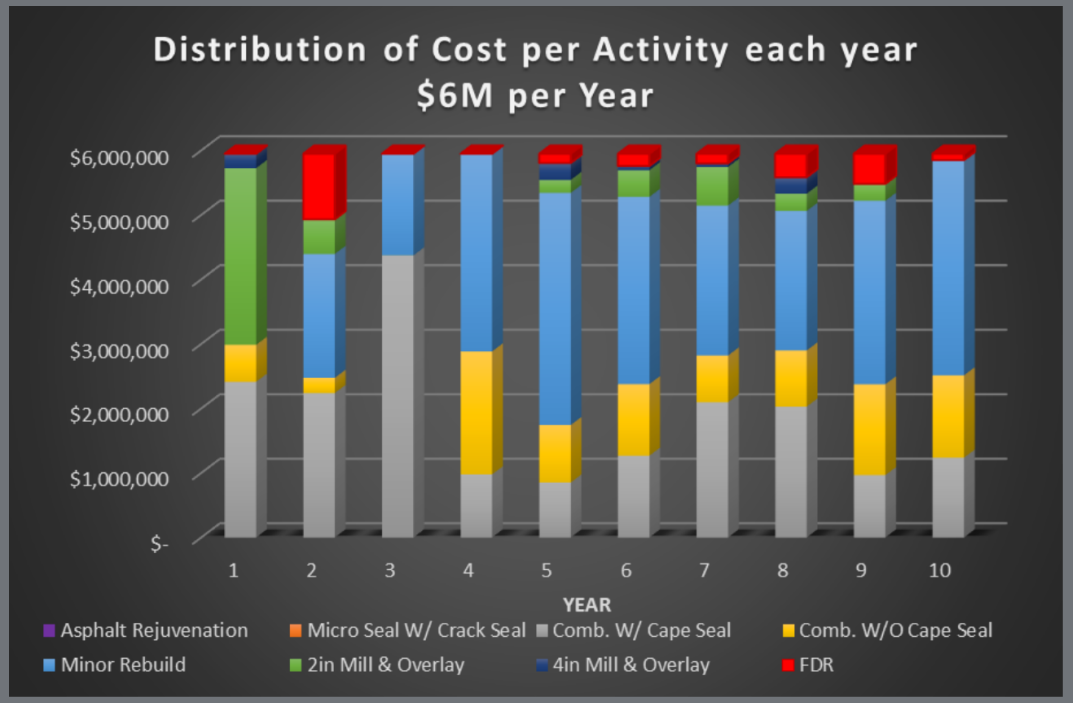
$6M Budget Model

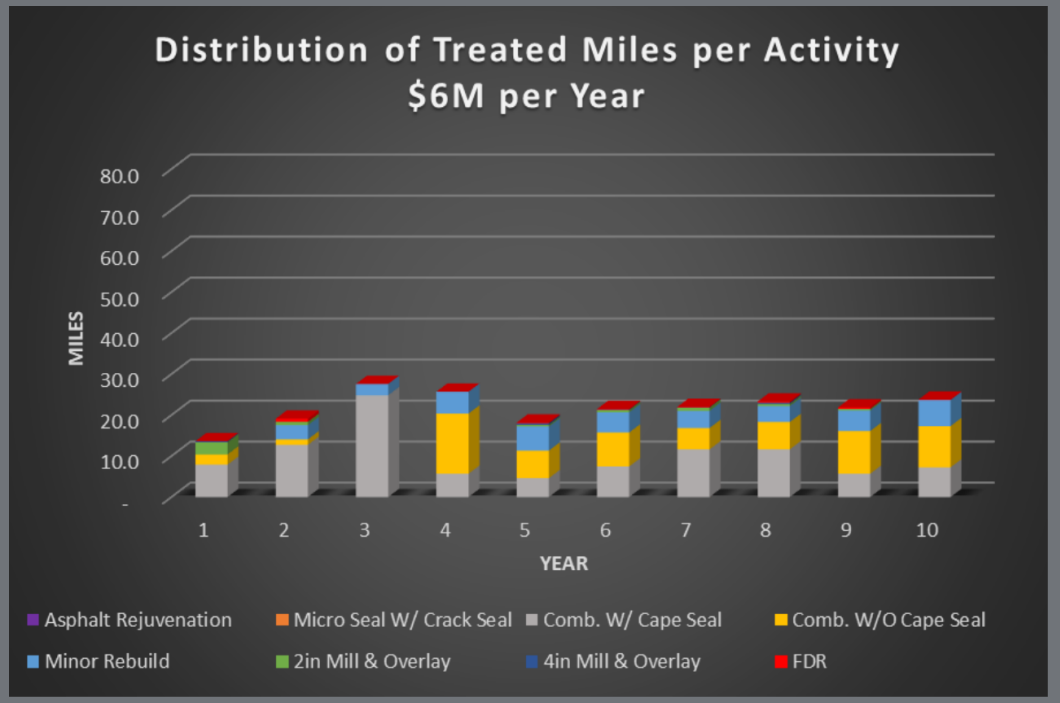
$8.5M Budget Scenario

($6M – Paving; $2.5M Consulting)

Year	Length (mi)	Cost	Average Condition Index	Condition Index Change
1	13.6	$5,949,809	66	-2
2	19.1	$5,949,782	65	-1
3	27.6	$5,949,915	63	-2
4	25.7	$5,949,985	62	-1
5	18.2	$5,949,719	60	-1
6	21.5	$5,949,873	59	-1
7	22.0	$5,949,883	58	-1
8	23.3	$5,949,816	57	-1
9	21.9	$5,949,969	57	-
10	23.8	$5,949,702	56	-1





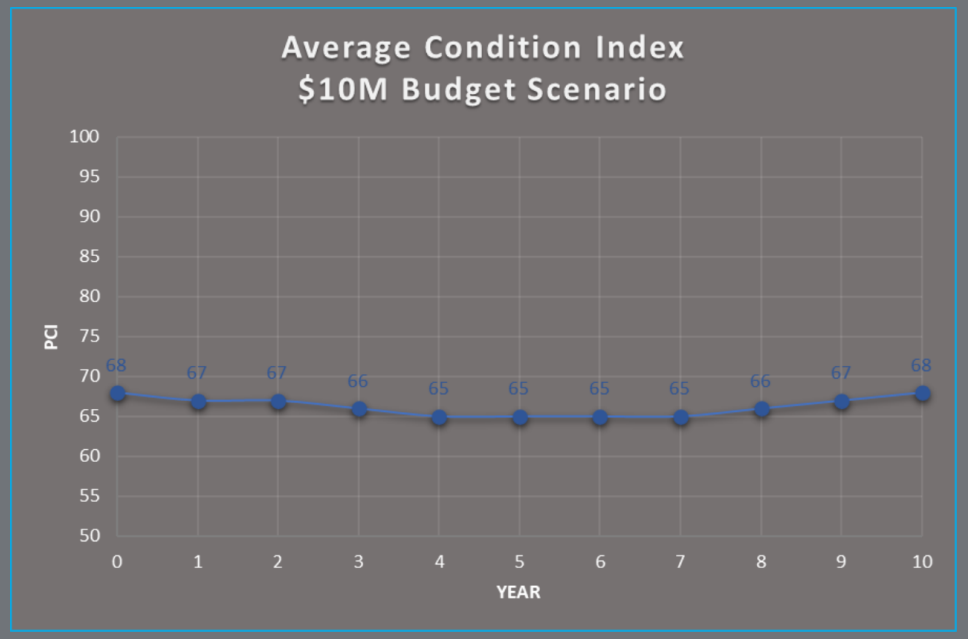


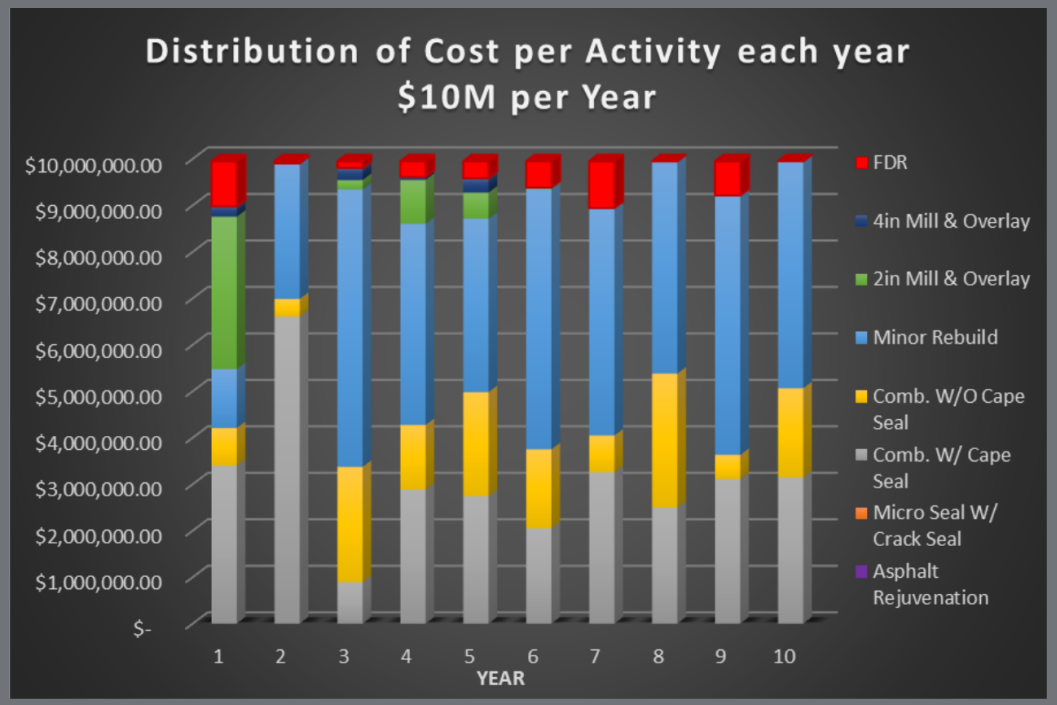
*Does not include inspection, testing, & programming

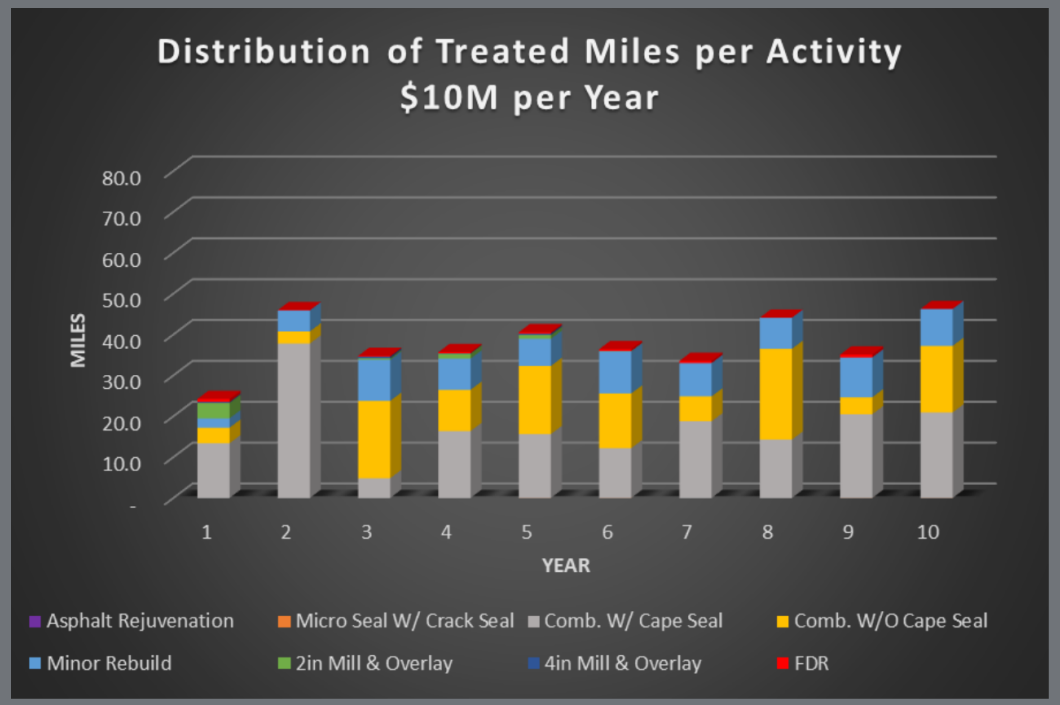
$12.5M Budget Scenario

($10M – Paving; $2.5M Consulting)

Year	Length (mi)	Cost	Average Condition Index	Condition Index Change
1	24.2	$9,949,664.00	67	-1
2	46.0	$9,949,922.00	67	-0.5
3	34.8	$9,949,939.00	66	-1
4	35.7	$9,949,892.00	65	-1
5	40.6	$9,949,922.00	65	-
6	36.4	$9,949,991.00	65	-
7	33.6	$9,949,962.00	65	-
8	44.1	$9,949,951.00	66	+1
9	35.1	$9,949,952.00	67	+1
10	46.3	$9,949,994.00	68	+1







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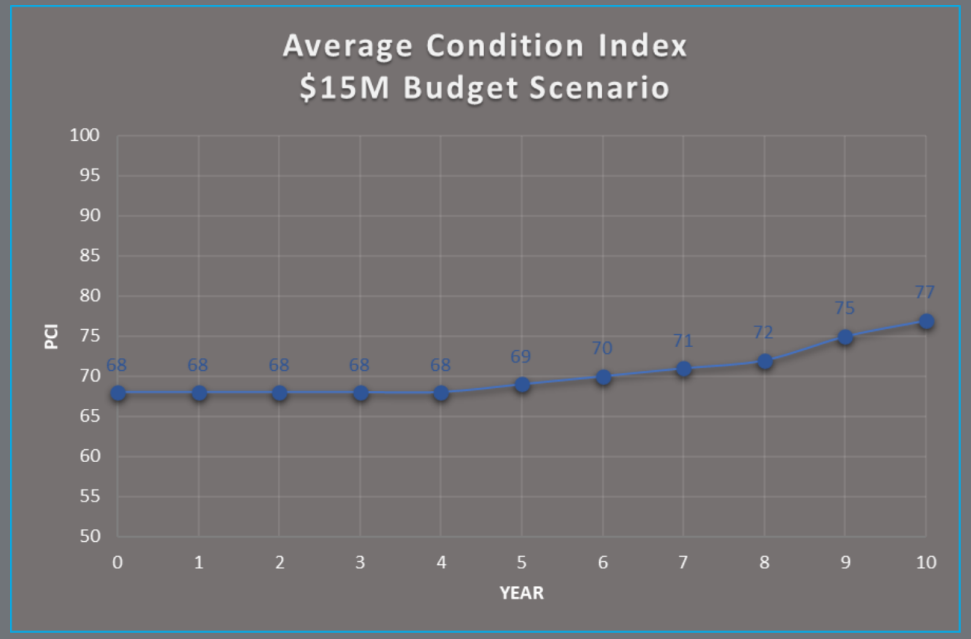
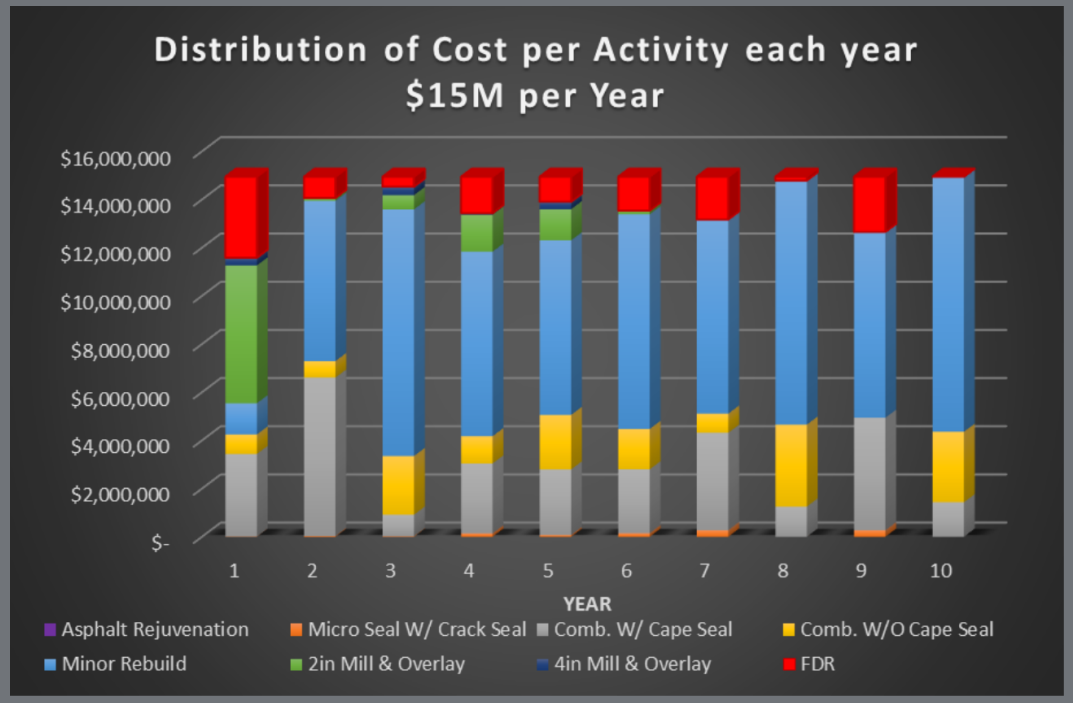
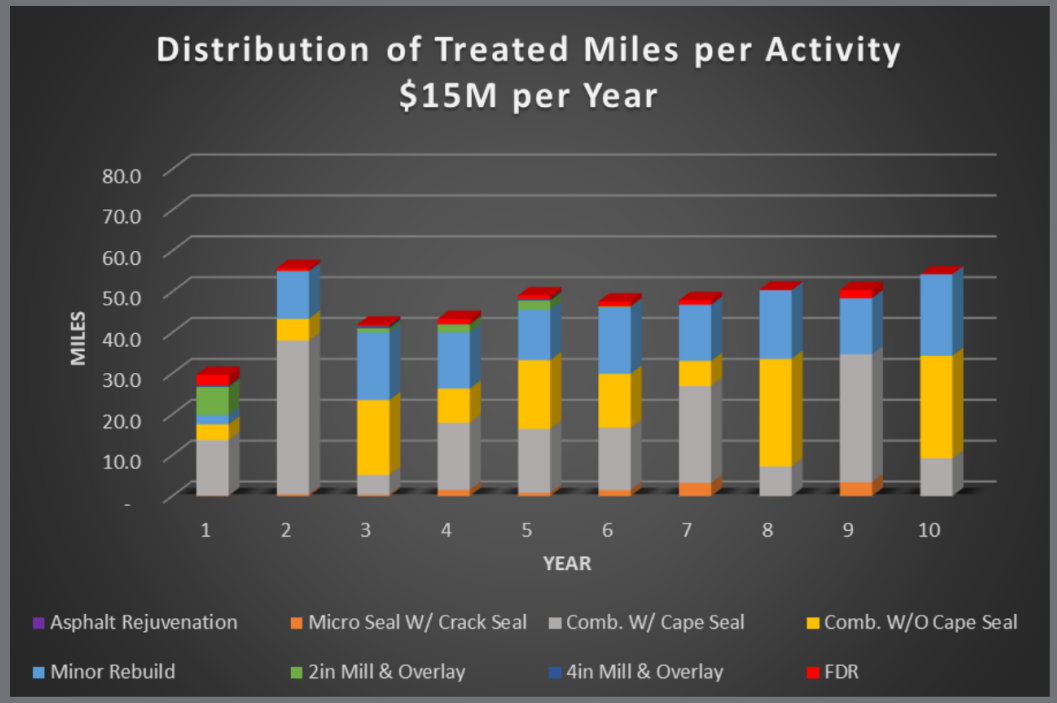
$19M Budget Scenario

($15M – Paving; $4M Consulting)

Year	Length (mi)	Cost	Average Condition Index	Condition Index Change
1	29.6	$14,949,749.00	68	0
2	55.8	$14,949,938.00	68	0
3	42.0	$14,949,702.00	68	0
4	43.3	$14,949,691.00	68	0
5	49.1	$14,949,798.00	69	+1
6	47.6	$14,949,818.00	70	+1
7	47.9	$14,949,899.00	71	+1
8	50.5	$14,949,974.00	72	+1
9	50.4	$14,949,844.00	75	+3
10	54.3	$14,949,665.00	77	+2







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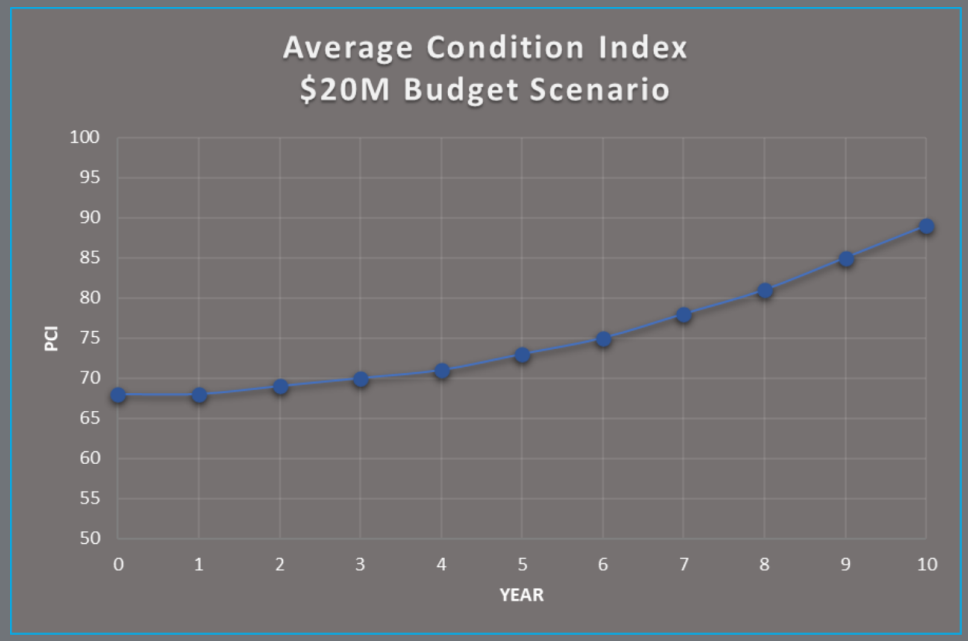
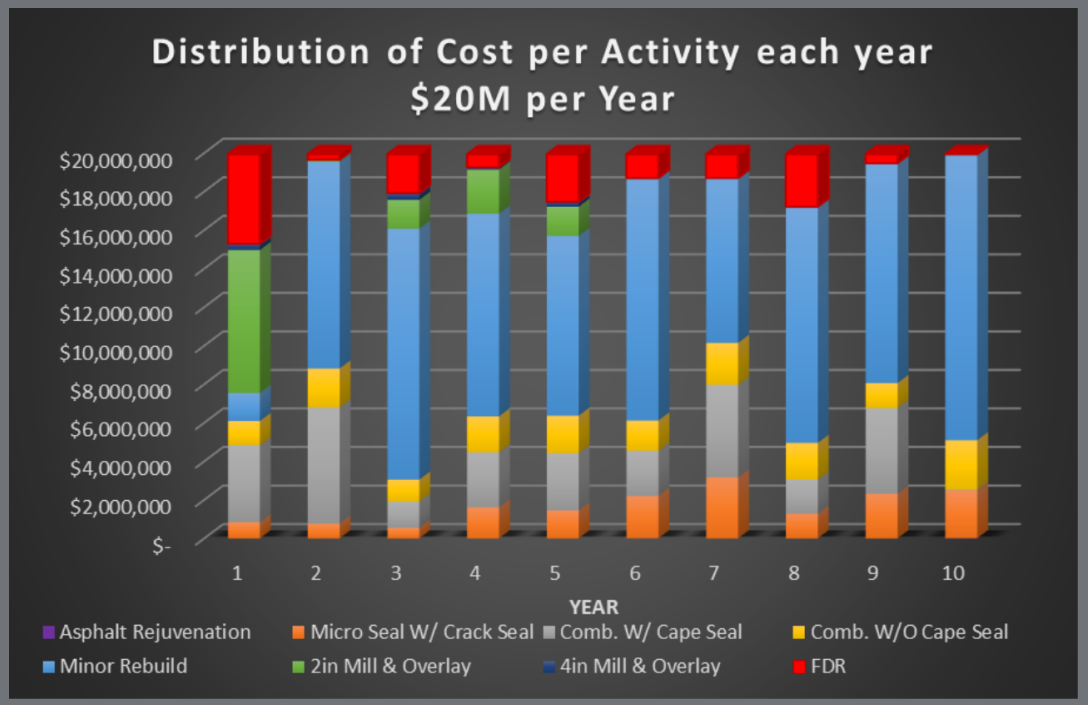
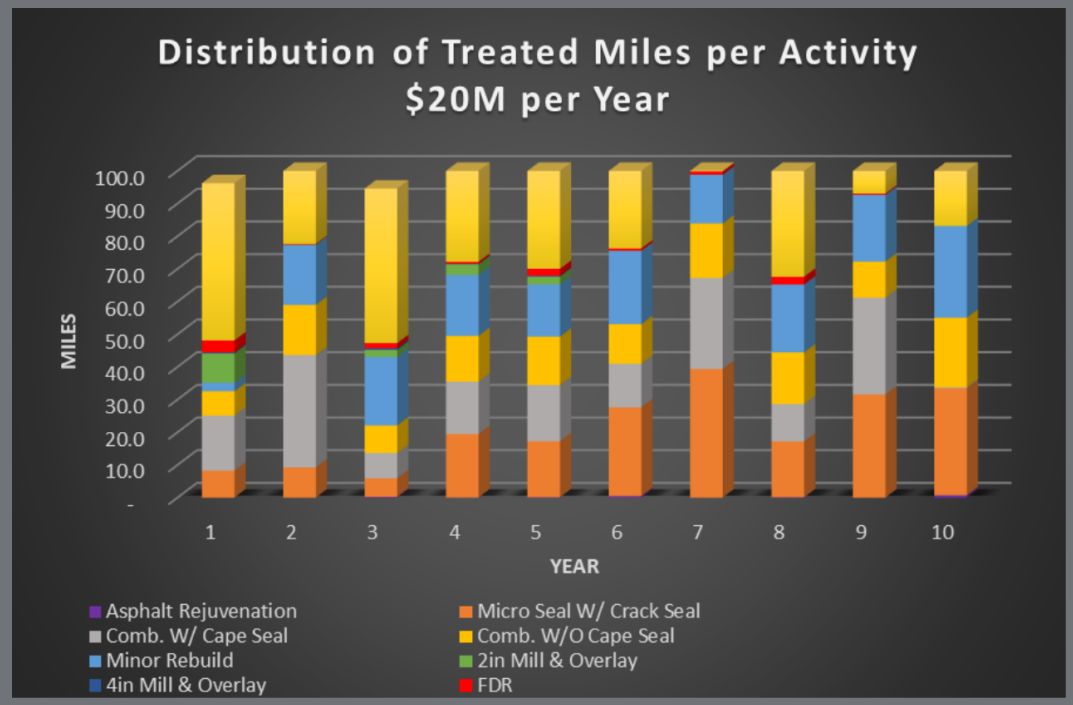
$25M Budget Scenario

($20M – Paving; $5M Consulting)

Year	Length (mi)	Cost	Average Condition Index	Condition Index Change
1	48.1	$19,949,990.00	68	-
2	77.6	$19,949,806.00	69	+1
3	47.3	$19,949,823.00	70	+1
4	72.2	$19,949,639.00	71	+1
5	70.0	$19,949,963.00	73	+2
6	76.3	$19,949,814.00	75	+2
7	99.8	$19,949,922.00	78	+3
8	67.6	$19,949,895.00	81	+3
9	93.1	$19,949,895.00	85	+4
10	83.1	$19,944,384.00	89	+4







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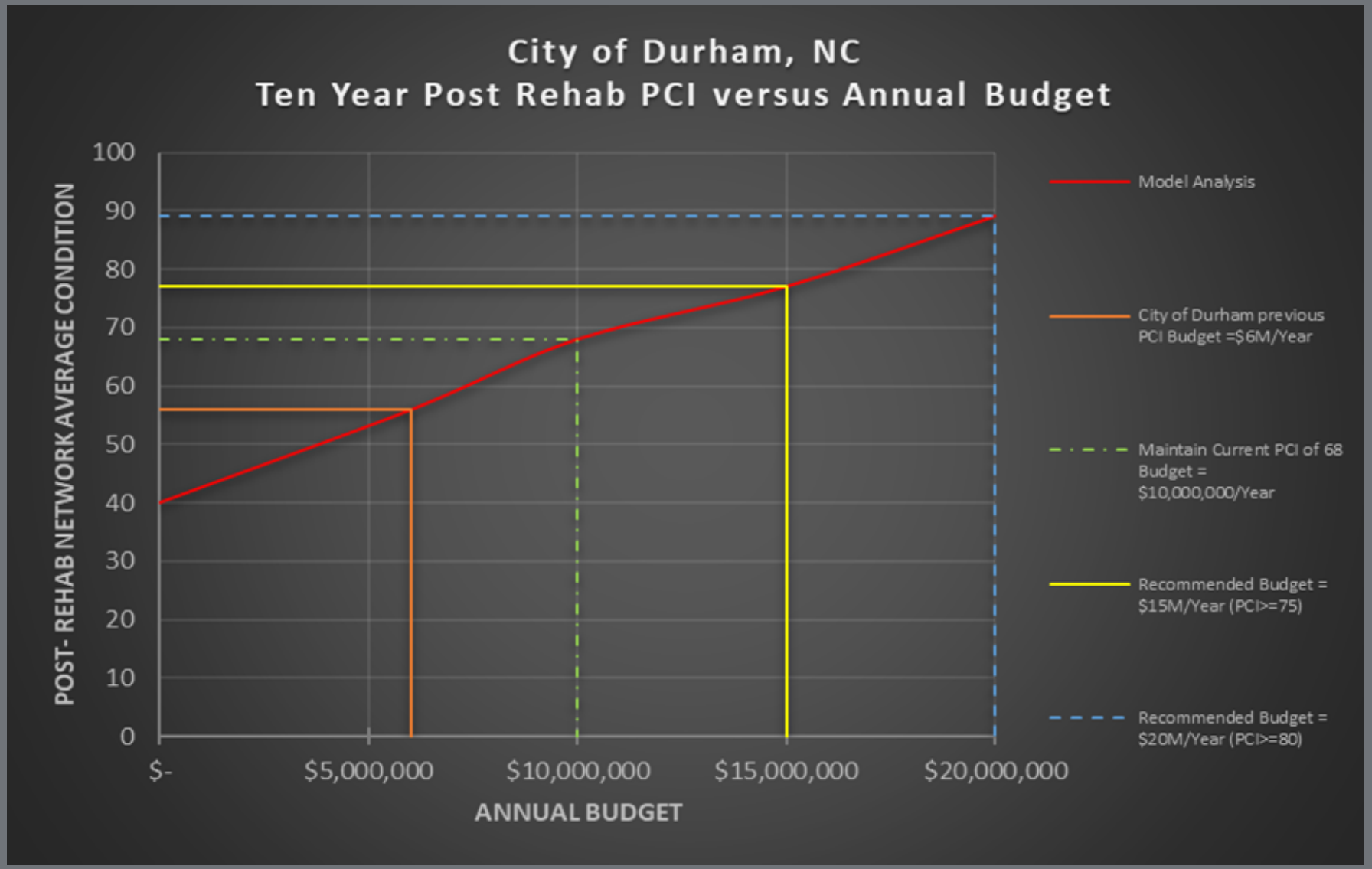
Budget Requirements & Needs

Residents Rated Streets Within the Top Three Highest Priority Items for the Last 10 Years

Budget Requirements & Needs…



Network Growth

$13K/mile on average to maintain new roads annually.

- Assuming 1.6% Annual Growth
- **Additional $172K needed each year on average**, equating to over $1.7M in the 10 year analysis horizon just for growth

Costs Do Not Include PROWAG

Questions