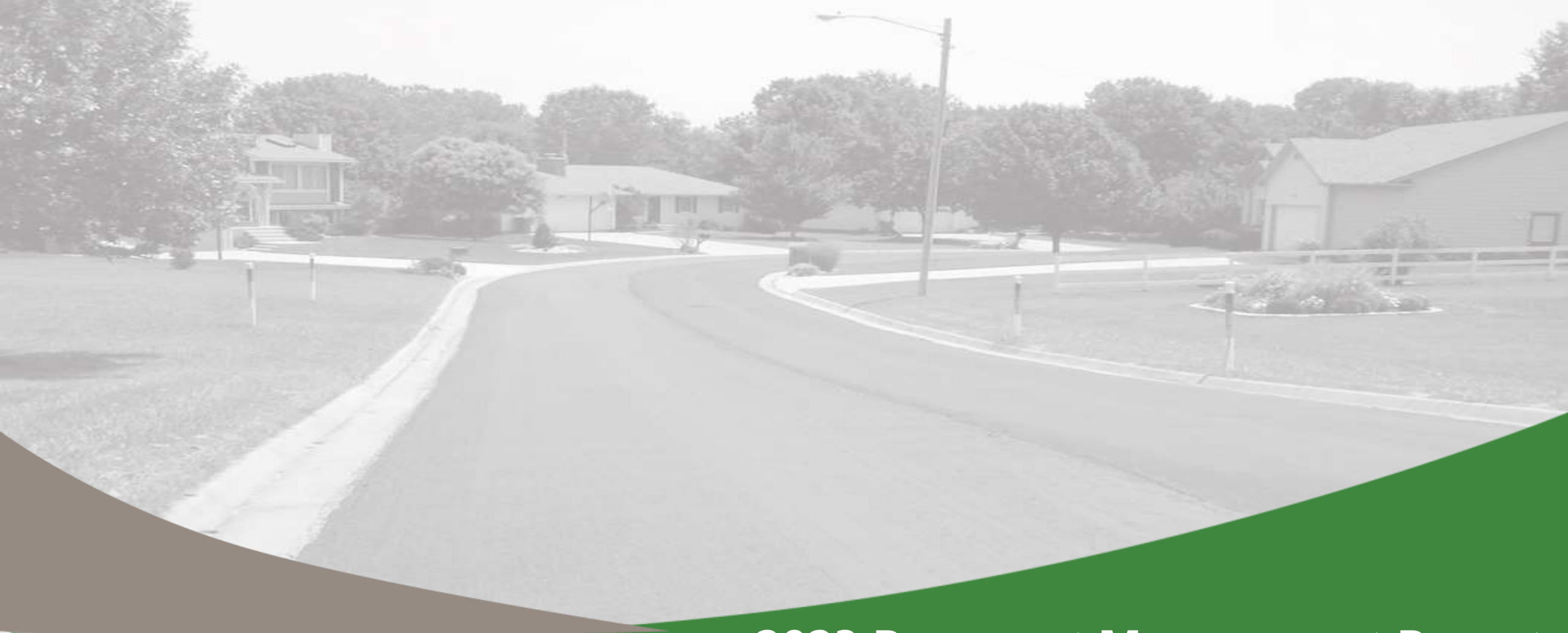

2023 Pavement Management Report

Town Council Meeting

April 9, 2024

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AGENDA

- Pavement Condition Data Collection
- 2023 Network Condition
- Pavement Treatment Toolbox
- Pavement Preservation
- Pavement System Analysis Results
- Conclusions/Recommendations

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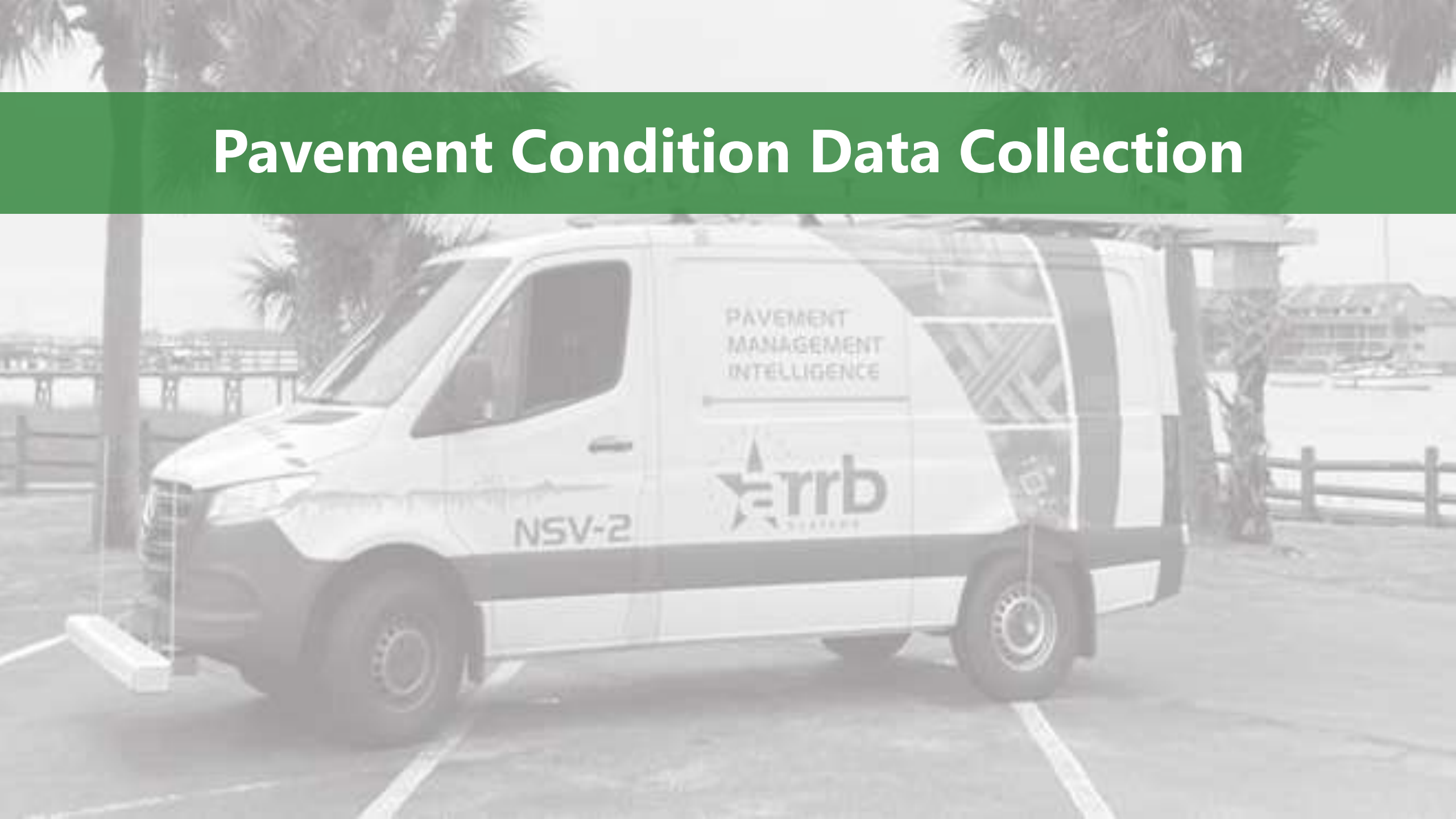
Pavement Condition Data Collection



2023 Pavement Management Project

- The Town of Apex maintains a pavement network consisting of approximately 240 centerline miles of asphalt streets.

- Mott MacDonald completed a pavement management study which included a Pavement Condition Survey (PCS) of all Town-maintained streets and a pavement management system (PMS) analysis.

- Pavement Data was collected in the Summer of 2023.

- Mott MacDonald completed a full pavement management analysis to provide the Town with optimized 10-year work plans.

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Pavement Condition Data Collection

1

Studies the performance of in-service pavements.

2

The primary goal is to collect data believed to be most important in characterizing factors that affect pavement performance.

3

Pavement Condition Data is used to model pavement performance and make treatment recommendations to maximize network condition over the long term.

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Visual (Windshield) Pavement Data Collection

Used by Town on the previous two data collection cycles.
(ITRE, LTPP)

Manual data collection tends to have inconsistencies between different raters.

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Automated Data Collection Vans – ARRB System

Laser Crack Measurement Systems (LCMS) and High-definition cameras

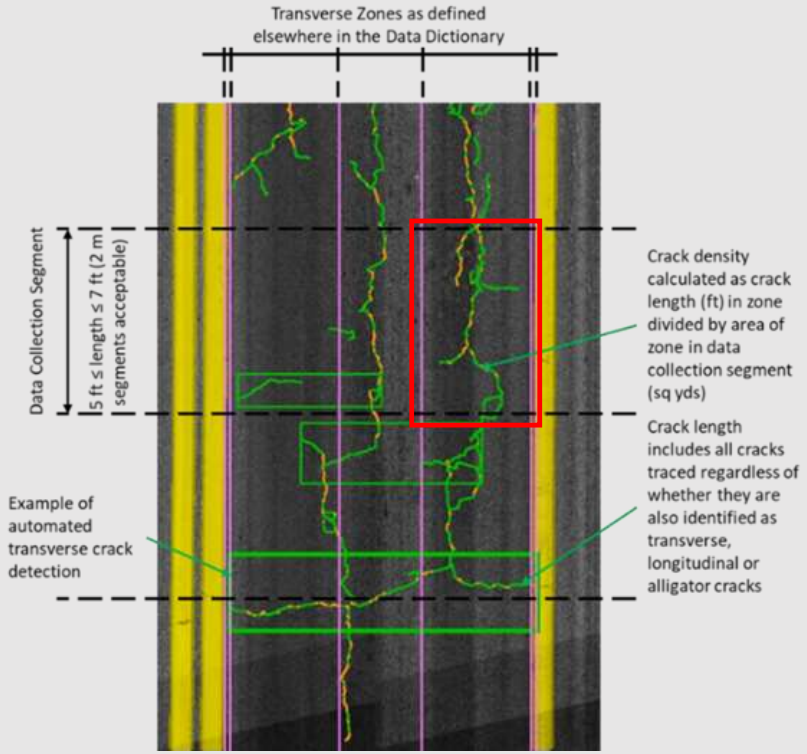
Crack density approach

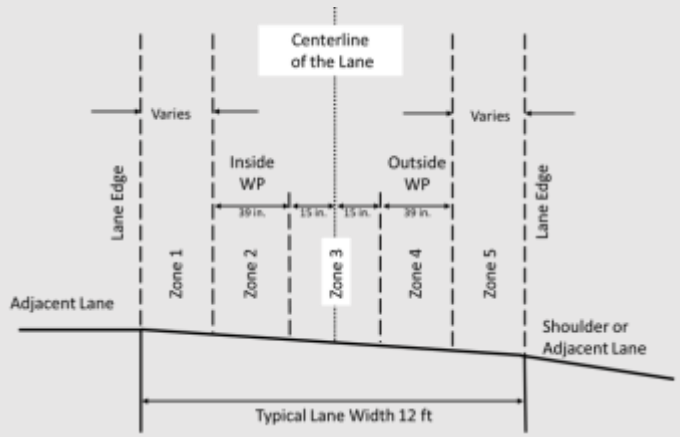
- Crack Density= Total length of cracks/unit area (ft/sy)

- Magnitude can indicate:
  - Patterned cracking
  - Non-patterned cracking

- Crack Density Zones:
  - Load-related cracking
  - Non-load related cracking

- Informs decision-making:
  - Patterned cracking→ patching/rehab
  - Non-patterned cracking → crack sealing





Definition of Transverse Zones. Source: AASHTO R85-18

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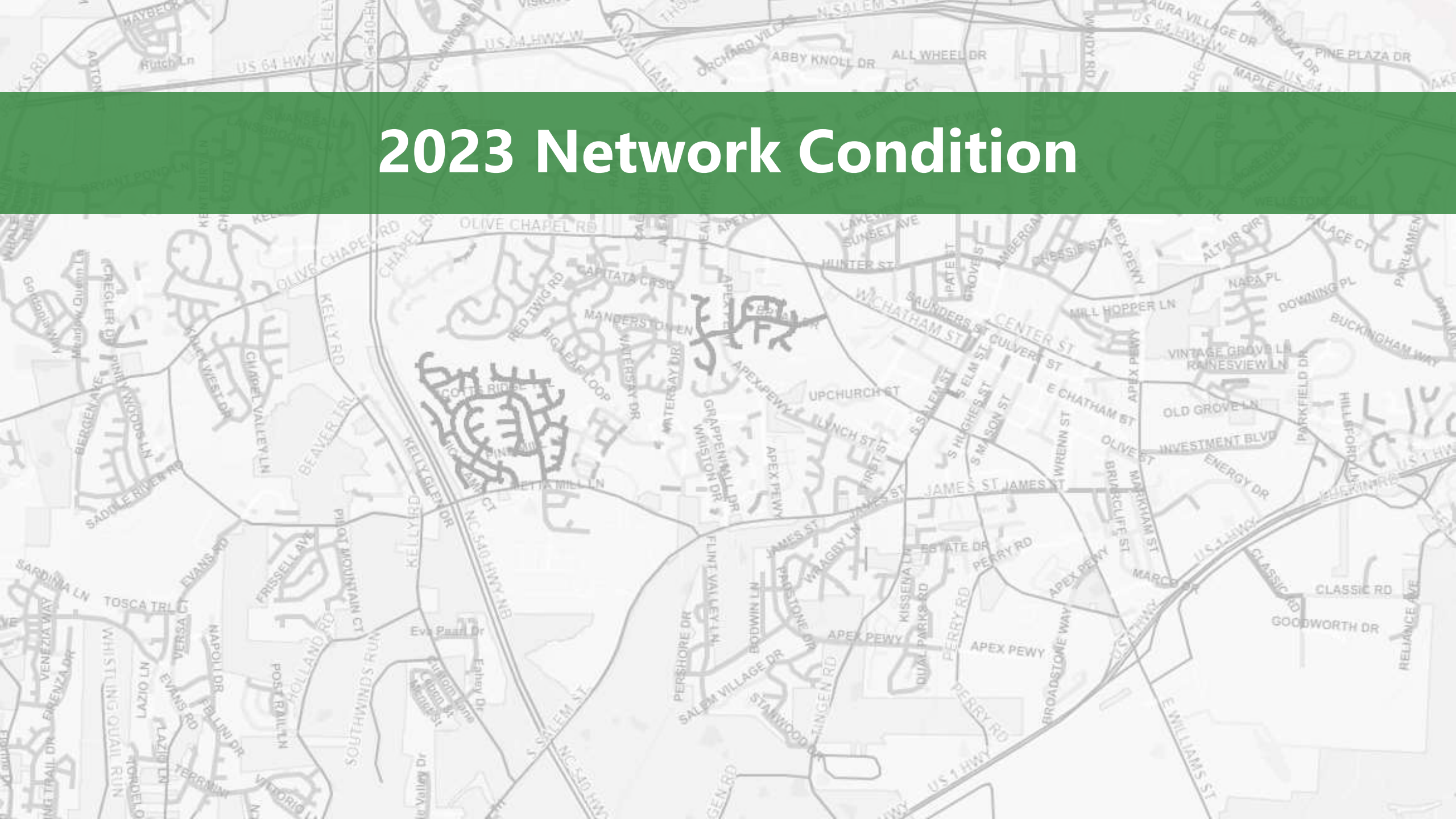
Benefits of using crack density

- Independent of data collection vendor's experience/specific technology
- Allows agencies flexibility in aggregating data to condition scores
- Highly repeatable
- Less reliant on subjective definitions of distress types and severities

2023 Network Condition



2023 Network Condition

Network Summary

Description	Value
Length of Network (Center Line Miles)	240.4
Lane Miles	487.8
Area of Network (Square Yards)	3.3M
Weighted Average Network PCI	84.8
Previous Weighted Average Network PCI (2020)	79.3
Total Asset Value of Pavement Network	$222.1M *
Remaining Asset Value (Current Condition, PCI=84.8)	$188.4M **
Percent of Network in Good Condition (PCI ≥ 80)	75.1%
Percent of Network in Poor (PCI < 60)	12.6%

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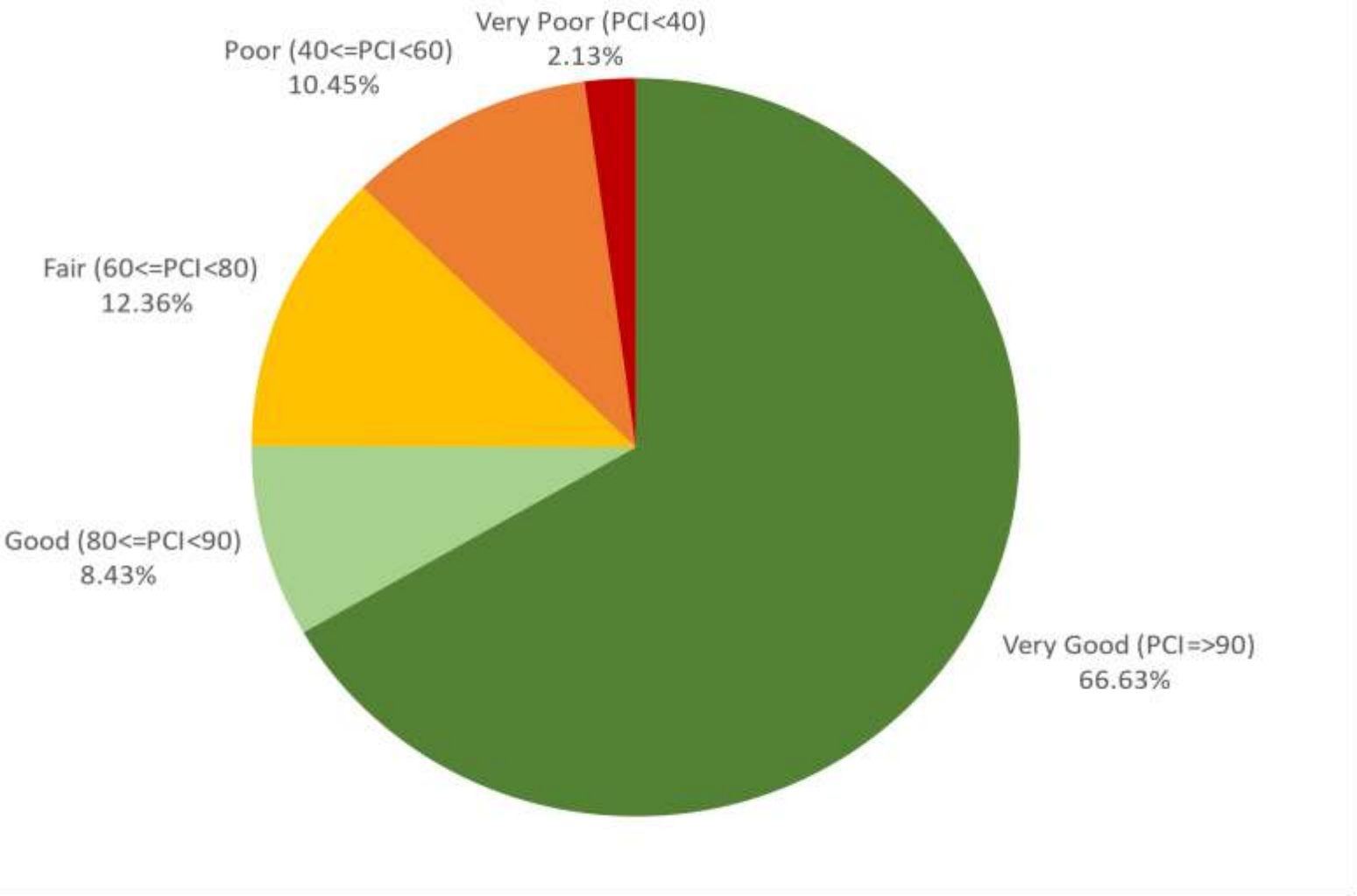
* Total area of the network x industry average replacement cost

** Value of network in its current condition (PCI = 84.8)

2023 Network Condition



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2023 Network Condition

Backlog of Current Treatment Needs

Treatment	Lane Miles	Total Area (yd^3)	Cost
Do Nothing	193.03	1,287,133	$0.00
Crack Seal	0.41	2,707	$2,302
Patching	80.96	545,735	$1,373,445
Rejuvenator	43.36	296,846	$296,850
Preservation*	101.73	712,326	$2,493,169
Rehab (Minor)	63.37	454,809	$10,069,482
Rehab (Major)	4.96	38,776	$1,046,955
Total	487.82	**3,338,333**	**$15,282,203**

Treatment Name	Unit Cost
Crack Seal	$0.85 / LF
Rejuvenator	$1.00 / SY
Microsurfacing	$3.50 / SY
Rehab (Minor)	$22.14 / SY
Rehab (Major)	$27.00 / SY
Reconstruction/FDR	$66.53 / SY

* Microsurfacing or ultra-thin lift asphalt treatment

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Pavement Treatment Toolbox

Pavement Treatment Toolbox

Crack Sealing (most cost-effective treatment to preserve pavements)

Issues addressed:

- Cracking is inevitable and left untreated will cause pavement failure like potholes and subbase failure.
- Used to treat all types of cracks greater than ¼”.

Benefits:

- Slows crack deterioration
- Protects pavement from moisture damage
- Extends pavement life up to 3 - 5 years
- Lowest cost preservation (maintenance) treatment
- Highest benefit for money spent

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Pavement Treatment Toolbox

Asphalt Rejuvenation

Issues addressed:

- Oxidation (graying of pavement)
- Loss of asphalt elasticity
- Raveling (loss of binder)

Benefits:

- Improves flexibility of the asphalt surface
- Restores lost oxidized components of the asphalt binder
- Slows rate of aging and oxidization.

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Pavement Treatment Toolbox

Preservation – Microsurfacing/Slurry Seals

Issues addressed:

- Surface Defects
  - Oxidation
  - Raveling
- Cracking
- Minor Rutting

Benefits:

- Provides skid resistance
- Prevents moisture intrusion
- Protects against oxidation and raveling
- Most economical choice when leveling is required.
- Quick construction times and minimal disruption to the traveling public.

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Pavement Treatment Toolbox

Pavement Rehab (Minor or Major)

Issues addressed:

- Pavement rehabilitation completely removes and replaces a portion of the asphalt pavement surface.
- The depth of rehabilitation (minor vs. major) depends on the severity of pavement damage.

Benefits:

- Pavement rehabilitation is necessary because it can help extend the life of a pavement.
- Prevents further deterioration and expensive repairs such as Full-Depth Reclamation (FDR) at a later date.

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Pavement Treatment Toolbox

Full-Depth Reclamation (FDR)

FDR is an in-place recycling method for reconstruction of existing flexible pavements using the existing pavement section material as the base for the new roadway-wearing surface.

Benefits:
The advantages are considerable compared to remove and replace reconstruction, but FDR is still expensive!

The use of less expensive treatments to preserve the network are recommended!

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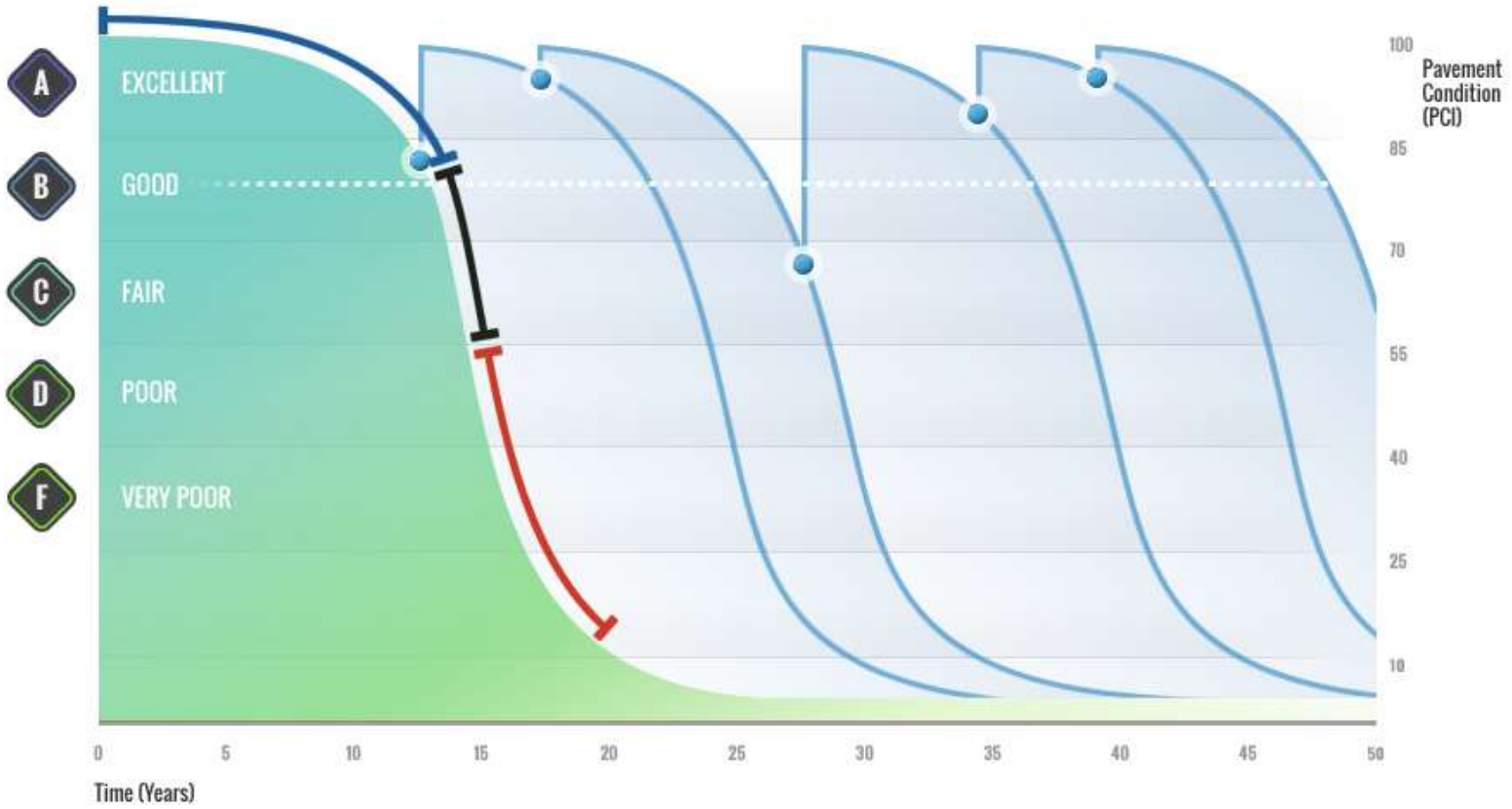
Pavement Preservation

Why is Pavement Preservation so important?



PCI Range	Treatment Name	Unit Cost
A	Crack Seal	$0.85/LF
A	Rejuvenator	$1.00/SY
B	Preservation	$3.50/SY
C	Rehab (Minor)	$22.14/SY
D, F	Rehab (Major)	$27.00/SY
F	Reconstruction/ FDR	$66.53/SY

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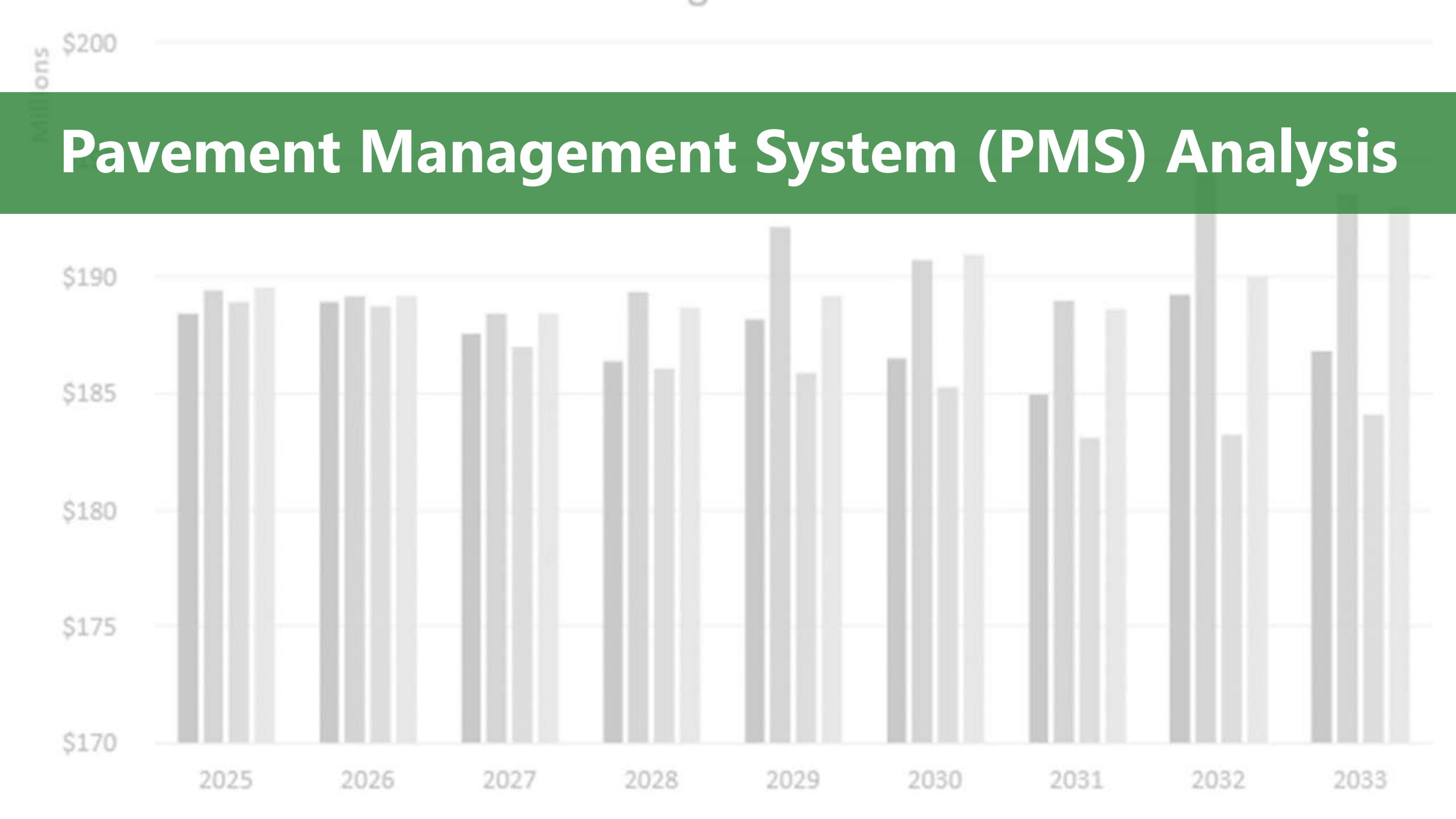
Pavement Management System (PMS) Analysis



Pavement Management System Analysis

AgileAssets Pavement Analyst Software

Multiple Budget Scenarios

- Utilized current budgets and requested budgets to determine benefits of increased funding

Inflation calculation was utilized in current analysis

- Inflation concerns have been significant in the past few years since pandemic
- An inflation rate of 2.5% was utilized in the analysis

Neighborhood Grouping Analysis

- Groups projects by neighborhood
- Reduces mobilization costs and reduces disruption to residents

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Pavement Management System Analysis

Two Funding Levels Analyzed

Current Budgets		Requested Budgets (asphalt)		*CIP requests	
FY 23-24	$2,200,000	FY 24-25	$2,800,000	FY 24-25	$3,500,000
FY 24-25	$2,300,000	FY 25-26	$2,900,000	FY 25-26	$3,625,000
FY 25-26	$2,400,000	FY 26-27	$3,000,000	FY 26-27	$3,750,000
FY 26-27	$2,500,000	FY 27-28	$3,100,000	FY 27-28	$3,875,000
FY 27-28	$2,600,000	FY 28-29	$3,200,000	FY 28-29	$4,000,000
Future	$2,700,000	Future	$3,300,000	Future	$4,125,000

* Includes curb ramp retrofits for Public Right-of-Way Accessibility Guidelines (PROWAG) compliance

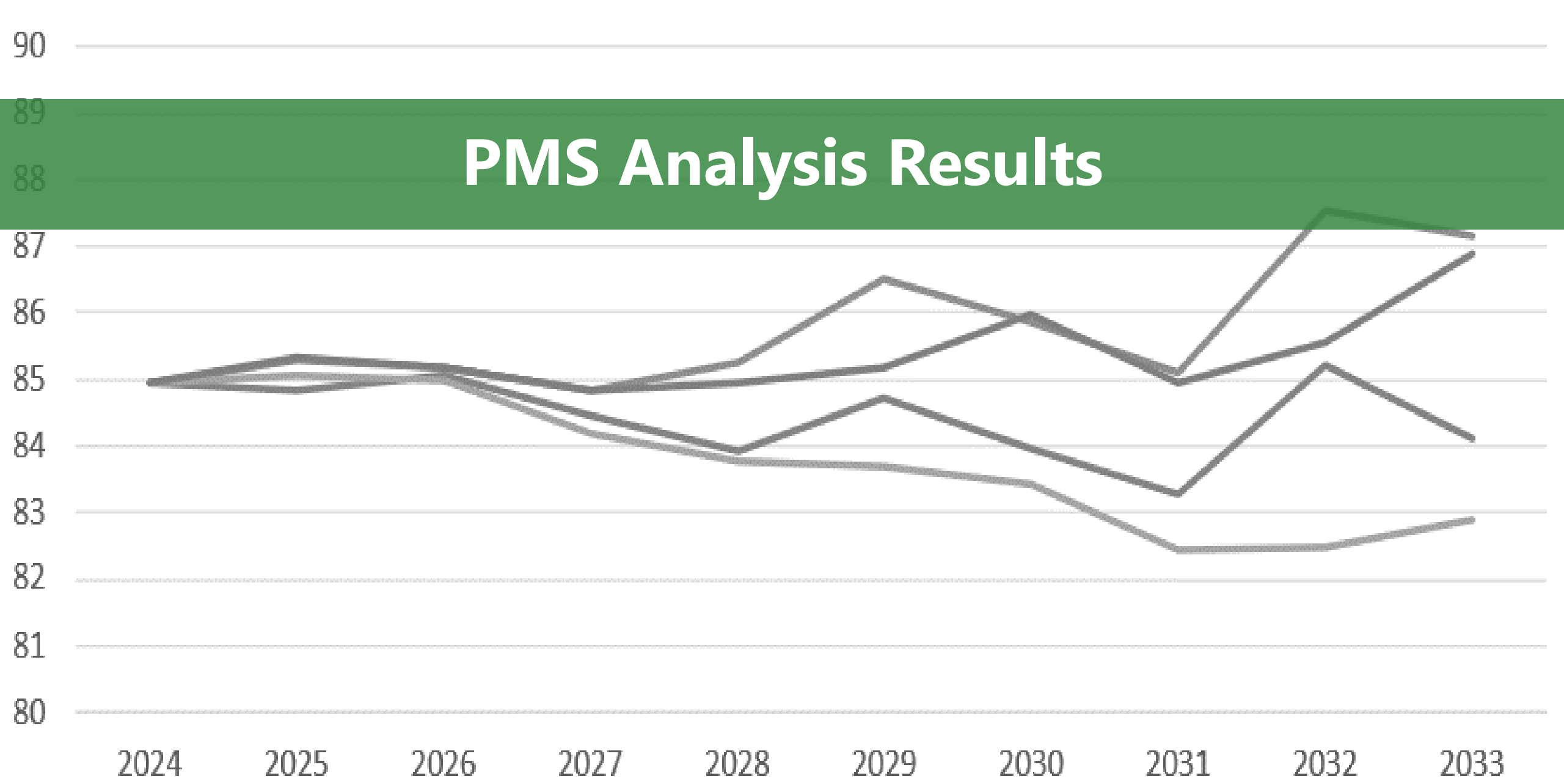
Pavement Management System Analysis

Scenarios included in PMS Analysis

Scenario	Scenario Length	Scenario Type
Current Budgets – No Limit On Preservation	10 years	*NGA - Optimized
Requested Budgets – No Limit On Preservation	10 years	*NGA - Optimized
Current Budgets – 40% Limit On Preservation	10 years	*NGA - Optimized
Requested Budgets – 40% Limit On Preservation	10 years	*NGA - Optimized

* Neighborhood Grouping Analysis, 2.5% inflation rate used

PMS Analysis Results



PMS Analysis Results

Pavement Condition Index - Results of all scenarios

Year	Current Budgets (No Preservation Limit)	Requested Budgets (No Preservation Limit)	Current Budgets (40% Preservation Limit)	Requested Budgets (40% Preservation Limit)
2024	84.95	84.95	84.95	84.95
2025	84.83	85.28	85.06	85.33
2026	85.05	85.18	84.99	85.18
2027	84.46	84.83	84.20	84.83
2028	83.93	85.25	83.78	84.95
2029	84.74	86.51	83.70	85.17
2030	83.98	85.86	83.42	85.98
2031	83.27	85.10	82.43	84.94
2032	85.20	87.54	82.49	85.57
2033	84.12	87.16	82.89	86.89

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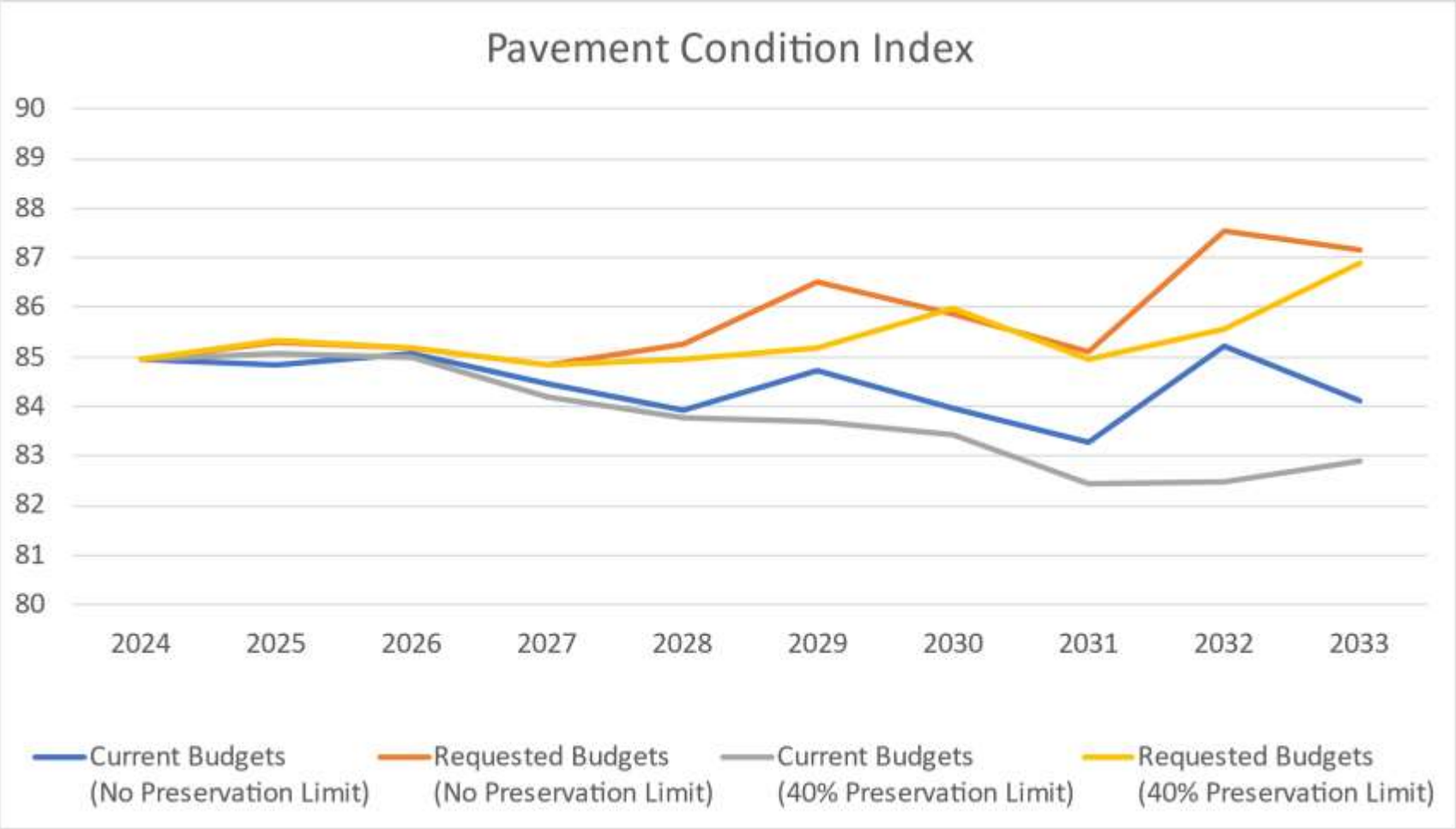
PMS Analysis Results

Pavement Condition Index - Results of all scenarios



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PMS Analysis Results

Remaining Asset Value - Results of all scenarios

Year	Current Budgets (No Preservation Limit)	Requested Budgets (No Preservation Limit)	Current Budgets (40% Preservation Limit)	Requested Budgets (40% Preservation Limit)
2024	$ 188,401,929	$ 189,400,043	$ 188,919,864	$ 189,510,870
2025	$ 188,900,763	$ 189,192,158	$ 188,760,841	$ 189,174,168
2026	$ 187,579,273	$ 188,403,705	$ 187,017,140	$ 188,416,365
2027	$ 186,405,922	$ 189,332,969	$ 186,078,770	$ 188,663,784
2028	$ 188,196,042	$ 192,130,309	$ 185,896,871	$ 189,167,727
2029	$ 186,514,307	$ 190,685,997	$ 185,277,436	$ 190,959,402
2030	$ 184,948,951	$ 189,007,149	$ 183,072,656	$ 188,640,685
2031	$ 189,224,584	$ 194,421,707	$ 183,206,360	$ 190,057,234
2032	$ 186,833,019	$ 193,578,618	$ 184,108,527	$ 192,977,618
2033	$ 188,401,929	$ 189,400,043	$ 188,919,864	$ 189,510,870

APEX NORTH CAROLINA

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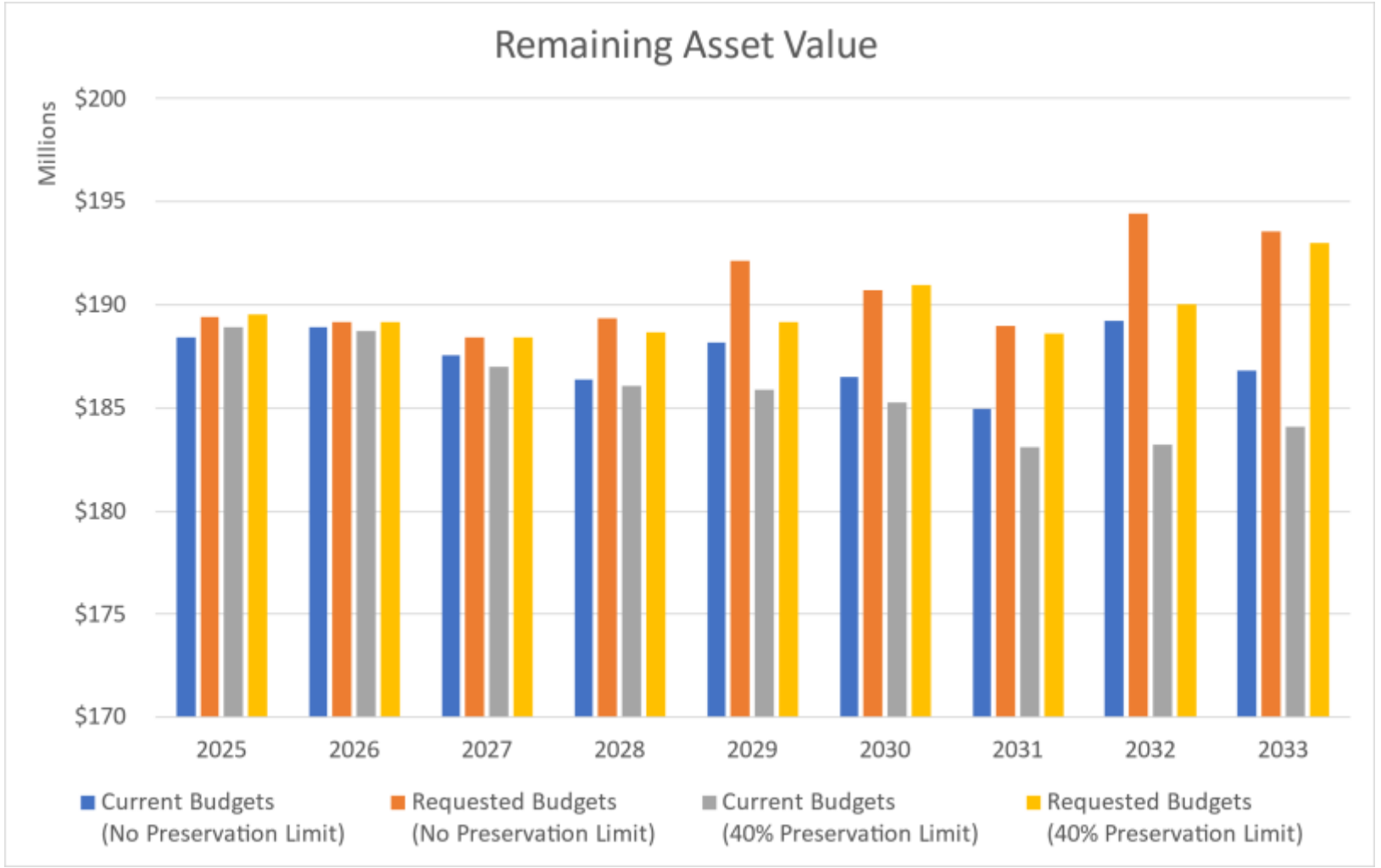
PMS Analysis Results

Remaining Asset Value - Results of all scenarios



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Conclusions & Recommendations

Conclusions and Recommendations

- The Town's network continues to grow quickly (up 15% since 2020)
- The Town has spent considerable funds on the resurfacing program which has paid off in increased condition.
- The network is currently in quite good condition with a weighted average network PCI of 84.8 (5.5-point increase since the last survey).
- This 5.5% increase in PCI represents an increase of approximately $12.2M in the value of the network.

Conclusions and Recommendations

The Town will benefit greatly by increasing the use of preservation treatments.

- Preservation treatments extend the life of asphalt pavements in good condition. Good roads cost less to maintain since less expensive treatments can be applied.

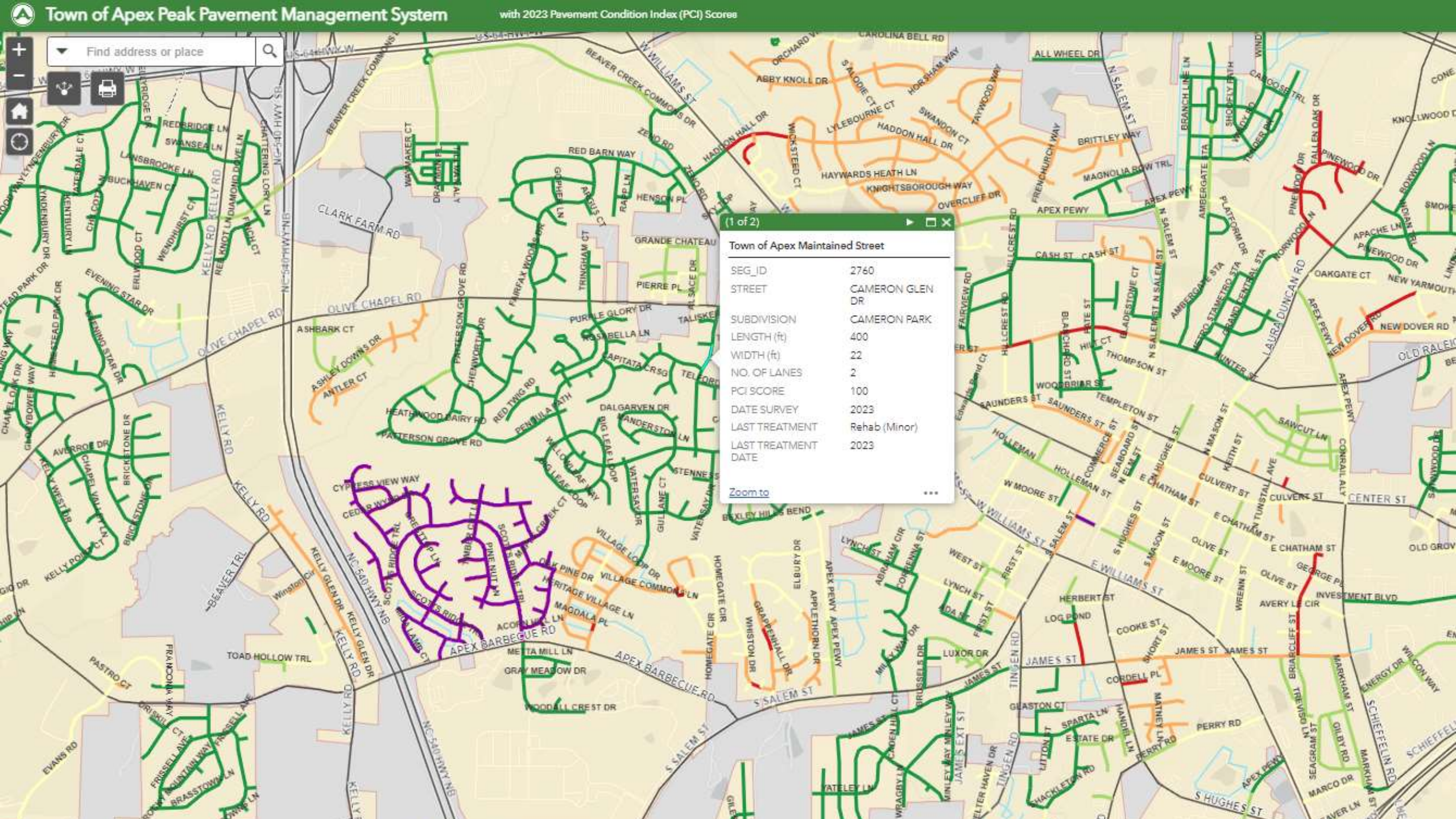
- Rejuvenators help maintain the surface of new asphalt:
  - Delaying oxidation and raveling
  - Slow environmental cracking

- Preservation treatments provide positive long-term impacts by slowing deterioration which may not be fully seen until after the 10-year analysis period.

Conclusions and Recommendations

- If the Town increases annual pavement budgets as recommended, Town should continue to see an increase in overall PCI scores and value of the street network over the next 10 years.

- Additional funding will help preserve and maintain the previous investments made through the 2021 Streets and Sidewalks Bond.


Town of Apex Peak Pavement Management System
with 2023 Pavement Condition Index (PCI) Scores
Find address or place
(1 of 2)
Town of Apex Maintained Street
SEG_ID 2760
STREET CAMERON GLEN DR
SUBDIVISION CAMERON PARK
LENGTH (ft) 400
WIDTH (ft) 22
NO. OF LANES 2
PCI SCORE 100
DATE SURVEY 2023
LAST TREATMENT Rehab (Minor)
LAST TREATMENT DATE 2023
Zoom to
CLARK FARM RD
OLIVE CHAPEL RD
KELLY RD
APEX BARBECUE RD
S SALEM ST
W WILLIAMS ST
E WILLIAMS ST
E CHATHAM ST
W MOORE ST
OLIVE ST
JAMES ST
CENTER ST
OLD RALEIGH RD
NEW DOVER RD
APEX PKWY
CAREY CHAPEL RD
NC 540 HWY NB
US 64 HWY W
BEAVER CREEK COMMONS DR
RED BARN WAY
HADDON HALL DR
HAYWARDS HEATH LN
KNIGHTSBOROUGH WAY
OVERCLIFF DR
BRITTLEY WAY
MAGNOLIA BOW TRL
ALL WHEEL DR
CAROLINA BELL RD
ABBY KNOLL DR
LYLEBOURNE CT
SWANDON CT
TAYWOOD WAY
FRENCHURCH WAY
GRANDE CHATEAU
PIERRE PL
PURPLE GLORY DR
ROSABELLA LN
CAPITATA CRSG
DALGARVEN DR
VANDERSTON LN
PATTERSON GROVE RD
HEATHWOOD DAIRY RD
RED TWIG RD
PENDULA PATH
ASHBARK CT
ASHLEY DOWNS DR
ANTLER CT
CYPRESS VIEW WAY
CEDAR WOOD CT
SCOTTS RIDGE TRL
SCOTTS RIDGE LN
PINE NUT LN
OLIVE PINE DR
HERITAGE VILLAGE LN
VILLAGE LOOP DR
VILLAGE COMMON LN
MAGDALA PL
ACORN HILL LN
MEITA MILL LN
GRAY MEADOW DR
WOODHILL CREST DR
TOAD HOLLOW TRL
HOMEGATE CIR
WHISTON DR
GRAPENHALL DR
APPLETHORN DR
BEXLEY HILLS BEND
GUILLANE CT
WATERSAVER DR
STENNES CT
BIG LEAF LOOP
WILLOWLEAF WAY
CREEK CT
BEAVER TRL
KELLY GLEN DR
WINSTON CT
PASTRO CT
EVANS RD
FRISSELL AVE
BRASSTOWN LN
FRANCONIA WAY
ORIOLE CT
KELLY WEST DR
KELLY POINT CT
CHAPEL VALLEY LN
BRICKSTONE DR
AVERROE DR
EVENING STAR DR
HOMESTEAD PARK DR
CHAPEL OAK DR
GROVE BOWER WAY
KING WAY
ASHLEY LYNNEBURY DR
REDBRIDGE DR
REDBRIDGE LN
SWANSEA LN
LANSBROOKE LN
BUCKHAVEN CT
CHATTERING LORY LN
DIAMOND DOVE LN
RED KNOT LN
FINCH CT
WENDHURST CT
ERLYWOOD CT
KENTBURY LN
FATESDALE CT
CHESTNUT CT
WAXMAKER CT
DRAKEMAN PL
GREBE LN
RAIL LN
SKY TOP
HENSON PL
ZENO RD
WICKSTEED CT
FAIRFAX WOODS DR
TRINGHAM CT
PARISH CT
PATTERSON GROVE RD
CHENWORTH DR
TALISKER
LAURA DUNCAN RD
APACHE LN
PINEWOOD DR
PINETOP DR
FALLEN OAK DR
OAKGATE CT
NEW YARMOUTH
ROXWOOD LN
NORWOOD LN
SMOKE
AMBERGATE PL
AMBERGATE STA
PLATFORM DR
METRO STA
GRAND CENTRAL STA
HUNTER ST
FAIRVIEW RD
HILLCREST RD
CASH ST
N SALEM ST
GLADESTONE CT
BANCHORD ST
PATE ST
HILT CT
THOMPSON ST
WOODBRIAR ST
SAUNDERS ST
TEMPLETON ST
HOLLEMAN
COMMERCE ST
SEABOARD ST
N ELM ST
N HUGHES ST
N MASON ST
KEITH ST
CULVERT ST
CONRAIL ALY
SAWCUT LN
TUNSTALL AVE
S HUGHES ST
S MASON ST
WREN ST
AVERY LE CIR
INVESTMENT BLVD
GEORGE PL
HERBERT ST
LOG POND
COOKE ST
SHORT ST
CORDELL PL
MATNEY LN
PERRY RD
BRIARCLIFF ST
MARKHAM ST
WILSON WAY
ENERGY DR
SCHIEFFELIN RD
SEAGRAM ST
GILBY RD
MARCO DR
LUXOR DR
BRUSSELS DR
TINGEN RD
GLEASTON CT
SPARTA LN
ESTATE DR
HAMBEL LN
CHACKLETON RD
LUTTON CT
JAMES EXT ST
MINLEY WAY
CADEN HILL CT
WRAGBY LN
YATELEY LN
SELTER HAVEN DR
LYNCH ST
ABRAHAM CIR
CORDELIA ST
WEST ST
FIRST ST
IDA ST
MILL WORK DR
ELBURY DR
TRAVIS LN

Subdivision Street System Resurfacing Candidates

Ranked by PCI

Subdivision	PCI
Brookfield	38.4
Waterford Green	40.3
Perry Farms 1&2, Perry Village, Winslowe	42.8
Kelly Glen	43.9
Haddon Hall	47.8
Woodridge	51.7
Shepherds Vineyard Phase 6&7	53.8
Ashley Downs Phase 2&3	55.3
Green at Scotts Mill	55.4
Miramonte	56.7
Whitehall Village & Manor	59.8

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Thank you!

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