Alachua County, FL

2021 Pavement Management Report

Submitted by:

The Kercher Group, Inc.

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GLOSSARY

Name / Abbreviation	Description
CL	Centerline
FC	Fatigue Cracking – See Appendix B for a detailed explanation
Backlog	Projects that are unfunded due to financial constraints
BC	Block Cracking – See Appendix B for a detailed explanation
BST	Bituminous Surface Treatment
FDR	Full Depth Reclamation
FHWA	Federal Highway Administration - See https://www.fhwa.dot.gov/about/
LTPP	FHWA's Long Term Pavement Performance rating methodology approach
PCI	Pavement Condition Index
PCS	Pavement Condition Survey
PP	Defective Patching and Potholes – See Appendix B for a detailed explanation
RAV	Remaining Asset Value
RC	Reflective Cracking – See Appendix B for a detailed explanation
RR	Rutting and Roughness – See Appendix B for a detailed explanation
SD	Surface Defects - Includes Oxidation and Raveling
TC	Transverse Cracking – See Appendix B for a detailed explanation
WF	Worst-First – Selecting projects on a worst first basis

I. EXECUTIVE SUMMARY

Introduction

The Kercher Group, Inc. (Kercher) was retained by Alachua County to perform a pavement management study for the County maintained asphalt pavement streets (approximately 690.3 centerline miles). A visual Pavement Condition Survey (PCS) of the asphalt pavement streets was conducted by Kercher, following the Federal Highway Administration's (FHWA) Long Term Pavement Performance (LTPP) methodology approach.

AgileAssets Pavement Analyst Software (Software) was used to perform the analysis on the County maintained asphalt streets. The Software incorporates deterioration models and treatment decision trees into the analysis while utilizing integer optimization. This analysis process allows the user to easily determine the greatest amount of benefit for any fixed budget or conversely determine the minimum level of funding needed over time to meet user-specified performance goals. This leads to the most cost-effective project selection for any given budget scenario the County requires. The analysis included a calculation of the current Pavement Condition Index (PCI), determining the Remaining Asset Value (RAV is defined as the dollar value of the asset based on the asset's condition, relative to the asset replacement value) and running multiple budget scenarios over a 20-year period and how this relates to the projected PCI and RAV.

Below is a brief summary of the results:

Condition Year (2020) Results:

The current (based on 2020 distress data) condition and summary of critical elements of the network are described in Table 1. The County's weighted average network condition or Pavement Condition Index (PCI) is 60. The net worth (or Asset Value) of the County street network is estimated to be approximately $1.5 billion. This estimate is derived by multiplying the total number of pavement square yards comprising the network (approximately 9.8 million square yards) by County's average square yard replacement cost of $156.00.

Table 1 – Current Condition and Inventory Summary

Element	Total
1. Length (CL Miles)	690.28
2. Lane Miles	1,422.90
3. Pavement Square Yards	9,814,657
4. PCI	60
5. Net Worth/Asset Value ($)	$1,531,086,474
8. Asset Value for Current Condition ($) *	$920,338,804
9. % Network in Good (PCI ≥ 80) Condition	25.3%
10. % Network in Poor (PCI < 60) Condition	43.9%

* 5. Net Worth/Asset Value ($) x 4. PCI/100

Based on an unlimited funding scenario, the current backlog of needs for the County roadway network was determined to be $408,167,827 and 1,210.10 backlog lane miles. Table 2 shows the backlog treatment needs detailed by the type of treatments needed.

Table 2 – Initial Backlog Treatment Needs and Type Breakdown

Budget Group	Lane Miles	Treatment Cost
Maintenance	148.46	$6,099,167
Preservation	67.18	$3,177,932
Rehab-Thin	439.79	$88,405,495
Rehab-Thick	488.21	$239,214,663
Reconstruction	66.70	$71,395,237
Grand Total	**1210.10**	**$408,167,827**

Projected Twenty Year Optimized Analysis Results (Year: 2040)

The Consultant Team ran six "what if" scenarios utilizing the PCI Rating System and the AgileAssets Software.

- Scenario 1 is setup to simulate the current practice followed by the County. Current practice means all the funding (Approx. $4M/year) goes to High Traffic (HT) volume or Non-Subdivision Routes only and only reconstruction and rehabilitation projects are funded.
- Scenario 2 splits $10M/year between Low Traffic (LT) volume and HT roads,
- Scenario 3 splits $15M/year between LT and HT roads,
- Scenario 4 splits $15M/year between LT and HT roads but optimization starts from 2023,
- Scenario 5 is setup to maintain current network condition (PCI = 60), and
- Scenario 6 is setup to achieve a Target network PCI = 70.

The detailed description of each scenario is provided in Section II C. Optimization and Predictive Modeling. Figure 1 - Figure 10 graphically depict the analysis results for each of the six scenarios using a twenty (20) year analysis period. Scenarios are compared in two groups; Need Analysis scenarios (1, 5, & 6) and Alternative Budget Analysis scenarios (1, 2, 3, & 4). A detailed explanation of the methodology used to calculate Remaining Asset Value (RAV) is provided in Section II F. Scenario Analysis Results The yearly budget amounts for the Current Budget and Maintain Current Condition are included in Table 5 located in Section II F. Scenario Analysis Results.

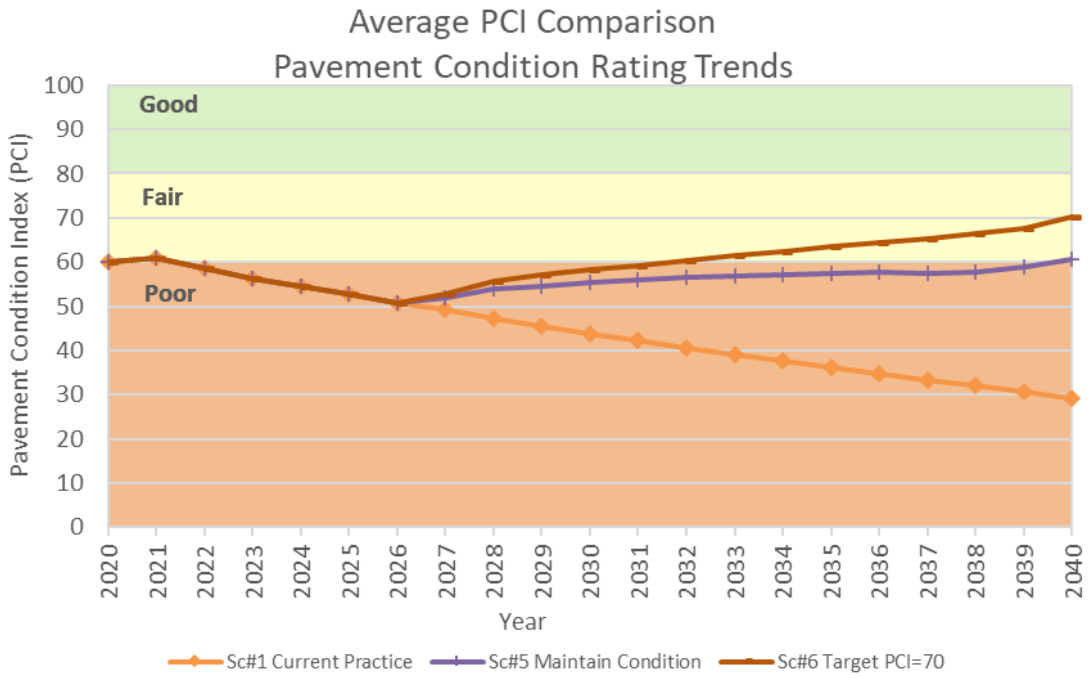


Figure 1 – PCI Comparison Across Scenarios 1, 5, & 6

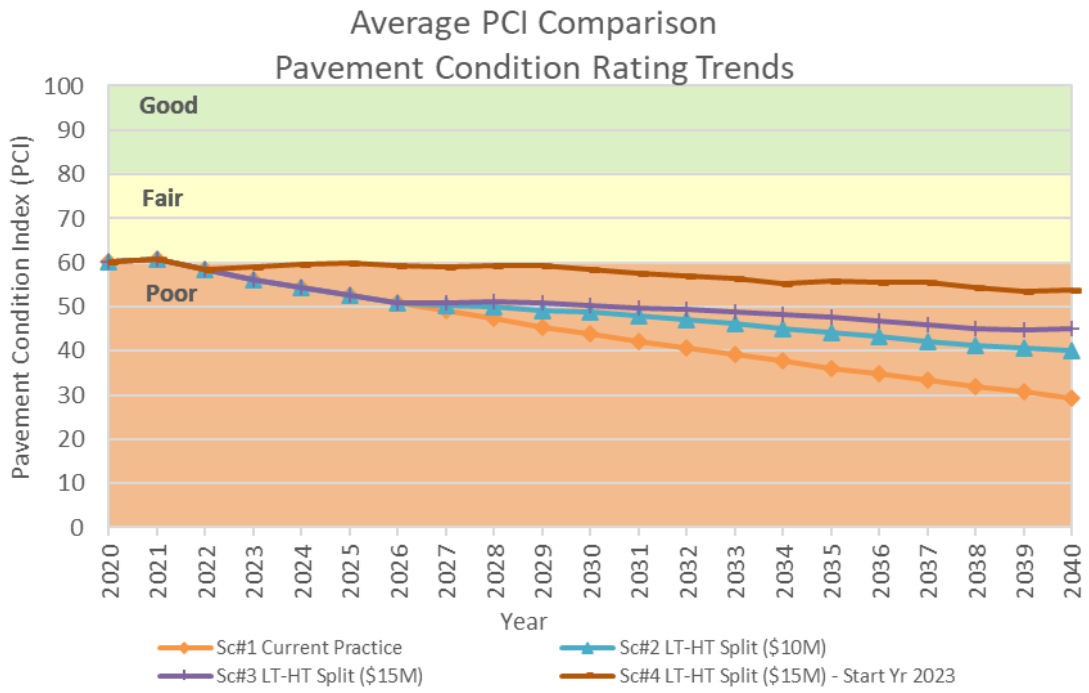


Figure 2 PCI Comparison Across Scenarios 1, 2, 3, & 4

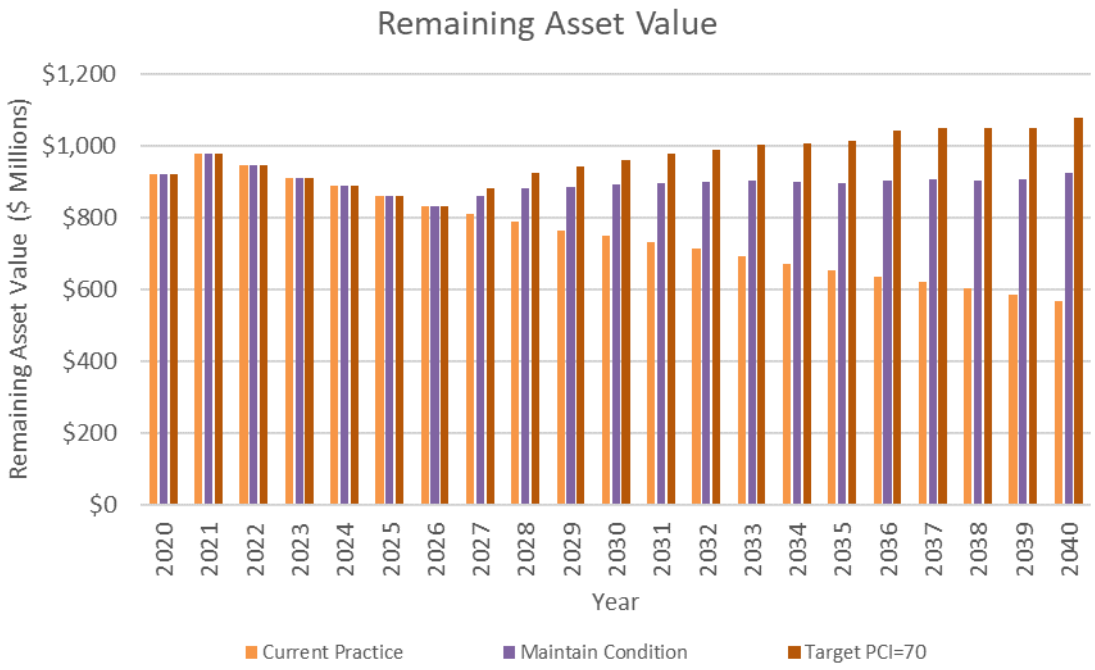


Figure 3 – Remaining Asset Value over the Analysis Period - Scenarios 1, 5, & 6

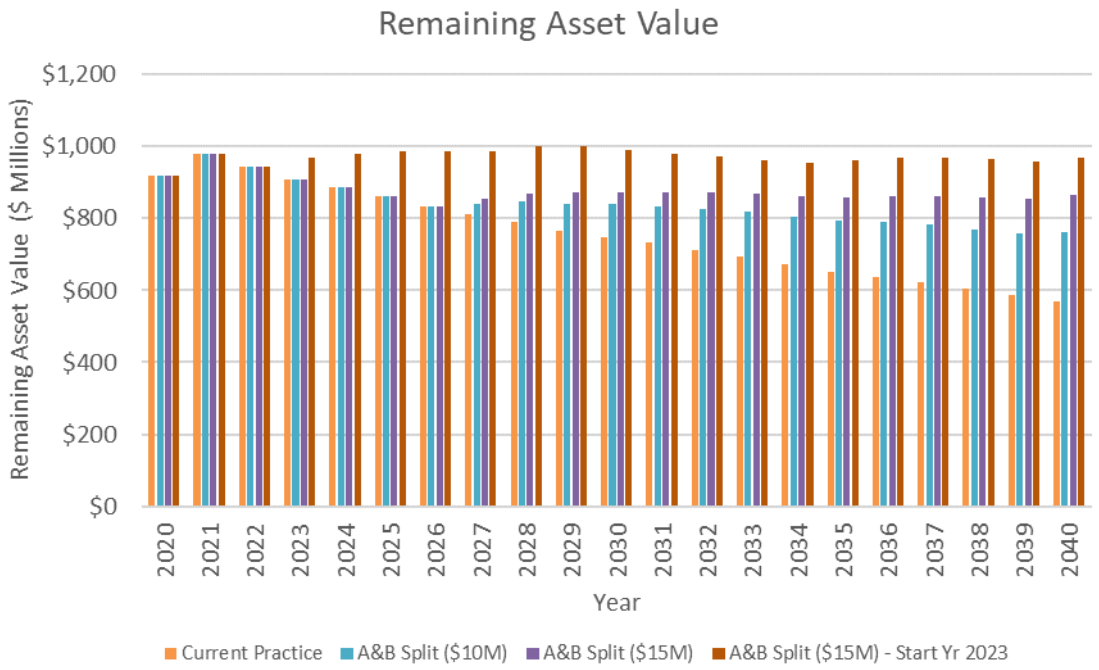


Figure 4 – Remaining Asset Value over the Analysis Period - Scenarios 1, 2, 3, & 4

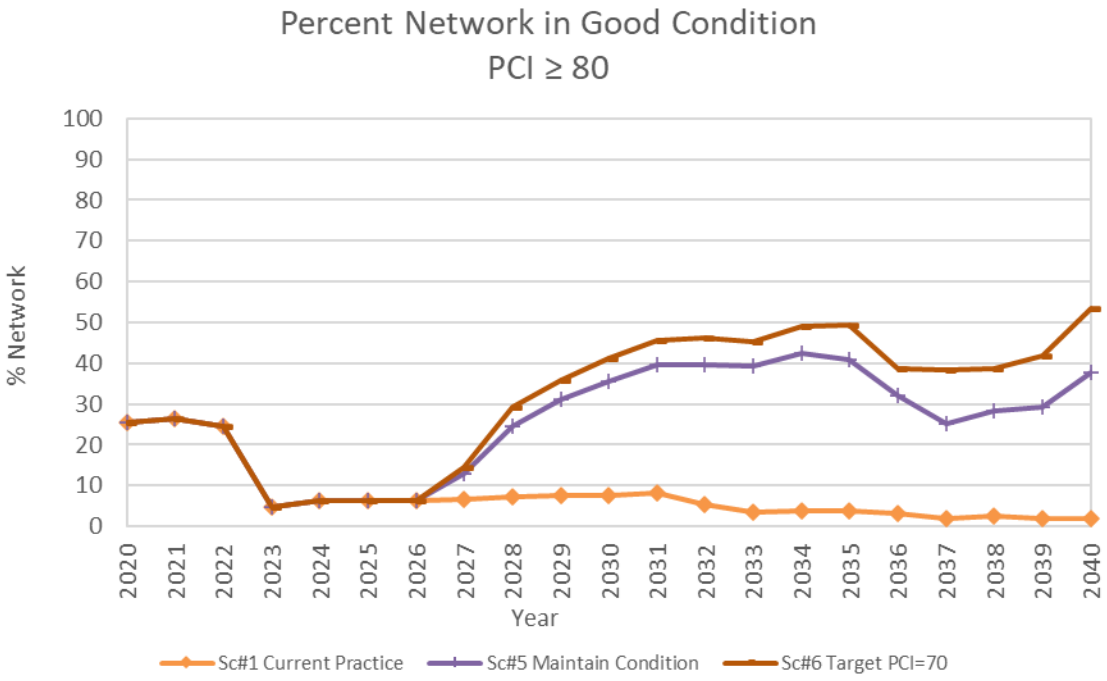


Figure 5 – Percent Network in Good Condition over the Analysis Period - Scenarios 1, 5, & 6

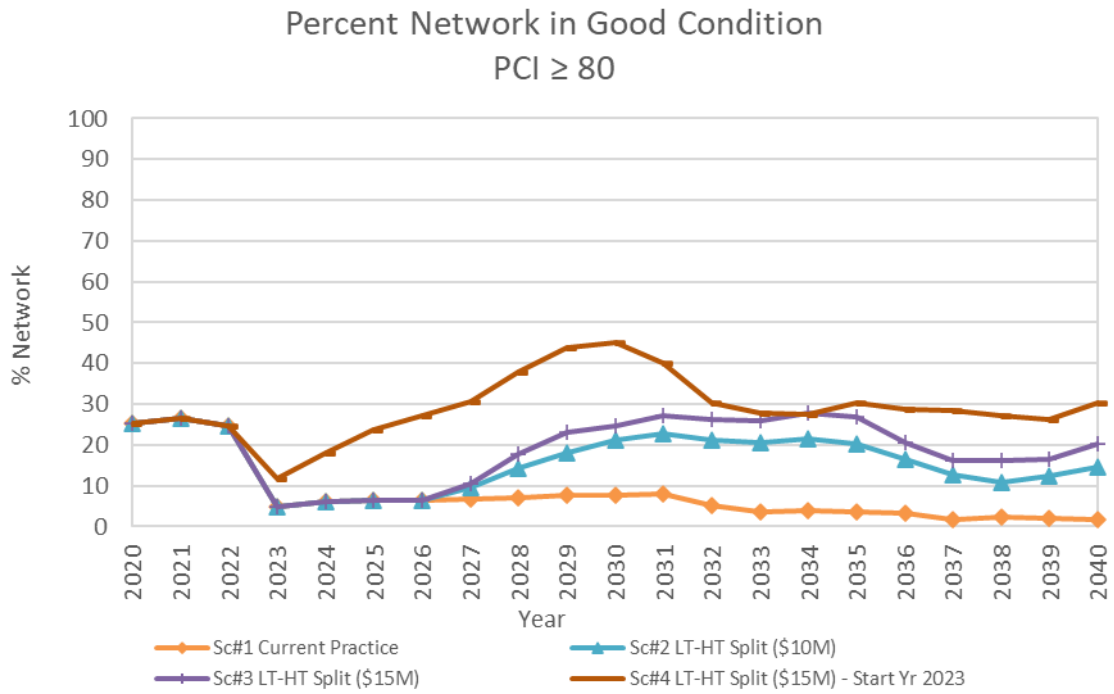


Figure 6 – Percent Network in Good Condition over the Analysis Period – Scenarios 1, 2, 3, & 4

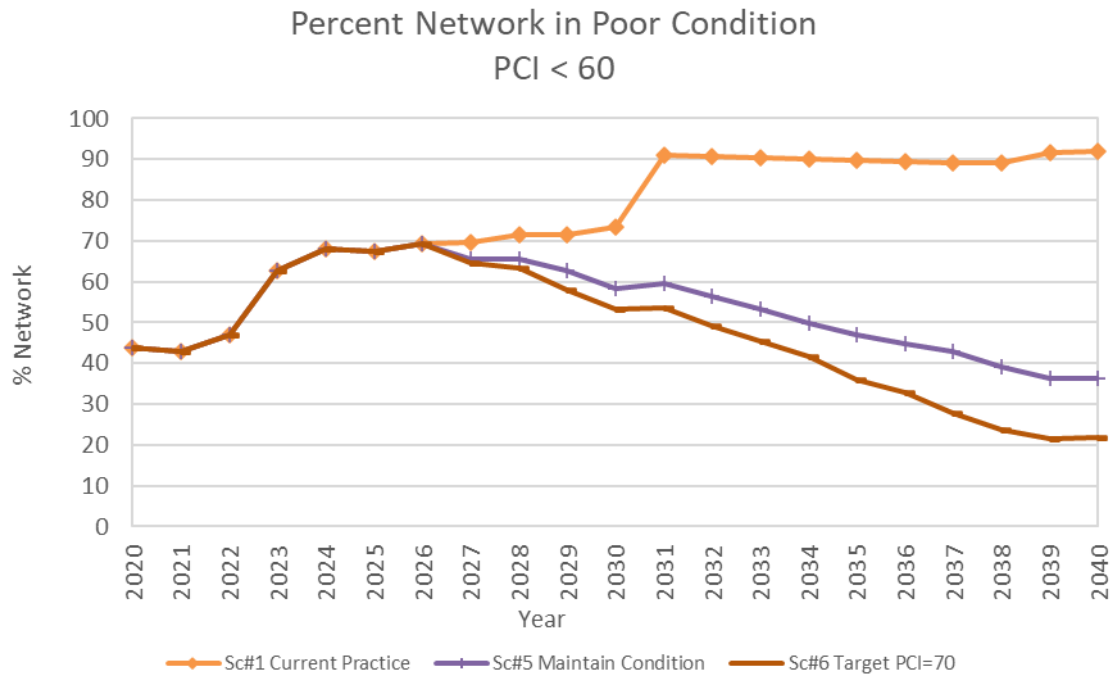


Figure 7 – Percent Network in Poor Condition over the Analysis Period - Scenarios 1, 5, & 6

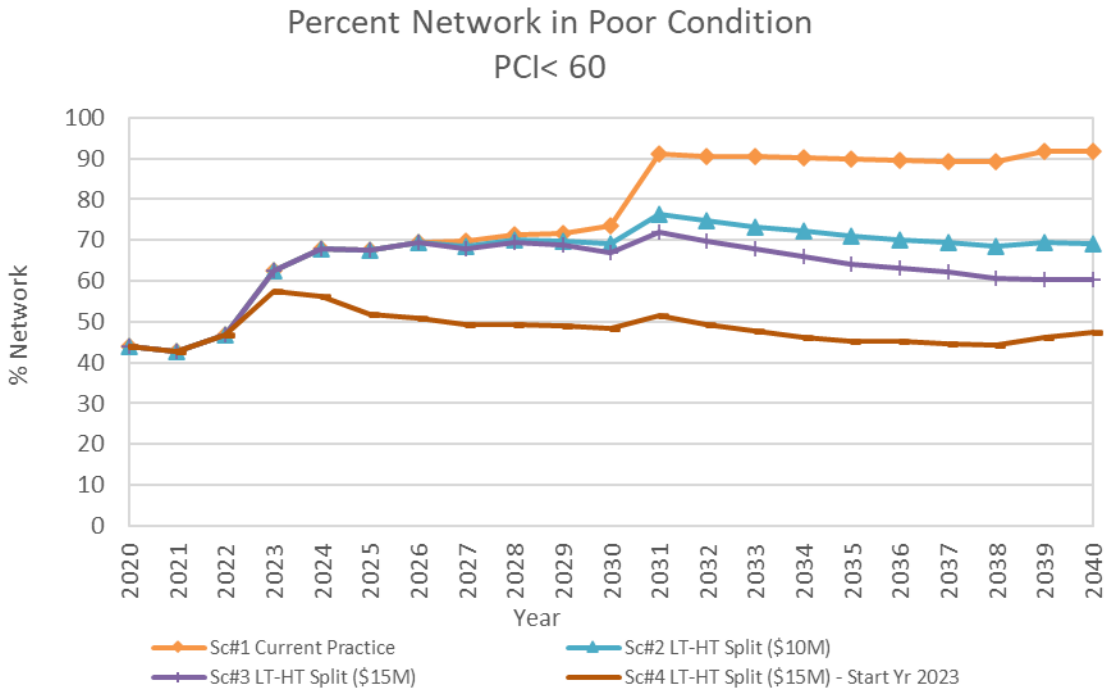


Figure 8 – Percent Network in Poor Condition over the Analysis Period - Scenarios 1, 2, 3 & 4

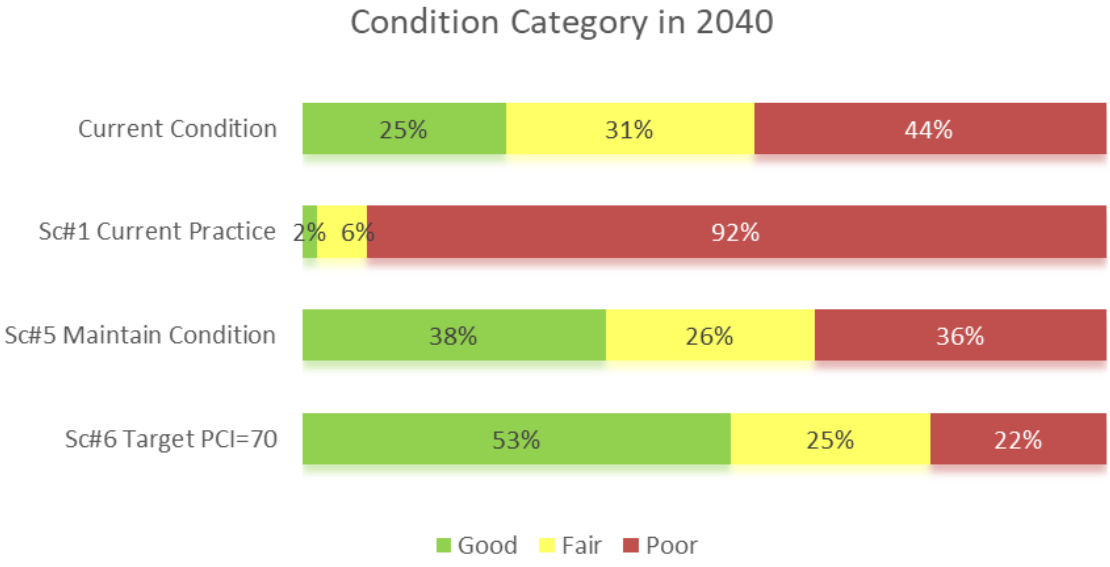


Figure 9 – Percent Network Condition Category - Scenarios 1, 5, & 6

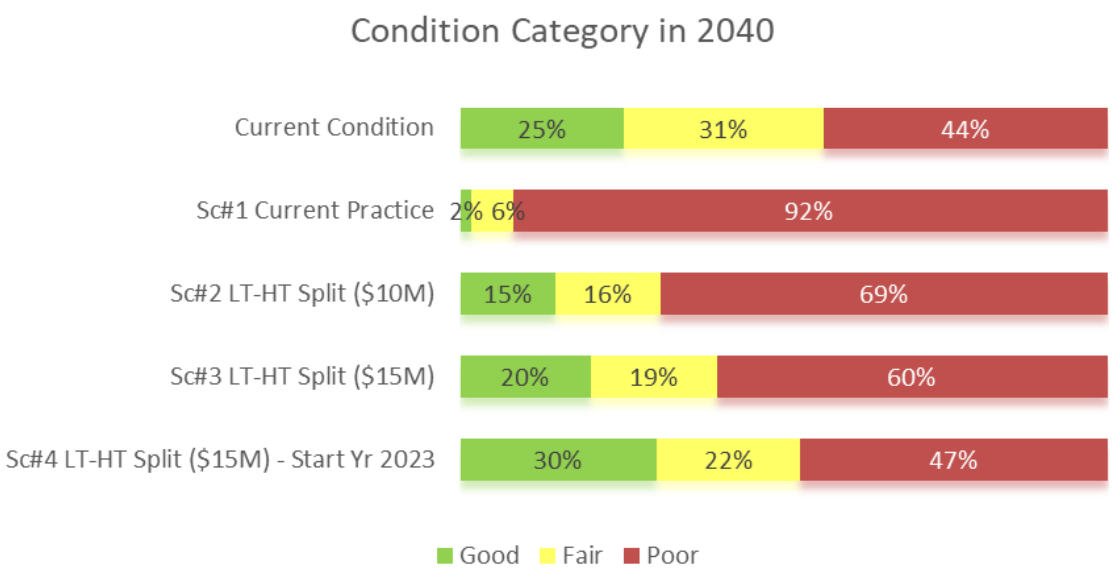


Figure 10 - Percent Network Condition Category - Scenarios 1, 2, 3 & 4

Summary

Based on the current condition of the network and the analysis included in this Pavement Management Report, Kercher has the following recommendations:

- The network is in poor condition today and is projected to continue to deteriorate substantially in the coming years at the current low funding levels and using the current project delivery approach of waiting until the pavements fail prior to reacting.
- Starting in 2027, increase current yearly pavement budget to approximately $31.5M/year to maintain the network condition through 2040.
- Or, starting in 2023, increase current yearly pavement budget to approximately $15M/year to maintain the network condition through 2030 with lesser deterioration through 2040.
- Implement a “mix of fixes” approach, including preserving good roads as long as possible in order to manage the network, repairing the network at all condition levels instead of waiting until they reach end of life to reconstruct. This approach has proven less costly in the long run while improving overall level of service for the public.
- Provide adequate funding for both the mainline and subdivision road networks.
- Look to develop a pavement program fund that separates ancillary assets from the cost of the pavement project. Currently the County’s pavement purchasing power is limited by the amount of ancillary project work that goes into improving the pavement network condition.

II. REPORT

A. Introduction

The Kercher Group, Inc. is a full-service engineering consulting firm providing municipal engineering, asset management, pavement management, and construction management services for more than 25 years. Our firm's primary focus has been on providing local government agencies with high quality infrastructure management consulting services. These services include municipal engineering, project management, pavement condition surveys, pavement and bridge management analysis and reporting, preparation of contract documents, contract administration and in-depth construction inspection. This portfolio of services helps ensure that our clients are spending their limited infrastructure budgets as efficiently and effectively as possible, and that projects constructed are of the highest quality to the highest level of service possible to the traveling public.

Pavement Condition Survey

Kercher was retained by the Alachua County to perform a Pavement Condition Survey (PCS) of the County maintained street system. Kercher identified approximately 690.3 miles of County maintained asphalt pavement roadways. A visual PCS of these streets was conducted by Kercher in July 2020 utilizing the Long-Term Pavement Performance (LTPP) condition evaluation methodology (recommended by FHWA). The pavement segments were rated by driving each road or street and observing six common pavement surface distresses, severities and extents are defined below:

1. Fatigue Cracking – aka Alligator Cracking (FC)
2. Transverse Cracking (TC)
3. Block Cracking (BC)
4. Defective Patching and Potholes (PP)
5. Surface Defects – Includes Oxidation and Raveling (SD)
6. Rutting and Roughness (RR)

Analysis and Reporting

The individual distress condition data collected from this PCS was then used to calculate several condition indices. A structural condition index (indicator of deterioration due to structural factors: FC & PP), an environmental condition index (indicator of deterioration due to environmental factors: TC, BC, & SD), and a functional condition index (RR) were calculated for each management section. These "combined" condition indices were used to select the most cost-effective treatment in each analysis scenario. In order to provide an indicator of general health of the pavements, a Pavement Condition Index (PCI) for each street segment and a length-weighted average PCI for the entire roadway network were also calculated.

AgileAssets Pavement Analyst™ Software (Software), as configured by Kercher specifically for local agency road networks, was used to generate future projections of both PCI and RAV for the County maintained network based on current and projected funding levels. The analysis results were then used to develop

optimized yearly work plans. The optimized yearly work plans provide the recommended repair activities to address the deficiencies on affected street segments in the most cost-effective manner possible. Costs for the recommended repair activities were calculated using current unit repair costs provided by the County (see Table 3 – Repair Activities and Unit Costs below). It is important to note that Project-level unit costs (usually higher than the network level unit costs) are used to run the analysis. Recommended repair activities for the County's Streets are provided in the Alachua County 2020 PMS Database.

Table 3 – Repair Activities and Unit Costs

Maintenance Activity	Unit Cost ($/SY)
Crack Seal	$0.65
Rejuvenator	$1.00
Patching	$11.00
Preservation	$6.50
Rehab (Minor) - Res	$11.00
Rehab (Minor)	$48.50
Rehab (Major)	$75.00
Reconstruction-FDR	$156.00

B. Procedures

The procedures used for this survey include:

- Identifying an inventory of the physical characteristics of the County's streets. These characteristics include direction, block, street name, type, begin and end descriptions, length, pavement type, number of lanes, class (high or low volume) width and neighborhood ID.

- Evaluation of the surface pavement distresses using the LTPP rating methodology. Fatigue cracking, transverse cracking, block cracking, defective patching and potholes, surface defects, rutting and roughness and are measured according to well-defined severity and extent levels. See Appendix B - Distress Definitions.

- Entering and compilation of the collected field data, and post processing information into the Software. By utilizing the Software, Kercher generated multiyear budget scenarios based on revenue numbers identified by the County for various funding levels. Because this software uses multi-constraint optimization, Kercher has the ability to identify the County's PCI and RAV in the most cost-effective manner. The software also proves to be of great benefit for justifying the pavement management plan funding to Commission.

C. Optimization and Predictive Modeling

The Kercher Consultant Team ran six "what if" scenario analyses utilizing the AgileAssets Pavement Analyst software. Accordingly, yearly work plans were generated for the following budgets scenarios:

- Scenario #1 Current Practice -- All funding (Approx. $4M/year) goes to Higher Traffic (HT) volume or Non-Subdivision Routes only. Only Reconstruction and Rehabilitation projects are funded. Low Traffic (LT) volume or Subdivision Routes are not funded. Each of the scenarios has a committed projects list for the first 6 years, and the optimization analysis picks the projects from year 7-20. Based on an unlimited scenario analysis, two additional projects worth $21.5M were selected by the County. It was decided to complete them in multiple phases; a deduction of $2M was therefore applied on annual budget of $4M to save for those projects. A complete list of committed projects (Master Work Plan) is provided in Table 4.

- Scenario #2 LT-HT Split ($10M) -- $10M/year split into LT ($3M) and HT ($7M) Routes. Only Reconstruction and Rehabilitation projects are funded. Includes committed projects for first 6 years of the analysis.

- Scenario #3 LT-HT Split ($15M) -- $15M/year split into LT ($5M) and HT ($10M) Routes. Only Reconstruction and Rehabilitation projects are funded. Includes committed projects for first 6 years of the analysis.

- Scenario #4 LT-HT Split ($15M) - Start Yr. 2023 -- $15M/year split into LT ($5M) and HT ($10M) Routes, optimized project selection starting from Year 2023. Only Reconstruction and Rehabilitation projects are funded. No committed (planned) projects beyond 2022.
    - As mentioned above, each of these scenarios has a committed projects list for the first 6 years, and the optimization analysis picks the projects from year 7-20. The only exception is scenario #4 which starts the budget funding in year 3 of the analysis.

- Scenario #5 Maintain Condition -- Maintaining Current network condition (PCI = 60) by the end of analysis period. Only Reconstruction and Rehabilitation projects are funded. The yearly budget used for the Maintain Condition scenario analysis are provided in Table 5.

- Scenario #6 Target PCI = 70 -- Achieving target network condition of PCI = 70 by the end of analysis period. Only Reconstruction and Rehabilitation projects are funded. The yearly budget used for the Target PCI = 70 scenario analysis are provided in Table 5.

Table 4 – Master Work Plan (Committed Projects for the Analysis Period)

Plan Year	Street Name	Begin Point	End Point	Treatment	Project Price
2021	NE/NW 53 AV	US 441	SR 24	Recon-FDR	$1,735,490
2021	SW 170 ST	CL	SW 134 AV	Rehab (Major)	$600,000
2022	NE/NW 53 AV	US 441	SR 24	Recon-FDR	$1,496,698
2023	NW 76 Blvd	SR 26 North	End of Pavement	Recon-FDR	$93,879
2024	Fort Clarke Blvd	-	-	Rehab (Minor)	$719,400
2024	NW 76 Blvd	SR 26 North	End of Pavement	Recon-FDR	$386,121
2024	NW 98 ST	SR 26	NW 39 AV	Rehab (Minor)	$609,709
2024	Wacahoota RD	-	-	Recon-FDR	$445,980
2025	NW 98 ST	SR 26	NW 39 AV	Rehab (Minor)	$1,322,291
2025	SE 219 AV	-	-	Recon-FDR	$1,903,508
2025	Wacahoota RD	-	-	Recon-FDR	$1,337,824
2026	SE 219 AV	-	-	Recon-FDR	$1,496,492
2026	Wacahoota RD	-	-	Recon-FDR	$5,516,196
2030	CR 235	SR 26	NW 62 AVE	Rehab (Major)	$4,041,200
2031	Millhopper RD	CR 241	NW 90 ST	Rehab (Major)	$4,717,467
2034	CR 235	NW 62 AVE	NW 94 AVE	Rehab (Major)	$4,041,200
2036	Millhopper RD	NW 90 ST	NW 43 ST	Rehab (Major)	$4,717,467
2038	CR 235	NW 94 AVE	SR235 - RR Track Paving Joint	Rehab (Major)	$4,041,200

Table 5 – Annual Budgets for Scenarios 1, 5, & 6

Year	Current Practice		Maintain Condition			Target PCI=70		
	LT[1]	HT[2]	LT	HT	Total	LT	HT	Total
2021/2022	-	$2.34M	-	$2.34M	$2.34M	-	$2.34M	$2.34M
2022/2023	-	$1.5M	-	$1.5M	$1.5M	-	$1.5M	$1.5M
2023/2024	-	$0.94M	-	$0.94M	$0.94M	-	$0.94M	$0.94M
2024/2025	-	$2.16M	-	$2.16M	$2.16M	-	$2.16M	$2.16M
2025/2026	-	$4.56M	-	$4.56M	$4.56M	-	$4.56M	$4.56M
2026/2027	-	$7.0M	-	$7.0M	$7.0M	-	$7.0M	$7.0M
2027/2028	-	$1.79M	$7.0M	$24.5M	$31.5M	$10.5M	$31.0M	$41.5M
2028/2029	-	$1.83M	$7.0M	$24.5M	$31.5M	$10.5M	$31.0M	$41.5M
2029/2030	-	$1.87M	$7.0M	$24.5M	$31.5M	$10.5M	$31.0M	$41.5M
2030/2031	-	$4.04M	$7.0M	$24.5M	$31.5M	$10.5M	$31.0M	$41.5M
2031/2032	-	$4.7M	$7.0M	$24.5M	$31.5M	$10.5M	$31.0M	$41.5M
2032/2033	-	$1.97M	$7.0M	$24.5M	$31.5M	$10.5M	$31.0M	$41.5M
2033/2034	-	$1.97M	$7.0M	$24.5M	$31.5M	$10.5M	$31.0M	$41.5M

Year	Current Practice		Maintain Condition			Target PCI=70		
	LT[1]	HT[2]	LT	HT	Total	LT	HT	Total
2034/2035	-	$4.04M	$7.0M	$24.5M	$31.5M	$10.5M	$31.0M	$41.5M
2035/2036	-	$2.08M	$7.0M	$24.5M	$31.5M	$10.5M	$31.0M	$41.5M
2036/2037	-	$4.72M	$7.0M	$24.5M	$31.5M	$10.5M	$31.0M	$41.5M
2037/2038	-	$2.18M	$7.0M	$24.5M	$31.5M	$10.5M	$31.0M	$41.5M
2038/2039	-	$4.04M	$7.0M	$24.5M	$31.5M	$10.5M	$31.0M	$41.5M
2039/2040	-	$2.2M	$7.0M	$24.5M	$31.5M	$10.5M	$31.0M	$41.5M
2040/2041	-	$2.3M	$7.0M	$24.5M	$31.5M	$10.5M	$31.0M	$41.5M

[1] Low Traffic
[2] High Traffic

An unlimited funding scenario was also run to determine all current network needs. Because the software uses deterioration models developed by Kercher and multi-constraint optimization analysis, the software selects the optimal set of projects for each year based on timing, cost, and benefit to the County. The unlimited funding scenario can be used to prioritize the current list of projects by benefit/cost ratio. Table 6 shows the top ten projects selected based on Benefit-to-cost ratio.

Table 6 – Top 10 B/C ratio projects

Year	Treatment	Project Price	B/C Ratio	Street Name	Begin Location	End Location
2021	Crack Seal	$21,476.00	873.91	N MAIN ST	16 AV	39 AV
2021	Preservation	$280,719.00	773.05	SW 20 AV/SW 24 AV	SW 75 ST	HOGTOWNE CREEK
2021	Rehab (Minor)-Res	$44,147.00	576.60	SW 87 WAY		
2021	Preservation	$410,771.00	566.74	NW COUNTY RD 239		
2021	Preservation	$1,092,000.00	526.44	NW 140 ST / NW 143 ST	SR 26	CR 235
2021	Preservation	$303,319.00	366.70	HOLDEN PARK RD	US 301	CL
2021	Rehab (Minor)	$2,060,151.00	269.89	SW 24 AV	SW 122 ST	SW 75 ST
2021	Rehab (Minor)	$1,365,631.00	267.78	NW/SW 122 ST	SW 24 AV	SR 26
2021	Rehab (Major)	$2,188,800.00	260.73	NW 98 ST	SR 26	NW 39 AV
2021	Rehab (Minor)	$571,330.00	228.63	SW 91 ST	SW 24 AV	SW 8 AV
2021	Rehab (Major)	$1,339,800.00	222.94	FORT CLARKE BLVD		
2021	Rehab (Minor)	$1,746,172.00	204.20	NW 39 AV	NW 143 ST	NW 115 TER

Traffic is part of prioritization in the work plan as B/C ratio. It also modifies the Benefit side of the equation using the following multipliers in optimization (Table 7). Since typical Mill/Fill treatments (Minor Rehab) differ in unit cost by approximately 4.4x ($48.50/$11.00), the Traffic Weight Factor needs be higher than that to compete in free spend scenario. However, in scenarios where the budget is already subdivided by High Traffic and Low Traffic roads, it will not affect treatment selection since they do not have to compete for funds.

Table 7 – Benefit Modifiers - Traffic Weight Factors

Classification (in PMS)	Function (from GIS)	AADT Range	Traffic Weight
A	Subdivision	AADT <= 1,000	1
B	Local / Minor / Major Collector	1,000 < AADT <= 2,500	5
B	Local / Minor / Major Collector	2,500 < AADT <= 5,000	7.5
B	Local / Minor / Major Collector / Minor Arterial	5,000 < AADT <= 10,000	10
B	Major Collector / Minor Arterial	AADT > 10,000	15

D. PCS and Management System

Information provided to the County by the PCS and the optimization analysis using the software includes:

- An updated basic inventory of bituminous paved streets with direction, block, street name, begin and end points, type, length, pavement type, number of lanes, and width.
- Pavement distresses, by type, severity, and extent, along with the PCI for each street segment.
- Recommended repair activities and anticipated repair costs.
- Digital copies of all data, reports, and charts.
- Multiyear budget scenario graphs and charts for County streets.
- A digital list of street sections that includes field inventory data, distress ratings and estimated repair and cost data.

E. Observations

The PCS provides an objective evaluation by visual observation of six types of pavement distress and the relative amount and severity of each type of distress. The following are some observations from the survey:

Surface Defects (SD) – The most predominant distress was found to be Surface Defects (raveling and oxidation). Approximately 97% of the surveyed street system exhibits some level of surface defects. Approximately 9.0% of the streets exhibit high severity surface defects. About 56% of the streets exhibit Medium severity surface defects while 31% of the streets exhibit Low severity surface defects. Surface defects are the result of the wearing away and discoloration of the asphalt surface caused by vehicular traffic, environmental conditions, sun exposure, and age hardening of the asphalt materials. Oxidation and minor surface defects can be cost effectively addressed using treatments such as rejuvenators, Microsurfacing, and other preservation treatments. The timely application of these preservation

treatments can extend the life of the underlying pavement. If not properly managed, the age hardening of asphalt materials will ultimately lead to cracking of the pavement surface.

Fatigue Cracking (FC) – The most structurally damaging and costliest distress to repair is Fatigue Cracking (aka alligator cracking). Approximately 84% of the rated street system exhibits some level of fatigue cracking. About 44% of roadways exhibit a High severity level and about 23% of roadways are at a Medium severity level both of which require full-depth patching. About 18% of roadway exhibits a Low Severity Level. Fatigue cracking is a high priority distress and is the most serious pavement distress because it results from a structural pavement failure, whether by repeated loading from vehicles, or loss of support from underlying layers. Unless corrected, it will progress to the point of requiring complete pavement reconstruction.

Transverse Cracking (TC) – Approximately 54% of the roadway network exhibited transverse cracking. About 2.2% of the roadway network exhibited High severity transverse cracking, 26% exhibited Medium severity transverse cracking, and 26% exhibited Low severity transverse cracking. Transverse cracks are shrinkage cracks caused by the heating and cooling of the asphalt surface and if this environmental distress is not addressed by protecting the surface through preservation treatments, then the crack spacing will decrease until it forms into block cracking. When medium transverse cracks exist with spacing greater than 25 feet, a crack sealant can be used to prevent surface water from entering in the roadway base.

Block Cracking (BC) – Approximately 76% of the surveyed street system exhibits some level of block cracking. About 3% of the roadway network exhibited High severity block cracking, 72% exhibited Medium severity block cracking, and 1% exhibited Low severity block cracking. Like transverse cracks, block cracking is an environmental distress caused by the heating and cooling of the asphalt surface. Block cracking is progressively worse than transverse cracking and if left untreated, will develop into fatigue cracking.

F. Scenario Analysis Results

The Remaining Asset Value (RAV) is a dollar value of the asset based on the asset's condition relative to the total asset replacement value. As explained previously in the Executive Summary, the net worth (or Asset Value) of the County street network is estimated to be approximately $1.5 billion. This estimate is derived by multiplying the number of pavement square yards (approximately 9.8 million square yards) by County defined square yard replacement cost of $156.00. If the entire network is reconstructed irrespective of its current condition, the network PCI would be 100. In other words, the Asset is valued to be $1.5 billion in its perfect/new condition (PCI=100). Obviously, reconstruction for all County streets is not achievable or practical. The Asset Value for Current Condition is calculated by multiplying the Asset Replacement Value by the Current Condition PCI as a percentage of remaining life. Based on the survey, the Asset Value of Current Condition is approximately $920 million. Changes to the asset value based on the scenarios run are summarized in Table 8. This table summarizes the changes in Remaining Asset Value compared to current condition and compared to a Current Budget scenario with project selections based on current practice approach. Usually, a worst first approach is used as a base scenario, however, for Alachua County, a current practice scenario was used as it resembles the worst first approach.

Table 8 – Predictive Modeling Results - Remaining Asset Value

Scenario Name	PCI (Year 20)	20 Year RAV	Change in RAV*	Change in RAV**
Current Condition	60	$920,338,804	N/A	N/A
Sc#1 Current Practice	29	$446,506,735	-$473,832,069	N/A
Sc#2 LT-HT[1] Split ($10M)	40	$615,176,814	-$305,161,990	$168,670,079
Sc#3 LT-HT Split ($15M)	45	$690,946,271	-$229,392,533	$244,439,536
Sc#4 LT-HT Split ($15M) - Start Yr 2023	54	$822,848,739	-$97,490,065	$376,342,004
Sc#5 Maintain Condition	61	$927,496,314	$7,157,510	$480,989,579
Sc#6 Target PCI=70	70	$1,076,877,562	$156,538,758	$630,370,827

*With Respect to Current Condition

** From Baseline Current Practice Approach

[1] LT= Low Traffic Routes, HT = High Traffic Routes

Key takeaways from the predictive modeling and survey results:

Figure 11 and Figure 12 below show the current condition of the Alachua County network, as well as a comparison between current budget and the rest of the analysis scenarios.

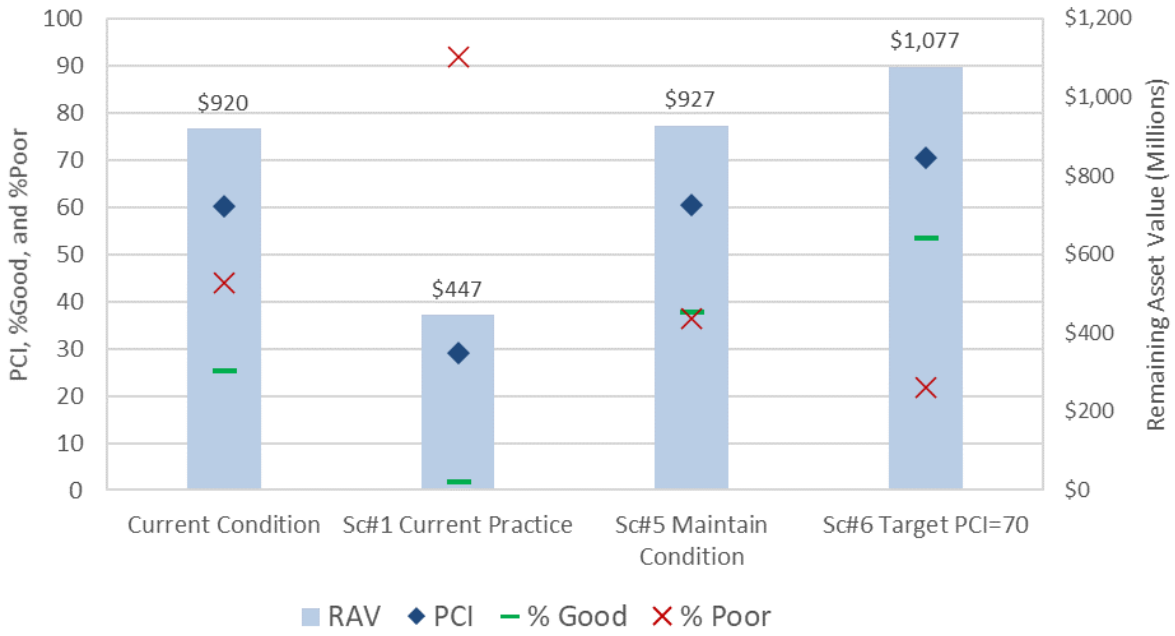


Figure 11 – Summary of Current Condition and Analysis Scenarios 1, 5, & 6.

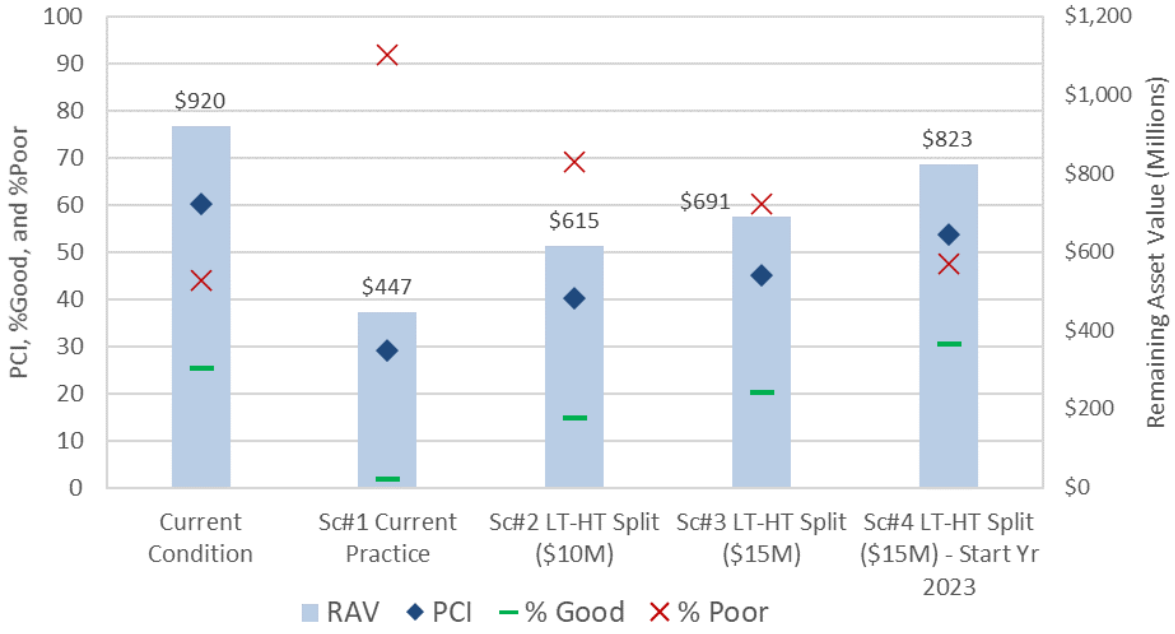


Figure 12 – Summary of Current Condition and Analysis Scenarios 1, 2, 3, & 4.

Following is the summary of the scenario analyses runs and their outcomes:

- ***Current Condition***
  - The County has an average PCI of 60.
  - Currently the County has a RAV of $920.3M.
  - Network % Good: 25.
  - Network % Poor: 43.9.

- ***Scenario #1 Current Practice***
  - If the average allocated funding per year is $2.87M (including planned projects) for the next 20 years (2021-2040) and only HT network (Locals, Collectors, Arterials) Rehabilitation and Reconstruction projects are funded, and an optimized project selection approach is used:
    - The PCI will decrease to 29.
    - The RAV will decrease to $446.5M.
    - Network % Good will decrease to 1.7.
    - Network % Poor will increase to 91.9.

- ***Scenario #2 LT-HT Split ($10M)***
  - If the average allocated funding per year is $10M from year 2027 to 2040 and the funding is split between HT ($7M) and LT ($3M) Rehabilitation and Reconstruction projects, and an optimized project selection approach is used:
    - The PCI will decrease to 40.
    - The RAV will decrease to $615.2M.
    - Network % Good will decrease to 14.7.
    - Network % Poor will increase to 69.1.

- ***Scenario #3 LT-HT Split ($15M)***
  - If the average allocated funding per year is $15M from year 2027 to 2040 and the funding is split between HT ($10M) and LT ($5M) Rehabilitation and Reconstruction projects, and an optimized project selection approach is used:
    - The PCI will decrease to 45.1.
    - The RAV will decrease to $690.9M.
    - Network % Good will decrease to 20.2.
    - Network % Poor will increase to 60.3.

- ***Scenario #4 LT-HT Split ($15M) – Start Yr. 2023***
  - If the average allocated funding per year is $15M from year 2023 to 2040 and the funding is split between HT ($10M) and LT ($5M) Rehabilitation and Reconstruction projects, and an optimized project selection approach is used:
    - The PCI will decrease to 53.7.
    - The RAV will decrease to $822.8M.
    - Network % Good will increase to 30.4.
    - Network % Poor will increase to 47.4.

- ***Scenario #5 Maintain Condition***

  - If the average allocated funding per year is $31.5M from year 2027 to 2040 and the funding is split between HT ($24.5M) and LT ($7M) Rehabilitation and Reconstruction projects, and an optimized project selection approach is used:
    - The PCI will maintain at about 61 for both HT and LT roads and consequently the whole network.
    - The RAV will increase to $927.5M
    - Network % Good will increase to 37.7.
    - Network % Poor will decrease to 36.3.

- ***Scenario #6 Target PCI = 70***
  - If the average allocated funding per year is $41.5M from year 2027 to 2040 and the funding is split between HT ($31.0M) and LT ($10.5M) Rehabilitation and Reconstruction projects, and an optimized project selection approach is used:
    - The PCI will increase to 70 for both HT and LT roads and consequently the whole network.
    - The RAV will increase to $1,076.9M.
    - Network % Good will increase to 53.3.
    - Network % Poor will decrease to 21.8.

G. Recommendations

Kercher recommends the following:

- **Funding** – The County should consider increasing funding for its roadway pavements to protect the investment in this critical asset.
- **Regular Pavement Condition Surveys (PCS)** – The County should continue to conduct a PCS every 3 years; this interval is recommended by FHWA and is a nationally accepted practice.
- **Rejuvenators** – The County should consider the use of rejuvenators to prolong the life of its asphalt pavement network. Rejuvenators, when applied to newly overlaid streets (typically 1 to 4 years old), will preserve the plasticity and durability of the asphalt which will effectively extend the life of the pavement by resisting the age hardening of the asphalt surface that leads to cracking.
- **Pavement Preservation** –The County should consider expanding its pavement preservation treatment toolbox to include additional thin lift treatments such as a single application Microsurfacing or ultra-thin asphalt overlays in order to maximize its yearly roadway funding. Microsurfacing and ultra-thin asphalt overlays are cost-effective treatments, and when applied correctly, can be applied earlier than conventional thin rehabs and will allow the County to maintain the roads at a higher level of service for the least amount of money. The typical cost of these treatments range between $2.00 to $7.00 per square yard as compared to Rehab (Minor) which costs the County $48.50 per square yard. Implementation of a successful pavement preservation program includes educating both County personnel and its citizens to better understand why it is more cost-effective to have a balanced approach (the right mix of fixes) as opposed to simply always fixing the roads in worst shape.

H. Conclusion

Roadway Assets: This is the first LTPP pavement condition survey and optimization analysis conducted by Alachua County and therefore serves to provide a baseline pavement condition. The County is to be commended for taking this important step to protect its greatest infrastructure asset by assessing the condition and understanding its predicted performance over time. Assuming that the current level of funding for pavements remains unchanged, the overall pavement condition will deteriorate over the next twenty years based upon the software predictions. With the information presented above, it is recommended that the County continue taking steps to reverse this expected downward trend in pavement condition and reevaluate the funding decisions impacting the County-wide pavement network. The County does not currently utilize a preservation approach and in fact has very few candidates for preservation treatments due to the advanced level of deterioration present. However, the County could also see immediate benefits from expanding its pavement treatment toolbox to include broader use of available preservation treatments for those few candidates that currently exist and as the network improves with additional funding in the future, continue to focus funds to keeping the "good roads good". The County should also continue to leverage the Pavement Management Software optimization analysis for predicting the future condition of the network and selecting the mix of projects for its annual program of work that maximizes performance based upon the available budget.

***Software Performance Models*:** Pavement performance models were not specifically developed for the pavements within the County. The development of performance models is a complex process and requires vast amounts of quality pavement condition data and construction history records. The Software system utilized performance models developed by Kercher based upon actual experience and validation on similar street networks in the region. Factors that can affect pavement performance include pavement design, quality of construction, soil types, traffic volume and the infusion of money over and above the current funding (≈$4M/Yr.). As the County performs future pavement condition surveys and records its construction history over time, data points will be established for the County which will allow the correction of the performance models as necessary, which will provide more accurate estimates of funding needs.

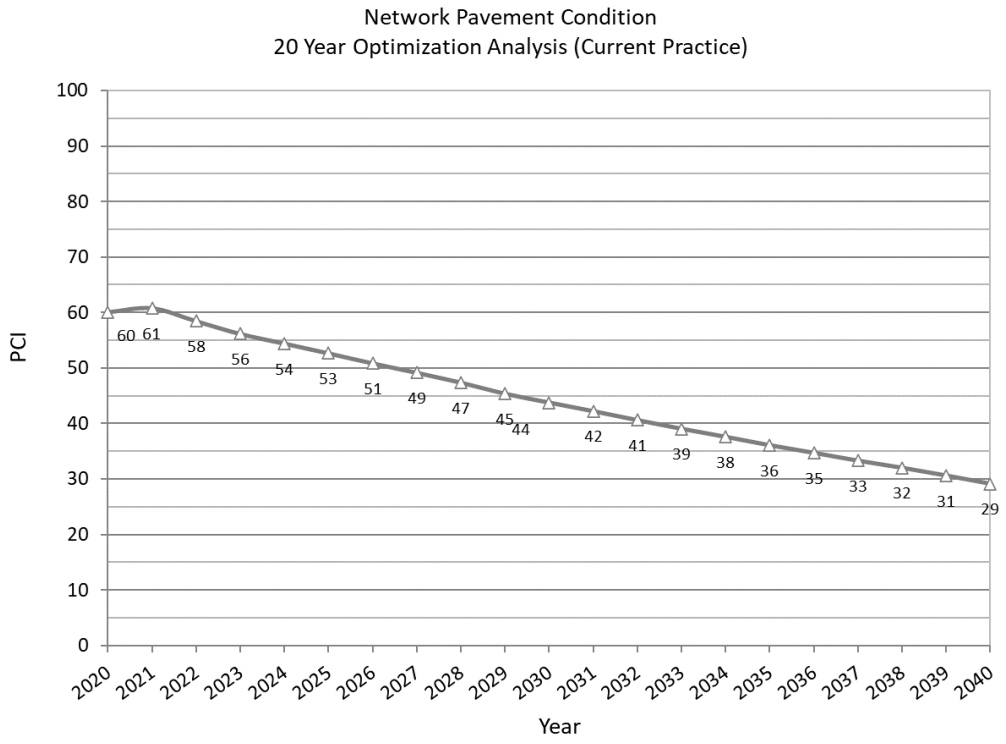
Other Assets: The County is encouraged to consider assessing other infrastructure assets in a similar fashion to perform these types of analyses to determine the overall budgeting needs for the County's infrastructure. It would be extremely cost-effective to extend the use of the AgileAssets software to assist the County in coordinating infrastructure maintenance and construction projects to avoid overlaps in scheduling of projects. This would help to avoid the challenge faced in maintaining the pavements that occurs when money is spent to repair a road and shortly thereafter the road is cut open to replace a culvert or utility. Cross-asset coordination greatly alleviates these types of costly occurrences. Currently, the County is using funds that should be allocated to addressing pavement needs to pay for additional assets. The County should consider a separate, dedicated funding mechanism for improving the pavement network and fund ancillary asset repairs from other sources.

APPENDICES

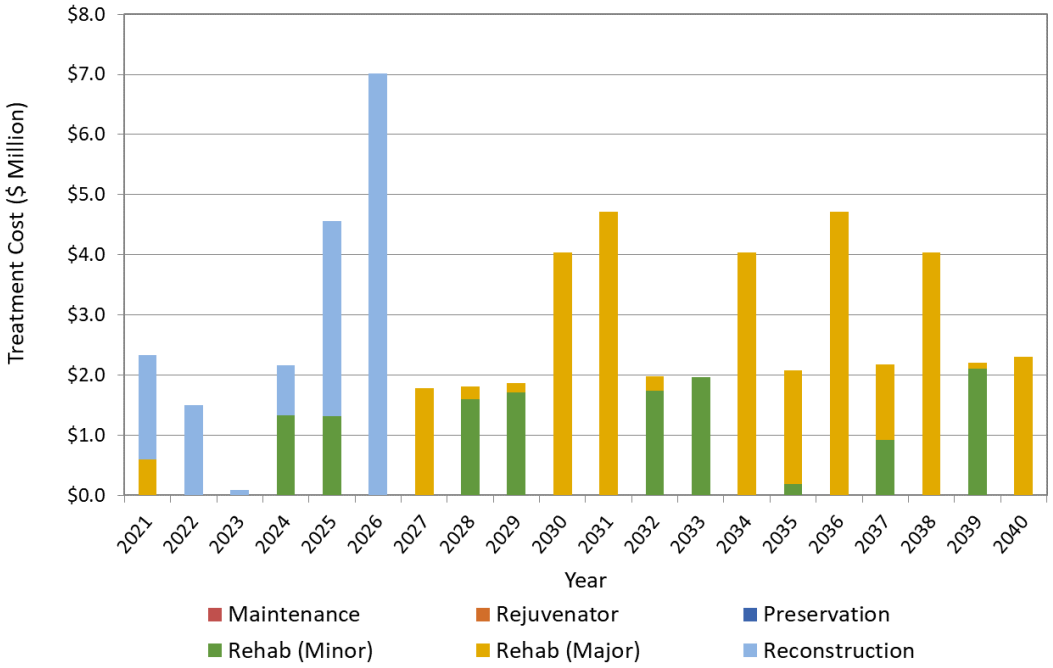
Appendix A- Graphs and Charts

Scenario #1 Current Practice - Only HT Rotues funded ($4M/year)

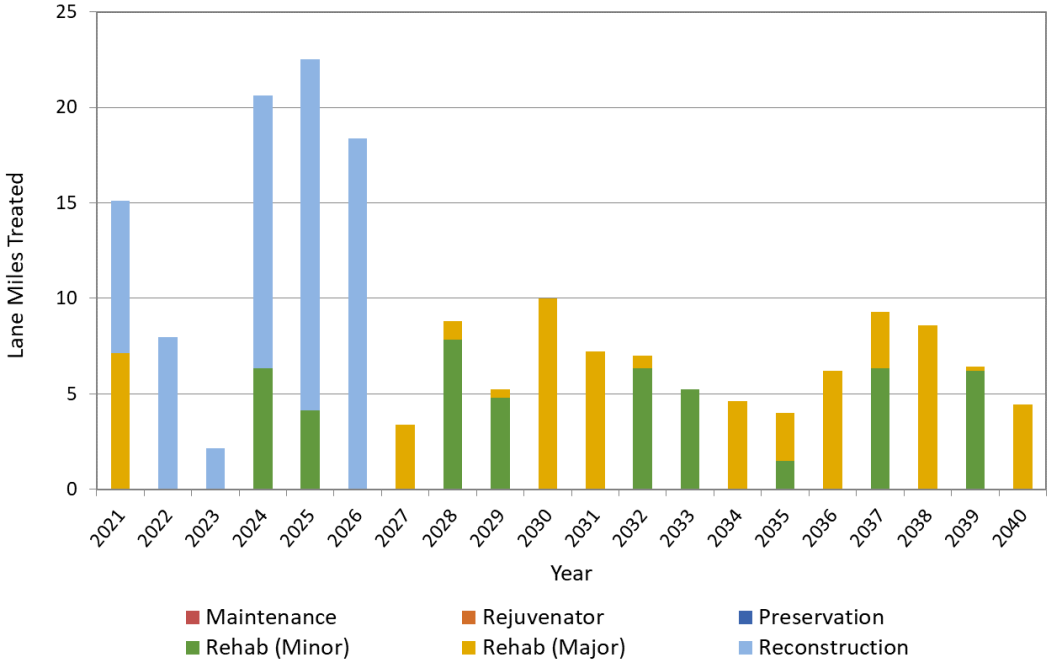
Whereas HT = High Traffic Routes



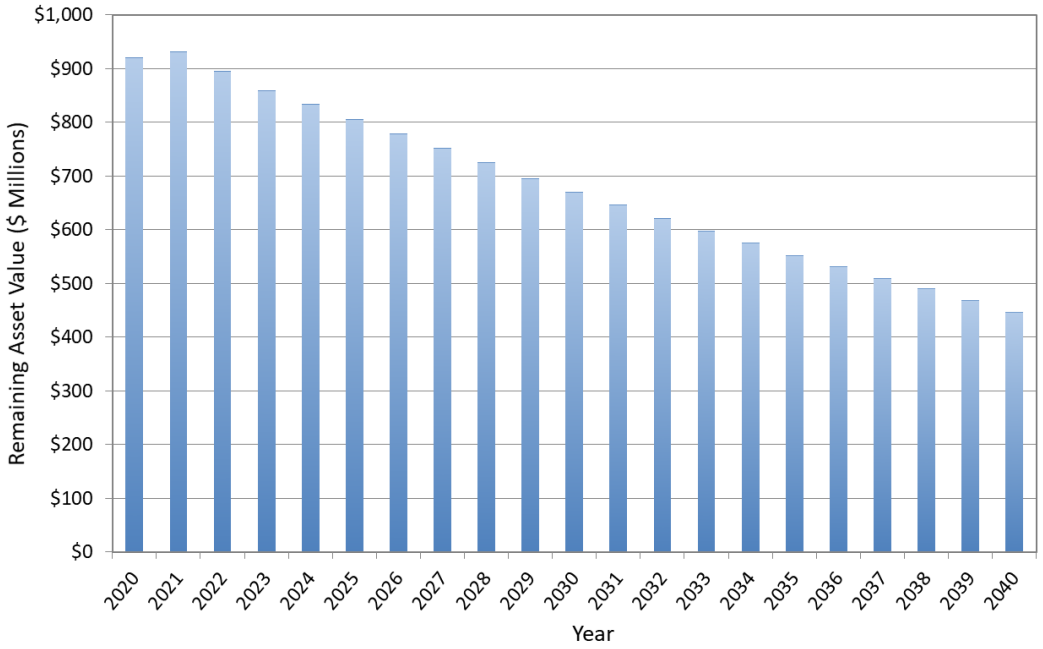
Budget Breakout by Selected Treatment
20 Year Optimization Analysis (Current Practice)



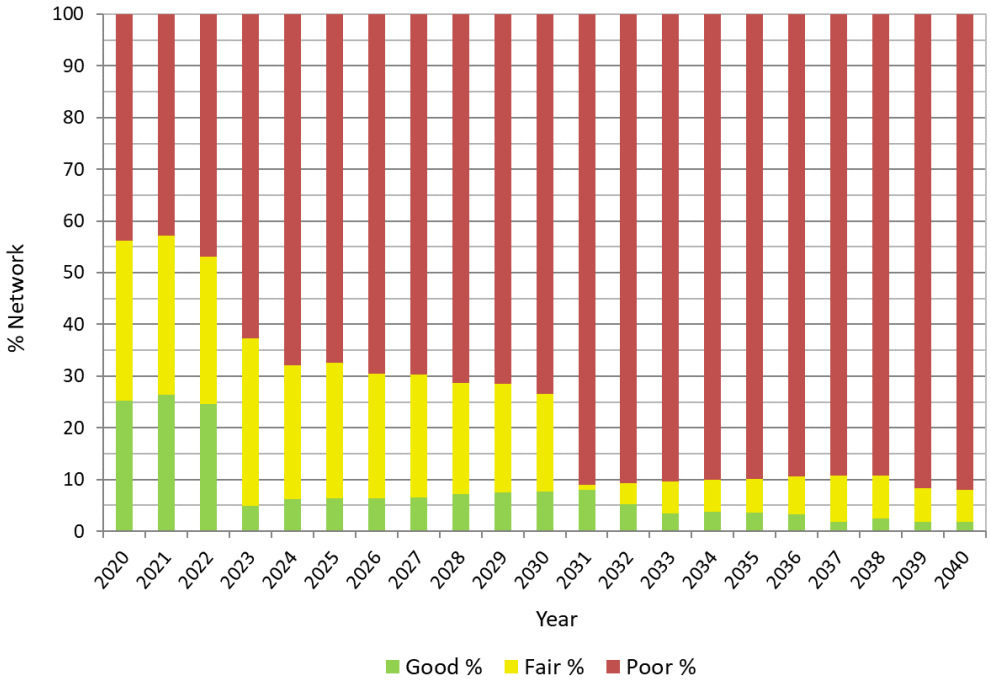
Treated Lane Miles for Applied Budget
20 Year Optimization Analysis (Current Practice)



Remaining Asset Value
20 Year Optimization Analysis (Current Practice)

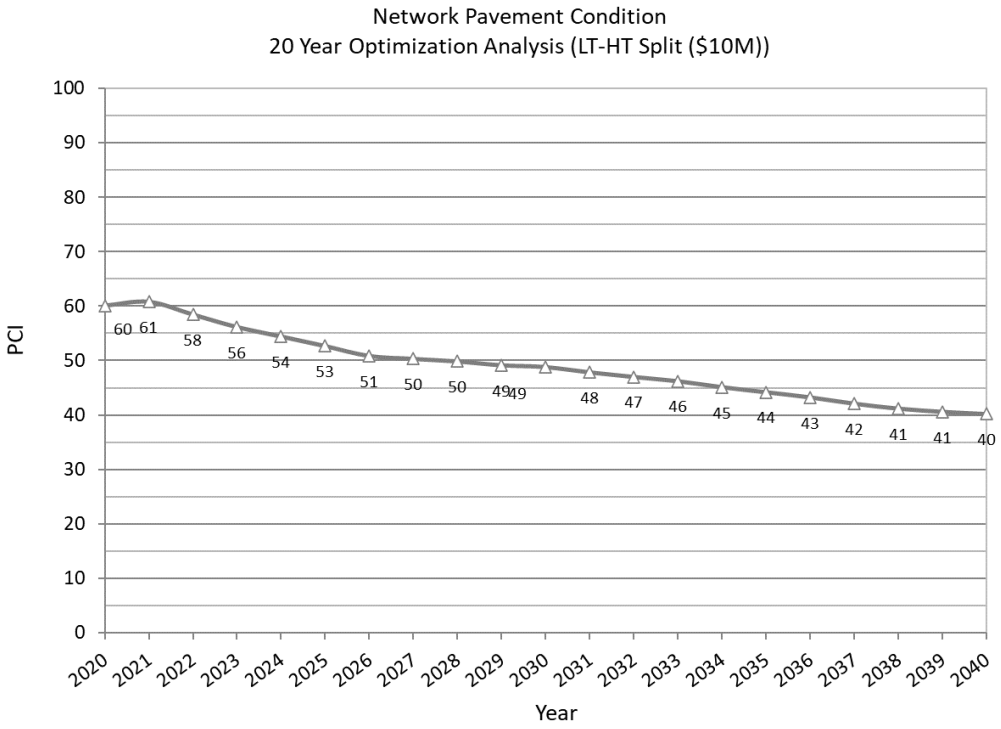


Network Condition Category
20 Year Optimization Analysis (Current Practice)

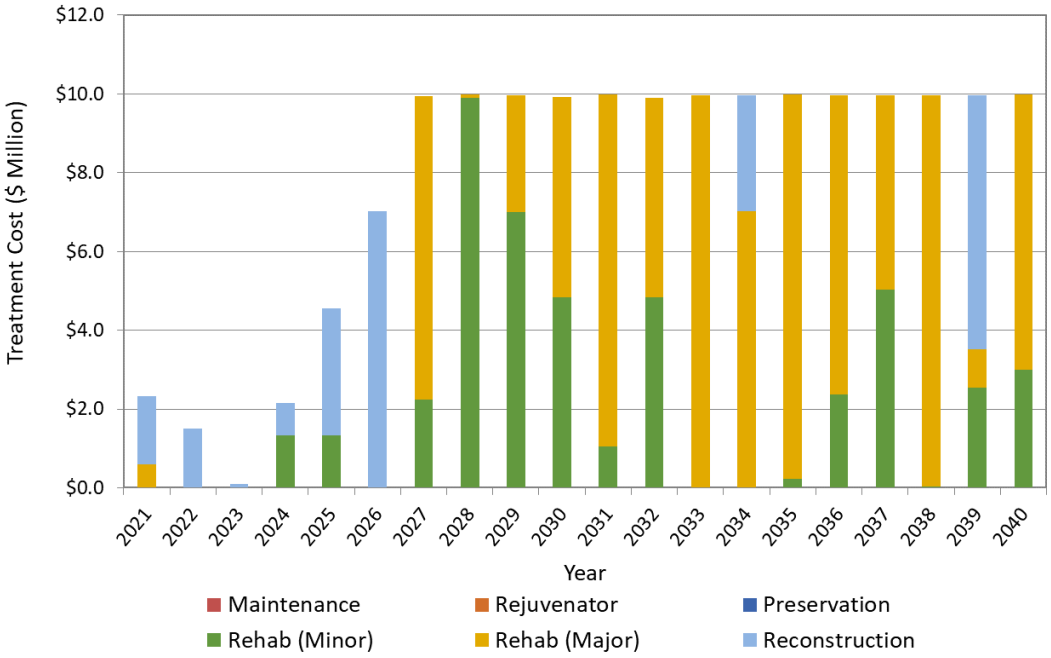


Scenario #2 LT-HT Split ($10M/year)

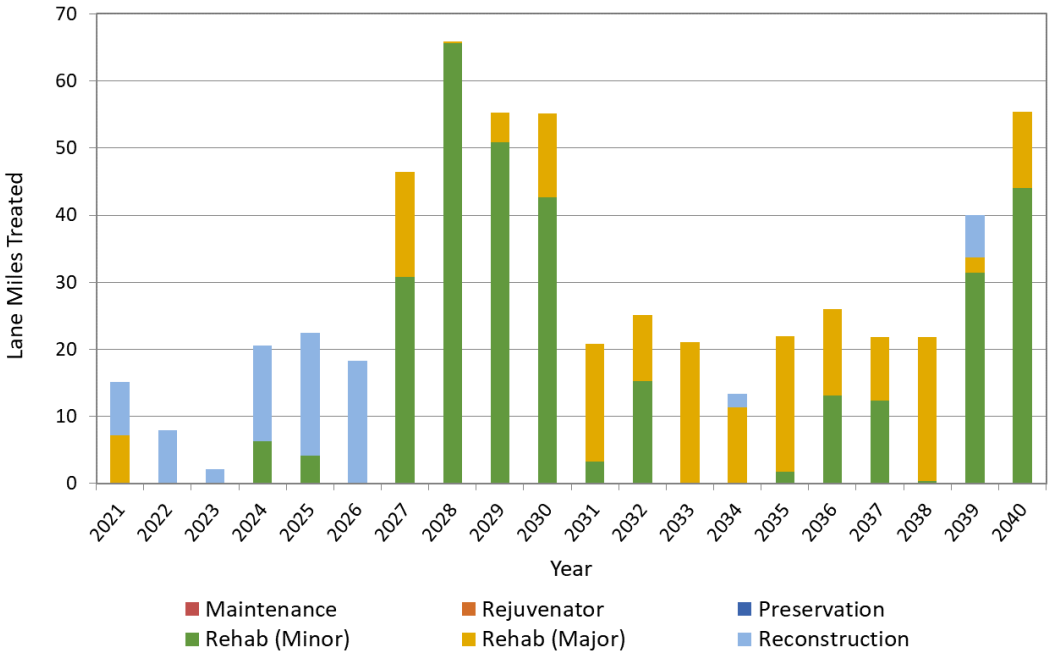
Whereas LT = Low Traffic Routes, HT = High Traffic Routes



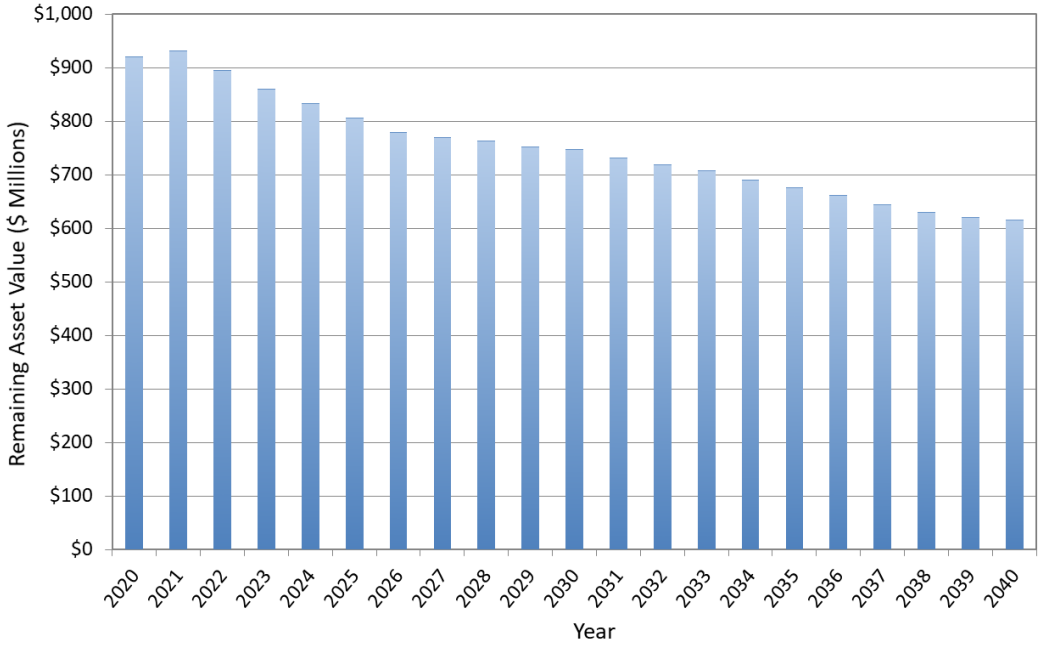
Budget Breakout by Selected Treatment
20 Year Optimization Analysis (LT-HT Split ($10M))



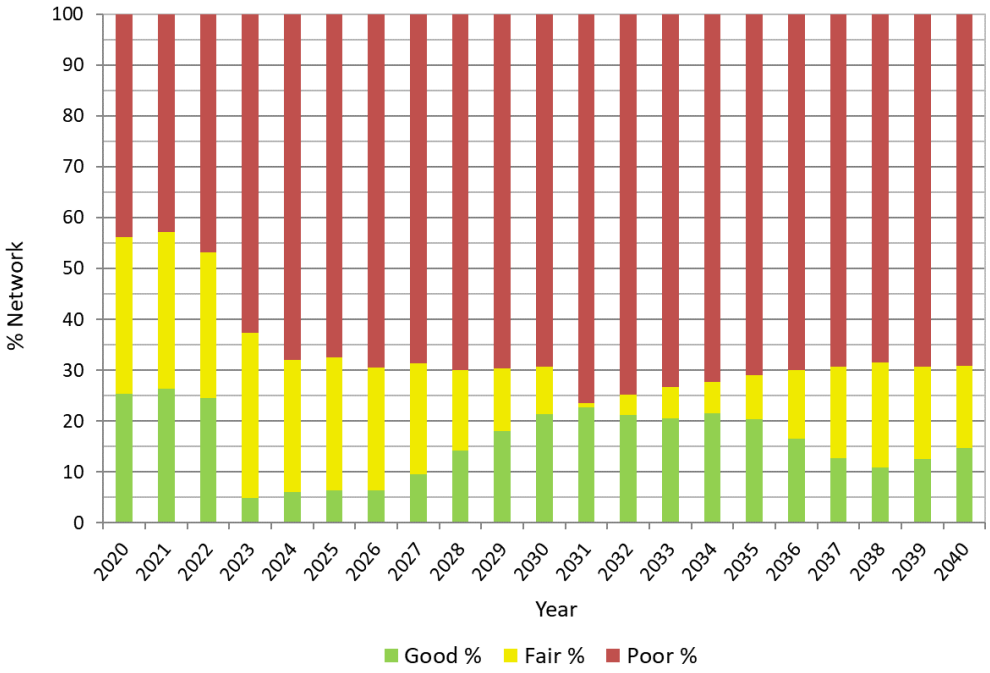
Treated Lane Miles for Applied Budget
20 Year Optimization Analysis (LT-HT Split ($10M))



Remaining Asset Value
20 Year Optimization Analysis (LT-HT Split ($10M))

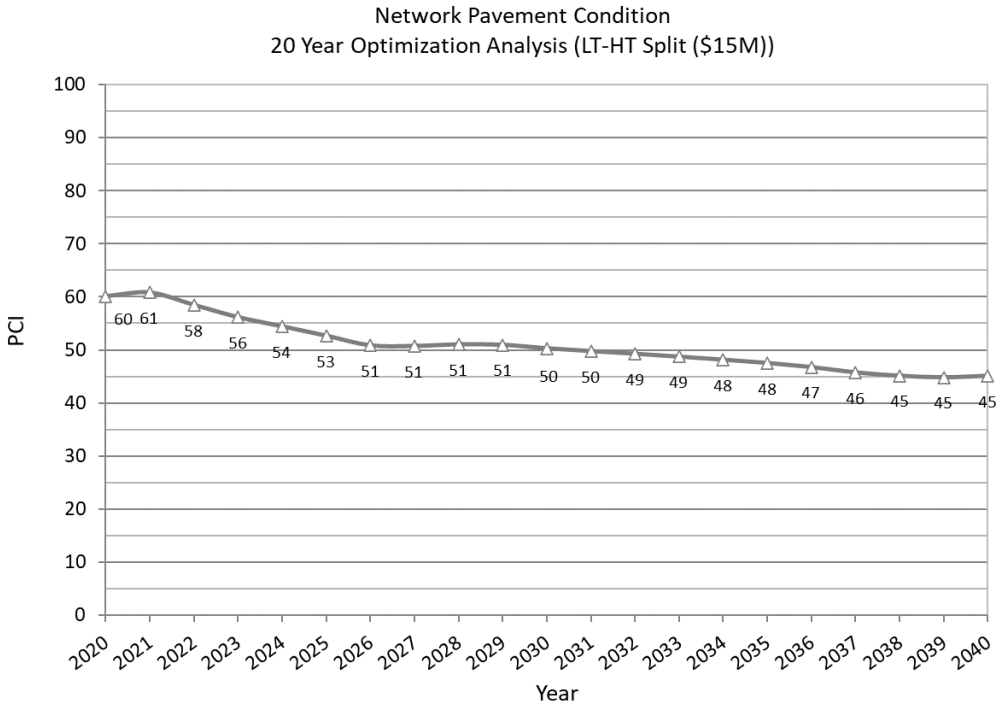


Network Condition Category
20 Year Optimization Analysis (LT-HT Split ($10M))

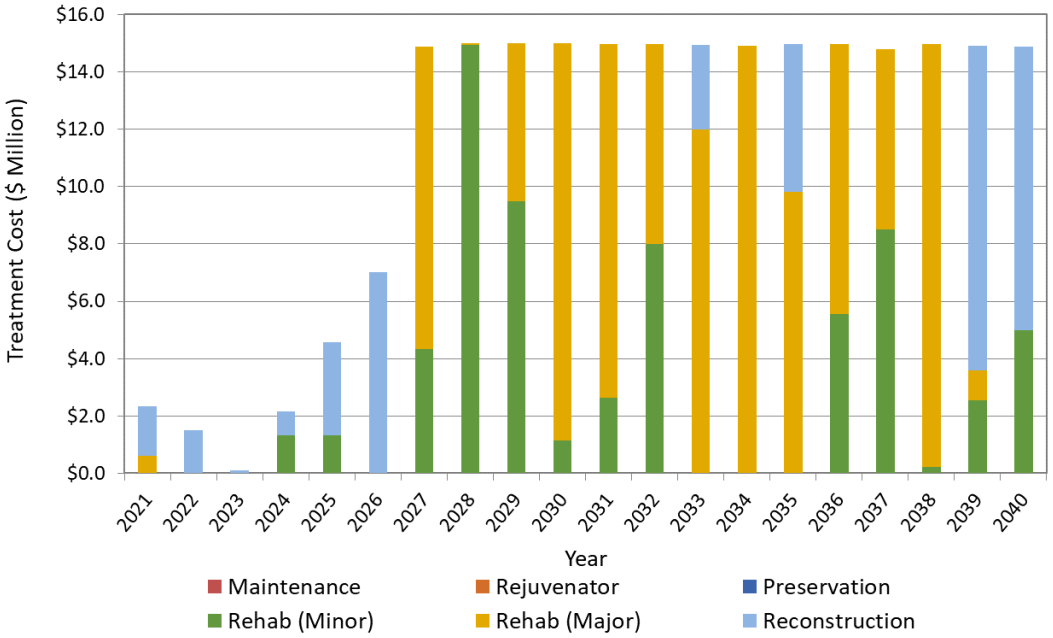


Scenario #3 LT-HT Split ($15M/year)

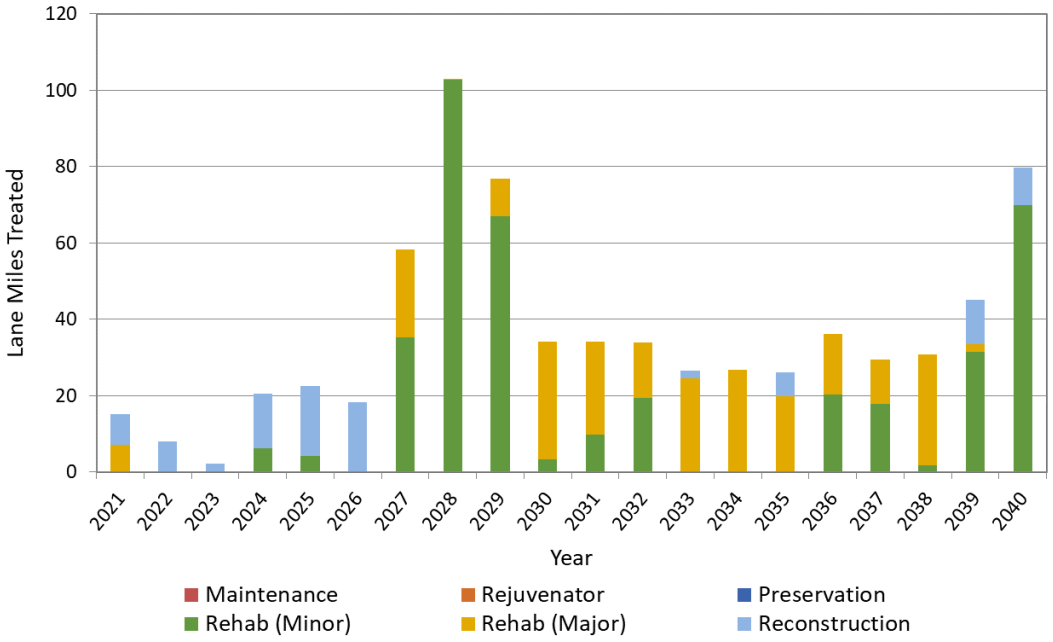
Whereas LT = Low Traffic Routes, HT = High Traffic Routes

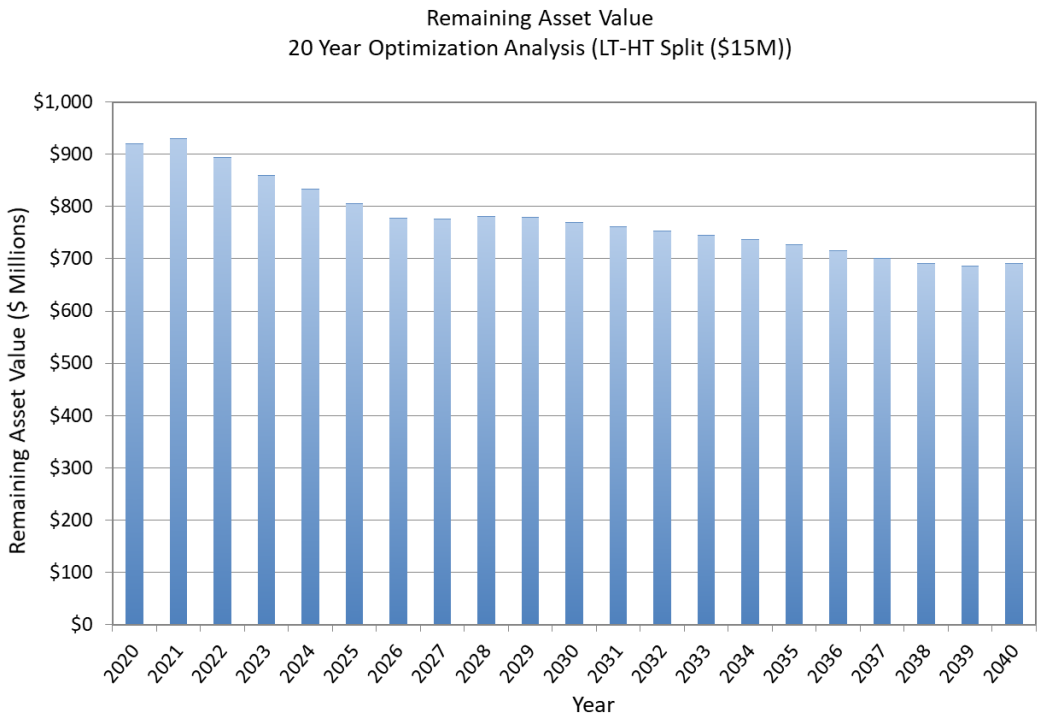


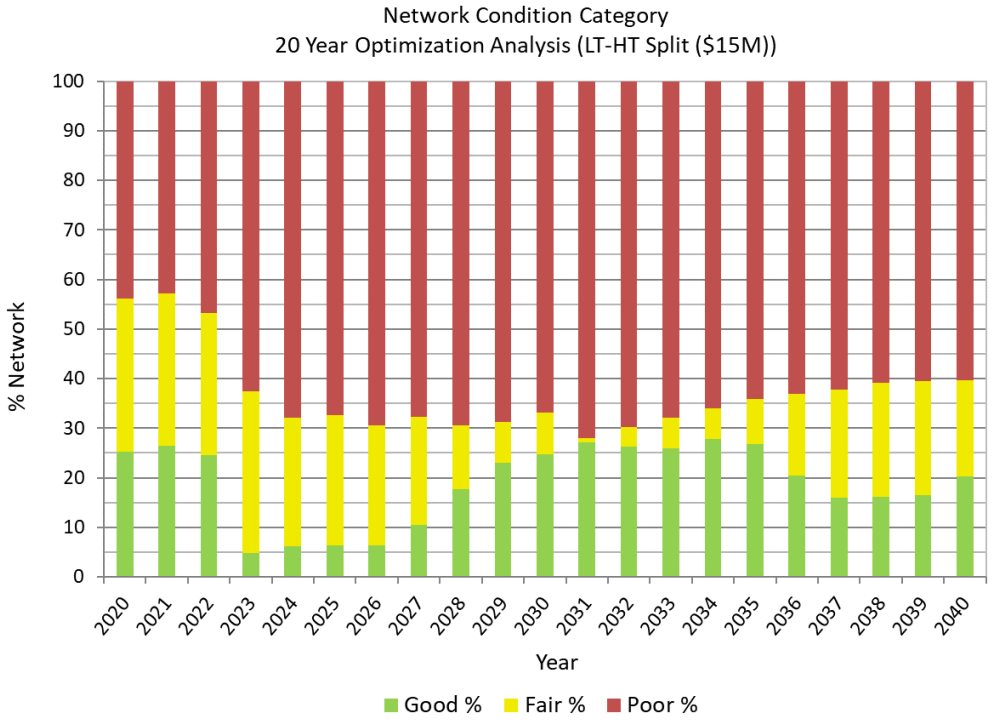
Budget Breakout by Selected Treatment
20 Year Optimization Analysis (LT-HT Split ($15M))



Treated Lane Miles for Applied Budget
20 Year Optimization Analysis (LT-HT Split ($15M))

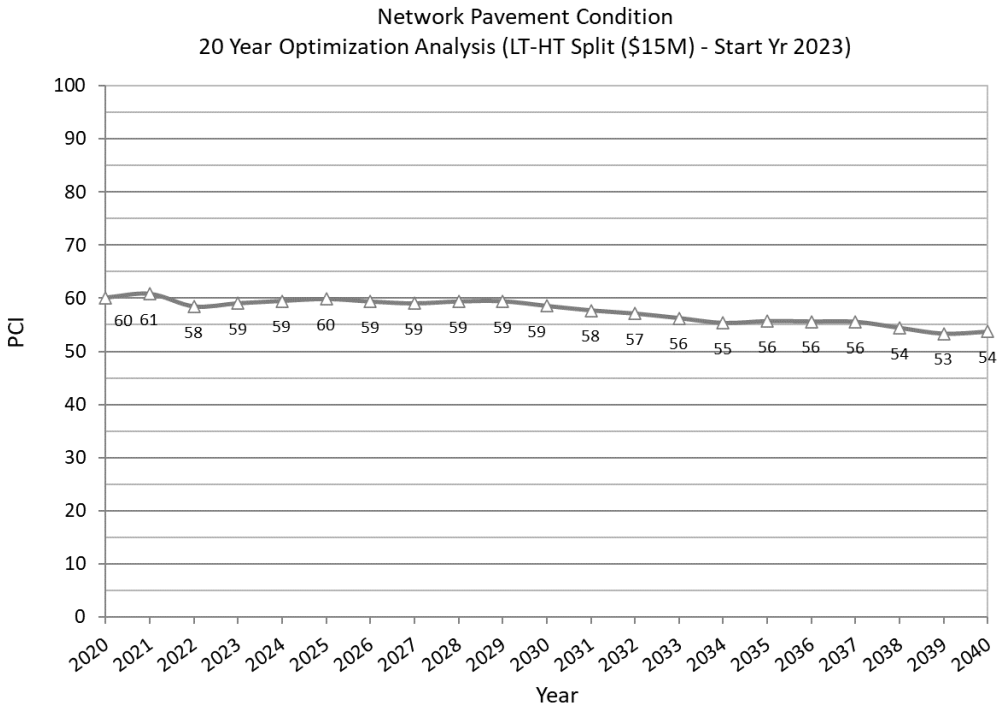


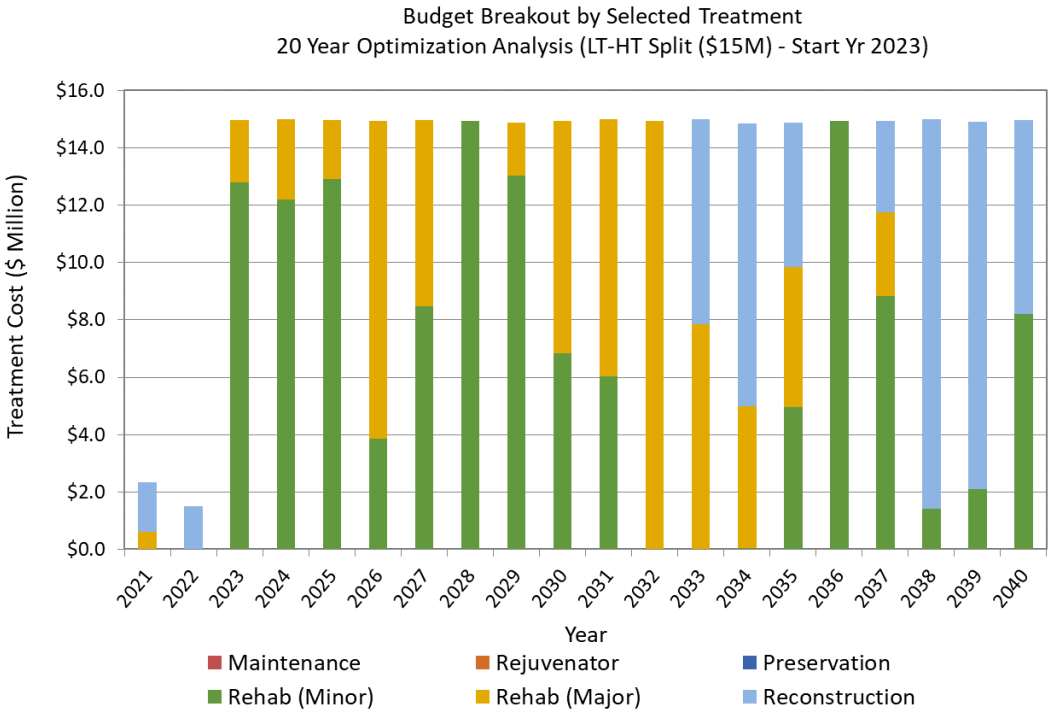

Remaining Asset Value
20 Year Optimization Analysis (LT-HT Split ($15M))
Remaining Asset Value ($ Millions)
$1,000
$900
$800
$700
$600
$500
$400
$300
$200
$100
$0
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
Year

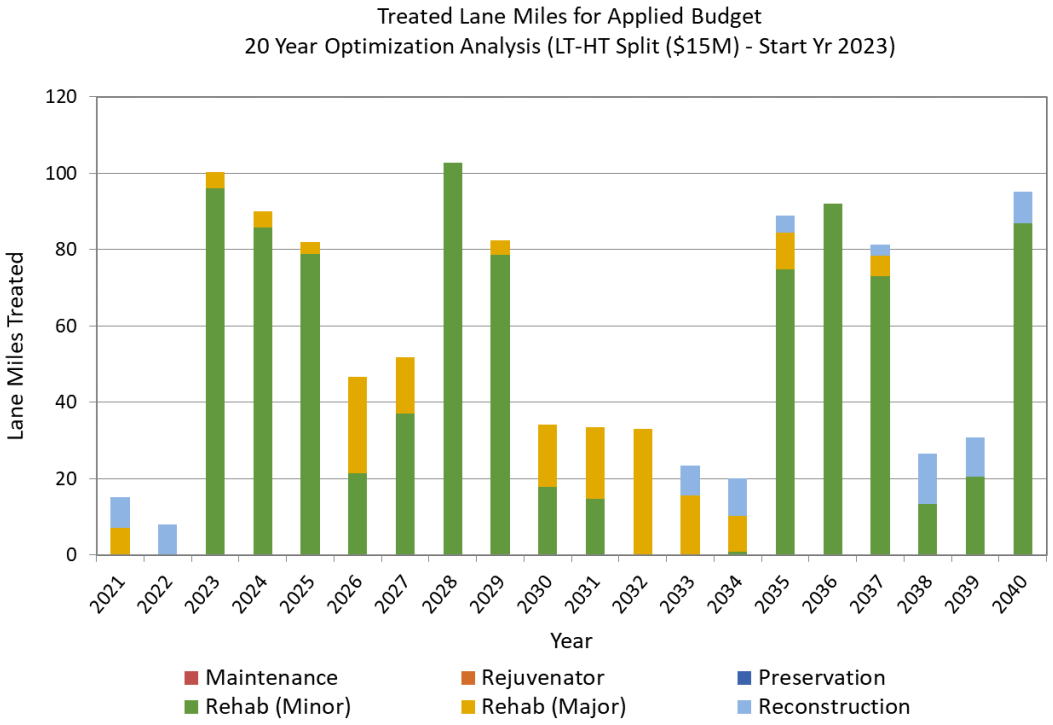

Network Condition Category
20 Year Optimization Analysis (LT-HT Split ($15M))
% Network
100
90
80
70
60
50
40
30
20
10
0
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
Year
Good %
Fair %
Poor %

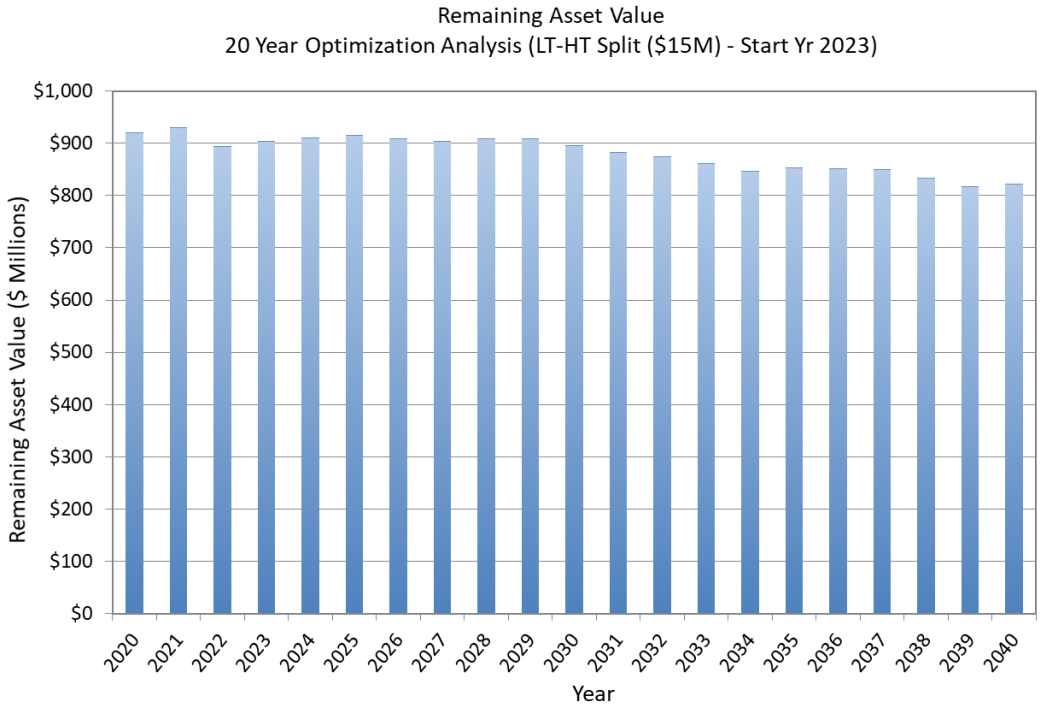
Scenario #4 LT-HT Split ($15M/year) – Start Yr. 2023

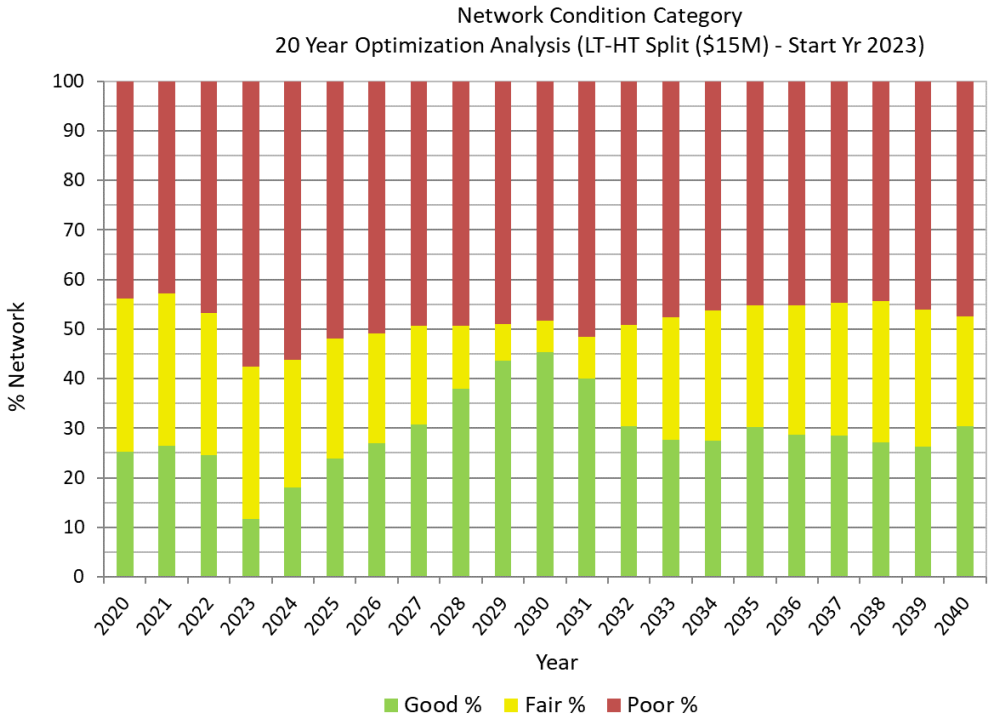
Whereas LT = Low Traffic Routes, HT = High Traffic Routes



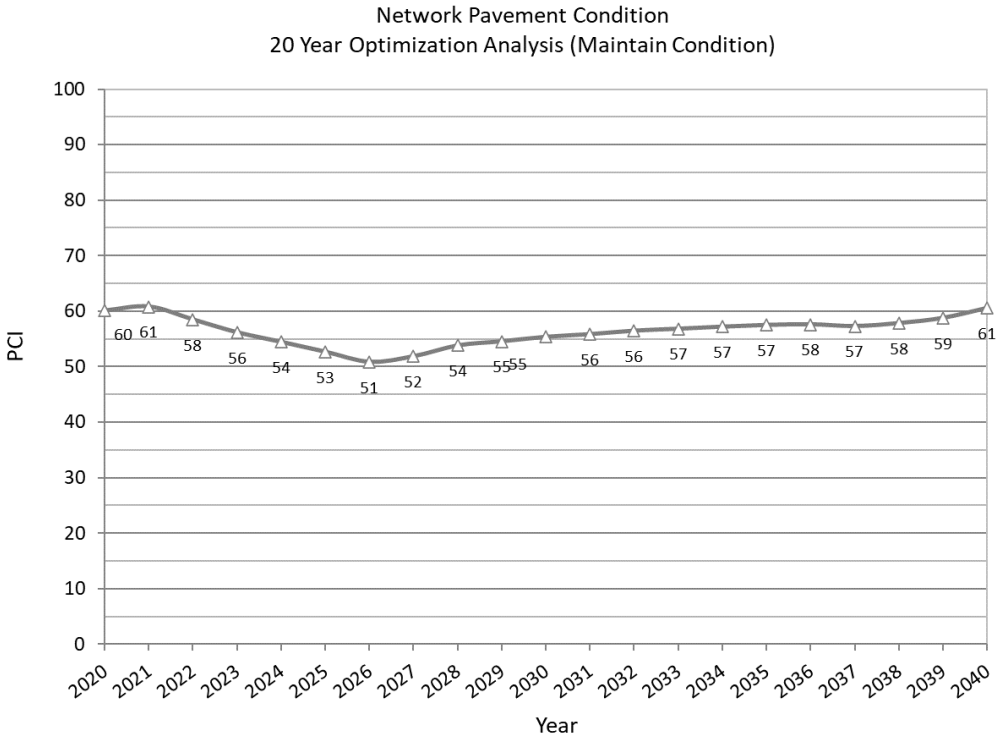

Budget Breakout by Selected Treatment
20 Year Optimization Analysis (LT-HT Split ($15M) - Start Yr 2023)
Treatment Cost ($ Million)
$16.0
$14.0
$12.0
$10.0
$8.0
$6.0
$4.0
$2.0
$0.0
2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
Year
Maintenance
Rejuvenator
Preservation
Rehab (Minor)
Rehab (Major)
Reconstruction


Treated Lane Miles for Applied Budget
20 Year Optimization Analysis (LT-HT Split ($15M) - Start Yr 2023)
Lane Miles Treated
120
100
80
60
40
20
0
2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
Year
Maintenance
Rejuvenator
Preservation
Rehab (Minor)
Rehab (Major)
Reconstruction

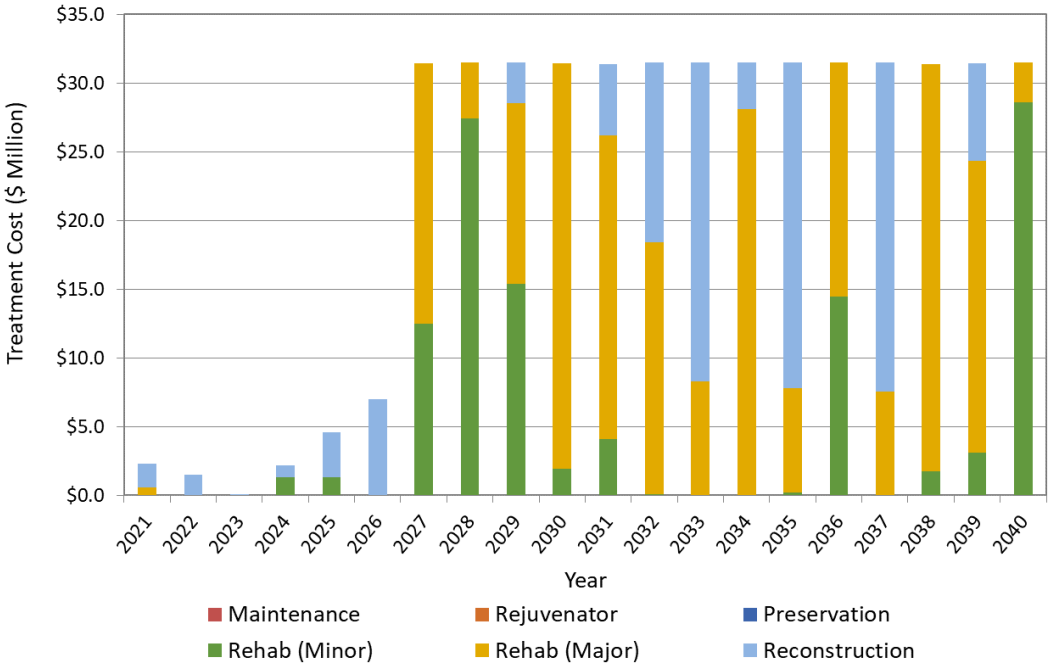

Remaining Asset Value
20 Year Optimization Analysis (LT-HT Split ($15M) - Start Yr 2023)
Remaining Asset Value ($ Millions)
$1,000
$900
$800
$700
$600
$500
$400
$300
$200
$100
$0
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
Year


Network Condition Category
20 Year Optimization Analysis (LT-HT Split ($15M) - Start Yr 2023)
% Network
100
90
80
70
60
50
40
30
20
10
0
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
Year
Good %
Fair %
Poor %

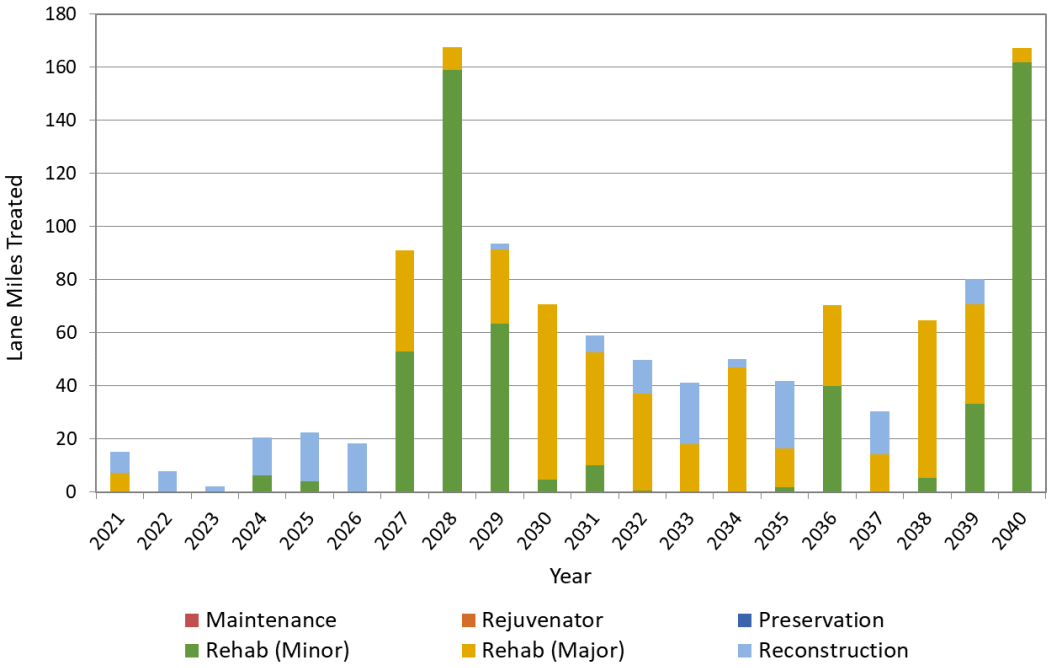
Scenario #5 Maintain Condition (PCI = 60) - $31.5M/year 2027 onward



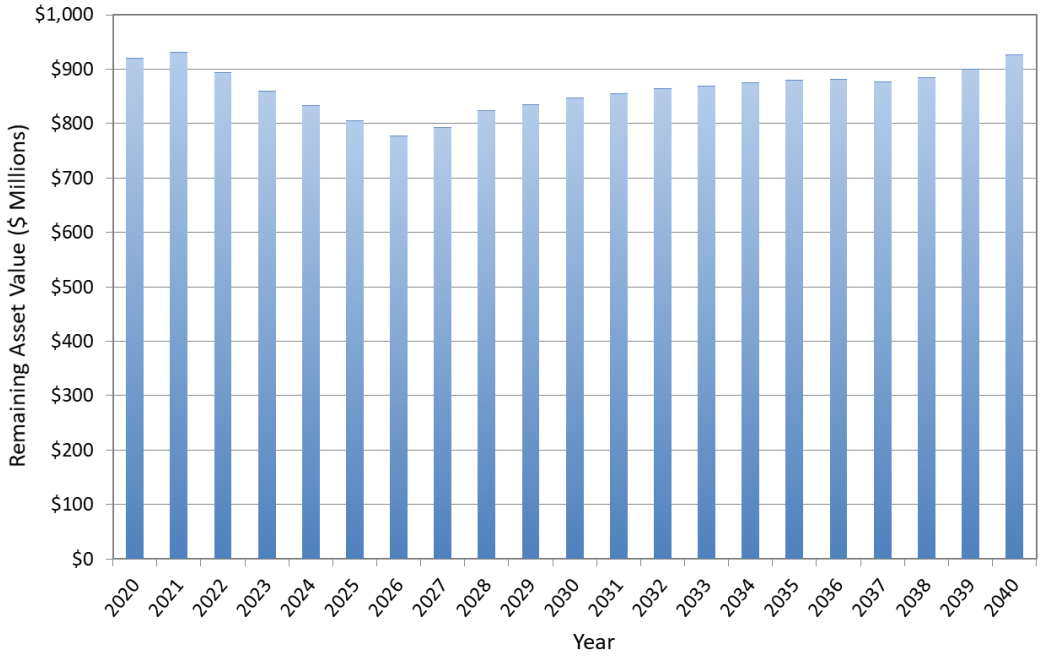
Budget Breakout by Selected Treatment
20 Year Optimization Analysis (Maintain Condition)



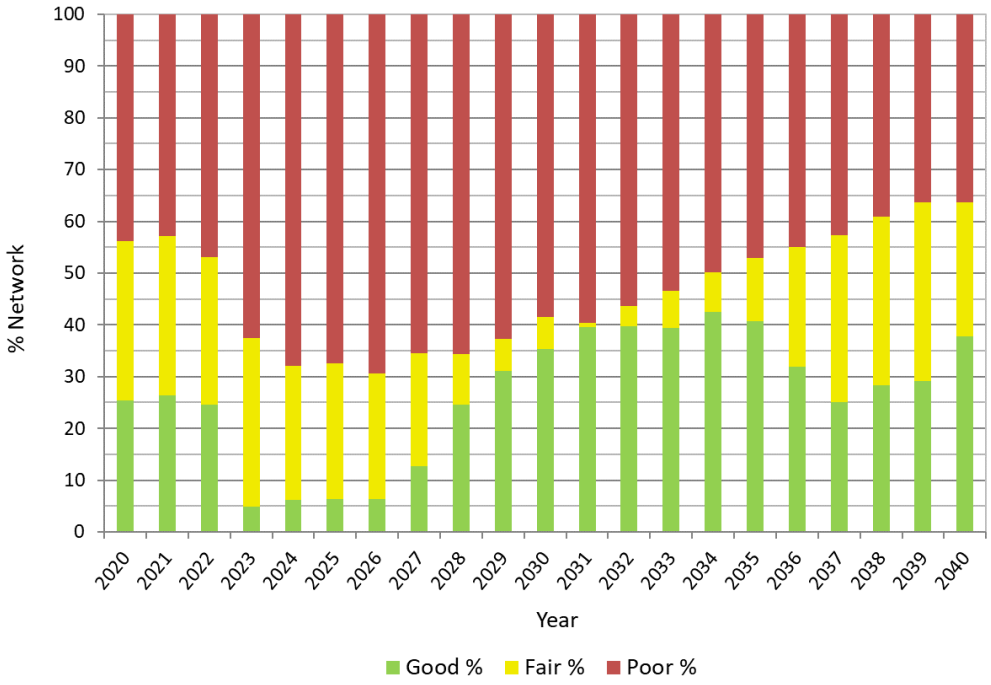
Treated Lane Miles for Applied Budget
20 Year Optimization Analysis (Maintain Condition)



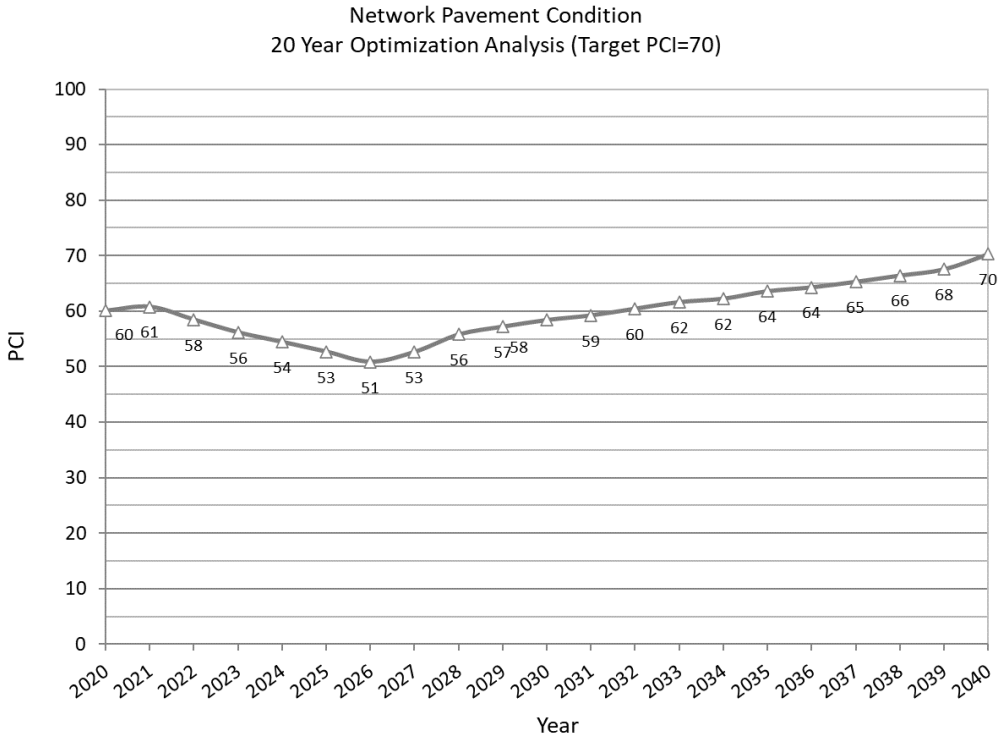
Remaining Asset Value
20 Year Optimization Analysis (Maintain Condition)



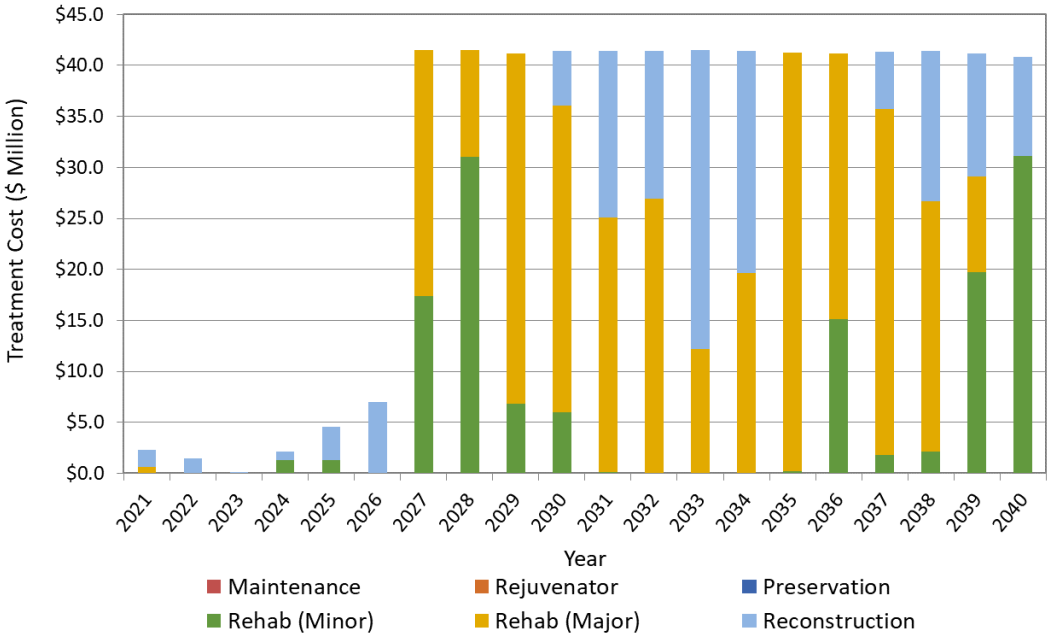
Network Condition Category
20 Year Optimization Analysis (Maintain Condition)



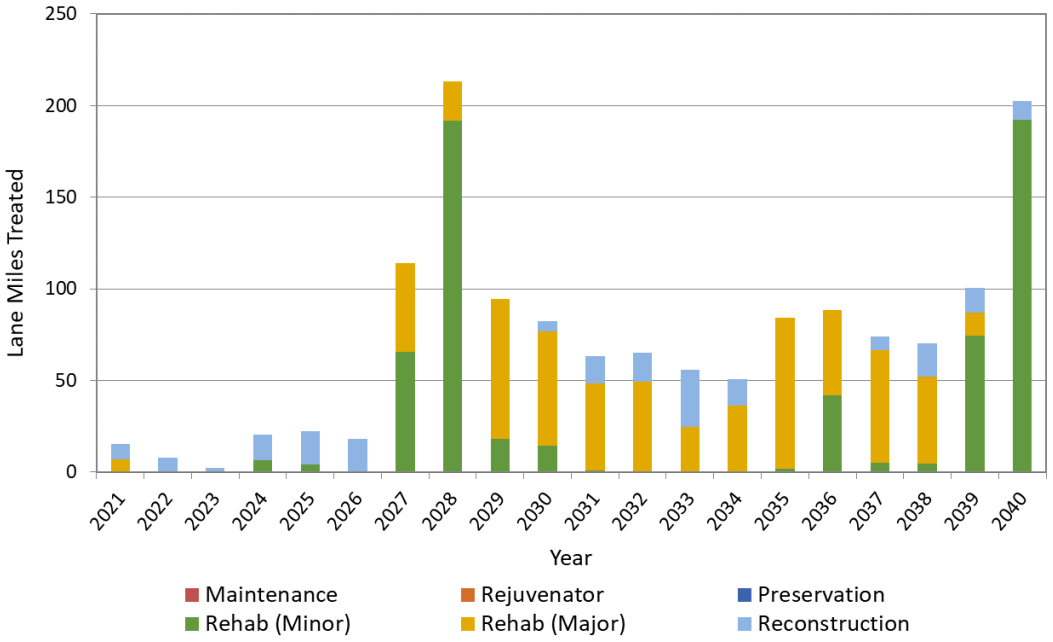
Scenario #6 Target PCI = 70 - $41.5M/year 2027 onward



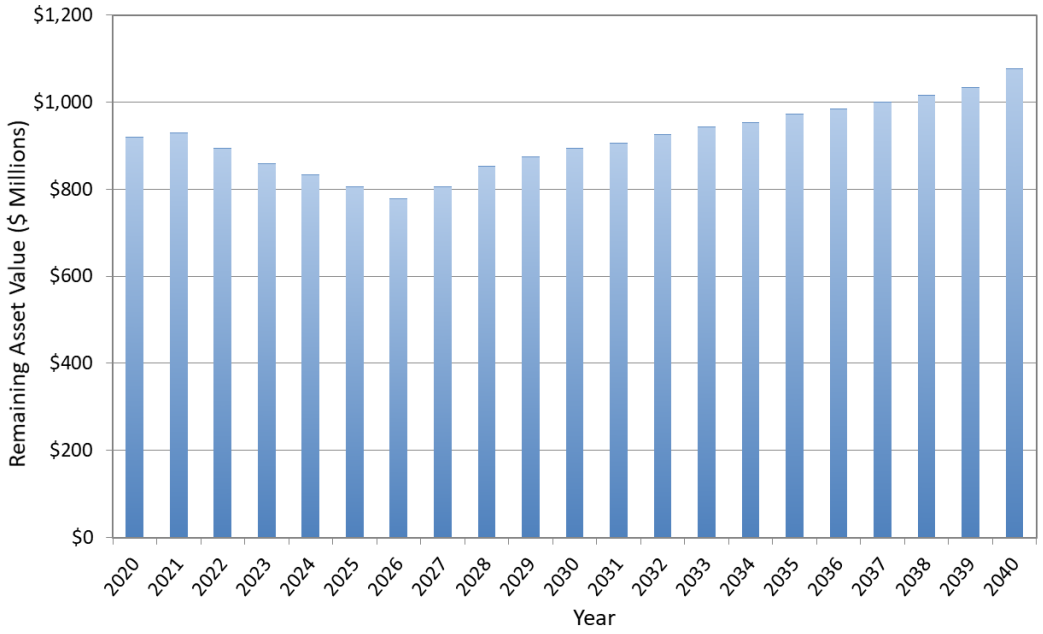
Budget Breakout by Selected Treatment
20 Year Optimization Analysis (Target PCI=70)



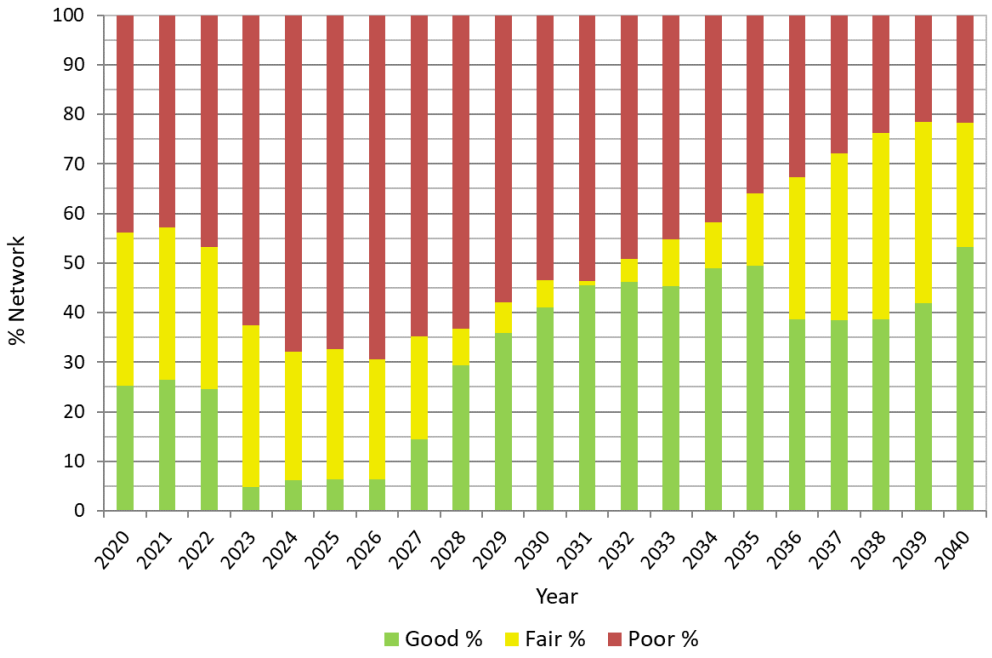
Treated Lane Miles for Applied Budget
20 Year Optimization Analysis (Target PCI=70)



Remaining Asset Value
20 Year Optimization Analysis (Target PCI=70)



Network Condition Category
20 Year Optimization Analysis (Target PCI=70)



Appendix B- Distress Definitions

DISTRESS DEFINITIONS

The distresses identified and classified for each road segment were collected in accordance with FHWA-RD-03-031, Distress Identification Manual for the Long-Term Pavement Performance Project (June 2003). The following distresses were collected:

- Fatigue Cracking (FC – Alligator Cracking)
- Environmental Cracking – Transverse Cracking (TC) and Block Cracking (BC)
- Patching/Potholes (PP)
- Surface Defects (SD – Oxidizing/Raveling)
- Roughness/Rutting (RR)
- Reflective Cracking (RC)

Each distress and its rating are explained in detail below:

Fatigue Cracking (FC – Alligator Cracking)

Description:

Occurs in areas subjected to repeated traffic loadings (wheel paths).

Can be a series of interconnected cracks in early stages of development. Develops into many-sided, sharp-angled pieces, usually less than 1 ft. on the longest side, characteristically with a chicken wire/alligator pattern, in later stages.

Must have a quantifiable area.

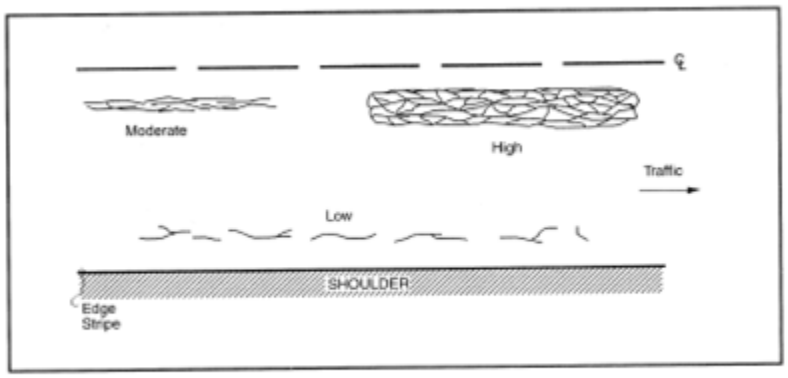


FIGURE 3
Distress Type ACP 1—Fatigue Cracking

Severity

LOW

An area of cracks with no or only a few connecting cracks; cracks are not spalled or sealed; pumping is not evident.

Note: If there is one straight crack in the wheel path this is not considered alligator. The key is a set of small cracks.

Low Severity Fatigue Cracking.

MEDIUM

An area of interconnected cracks forming a complete pattern; cracks may be slightly spalled; cracks may be sealed; pumping is not evident.

HIGH

An area of medium or severely spalled interconnected cracks forming a complete pattern; pieces may move when subjected to traffic; cracks may be sealed; pumping may be evident.

Extent

The extent is determined by the percentage of area for which the distress expands. The percent ranges within each cell determine the repair strategy for defining the decision matrix analysis result. The percent ranges are: 0-5%, 5-10%, 10-25%, 25-50%, 50-75%, and 75-100%.

Medium Severity Fatigue Cracking.

High Severity Fatigue Cracking.

Environmental Cracking – Transverse Cracking (TC) and Block Cracking (BC)

Description:

Transverse cracks run perpendicular to the roadway centerline. Transverse cracks are generally spaced at regular intervals and caused by expansion and contraction of the road surface material. Transverse cracks can also be reflective, appearing above joints and cracks in underlying pavements.

Block cracks are a pattern of cracks that divides the pavement into approximately rectangular pieces. Rectangular blocks range in size from approximately 1 ft^2 to 100 ft^2.

Transverse Cracking.

Severity

LOW

A crack with a mean width ≤ 1/4 in.; or a sealed crack with sealant material in good condition and with a width that cannot be determined.

MEDIUM

Any crack with a mean width > 1/4 in. and ≤ 3/4 in.; or any crack with a mean width ≤ 3/4 in) and adjacent low severity random cracking.

HIGH

Any crack with a mean width > 3/4 in.; or any crack with a mean width ≤ 3/4 in. and adjacent medium to high severity random cracking.

Note: A quarter of an inch is roughly the width of a no. 2 pencil.

Low Severity Transverse Cracking.

Extent

The extent is dependent on the predominant type of environmental cracking present on the road section.

Transverse Cracking extent is evaluated based on crack spacing over the road section with > 100' is considered Low, 50'-100' is considered Medium, 25'-50' is considered High, and < 25' is considered Extreme.

Block Cracking extent is evaluated based on percent area affected. The percent ranges within each cell determine the repair strategy for defining the decision matrix analysis result. The percent ranges are: 0-5%, 5-10%, 10-25%, 25-50%, 50-75%, and 75-100%. If the rectangular blocks are between 1 ft^2 and 10 ft^2 then the light severity cracking will be considered medium and the medium severity cracking will be considered high.

Medium Severity Transverse Cracking.

High Severity Transverse Cracking.

Medium Severity Block Cracking

High Severity Block Cracking

Patching/Potholes (PP)

Description:

Patching refers to areas where the original pavement has been removed and subsequently replaced and the replaced pavement is showing deterioration.

Potholes are areas where portions of the road pavement have broken, and loss of pavement has resulted in a bowl-shaped depression. The diameter of this depression has to be greater than 6 inches to be called a pothole.

Medium Severity Pothole

Severity

LOW

Patches are present and have at most, low severity distress of any kind. Potholes are not present.

MEDIUM

Patches are present and have at most, medium severity distress of any kind. Potholes < 1" depth present.

HIGH

Patches are present and have at most, high severity distress of any kind. Potholes > 1" depth present.

Extent

The extent is determined by the percentage of area for which the patches are present on the road section. The percent ranges within each cell determine the repair strategy for defining the decision matrix analysis result. The percent ranges are: 0-5%, 5-10%, 10-25%, 25-50%, 50-75%, and 75-100%.

NOTES

1. Only patches that show deterioration are evaluated. Good patches are ignored. Frost heaves, including culverts that are protruding and rocks that are coming up through the surface, are included. Surface area, rather than depth of deterioration, is used to assess extent.

High Severity Pothole

High Severity Patch

Surface Defects (SD – Oxidation/Raveling)

Description

Wearing away of the pavement surface in high-quality hot mix asphalt concrete. Caused by the dislodging of aggregate particles and loss of asphalt binder.

Severity

LOW

Binder has begun to wear away but has not progressed significantly with some minor "greying" of the road surface. Some loss of fine aggregate.

MEDIUM

Binder has mostly worn away and surface is somewhat rough and pitted. Significant loss of fine aggregate and some coarse aggregate. Significant "greying" of the road surface.

HIGH

Binder has completely worn away and surface is very rough and pitted. Significant loss of coarse aggregate. Extreme "greying" of the road surface.

Low Severity Raveling

Extent

The extent is evaluated based on percent area affected with 0-25% considered Low, 25-50% considered Medium, 50-75% considered High, and 75-100% considered Extreme.

Medium Severity Raveling

High Severity Raveling

Rutting/Roughness (RR)

Description:

Rutting is a longitudinal surface depression in the wheel path. It may have associated transverse displacement.

Roughness refers to uneven pavement, bumps, dips, rises, and in some cases pavement failure. This is not caused by other distresses and will cause the asphalt surface to have a rough ride.

Severity

LOW

Existing asphalt pavement can be repaired with a thin rehab.

MEDIUM

Existing asphalt pavement can be repaired with a thick rehab.

HIGH

Existing asphalt pavement can be repaired with reconstruction.

Extent

The extent is evaluated based on percent area affected with 0-25% considered Low, 25-50% considered Medium, 50-75% considered High, and 75-100% considered Extreme.

Rutting

Medium Severity Roughness