

NOACA will STRENGTHEN regional cohesion, PRESERVE existing infrastructure and BUILD a sustainable multimodal transportation system to SUPPORT economic development and ENHANCE the quality of life in Northeast Ohio

# ROADWAY PAVEMENT MAINTENANCE REPORT



## VILLAGE OF GRAFTON

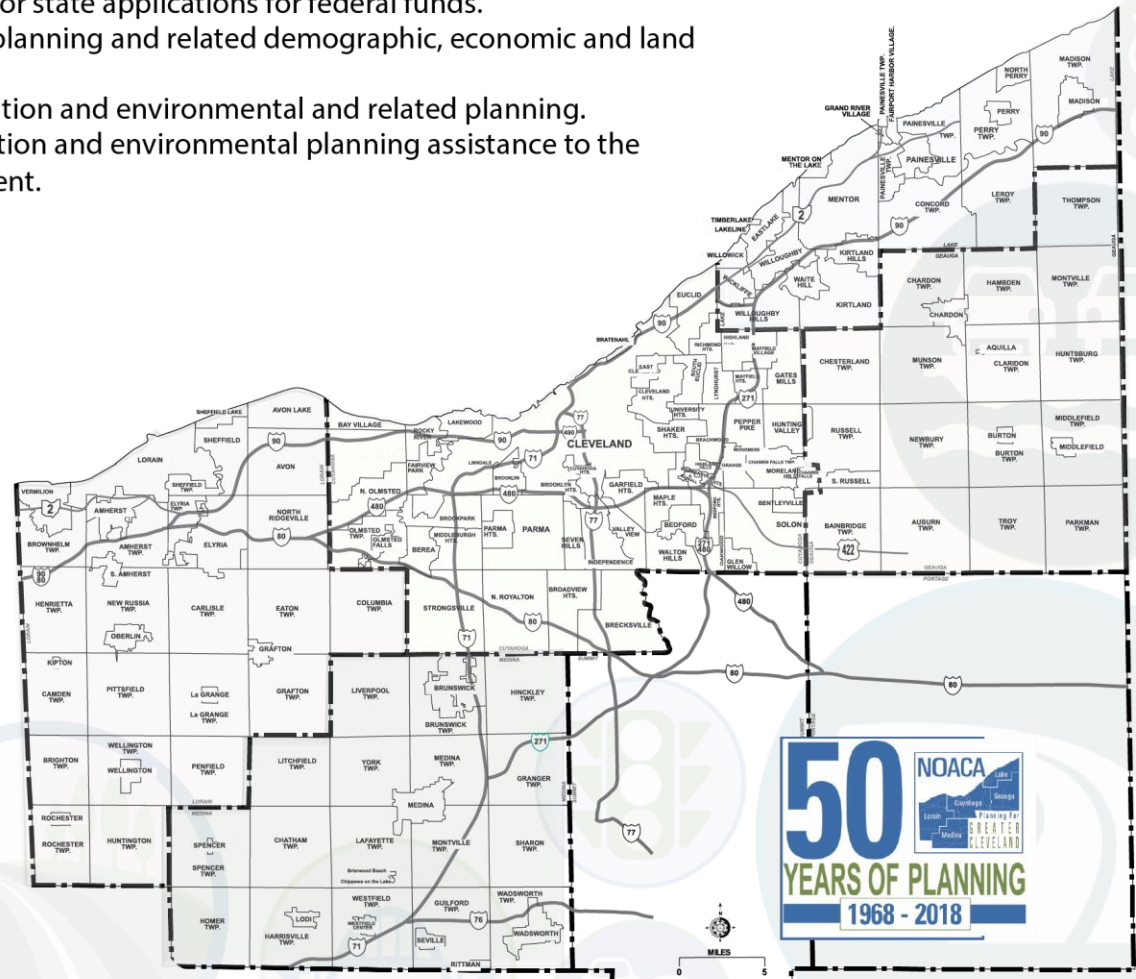


The **Northeast Ohio Areawide Coordinating Agency** (NOACA) is a public organization serving the counties of and municipalities and townships within Cuyahoga, Geauga, Lake, Lorain and Medina (covering an area with 2.1 million people). NOACA is the agency designated or recognized to perform the following functions:

- Serve as the Metropolitan Planning Organization (MPO), with responsibility for comprehensive, cooperative and continuous planning for highways, public transit, and bikeways, as defined in the current transportation law.
- Perform continuous water quality, transportation-related air quality and other environmental planning functions.
- Administer the area clearinghouse function, which includes providing local government with the opportunity to review a wide variety of local or state applications for federal funds.
- Conduct transportation and environmental planning and related demographic, economic and land use research.
- Serve as an information center for transportation and environmental and related planning.
- As directed by the Board, provide transportation and environmental planning assistance to the 172 units of local, general purpose government.

The NOACA Board of Directors is composed of 45 local public officials. The Board convenes quarterly to provide a forum for members to present, discuss and develop solutions to local and areawide issues and make recommendations regarding implementation strategies. As the area clearinghouse for the region, the Board makes comments and recommendations on applications for state and federal grants, with the purpose of enhancing the region's social, physical, environmental and land use/transportation fabric. NOACA invites you to take part in its planning process. Feel free to participate, to ask questions and to learn more about areawide planning.

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## EXECUTIVE SUMMARY

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The 2016 Ohio Department of Transportation (ODOT) pavement database has 3,626 segment records for the Northeast Ohio Areawide Coordinating Agency (NOACA) region. The NOACA region has a total of 3,330 centerline miles of roadways including freeways and federal-aid highways which is equivalent to 8,561 lane-miles. The regional segment average Pavement Condition Ratings (PCR) is about 77.

In the Village of Grafton there are 3.22 centerline miles of federal-aid roads, which are equivalent to 6.44 lane-miles within the village boundary that include State Route 57 (SR 57) and State Route 83 (SR 83). The 2016 ODOT pavement database has eight segment records for the Village of Grafton roadway system. Each record comprises of several fields of various information and measures such as Street name, Length (miles), Lane-miles length, Number of Lanes, Function Class, Pavement Condition Ratings (PCR), etc.

According to the PCR measure, 85 percent of the pavement lane-miles are currently in the “Good” to “Very Good” condition. The rest of the lane-miles are in the “Fair” status and demand some kind of preventive maintenance treatments.

This pavement study includes four parts:

- Part I: The 2016 pavement network condition,
- Part II: The 2018 backlog,
- Part III: The Maintenance and Rehabilitation (M&R) program,
- Part IV: The Comparative analysis.

Considering the five-year study period of 2018 - 2022, this pavement study focuses on the required preventive maintenance treatments and some rehabilitation techniques rather than reconstruction.

Part I of this study analyzes the 2016 pavement network condition and tabulates the important information of all the eight road segments in the Village of Grafton.

In Part II, the backlog is defined as the cost of pavement rehabilitation of all roads within one year (2018) and bringing the average network PCR to 80. Backlog is a “snapshot” or relative measure of outstanding rehabilitation work.

Part III introduces the optimal preventive maintenance and rehabilitation strategy for each segment and its recommended implementation year based on the NOACA maintenance decision tree.

Finally, Part IV compares the backlog and the “M&R” program with the NOACA transportation asset management strategies. All these strategies were compared regarding their costs, the average network PCR and percent of the lane-miles below the acceptable level.

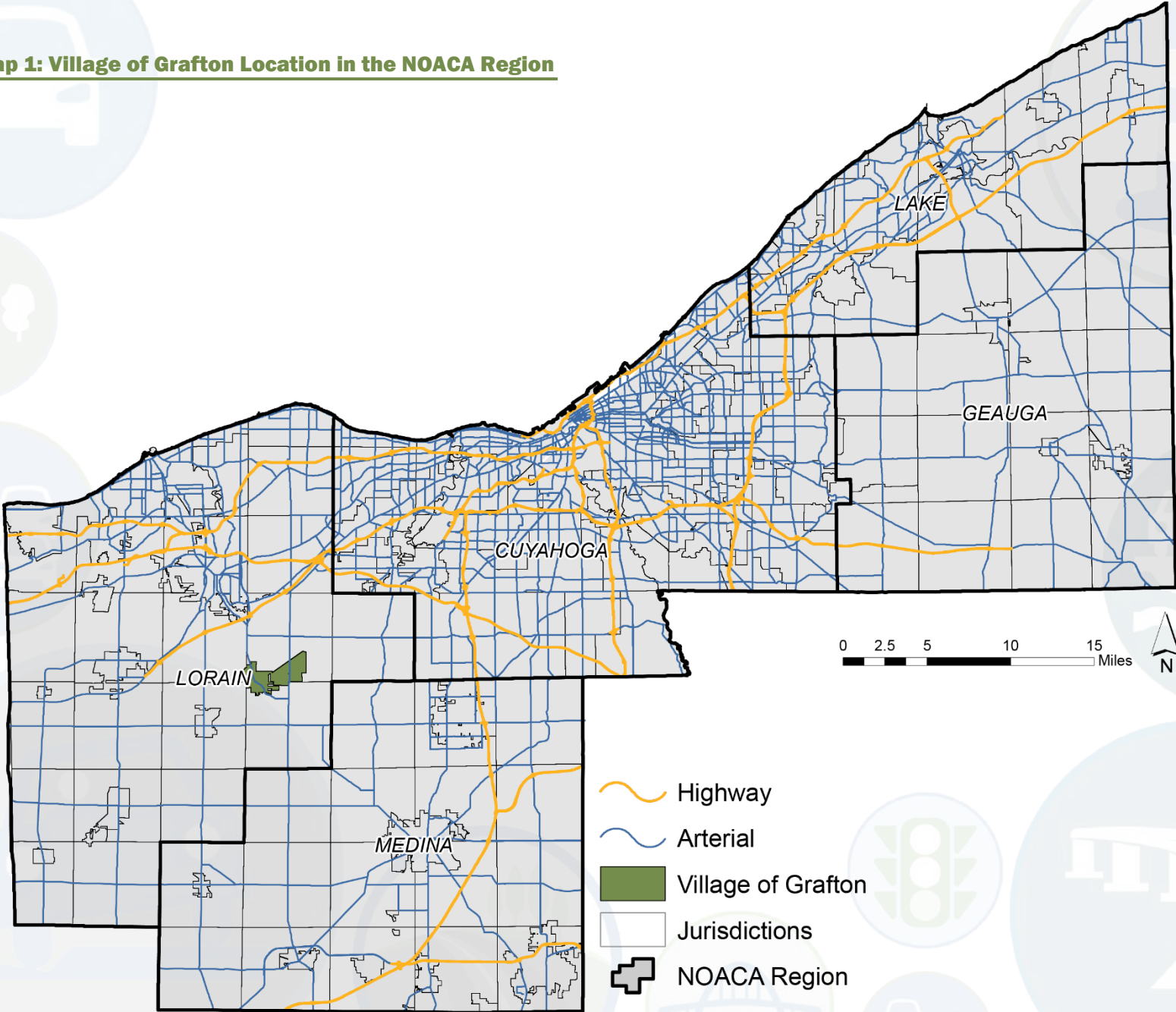
## BACKGROUND

The Village of Grafton is located in Lorain County, along the East Branch of the Black River. In 1816 Jonathan and Grindall Rawson, brothers from Massachusetts, traveled to the Connecticut Western Reserve, in Ohio to locate the 160 acres, their father, Samuel had purchased from the Connecticut Land Company. In 1846, the Cleveland, Columbus and Cincinnati Railroad (CCC RR) completed its track survey. Since there was no large settlement in the township within four miles of the route and water was available, the railroad would build a station here if Jonathan would plat a village. The 15 Lots along the Elyria-Medina Road that Jonathan had sold since 1820 became Grafton Station, so named by the railroad and accepted by the postal service in January 1852. Due to the confusion with Grafton Center, Grafton Township and Grafton Station, the name of the village was officially changed to Rawsonville in May 1852. When the village was incorporated on January 1, 1877, the name was changed to Grafton.

As of the Northeast Ohio Areawide Coordinating Agency (NOACA) 2015 estimates, the village had a population of 6,641 and employment of 2,483. The Village of Grafton highway includes the State Route 57 (SR 57) and State Route 83 (SR 83). Cleveland-Hopkins International Airport is the nearest airport.

Map 1 illustrates the Village of Grafton location in the NOACA region.

Map 1: Village of Grafton Location in the NOACA Region



For the purpose of this study:

**Pavement Reconstruction** is defined as the replacement or reestablishment of the original pavement structural capacity by the placement of the equivalent or increased pavement structure. Reconstruction may utilize either new or recycle materials for the reconstruction of the complete pavement structure.

**Pavement Rehabilitation** is defined as resurfacing, restoration, and rehabilitation (3R) work consisting of structural enhancements that extend the service life of an existing pavement and/or improve its structural capacity. Rehabilitation techniques include restoration treatments and/or structural overlays. This may include partial recycling of the existing pavement, placement of additional surface materials, and/or other work necessary to return an existing pavement to a condition of structural or functional adequacy.

**Preventive Maintenance** is considered as cost effective treatments to an existing roadway system and its appurtenances that preserves the system, delays future deterioration, and maintains or improves the functionality condition of the system without increasing structural capacity. Projects that address deficiencies in the pavement structure or increase the structural capacity of the facility are not considered preventive maintenance.

Maintaining the roadways in a state of good repair is essential and experience has shown that, over time it is less expensive to invest in preventive maintenance and/or rehabilitation in an ongoing basis rather than in reconstruction of pavement that has deteriorated to a poor condition.

This pavement study analyzes the current status of the Grafton pavement network condition and considers the five-year study period of 2018-2022. It mainly focuses on the required roadway pavement preventive maintenance treatments and some rehabilitation techniques rather than reconstruction. The 2016 Ohio Department of Transportation (ODOT) pavement database was used as the input data and RoadMatrix software was utilized as the NOACA Pavement Management platform.

Seven roadway pavement preventive maintenance and rehabilitation treatments were considered in the Grafton pavement network analysis for the study period and Table 1 illustrates the selected treatment and their associated planning level costs.

**Table 1: Selected Pavement Treatments and Their Planning Level Costs**

Maintenance Treatment Type	Cost per SQ FT (2016\$)	Estimated Cost per 12-FT lane-Mile (2016\$)
Crack Fill	0.08	5,100
Joint Repair	0.24	15,200
Crack Fill and Slurry	0.4	25,300
Preventive Maintenance Minor	0.5	31,700
Micro – Pave Type    Surface Treatment	0.722	45,700
Selective Patch, Mill and 1.5” O/L	1.5	95,000
2.0 inch Hot Mix Mill and Overlay	1.9	120,400

**Pavement Maintenance Treatment Definitions**

**Crack Fill:** it is the placement of asphalt emulsion into non-working cracks to reduce water infiltration and to reinforce the adjacent pavement.

**Slurry Seal:** a mixture of fine aggregate, asphalt emulsion, water, and mineral filler, used when the primary problem is excessive oxidation and hardening of the existing surface. Slurry seals are used to retard surface raveling, and improve surface friction.

**Joint Repair:** used to remove deteriorated concrete pavement long joint/crack repairs. It minimizes infiltration of surface water and incompressible material into the joint system.

**Preventive Maintenance (Minor):** typically applied to pavements in good condition having significant remaining service life. Examples of minor preventive treatments include asphalt crack sealing, chip sealing, slurry or micro-surfacing, thin and ultra-thin hot-mix asphalt overlay, and concrete joint sealing.

**Micro – Pave (Type II Surface Treatment):** consist of the application of a mixture of water, asphalt emulsion, aggregate (very small crushed rock), and chemical additives. It is used to treat surfacing and rut filling on roads that get moderate to heavy levels of traffic.

**2.0in Hot Mix Mill & Overlay:** applied as a maintenance treatment. Thin overlays should only be placed on structurally sound pavements. That is because they offer little structural improvement, but they can renew the surface in terms of functional performance (i.e., ride quality).

**Selective Patching, Mill & 1.5 O/L:** it is primarily done to extend the life of a roadway. Patch mill and overlay projects are designed to remove damaged portions of the roadway and replace it with new smooth pavement.

This report includes the following four parts:

- I. The 2016 status of the Grafton pavement network condition,
- II. The 2018 “backlog” treatment list,
- III. The optimal preventive maintenance and rehabilitation strategies, and
- IV. The comparative analysis.

**PART I: 2016 PAVEMENT CONDITION**

In order to provide an accurate assessment of the current status and further pavement analyses, the pavement network is required to be divided into homogeneous discrete sections in terms of surface distress, traffic volumes, pavement structure, etc. The 2016 ODOT pavement database has eight segment records for the Village of Grafton roadway system. Each record comprises of several fields of various information and measures such as Street name, Length (miles), Lane-miles length, Number of Lanes, Function Class, Pavement Condition Ratings (PCR), etc.

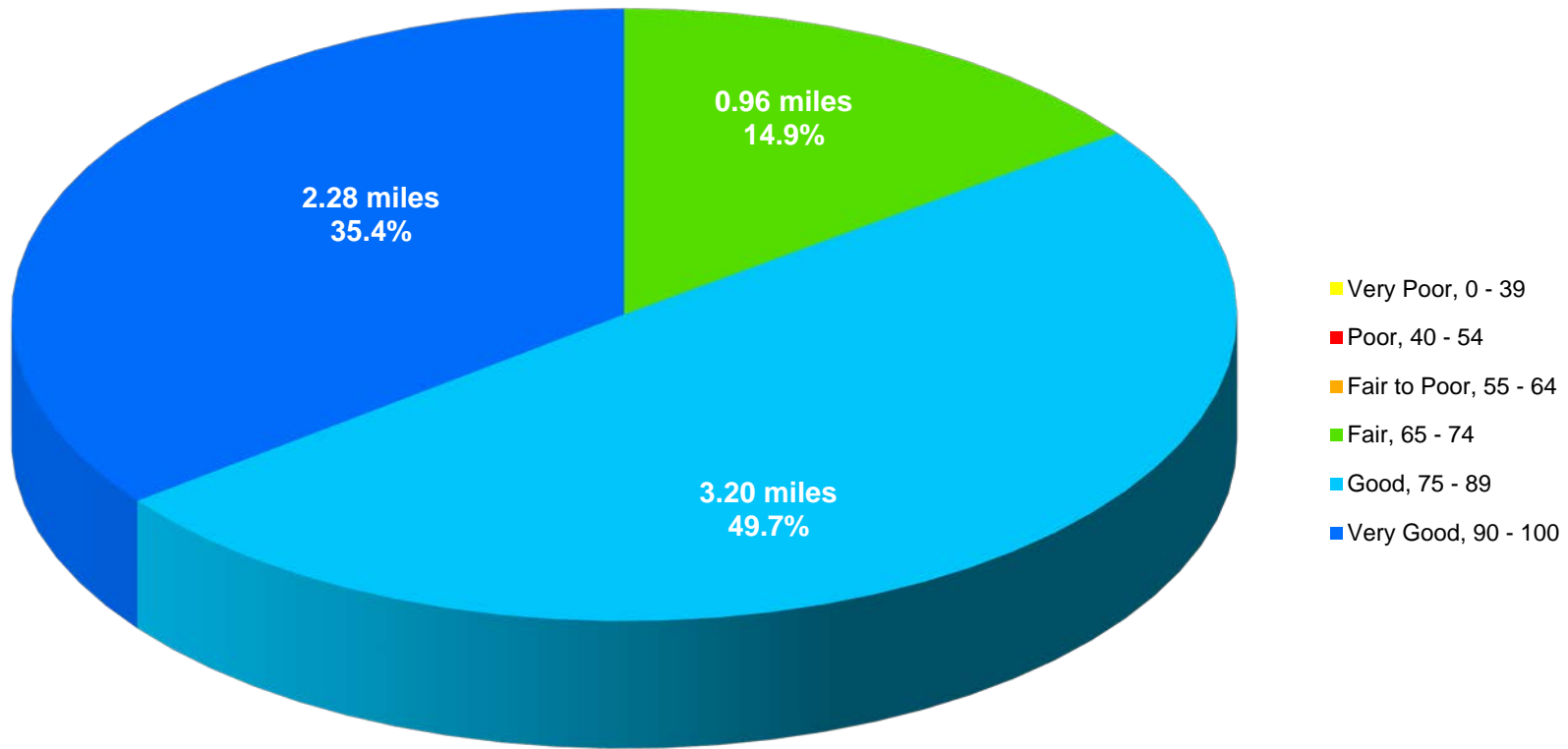
Based on the utilized ODOT database, there are 3.22 centerline miles of federal-aid eligible roads which are equivalent to 6.44 lane-miles in the Village of Grafton. The total area of roadway is 523,248 Sq. Ft.

The PCR measure is a qualitative description of the structural state of the pavement. The PCR values span a spectrum of descriptive narrative ranging from “Very Good” to “Very Poor”. Each roadway segment is scored from 0 to 100 with 0 representing completely distressed pavement and 100 indicating perfect pavement condition. The lane-mile weighted average of the Village of Grafton segment PCRs is about 84. Table 2 and Figure 1 summarize the 2016 Grafton pavement network conditions by percentages of roadway lane-miles length.

**Table 2: 2016 Village of Grafton Pavement Network Condition**

Pavement Condition	PCR Range	Lane-Miles	Percent of Lane-Miles
Very Poor	0 - 39	0	0%
Poor	40 - 54	0	0%
Fair to Poor	55 - 64	0	0%
Fair	65 - 74	0.96	14.9%
Good	75 - 89	3.20	49.7%
Very Good	90 - 100	2.28	35.4%

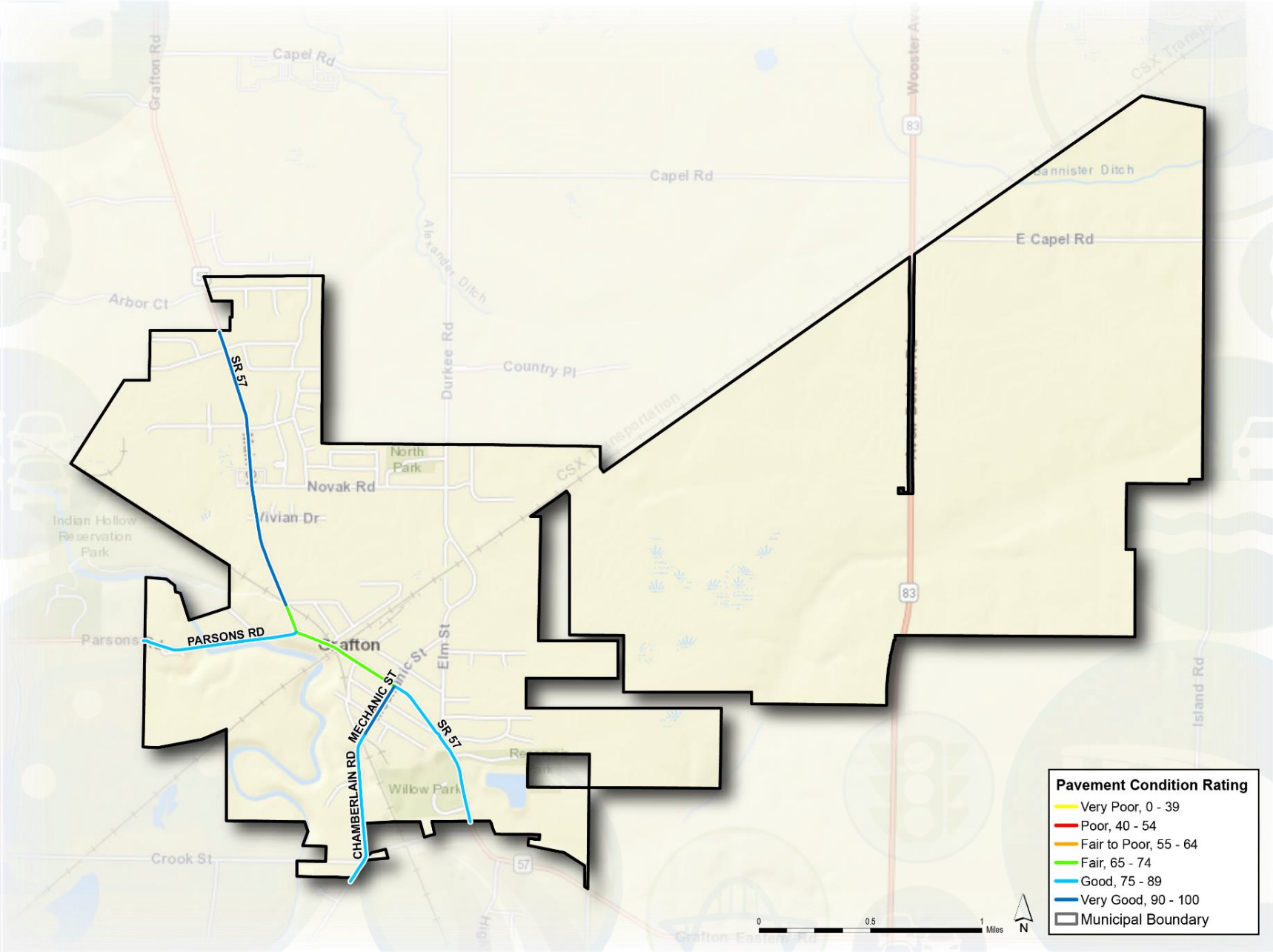
**Figure 1: 2016 Village of Grafton Pavement Network Condition Chart by Lane-Miles**



As indicated, about 85 percent of the pavement lane-miles are currently in the “Good” to “Very Good” condition and the lane-mile weighted average PCR also represents a “Good” condition. The rest of the lane-miles are in the “Fair” status and demand some kind of preventive maintenance treatments.

Map 2 illustrates the 2016 Grafton roadway pavement condition for each segment record and Table 3 tabulates the 2016 Grafton pavement condition listing.

Map 2: 2016 Village of Grafton Pavement Condition



**Table 3: 2016 Village of Grafton Pavement Condition Listing**

ROAD NAME	FROM	TO	FUNCTION CLASS	LANE-MILES	PCR
PARSONS RD	GRAFTON WCL	SR-57 (MAIN ST)	MAJOR COLLECTOR	1.08	79
CHAMBERLAIN RD	0.18 MILES N OF CROOK ST	RAILROAD ST/MECHANIC ST	MINOR COLLECTOR	0.60	75
MECHANIC ST	RAILROAD ST	SR-57 (MAIN ST)	MINOR COLLECTOR	0.38	96
CHAMBERLAIN RD	GRAFTON SCL	0.18 MILES N OF CROOK ST	MINOR COLLECTOR	0.44	78
SR 57	CLEVELAND ST	ERIE ST	MINOR ARTERIAL	0.50	71
SR 57	GRAFTON SCL	MECHANIC ST	MINOR ARTERIAL	1.08	80
SR 57	ERIE ST	GRAFTON NCL	MINOR ARTERIAL	1.90	98
SR 57	MECHANIC ST	CLEVELAND ST	MINOR ARTERIAL	0.46	69

## PART II: 2018 CURRENT BACKLOG

The backlog is defined as the cost of pavement rehabilitation of all roads within the current year (2018) and bringing the average network PCR to 80. Backlog is a “snapshot” or relative measure of outstanding rehabilitation work. The backlog not only represents how far behind the pavement network is in terms of its present physical condition, but also its cost value serves as a benchmark to measure the impact of various funding strategies. Additionally, the current backlog offers a basis for comparison to future and/or past year’s backlogs.

The backlog strategy does not utilize any pavement preventive maintenance treatments, but instead considers rehabilitation or reconstruction treatments. This strategy achieves the average network PCR 80, and also maintains all the pavement conditions above the minimum acceptable level. In this study, the minimum acceptable PCR for the arterial roadway function class is 55 and for the major and minor collector is 50.

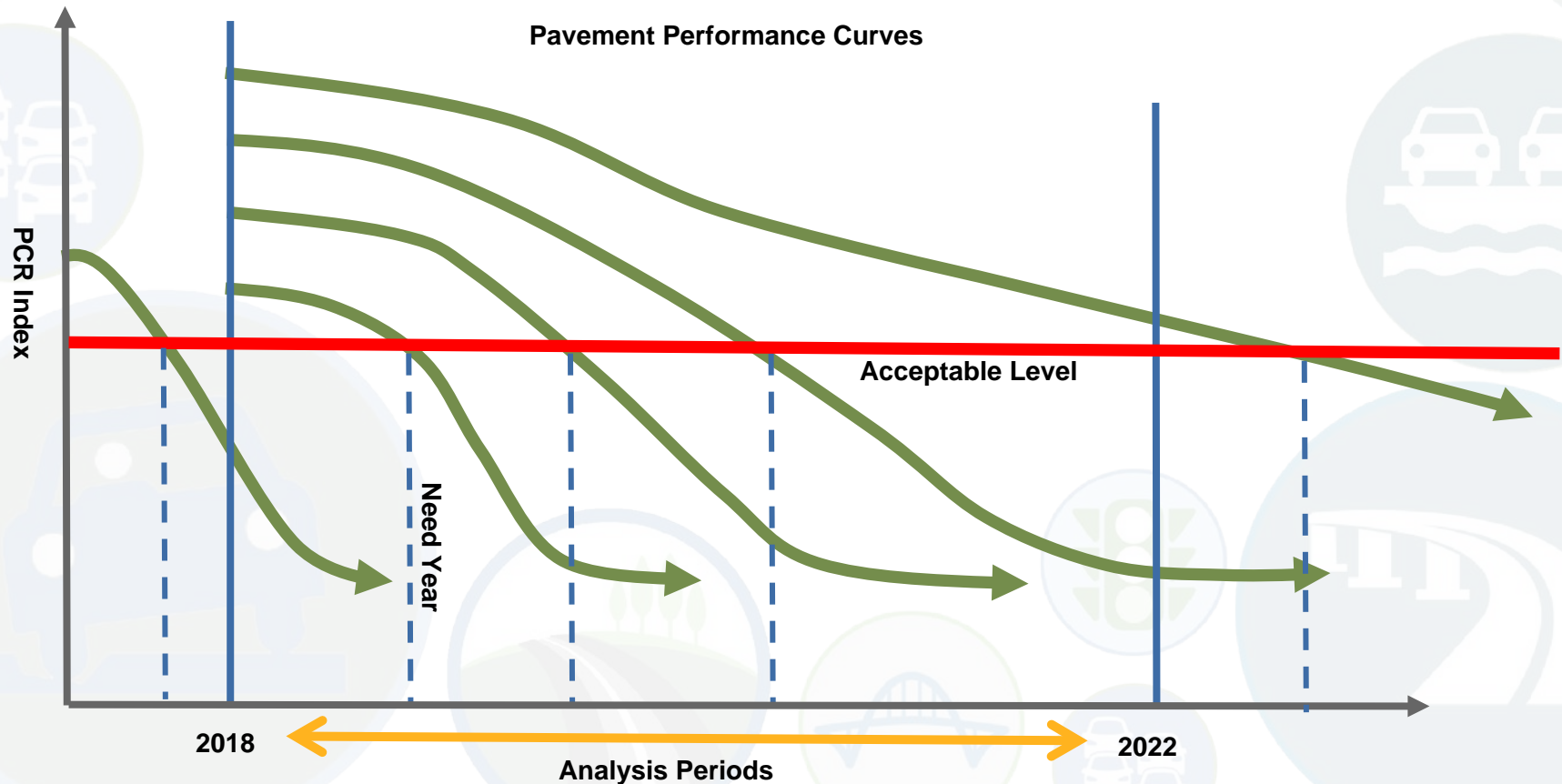
Results of the analysis indicate that there is no recommendation for pavement reconstruction treatments under the current 2018 backlog strategy. As illustrated, the average network PCR for the current year (2018) is 81.2, and all pavement conditions are above the minimum acceptable PCR.

**PART III: MAINTENANCE & REHABILITATION (M&R) PROGRAM**

In order to estimate the preventive maintenance and rehabilitation requirements of a pavement network over a period of time, the first step is to determine the “Need Year” or when a pavement segment requires rehabilitation. The “Need Year” of a pavement is defined as the year in which the pavement condition falls below a critical level. Pavement condition of a road segment deteriorates under traffic, climate, etc. and consequently its PCR value is reduced. Without any treatments and depending on the deteriorating factors, pavements perform differently and Figure 2 depicts the typical acceptable level and “Need Year” relation for several road segments. As shown, the definition of the acceptable level is a critical factor in determining the “Need Year” for any road segment.

In this study, the critical level is set by the minimum acceptable PCR. As mentioned earlier, In the NOACA region, the minimum acceptable PCR for the arterial roadway function class is 55 and for the major and minor collector is 50.

**Figure 2: The PCR Acceptable Level and “Need Year” Relation**





## PART IV: COMPARATIVE ANALYSIS

The current NOACA transportation asset management policy includes two strategies

- Maintain 15% Deficiency: this strategy attempts to maintain the total lane-miles with PCR below the acceptable level no more than 15%.
- Maintain an Average Network PCR of 80: applies a set of maintenance treatments in order to keep the roadway network average PCR more than, or equal to 80 over the study period.

This section compares the discussed backlog and the “M&R” program treatments with the NOACA transportation asset management strategies.

In addition to the above strategies, this comparative analysis considers another scenario as the minimum benchmark. The “Maintain Lowest Standard PCR” treatment strategy is based on the minimum PCR thresholds of 55 for arterials and 50 for collectors and a set of annual budget constraints. The annual budget constraints are calculated in three steps: First, the segments with the “M&R” recommended implementation in each specific analysis year are selected. Second, a subset of the selected segments which their “Need Years” are in the analysis period are identified. It should be noted that the selected segments with the “Need Year” beyond the analysis period are excluded from the budget constraint calculation. Third, the “M&R” treatment costs for the identified segments in the second step, are added together to provide an annual budget constraint for this scenario.

As discussed, all the above scenarios apply a decision tree approach to determine technically feasible maintenance and rehabilitation strategies for each segment requiring rehabilitation during the five-year period.

Table 4 summarizes the comparison results of all the above scenarios over the five-year period for the Village of Grafton. In this table, the “5-Year Total Required Dollars” column shows the accumulation of the annual costs over five years calculated based on inflation-adjusted dollars for each strategy. Also, the Network average PCR is the lane-mile weighted average.

**Table 4: Performance Comparison of the Constraint Scenarios**

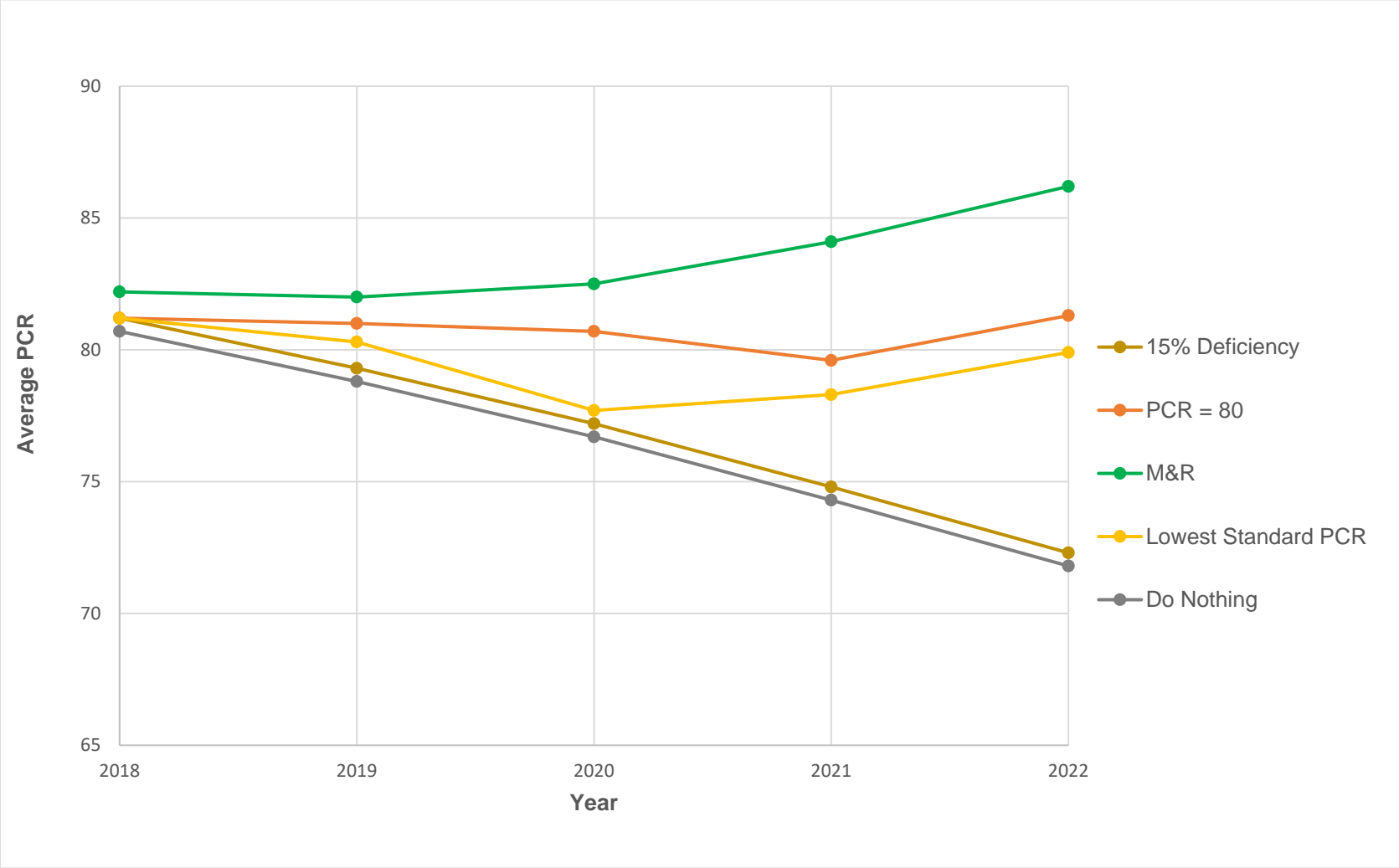
Maintenance Strategy	Strategy Group	5-Year Total Required Dollars	Network Average PCR	Network PCR at the End of the 5-Year Period	Percent of Pavement below the Minimum PCR
2018 Current Backlog	2018 Backlog	0	81.2	-	0%
Maintain 15% Deficiency	NOACA Transportation Asset Management Targets	0	77	72.3	14.9%
Maintain an Average Network PCR of 80		202,642	80.8	81.3	7.1%
M&R Program	Scenarios	289,713	83.4	86.2	0%
Maintain Lowest Standard PCR		156,924	79.2	79.9	0%

Note: The backlog required budget is for the year of 2018 only.

The Appendix lists all the treatments with their implementation years in the period of 2018 to 2022 for the above maintenance strategies.

Figure 3 illustrates the annual network average PCR for the discussed maintenance and rehabilitation strategies. It should be noted that the backlog scenario has only one value of 81.2 for 2018.

Figure 3: Average PCR Comparison by the Constraint Scenarios and by Year



As expected, the treatments of the “M&R” program maintain the pavement network condition with the highest network average PCR. This strategy requires a budget of 290,000 dollars during the analysis period.

The “Maintain an Average Network PCR of 80” scenario provides almost the same level of condition with a lower budget requirement. The “Maintain 15% Deficiency” scenario does not recommend any treatments and its network average PCR is 14 points less than that of the “M&R” program. . As the scenario name indicates, about 15 percent of the pavements will be below the minimum acceptable PCR level.

The “Maintain Lowest Standard PCR” scenario costs almost half of the “M&R” program budget and its network average PCR is six points less than that of the “M&R” program at the end of the five-year period.

It should be noted that the current backlog scenario does not recommend any treatments in this village. The average network PCR for the current year (2018) is 81.2, and all pavement conditions are above the minimum acceptable PCR level. In order to maintain the good pavement conditions, it is recommended to investment in the annual maintenance rather than the reconstruction treatments with high costs.

APPENDIX

2018 Current Backlog

Pavement Treatment List

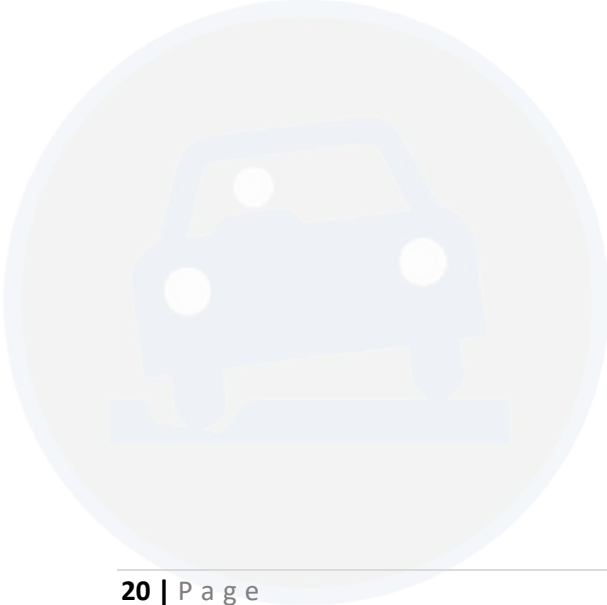
As indicated in Table 4, the "2018 Current Backlog" cost is zero. Results of the analysis indicate that there is no recommendation for pavement reconstruction treatments under the 2018 current backlog strategy. As illustrated, the average network PCR for the current year (2018) is 81.2, and all pavement conditions are above the minimum acceptable PCR.



**Maintain 15% Deficiency**

**Pavement Treatment List**

As indicated in Table 4, the “Maintain 15% Deficiency” cost is zero and therefore, this strategy does not recommend any pavement maintenance treatments.



**Maintain an Average Network PCR of 80**

**Pavement Treatment List**

ROAD NAME	FROM	TO	RECOMMENDED TREATMENT	LANE-MILES	IMPLEMENTATION	
					COST (2019\$)	YEAR
SR 57	GRAFTON SCL	MECHANIC ST	PREVENTATIVE MAINTENANCE MINOR	1.08	\$56,770	2019
THE 2019 REQUIRED BUDGET FOR THE "MAINTAIN AN AVERAGE NETWORK PCR OF 80" STRATEGY					\$56,770	
ROAD NAME	FROM	TO	RECOMMENDED TREATMENT	LANE-MILES	IMPLEMENTATION	
					COST (2020\$)	YEAR
PARSONS RD	GRAFTON WCL	SR 57 (MAIN ST)	PREVENTATIVE MAINTENANCE MINOR	1.08	\$37,737	2020
THE 2020 REQUIRED BUDGET FOR THE "MAINTAIN AN AVERAGE NETWORK PCR OF 80" STRATEGY					\$37,737	
ROAD NAME	FROM	TO	RECOMMENDED TREATMENT	LANE-MILES	IMPLEMENTATION	
					COST (2021\$)	YEAR
CHAMBERLAIN RD	0.18 MILES NORTH OF CROOK ST	RAILROAD ST/MECHANIC ST	PREVENTATIVE MAINTENANCE MINOR	0.60	\$23,275	2021
THE 2021 REQUIRED BUDGET FOR THE "MAINTAIN AN AVERAGE NETWORK PCR OF 80" STRATEGY					\$23,275	
ROAD NAME	FROM	TO	RECOMMENDED TREATMENT	LANE-MILES	IMPLEMENTATION	
					COST (2022\$)	YEAR
SR 57	CLEVELAND ST	ERIE ST	SELECTIVE PATCH, MILL & 1.5" O/L	0.50	\$84,860	2022
THE 2022 REQUIRED BUDGET FOR THE "MAINTAIN AN AVERAGE NETWORK PCR OF 80" STRATEGY					\$84,860	

Note: The "Maintain an Average Network PCR of 80" strategy does not have any pavement maintenance treatments with the recommended implementation year of 2018.

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**M&R Program**

ROAD NAME	FROM	TO	RECOMMENDED TREATMENT	LANE-MILES	IMPLEMENTATION	
					COST (2018\$)	YEAR
CHAMBERLAIN RD	0.18 MILES NORTH OF CROOK ST	RAILROAD ST/MECHANIC ST	PREVENTATIVE MAINTENANCE MINOR	0.60	\$21,626	2018
<b>THE 2018 REQUIRED BUDGET FOR THE "M&amp;R" PROGRAM</b>					<b>\$21,626</b>	
ROAD NAME	FROM	TO	RECOMMENDED TREATMENT	LANE-MILES	IMPLEMENTATION	
					COST (2019\$)	YEAR
SR 57	GRAFTON SCL	MECHANIC ST	PREVENTATIVE MAINTENANCE MINOR	1.08	\$56,770	2019
<b>THE 2019 REQUIRED BUDGET FOR THE "M&amp;R" PROGRAM</b>					<b>\$56,770</b>	
ROAD NAME	FROM	TO	RECOMMENDED TREATMENT	LANE-MILES	IMPLEMENTATION	
					COST (2020\$)	YEAR
CHAMBERLAIN RD	GRAFTON SCL	0.18 MILES NORTH OF CROOK ST	PREVENTATIVE MAINTENANCE MINOR	0.44	16,656	2020
PARSONS RD	GRAFTON WCL	SR 57 (MAIN ST)	PREVENTATIVE MAINTENANCE MINOR	1.08	37,737	2020
<b>THE 2020 REQUIRED BUDGET FOR THE "M&amp;R" PROGRAM</b>					<b>54,393</b>	
ROAD NAME	FROM	TO	RECOMMENDED TREATMENT	LANE-MILES	IMPLEMENTATION	
					COST (2021\$)	YEAR
SR 57	MECHANIC ST	CLEVELAND ST	SELECTIVE PATCH, MILL & 1.5" O/L	0.46	\$72,064	2021
<b>THE 2021 REQUIRED BUDGET FOR THE "M&amp;R" PROGRAM</b>					<b>\$72,064</b>	

**M&R Program**

**Pavement Treatment List (Continued)**

ROAD NAME	FROM	TO	RECOMMENDED TREATMENT	LANE-MILES	IMPLEMENTATION	
					COST (2022\$)	YEAR
SR 57	CLEVELAND ST	ERIE ST	SELECTIVE PATCH, MILL & 1.5" O/L	0.50	\$84,860	2022
<b>THE 2022 REQUIRED BUDGET FOR THE "M&amp;R" PROGRAM</b>					<b>\$84,860</b>	

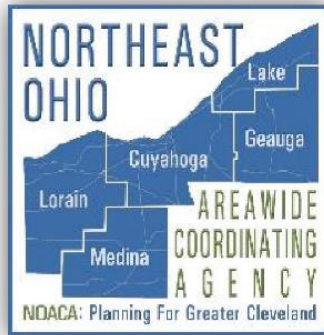
**Maintain Lowest Standard PCR**

**Pavement Treatment List**

ROAD NAME	FROM	TO	RECOMMENDED TREATMENT	LANE-MILES	IMPLEMENTATION	
					COST (2021\$)	YEAR
SR 57	MECHANIC ST	CLEVELAND ST	SELECTIVE PATCH, MILL & 1.5" O/L	0.46	\$72,064	2021
THE 2021 REQUIRED BUDGET FOR THE "MAINTAIN LOWEST STANDARD PCR" STRATEGY					\$72,064	
ROAD NAME	FROM	TO	RECOMMENDED TREATMENT	LANE-MILES	IMPLEMENTATION	
					COST (2022\$)	YEAR
SR 57	CLEVELAND ST	ERIE ST	SELECTIVE PATCH, MILL & 1.5" O/L	0.50	\$84,860	2022
THE 2022 REQUIRED BUDGET FOR THE "MAINTAIN LOWEST STANDARD PCR" STRATEGY					\$84,860	

**Note: The "Maintain Lowest Standard PCR" strategy does not have any pavement maintenance treatments with the recommended implementation years of 2018, 2019 and 2020.**





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**NOACA will STRENGTHEN regional cohesion, PRESERVE existing infrastructure, and BUILD a sustainable multimodal transportation system to SUPPORT economic development and ENHANCE the quality of life in Northeast Ohio. NOACA will STRENGTHEN regional cohesion, PRESERVE existing infrastructure, and BUILD a sustainable multimodal transportation system to SUPPORT economic development and ENHANCE the quality of life in Northeast Ohio.**