



Macomb County Department of Roads

Transportation Asset Management Plan

September 2023

Prepared by:

HNTB Michigan, Inc.

Letter from Macomb County Department of Roads Director

Dear Reader,

Macomb County is dedicated to providing a quality road system, with a key focus on safety. The Department of Roads (MCDR), as the principal steward of these public assets, is committed to serving our community through the delivery of road, bridge and safety projects that meet the priority needs of our stakeholders. This Transportation Asset Management Plan is intended to document our collaborative efforts to be the best stewards of these critical county assets. MCDR's dedicated team of staff and technical experts have worked together to assess the current condition of our roads, bridges, and other assets to develop and implement effective cost-effective preservation strategies.

This plan also reflects the Department of Roads' ongoing commitment to better understanding our financial resources, identifying our risks, and recognizing the importance of engaging and coordinating with local agencies and other infrastructure partners. This planning effort enables us to best prepare for the future.

The Transportation Asset Management Plan represents our commitment to quality infrastructure. The information gathered in this plan offers a tremendous opportunity for the county to manage our public roads and bridges in a manner that improves their condition and life span while maximizing taxpayer funds.

Respectfully,

E-SIGNED by Bryan Santo
on 2023-09-28 11:38:06 EDT

Bryan Santo

Director of Macomb County Department of Roads



CONTENTS

Letter from Macomb County Department of Roads Director i

Executive Summary 1

1. Introduction 3

2. Pavement Assets 4

 2.1 Inventory of Assets4

 2.1.1 Pavement Types 5

 2.1.2 Location and Condition 6

 2.1.3 Paved Roads 6

 2.1.4 Unpaved Roads 7

 2.2 Goals7

 2.3 Historical Trends and Gap Analysis8

 2.4 Planned Projects9

3. Bridge Assets 14

 3.1 Inventory of Assets15

 3.1.1 Scour Critical Bridges 15

 3.1.2 Structurally Deficient Bridges 16

 3.1.3 Functionally Obsolete Bridges 16

 3.1.4 Load Posted Bridges 16

 3.1.5 Closed Bridges 16

 3.1.6 Fracture Critical Bridges 16

 3.2 Baseline Condition17

 3.2.1 Location 17

 3.3 Goals21

 3.4 Program Development and Condition Forecasting Scenarios21

 3.5 Primary Inventory Investment Strategy22

 3.5.1 Summary of Condition Forecast22

 3.6 Planned Projects23

 3.7 Gap Analysis23

4. Culvert Assets 27

 4.1 Inventory of Assets27

 4.2 Goals27

 4.3 Planned Projects28

5. Signal Assets 29

 5.1 Inventory of Assets29

 5.2 Goals31

 5.3 Planned Projects31

6. Financial Resources 32

6.1 Investment Plan and Targets32

6.2 Revenue Assumptions33

6.3 Traffic and Safety Department – Capital Program and Traffic Operations Center33

6.4 TAMP CIP Revenue Sources and Target Programs34

6.5 TAMP CIP Investment Programs and Targets.....35

7. Risk of Failure Analysis 38

7.1 Risk of Failure Analysis Approach.....41

7.2 Risk of Failure Analysis Results41

8. Coordination with Other Entities 44

9. Proof of Acceptance 45

Appendix A: Pavement Primer

Appendix B: Performance Plan

Appendix C: Capital Improvement Program

Appendix D: Bridge Inventory

Appendix E: Scour Critical Bridges

Appendix F: Structurally Deficient Bridges

Appendix G: Functionally Obsolete Bridges

Appendix H: Load Posted Bridges

Appendix I: Closed Bridges

Appendix J: Bridge Preservation Criteria

Appendix K: Revenue and Investment Estimating Assumptions

Appendix L: MCDR Risk Assessment

Appendix M: NEXTGEN Asset Management

List of Tables

Table 1: PASER Ratings4

Table 2: Road System Breakdown by NFC5

Table 3: Asphalt and Composite Repairs.....8

Table 4: Concrete Repairs.....8

Table 5: Road Work for Fiscal Year 202310

Table 6: Road Work for Fiscal Year 202410

Table 7: Road Work for Fiscal Year 202511

Table 8: Road Work for Fiscal Year 202611

Table 9: NBI Conditions15

Table 10: Current NBI Conditions17

Table 11: Bridge Work for Fiscal Year 202324

Table 12: Bridge Work for Fiscal Year 202424

Table 13: Bridge Work for Fiscal Year 202525

Table 14: Current Known Culvert Inventory27

Table 15: Traffic Signal Assets.....30

Table 16: NEXTGEN Descriptions.....30

Table 17: Planned Signal and Safety Projects.....31

Table 19: Program Investments35

Table 20: Revenues36

Table 21: Critical Linkages40

Table 22: RFA Qualitative Scoring Matrix41

Table 23: Highest RPN Critical Linkages42

Table 24: Goal Matrix.....1

Table 25: 2023 Projects1

Table 26: 2024 Projects and Investments1

Table 27: 2025 Projects and Investments3

Table 28: 2026 Projects and Investments1

Table 29: 2027 Investments1

List of Figures

Figure 1: Macomb County Surface Types.....6

Figure 2: Last Rated PASER Condition – County Roads7

Figure 3: Current IBR System™ Condition – All Rated Unpaved County Roads7

Figure 4: Historic Pavement Condition9

Figure 5: Planned Road Projects13

Figure 6: Bridge Elements14

Figure 7: Northern Macomb County, Bridge Conditions18

Figure 8: Central Macomb County, Bridge Conditions19

Figure 9: Southern Macomb County, Bridge Conditions.....20

Figure 10: 10-Year Bridge Condition Forecast22

Figure 11: Planned Bridge Projects26

Figure 12: Macomb County Critical Linkages39

Executive Summary

Providing connections for commerce and vital services, roads play a significant role in the community. The success of a community's transportation network is tied to assets like bridges, culverts, traffic signals, and utilities that support and affect roads. The Macomb County Department of Roads' (MCDR) assets include roads, bridges, traffic signals, culverts, and other transportation infrastructure and support systems that compose some of the most valuable and sizeable public investments for taxpayers. This asset management plan describes the processes that MCDR uses to maintain the transportation assets for which the agency is responsible.

Asset management plans are required by Michigan Public Act 325 of 2018, and this document will act as part of MCDR's obligation to meet these requirements. This Transportation Asset Management Plan (TAMP) also helps demonstrate the responsible use of public funds to elected and appointed officials, as well as the general public with inventory and condition information for county road assets. The plan also provides taxpayers the essential information they need to understand investment decisions for transportation infrastructure.

Based on 2021-2022 PASER data, 26% of the County priority¹ roadways are rated in good condition, 29% are in fair condition, and 45% are in poor condition. The County's on-going goal for its pavement system is to increase and sustain the percentage of good/fair roads, and its aspirational goal is to achieve 90% good/fair pavement conditions. According to SEMCOG's pavement condition data for MCDR rated roadways, based on 2016-17 data, the system good / fair / poor metrics were 19% / 27% / 55%, respectively. This five-year trend demonstrates that MCDR is beginning to achieve and maintain its on-going objective of sustained improved pavement condition, which acknowledging that achieving its aspirational goal will require significant additional investment in order to mitigate the impacts of decades of underinvestment due to lack of federal and state funding.

MCDR is also committed to meet priority access and mobility needs and has planned modest yet strategic investments in roadway capacity improvements over the next five years to meet long-standing commitments and critical needs both in its federal aid and county programs. Improved capacity projects along key segments of Romeo Plank, Schoenherr, and Garfield Roads are planned to be completed within the timeframe of this TAMP, depending on available funding and key project development milestones.

MCDR is also responsible for 225 bridge structures, including twenty-seven of which are structurally deficient, which means they have a National Bridge Inventory (NBI) rating of poor (4) or worse. MCDR's bridge inventory includes twenty load posted structures, twenty-two functionally obsolete bridges, two closed structures, zero fracture critical structures, and eight scour critical structures. MCDR also manages several other transportation related assets, including culverts and traffic signals.

In terms of the County bridge network, approximately 88% of County National Bridge Inventory Standard (NBIS) bridges are in good or fair condition, and 12% are in poor/serious/critical condition, including twelve bridges in serious/critical condition. Six of these structures are programmed for replacement in the next three years. The remaining six will be prioritized for replacement in the 6-7 years that follow. MCDR is forecasting continued improved conditions on the bridge network based on the planned investment strategy outlined in the plan.

MCDR's overall system condition goal is to increase and sustain the percentage of roads and bridges rated 'good or fair' and to achieve and sustain zero serious and critical bridges; however, achieving and sustaining

¹ Priority roadways are those prioritized generally by federal aid classification and within corridors deemed significant by MCDR stakeholders. PASER ratings are currently collected and monitored on the paved federal aid road network.

these goals depends on continued funding and will also depend on how much of that funding may need to be directed toward other critical needs (e.g., culverts) moving forward.

Over the next five years, the agency is committed to investing an average of \$137.6 million per year in its overall Capital Improvement Program, totaling nearly \$250 million in investments in its core, road, bridge, and capacity improvement programs. Additional strategic investments are planned along Mound Road and Metropolitan Parkway (16 Mile Road), assuming federal grants are approved for those investments. This level of investment will continue to require MCDR to dip into its fund balance. This planned investment will allow the agency to continue to achieve incremental improvement in the paved primary road network condition.

The TAMP is based on available funding including utilizing a portion of its strategic fund balance reserves, and while it does not meet the County's aspirational pavement condition goal, it does significantly target serious and critical bridge needs. This planned system investment depends on forecasted revenues from the Michigan Transportation Fund (MTF), local agency contributions, and baseline federal/state program awards. A more complete summary of the overall investment plan is provided in the full report.

This TAMP includes five years of project priorities, committed investment levels and 'mix of fix' strategies. Since a TAMP is a living document these priorities are subject to change moving forward as a result of available funding, stakeholder input, coordination issues, system condition changes, program production, and other factors. As road and bridge conditions change, higher priority rehabilitation candidates could be advanced and segments that are not deteriorating as fast could be deferred to a different year to be worked on. In particular, capital preventive maintenance projects will be reviewed and evaluated annually to ensure these are the 'right fix at the right time'.

1. Introduction

The history of Macomb County can be traced back to 1818 when it was formally organized as the third county in the Michigan Territory. Containing 27 different communities, Macomb County has a rich transportation tradition dating back over 100 years. The county road system was established in 1893, followed by the founding of the Macomb County Road Commission in 1912. The Macomb County Road Commission was renamed the Macomb County Department of Roads within the County Executive Office in 2011. MCDR employs 235 people who perform multiple functions across several departments to deliver



MCDR is dedicated to providing the public with a quality county road system, with a focus on safety and convenience for motorists and the community, environmental responsibility, and financial accountability.

defines asset management as “an ongoing process of maintaining, preserving, upgrading and operating physical assets in a cost-effective manner, based on a continuous physical inventory and condition assessment and investment to achieve established performance goals”.² Asset management uses data to manage and track asset condition, like roads and bridges, in a cost-effective manner that combines principles of engineering and business.

By developing and implementing a formal TAMP, MCDR is taking the necessary steps to ensure that public funds are spent efficiently to maximize the life of the county’s road and bridge network. The MCDR TAMP will also provide a clear guide to support decision-making for the allocation and use of county funds.

This TAMP is focused on MCDR’s road and bridge assets, their condition, and the strategies that MCDR will use to maintain and upgrade these assets to meet condition goals and network priorities. Future plans will expand on these principles and will include more detailed inventory, condition and investment data for culverts, signals and other ancillary structures owned, operated, and maintained by MCDR. In accordance with Public Act 325, this plan will be updated every three years to reflect the condition of assets, finances, and priorities.

technical, professional, and administrative services in support of MCDR’s mission.

These services are delivered in response to ever-growing public demand for safe and efficient travel. The MCDR Traffic Department, which oversees the installation and maintenance of traffic signs and signals on county roads, receives an average of 1,500 service requests annually.

In Macomb County, MCDR is responsible for the maintenance and management of more than 1,500 centerline miles of roadway. MCDR is also responsible for more than 220 bridges, more than 500 culverts, 375 traffic signals, including advanced traffic signal systems, more than 300 traffic cameras and 60,000 signs.

Michigan’s Public Act 325 of 2018

² Act No. 325, Public Acts of 2018, State of Michigan, 99th Legislature, Regular Session of 2018
<http://www.legislature.mi.gov/documents/2017-2018/publicact/pdf/2018-PA-0325.pdf>

2. Pavement Assets

To evaluate the County's pavement conditions MCDR utilizes the Pavement Surface Evaluation and Rating (PASER) system. PASER is a system for visually rating the surface condition of pavement on a scale of 1 to 10. **Table 1** shows the PASER system rating and treatment required for each condition.

Table 1: PASER Ratings

PASER Rating	Condition	Treatment
9, 10	Excellent	No maintenance required
8	Very Good	Little or no maintenance
7	Good	Crack sealing and minor patching
5, 6	Fair-Good	Preservative treatments
3, 4	Poor-Fair	Structural improvements
1, 2	Failed	Reconstruction

The high cost of constructing new or reconstructing existing pavements, \$1.15 million per lane mile or more in most contexts, underlines the critical nature of effectively managing and maintaining these historical investments. MCDR understands the importance of accurately assessing and addressing these needs in a systematic, integrated, transparent manner. Planning and implementing an effective program of maintaining and improving the road network while overseeing its safe and efficient operation is a dynamic and complex process, especially when considering rapidly changing conditions and the varying expectations of road users.

In Michigan, public agencies at the state, county and municipal levels own and maintain roads and bridges, so it can be difficult for the public to understand who is responsible for items such as planning and funding construction projects, repairs, traffic control, safety, and winter maintenance for any given road. The Michigan Department of Transportation (MDOT) is responsible for interstate freeways, trunkline, and non-trunkline, which typically use "M," "I," or "US" designations regardless of their geographic location in Michigan. Cities and villages are typically responsible for most of the public roads accessing MDOT's statewide system within their geographic boundary. Counties are typically responsible for all the remaining public roads within the County's geographic boundary.

In cases where local roads fall along jurisdictional borders, intergovernmental agreements guide ownership and maintenance responsibility. MCDR has such boundary agreements with Oakland, Lapeer and St. Clair counties regarding the maintenance and improvement of these 'border' assets. These agreements seek to leverage economies of scale and opportunities for more efficient use of resources through mutual aid and maintenance agreements.

2.1 Inventory of Assets

Michigan law defines how funds from the MTF are distributed and utilized, and classifies roads owned by MCDR as either county primary or county local roads. Primary roads serve to collect and distribute vehicle traffic network-wide, while local roads provide basic access to that network. MCDR is guided by state statute to prioritize investments on its county primary road network. According to data from Roadsoft, of the 1,801 centerline miles of roads in its inventory, 503 miles are primary roads, and 1,298 miles are local roads.

Approximately 98% of all County primary roads are classified as federal aid eligible, which allows them to receive federal funding for their maintenance and construction, subject to various constraints. Only 6% of county local roads are considered federal aid eligible, which means state and local funds must be used to manage these roads. Overall, 577 miles (32%) of County-owned roads are currently federal-aid eligible.

MCDR manages 162 miles of roads that are part of the National Highway System (NHS). Defined as roads critical to the nation’s economy, defense and mobility, NHS roads are subject to special rules and regulations and have their own performance metrics dictated by the Federal Highway Administration (FHWA). While most NHS roads in Michigan are managed by MDOT, MCDR manages NHS routes within its jurisdiction, such as a portion of Mound Road from 11 Mile to M-59, which has been undergoing massive renewal (see www.innovatemound.org for more information about ongoing MCDR plans for this critical asset investment).

The Macomb County road system is comprised of various classifications of roads as defined by the National Functional Classification of Roads (NFC). **Table 2** shows the miles of Macomb County roads for each classification. Principle arterial, minor arterial, and major collector are the road classifications that make up the federal aid system in Macomb County.

Table 2: Road System Breakdown by NFC

Federal Aid Eligibility	NFC	Road Miles
Federal-Aid System (32% of the network)	Other Principal Arterial	160.0
	Minor Arterial	237.1
	Major Collector	175.5
	Minor Collector	4.6
Non-federal aid system (68% of the network)	Minor Collector	16.9
	Local	1,207.2
Total Centerline Miles		1,801.2

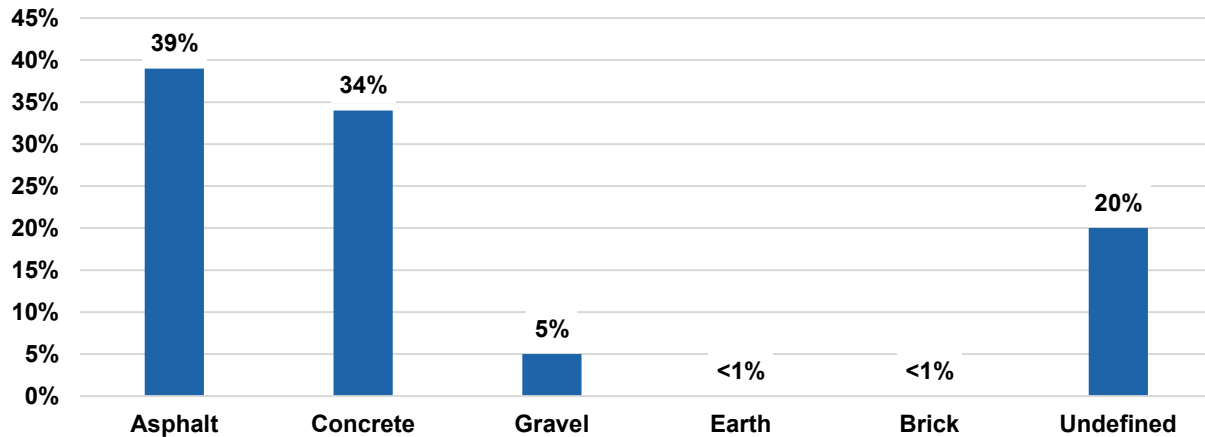
Source: Roadsoft, 2023

2.1.1 Pavement Types

MCDR has multiple types of pavements in its jurisdiction, including asphalt, concrete, composite surfaces, and unpaved roads (such as gravel and/or earth). Factors influencing pavement type include cost of construction, cost of maintenance, frequency of maintenance, type of maintenance, asset service life, and road user experience. More information on pavement types is available in the Pavement Primer in **Appendix A**.

Figure 1 shows the breakdown of the percentage of various pavement surface types that MCDR has in its network. Future plans will document the ‘undefined’ portion of the local road inventory.

Figure 1: Macomb County Surface Types



Source: Roadsoft, 2023

2.1.2 Location and Condition

MCDR documents the locations and other physical features of its pavement assets using various software tools such as ArcGIS, a geospatial mapping and analytics platform, and Roadsoft. More information on these tools can be found at www.roadsoft.org.

Collecting and documenting pavement condition data-based on consistent, standard visual or engineering-grade inspections are at the heart of developing and maintaining asset inventories. Pavement condition is a



major factor in determining the most cost-effective treatment for a given section of roadway. MCDR uses pavement condition and age to anticipate when a specific section of pavement will be a potential candidate for preventive maintenance or reconstruction.

Pavement condition data enables MCDR to evaluate the benefits of preventive maintenance projects and to identify the most cost-effective use of road construction and maintenance dollars. Historic pavement condition data can be used to predict future road conditions based on budget constraints and to determine if a road network’s condition will improve, stay the same, or degrade at the current or planned investment level. This

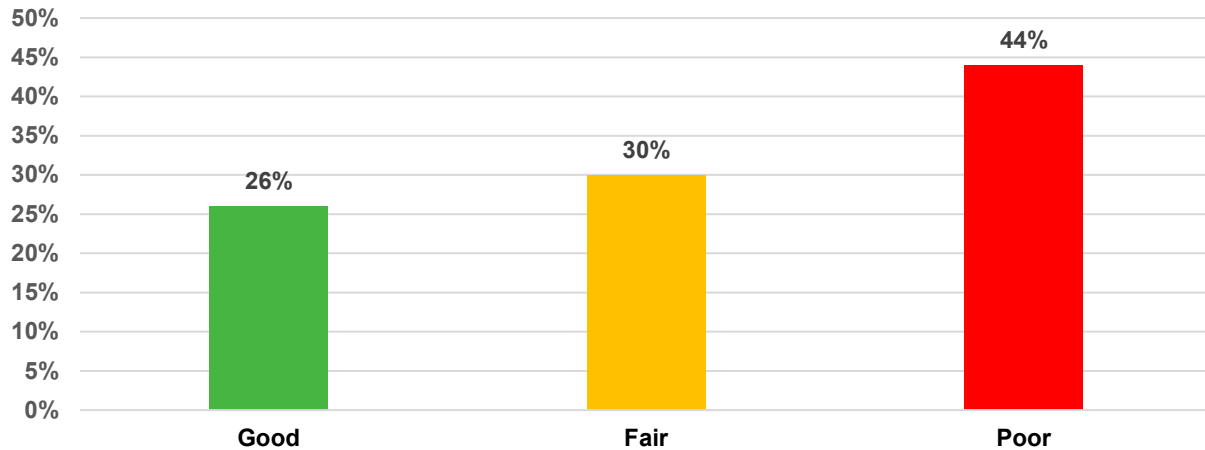
analysis helps to determine how much additional funding is necessary to meet a network’s condition improvement goals. More detail on this topic is included in the Pavement Primer in **Appendix A**.

2.1.3 Paved Roads

MCDR is committed to monitoring the condition of its road network and using pavement condition data to drive cost-effective decision-making for the preservation of valuable road assets. MCDR uses the PASER system, which has been adopted by the Michigan Transportation Asset Management Council (TAMC) for measuring statewide pavement conditions, to assess its paved roads. More information regarding the PASER system can be found in the Pavement Primer in **Appendix A**.

Figure 2 shows the percentages of federal aid roads in good, fair, and poor condition based on 2021-2022 PASER data from SEMCOG.

Figure 2: Last Rated PASER Condition – County Roads

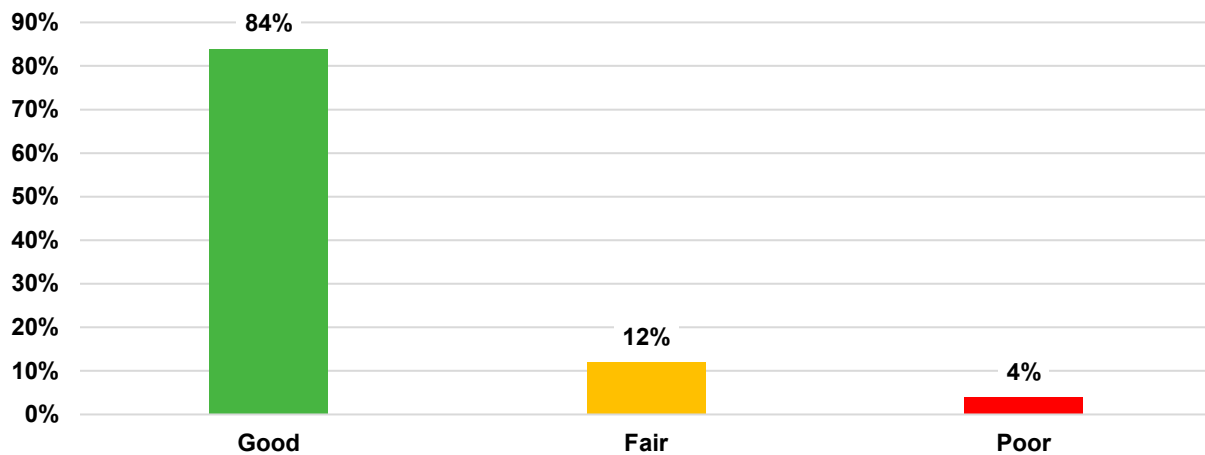


Source: SEMCOG, 2023

2.1.4 Unpaved Roads

The condition of unpaved roads can change rapidly, which makes it difficult to obtain a consistent surface condition rating over the course of weeks or even days. The TAMC adopted the Inventory Based Rating (IBR) System™ for rating unpaved roads, and MCDR uses the IBR System™ for rating its unpaved roads. More information regarding the IBR System™ can be found in the Pavement Primer in **Appendix A. Figure 3** shows the percentage of roads in each of the IBR categories.

Figure 3: Current IBR System™ Condition – All Rated Unpaved County Roads



Source: Roadsoft, 2023

2.2 Goals

Goals help drive the development of strategies to address how road conditions change over time. Pavement condition changes are influenced by water infiltration, soil conditions, sunlight exposure, traffic loading, and repair work performed. MCDR is not able to control any of these factors fully due to seasonal weather changes, traffic pattern changes, and its limited budget. In spite of these uncontrollable variables, it is still important to set realistic network condition goals that efficiently use budget resources to build and maintain roads that meet taxpayer expectations.

The overall goal for MCDR's road network is to improve and sustain priority pavement conditions network wide. Additional performance goals supporting overall implementation of the TAMP involve overall measurable improvements to program integration, transparency, accountability, and communication.

Additional information about MCDR's overall performance plan framework can be found in **Appendix B**.

2.3 Historical Trends and Gap Analysis

Roads age and deteriorate just like any other asset. All pavements are damaged by water, freeze/thaw cycles, sunlight, and traffic weight. To offset natural deterioration and normal wear-and-tear on the road, MCDR must complete treatment projects that either protect and/or add life to its pavements. The year-end condition of the whole network depends upon changes or preservation of individual road section conditions that preservation treatments have affected.

MCDR uses many types of repair treatments for its roads, each selected to balance costs, benefits, and road life expectancy. When agency trends are modeled, any gap between goals and accomplishable work becomes evident. Financial resources influence how much work can be accomplished across the network within agency budget and what treatments and strategies can be afforded; a full discussion of MCDR's financial resources can be found in the Financial Resources section.

Treatments and strategies that counter pavement-damaging forces include reconstruction, rehabilitation, and CPM. For a complete discussion on the pavement treatment tools, refer to **Appendix A**.

Correlated with each PASER score are specific types of treatments best performed either to protect the pavement (CPM) or to add strength back into the pavement (structural improvement). These identified PASER scores "trigger" the timing of projects appropriately to direct the right pavement fix at the right time, thereby providing the best chance for a successful project. Other information such as future development, traffic volume, utility projects, and budget play a role in project selection.

Table 3 and **Table 4** show the mix of fixes that MCDR uses on their roads.

Table 3: Asphalt and Composite Repairs

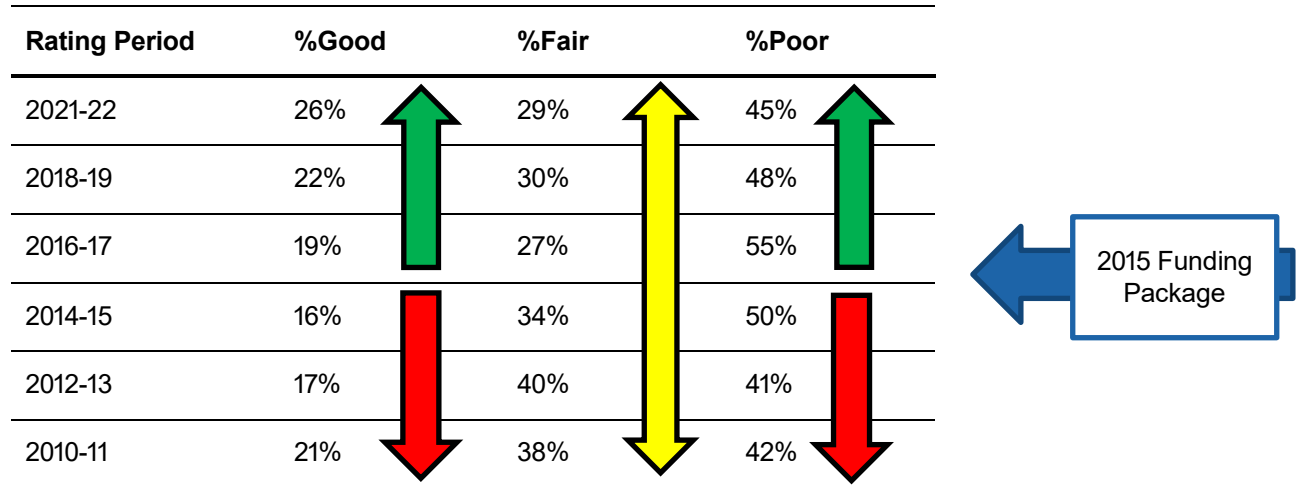
Mix of Fix Asphalt and Composite (Asphalt Surfaced) Roads	Cost (per lane mile)	PASER Trigger Number	Reset PASER Number
Crack Seal	\$20,000	6-7	6-7
Chip Seal	\$25,000	6-7	6-7
Mill, HMA Overlay	\$585,000	5	9
Mill, Base Repair, Asphalt Overlay	\$630,000	4	9
Reconstruction	\$1,150,000	1-3	10

Table 4: Concrete Repairs

Mix of Fix Concrete Roads	Cost (per lane mile)	PASER Trigger Number	Reset PASER Number
Full Depth Concrete Repair	\$20,000	6-7	7
Panel Replacement, Base Repair	\$750,000	4-5	9
Reconstruction	\$1,750,000	1-3	10

Historical trends can be helpful in analyzing where pavement system performance may go in the future. **Figure 4** shows the historical trend of pavement condition of MCDR's priority road network according to SEMCOG's historical data.

Figure 4: Historic Pavement Condition



The data shows a general downward trend in conditions from 2010-2015, with an upward trend since 2015. This correlates with the additional funding received after 2015 and the County's increasing focus on applying sound principles of asset management to its roadway system. This trend demonstrates that the County is beginning to achieve its on-going goal of increasing the percentage of good/fair roads over the past seven years (2017-2022) from 46% (19% good + 27% fair) to 55% (26% good and 29% fair). Based on this historical trend data it can be reasonably predicted that the County will be able to achieve incremental improvements in pavement conditions under current funding scenarios and investment strategies.

Achieving the County's aspirational goals for its priority road system, however, will require significant additional funding. An analysis conducted last year in connection with a county-wide Corridors of Significance Study showed that upwards of \$1B in additional funding would be needed to achieve the aspirational goal in the next ten years.

The County's Performance Plan contains several key goals that are aimed at improving and sustaining those improvements on its priority road system, with the following serving as a key primary goal (see **Appendix B** for the full MCDR Performance Plan framework):

Increase and sustain the percentage of roads rated "Good/Fair" with a focus on the National Highway System and the Corridors Of Significance.

With that goal in mind and effectively utilizing the available resources, the next section of the TAMP will provide information on how MCDR plans, develops, and delivers specific improvements planned for implementation.

2.4 Planned Projects

With this TAMP, MCDR is rolling out a five-year plan of construction, maintenance, and strategies to guide its ongoing asset investment strategies. A multi-year planning threshold is required due to the time necessary to plan, design, finance, construct, and maintain the projects on the county road network. This

includes planning and programming requirements from state and federal agencies that must be met prior to starting a project and can include studies on environmental and archeological impacts, review of construction and design documents and plans, documentation of rights-of-way ownership, utility relocations, planning and environmental permitting for storm water discharges, and other regulatory and administrative requirements.

Factors used when determining the list of projects include current project commitments, community input, current PASER rating, available budget, identified critical linkages, mix of fixes, network and corridor priorities. The last PASER ratings were reviewed as well as the mix of fixes to help develop the list of project candidates. This TAMP continues MCDR's core strategy of prioritizing preservation over new construction and represents overall investments at historic levels, while implementing much needed and long-planned strategic capacity improvements.

Per Public Act 499 of 2002 (later amended by PA 199 of 2007), road projects for the upcoming three years are required to be reported annually to the TAMC. Planned projects represent the best estimate of future activity; however, changes in design, funding, and permitting may require MCDR to alter initial plans. Project planning information is used to predict the future condition of the road networks that MCDR maintains. Detailed lists and maps of projects by year can be found in **Appendix C**.

Since the TAMP is a working document the projects are subject to change. This is because the PASER ratings are updated annually, and the report is updated every three years. As road conditions change, higher priority candidates could be moved up the list and ones that are not deteriorating as fast could be deferred until a later year to be worked on.

Table 5: Road Work for Fiscal Year 2023

Road Name	Limits	Work Type	Construction Cost
Capac Rd	Irwin Rd to Pratt Rd	Maintenance (CPM - Road)	\$893,913
23 Mile Rd	Gratiot Ave to CN Railroad	Road Rehab/ Reconstruction	\$4,004,195
Kelly Rd	14 Mile Rd to 15 Mile Rd	Road Rehab/ Reconstruction	\$4,450,000
			\$9,348,108

Table 6: Road Work for Fiscal Year 2024

Road Name	Limits	Work Type	Construction Cost
33 Mile Rd	Lowe Plank Rd to M-19	Maintenance (CPM - Road)	\$550,000
10 Mile Rd	Ryan Rd to Lorraine Ave	Road Rehab/ Reconstruction	\$11,276,126
Garfield Rd	14 Mile Rd to 15 Mile Rd	Capacity Increase/ New Road	\$1,833,333
Garfield Rd	14 Mile Rd to 14 Mile Rd	Road Rehab/ Reconstruction	\$3,666,667
School Section Road	Lowe Plank Rd to Memphis Ridge	Maintenance (CPM - Road)	\$500,000
Romeo Plank Rd	21 ½ Mile Rd to 23 Mile Rd	Capacity Increase/ New Road	\$9,695,759

Road Name	Limits	Work Type	Construction Cost
Romeo Plank Rd	21 ½ Mile Rd to 23 Mile Rd	Road Rehab/ Reconstruction	\$6,463,840
Kelly Rd	15 Mile Rd to S Nunnely	Road Rehab/ Reconstruction	\$1,557,423
Moravian Drive	Schoenherr Rd to Garfield Rd	Road Rehab/ Reconstruction	\$4,747,303
Garfield Rd	23 Mile Rd to 25 Mile Rd	Capacity Increase/ New Road	\$9,000,000
			\$52,397,840

Table 7: Road Work for Fiscal Year 2025

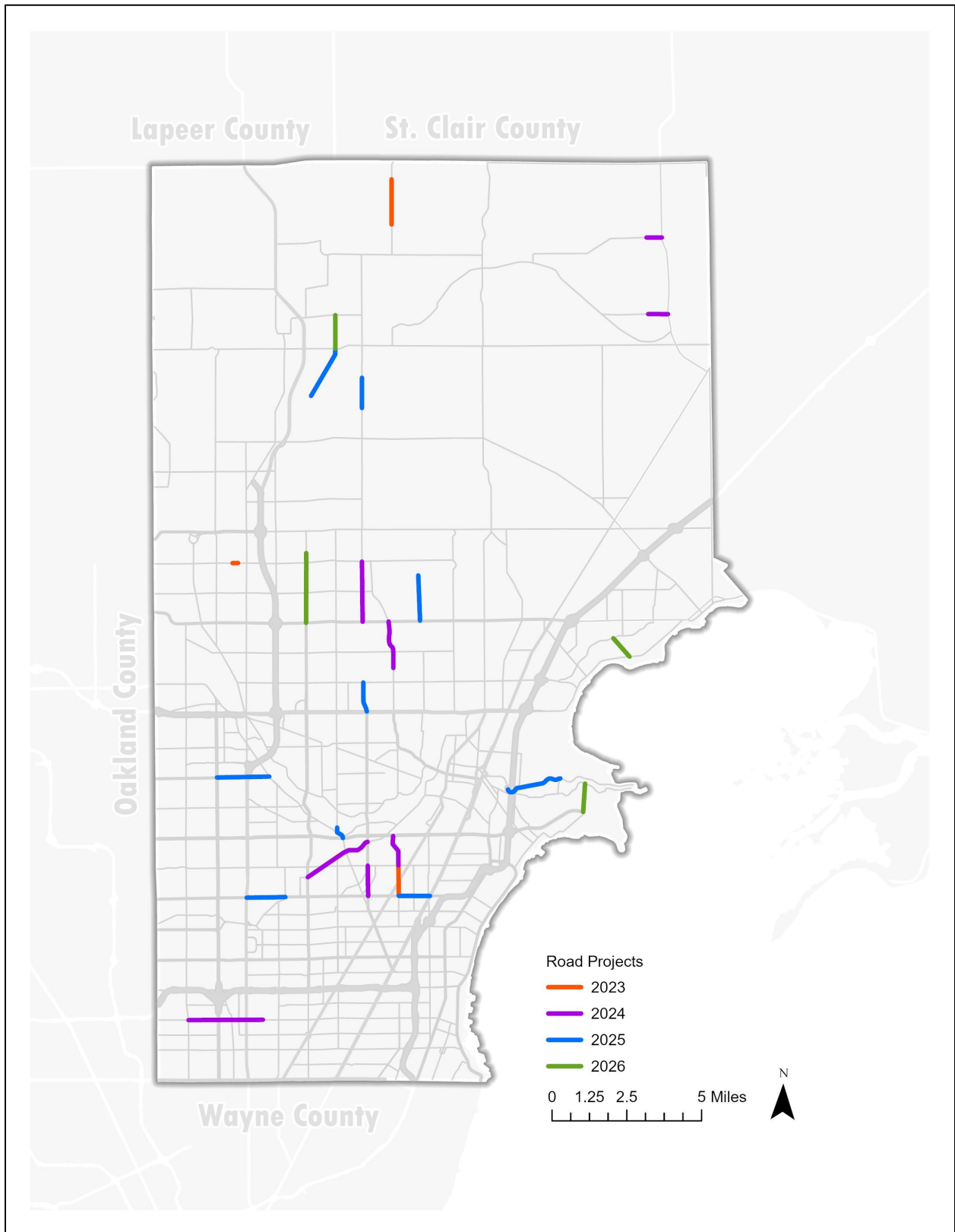
Road Name	Limits	Work Type	Construction Cost
Broughton Rd	23 Mile Rd to 24 ½ Mile Rd	Capacity Increase/ New Road	\$7,000,000
Romeo Plank Rd	30 Mile Rd to 31 Mile Rd	Maintenance (CPM - Road)	\$500,000
Garfield Rd	M-59 to 21 Mile Rd	Capacity Increase/ New Road	\$1,752,333
Garfield Rd	M-59 to 21 Mile Rd	Road Rehab/ Reconstruction	\$3,504,667
Powell Rd	30 ½ Mile Rd to 31 Mile Rd	Road Rehab/ Reconstruction	\$3,503,249
14 Mile Rd	Van Dyke Ave to Hoover Rd	Road Rehab/ Reconstruction	\$4,780,000
14 Mile Rd	Kelly Rd to Gratiot Ave	Road Rehab/ Reconstruction	\$4,125,000
18 Mile Rd	Mound Rd to Utica Rd	Road Rehab/ Reconstruction	\$6,000,000
Hayes/Utica Rd	River Lane to 16 Mile Rd	Road Rehab/ Reconstruction	\$3,986,690
N River Rd	Mt. Clemens/ Harrison boundary to Bridgeview	Road Rehab/ Reconstruction	\$3,000,000
			\$54,729,939

Table 8: Road Work for Fiscal Year 2026

Road Name	Limits	Work Type	Construction Cost
Schoenherr Rd	23 Mile Rd to N of 25 Mile Rd	Capacity Increase/ New Road	\$2,972,282
Schoenherr Rd	23 Mile Rd to N of 25 Mile Rd	Road Rehab/ Reconstruction	\$5,944,563

Road Name	Limits	Work Type	Construction Cost
Sugarbush Rd	Callens Rd to Jefferson Ave	Road Rehab/ Reconstruction	\$1,300,000
Jefferson Ave	S River Rd to Metropolitan Parkway	Road Rehab/ Reconstruction	\$1,695,000
Powell Rd	32 Mile Rd to 33 Mile Rd	Road Rehab/ Reconstruction	\$801,951
			\$12,713,796

Figure 5: Planned Road Projects



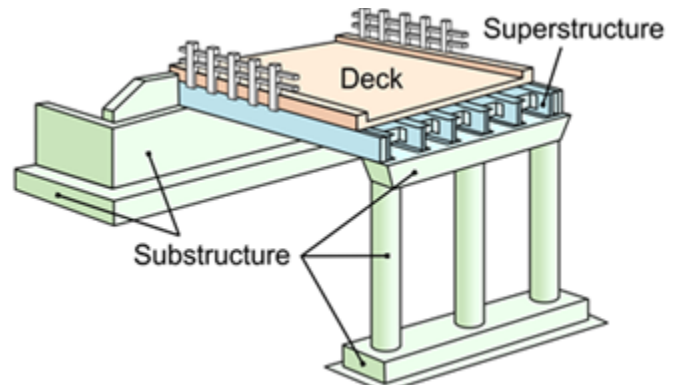
3. Bridge Assets

The National Bridge Inspection Standards (NBIS) sets national standards for the proper safety inspection and evaluation of all highway bridges. The NBIS regulations apply to all publicly owned highway bridges carrying vehicular traffic that are longer than 20 feet along the direction of the roadway between abutments, spring lines of arches, extreme ends of openings for multiple boxes, or extreme ends of openings for multiple pipes.

MCDR is responsible for 225 NBI bridges throughout Macomb County. MCDR inspectors use the National Bridge Inventory (NBI) scale to rate county bridges. NBI condition ratings are based on a zero to nine scale for the deck, superstructure, and substructure of each bridge element. **Figure 6** shows the primary elements rated by the NBI.

Condition ratings are an important tool for transportation asset management because they identify preventive maintenance needs and help determine funding requirements for rehabilitation and replacement projects. **Table 14** describes NBI condition ratings.

Figure 6: Bridge Elements



Source: MDOT, 2020

Table 9: NBI Conditions

Rating	Condition	Description	Treatment
9	Excellent Condition	No problems noted	Routine maintenance
8	Very Good Condition	No problems noted	Routine maintenance
7	Good Condition	Some minor problems	Routine maintenance
6	Satisfactory Condition	Structural elements show minor deterioration	Preventive maintenance or minor rehabilitation
5	Fair Condition	All primary structural elements are sound but may have minor corrosion, cracking or chipping. May include minor erosion on bridge piers.	Preventive maintenance or minor rehabilitation
4	Poor Condition	Advanced corrosion, deterioration, cracking and chipping. Also, significant erosion of concrete bridge.	Major rehabilitation or replacement
3	Serious Condition	Corrosion, deterioration, cracking and chipping or erosion of concrete bridge piers have seriously affected deck, superstructure or substructure. Local failures are possible.	Emergency repair or high priority major rehabilitation or replacement. Unless closely monitored it may be necessary to close until corrective action can be taken.
2	Critical Condition	Advanced deterioration of deck, superstructure or substructure. May have cracks in steel or concrete or erosion may have removed substructure support. It may be necessary to close the bridge until corrective action is taken.	Emergency repair or high priority major rehabilitation or replacement. Unless closely monitored it may be necessary to close until corrective action can be taken.
1	“Imminent” Failure Condition	Major deterioration or corrosion in deck, superstructure or substructure or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but with corrective action it may be put back in light service.	Major rehabilitation or replacement. Bridge is closed.
0	Failed Condition	Out of service and beyond corrective action.	Major rehabilitation or replacement. Bridge is closed.

3.1 Inventory of Assets

MCDR's inventory includes bridges that range in length from 20 feet to 349 feet. Among the inventory are 20 load posted structures, two closed structures, zero fracture critical structures and 8 scour critical structures. Bridge inventory data can be found in **Appendix D**.

3.1.1 Scour Critical Bridges

Bridge scour is the removal of sand and gravel from around bridge abutments or piers on bridges over water. Scour, caused by swiftly moving water, can remove materials causing scour holes, compromising the integrity of a structure. A scour critical bridge is one with abutment or pier foundations which are rated as unstable due to either observed scour at the bridge site or has scour potential as determined from a scour evaluation study. Scour critical bridges are not desirable in a bridge inventory, however they can be

managed through inspection and routine maintenance activities. **Appendix E** details the inventory of MCDR's 8 scour critical structures.

3.1.2 Structurally Deficient Bridges

Bridges are “structurally deficient” if the physical condition of any of the major structural components, such as deck, superstructure, substructure, are rated as “poor” or below (a numerical rating of four or less). Bridges can be listed as “structurally deficient” if the appraisal ratings for the structure or waterway adequacy are rated as requiring a high priority for replacement (a numerical rating of two or less).

A structurally deficient bridge is typically one where corrosion or deterioration has resulted in a portion of the bridge being in poor condition; for example, where water leaking through an expansion joint has caused the end of a steel girder to rust. Depending on the degree of deterioration, bridges that are structurally deficient require additional monitoring, maintenance, or repair to ensure safety and continued service. The fact that a bridge is structurally deficient does not imply that it is likely to collapse or is unsafe. It may only indicate that maintenance or rehabilitation of various components is necessary to restore its condition.

MCDR inventory includes 27 structurally deficient NBI bridges. Of particular interest are structures rated 3 or below, which are designated as serious/critical. There are 12 structures in MCDR inventory according to data from the National Bridge Inventory, acquired in July 2023. MCDR's stated goal is to eliminate all serious/critical structures within ten years (2032). Five of these structures are currently programmed for replacement and the other seven have been identified as priorities for programming in the later years of the current plan and will be included in the next five-year CIP (FY 28-32). See **Appendix F** for a detailed listing.

3.1.3 Functionally Obsolete Bridges

A bridge is considered “functionally obsolete” if the structural evaluation, deck geometry, under clearances, approach roadway alignment, or waterway adequacy is rated as “intolerable requiring high priority of corrective action” (a numerical rating of three or less). A functionally obsolete bridge may or may not be able to carry all legal loads (i.e., load posted), but its configuration impairs its ability to carry traffic safely or pass high water, meaning the entire opening could fill and hit the side of the beams which creates pressure flow. It could also flow over-top the bridge. Examples include a bridge that has substandard shoulder width across the bridge or inadequate under-clearance causing overtopping of the bridge deck during high water events. Functionally obsolete and structurally deficient are mutually exclusive to one another.

MCDR inventory includes 22 functionally obsolete bridges, which is unchanged from the previous TAMP in 2020. See **Appendix G** for a detailed listing.

3.1.4 Load Posted Bridges

A load posting is often required for bridges when the structure does not have enough capacity to safely carry the legal load limits. Their purpose is to prevent heavy loads that cause stress above the safe limit from crossing the bridge. **Appendix H** lists the 20 load posted structures in Macomb County.

3.1.5 Closed Bridges

Bridge condition can deteriorate to a point where it is no longer safe for vehicular traffic. MCDR has two closed bridges, which are described in more detail in **Appendix I**.

3.1.6 Fracture Critical Bridges

A fracture critical bridge is defined by FHWA as a steel member in tension, or with a tension element, whose failure could cause a portion of or the entire bridge to collapse. Fracture critical bridges lack redundancy, which means that in the event of a steel member's failure there is no path for the transfer of the weight being supported by that member to hold up the bridge. Many pedestrian bridges, for example, are considered fracture critical since there are only two main supporting beams. Fracture critical structures are not desirable

in a bridge inventory, however, can be managed through thorough inspection and routine maintenance activities. There are zero fracture critical bridges in MCDR inventory.

3.2 Baseline Condition

Condition ratings are used to describe the existing condition of in-place bridge components compared to their original as-built condition. Evaluation is done for the deck, superstructure, and substructure components of each bridge. The overall condition rating for a given bridge is the lowest of the aforementioned components. The condition evaluation of channels, channel protection and culverts are also included. The current state of MCDR’s NBI bridges are shown in **Table 10**.

Table 10: Current NBI Conditions

	Good/Fair (5-9)	Poor (4)	Serious/Critical (1-3)	% of Inventory
Open	126	68	9	90.2%
Open/Posted	1	3	16	8.9%
Closed	–	–	2	0.9%
Total	127	71	27	225
% of NBI Inventory	56.4%	31.6%	12.0%	–

Source: MiBridge, July 2023

3.2.1 Location

Figure 7 through Figure 9 show the location of each of the NBI structures located within Macomb County as well as their conditions.



Figure 7: Northern Macomb County, Bridge Conditions

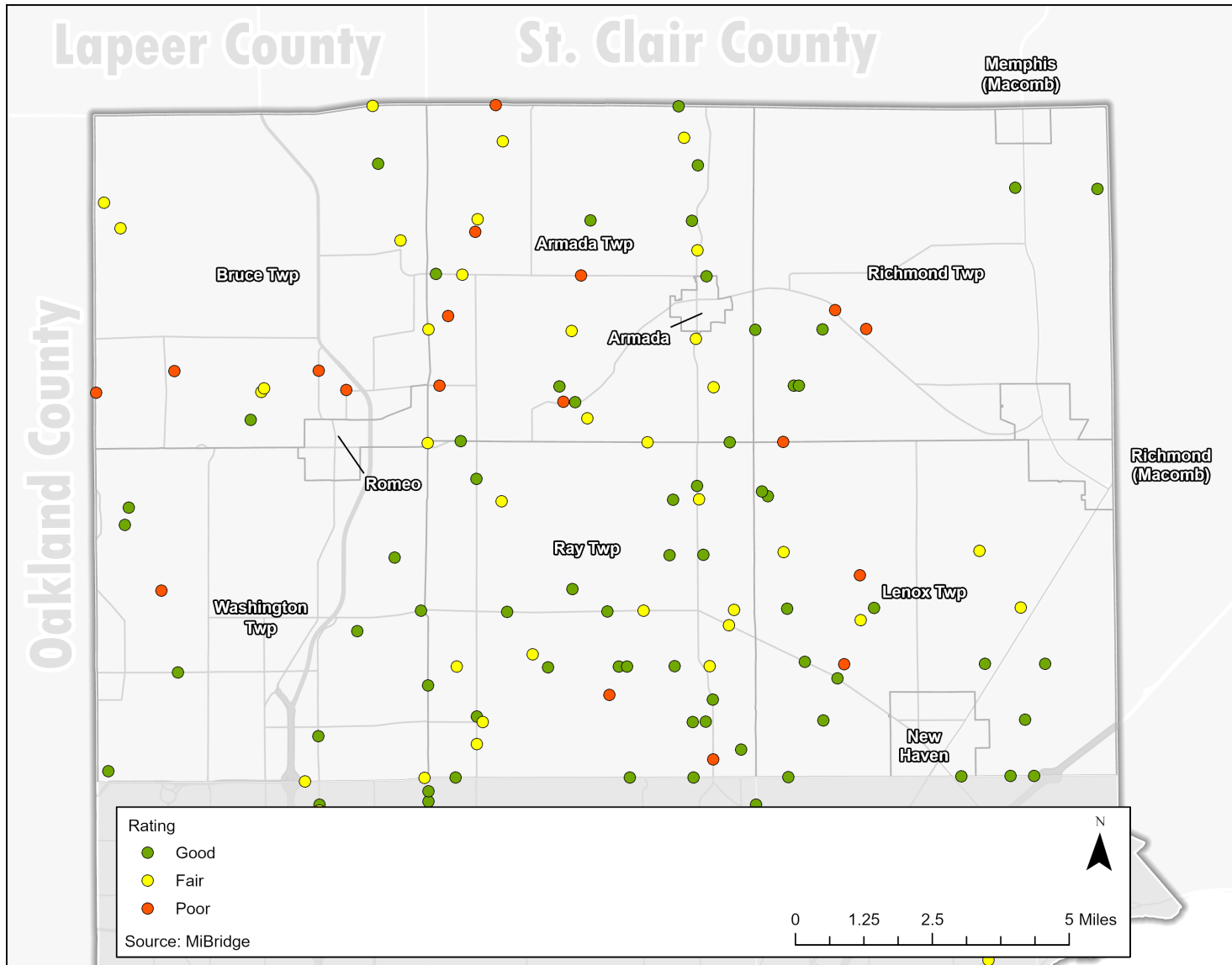


Figure 8: Central Macomb County, Bridge Conditions

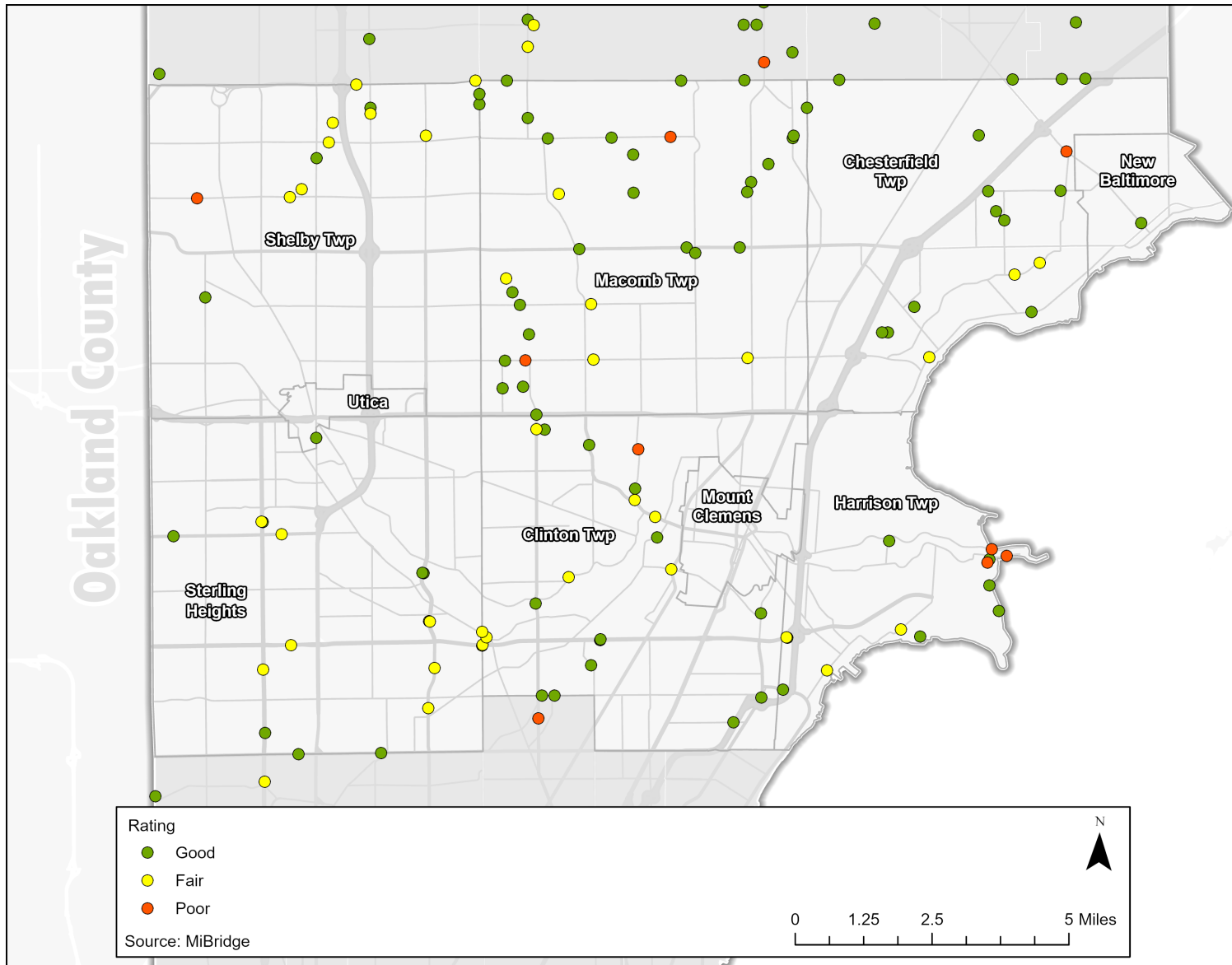
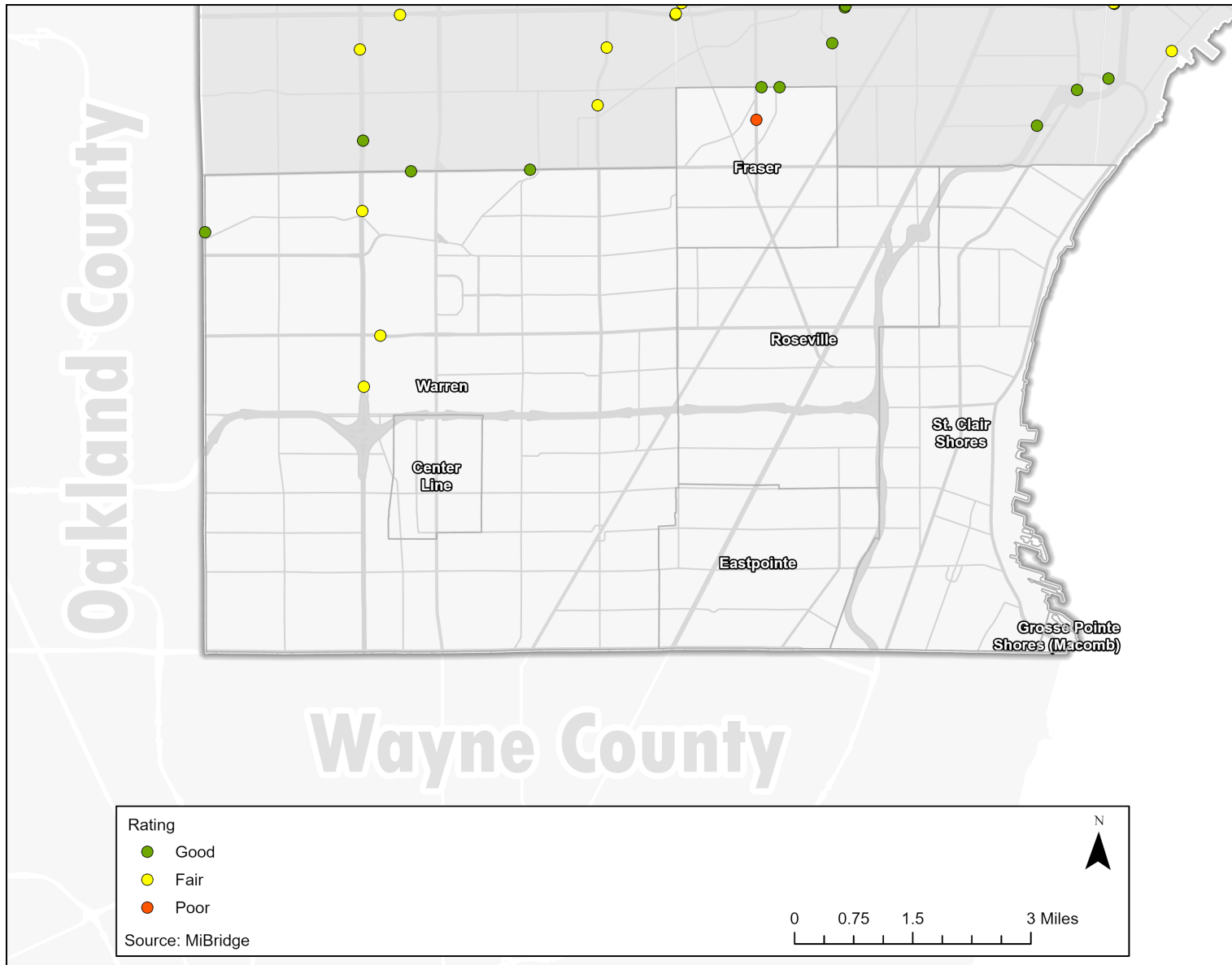


Figure 9: Southern Macomb County, Bridge Conditions





3.3 Goals

The County's Performance Plan contains several key goals that are aimed at improving and sustaining those improvements on its bridge network, with its two key goals regarding bridges as follows (see the full Performance Plan in **Appendix B**).

- Increase and sustain the percentage of bridges rated "Good/Fair" with a focus on the National Highway System and the Corridors of Significance.
- Achieve and sustain zero serious/critical rated bridges.

With these goals in mind and effectively utilizing available resources, the next sections of the TAMP outline how MCDR plans, develops, and delivers specific improvements planned to achieve these goals.

3.4 Program Development and Condition Forecasting Scenarios

The methodology for developing bridge program investment project priorities for the TAMP can be summarized as follows:

- The current condition of each of the bridges in the network being analyzed is determined using NBIS and MDOT recommended tools. Inspection inventory and condition data are consolidated in spreadsheet format for MCDR's bridges in **Appendix D**.
- Initial scope and cost estimates for each bridge are developed using MDOT's Local Agency Program Bridge Cost Estimate template.
- The scope of work and cost estimate data is then compiled and utilized in conjunction with other factors, including traffic volumes, criticality, and open/posted/closed status, in selecting bridge project priorities for the five-year time period 2024-2028, see the Summary of Preservation Criteria table in **Appendix K**.
- In terms of management and preservation actions, MCDR's asset management program uses a mix-of-fixes strategy that is made up of replacement, rehabilitation, preventive maintenance.
- The replacement, rehabilitation, and preventive maintenance projects may be generally eligible for funding under MDOT's Local Agency Bridge program, and requests for funding will be submitted in response to the Local Bridge Program Call for Applications.

3.5 Primary Inventory Investment Strategy

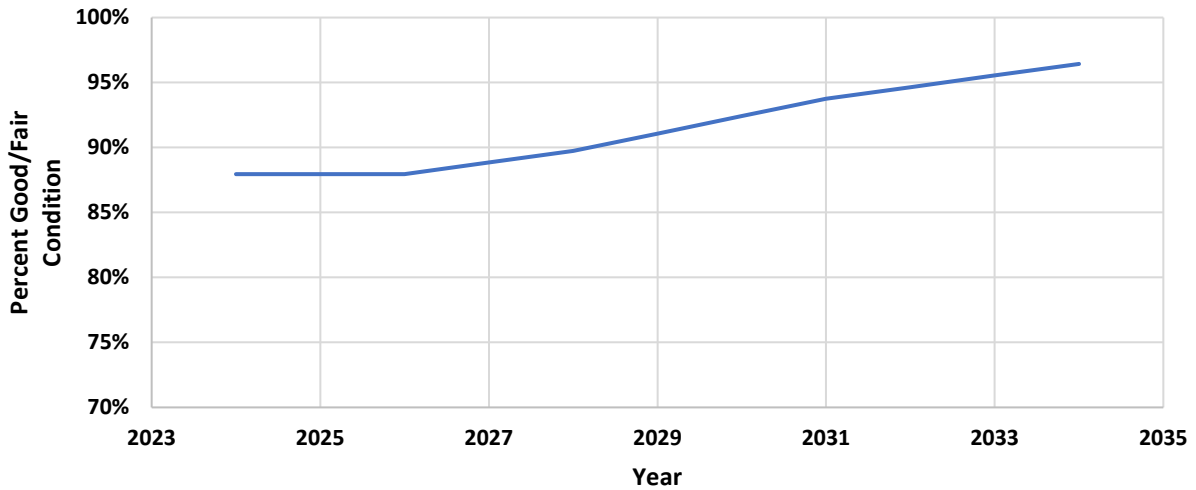
In order to forecast the condition of the Macomb County bridge system, the BCFS tool was applied to the bridge inventory. BCFS models the anticipated inflation in construction costs as a reduction in the available funds. The inflation rate is currently modeled as 5%, the BCFS model takes the annual program and deducts 5% from the available funding pool to account for the inflation in prices, compounding annually.

3.5.1 Summary of Condition Forecast

It is anticipated that the overall condition of the system will increase to approximately 94% Good/Fair by year 2032, see **Figure 10**.

The MCDR goal is to utilize the number of CPM projects projected in the BCFS model as a minimum average threshold. Additional smaller repairs may be bundled together to optimize the use of the funding and continue to maintain these good/fair structures.

Figure 10: 10-Year Bridge Condition Forecast



3.6 Planned Projects

To achieve its goals, MCDR has developed a program with three to five years of identified project priorities or program commitments and five years of network-level strategies targeted at addressing serious and critical bridges and implementing a mix-of-fix strategy to prevent the deterioration of good/fair bridges into poor, serious, or critical condition.

MCDR computes the estimated cost of each typical management and/or preservation action using unit prices in the latest Bridge Repair Cost Estimate spreadsheet contained in MDOT's Local Bridge Program Call for Projects. The cost of items of varying complexity, such as maintenance of traffic, staged construction, scour countermeasures, and so forth, are computed on a bridge-by-bridge basis. The cost estimates are reviewed and updated annually. Scheduled maintenance activities and minor repairs that are not affiliated with any applications, grants, or other funded projects will be performed by the agency's in-house maintenance forces and funded through MCDR's annual operating budget.

Capital program expenditures for bridges prioritized over the next five years include the following:

- Capital Preventive Maintenance projects,
- Rehabilitation projects, and
- Replacement projects.

Planned capital improvements on MCDR's bridge network are listed in **Table 11** through **Table 13**. They include planned CPM, Rehabilitation and Replacement projects currently programmed and either in the process of being implemented (FY 2023) or under development and planned for obligation and construction in FY 2024-2025. Unprogrammed but identified as priority needs for FY 2026-2032 include necessary CPM, routine maintenance and rehab treatments on the structures listed on the Critical Linkages list in **Table 20**, and the remaining structures in the inventory in serious-critical condition. MCDR continually seeks funding opportunities to meet these priority needs but is committed to prioritizing these needs within the next 7-8 years to achieve its stated goals.

3.7 Gap Analysis

When MCDR compares its funding and its programmed/funded projects with all of its prioritized projects as shown in **Appendix C**, MCDR believes it should be able to achieve its asset management goals for the period of this plan. In the event that MCDR is unable to complete some of these projects due to unforeseen budgetary decreases, MCDR will continue to monitor those bridge assets and take any necessary steps within its budget to prevent or mitigate a condition decline or a need to post or close structures. A network-level re-evaluation of MCDR bridge system condition trends and forecasted conditions will be performed every three years or less in connection with the overall TAMP update.

Table 11: Bridge Work for Fiscal Year 2023

#	Structure	Work Type	Condition	Year Built	Status	Scour Critical	Construction Cost
6277	New Haven Rd over Salt River	Replacement	Serious/ Critical	1965	Load Posted	-	\$4,537,269
6298	Coon Creek over Coon Creek	Replacement	Serious/ Critical	1971	Load Posted	-	\$894,903
6325	W Archer Dr over Channel to Lake St. Clair	Replacement	Poor	1980	Open	-	\$2,336,958
N/A	Conrail Railroad	New Crossing Surface	N/A	N/A	N/A	-	\$130,970
							\$7,900,100

Table 12: Bridge Work for Fiscal Year 2024

#	Structure	Work Type	Condition	Year Built	Status	Scour Critical	Construction Cost
6202	South River Rd over Channel to Lake St. Clair	Replacement	Serious/ Critical	1974	Load Posted	Yes	\$2,191,218
6269	North Avenue over EB Coon Creek	Capital Preventive Maintenance	Fair	1994	Open	-	\$269,000
6320	North River Rd over Catfish Channel	Replacement	Serious/ Critical	1966	Load Posted	-	\$5,057,904
6349	22 Mile Rd over Clinton River	Capital Preventive Maintenance	Fair	1993	Open	-	\$600,000
6367	28 Mile Rod over Camp Brook Drain	Capital Preventive Maintenance	Fair	1995	Open	-	\$188,000
6385	Wolcott Rd over NB Clinton River	Capital Preventive Maintenance	Good	2014	Open	-	\$109,000

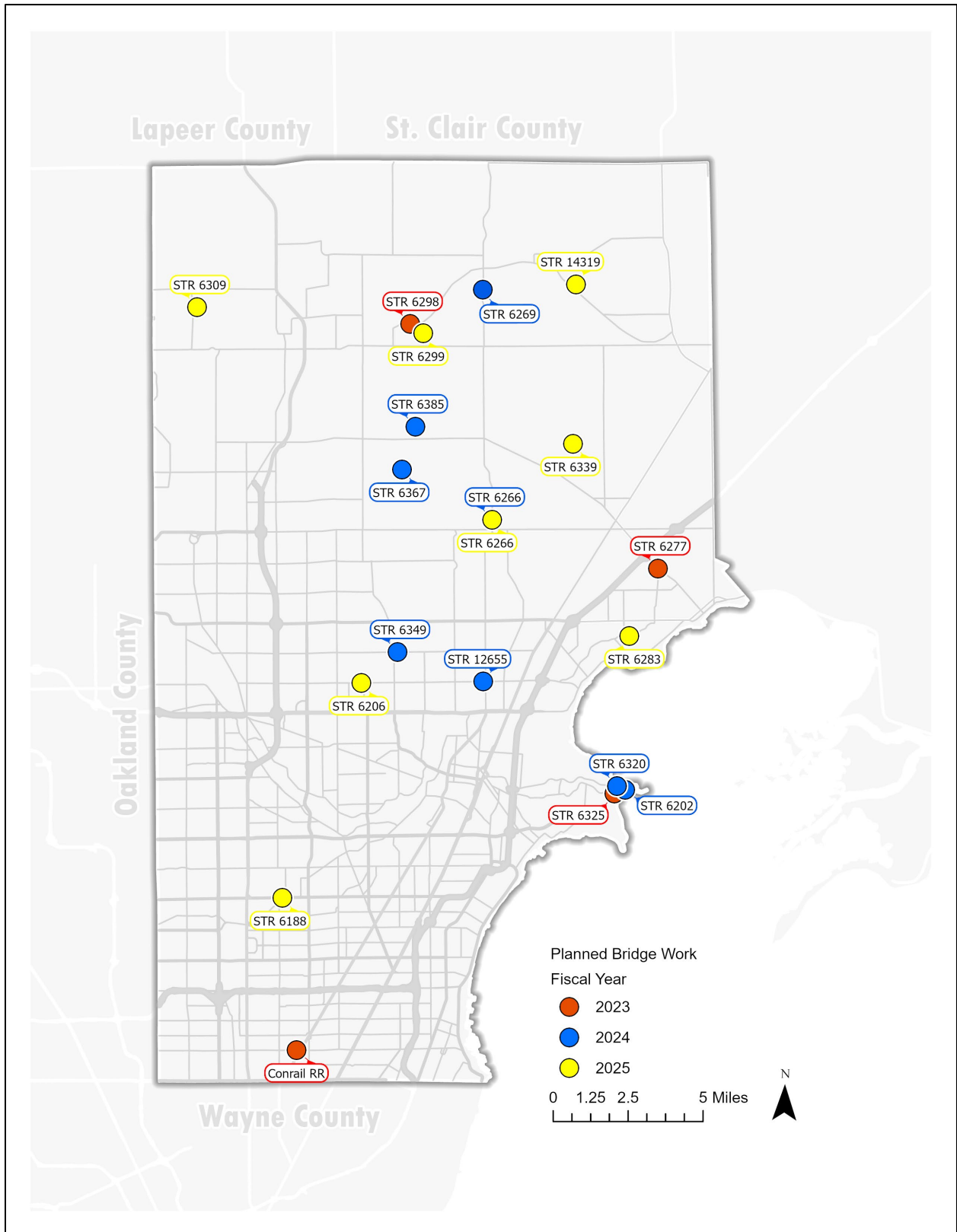
#	Structure	Work Type	Condition	Year Built	Status	Scour Critical	Construction Cost
12655	21 Mile Rd over Clinton River	Capital Preventive Maintenance	Fair	1996	Open	-	\$600,000
							\$9,015,122

Table 13: Bridge Work for Fiscal Year 2025

#	Structure	Work Type	Condition	Year Built	Status	Scour Critical	Construction Cost
6188	14 Mile Rd over Red Run Drain	Capital Preventive Maintenance	Fair	2009	Open	-	\$477,000
6206	21 Mile Rd over Salt Slang Gloede Drain	Replacement	Poor	1968	Open	-	\$5,120,000
6266	North Avenue over EB Coon Creek	Replacement	Serious/Critical	1977	Load Posted	-	\$2,993,000
6283	Callens Rd over Fish Creek	Capital Preventive Maintenance	Fair	1964	Open	-	\$179,000
6299	Hicks Rd over Coon Creek	Capital Preventive Maintenance	Fair	1964	Open	-	\$192,000
6309	Raap Rd over Fisher Lake Outlet	Replacement	Poor	1982	Load Posted	-	\$659,000
6339	Bates Rd over Deer Creek	Capital Preventive Maintenance	Fair	1964	Open	-	\$206,000
14319	34 Mile Rd over Highbank Creek	Replacement	Serious/Critical	1968	Load Posted	-	\$1,493,000
							\$11,319,000

Source: MiBridge, 2023

Figure 11: Planned Bridge Projects



4. Culvert Assets

MCDR defines a culvert as a structure or crossing that is 20 feet or less in span. This definition complements the definition of a bridge, and it is MCDR's intent to utilize this TAMP as a platform for the development of a program to assess and address its culvert inventory in a similar manner as it does its NBI bridges.

4.1 Inventory of Assets

MCDR is in the process of developing a more complete inventory and database of culverts to track inspection data. The number of MCDR owned culverts by location is shown in **Table 14**.

Table 14: Current Known Culvert Inventory

Community	Number of Culverts*
Armada Twp	27
Bruce Twp	14
Chesterfield Twp	36
Clinton Twp	38
Fraser	5
Harrison Twp	45
Lenox Twp	53
Macomb Twp	60
New Baltimore	3
New Haven	3
Ray Twp	23
Richmond Twp	59
Shelby Twp	58
Sterling Heights	9
St. Clair Shores	2
Utica	1
Washington Twp	31
Total	467

**Numbers will be adjusted when complete inventory is obtained.*

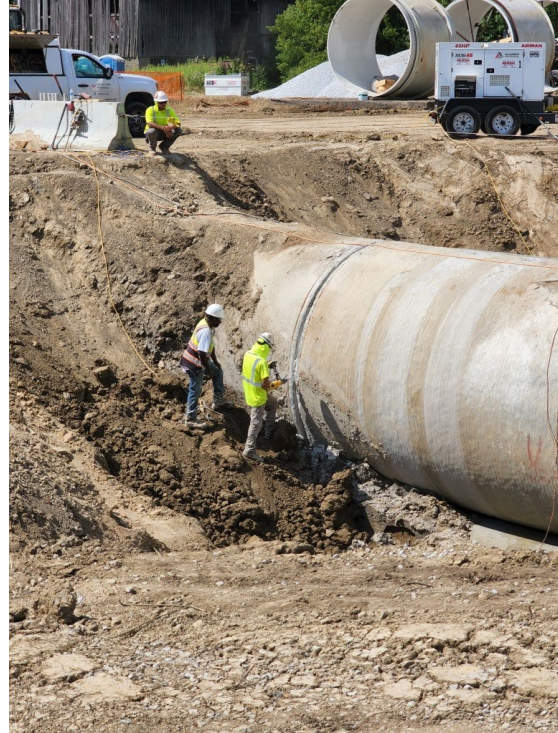
4.2 Goals

Goals for this asset plan will be an important consideration in the development of an overall investment strategy. MCDR sees these assets as a critical part of its infrastructure, especially in the southern, more low-lying areas of the county. There are also large culverts that are part of the critical system linkages and some bridges that could be converted to culverts and vice versa. These considerations suggest the following set of near-term goals:

- Continued assessment of the needs of county culverts beginning with a more complete inventory of type, size, location, and condition data;
- Prioritize needs within the larger context of the road and bridge capital program;
- Integrate needs and commitments with the bridge program over time; and
- Establish and repeat a regular asset management cycle of data collection and analysis, strategy development, program planning and implementation, maintenance, and operation, and then back to data collection and analysis.

4.3 Planned Projects

MCDR has been working to use Geographic Information System (GIS) to inventory and assess culvert condition, which included establishing standard procedures for condition assessment. Once this is completed, all existing data will be migrated and stored in the GIS database. The county is now in the process of developing plans to preserve culvert assets through appropriate and coordinated maintenance, rehabilitation, or replacement interventions. These activities and projects will be closely coordinated with MCDR's road and bridge program.



Macomb Daily, August 20, 2022

5. Signal Assets

MCDR has a dedicated team of technical and professional staff focused on maintaining and upgrading their traffic signal assets. MCDR develops and manages projects to modernize signals to the latest standards. The traffic signal system has excellent operational performance, but the system is aging and will require significant future investment. In addition, MCDR also has a robust communications network that employs advanced traffic signal technology and is contracted to perform routine and emergency maintenance of MDOT and city, village, and private signals. MCDR maintains an inventory database of the majority of signals, NEXGEN Asset



Macomb Daily, June 4, 2021

Management. This is useful in supporting operations and maintenance activities and provides a system to track work orders, asset condition, and proactively monitor age and viability of each asset.

5.1 Inventory of Assets

At present, MCDR tracks inventory data for traffic signals as well as traffic signal installation and modernization investment and improvement data. The county oversees approximately 373 traffic signals. More details are in **Table 15**. MCDR utilizes NEXGEN Asset Management Computer Maintenance Management System (CMMS). The intuitive web-based interface enables MCDR with Asset Management along with a work order tracking system. NEXGEN Asset Management has ability to customize information for various asset classes, such as Vehicle, Structure, and Linear items. The optional Asset Condition Index can proactively monitor age and viability of each asset, allowing users to track assets that aren't accessible through routine field inspections.

A high-level description of some of the key elements of the NEXGEN System Functionality is located in **Table 16**. MCDR is continually evaluating and implementing additional functionality to meets its evolving needs.

In terms of the high-level inventory and life-cycle data driving the systematic investment and maintenance decision-making considerations, the following tables identify the key asset classes, replacement costs and life-cycle cost estimates.

Table 15: Traffic Signal Assets

Item	Number	Replacement Value (each)	Total Replacement Value
Signal Locations	373	\$350k (including all listed subcomponents)	\$130,550,000
Signal Cabinets	266		
Surveillance Cameras	163		
DSRC Connected Vehicle Radios	341		
Acyclica Travel Time Units	99		
Vehicle Detection Intersections	158		
Radios for Signal Interconnect	475		
Miles of Fiber Optic Cable	51		
Regional Communication Hubs	27		

Table 16: NEXTGEN Descriptions

Years	Asset Class	2020 Replacement Cost	Life-Cycle Term Cost
10	Stop Bar Detection	\$25k	\$80k
10	Advanced Detection	\$35k	
10	CCTV	\$8k	
10	Comm Equipment	\$3.5k	
10	RSU	\$4k	
10	Wi-Fi Travel Time	\$4.5k	
20	ITS Cabinet	\$30k	\$73k
20	OH Signals	\$17k	
20	Ped Signals	\$12k	
20	Street Name Signs	\$14k	
40	OH Signal Poles	\$44k	\$86k
40	Ped Signal Poles	\$24k	
40	Underground	\$11k	
40	Truss Arms	\$5k	
40	Power	\$2k	

5.2 Goals

The goal of MCDR's traffic signal asset management program is the continued reliable operation and preservation of all of its traffic signals.

5.3 Planned Projects

MCDR's policy is to evaluate traffic signal assets based on condition assessment for replacement or repair during any reconstruction, rehabilitation, preventive maintenance, or schedule maintenance activities on the roadway affected by the particular signal. It also conducts replacements or repairs for those traffic signal assets reported as non-functional or as performing with reduced function. MCDR adheres to regular maintenance and servicing policies outlined in the Michigan *Manual on Uniform Traffic Control Devices*. MCDR has planned traffic safety investments for signals, as outlined in Error! Reference source not found..

Table 17: Planned Signal and Safety Projects

Fiscal Year	Project Description	Total Estimated Amount
2023	Traffic Operations Center-Countywide	\$ 3,950,000
2023	Distributing aggregated communications bandwidth load capacities	\$ 2,383,500
2023	Signal upgrades	\$ 1,330,189
2024	Automated Traffic Signal Performance Measures (ATSPM) Detection upgrades	\$ 2,950,000
2024	Signal Modernization, box span, backplates, and dilemma zone	\$ 1,665,903
2024	Various Project Types/Treatments/Activities	\$ 1,800,000
2025	Automated Traffic Signal Performance Measures (ATSPM) Detection	\$ 4,450,000
2025	Traffic Operations Center - Operations	\$ 4,015,000
2025	Various Project Types/Treatments/Activities	\$ 1,450,000
2025	Various Project Types/Treatments/Activities	\$ 3,000,000
2026	Traffic Operations Center - Operations	\$ 4,080,000
2026	Automated Traffic Signal Detection, Communication, Roadside Units and CCTV	\$ 2,950,000
2026	Various Project Types/Treatments/Activities	\$ 3,000,000
	Total Investment	\$ 37,024,592

6. Financial Resources

MCDR is committed to providing a road and bridge network that meets the safety, access and mobility needs of its customers. This commitment is at the core of our mission statement:

'MCDR is dedicated to providing the public with a quality county road system, with a focus on safety and convenience for motorists and the community, environmental responsibility, and financial accountability.'

Part of this mission is the effective use of the funding resources provided to the agency, which is the 'financial accountability' part of the mission. The Macomb County Department of Roads (MCDR) is the fiduciary authority responsible for the stewardship of public transportation revenues provided to the agency to perform its mission from authorized local, state, and federal sources. State law and federal regulations provide the legal framework for the execution of this responsibility, and MCDR policies and procedures provide the operational framework.

MCDR understands the importance of balancing the competing constraints of available revenues and system maintenance needs. MCDR develops its asset management budget annually with a focus on near-term capital improvement needs and longer-term network-level strategies. Investments are prioritized and targeted to support short and long-term goals that have been vetted and prioritized within the agency based on an on-going assessment of needs and key stakeholder input. These needs are assessed based on available data and within a policy framework that guides investment decision-making.

6.1 Investment Plan and Targets

Road and bridge assets are designed to last decades and involve large expenditures of public capital to construct and maintain. Traffic & Safety assets have shorter life-cycles due to the nature of the materials utilized and the impact of rapidly evolving technologies. This work is performed as part of either the annual MCDR CIP or as part of an operations or maintenance program carried out.

By direct forces or third-party contractors. Budgets for these programs, projects and activities are developed, approved, and implemented in accordance with established procedures. The investment plan provided herein (see **Appendix A**) includes targets for such investments on a fiscal year (October 1-September 30, eventually moving to a calendar year) basis for each of the programs or activities listed.

The investment amounts are provided as targets and a guide for on-going planning, engineering, and financial decisions, and are based on assumptions in play at the time of initial plan approval. There will not be an exact fit between project estimates and program budgets at any given time in the TAMP due to the dynamic nature of these projects. In particular, CPM projects have an inherent dynamic in that they are normally not fully identified within the time frame of a TAMP but developed and validated in response to more near-term conditions on 1-3 year basis.

For the FY 23-27 Investment Plan update, MCDR is adding its Traffic and Safety Program template. This demonstrates MCDR's commitment to integrate its capital and operational program planned expenditures into an overall system investment and management strategy.

The plan is intended to be rolling, i.e., each year another year of investment targets will be added and adjustments to existing targets and programs (if necessary) will also be made based on goals, needs, available and anticipated funding, and existing and emerging priorities.

6.2 Revenue Assumptions

Within the timeframe of the FY 2023-27 TAMP, MCDR plans to invest up to 68% of its revenues from the MTF for its capital improvement program. In addition, MCDR is investing an average of \$26.6M in federal aid allocation from the SEMCOG over the five-year period in county-owned road and bridge projects identified by the Macomb Federal Aid Committee (FAC) and MDOT as priorities.

Overall, MCDR estimates that approximately \$118.4 million per year in revenue will be available for its overall capital improvement program from federal, state, and local sources. This assumes a slight increase in planned MTF revenues due to: (a) a return to more normal levels of fuel consumption following COVID-19 related travel impacts along with (b) the anticipated impact of the inflation index increases in the gas tax which took effect on January 1, 2022. Local revenues are estimated based on anticipated contributions from township, city, and village government towards improvement projects on the county primary and local system in accordance with long-standing participation agreements.

The revenue estimate does not include \$96.0M in federal non-discretionary targets listed in Table 1 which are grants being pursued to fund the Metro Parkway and Mound Road (City of Warren) investments shown in the plan.

Over the next five years, MCDR plans to invest nearly \$250 million in road reconstruction, rehabilitation, preventive maintenance, and capacity improvement projects. These investments will depend heavily on the above anticipated revenues from the MTF, local contributions, and federal/state programs.

In terms of its bridges, MCDR is investing over \$56 million over the next five years for its bridges and culverts. Routine and scheduled maintenance activities and minor repairs that are not affiliated with any applications, grants, or other funded projects will be performed by the agency's in-house maintenance forces and funded through MCDR's annual operating budget.

6.3 Traffic and Safety Department – Capital Program and Traffic Operations Center

Funding sources for these investments generally consist of a combination of federal, state and local transportation funds either directly allocated to MCDR and budgeted for use or granted via competitive award or earmark.

MCDR's Traffic & Safety Department has historically competed for and successfully won multiple, major CMAQ Grants for use in operating its state-of-the-art COMTEC center as well as implementation of key safety projects and traffic signal modernization and optimization projects.

For the 2023-27 investment plan, the MCDR Traffic & Safety Department will focus on three key areas:

- Traffic Operations Center (TOC)
- Traffic & Safety Programs
- ITS System Improvements

Funding amounts shown are targeted for a combination of capital and operating program investments.

In addition, MCDR will continually pursue any and all potential funding sources moving forward to support its asset management investment programs. An example of this is the \$97.8 million Innovate Mound Infrastructure For Rebuilding America (INFRA) Grant pursued and received to anchor funding for this vital National Highway System (NHS) corridor from I-696 to M-59. On average, MCDR plans to submit three to five applications per year to the LAP Bridge Program and will evaluate opportunities to submit on other federal and state grant programs, such as Transportation Economic Development Funding (TEDF), Transportation Alternatives Program (TAP), RAISE, INFRA, MEGA, Rural, etc. Federal grant applications for two priority long-term investments in Metro Parkway from Mound to VanDyke and Mound Road south of I-696 in the City of Warren have already been prepared and tendered and will continue to be prioritized as discretionary grant investments for MCDR.

This financial information is not intended to be a full financial disclosure or a formal report, and this document will be updated annually and the underlying budget supporting implementation will be adjusted as needed to meet on-going capital and operational needs as determined by MCDR leadership.

6.4 TAMP CIP Revenue Sources and Target Programs

Revenue sources currently identified for the Road and Bridge CIP include:

- a. County Act 51 funds received from the MTF,
- b. Federal Transportation funds received through SEMCOG's rolling Local Federal Aid program and implemented through the MDOT LAP,
- c. Federal/State funds received through the MDOT statewide LAP Program,
- d. Federal and state discretionary earmarks, and
- e. Local funds used as match for County-led projects on the county system.

Revenue Sources for Traffic & Safety Programs and the TOC include:

- a. Federal CMAQ funding grants from SEMCOG through FY 25,
- b. \$1.5M Carbon Reduction Program grant for FY 24,
- c. MTF allocated to MCDR and budgeted to MCDR Traffic & Safety through the annual budgeting cycle, and
- d. MDOT LAP and SEMCOG Safety Program awards.

Funding targeted for the following established Capital Investment Programs: include:

- a. Road Rehabilitation and Reconstruction– Longer Term Pavement Asset Preservation,
- b. Bridge Rehabilitation and Reconstruction – Longer Term Bridge Asset Preservation,
- c. Capacity Improvement and New Roads – Targeted and strategic investments in adding overall network capacity along key corridors with long-standing public support, purpose and need,
- d. Pavement Preservation Program (PPP) – Capital Preventative Maintenance (CPM) Fixes on Good/Fair Roads that extend the current service life,
- e. Innovate Mound Program – Remaining investments to complete this \$200 M corridor improvement from I-696 to M-59,
- f. Non-motorized – Working with local communities to meet key non-motorized connectivity needs,
- g. Traffic & Safety Program – Signal, Signing and Safety Projects + Traffic Operations Center,
- h. Intelligent Transportation Systems Program – Incorporating proven technologies to improve traffic safety and mobility,
- i. Subdivision Program – Engaging with local communities to identify needs and prioritize needed investments, and
- j. Engineering & Administration – Estimated costs for the necessary preliminary, design and construction engineering and program administration functions.

New programs being established as part of MCDR's Strategic Performance Plan:

- a. Culvert Program – Asset inventory, condition assessment, identification of needs, and rehabilitating or replacing assets and
- b. MS4 Program – set aside investment to maintain critical drainage permits and to strengthen existing partnerships.

6.5 TAMP CIP Investment Programs and Targets

Table 18: Program Investments

PROGRAM INVESTMENTS	FY23	FY24	FY25	FY26	FY27	Total	Average
Road (Rehab + Reconstruction)	\$8.5	\$27.7	\$33.9	\$25.2	\$30.0	\$125.3	\$25.1
Bridge (Rehab + Reconstruction)	\$7.9	\$7.2	\$10.3	\$10.0	\$15.0	\$50.4	\$10.1
Capacity Increase/New Roads	\$0.0	\$20.5	\$8.8	\$3.0	\$0.0	\$32.3	\$6.5
Innovate Mound Road (all phases – County share)	\$37.3	\$14.3	\$0.8	\$0.3	\$0.0	\$52.7	\$10.5
Romeo-Plank ROW	\$1.5	\$1.5	\$1.5	\$0.0	\$0.0	\$4.5	\$0.9
Innovate Mound – Segment II	\$0.0	\$5.0	\$10.0	\$42.5	\$42.5	\$100.0	\$20.0
Metro Parkway	\$0.0	\$2.1	\$5.0	\$37.5	\$37.5	\$82.1	\$16.4
Traffic & Safety Programs	\$3.7	\$3.5	\$3.0	\$3.0	\$4.0	\$17.2	\$3.4
Intelligent Transportation Systems (ITS)	\$0.0	\$3.0	\$5.9	\$3.0	\$4.0	\$15.8	\$3.2
Maintenance (CPM – Road)	\$6.9	\$6.6	\$7.5	\$7.5	\$7.5	\$35.9	\$7.2
Maintenance (CPM) – Bridge)	\$0.0	\$1.8	\$1.1	\$1.0	\$1.0	\$4.8	\$1.0
Culverts	\$0.6	\$1.0	\$1.5	\$2.0	\$2.5	\$7.6	\$1.5
Subdivision	\$4.0	\$4.0	\$4.0	\$4.0	\$4.0	\$20.0	\$4.0
Non-Motorized	\$3.0	\$3.0	\$3.0	\$3.0	\$3.0	\$15.0	\$3.0
TAMP/GEC Program Mgmt	\$1.0	\$1.0	\$1.0	\$1.3	\$1.0	\$5.3	\$1.1
MS4 Program	\$0.0	\$0.5	\$0.5	\$0.5	\$0.5	\$2.0	\$0.4
Total – Capital Program	\$71.7	\$101.1	\$97.7	\$143.8	\$152.5	\$687.8	\$137.6
Engineering & Administration (E&A)*	\$14.9	\$21.8	\$19.9	\$21.2	\$43.2	\$121.0	\$24.2
Traffic Operations Center	\$4.0	\$0.0	\$4.0	\$4.1	\$4.0	\$16.0	\$3.2

Table 19: Revenues

REVENUES	FY23	FY24	FY25	FY26	FY27	Total	Avg
FEDERAL, STATE, AND LOCAL FUNDS							
Federal Non-Discretionary Share	\$23.5	\$28.7	\$30.6	\$20.2	\$30.0	\$133.0	\$26.6
Federal Discretionary Target Share	\$0.0	\$0.0	\$0.0	\$48.0	\$48.0	\$96.0	\$19.2
State Budget Earmark Contribution	\$32.0	\$1.7	\$5.0	\$0.0	\$0.0	\$38.7	\$7.7
Other State Funds	\$0.0	\$3.5	\$3.0	\$1.5	\$0.0	\$8.0	\$1.6
Local Share of Federal Aid Construction Projects (including discretionary targets)*	\$4.0	\$3.4	\$3.3	\$17.8	\$19.5	\$48.1	\$19.6
Local Share of E&A + Non- Federal Programs*	\$4.7	\$21.2	\$22.3	\$6.7	\$14.1	\$68.9	\$13.8
MCDR REVENUES							
MCDR Funds Needed for CIP (Total Capital Program + E&A* less Federal + State + Local Shares)	\$22.5	\$64.5	\$53.3	\$70.7	\$84.2	\$295.1	\$59.0

The tables do not include road and bridge scheduled maintenance, equipment and facilities, or non-capital administration.

Core TAMP Program Target Investment Assumptions:

1. Capital Program Investment Tools are based on publicly-available SEMCOG TIP data + Non-Federal data obtained from MCDR May through August 2023.
2. Planned Federal, state, and local revenue estimates are based on best available data August 2023 from SEMCOG, MDOT, and MCDR sources.
3. Engineering and Administrative costs include estimated costs to develop and deliver the capital program, Programmatic estimate for budgeting purposes.
 - a. 10% PE costs for Road and Bridge Rehab and Recon, CI/NR
 - b. 8% PE costs for Road and Bridge CPM + traffic and safety
 - c. 15% CE costs for Road and Bridge R&R, CI/NR
 - d. 10% CE costs for Road and Bridge CPM + traffic and safety
 - e. Capital Program Administration Costs estimated at 6% of total CIP
 - f. Capital Program Engineering costs in any given CIP year is estimated as follows: 50% of the CEI and PE costs for the capital program for that year + 50% of the cost of CEI and PE costs for the following year's program.
 - g. FY 23 TOC operations will be funded with prior year obligations; amount shown for FY 23 will be used to fund FY 24 operations; amounts shown for FY 25-27 are planned obligations for use during that fiscal year.

4. Local Share of CIP is based on the following:
 - a. Local municipalities and MCDR have a 50-50 split of engineering costs and construction costs match on federal aid projects on Primary roads.
 - b. Local municipalities responsible for 60% of the cost of projects on Local roads (Local Roads normally ineligible for federal aid)
 - c. Local municipalities responsible for 50% of the Subdivision Reconstruction Program (Construction) and 100% of the engineering of said program (local engineering costs not shown here)
 - d. Local municipalities have a 50-50 split of any ROW acquisition costs on existing roadways.
 - e. Local municipalities are responsible for a 3% administrative fee for projects.

7. Risk of Failure Analysis

By forming an interconnected system, the road and bridge network throughout Macomb County is designed to be resilient. In the event of an unplanned disruption to one part of the system, there will be at least one alternative option to support area mobility. However, there are critical linkages in the transportation system that could cause significant disruption to an unexpectedly closed road.

The following criteria have been considered in identifying critical linkages:

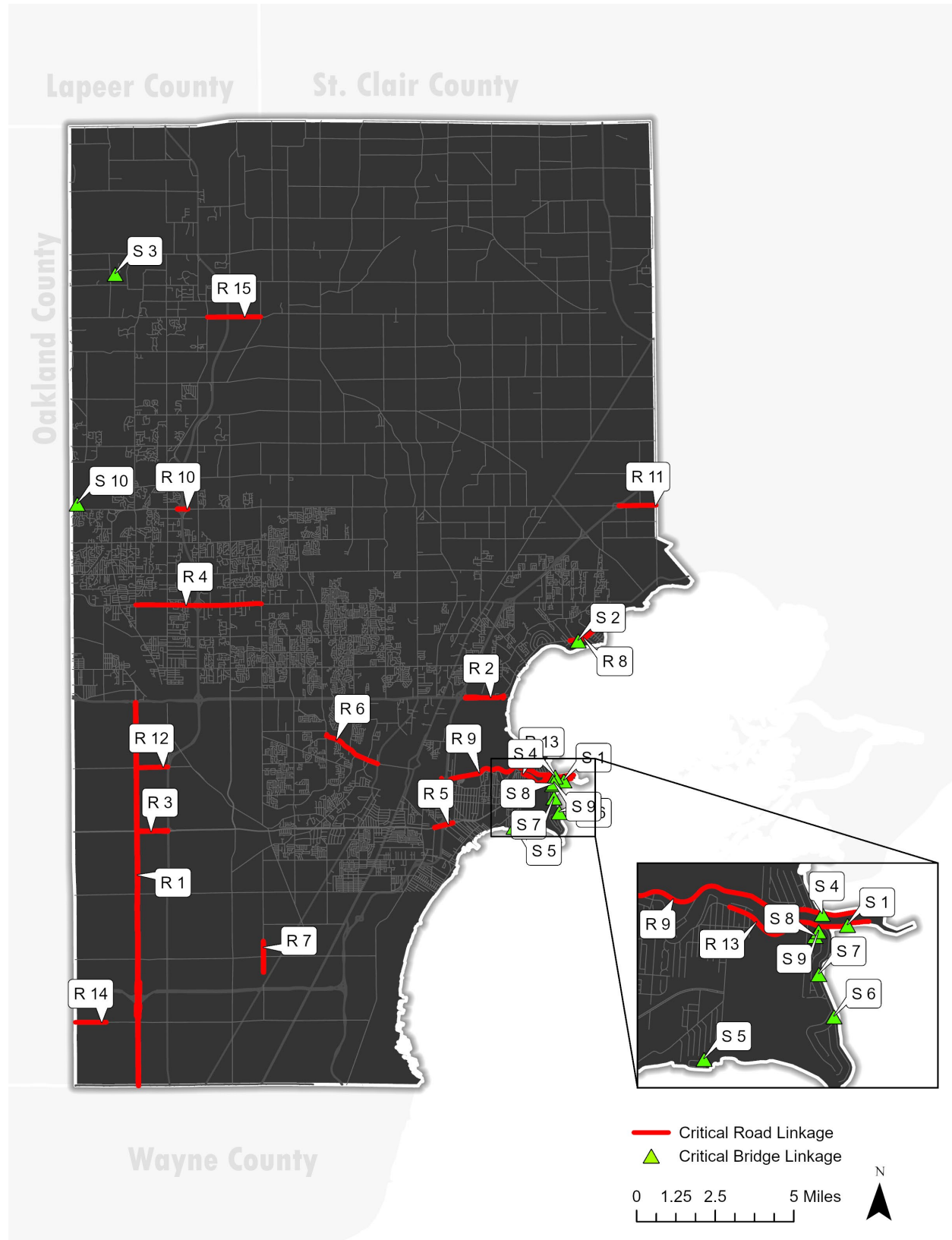
- **Geographic Divides:** Areas where a geographic feature (river, lake, mountain or limited access road) limits crossing points.
- **Emergency alternative routes for high-volume roads:** Roads that are routinely used as alternative routes for high volume roads, or roads included in an emergency response plan.
- **Limited access areas:** Roads that serve remote or limited access areas that result in long detours if closed.
- **Main access to key commercial districts:** Areas where a large number or large sized businesses will be significantly impacted if a road is unavailable.

MCDR identified the following performance objectives as critical for measuring failure mode impacts and monitoring activity effectiveness.

- Macomb pavement system performance results in high customer satisfaction through maintaining county primary roads in 85% good/fair condition, reducing crashes, and creating access that enhances quality of life.
- Macomb bridge system performance results in high customer satisfaction through maintaining zero bridge structures in serious condition, reducing crashes, and creating access that enhances quality of life.

Risk Priority Numbers (RPN) can be used as a relative prioritization of the critical linkages against one another to focus limited resources, including financial and workforce resources, on critical linkages that could potentially have the most impact on Macomb County and the community at-large should they fail. The critical linkages evaluated in this Risk of Failure Analysis (RFA) are shown in **Figure 12**.

Figure 12: Macomb County Critical Linkages



A total of twenty-six roadway and bridge elements of the MCDR system have been determined to be critical linkages. The MCDR road and bridge network includes the following key critical assets:

Table 20: Critical Linkages

Map Code	Critical Linkage
R1	Mound Road from 8 Mile Rd to M-59
R2	William P Rosso Highway from I-94 to Jefferson Avenue at Selfridge
R3	Metropolitan Parkway (16 Mile Road) from Mound Road to Van Dyke Avenue
R4	23 Mile Road from Mound Road to Hayes and at the M-53 Interchange
R5	Metropolitan Parkway (16 Mile Road) at I-94
R6	Cass Avenue from Romeo Plank Road to Groesbeck Highway (M-97)
R7	Hayes Road from Martin Road to Common Road
R8	Jefferson Avenue from Sugarbush Road to Altman Road
R9	N River Road from I-94 to East End
R10	26 Mile Road at M-53
R11	26 Mile Road from I-94 to County Line
R12	18 Mile Road from Mound Road to Van Dyke Avenue
R13	S River Road from Jefferson Avenue to East End
R14	10 Mile Road from Dequindre Road to Ryan Road
R15	32 Mile Road from South Main Street to Powell Street
S1	SN 6202: South River Road over Channel between Lake and River
S2	SN 6275: Jefferson Avenue over Salt River
S3	SN 6309: Raap Road over Fisher Lake Outlet
S4	SN 6320: North River Road over Catfish Channel
S5	SN 6321: Seaway Drive over Canal to Seaway Island
S6	SN 6322: South Lakeshore Drive over Channel
S7	SN 6323: North Lakeshore Drive over Channel
S8	SN 6325: West Archer Drive over Channel to Lake St. Clair
S9	SN 6326: Archer Drive over Channel
S10	SN 6409: Mt. Vernon Road over Stony Creek

7.1 Risk of Failure Analysis Approach

The RFA was completed using the Failure Modes Effects Analysis (FMEA) approach. FMEA is a common design and process analysis tool and closely aligns with the common risk management principles of identification, assessment, treatment, and monitor/control. Critical linkage evaluation focused on the following three “failure modes”:

1. Safety – Contribution of the asset to operating conditions that results in crashes;
2. Condition – State of good repair rating of the asset; and
3. Customer satisfaction – Complaints about the system, linked to a variety of elements including pavement or structure design, asset condition, access, congestion, load postings, customer service, and timely maintenance.

For purposes of the RFA, “failure” is intended to mean the inability of the asset to perform as intended, up to and including satisfactory achievement of the overall system goals. With respect to condition, road and structure condition were evaluated separately.

For each critical linkage, failure was evaluated with respect to the following factors:

- Severity, which is the degree of failure’s impact on the system;
- Occurrence, which is the probability of failure over a 10-year period; and
- Detection, which is the ability to detect and address issues before failure occurs.

A qualitative scale was developed for scoring Severity, Occurrence, and Detection considerations for each critical linkage and per failure mode. The scoring scale is shown in **Table 21**.

Table 21: RFA Qualitative Scoring Matrix

Rating	Severity	Occurrence	Detection
5	Critical impacts on economic, safety, or access	Failure is almost certain within 10-year horizon	Will not be detected before failure
4	Significant impacts on economic, safety, or access	Likely to fail within 10-year horizon	Unlikely to be detected before failure
3	Noticeable impacts on economic, safety, or access	May or may not fail within 10-year horizon	Monitoring in accordance with recommended practices
2	Slight impacts on economic, safety, or access	Not likely to fail within 10-year horizon	Monitoring more frequently than recommended
1	No or minimal impacts on economic, safety, or access	Very unlikely to fail within 10-year horizon	Constant monitoring

Based on the qualitative risk scores, each critical linkage received an RPN. The sum of RPNs for all failure modes of a critical linkage provides a total RPN for the given critical linkage for additional prioritization of resources.

7.2 Risk of Failure Analysis Results

The qualitative scale for RFA scoring, included in **Table 21**, provides a general method for evaluating failure of critical linkages against one another and with respect to acceptable system performance.

The 10 highest RPNs are included below in **Table 22**. The RFA Register provides the RPN for all critical linkages and is included as in **Appendix L**.

MCDR will review additional actions to address critical linkages at high risk of failure during the CIP development. Future actions will be captured in the CIP. MCDR will be responsible for implementing action plans captured in the CIP.

Table 22: Highest RPN Critical Linkages

Critical Linkage Identification					Severity	Occurrence	Detection	Total
Map ID	CL #	Location	CL Criteria	Failure Type	Consequence of Impact	Probability of Failure	Monitoring for Failure	Risk Priority Number (SxOxD)
S1	22	STR 6202 S River Rd over Channel between Lake and River	Geographic boundary	Condition	5	5	4	100
S4	24	STR 6320 N River Rd over Catfish Channel	Geographic boundary	Condition	5	5	4	100
S3	03	#6309 – Raap Road over Fisher Lake Outlet	Geographic boundary	Condition	4	5	4	80
R4	09	23 Mile from Mound to Hayes and 23 Mile Rd @ 53 Interchange	Commercial access	Safety	5	5	3	75
R3	02	Metropolitan Pkwy (16 mile) from Mound to Van Dyke	Commercial access	Safety	4	5	3	60
R12	08	18 Mile from Mound to Van Dyke	Commercial access	Safety	4	5	3	60
R12	08	18 Mile from Mound to Van Dyke	Commercial access	Condition	4	5	3	60
R7	16	Hayes from Martin to Common	Commercial access	Condition	5	4	3	60

Critical Linkage Identification					Severity	Occurrence	Detection	Total
R8	17	Jefferson Ave from Sugarbush Rd to Altman Rd	High traffic	Condition	5	4	3	60
S1	22	STR 6202 S River Rd over Channel between Lake and River	Geographic boundary	Other	4	5	3	60

8. Coordination with Other Entities

An asset management plan provides a significant value for infrastructure owners because it serves as a platform to engage other infrastructure owners using the same shared right of way space. MCDR coordinates proposed work with both internal and external agencies to minimize disruptions, reduce cost, and maximize value. Internally, the Road and Bridge divisions coordinate projects to minimize disruptions on the same road in multiple years and to avoid working on detour routes of adjacent projects.

MCDR meets with communities on a regular basis and formally starts the process in July of each year to discuss their needs. Historically projects on primary roads are funded (after any federal aid is utilized) using a 50%-50% split with the community and a 60%-40% split with local roads. Projects are coordinated with the cities and townships to replace water and sewer lines at the same time road construction is performed. MCDR also has an annual subdivision reconstruction program that consists of \$2 million in county funds and a \$2 million match from the local community.

MCDR coordinates its projects with MDOT and adjacent counties to ensure effective and efficient communications and planning. Externally, MCDR works with public and private utilities to coordinate projects and internally it coordinates within other county departments such as Public Works and Economic Development. One of MCDR's goals with its expanded program investment is to coordinate its capital and maintenance program activities more formally with all users in the right-of-way, introducing annual 'summits' to provide opportunity for greater coordination.

9. Proof of Acceptance

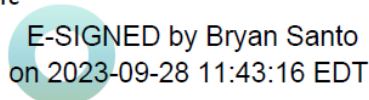
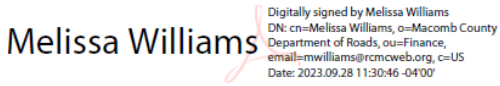
PUBLIC ACT 325 OF 2018

CERTIFICATION OF TRANSPORTATION ASSET MANAGEMENT PLAN

Certification Year: 2023

Agency Name: Macomb County Department of Roads (MCDR)

MCDR hereby certifies that the agency has developed and approved a Transportation Asset Management Plan (TAMP) meeting the requirements of Public Act 325 of 2018. Furthermore, the agency certifies that this TAMP includes all required elements including agency-defined goals and objectives, and a capital improvement plan for roads and bridges.

<p>Signature</p> 	<p>Signature</p> 
<p>Bryan Santo</p> <p>Director</p> <p>Macomb County Department of Roads</p>	<p>Melissa Williams</p> <p>Assistant Finance Director – Fiscal Services</p> <p>Macomb County Finance Department</p>
<p>Date</p>	<p>Date 09/28/2023</p>

Due every three years based on agency submission schedule.

Submittal Date: 9/29/2023

Appendix A. Pavement Primer

Roads can be either paved or unpaved. Paved roads have hard surfaces, usually constructed using asphalt, concrete, or a composite that combines the two. Other materials used to construct paved roads include sealcoat, brick, or blocks. Unpaved roads, on the other hand, are primarily comprised of gravel or, simply, unimproved earth.

Deciding whether a road should be paved or remain unpaved, as well as which material(s) to use, is based on several factors, including its purpose, the surrounding environment, what materials are available, and the budget. These choices represent a trade-off between budget and costs for construction and maintenance.

Maintenance is essential for roads to fulfill their purpose and achieve maximum service. This includes monitoring pavement conditions and applying the right fix at the right time. This pavement primer serves as a brief overview of the different types of pavements, condition assessments, and treatment options available to lengthen a road's service life.

A.1. Roadway Surfacing

The cost of construction, and the type, cost, and frequency of maintenance all influence the pavement type chosen by an agency.

A.1.1. Paved Surfacing

For hard road surface types, there are several different benefits and tradeoffs, which are outlined in the following section.

(1) Concrete Pavement

Concrete pavement is also referred to as rigid pavement. It is durable and can last a long time when properly constructed and maintained. A longer life helps reduce maintenance-related traffic disruptions. However, the initial cost for concrete is high and these roadways can be challenging to rehabilitate and maintain towards the end of their service life. The typical service life for concrete pavement can be up to thirty years before requiring major rehabilitation.

(2) Hot-mix Asphalt Pavement

Hot-mix Asphalt Pavement (HMA), also referred to as asphalt or flexible pavement, is currently less expensive to construct than concrete pavement. However, HMA requires frequent maintenance activities to maximize their service life. Typically, HMA roadways have a service life up to eighteen years before requiring major rehabilitation.

(3) Composite Pavement

Composite pavements are a combination of concrete and asphalt layers. Many composite roadways are old concrete pavements that are overlaid with several inches of HMA. This extends the service life of the roadway and addresses ride-related issues that occur in the later life of concrete pavement. Converting concrete pavement to composite pavement serves as an interim treatment to maintain the road in usable condition until reconstruction is feasible.

A.1.2. Unpaved Surfacing

Agencies can also choose to leave roads unpaved, but there are less road types to choose from than for paved road.

(1) Gravel

Gravel is a low-cost and low-maintenance pavement surface option that is made from layers of soil and aggregate (gravel). Drawbacks from this surface option include dust, mud, and ride smoothness when maintenance is delayed or traffic volume exceeds design expectations, as gravel roads are intended for lower-volume and lower-speed traffic. These unpaved roadways require frequent, but low cost, maintenance. A properly constructed and well-maintained gravel roadway can have a service life comparable to HMA but is much less expensive.

A.1.3. Pavement Condition

Monitoring pavement condition is necessary in choosing cost-effective maintenance practices. As pavement ages, it transitions between periods of opportunity for the application of different treatment types which can be used to increase the quality of and extend the service life of roadways.

(1) Paved Roads

The Pavement Surface Evaluation and Rating (PASER) system is utilized to assess the condition of paved roads. Developed by the University of Wisconsin Transportation Information Center, PASER is a way to provide a simple, efficient, and consistent way to evaluate roadway condition through visual inspection. The system has a different set of criteria for each of the types of paved roads, including concrete and asphalt, as well as for unpaved roads. More detailed information about the PASER system can be found on the Transportation Asset Management Council (TAMC) website at <https://www.michigan.gov/mic/tamc/training/paser>. Broad use of the PASER system ensures that data collected across road agencies is consistent statewide.

The PASER system rates surface condition using a scale between one and ten, where ten is a brand-new road with no maintenance action required; a road rated five is structurally sound but has some distress that can be treated with routine maintenance; and a road rated one has extensive surface and structural distress, requiring total reconstruction. The TAMC has developed statewide definitions of road condition with three simplified condition categories, each associated with a range of PASER ratings: good (8-10), fair (5-7), and poor (1-4).

As the condition of a road deteriorates and its PASER rating decreases, it generally costs more to fix the road. In other words, as a road deteriorates, the cost effectiveness of treating it decreases because it costs more per mile to fix the road and increase its service life.

PASER data are collected at a minimum of every two years, as required for all federal-aid eligible roads in Michigan. The TAMC dictates and funds the necessary training for data collection and shares the data regionally and statewide. Many agencies choose to split their jurisdictions into sections, completing half one year and the other half another year.

(2) Unpaved Roads

The condition of unpaved roads can change rapidly, making it more difficult to obtain consistent surface condition ratings compared to the more stable surface conditions of paved roads. The condition of an unpaved road can change between days and weeks whereas paved roadway condition typically changes over months to years. The TAMC adopted the Inventory Based Rating (IBR) System™ to rate unpaved

roads. More information about this rating system can be found at <http://ctt.mtu.edu/publications-resources/inventory-based-rating-system>.

The IBR System™ evaluates three features to gain an overall condition assessment of a roadway: surface width, drainage adequacy, and structural adequacy. By comparing these features to an industry-recommended baseline, the IBR System™ determines the overall condition of the roadway. The three aspects are then considered together to generate an overall IBR rating between one (worst) and ten (best).

Unpaved roads have different uses and, therefore, are constructed differently throughout Michigan. For example, a narrow, unpaved road with little gravel (a low IBR number) may be acceptable in a short, terminal end of the road network. On the other hand, a high-volume unpaved road that serves agricultural or other industrial activities requiring heavy vehicles and equipment would require a wide roadway with good drainage and a well-constructed base (a high IBR rating). Overall, the IBR rating is not indicative of a road's suitability for use, but instead it indicates the capability of a roadway to support different traffic volumes and types.

A.1.4. Pavement Treatments

Choosing pavement treatments involves balancing costs, benefits, and road life expectancy. All pavement types are damaged by water, traffic weight, freeze/thaw cycles, and sunlight, and different treatments can be used to address each of them. The following tables outline the different pavement types and the appropriate treatments depending on the rating.

(1) Reconstruction

Reconstruction involves completely removing the old pavement and base followed by the construction of a new road. This is usually done after other cost-effective maintenance treatments have been done over time, or if the road requires significant changes to road geometry, base, or buried utilities. Reconstruction is the most extensive road treatment, costing the most per mile and requiring the largest interruption to existing traffic patterns.

(2) Structural Improvement

Roads that require structural improvements are those that are rated poor and, typically, have alligator cracking and rutting. Road rutting is evidence of a failing underlying structure that needs to be rehabilitated. The following are specific treatments that are used for structural improvements.

Overlay – 3.5” Thick

Overlaying 3.5” thick asphalt is an appropriate treatment for roadways with rutting or many cracks, but have a stable base. It is also an appropriate treatment for concrete roadways with many cracks, but overall stable pavement. Roadways receiving this treatment are usually rated four on the PASER scale. The joints and cracks are sealed with tar and new asphalt is applied to the surface. This treatment extends the life of a roadway and costs less than complete reconstruction.

Mill and Overlay – 3” Thick

For roads that have a lot of cracks and a fairly stable base, milling and overlaying with 3” thick asphalt is an appropriate treatment. These roads are usually rated three on the PASER scale. With this treatment, the existing surface is milled down by 3”, cracks are sealed with tar, and a new 3” asphalt surface is applied.

Panel Replacement with Base Repairs

Concrete roads with portions of failed roadway that are rated four on the PASER scale are usually treated with panel replacements and base repairs. The concrete panels are removed, the failed base material is replaced and compacted, the panel is replaced, and the joints are sealed.

Panel Replacement with Base and Storm Repairs

Concrete roads with portions of failed roadway that are rated three on the PASER scale are usually treated with panel replacements, base repairs, and storm sewer repairs. The concrete panels are removed, the failed base material is replaced and compacted, any storm sewer in the area of influence is replaced, the concrete panel is replaced, and the joints are sealed. Updating infrastructure that is old or failing in conjunction with a roadway replacement helps to ensure the panel does not need to be removed again at a later date to replace the infrastructure.

(3) Capital Preventative Maintenance

Maintenance and Capital Preventative Maintenance (CPM) efforts are used to address fair-rated pavements before the structural integrity of the pavement is severely impacted and the roadway falls into the poor rating. These treatments are cost-effective and are used to slow the deterioration of the road, correct pavement deficiencies, and protect pavement structure.

Crack Sealing

For asphalt roads rated between five and eight on the PASER scale and concrete roads rated between seven and eight on the PASER scale, crack sealing can be used. Hot tar is used to seal the cracks to keep water and ice from further deteriorating the roadway.

Crack Sealing with Joint Repairs

Concrete roads that reach a rating of six on the PASER scale are usually treated with crack sealing and joint repairs. The joints are removed and replaced at either full or partial depth, then sealed with tar.

Maintenance Grading

On unpaved roads, maintenance grading can be used to remove isolated potholes, washboarding, and ruts, restoring the compacted crust layer so water can be shed easily. Maintenance grading typically needs to be performed three to five times per year.

(4) Dust Control

On unpaved roads, chloride or other chemicals are sometimes sprayed onto a gravel road to reduce the dust loss, aggregate loss, and to assist with maintenance. This is a short-term fix that helps to create a crusted surface. The chlorides attract moisture from the air and gravel. Timing for applying this fix is important, as if the surface is too dry or heavy rain is imminent, it may not work as intended. Dust control efforts are typically done two to four times per year.

Appendix B. Performance Plan

MCDR administrative and operational leadership came together in early 2023 to update relevant TAMP implementation goals and identify appropriate performance measures to track progress. The goals were identified by the county to address key programmatic and operational risks to overall system improvement and agency performance.

The performance measures represent the team’s consensus on identifying the appropriate near-term outcome or deliverable that would best drive and track overall success in accomplishing the stated goal within the timeframe of the committed 5-Year TAMP investment plan.

Table 26 lists those identified goals and measures, as well as the priority indicator, High, Medium, or Low.

Table 23: Goal Matrix

Goal	Performance Measure(s)	Priority
Organize the agency for success in the implementation of the TAMP	Identify agency Core Competencies and Key Person Dependencies and develop/implement strategies to support and sustain performance	Medium
Preserve Local/Subdivision road network	Identify local road corridors for investment prioritization	Medium
	Partner with locals to develop and implement strategy for preserving subdivision network	Medium
Increase overall customer satisfaction	Offer a 'MCDR Road 101' presentation annually to elected officials	High
	Improve response time to customer requests for action	Low
	Educate and inform customers on key MCDR programs and initiatives	Medium
Improve priority road and bridge network condition	Increase and sustain the percentage of roads and bridges rated “Good/Fair” with a focus on the NHS and COS	High
	Achieve and sustain zero serious/critical rated bridges	Medium
Provide a safe road network	Reduce the number and severity of crashes on NHS roads to below regional averages	Medium
	Establish and Maintain Safety Action Plan for MCDR	Medium
	Reduce number intersections in regional crash rate list	High

Goal	Performance Measure(s)	Priority
Improve Network Mobility	Maintain current corridor assessment plan and perform improvements systematically to improve overall network performance	High
Increase overall program funding and efficiency	Budget and obligate at least 95% of the yearly available program funding	High
	Work with SEMCOG and locals to update federal aid committee project selection criteria	Low
	Utilize 100% of available federal funding each year	High
Include additional asset classes in future TAMPs	Collect and analyze culvert inventory data as part of an emerging Culvert Replacement Program	High
	Include summary of signal inventory, condition and planned improvement data in next TAMP update	Low
Improve overall program integration and coordination	Identify and implement strategies to improve integration of road, bridge and safety goals, programs and projects	High
	Schedule and implement regular program updates with key local stakeholders and affected entities in primary system ROW	Medium
Improve overall program Performance, Transparency, Accountability and Communication	Increase percentage of committed capital projects completed on time and on budget (Performance)	High
	Establish and sustain enhanced overall program dashboard (Transparency and Accountability)	Medium
	Conduct an annual public and stakeholder “open house” style meeting to inform and collect feedback (Communication)	High

Appendix C. Capital Improvement Plan

Table 24: 2023 Projects and Investments

Project Name	Map ID	Limits	Investment Program	Total Estimated Amount
23 Mile Rd	1	23 Mile Rd from Gratiot Avenue to Canadian National RR	Road Rehab/Reconstruction	\$4,004,195
Capac Rd	2	Capac Rd from Irwin Rd to Pratt Rd	Maintenance (CPM - Road)	\$893,913
Kelly Rd	3	Kelly Rd from 14 Mile Rd to 15 Mile Rd	Road Rehab/Reconstruction	\$4,450,000
STR 6277	6277	New Haven Rd over Salt River	Bridge Rehab/Reconstruction	\$4,537,269
STR 6298	6298	Coon Creek Rd over Coon Creek	Bridge Rehab/Reconstruction	\$894,903
STR 6325	6325	W Archer Drive over Channel to Lake St. Clair	Bridge Rehab/Reconstruction	\$2,336,958
Conrail RR	Conrail RR	9 Mile Rd over Conrail RR	Bridge Rehab/Reconstruction	\$130,970
25 Mile Rd	N/A	25 Mile Rd Apple Lane to Heathside Drive	Non-Motorized	\$335,211
ITS	N/A	Traffic Operations Center	Traffic Operations Center	\$3,950,000
Safety	N/A	Countywide communications upgrades	Traffic and Safety Programs	\$2,383,500
Safety	N/A	Countywide signal upgrades	Traffic and Safety Programs	\$1,330,189
Various Locations	N/A	Various Limits	Culverts	\$600,000
Various Locations	N/A	Various Limits	Maintenance (CPM - Road)	\$6,000,000
Various Locations	N/A	Various Limits	Subdivision Reconstruction	\$4,000,000

Figure 13: 2023 Projects

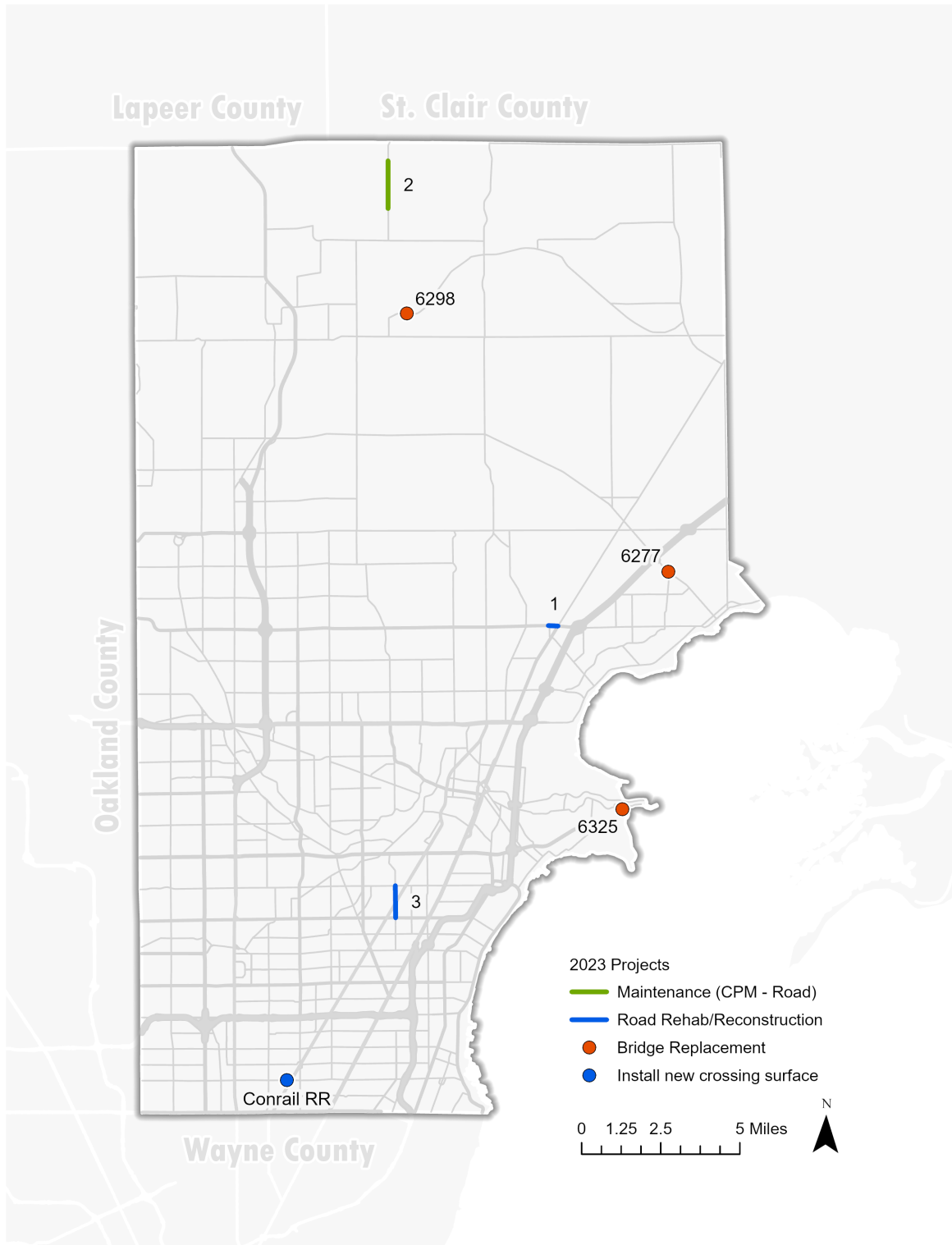


Table 25: 2024 Projects and Investments

Project Name	Map ID	Limits	Investment Program	Total Estimated Amount
10 Mile Rd	1	10 Mile Rd from Ryan Rd to Lorraine Avenue	Road Rehab/Reconstruction	\$11,276,126
33 Mile Rd	2	33 Mile Rd Lowe Plank Rd to M-19 (Main St)	Maintenance (CPM - Road)	\$550,000
Garfield Rd	3	Garfield Rd from 14 Mile Rd to 15 Mile Rd	Capacity Increase/New Road	\$1,833,333
			Road Rehab/Reconstruction	\$3,666,667
Garfield Rd	4	23 Mile Rd to 25 Mile Rd	Capacity Increase/New Road	\$9,000,000
Kelly Rd	5	Kelly Rd from 15 Mile to S Nunnelly	Road Rehab/Reconstruction	\$1,557,423
Moravian Drive	6	Moravian Drive from Schoenherr to Garfield	Road Rehab/Reconstruction	\$4,747,303
Romeo Plank Rd	7	Romeo Plank Rd from 21 1/2 Rd to 23 Mile Rd	Capacity Increase/New Road	\$9,695,759
			Road Rehab/Reconstruction	\$6,463,840
School Section Rd	8	School Section Rd from Lowe Plank to Memphis Ridge (M-19)	Maintenance (CPM - Road)	\$500,000
STR 6202	6202	South River Rd over Channel to Lake St. Clair	Bridge Rehab/Reconstruction	\$2,191,218
STR 6269	6269	North Avenue over EB Coon Creek	Maintenance (CPM - Bridge)	\$269,000
STR 6320	6320	North River Rd over Catfish Channel	Bridge Rehab/Reconstruction	\$5,057,904
STR 6349	6329	22 Mile Rd over Clinton River	Maintenance (CPM - Bridge)	\$600,000
STR 6367	6367	28 Mile Rd over Camp Brook Drain	Maintenance (CPM - Bridge)	\$188,000
STR 6385	6385	Wolcott Rd over NB Clinton River	Maintenance (CPM - Bridge)	\$109,000
STR 12655	12655	21 Mile Rd over Clinton River	Maintenance (CPM - Bridge)	\$600,000
25 Mile Rd	N/A	25 Mile Rd and Broughton Rd new non-motorized pathway	Non-Motorized	\$390,870
26 Mile Rd	N/A	26 Mile Rd pedestrian bridge	Non-Motorized	\$1,050,616
ITS	N/A	Countywide ATSPM upgrades	Intelligent Transportation Systems (ITS)	\$2,950,000
Safety	N/A	Countywide signal upgrades	Traffic and Safety Programs	\$1,665,903
Various Locations	N/A	Various Limits	Culverts	\$1,000,000
Various Locations	N/A	Various Limits	Maintenance (CPM - Road)	\$5,550,000
Various Locations	N/A	Various Limits	Traffic and Safety Programs	\$1,800,000
Various Locations	N/A	Various Limits	Subdivision Reconstruction	\$4,000,000

Figure 14: 2024 Projects

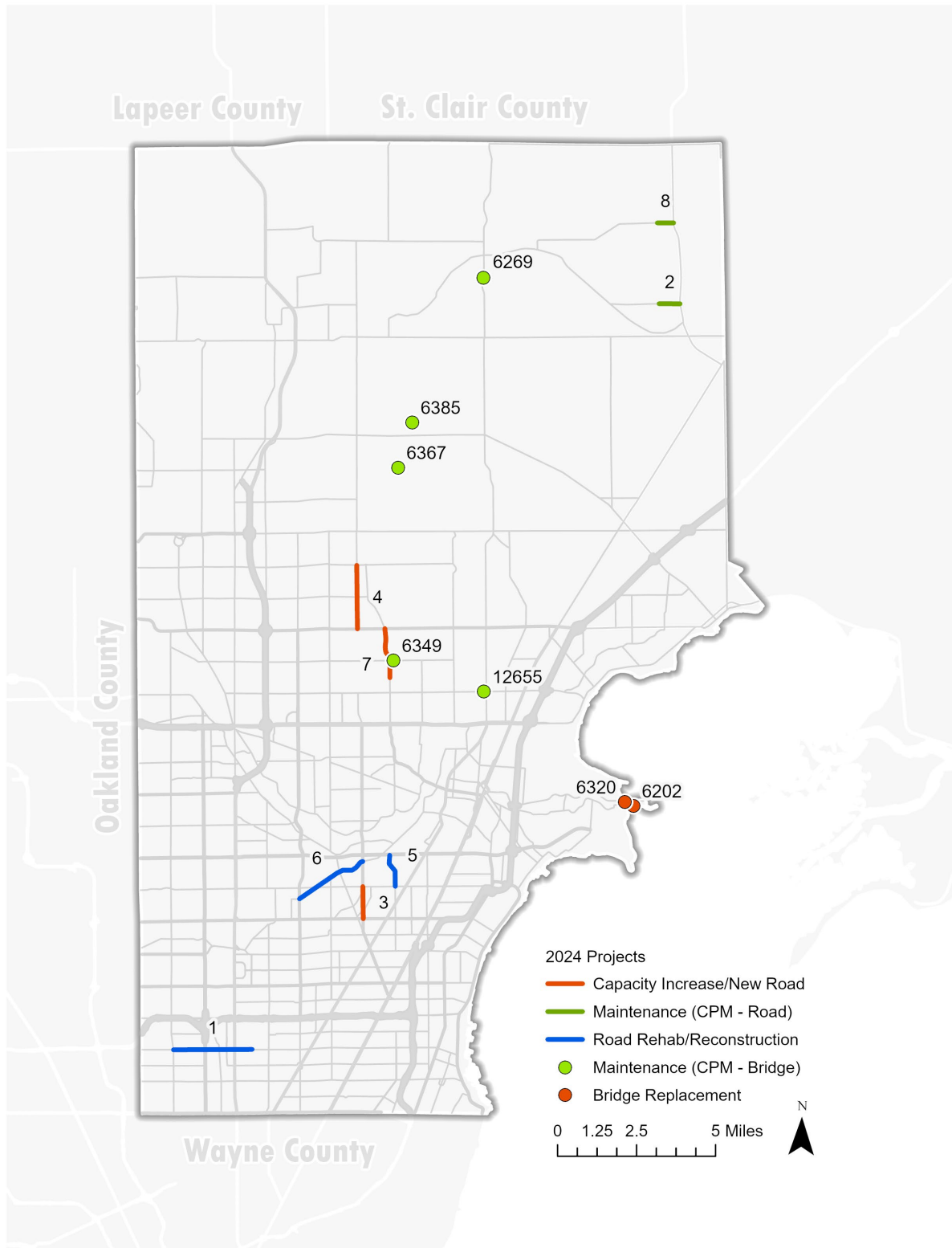


Table 26: 2025 Projects and Investments

Project Name	Map ID	Limits	Investment Program	Total Estimated Amount
14 Mile Rd	1	14 Mile Rd from Van Dyke Avenue to Hoover Rd intersection	Road Rehab/Reconstruction	\$4,780,000
14 Mile Rd	2	14 Mile Rd from Kelly Rd to Gratiot Ave	Road Rehab/Reconstruction	\$4,125,000
18 Mile Rd	3	18 Mile Rd from Mound Rd to Utica Rd	Road Rehab/Reconstruction	\$6,000,000
Broughton Rd	4	Broughton Rd from 23 Mile Rd to 24 1/2 Mile Rd	Capacity Increase/New Road	\$7,000,000
Garfield Rd	5	Garfield Rd from M-59 to 21 Mile Rd	Capacity Increase/New Road	\$1,752,333
			Road Rehab/Reconstruction	\$3,504,667
Hayes/Utica Rd	6	Hayes Rd from River Ln-south to Utica & Utica Rd from Hayes to 16 Mile	Road Rehab/Reconstruction	\$3,986,690
N River Rd	7	North River Rd from boundary at Mt. Clemens and Harrison to Bridgeview	Road Rehab/Reconstruction	\$3,000,000
Powell Rd	8	Powell Rd from 30 1/2 Mile Rd to 32 Mile Rd	Road Rehab/Reconstruction	\$3,503,249
Romeo Plank Rd	9	Romeo Plank Rd from 30 Mile Rd to 31 Mile Rd	Maintenance (CPM - Road)	\$500,000
STR 6188	6188	14 Mile Rd over Red Run Drain	Maintenance (CPM - Bridge)	\$477,000
STR 6206	6206	21 Mile Rd over Salt Slang Gloede Drain	Bridge Rehab/Reconstruction	\$5,120,000
STR 6266	6266	North Avenue over EB Coon Creek	Bridge Rehab/Reconstruction	\$2,993,000
STR 6283	6283	Callens Rd over Fish Creek	Maintenance (CPM - Bridge)	\$179,000
STR 6299	6299	Hicks Rd over Coon Creek	Maintenance (CPM - Bridge)	\$192,000
STR 6309	6309	Raap Rd over Fisher Lake Outlet	Bridge Rehab/Reconstruction	\$659,000
STR 6339	6339	Bates Rd over Deer Creek	Maintenance (CPM - Bridge)	\$206,000
STR 14319	14319	34 Mile Rd over Highbank Creek	Bridge Rehab/Reconstruction	\$1,493,000
ITS	N/A	Countywide ATSPM Detection	Intelligent Transportation Systems (ITS)	\$4,450,000
ITS	N/A	Traffic Operations Center	Traffic Operations Center	\$4,015,000
Jefferson Ave	N/A	Clinton River Spillway adjacent to Jefferson Avenue	Non-Motorized	\$2,284,566
Various Locations	N/A	Various Limits	Road Rehab/Reconstruction	\$5,000,000
Various Locations	N/A	Various Limits	Maintenance (CPM - Road)	\$7,000,000
Various Locations	N/A	Various Limits	Non-Motorized	\$715,434

Project Name	Map ID	Limits	Investment Program	Total Estimated Amount
Various Locations	N/A	Various Limits	Intelligent Transportation Systems (ITS)	\$1,450,000
Various Locations	N/A	Various Limits	Traffic and Safety Programs	\$3,000,000
Various Locations	N/A	Various Limits	Culverts	\$1,500,000
Various Locations	N/A	Various Limits	Subdivision Reconstruction	\$4,000,000

Figure 15: 2025 Projects

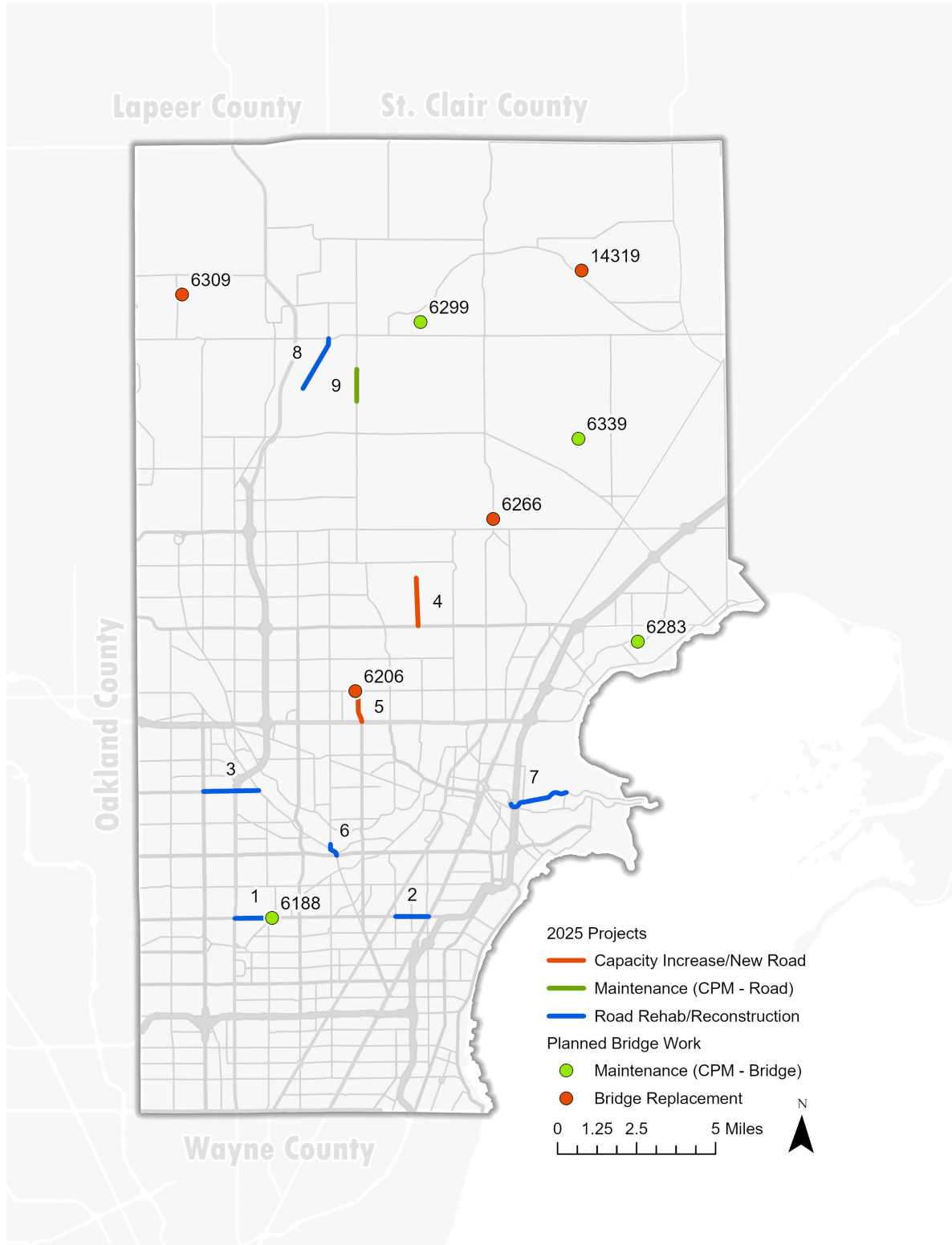


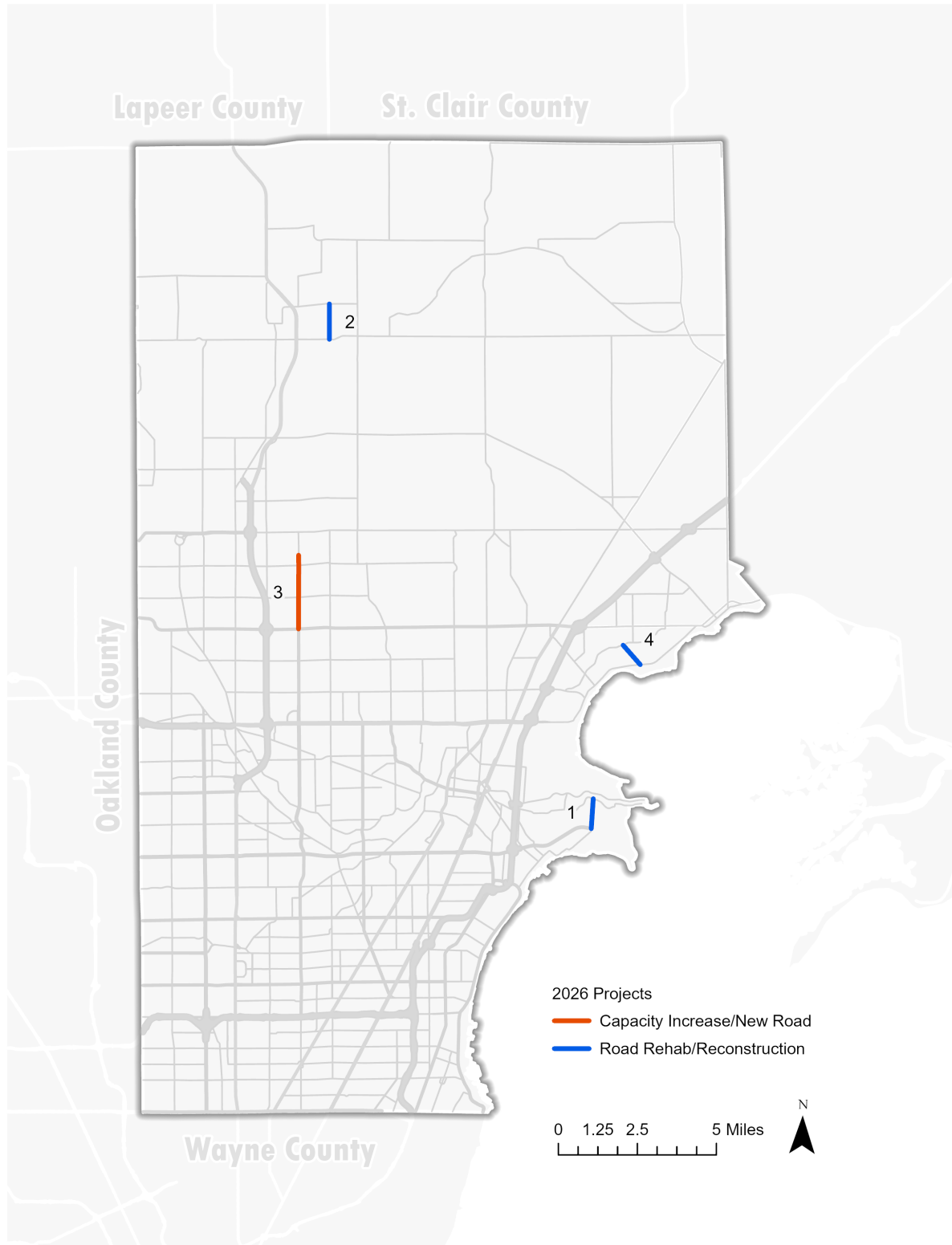
Table 27: 2026 Projects and Investments

Project Name	Map ID	Limits	Investment Program	Total Estimated Amount
Jefferson Ave	1	Jefferson Rd from South River Rd to Metropolitan Parkway	Road Rehab/Reconstruction	\$1,695,000
Powell Rd	2	Powell Rd from 32 Mile Rd Intersection to 33 Mile Rd Intersection	Road Rehab/Reconstruction	\$801,951
Schoenherr Rd	3	Schoenherr from 23 Mile Rd to N of 25 Mile Rd	Capacity Increase/New Road	\$2,972,282
			Road Rehab/Reconstruction	\$5,944,563
Sugarbush Rd	4	Sugarbush Rd from Callens Rd to Jefferson Ave	Road Rehab/Reconstruction	\$1,300,000
ITS	N/A	Traffic Operations Center	Traffic Operations Center	\$4,080,000
ITS	N/A	Countywide ITS applications	Intelligent Transportation Systems (ITS)	\$2,950,000
Various Locations	N/A	Various Limits	Road Rehab/Reconstruction	\$15,500,000
Various Locations	N/A	Various Limits	Bridge Rehab/Reconstruction	\$10,000,000
Various Locations	N/A	Various Limits	Maintenance (CPM - Road)	\$7,500,000
Various Locations	N/A	Various Limits	Non-Motorized	\$3,000,000
Various Locations	N/A	Various Limits	Maintenance (CPM - Bridge)	\$1,000,000
Various Locations	N/A	Various Limits	Traffic and Safety Programs	\$3,000,000
Various Locations	N/A	Various Limits	Culverts	\$2,000,000
Various Locations	N/A	Various Limits	Subdivision Reconstruction	\$4,000,000

Table 28: 2027 Investments

Project Name	Limits	Investment Program	Total Estimated Amount
Various Locations	Various Limits	Road Rehab/Reconstruction	\$30,000,000
Various Locations	Various Limits	Bridge Rehab/Reconstruction	\$15,000,000
Various Locations	Various Limits	Maintenance (CPM - Road)	\$7,500,000
Various Locations	Various Limits	Maintenance (CPM - Bridge)	\$1,000,000
Various Locations	Various Limits	Traffic Operations Center	\$4,000,000
Various Locations	Various Limits	Intelligent Transportation Systems (ITS)	\$4,000,000
Various Locations	Various Limits	Non-Motorized	\$3,000,000
Various Locations	Various Limits	Traffic and Safety Programs	\$4,000,000
Various Locations	Various Limits	Culverts	\$2,500,000
Various Locations	Various Limits	Subdivision Reconstruction	\$4,000,000

Figure 16: 2026 Projects



Appendix D. Bridge Inventory

SN	DECK AREA	FACILITY CARRIED	INTERSECTED FEATURES	OPEN (A), POSTED (P), CLOSED (K)	CONDITION	DECK RATING	SUPER RATING	SUB RATING	CULVERT RATING	SCOUR CRITICAL	NBI	NHS
6020	1,334	VAN DYKE (OLD M-53)	EAST POND CREEK	A	POOR	5	4	6	-	U	Y	N
6186	4,176	12 MILE ROAD	BEAR CREEK	A	FAIR	-	-	-	5	8	Y	Y
6187	3,247	14 MILE RD	BIG BEAVER CREEK	A	FAIR	8	8	7	-	8	Y	Y
6188	20,636	14 MILE ROAD	RED RUN DRAIN	A	FAIR	7	8	7	-	5	Y	Y
6189	2,277	QUINN ROAD	CLINTON HARRISON DRAIN	A	FAIR	8	7	8	-	8	Y	N
6190	11,772	MORAVIAN DRIVE	CLINTON RIVER	A	FAIR	7	8	7	-	5	Y	N
6191	1,200	15 MILE RD	HARRINGTON DRAIN	A	GOOD	-	-	-	8	8	Y	N
6192	1,200	15 MILE RD	SWEENEY DRAIN	A	FAIR	-	-	-	7	8	Y	N
6193	3,794	SHOOK RD	CLINTON HARRISON DRAIN	A	GOOD	8	8	8	-	8	Y	Y
6194	27,574	METROPOLITAN PKWY	CONRAIL RAILROAD	A	FAIR	6	5	5	-	-	Y	Y
6195	10,849	EB METRO PARKWAY	RED RUN DRAIN	A	FAIR	7	7	6	-	4	Y	Y
6196	11,113	WB METRO PARKWAY	RED RUN DRAIN	A	FAIR	7	6	5	-	8	Y	Y
6197	1,866	EB METRO PARKWAY	HARRINGTON DRAIN	A	FAIR	7	8	7	-	7	Y	Y
6198	1,866	WB METRO PARKWAY	HARRINGTON DRAIN	A	FAIR	7	8	7	-	8	Y	Y
6199	11,575	EB METRO PARKWAY	CLINTON RIVER SPILLWAY	A	FAIR	7	7	7	-	8	Y	Y
6200	14,856	WB METRO PARKWAY	CLINTON RIVER SPILLWAY	P	FAIR	7	5	6	-	8	Y	Y
6201	5,481	HARRINGTON ROAD	HARRINGTON DRAIN	A	FAIR	6	7	7	-	8	Y	N
6202	686	SOUTH RIVER RD	CHANNEL BETW LAKE & RIVR	P	SERIOUS/CRITICAL	3	3	3	-	2	Y	N
6203	1,106	18 MILE RD	GIBSON DRAIN	A	FAIR	-	-	-	7	8	Y	Y
6204	3,002	18 MILE RD	PLUMBROOK DRAIN	A	FAIR	5	6	7	-	8	Y	Y
6205	20,278	CASS AVE	NORTH BRANCH CLINTON RIV	A	FAIR	8	7	6	-	8	Y	Y

SN	DECK AREA	FACILITY CARRIED	INTERSECTED FEATURES	OPEN (A), POSTED (P), CLOSED (K)	CONDITION	DECK RATING	SUPER RATING	SUB RATING	CULVERT RATING	SCOUR CRITICAL	NBI	NHS
6206	1,320	21 MILE ROAD	SALT SLANG GLOEDE DRAIN	A	POOR	5	6	4	-	8	Y	N
6207	679	21 MILE ROAD	LEWIS DRAIN	A	FAIR	-	-	-	7	8	Y	N
6208	8,869	23 MILE RD	MIDDLE BR CLINTON RIVER	A	FAIR	-	-	-	7	8	Y	Y
6209	16,192	23 MILE ROAD	N BRANCH CLINTON RIVER	A	FAIR	7	8	8	-	5	Y	Y
6210	4,528	23 MILE ROAD	MCBRIDE DRAIN	A	GOOD	-	-	-	9	8	Y	Y
6211	1,883	24 MILE ROAD	NEWLAND DRAIN	A	SERIOUS/CRITICAL	-	-	-	3	8	Y	N
6212	867	24 MILE ROAD	MIDDLE BRANCH CLINTON R	A	FAIR	-	-	-	6	8	Y	N
6213	4,033	26 MILE ROAD	YATES DRAIN	A	FAIR	6	6	6	-	8	Y	N
6214	1,931	26 MILE ROAD	PRICE BROOK DRAIN	A	FAIR	-	-	-	6	8	Y	N
6215	2,723	26 MILE ROAD	HEALY BROOK DRAIN	A	FAIR	7	8	8	-	5	Y	N
6216	3,552	26 MILE ROAD	NORTH BRANCH CLINTON R	A	FAIR	9	9	7	-	8	Y	N
6217	3,752	26 MILE ROAD	COON CREEK	A	FAIR	7	7	7	-	5	Y	N
6218	2,434	26 MILE ROAD	DEER CREEK	A	GOOD	-	-	-	8	5	Y	N
6219	3,205	26 MILE ROAD	SALT RIVER	A	FAIR	7	7	7	-	5	Y	N
6220	1,078	26 MILE ROAD	KIRKHAM DRAIN	A	FAIR	-	-	-	7	8	Y	N
6221	1,078	26 MILE ROAD	BRANCH OF KIRKHAM DRAIN	A	FAIR	-	-	-	7	8	Y	N
6222	1,614	29 MILE ROAD	HEALY BROOK DRAIN	A	GOOD	-	-	-	8	8	Y	N
6223	1,108	29 MILE ROAD	CAMP BROOK DRAIN	A	GOOD	-	-	-	8	8	Y	N
6224	11,657	29 MILE ROAD	NORTH BRANCH CLINTON RIV	A	FAIR	7	7	7	-	8	Y	N
6225	1,292	29 MILE ROAD	TUPPER BROOK	A	FAIR	-	-	-	6	3	Y	N
6226	1,377	29 MILE ROAD	SALT RIVER	A	FAIR	7	8	5	-	8	Y	N
6227	3,897	32 MILE ROAD	N BR CLINTON RIVER	A	GOOD	8	8	8	-	8	Y	N
6228	1,790	32 MILE ROAD	COON CREEK	A	FAIR	-	-	-	6	8	Y	N
6229	2,336	32 MILE ROAD	E B COON CREEK	A	FAIR	7	7	7	-	8	Y	N
6230	2,964	32 MILE ROAD	HIGHBANK CREEK	P	POOR	5	4	7	-	8	Y	N

SN	DECK AREA	FACILITY CARRIED	INTERSECTED FEATURES	OPEN (A), POSTED (P), CLOSED (K)	CONDITION	DECK RATING	SUPER RATING	SUB RATING	CULVERT RATING	SCOUR CRITICAL	NBI	NHS
6231	1,587	ARMADA RIDGE RD	COON CREEK	A	GOOD	-	8	8	-	8	Y	N
6232	794	ARMADA RIDGE RD	HIGHBANK CREEK	A	POOR	-	-	-	4	2	Y	N
6233	3,451	ARMADA CENTER RD	N. BRANCH CLINTON RIVER	A	FAIR	7	8	8	-	5	Y	N
6234	1,139	ARMADA CENTER RD	NEULAND DRAIN	A	FAIR	-	-	-	6	8	Y	N
6235	723	ARMADA CENTER RD	COON CREEK	P	POOR	5	4	6	-	8	Y	N
6236	2,012	ARMADA CENTER RD	EAST BRANCH COON CREEK	A	FAIR	7	8	7	-	5	Y	N
6237	3,176	RYAN RD	CLINTON RIVER	A	GOOD	8	8	8	-	8	Y	N
6238	2,124	MOUND RD	SHARKEY DRAIN	A	FAIR	-	-	-	5	8	Y	Y
6240	13,442	SB & NB MOUND RD	RED RUN DRAIN	A	FAIR	6	8	7	-	5	Y	Y
6242	7,277	NB & SB MOUND RD	BIG BEAVER CREEK	A	FAIR	-	-	-	7	5	Y	Y
6243	6,779	MOUND RD	STERLING RELIEF DRAIN	A	FAIR	-	-	-	6	8	Y	Y
6244	1,937	NB MOUND RD	PLUM BROOK DRAIN	A	FAIR	7	8	7	-	5	Y	Y
6245	2,379	SB MOUND RD	PLUM BROOK DRAIN	A	FAIR	7	8	6	-	5	Y	Y
6246	7,440	VAN DYKE AVE	CLINTON RIVER	A	FAIR	7	8	7	-	8	Y	N
6247	3,445	EARL MEM HWY	M B CLINTON RIVER	A	GOOD	-	-	-	8	8	Y	N
6248	20,920	UTICA RD	RED RUN DRAIN	A	FAIR	6	7	7	-	8	Y	N
6249	17,800	SCHOENHERR RD	RED RUN DRAIN	A	FAIR	6	7	6	-	8	Y	Y
6250	5,027	SB SCHOENHERR RD	PLUM BROOK DRAIN	A	FAIR	7	7	6	-	5	Y	Y
6251	3,782	SCHOENHERR RD	STERLING RELIEF DRAIN	A	FAIR	-	-	-	6	8	Y	Y
6252	5,027	NB SCHOENHERR RD	PLUM BROOK DRAIN	A	FAIR	7	8	6	-	5	Y	Y
6253	6,184	SCHOENHERR RD NBD	CLINTON RIVER	A	FAIR	7	8	7	-	5	Y	Y
6254	6,184	SCHOENHERR RD SBD	CLINTON RIVER	A	FAIR	7	7	7	-	5	Y	Y
6255	12,161	HAYES RD	CLINTON RIVER	A	FAIR	7	6	7	-	5	Y	N
6256	10,673	GARFIELD RD	CLINTON RIVER	A	FAIR	7	8	7	-	8	Y	Y
6257	1,621	GARFIELD RD	UTICA DRAIN	A	FAIR	-	-	-	6	8	Y	Y

SN	DECK AREA	FACILITY CARRIED	INTERSECTED FEATURES	OPEN (A), POSTED (P), CLOSED (K)	CONDITION	DECK RATING	SUPER RATING	SUB RATING	CULVERT RATING	SCOUR CRITICAL	NBI	NHS
6258	2,981	ROMEO PLANK RD	GLOEDE DRAIN	A	GOOD	-	-	-	8	8	Y	Y
6259	5,480	ROMEO PLANK RD	M B CLINTON RIVER	A	FAIR	7	8	7	-	5	Y	N
6260	1,910	ROMEO PLANK RD	HEALY BROOK DRAIN	A	FAIR	-	-	-	7	8	Y	N
6261	1,112	ROMEO PLANK RD	HEALY BROOK DRAIN	A	FAIR	-	-	-	6	8	Y	N
6262	2,412	ROMEO PLANK RD	N B CLINTON RIVER	A	FAIR	9	8	7	-	8	Y	N
6263	5,981	HARPER AVE	CLINTON HARRISON DRAIN	A	FAIR	7	7	8	-	8	Y	Y
6264	16,524	HARPER AVE	CLINTON RIVER SPILLWAY	A	FAIR	7	7	7	-	8	Y	N
6265	1,371	NORTH AVENUE	DEER CREEK	A	FAIR	-	-	-	7	8	Y	N
6266	2,323	NORTH AVE	E B COON CREEK	P	SERIOUS/CRITICAL	-	-	-	3	8	Y	N
6267	1,769	NORTH AVE	COON CREEK	A	FAIR	-	-	-	7	8	Y	N
6268	1,450	NORTH AVE	COON CREEK	A	FAIR	-	-	-	7	8	Y	N
6269	1,958	NORTH AVE	E B COON CREEK	A	FAIR	6	8	7	-	5	Y	N
6270	1,420	NORTH AVE	E B COON CREEK	A	FAIR	6	6	6	-	8	Y	N
6271	7,134	JEFFERSON AVE	CLINTON RIVER SPILLWAY	A	FAIR	6	5	6	-	8	Y	N
6272	947	JEFFERSON AVE	VENTRE DE BEUF	A	FAIR	5	6	6	-	8	Y	N
6273	16,857	BRIDGEVIEW	CLINTON R & OLD N R RD	A	GOOD	8	8	8	-	8	Y	N
6274	2,600	JEFFERSON AVE	AUVASE CREEK	A	FAIR	5	6	7	-	8	Y	N
6275	5,900	JEFFERSON AVE	SALT RIVER	A	GOOD	9	9	9	-	8	Y	N
6276	906	WASHINGTON ST	CREPEAU CREEK	A	FAIR	-	-	-	7	8	Y	N
6277	2,078	WASHINGTON RD	SALT RIVER	P	SERIOUS/CRITICAL	4	4	3	-	8	Y	N
6278	2,756	NEW HAVEN RD	DEER CREEK	A	FAIR	7	8	8	-	8	Y	N
6279	3,711	NEW HAVEN RD	E B COON CREEK	A	GOOD	9	9	9	-	8	Y	N
6280	1,214	NEW HAVEN RD	COON CREEK	A	FAIR	-	-	-	6	8	Y	N
6281	906	CLINTON RIVER RD	KUKUK DRAIN	A	FAIR	-	-	-	6	8	Y	N
6282	1,152	36 MILE RD	SECORD LAKE OUTLET	A	FAIR	6	6	7	-	8	Y	N
6283	1,019	CALLENS RD	FISH CREEK	A	FAIR	6	6	8	-	8	Y	N

SN	DECK AREA	FACILITY CARRIED	INTERSECTED FEATURES	OPEN (A), POSTED (P), CLOSED (K)	CONDITION	DECK RATING	SUPER RATING	SUB RATING	CULVERT RATING	SCOUR CRITICAL	NBI	NHS
6284	5,417	CALLENS RD	SALT RIVER	A	FAIR	6	7	7	-	8	Y	N
6285	1,112	33 MILE ROAD	N B CLINTON RIVER	P	SERIOUS/CRITICAL	5	3	3	-	8	Y	N
6286	800	33 MILE ROAD	COON CREEK	A	FAIR	-	-	-	7	8	Y	N
6287	1,207	33 MILE ROAD	EAST BRANCH COON CREEK	A	FAIR	6	9	8	-	8	Y	N
6288	2,459	34 MILE ROAD	NORTH BRANCH CLINTON R	A	FAIR	6	7	7	-	5	Y	N
6289	757	34 MILE ROAD	COON CREEK	A	FAIR	-	-	-	6	8	Y	N
6290	666	IRWIN ROAD	NEWLAND DRAIN	A	FAIR	-	-	-	5	8	Y	N
6291	880	IRWIN ROAD	COON CREEK	A	GOOD	-	-	-	8	8	Y	N
6292	1,756	IRWIN ROAD	EAST BRANCH COON CREEK	A	GOOD	8	8	8	-	5	Y	N
6293	1,033	MCPHALL ROAD	EAST BRANCH COON CREEK	A	GOOD	-	-	-	8	8	Y	N
6294	679	HOLMES ROAD	NEWLAND DRAIN	A	FAIR	-	-	-	6	8	Y	N
6295	529	PRATT ROAD	EAST BRANCH COON CREEK	A	FAIR	-	-	-	5	8	Y	N
6296	1,314	BORDMAN ROAD	EAST BRANCH COON CREEK	A	GOOD	-	-	-	8	5	Y	N
6297	394	MC FADDEN ROAD	NEWLAND DRAIN	A	POOR	-	-	-	4	8	Y	N
6298	875	COON CREEK ROAD	COON CREEK	P	SERIOUS/CRITICAL	-	-	-	3	8	Y	N
6299	1,174	HICKS ROAD	COON CREEK	A	FAIR	6	6	7	-	8	Y	N
6300	777	ROMEO PLANK ROAD	NEWLAND DRAIN	P	POOR	-	-	-	4	8	Y	N
6301	2,546	GATES ROAD	EAST MILL LAKE OUTLET	A	FAIR	7	8	8	-	5	Y	N
6302	473	33 MILE ROAD	EAST MILL LAKE OUTLET	A	FAIR	-	-	-	6	8	Y	N
6303	1,486	BORDMAN ROAD	N B CLINTON RIVER	P	FAIR	7	5	7	-	8	Y	N
6305	708	CAMP GROUND ROAD	EAST MILL LAKE OUTLET	A	FAIR	-	-	-	6	8	Y	N
6306	782	MCVICAR ROAD	EAST POND CREEK	P	SERIOUS/CRITICAL	-	-	-	3	3	Y	N
6307	2,366	MCKAY ROAD	N B CLINTON RIVER	A	FAIR	7	8	8	-	5	Y	N
6308	1,751	BROWN ROAD	N B CLINTON RIVER	A	FAIR	6	7	7	-	8	Y	N
6309	620	RAAP ROAD	FISHER LAKE OUTLET	P	POOR	-	-	-	4	8	Y	N
6310	850	PEARL DRIVE	SECORD LAKE OUTLET	A	FAIR	-	-	-	5	8	Y	N

SN	DECK AREA	FACILITY CARRIED	INTERSECTED FEATURES	OPEN (A), POSTED (P), CLOSED (K)	CONDITION	DECK RATING	SUPER RATING	SUB RATING	CULVERT RATING	SCOUR CRITICAL	NBI	NHS
6311	1,306	HAGEN ROAD	DEER CREEK	A	GOOD	-	-	-	8	5	Y	N
6312	1,220	SASS ROAD	FISH CREEK	A	GOOD	-	-	-	8	5	Y	N
6313	820	24 MILE ROAD	FISH CREEK	A	FAIR	-	-	-	7	8	Y	N
6314	7,080	24 MILE ROAD	SALT RIVER	A	FAIR	7	8	8	-	5	Y	N
6315	1,098	KELLY ROAD	HARRINGTON DRAIN	A	FAIR	9	9	7	-	8	Y	N
6316	4,437	HEYDENREICH ROAD	MIDDLE BRANCH CLINTON R	A	FAIR	7	7	6	-	8	Y	N
6317	1,099	HEYDENREICH ROAD	MILLER DRAIN	A	FAIR	-	-	-	7	8	Y	N
6318	890	DUNHAM ROAD	MILLER DRAIN	P	POOR	5	4	7	-	8	Y	N
6320	3,782	NORTH RIVER ROAD	CATFISH CHANNEL	P	SERIOUS/CRITICAL	5	3	6	-	8	Y	N
6321	1,282	SEAWAY DRIVE	CANAL TO SEAWAY ISLAND	A	FAIR	7	7	7	-	8	Y	N
6322	2,058	LAKESHORE DRIVE	CHANNEL TO LAKE ST CLAIR	A	GOOD	8	8	8	-	8	Y	N
6323	2,058	LAKESHORE DRIVE	CHANNEL TO LAKE ST CLAIR	A	GOOD	8	8	8	-	8	Y	N
6325	940	WEST ARCHER DRIVE	CHANNEL TO LAKE ST CLAIR	A	POOR	5	6	4	-	8	Y	N
6326	1,613	EAST ARCHER DRIVE	CHANNEL TO LAKE ST CLAIR	A	GOOD	8	8	8	-	8	Y	N
6327	2,464	27 MILE ROAD	DEER CREEK	A	FAIR	7	8	8	-	8	Y	N
6328	2,960	27 MILE ROAD	KIRKHAM DRAIN	A	FAIR	7	7	8	-	5	Y	N
6329	2,330	28 MILE ROAD	SALT RIVER	A	FAIR	7	8	8	-	5	Y	N
6330	1,976	28 MILE ROAD	KIRKHAM DRAIN	A	FAIR	7	8	8	-	5	Y	N
6331	4,833	29 MILE ROAD	EAST BRANCH COON CREEK	A	GOOD	8	8	8	-	5	Y	N
6333	1,976	29 MILE ROAD	DEER CREEK	A	FAIR	7	8	8	-	5	Y	N
6334	3,612	30 MILE ROAD	EAST BRANCH COON CREEK	A	FAIR	6	7	7	-	8	Y	N
6336	3,714	31 MILE ROAD	EAST BRANCH COON CREEK	A	FAIR	7	7	7	-	8	Y	N
6338	3,806	OMO ROAD	EAST BRANCH COON CREEK	A	FAIR	7	8	7	-	5	Y	N
6339	1,109	BATES ROAD	DEER CREEK	A	FAIR	6	6	7	-	8	Y	N
6340	920	BATES ROAD	DEER CREEK	A	POOR	-	-	-	4	8	Y	N
6341	4,511	GARFIELD RD	SALT SLANG GLOEDE DRAIN	A	FAIR	-	-	-	7	5	Y	Y

SN	DECK AREA	FACILITY CARRIED	INTERSECTED FEATURES	OPEN (A), POSTED (P), CLOSED (K)	CONDITION	DECK RATING	SUPER RATING	SUB RATING	CULVERT RATING	SCOUR CRITICAL	NBI	NHS
6342	1,240	CARD ROAD	MCBRIDE DRAIN	A	FAIR	-	-	-	7	8	Y	N
6344	1,294	FAIRCHILD RD	DEER CREEK	A	FAIR	-	-	-	7	8	Y	N
6345	3,854	21 MILE ROAD	MIDDLE BR CLINTON RIVER	A	FAIR	7	6	7	-	8	Y	N
6348	1,277	22 MILE ROAD	SALT SLANG GLOEDE DRAIN	A	GOOD	-	-	-	9	8	Y	N
6349	8,645	22 MILE ROAD	MIDDLE BR CLINTON RIVER	A	FAIR	7	6	7	-	5	Y	N
6350	2,163	24 MILE ROAD	MIDDLE BR CLINTON RIVER	A	FAIR	5	5	7	-	8	Y	N
6352	10,809	24 MILE ROAD	N B CLINTON RIVER	A	FAIR	7	8	7	-	5	Y	N
6353	940	24 MILE ROAD	MCBRIDE DRAIN	A	GOOD	-	-	-	8	8	Y	N
6354	1,363	CHAPMAN RD	DEER CREEK	A	GOOD	8	8	8	-	8	Y	N
6355	3,067	25 MILE ROAD	MIDDLE BR CLINTON RIVER	A	FAIR	7	8	8	-	8	Y	N
6356	1,006	25 MILE ROAD	MCBRIDE DRAIN	A	FAIR	-	-	-	7	8	Y	N
6357	3,270	25 MILE ROAD	NORTH BRANCH CLINTON R	K	SERIOUS/CRITICAL	4	1	5	-	8	Y	N
6358	1,458	25 MILE ROAD	DEER CREEK	A	FAIR	-	-	-	7	8	Y	N
6359	2,517	HAYES ROAD	MIDDLE BR CLINTON RIVER	A	FAIR	7	7	7	-	8	Y	N
6360	1,401	HAYES ROAD	PRICE BROOK DRAIN	A	FAIR	-	-	-	7	8	Y	N
6361	1,996	TILCH RD	DUNN-BANISTER DRAIN	A	FAIR	-	-	-	7	8	Y	N
6363	576	27 MILE ROAD	HEALY BROOK DRAIN	A	FAIR	-	-	-	5	8	Y	N
6364	1,402	27 MILE ROAD	TUPPER BROOK DRAIN	A	FAIR	7	8	7	-	5	Y	N
6365	2,506	27 MILE ROAD	COON CREEK	A	FAIR	7	7	7	-	5	Y	N
6366	757	28 MILE ROAD	HEALY BROOK DRAIN	A	FAIR	-	-	-	6	8	Y	N
6367	1,129	28 MILE ROAD	CAMP BROOK DRAIN	A	FAIR	7	8	7	-	8	Y	N
6368	1,320	28 MILE ROAD	OVERFLOW N B CLINTON	A	GOOD	-	-	-	9	8	Y	N
6370	2,925	28 MILE ROAD	N B CLINTON RIVER	A	GOOD	8	9	9	-	8	Y	N
6371	909	28 MILE ROAD	TUPPER BROOK DRAIN	A	FAIR	-	-	-	7	8	Y	N
6372	1,174	28 MILE ROAD	COON CREEK	A	FAIR	6	8	7	-	8	Y	N
6373	930	29 MILE ROAD	COON CREEK	A	FAIR	5	5	5	-	8	Y	N

SN	DECK AREA	FACILITY CARRIED	INTERSECTED FEATURES	OPEN (A), POSTED (P), CLOSED (K)	CONDITION	DECK RATING	SUPER RATING	SUB RATING	CULVERT RATING	SCOUR CRITICAL	NBI	NHS
6378	460	30 MILE ROAD	TUPPER BROOK DRAIN	A	FAIR	-	-	-	7	8	Y	N
6379	1,354	30 MILE ROAD	COON CREEK	A	FAIR	-	-	-	7	5	Y	N
6380	1,200	31 MILE ROAD	N BRANCH CLINTON RIVER	P	FAIR	6	5	7	-	8	Y	N
6381	988	31 MILE ROAD	TUPPER BROOK DRAIN	A	FAIR	7	9	8	-	8	Y	N
6382	2,092	31 MILE ROAD	COON CREEK	A	FAIR	-	-	-	6	8	Y	N
6383	382	HAYES ROAD	PRICE BROOK DRAIN	A	FAIR	-	-	-	7	8	Y	N
6384	510	KUNSTMAN RD	CAMP BROOK DRAIN	A	FAIR	-	-	-	6	8	Y	N
6385	3,300	WOLCOTT ROAD	N BRANCH CLINTON RIVER	A	GOOD	8	8	8	-	8	Y	N
6386	396	TELLER ROAD	CAMP BROOK DRAIN	A	POOR	5	6	4	-	U	Y	N
6387	5,200	OMO ROAD	EAST BRANCH COON CREEK	A	GOOD	8	8	8	-	8	Y	N
6388	1,106	POWELL ROAD	EAST POND CREEK	A	FAIR	-	-	-	6	3	Y	N
6389	1,524	33 MILE ROAD	CEMETERY CREEK	A	GOOD	-	-	-	8	8	Y	N
6390	1,550	33 MILE ROAD	HIGHBANK CREEK	A	GOOD	-	-	-	8	8	Y	N
6391	1,680	34 MILE ROAD	CEMETERY CREEK	A	FAIR	-	-	-	7	3	Y	N
6392	971	34 MILE ROAD	HIGHBANK CREEK	A	FAIR	-	-	-	7	5	Y	N
6393	5,664	WEBER ROAD	BELLE RIVER	A	FAIR	7	8	7	-	8	Y	N
6394	688	WEBER ROAD	BEAVER CREEK	A	FAIR	-	-	-	7	8	Y	N
6398	518	25 MILE ROAD	MIDDLE BRANCH CLINTON R	A	FAIR	-	-	-	5	8	Y	N
6399	1,835	JEWELL ROAD	MIDDLE BR CLINTON RIVER	A	FAIR	5	5	7	-	8	Y	N
6400	1,468	JEWELL ROAD	YATES DRAIN	A	FAIR	7	8	7	-	8	Y	N
6401	1,835	SCHOENHERR RD	MIDDLE BR CLINTON RIVER	A	FAIR	6	7	7	-	8	Y	N
6402	414	BELLMAN ROAD	MIDDLE BRANCH CLINTON R	A	FAIR	-	-	-	6	8	Y	N
6404	1,248	28 MILE ROAD	STONY CREEK	A	GOOD	8	8	8	-	8	Y	N
6405	948	INWOOD ROAD	STONY CREEK	P	POOR	-	-	-	4	8	Y	N
6406	3,526	30 MILE ROAD	HEALY BROOK DRAIN	A	FAIR	-	-	-	7	8	Y	N
6407	1,027	31 MILE ROAD	STONY CREEK	A	FAIR	7	8	8	-	8	Y	N

SN	DECK AREA	FACILITY CARRIED	INTERSECTED FEATURES	OPEN (A), POSTED (P), CLOSED (K)	CONDITION	DECK RATING	SUPER RATING	SUB RATING	CULVERT RATING	SCOUR CRITICAL	NBI	NHS
6408	1,518	JEWELL ROAD	YATES DRAIN	A	FAIR	7	7	7	-	8	Y	N
6409	810	MT VERNON RD	STONY CREEK	A	FAIR	8	8	7	-	8	Y	N
10113	504	BORDMAN ROAD	NEWLAND DRAIN	P	SERIOUS/CRITICAL	4	3	4	-	5	Y	N
12655	17,546	21 MILE ROAD	NORTH BR CLINTON RIVER	A	FAIR	7	6	7	-	5	Y	N
12656	1,684	25 MILE ROAD	FISH CREEK	P	FAIR	7	8	8	-	8	Y	N
12847	7,248	DEQUINDRE RD	RED RUN DRAIN	A	FAIR	-	-	-	7	8	Y	Y
12859	1,056	FISH CREEK DRIVE	FISH CREEK	A	FAIR	7	8	8	-	8	Y	N
12865	2,413	IRIS DRIVE	SUTHERLAND - OEMIG DRAIN	A	FAIR	7	8	8	-	8	Y	N
13061	2,390	EAST VIEW DRIVE	GLODE DRAIN	A	FAIR	7	8	8	-	8	Y	N
13399	1,537	MT VERNON RD	TRIBUTARY OF STONEY CRK	A	FAIR	7	8	7	-	5	Y	N
13569	560	MONTE RD	FULLER DRAIN	A	GOOD	-	-	-	8	8	Y	N
13570	560	SANTA ANITA DRIVE	FULLER DRAIN	A	GOOD	-	-	-	8	8	Y	N
13571	4,836	PARTRIDGE CRK BLVD	GLOEDE DRAIN	A	FAIR	7	8	8	-	8	Y	N
13573	678	CRIMSON DRIVE	PRICE BROOK DRAIN	A	FAIR	-	-	-	7	8	Y	N
13577	601	GRACECHURCH LANE	SALT SLANG GLOEDE DRAIN	A	FAIR	7	7	6	-	3	Y	N
13956	1,204	DIAMANTE DRIVE	GLOEDE DRAIN	A	GOOD	-	-	-	8	8	Y	N
14318	580	28 MILE RD	DEER CREEK	K	SERIOUS/CRITICAL	-	-	-	1	8	Y	N
14319	968	34 MILE RD	HIGHBANK CREEK	P	SERIOUS/CRITICAL	-	-	-	3	8	Y	N
14329	2,000	BROUGHTON RD	MCBRIDE DRAIN	A	FAIR	-	-	-	7	8	Y	N
14330	2,112	HAVERHILL DR	SALT SLING GLOEDE DRAIN	A	FAIR	-	-	-	7	3	Y	N
14331	1,100	DEQUINDRE RD	STONY CREEK	A	POOR	-	-	-	4	8	Y	N
14360	1,033	GARFIELD RD	HARRINGTON DRAIN	P	POOR	4	4	5	-	U	Y	Y
14544	484	RUANN DR	MIDDLE BR CLINTON RIVER	A	FAIR	-	-	-	5	8	Y	N
14545	714	30 MI RD	SALT RIVER	A	FAIR	-	-	-	5	8	Y	N

Appendix E. Scour Critical Bridges

SN	DECK AREA	FACILITY CARRIED	INTERSECTED FEATURES	OPEN (A), POSTED (P), CLOSED (K)	CONDITION	DECK RATING	SUPER RATING	SUB RATING	CULVERT RATING	SCOUR CRITICAL	NBI	NHS
6202	686	SOUTH RIVER RD	CHANNEL BETW LAKE & RIVR	P	SERIOUS/CRITICAL	3	3	3	-	2	Y	N
6225	1,292	29 MILE ROAD	TUPPER BROOK	A	FAIR	-	-	-	6	3	Y	N
6232	794	ARMADA RIDGE RD	HIGHBANK CREEK	A	POOR	-	-	-	4	2	Y	N
6306	782	MCVICAR ROAD	EAST POND CREEK	P	SERIOUS/CRITICAL	-	-	-	3	3	Y	N
6388	1,106	POWELL ROAD	EAST POND CREEK	A	FAIR	-	-	-	6	3	Y	N
6391	1,680	34 MILE ROAD	CEMETERY CREEK	A	FAIR	-	-	-	7	3	Y	N
13577	601	GRACECHURCH LANE	SALT SLANG GLOEDE DRAIN	A	FAIR	7	7	6	-	3	Y	N
14330	2,112	HAVERHILL DR	SALT SLING GLOEDE DRAIN	A	FAIR	-	-	-	7	3	Y	N

Appendix F. Structurally Deficient Bridges

SN	DECK AREA	FACILITY CARRIED	INTERSECTED FEATURES	OPEN (A), POSTED (P), CLOSED (K)	CONDITION	DECK RATING	SUPER RATING	SUB RATING	CULVERT RATING	SCOUR CRITICAL	NBI	NHS
6020	1,334	VAN DYKE(OLD M-53)	EAST POND CREEK	A	POOR	5	4	6	-	U	Y	N
6202	686	SOUTH RIVER RD	CHANNEL BETW LAKE & RIVR	P	SERIOUS/CRITICAL	3	3	3	-	2	Y	N
6206	1,320	21 MILE ROAD	SALT SLANG GLOEDE DRAIN	A	POOR	5	6	4	-	8	Y	N
6211	1,883	24 MILE ROAD	NEWLAND DRAIN	A	SERIOUS/CRITICAL	-	-	-	3	8	Y	N
6230	2,964	32 MILE ROAD	HIGHBANK CREEK	P	POOR	5	4	7	-	8	Y	N
6232	794	ARMADA RIDGE RD	HIGHBANK CREEK	A	POOR	-	-	-	4	2	Y	N
6235	723	ARMADA CENTER RD	COON CREEK	P	POOR	5	4	6	-	8	Y	N
6266	2,323	NORTH AVE	E B COON CREEK	P	SERIOUS/CRITICAL	-	-	-	3	8	Y	N
6277	2,078	WASHINGTON RD	SALT RIVER	P	SERIOUS/CRITICAL	4	4	3	-	8	Y	N
6285	1,112	33 MILE ROAD	N B CLINTON RIVER	P	SERIOUS/CRITICAL	5	3	3	-	8	Y	N
6297	394	MC FADDEN ROAD	NEWLAND DRAIN	A	POOR	-	-	-	4	8	Y	N
6298	875	COON CREEK ROAD	COON CREEK	P	SERIOUS/CRITICAL	-	-	-	3	8	Y	N
6300	777	ROMEO PLANK ROAD	NEWLAND DRAIN	P	POOR	-	-	-	4	8	Y	N
6306	782	MCVICAR ROAD	EAST POND CREEK	P	SERIOUS/CRITICAL	-	-	-	3	3	Y	N
6309	620	RAAP ROAD	FISHER LAKE OUTLET	P	POOR	-	-	-	4	8	Y	N
6318	890	DUNHAM ROAD	MILLER DRAIN	P	POOR	5	4	7	-	8	Y	N
6320	3,782	NORTH RIVER ROAD	CATFISH CHANNEL	P	SERIOUS/CRITICAL	5	3	6	-	8	Y	N
6325	940	WEST ARCHER DRIVE	CHANNEL TO LAKE ST CLAIR	A	POOR	5	6	4	-	8	Y	N
6340	920	BATES ROAD	DEER CREEK	A	POOR	-	-	-	4	8	Y	N
6357	3,270	25 MILE ROAD	NORTH BRANCH CLINTON R	K	SERIOUS/CRITICAL	4	1	5	-	8	Y	N
6386	396	TELLER ROAD	CAMP BROOK DRAIN	A	POOR	5	6	4	-	U	Y	N

SN	DECK AREA	FACILITY CARRIED	INTERSECTED FEATURES	OPEN (A), POSTED (P), CLOSED (K)	CONDITION	DECK RATING	SUPER RATING	SUB RATING	CULVERT RATING	SCOUR CRITICAL	NBI	NHS
6405	948	INWOOD ROAD	STONY CREEK	P	POOR	-	-	-	4	8	Y	N
10113	504	BORDMAN ROAD	NEWLAND DRAIN	P	SERIOUS/CRITICAL	4	3	4	-	5	Y	N
14318	580	28 MILE RD	DEER CREEK	K	SERIOUS/CRITICAL	-	-	-	1	8	Y	N
14319	968	34 MILE RD	HIGHBANK CREEK	P	SERIOUS/CRITICAL	-	-	-	3	8	Y	N
14331	1,100	DEQUINDRE RD	STONY CREEK	A	POOR	-	-	-	4	8	Y	N
14360	1,033	GARFIELD RD	HARRINGTON DRAIN	P	POOR	4	4	5	-	U	Y	Y

Appendix G. Functionally Obsolete Bridges

SN	DECK AREA	FACILITY CARRIED	INTERSECTED FEATURES	OPEN (A), POSTED (P), CLOSED (K)	CONDITION	DECK RATING	SUPER RATING	SUB RATING	CULVERT RATING	SCOUR CRITICAL	NBI	NHS
6187	3,247	14 MILE RD	BIG BEAVER CREEK	A	FAIR	8	8	7	-	8	Y	Y
6188	20,636	14 MILE ROAD	RED RUN DRAIN	A	FAIR	7	8	7	-	5	Y	Y
6224	11,657	29 MILE ROAD	NORTH BRANCH CLINTON RIV	A	FAIR	7	7	7	-	8	Y	N
6237	3,176	RYAN RD	CLINTON RIVER	A	GOOD	8	8	8	-	8	Y	N
6246	7,440	VAN DYKE AVE	CLINTON RIVER	A	FAIR	7	8	7	-	8	Y	N
6249	17,800	SCHOENHERR RD	RED RUN DRAIN	A	FAIR	6	7	6	-	8	Y	Y
6253	6,184	SCHOENHERR RD NBD	CLINTON RIVER	A	FAIR	7	8	7	-	5	Y	Y
6254	6,184	SCHOENHERR RD SBD	CLINTON RIVER	A	FAIR	7	7	7	-	5	Y	Y
6256	10,673	GARFIELD RD	CLINTON RIVER	A	FAIR	7	8	7	-	8	Y	Y
6262	2,412	ROMEO PLANK RD	N B CLINTON RIVER	A	FAIR	9	8	7	-	8	Y	N
6264	16,524	HARPER AVE	CLINTON RIVER SPILLWAY	A	FAIR	7	7	7	-	8	Y	N
6270	1,420	NORTH AVE	E B COON CREEK	A	FAIR	6	6	6	-	8	Y	N
6271	7,134	JEFFERSON AVE	CLINTON RIVER SPILLWAY	A	FAIR	6	5	6	-	8	Y	N
6272	947	JEFFERSON AVE	VENTRE DE BEUF	A	FAIR	5	6	6	-	8	Y	N
6313	820	24 MILE ROAD	FISH CREEK	A	FAIR	-	-	-	7	8	Y	N
6316	4,437	HEYDENREICH ROAD	MIDDLE BRANCH CLINTON R	A	FAIR	7	7	6	-	8	Y	N
6345	3,854	21 MILE ROAD	MIDDLE BR CLINTON RIVER	A	FAIR	7	6	7	-	8	Y	N
6349	8,645	22 MILE ROAD	MIDDLE BR CLINTON RIVER	A	FAIR	7	6	7	-	5	Y	N
6380	1,200	31 MILE ROAD	N BRANCH CLINTON RIVER	P	FAIR	6	5	7	-	8	Y	N
6401	1,835	SCHOENHERR RD	MIDDLE BR CLINTON RIVER	A	FAIR	6	7	7	-	8	Y	N
6408	1,518	JEWELL ROAD	YATES DRAIN	A	FAIR	7	7	7	-	8	Y	N

SN	DECK AREA	FACILITY CARRIED	INTERSECTED FEATURES	OPEN (A), POSTED (P), CLOSED (K)	CONDITION	DECK RATING	SUPER RATING	SUB RATING	CULVERT RATING	SCOUR CRITICAL	NBI	NHS
6409	810	MT VERNON RD	STONY CREEK	A	FAIR	8	8	7	-	8	Y	N

Appendix H. Load Posted Bridges

SN	DECK AREA	FACILITY CARRIED	INTERSECTED FEATURES	OPEN (A), POSTED (P), CLOSED (K)	CONDITION	DECK RATING	SUPER RATING	SUB RATING	CULVERT RATING	SCOUR CRITICAL	NBI	NHS
6200	14,856	WB METRO PARKWAY	CLINTON RIVER SPILLWAY	P	FAIR	7	5	6	-	8	Y	Y
6202	686	SOUTH RIVER RD	CHANNEL BETW LAKE & RIVR	P	SERIOUS/CRITICAL	3	3	3	-	2	Y	N
6230	2,964	32 MILE ROAD	HIGHBANK CREEK	P	POOR	5	4	7	-	8	Y	N
6235	723	ARMADA CENTER RD	COON CREEK	P	POOR	5	4	6	-	8	Y	N
6266	2,323	NORTH AVE	E B COON CREEK	P	SERIOUS/CRITICAL	-	-	-	3	8	Y	N
6277	2,078	WASHINGTON RD	SALT RIVER	P	SERIOUS/CRITICAL	4	4	3	-	8	Y	N
6285	1,112	33 MILE ROAD	N B CLINTON RIVER	P	SERIOUS/CRITICAL	5	3	3	-	8	Y	N
6298	875	COON CREEK ROAD	COON CREEK	P	SERIOUS/CRITICAL	-	-	-	3	8	Y	N
6300	777	ROMEO PLANK ROAD	NEWLAND DRAIN	P	POOR	-	-	-	4	8	Y	N
6303	1,486	BORDMAN ROAD	N B CLINTON RIVER	P	FAIR	7	5	7	-	8	Y	N
6306	782	MCVICAR ROAD	EAST POND CREEK	P	SERIOUS/CRITICAL	-	-	-	3	3	Y	N
6309	620	RAAP ROAD	FISHER LAKE OUTLET	P	POOR	-	-	-	4	8	Y	N
6318	890	DUNHAM ROAD	MILLER DRAIN	P	POOR	5	4	7	-	8	Y	N
6320	3,782	NORTH RIVER ROAD	CATFISH CHANNEL	P	SERIOUS/CRITICAL	5	3	6	-	8	Y	N
6380	1,200	31 MILE ROAD	N BRANCH CLINTON RIVER	P	FAIR	6	5	7	-	8	Y	N
6405	948	INWOOD ROAD	STONY CREEK	P	POOR	-	-	-	4	8	Y	N
10113	504	BORDMAN ROAD	NEWLAND DRAIN	P	SERIOUS/CRITICAL	4	3	4	-	5	Y	N
12656	1,684	25 MILE ROAD	FISH CREEK	P	FAIR	7	8	8	-	8	Y	N
14319	968	34 MILE RD	HIGHBANK CREEK	P	SERIOUS/CRITICAL	-	-	-	3	8	Y	N
14360	1,033	GARFIELD RD	HARRINGTON DRAIN	P	POOR	4	4	5	-	U	Y	Y

Appendix I. Closed Bridges

SN	DECK AREA	FACILITY CARRIED	INTERSECTED FEATURES	OPEN (A), POSTED (P), CLOSED (K)	CONDITION	DECK RATING	SUPER RATING	SUB RATING	CULVERT RATING	SCOUR CRITICAL	NBI	NHS
6357	3,270	25 MILE ROAD	NORTH BRANCH CLINTON R	K	SERIOUS/CRITICAL	4	1	5	-	8	Y	N
14318	580	28 MILE RD	DEER CREEK	K	SERIOUS/CRITICAL	-	-	-	1	8	Y	N

Appendix J. BCFS Methodology

Forecasting future conditions based on funding levels and treatment strategies is a fundamental component of asset management. To help determine future funding needs and likely outcomes of its various programmatic strategies and scenarios, MCDR utilizes MDOT's Bridge Condition Forecasting System (BCFS). The BCFS modeling process helps identify an optimized strategy for funding allocations to each of the three primary fix type categories: reconstruction, rehabilitation, and capital preventive maintenance. BCFS also allows for program level planning and optimization of distribution of funds between rehabilitation, replacement and capital preventive maintenance projects. BCFS can be employed by an agency in many ways. Amongst the most useful, and those being employed by MCDR for its bridges, are the following:

- The ability to determine the future condition of the bridge inventory at a given funding level and distribution.
- The ability to determine the best investment strategy to distribute available funding between rehabilitation, replacement, and preventive maintenance to maximize limited resources.
- The ability to determine the funding levels and allocations required to reach a targeted inventory condition in the future.

Funding inputs in BCFS allow the user to vary the funding available on an annual basis, account for inflation, vary the funding distribution amongst work types, and deduct for projects already programmed/planned. By adjusting the funding levels and distribution of funds across the work types (replacement, rehabilitation, and preventive maintenance) an agency can adjust their program over time to allow for a transition from a worse first scenario to a "mix of fix" strategy or to account for any previously obligated projects. This also allows MCDR to account for variations in the program due to outside influences, changes in the annual program, as well as changing funding sources and availability of funds. Once a program is established, the projects section of BCFS allows the user to enter the annual projects by structure, work type and cost. This is then deducted from the annual budget when determining the best use of the remaining funds, if any are present. BCFS also adjusts for the specific structures entered into the projects tab when determining the effect of that year's program on the overall system.

BCFS utilizes deterioration probabilities based on historical condition data consisting of the past five years NBI inspection data to forecast a structure's condition yearly. For purposes of analysis, the BCFS deterioration model utilized actual historical inspection data for the MCDR inventory.

In addition to determining the overall condition of the system, the output of BCFS, otherwise called the "simulation" is a chart indicating the number of projects that should be implemented each year in order to achieve the condition goals being modeled. The simulation output is shown in Error! Reference source not found..

Figure 17: Programmed Project Entry in BCFS System

2020									
NBI ID	Area	NBI or Non-NBI	Bridge Rating Before Project	Structure Number	Structure Work Description	Project Cost	Major Work Type Code	Estimated Bridge Rating After Project	
B01-0 of 0016			3	12161	Replacement	\$3,000,000	Replacement	9	
Year	1	2	3	4	5	6	7	8	9
2020	0	0	1	18	46	52	53	45	14
Project Replacement	0	0	1	0	0	0	0	0	0
Sim Replacement	1	0	0	0	0	0	0	0	0
Total Replacement	1	0	0	1	0	0	0	0	0
Carry Over	5	5	0	0	0	0	0	0	0
New Count	0	0	17	46	52	53	45	14	3
Sim Rehab	0	0	0	0	0	0	0	0	0
Sim PM	0	0	0	1	2	0	0	0	0
New Count	0	0	13	45	50	53	45	14	3
Projects Moved To	0	0	0	0	0	0	0	0	1
Sim Replace Moved To	0	0	0	0	0	0	0	0	1
Sim Rehab Moved To	0	0	0	0	0	2	0	2	0
Sim PM Moved To	0	0	0	0	0	2	1	0	0
New Count	0	0	13	45	50	57	46	16	5
Deterioration Entering	0	0	0	2	3	4	3	2	0
Deterioration Leaving	0	0	0	2	2	4	4	2	2
End of Year Count	0	0	0	15	46	52	56	44	16

Source: Bridge Condition Forecasting System

Each year, the simulation calculates the number of structures at each condition level, applies the deterioration model to determine the annual condition decrease, and then applies the completed bridge improvement projects for the year as increases in condition. The number of projects is determined by distributing the funds according to the funding inputs described above and allocating replacement, rehabilitation and preventive maintenance work to structures at a user defined condition level. Historically this would be replacing serious/critical structures, rehabilitating poor structures and performing preventive maintenance on good/fair structures. From here, a bridge program manager can routinely utilize the BCFS tool as a backcheck to ensure that the minimum number of projects are being implemented annually in order to reach the target condition and, if necessary, adjust accordingly.

J.1. Bridge Unit Costs and Fix Types

Bridge fix types are routinely grouped into three categories as they relate to capital projects, not including routine and emergency maintenance measures. These are replacement, rehabilitation, and preventive maintenance. MCDR is utilizing the definitions of these work types as they are defined by the MDOT Local Bridge Program.

- **Replacement Projects:** Replacement of the entire “substructure, superstructure, deck and necessary approach work.”
- **Rehabilitation Projects:** “Major work required to restore the structural integrity of a bridge, as well as work necessary to correct major safety defects” such as full deck replacement, superstructure replacement, widening and complete removal of a structure (no replacement).
- **Preventive Maintenance:** Preservation fix types including, but not limited to (see Local Bridge Program guidance) bridge deck overlays (shallow and deep), joint replacement, patching, sealing, temporary supports and scour countermeasures.

MCDR currently employs a variety of fix types to maintain its bridge inventory. Currently, each fix type has been assigned an average cost in the BCFS model based historical data and on guidance from the MDOT Local Agency Program (LAP) on their Bridge Cost Estimate Worksheet.

For forecasting purposes, an average replacement cost of \$1.5 million was utilized, with a rehabilitation cost of \$1 million. CPM project costs are estimated at approximately \$275,000. This aligns with the initial scoping data as well as the acceptable range of industry standards for the Michigan Local Bridge Program. This does not include preliminary engineering (PE) or construction engineering and oversight (CE) costs.

J.2. Bridge Deterioration Curves

BCFS utilizes a transition probability matrix to determine the expected deterioration of a structure. The matrix utilizes the prior five years of condition data to determine the probability of a structure to either remain stable at a given condition rating or to deteriorate to a lower condition. A bridge's condition is identified as the lowest of three condition ratings, the deck, superstructure, and substructure (or culvert rating where applicable).

Appendix K. Bridge Preservation Criteria

Preservation Action	Bridge Selection Criteria	Expected Service Life
Replacement		
Total Replacement	<ul style="list-style-type: none"> NBI rating of 3 or less (MDOT, 2019) (MDOT, 2017) OR Cost of rehabilitation exceeds cost of replacement (MDOT, 2019) OR Bridge is scour critical with no counter-measures available (MDOT, 2019) 	70 years
Superstructure Replacement	<ul style="list-style-type: none"> NBI rating of 4 or less for the superstructure (MDOT, 2019) (MDOT, 2017) OR Cost of superstructure and deck rehabilitation exceeds cost of replacement (MDOT, 2019) 	40 years (MDOT 2019)
Deck Replacement Epoxy Coated Steel Black Steel	<ul style="list-style-type: none"> Use guidelines in MDOT’s Bridge Deck Preservation Matrix (MDOT, 2017) (MDOT, 2017) NBI rating of 4 or less for the deck surface and deck bottom (MDOT, 2019) (MDOT, 2017) Deck bottom has more than 25% total area with deficiencies (MDOT, 2019) OR Replacement cost of deck is competitive with rehabilitation (MDOT, 2019) 	60+ years (MDO T, 2017) (MDO T, 2017)
Rehabilitation		
Substructure Replacement (Full or Partial)	<ul style="list-style-type: none"> NBI rating of 4 or less for abutments, piers, or pier cap (MDOT, 2019) (MDOT, 2017) Has open vertical cracks, signs of differential settlement, or active movement (MDOT, 2019) Pontis rating of 3 or 5 for more than 30 percent of the substructure (MDOT, 2019) (MDOT, 2009) OR Bridge is scour critical with no counter-measures available 	40 years ^[1]
Steel Beam Repair	<ul style="list-style-type: none"> More than 25% section loss in an area of the beam that affects load carrying capacity (MDOT, 2019) OR To correct impact damage that impairs beam strength (MDOT, 2019) 	40 years ^[1]
Prestressed Concrete Beam Repair	<ul style="list-style-type: none"> More than 5% spalling at ends of prestressed I-beams (MDOT, 2019) OR Impact damage that impairs beam strength or exposes prestressing strands (MDOT, 2019) 	40 years ^[1]

Preservation Action	Bridge Selection Criteria	Expected Service Life
Substructure Concrete Patching and Repair	<ul style="list-style-type: none"> NBI rating of 5 or 4 for abutments or piers, and surface has less than 30% area spalled and delaminated (MDOT, 2019) (MDOT, 2017) OR Pontis rating of 3 or 4 for the column or pile extension, pier wall, and/or abutment wall and surface has between 2% and 30% area with deficiencies (MDOT, 2019) (MDOT, 2009) OR In response to inspector’s work recommendation for substructure patching (MDOT, 2019) 	
Abutment Repair/Replacement	<ul style="list-style-type: none"> NBI rating of 4 or less for the abutment (MDOT, 2019) (MDOT, 2017) OR Has open vertical cracks, signs of differential settlement, or active movement 	
Railing/Barrier Replacement	<ul style="list-style-type: none"> NBI rating greater than 5 for the deck (MDOT, 2019) (MDOT, 2017) NBI rating less than 5 for the railing with more than 30% total area having deficiencies (MDOT, 2019) (MDOT, 2017) OR Pontis rating is 4 for railing (MDOT, 2019) (MDOT, 2009) OR Safety improvement is needed (MDOT, 2019) 	
Culvert Repair/Replacement	<ul style="list-style-type: none"> NBI rating of 4 or less for culvert or drainage outlet structure OR Has open vertical cracks, signs of deformation, movement, or differential settlement 	
HMA Overlay with Waterproofing Membrane	<ul style="list-style-type: none"> NBI rating of 5 or less for deck surface, and both deck surface and bottom have between 15% and 30% area with deficiencies (MDOT, 2019) (MDOT, 2017) OR Bridge is in poor condition and will be replaced in the near future and the most cost-effective fix is HMA overlay (MDOT, 2019) 	
HMA Overlay Cap without Membrane	<ul style="list-style-type: none"> Note: All HMA caps should have membranes unless scheduled for replacement within five years. NBI rating of 3 or less for deck surface and deck bottom, and deck surface and deck bottom have more than 30% area with deficiencies. Temporary holdover to improve ride quality for a bridge in the five- year plan for rehab/replacement. (MDOT, 2019) (MDOT, 2017) 	3 years
Concrete Deck Patching	<ul style="list-style-type: none"> NBI rating of 5, 6, or 7 for deck surface, and deck surface has between 2% and 5% area with delamination and spalling (MDOT, 2019) (MDOT, 2017) OR In response to inspector’s work recommendation (MDOT, 2019) 	5 years
Steel Bearing Repair/Replacement	<ul style="list-style-type: none"> NBI rating of 5 or more for superstructure and deck, and NBI rating 4 or less for bearing (MDOT, 2017) 	

Preservation Action	Bridge Selection Criteria	Expected Service Life
Deck Joint Replacement	<ul style="list-style-type: none"> • Always include when doing deep or shallow concrete overlays (MDOT, 2019) • NBI rating of 4 or less for joints (MDOT, 2019) (MDOT, 2017) • OR Joint leaking heavily (MDOT, 2019) • OR In response to inspector’s work recommendation for replacement (MDOT, 2019) 	
Pin and Hanger Replacement	<ul style="list-style-type: none"> • NBI rating of 4 or less for superstructure for pins and hangers (MDOT, 2019) (MDOT, 2017) • Pontis rating of 1, 2, or 3 for a frozen or deformed pin and hanger (MDOT, 2019) (MDOT, 2009) 	15 years
Railing/Barrier Replacement	<ul style="list-style-type: none"> • NBI rating greater than 5 for the deck (MDOT, 2019) (MDOT, 2017) • NBI rating less than 5 for the railing with more than 30% total area having deficiencies (MDOT, 2019) (MDOT, 2017) • OR Pontis rating is 4 for railing (MDOT, 2019) (MDOT, 2009) • OR Safety improvement is needed (MDOT, 2019) 	
Culvert Repair/Replacement	<ul style="list-style-type: none"> • NBI rating of 4 or less for culvert or drainage outlet structure • OR Has open vertical cracks, signs of deformation, movement, or differential settlement 	
Preventive Maintenance		
Shallow Concrete Deck Overlay	<ul style="list-style-type: none"> • NBI rating is 5 or less for deck surface, and deck surface has more than 15% area with deficiencies (MDOT, 2019) (MDOT, 2017) • NBI rating of 4 or 5 for deck bottom, and deck bottom has between 5% and 30% area with deficiencies (MDOT, 2019) (MDOT, 2017) • OR In response to inspector’s work recommendation (MDOT, 2019) 	12 years
Deep Concrete Deck Overlay	<ul style="list-style-type: none"> • NBI rating of 5 or less for deck surface, and deck surface has more than 15% area with deficiencies (MDOT, 2019) (MDOT, 2017) • NBI deck bottom rating is 5 or 6, and deck bottom has less than 10% area with deficiencies (MDOT, 2019) (MDOT, 2017) • OR In response to inspector’s work recommendation (MDOT, 2019) 	25 years
HMA Overlay with Waterproofing Membrane	<ul style="list-style-type: none"> • NBI rating of 5 or less for deck surface, and both deck surface and bottom have between 15% and 30% area with deficiencies (MDOT, 2019) (MDOT, 2017) • OR Bridge is in poor condition and will be replaced in the near future • and the most cost-effective fix is HMA overlay (MDOT, 2019) 	

Preservation Action	Bridge Selection Criteria	Expected Service Life
HMA Overlay Cap without Membrane	<ul style="list-style-type: none"> Note: All HMA caps should have membranes unless scheduled for replacement within five years. NBI rating of 3 or less for deck surface and deck bottom, and deck surface and deck bottom have more than 30% area with deficiencies. Temporary holdover to improve ride quality for a bridge in the five- year plan for rehab/replacement. (MDOT, 2019) (MDOT, 2017) 	3 years
Concrete Deck Patching	<ul style="list-style-type: none"> NBI rating of 5, 6, or 7 for deck surface, and deck surface has between 2% and 5% area with delamination and spalling (MDOT, 2019) (MDOT, 2017) OR In response to inspector’s work recommendation (MDOT, 2019) 	5 years
Steel Bearing Repair/Replacement	<ul style="list-style-type: none"> NBI rating of 5 or more for superstructure and deck, and NBI rating 4 or less for bearing (MDOT, 2017) 	
Deck Joint Replacement	<ul style="list-style-type: none"> Always include when doing deep or shallow concrete overlays (MDOT, 2019) NBI rating of 4 or less for joints (MDOT, 2019) (MDOT, 2017) OR Joint leaking heavily (MDOT, 2019) OR In response to inspector’s work recommendation for replacement (MDOT, 2019) 	
Pin and Hanger Replacement	<ul style="list-style-type: none"> NBI rating of 4 or less for superstructure for pins and hangers (MDOT, 2019) (MDOT, 2017) Pontis rating of 1, 2, or 3 for a frozen or deformed pin and hanger (MDOT, 2019) (MDOT, 2009) OR Presence of excessive section loss, severe pack rust, or out-of- plane distortion (MDOT, 2019) 	15 years
Zone Repainting	<ul style="list-style-type: none"> NBI rating of 5 or 4 for paint condition, and paint has 3% to 15% total area failing (MDOT, 2019) (MDOT, 2017) OR During routine maintenance on beam ends or pins and hangers (MDOT, 2019) OR less than 15% of existing paint area has failed and remainder of paint system is in good or fair condition (MDOT, 2019) 	10 years
Complete Repainting	<ul style="list-style-type: none"> NBI rating of 3 or less for paint condition (MDOT, 2019) (MDOT, 2017) OR Painted steel beams that have greater than 15% of the existing paint area failing (MDOT, 2019) 	
Partial Repainting	<ul style="list-style-type: none"> See Zone or Spot Painting 	
Channel Improvements	<ul style="list-style-type: none"> Removal of vegetation, debris, or sediment from channel and banks to improve channel flow OR in response to inspector’s work recommendation 	

Preservation Action	Bridge Selection Criteria	Expected Service Life
Scour Countermeasures	<ul style="list-style-type: none"> • Pontis scour rating of 2 or 3 and is not scheduled for replacement (MDOT, 2019) (MDOT, 2009) • OR NBI comments in abutment and pier ratings indicate presence of • scour holes (MDOT, 2019) (MDOT, 2017) 	
Approach Repaving	<ul style="list-style-type: none"> • Approach pavement relief joints should be included in all projects that contain a significant amount of concrete roadway (in excess of 1000' adjacent to the structure). The purpose is to alleviate the effects of pavement growth that may cause distress to the structure. Signs of pavement growth include: <ul style="list-style-type: none"> ○ Abutment spalling under bearings (MDOT, 2019) ○ Beam end contact (MDOT, 2019) ○ Closed expansion joints and/or pin and hangers (MDOT, 2019) ○ Damaged railing and deck fascia at joints (MDOT, 2019) • Cracking in deck at reference line (45 degree angle) (MDOT, 2019) 	
Guard Rail Repair/Replacement	<ul style="list-style-type: none"> • Guard rail missing or damaged ^[2] • OR Safety improvement is needed ^[2] 	
Scheduled Maintenance		
Superstructure Washing	<ul style="list-style-type: none"> • When salt contaminated dirt and debris collected on superstructure is causing corrosion or deterioration by trapping moisture (MDOT, 2019) • OR Expansion or construction joints are to be replaced and the steel is not to be repainted (MDOT, 2019) • OR Prior to a detailed replacement (MDOT, 2019) • OR In response to inspector's work recommendation (MDOT, 2019) 	2 years
Drainage System Clean-Out/Repair	<ul style="list-style-type: none"> • When drainage system is clogged with debris (MDOT, 2019) • OR Drainage elements are broken, deteriorated, or damaged (MDOT, 2019) • OR NBI rating comments for drainage system indicate need for • cleaning or repair (MDOT, 2019) (MDOT, 2017) 	2 years
Spot Repainting	<ul style="list-style-type: none"> • For zinc-based paint systems only. Do not spot paint with lead-based paints. • Less than 5% of paint area has failed in isolated areas (MDOT, 2019) • OR In response to inspector's work recommendation (MDOT, 2019) 	5 years
Slope Paving Repair	<ul style="list-style-type: none"> • NBI rating is 5 or less for slope protection (MDOT, 2019) (MDOT, 2017) • OR Slope is degraded or sloughed • OR Slope paving has significant areas of distress, failure, or has settled (MDOT, 2019) 	
Riprap Installation	<ul style="list-style-type: none"> • To protect surface when erosion threatens the stability of side slopes • of channel banks 	

Preservation Action	Bridge Selection Criteria	Expected Service Life
Vegetation Control	<ul style="list-style-type: none"> • When vegetation traps moisture on structural elements (MDOT, 2019) • <i>OR</i> Vegetation is growing from joints or cracks (MDOT, 2019) • <i>OR</i> In response to inspector’s work recommendation for brush cut (MDOT, 2019) 	1 year
Debris Removal	<ul style="list-style-type: none"> • When vegetation, debris, or sediment accumulates on the structure or in the channel • <i>OR</i> In response to inspectors work recommendation 	1 year
Deck Joint Repair	<ul style="list-style-type: none"> • Do not repair compression joint seals, assembly joint seals, steel armor expansions joints, and block out expansion joints; these should always be replaced. (MDOT, 2019) • NBI rating is 5 for joint (MDOT, 2019) (MDOT, 2017) • <i>OR</i> In response to inspector’s work recommendation for repair (MDOT, 2019) 	
Concrete Sealing	<ul style="list-style-type: none"> • Top surface of pier or abutments are below deck joints and, when contaminated with salt, salt can collect on the surface (MDOT, 2019) • <i>OR</i> Surface of the concrete has heavy salt exposure. Horizontal surfaces of substructure elements are directly below expansion joints • (MDOT, 2019) 	
Concrete Crack Sealing	<ul style="list-style-type: none"> • Concrete is in good or fair condition, and cracks extend to the depth of the steel reinforcement (MDOT, 2019) • <i>OR</i> NBI rating of 5, 6, or 7 for deck surface, and deck surface has between 2% and 5% area with deficiencies (MDOT, 2019) (MDOT, 2017) • <i>OR</i> Unsealed cracks exist that are narrow and/or less than 1/8” wide and spaced more than 8’ apart (MDOT, 2019) • <i>OR</i> In response to inspector’s work recommendation (MDOT, 2019) 	5 years
Minor Concrete Patching	<ul style="list-style-type: none"> • Repair minor delaminations and spalling that cover less than 30% of the concrete substructure (MDOT, 2019) • <i>OR</i> NBI rating of 5 or 4 for abutments or piers, and comments indicate that their surface has less than 30% spalling or delamination (MDOT, 2019) (MDOT, 2017) • <i>OR</i> Pontis rating of 3 or 4 for the column or pile extension, pier wall and/or abutment wall, and surface has between 2% and 30% area with deficiencies (MDOT, 2019) (MDOT, 2009) • <i>OR</i> In response to inspector’s work recommendation (MDOT, 2019) 	
HMA Surface Repair/Replacement	<ul style="list-style-type: none"> • HMA surface is in poor condition • <i>OR</i> In response to inspector’s work recommendation 	

Preservation Action	Bridge Selection Criteria	Expected Service Life
Seal HMA Cracks/Joints	<ul style="list-style-type: none"> HMA surface is in good or fair condition, and cracks extend to the surface of the underlying slab or sub course OR In response to inspector's work recommendation 	
Timber Repair	<ul style="list-style-type: none"> NBI rating of 4 or less for substructure for timber members OR To repair extensive rot, checking, or insect infestation 	
Miscellaneous Repair	<ul style="list-style-type: none"> Uncategorized repairs in response to inspector's work recommendation 	

This table was produced by TransSystems and includes information from the following sources:

- [1] M DOT, *Project Scoping Manual*, MDOT, 2019.
- [2] M DOT, *MDOT NBI Rating Guidelines*, MDOT, 2017.
- [3] M DOT, *Bridge Deck Preservation Matrix - Decks with Uncoated "Blac Rebar*, MDOT, 2017.
- [4] M DOT, *Bridge Deck Preservation Matrix - Decks with Epoxy Coated Rebar*, 2017.
- [5] M DOT, *Pontis Bridge Inspection Manual*, MDOT, 2009.

* From source with interpretation added

Appendix L. MCDR Risk Assessment

Critical Linkage Description			Failure Assessment							Total Scores	
CL #	Location	CL Criteria	Failure Type	Severity		Occurrence		Detection		Criticality Score (SxO)	Risk Priority Number (SxOxD)
01	6321 Seaway Dr over Canal to Seaway Island	Geographic boundary	Condition	Moderate	3	Possible	3	Possible	3	9	27
01	6321 Seaway Dr over Canal to Seaway Island	Geographic boundary	Condition	Minor	2	Possible	3	Likely	2	6	12
01	6321 Seaway Dr over Canal to Seaway Island	Geographic boundary	Safety	Minimal	1	Almost Never	1	Possible	3	1	3
02	Metropolitan Pkwy (16 mile) from Mound to Van Dyke	Commercial access	Safety	Major	4	Almost Certain	5	Possible	3	20	60
02	Metropolitan Pkwy (16 mile) from Mound to Van Dyke	Commercial access	Other	Major	4	Likely	4	Possible	3	16	48
02	Metropolitan Pkwy (16 mile) from Mound to Van Dyke	Commercial access	Condition	Major	4	Unlikely	2	Likely	2	8	16
03	#6309 – Raap Road over Fisher Lake Outlet	Geographic boundary	Condition	Major	4	Almost Certain	5	Unlikely	4	20	80
03	#6309 – Raap Road over Fisher Lake Outlet	Geographic boundary	Other	Moderate	3	Likely	4	Possible	3	12	36
03	#6309 – Raap Road over Fisher Lake Outlet	Geographic boundary	Safety	Minimal	1	Almost Never	1	Possible	3	1	3

Critical Linkage Description			Failure Assessment							Total Scores	
CL #	Location	CL Criteria	Failure Type	Severity		Occurrence		Detection		Criticality Score (SxO)	Risk Priority Number (SxOxD)
04	#6322 – South Lakeshore Drive over Channel	Geographic boundary	Safety	Minor	2	Unlikely	2	Possible	3	4	12
04	#6322 – South Lakeshore Drive over Channel	Geographic boundary	Other	Minimal	1	Almost Never	1	Possible	3	1	3
04	#6322 – South Lakeshore Drive over Channel	Geographic boundary	Condition	Minimal	1	Almost Never	1	Possible	3	1	3
05	#6323 – North Lakeshore Drive over Channel	Geographic boundary	Safety	Minor	2	Possible	3	Possible	3	6	18
05	#6323 – North Lakeshore Drive over Channel	Geographic boundary	Other	Minimal	1	Almost Never	1	Possible	3	1	3
05	#6323 – North Lakeshore Drive over Channel	Geographic boundary	Condition	Minimal	1	Almost Never	1	Possible	3	1	3
06	10 Mile from Dequindre to Ryan	Commercial access	Safety	Major	4	Likely	4	Possible	3	16	48
06	10 Mile from Dequindre to Ryan	Commercial access	Condition	Minimal	1	Possible	3	Possible	3	3	9
06	10 Mile from Dequindre to Ryan	Commercial access	Other	Major	4	Unlikely	2	Possible	3	8	24
07	16 Mile Rd @ I-94	High traffic	Condition	Major	4	Likely	4	Likely	2	16	32
07	16 Mile Rd @ I-94	High traffic	Safety	Minor	2	Likely	4	Possible	3	8	24

Critical Linkage Description			Failure Assessment							Total Scores	
CL #	Location	CL Criteria	Failure Type	Severity		Occurrence		Detection		Criticality Score (SxO)	Risk Priority Number (SxOxD)
07	16 Mile Rd @ I-94	High traffic	Operations	Moderate	3	Unlikely	2	Possible	3	6	18
08	18 Mile from Mound to Van Dyke	Commercial access	Safety	Major	4	Almost Certain	5	Possible	3	20	60
08	18 Mile from Mound to Van Dyke	Commercial access	Condition	Major	4	Almost Certain	5	Possible	3	20	60
08	18 Mile from Mound to Van Dyke	Commercial access	Other	Moderate	3	Possible	3	Possible	3	9	27
09	23 Mile from Mound to Hayes and 23 Mile Rd @ 53 Interchange	Commercial access	Safety	Severe	5	Almost Certain	5	Possible	3	25	75
09	23 Mile from Mound to Hayes and 23 Mile Rd @ 53 Interchange	Commercial access	Other	Moderate	3	Likely	4	Possible	3	12	36
09	23 Mile from Mound to Hayes and 23 Mile Rd @ 53 Interchange	Commercial access	Condition	Moderate	3	Likely	4	Likely	2	12	24
10	26 Mile Rd @ I-94 to County Line	High traffic	Condition	Major	4	Likely	4	Possible	3	16	48
10	26 Mile Rd @ I-94 to County Line	High traffic	Safety	Major	4	Likely	4	Possible	3	16	48
10	26 Mile Rd @ I-94 to County Line	High traffic	Other	Moderate	3	Likely	4	Possible	3	12	36
11	26 Mile Rd @ M-53	High traffic	Other	Moderate	3	Possible	3	Possible	3	9	27

Critical Linkage Description			Failure Assessment							Total Scores	
CL #	Location	CL Criteria	Failure Type	Severity		Occurrence		Detection		Criticality Score (SxO)	Risk Priority Number (SxOxD)
11	26 Mile Rd @ M-53	High traffic	Safety	Moderate	3	Possible	3	Possible	3	9	27
11	26 Mile Rd @ M-53	High traffic	Condition	Moderate	3	Unlikely	2	Possible	3	6	18
12	32 Mile Rd from S Main St to Powell St	Commercial access	Condition	Major	4	Likely	4	Possible	3	16	48
12	32 Mile Rd from S Main St to Powell St	Commercial access	Other	Minor	2	Unlikely	2	Possible	3	4	12
12	32 Mile Rd from S Main St to Powell St	Commercial access	Safety	Minor	2	Unlikely	2	Possible	3	4	12
13	6325 West Archer Drive over Channel to Lake St Clair	Geographic boundary	Condition	Minimal	1	Likely	4	Possible	3	4	12
13	6325 West Archer Drive over Channel to Lake St Clair	Geographic boundary	Other	Moderate	3	Likely	4	Possible	3	12	36
13	6325 West Archer Drive over Channel to Lake St Clair	Geographic boundary	Safety	Minimal	1	Almost Never	1	Possible	3	1	3
14	6326 Archer Dr over channel	Geographic boundary	Safety	Minor	2	Possible	3	Possible	3	6	18
14	6326 Archer Dr over channel	Geographic boundary	Other	Minimal	1	Almost Never	1	Possible	3	1	3
14	6326 Archer Dr over channel	Geographic boundary	Condition	Minimal	1	Almost Never	1	Possible	3	1	3

Critical Linkage Description			Failure Assessment							Total Scores	
CL #	Location	CL Criteria	Failure Type	Severity		Occurrence		Detection		Criticality Score (SxO)	Risk Priority Number (SxOxD)
15	6409 Mt Vernon Rd over Stony Creek	Geographic boundary	Other	Minimal	1	Almost Never	1	Possible	3	1	3
15	6409 Mt Vernon Rd over Stony Creek	Geographic boundary	Safety	Minimal	1	Almost Never	1	Possible	3	1	3
15	6409 Mt Vernon Rd over Stony Creek	Geographic boundary	Condition	Minimal	1	Almost Never	1	Possible	3	1	3
16	Hayes from Martin to Common	Commercial access	Condition	Severe	5	Likely	4	Possible	3	20	60
16	Hayes from Martin to Common	Commercial access	Other	Minor	2	Unlikely	2	Possible	3	4	12
16	Hayes from Martin to Common	Commercial access	Safety	Minor	2	Unlikely	2	Possible	3	4	12
17	Jefferson Ave from Sugarbush Rd to Altman Rd	High traffic	Condition	Severe	5	Likely	4	Possible	3	20	60
17	Jefferson Ave from Sugarbush Rd to Altman Rd	High traffic	Safety	Minor	2	Possible	3	Possible	3	6	18
17	Jefferson Ave from Sugarbush Rd to Altman Rd	High traffic	Other	Minimal	1	Unlikely	2	Possible	3	2	6
18	Mound from 8 Mile to M-59	Commercial access	Condition	Moderate	3	Likely	4	Possible	3	12	36
18	Mound from 8 Mile to M-59	Commercial access	Other	Major	4	Likely	4	Possible	3	16	48

Critical Linkage Description			Failure Assessment							Total Scores	
CL #	Location	CL Criteria	Failure Type	Severity		Occurrence		Detection		Criticality Score (SxO)	Risk Priority Number (SxOxD)
18	Mound from 8 Mile to M-59	Commercial access	Safety	Moderate	3	Likely	4	Possible	3	12	36
19	N River Rd from Gratiot to east end	Geographic boundary	Condition	Major	4	Possible	3	Possible	3	12	36
19	N River Rd from Gratiot to east end	Geographic boundary	Other	Moderate	3	Possible	3	Possible	3	9	27
19	N River Rd from Gratiot to east end	Geographic boundary	Safety	Moderate	3	Unlikely	2	Possible	3	6	18
20	Parallel neighborhood streets that cross culverts	Geographic boundary	Other	Moderate	3	Possible	3	Possible	3	9	27
20	Parallel neighborhood streets that cross culverts	Geographic boundary	Condition	Moderate	3	Possible	3	Possible	3	9	27
20	Parallel neighborhood streets that cross culverts	Geographic boundary	Safety	Minor	2	Possible	3	Possible	3	6	18
21	S River Rd from Jefferson to E end	Geographic boundary	Condition	Major	4	Possible	3	Possible	3	12	36
21	S River Rd from Jefferson to E end	Geographic boundary	Other	Moderate	3	Possible	3	Possible	3	9	27
21	S River Rd from Jefferson to E end	Geographic boundary	Safety	Minor	2	Unlikely	2	Possible	3	4	12
22	STR 6202 S River Rd over Channel between Lake and River	Geographic boundary	Condition	Severe	5	Almost Certain	5	Unlikely	4	25	100

Critical Linkage Description			Failure Assessment							Total Scores	
CL #	Location	CL Criteria	Failure Type	Severity		Occurrence		Detection		Criticality Score (SxO)	Risk Priority Number (SxOxD)
22	STR 6202 S River Rd over Channel between Lake and River	Geographic boundary	Other	Major	4	Almost Certain	5	Possible	3	20	60
22	STR 6202 S River Rd over Channel between Lake and River	Geographic boundary	Safety	Minor	2	Possible	3	Possible	3	6	18
23	STR 6275 Jefferson Ave over Salt River	Geographic boundary	Safety	Major	4	Likely	4	Possible	3	16	48
23	STR 6275 Jefferson Ave over Salt River	Geographic boundary	Other	Minor	2	Unlikely	2	Possible	3	4	12
23	STR 6275 Jefferson Ave over Salt River	Geographic boundary	Condition	Minimal	1	Almost Never	1	Possible	3	1	3
24	STR 6320 N River Rd over Catfish Channel	Geographic boundary	Condition	Severe	5	Almost Certain	5	Unlikely	4	25	100
24	STR 6320 N River Rd over Catfish Channel	Geographic boundary	Other	Moderate	3	Almost Certain	5	Possible	3	15	45
24	STR 6320 N River Rd over Catfish Channel	Geographic boundary	Safety	Minor	2	Possible	3	Possible	3	6	18
25	William P. Rosso Hwy from I-94 E to Jefferson Ave. @ Selfridge	Commercial access	Condition	Moderate	3	Likely	4	Possible	3	12	36
25	William P. Rosso Hwy from I-94 E to Jefferson Ave. @ Selfridge	Commercial access	Other	Minimal	1	Unlikely	2	Possible	3	2	6
25	William P. Rosso Hwy from I-94 E to Jefferson Ave. @ Selfridge	Commercial access	Safety	Minor	2	Almost Never	1	Possible	3	2	6

Critical Linkage Description			Failure Assessment							Total Scores	
CL #	Location	CL Criteria	Failure Type	Severity		Occurrence		Detection		Criticality Score (SxO)	Risk Priority Number (SxOxD)
26	Cass Avenue from Romeo Plank to Groesbeck (M-97)	Geographic boundary	Condition	Minimal	1	Unlikely	2	Very Likely	1	2	2
26	Cass Avenue from Romeo Plank to Groesbeck (M-97)	Geographic boundary	Safety	Minor	2	Unlikely	2	Very Likely	1	4	4
26	Cass Avenue from Romeo Plank to Groesbeck (M-97)	Geographic boundary	Operations	Moderate	3	Possible	3	Likely	2	9	18

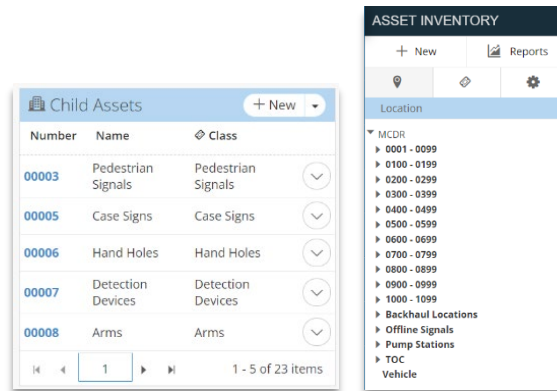
Appendix M. NEXTGEN Asset Management

M.1. Overview

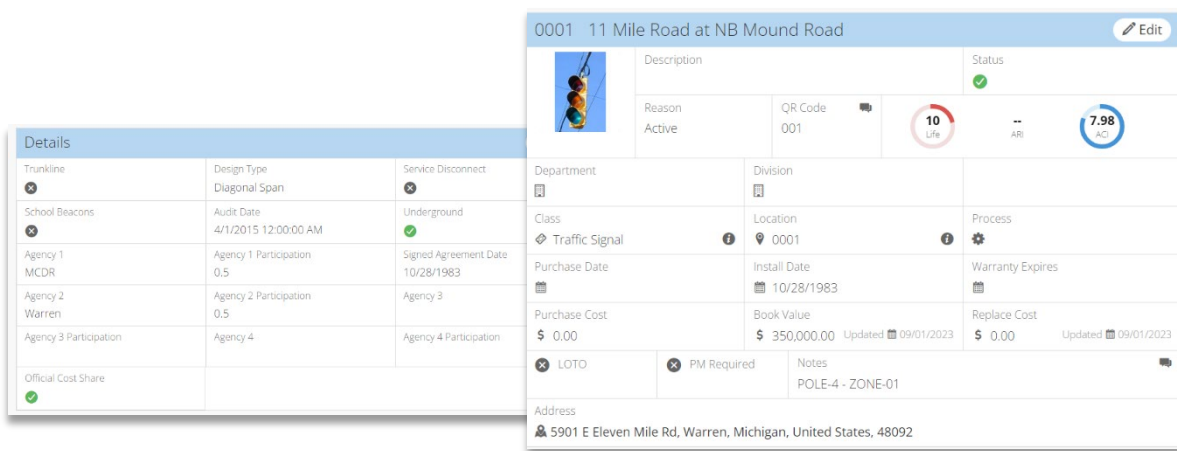
Macomb County Department of Roads utilizes NEXGEN Asset Management a Computer Maintenance Management System or CMMS. The intuitive web-based interface enables MCDR with Asset Management along with a work order tracking system. NEXGEN Asset Management has ability to customize information for various asset classes, such as Vehicle, Structure, and Linear items. The optional Asset Condition Index, can proactively monitor age and viability of each asset, allowing users to keep tabs on assets that aren't accessible through routine field inspections.

M.2. Assets

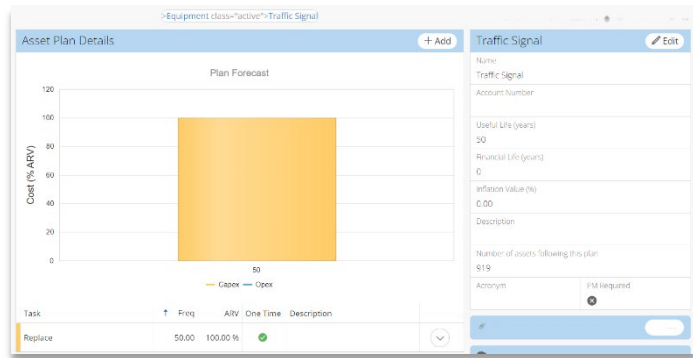
All signal assets are loaded into the NexGen database. Signals are classified as a Parent with sub assets known as the child. The child assets may include handholes, signal heads, cabinet, and ITS devices.



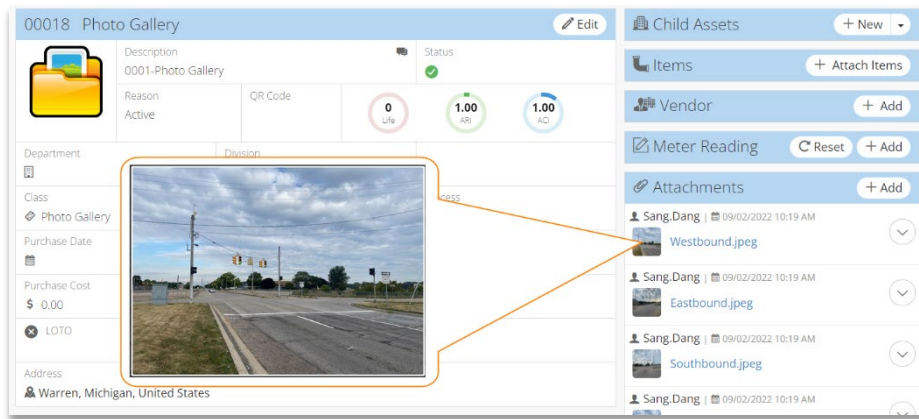
Signals are titled by location number and cross-streets. As the parent asset a high-level of detail is described within the format. Details include, address, design type, agency cost share, install date and warranty info, etc.



Database items can be tracked from install date for lifecycle and warranty tracking purposes. Lifecycles are formatted under classifications.



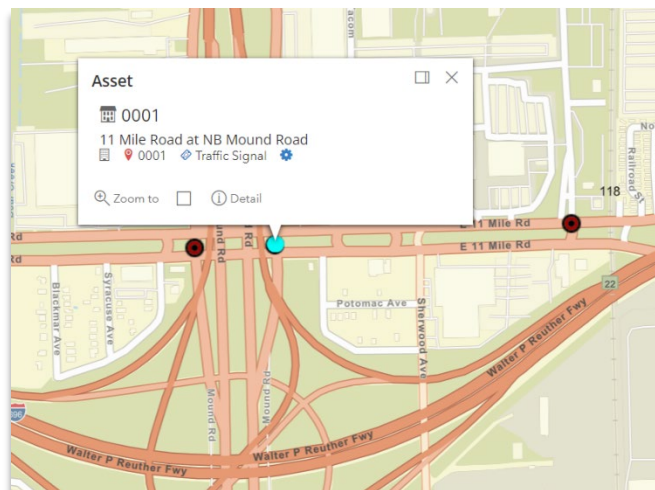
Assets incorporate a photo gallery displaying all four directions of the intersection with exterior and interior captures of the traffic cabinet.



Additional assets include County vehicles aka **Resources**, salvage, and loaner equipment.

M.3. GIS Map

NexGen integrates a County GIS map. This provides signal visibility to location coordinates and SR/WO tracking overview.



M.4. SERVICE REQUEST

NexGen provides a customer interface for creating service requests (SR's). The motoring public can call-in concerns to TOC operations which are then recorded as SR's. Intersection SRs are forwarded as work orders (WO's) to signal engineers for review. Each WO has the signal asset attached, recording time, date and resolve notations for historical database tracking.

M.5. WORK ORDER

NexGen's WO interface provides maintenance the same value provided to operations and engineers. ITS technicians can create, and or review assigned WOs to specific assets that require service. Each WO records the main task (issue category) and device type, including repair inventory used and comments of the eventual resolve.

Asset Number	Asset Name	Class	Department	Location	Process	Compl...	Completion Date	Cost
0358	I-94 Eastbound Service Drive at 12 Mile Road	Traffic Signal	0358			<input type="checkbox"/>		
18-53005	CCTV - I94 & 12 Mile - Rise PoE - (GE26)	CCTV	IT/ITS	0358		<input type="checkbox"/>		\$ 0.00

Additional maintenance options include **Preventive** and **Predictive** categories. Currently only the preventive category is utilized for recording annual 100' pole maintenance.

M.6. RESOURCE

NexGen can attach resources, such as personnel or vehicles to WO tickets that involve multiple departments in cross-communication of the overall resolution. This option also informs management of direct or indirect personnel and equipment involvement from start to finish.

Resource							+ Add
Resource	Pay Type	Date	Estimated	Actual	Unit Cost	Cost	
125116	Hourly	09/05/2023	0.00	0.25	0.00	0.00	
Estimated Cost \$ 0.00				Actual Cost \$ 0.00			

M.7. PERFORMANCE REPORTS

NexGen reporting is customizable to the required need. Offering a variety of Standard reports or customized for Adhoc reporting parameters. The subscribe feature allows automated reports to be run on daily, weekly monthly and annual basis.

PERFORMANCE REPORTS

- Favorite Standard Adhoc Subscribe
- Asset Inventory Risk
- Asset Plan Service Request
- Backflow Training
- Condition Assessment
- Contractor
- Crew
- Customer
- Employee
- Equipment
- Funding
- Inspection
- Preventive Maintenance
- Prioritization
- Projects
- Purchase Order

ASSET WITH REASON LIST

NUMBER	ASSET	REASON	DEPARTMENT/DIVISION	CLASS	LOCATION
21-52021	RSU	Defective	IT/ITS	Equipment - Engineer & IT/ITS Technician - Connected Vehicle	0000 - 0399 - 0321
21-52022	RSU	Defective	IT/ITS	Equipment - Engineer & IT/ITS Technician - Connected Vehicle	0000 - 0599 - 0322
21-52023	RSU	Defective	IT/ITS	Equipment - Engineer & IT/ITS Technician - Connected Vehicle	0000 - 0599 - 0323
21-52024	RSU	Defective	IT/ITS	Equipment - Engineer & IT/ITS Technician - Connected Vehicle	1000 - 1099 - 1024
21-52025	RSU	Defective	IT/ITS	Equipment - Engineer & IT/ITS Technician - Connected Vehicle	0000 - 0499 - 0411
		Defective	IT/ITS	Equipment - Engineer & IT/ITS Technician - Connected Vehicle	0500 - 0599 - 0561
		Defective	IT/ITS	Equipment - Engineer & IT/ITS Technician - Connected Vehicle	0001 - 0099 - 0031
		Defective	IT/ITS	Equipment - Engineer & IT/ITS Technician - Connected Vehicle	0700 - 0799 - 0726
		Defective	IT/ITS	Equipment - Engineer & IT/ITS Technician - Connected Vehicle	0500 - 0599 - 0574
		Defective	IT/ITS	Equipment - Engineer & IT/ITS Technician - Connected Vehicle	0000 - 0399 - 0304
		Defective	IT/ITS	Equipment - Engineer & IT/ITS Technician - Connected Vehicle	0000 - 0399 - 0366
		Defective	IT/ITS	Equipment - Engineer & IT/ITS Technician - Connected Vehicle	0001 - 0099 - 0050
		Defective	IT/ITS	Equipment - Engineer & IT/ITS Technician - Connected Vehicle	1000 - 1099 - 1063
		Defective	IT/ITS	Equipment - Engineer & IT/ITS Technician - Connected Vehicle	0000 - 0399 - 0181

MCDR Vehicle Report

Traffic Operations Center Weekly Vehicle Data
09/01/2023

Lead/Worker	Vehicle Number	Resource/Date	Hours	Department
Bill Boeve	123816	08/04/23	1.00	IT/ITS
Bill Boeve	123816	08/04/23	2.00	IT/ITS
Bill Boeve	123816	08/07/23	0.50	IT/ITS
Ken Abner	124914	08/16/23	0.00	IT/ITS
Ken Abner	125116	08/21/23	1.50	IT/ITS
Ken Abner	125116	08/22/23	1.50	IT/ITS
Ken Abner	125116	08/24/23	0.50	IT/ITS
Mike Ray	120815	08/10/23	0.50	TOC
Rich Kindinger	124914	08/21/23	2.00	IT/ITS
Rich Kindinger	124914	08/21/23	2.50	IT/ITS
Rich Kindinger	124914	08/22/23	2.50	IT/ITS
Robert Pasque	120815	08/10/23	0.25	IT/ITS
Robert Pasque	125116	08/10/23	0.75	IT/ITS
Robert Pasque	125116	08/11/23	0.00	IT/ITS
Robert Pasque	125116	08/21/23	0.50	IT/ITS
Robert Pasque	125116	08/22/23	0.75	IT/ITS
Robert Pasque	125116	08/24/23	0.25	IT/ITS
Robert Pasque	125116	08/24/23	0.50	IT/ITS
Robert Pasque	131709	08/10/23	0.25	IT/ITS
			17.75	Total Hours

Traffic Cabinet Report

Traffic Operations Center Cabinet Location Data
09/05/2023

Location Number	Cabinet Type	AssetName
0001	TS 2	Cabinet
0002	TS 1	Cabinet
0003	TS 1	Cabinet
0004	TS 1	Cabinet
0005	TS 1	Cabinet
0007	TS 2	Cabinet
0008	TS 1	Cabinet
0009	TS 1	Cabinet
0010	ITS 340	Cabinet
0011	IS 2	Cabinet
0013	TS 1.5	Cabinet
0014	TS 1	Cabinet
0015	TS 1	Cabinet

September 2023

M-4

Macomb County Department of Roads