City of Portage
2023 Transportation Asset Management Plan

Prepared by:

Department of Transportation & Utilities
Jamie Harmon, Deputy Director

Department of Public Works
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CONTENTS

Executive Summary ii

Introduction 1

1. Pavement Assets 2

Inventory of Assets *2*
Condition, Goals, and Trend *4*

2. Bridge Assets 8

Inventory of Assets *8*
Condition, Goals, and Trend *10*
Programmed/Funded Projects, Gap Analysis, and Planned Projects *10*

3. Culvert Assets 11

Inventory of Assets *11*
Goals *12*
Planned Projects *12*

4. Traffic Signal Assets 13

Inventory of Assets *13*
Goals *14*
Planned Projects *14*

5. Financial Resources 15

6. Risk of Failure Analysis 17

7. Coordination with Other Entities 18

8. Proof of Acceptance 20

Appendices

A. Pavement Asset Management Plan A-1

B. Bridge Asset Management Plan B-1

C. Culvert Asset Management Plan Supplement C-1

D. Traffic Signals Asset Management Plan Supplement D-1

E. Glossary & Acronyms E-1

EXECUTIVE SUMMARY

As conduits for commerce and connections to vital services, roads and bridges are some of the most important assets in any community. Other assets like culverts, traffic signs, traffic signals, and utilities support and affect roads and bridges. The City of Portage (Portage) roads, bridges, and support systems are some of the most valuable and extensive public assets, all of which are supported with taxes collected from citizens and businesses. The cost of building and maintaining these assets, their importance to society, and the investment made by taxpayers all place a high level of responsibility on local agencies to plan, build, and maintain roads, bridges, and support assets in an efficient and effective manner. This asset management plan is intended to report on how Portage is meeting its obligations to maintain the public assets for which it is responsible.

An asset management plan is a plan for managing the asset base over a period of time in order to deliver the agreed levels of service and performance targets in the most cost-effective way. The Moving Ahead for Progress in the 21st Century (MAP-21) Act defines asset management as a strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the lifecycle of the assets at minimum practicable cost.

This asset management plan identifies transportation assets and their condition and explains how Portage maintains and plans to improve the overall condition of those assets. An asset management plan is required by Michigan Public Act 325 of 2018, and this document represents fulfillment of Portage obligations towards meeting these requirements. However, this plan and its supporting documents are intended to be much more than a fulfillment of required reporting. This asset management plan helps to demonstrate Portage's responsible use of public funds by providing elected and appointed officials as well as the general public with the inventory and condition information of Portage assets. The plan provides the information needed by City Councilmembers to make informed decisions about investing in essential transportation infrastructure.

INTRODUCTION

Asset management is defined by Public Act 325 of 2018 as "an ongoing process of maintaining, preserving, upgrading, and operating physical assets cost effectively, based on a continuous physical inventory and condition assessment and investment to achieve established performance goals". Asset management is a process that uses data to manage and track assets, like roads and bridges, in a cost-effective manner using a combination of engineering and business principles. This process is endorsed by leaders in municipal planning and transportation infrastructure, including the Michigan Municipal League (MML), County Road Association of Michigan (CRAM), the Michigan Department of Transportation (MDOT), and the Federal Highway Administration (FHWA). Portage is supported in its use of asset management principles and processes by the Michigan Transportation Asset Management Council (TAMC), formed by the State of Michigan.

Asset management, in the context of this plan, ensures that public funds are spent as effectively as possible to maximize the condition of the road and bridge network. Asset management also provides a transparent decision-making process that allows the public to understand the technical and financial challenges of managing transportation infrastructure with a limited budget.

Portage has adopted an "asset management" business process to overcome the challenges presented by having limitations in financial, staffing, and other resources while needing to meet road users' expectations. Portage is responsible for maintaining and operating over 220 centerline miles of roads and 3 bridge structures. Portage also owns, operates and maintains traffic signals at 54 intersections and 91 culverts.

This plan identifies transportation assets and their condition as well as the strategy that Portage uses to maintain and upgrade particular assets given condition goals, priorities of the network's road users, and resources. An updated plan is to be completed every three years to comply with Public Act 325 and reflect changes in road conditions, finances and priorities.

Questions regarding the use or content of this plan should be directed to Jamie Harmon at (269)-329-4428, harmonj@portagemi.gov, and Nick Haines at (269)-329-4430, hainesn@portagemi.gov, or to their offices located at 7719 S. Westnedge Avenue, Portage, MI 49002. A copy of this plan can be viewed at www.portagemi.gov/301/Transportation.

1. PAVEMENT ASSETS

Portage is responsible for 224.02 centerline miles of public roads. An inventory of these miles divides them into two different network classes based on road purpose/use and funding priorities as identified at the state level: 1) city major road network, which is prioritized for state-level funding, and 2) city minor road network.

Inventory of Assets

Of the 224.02 miles of road that Portage maintains, 72.90 miles are classified as city major and 151.12 miles are classified as city minor. Figure 1 identifies these roads corresponding to the road segment's condition using green for good, yellow for fair and red for poor. Of the 72.90 miles of city major road, 19.74 miles are part of the National Highway System (NHS); the NHS is subject to special rules and regulations and has its own performance metrics dictated by the FHWA.

More detail about these road assets are located in Appendix A.

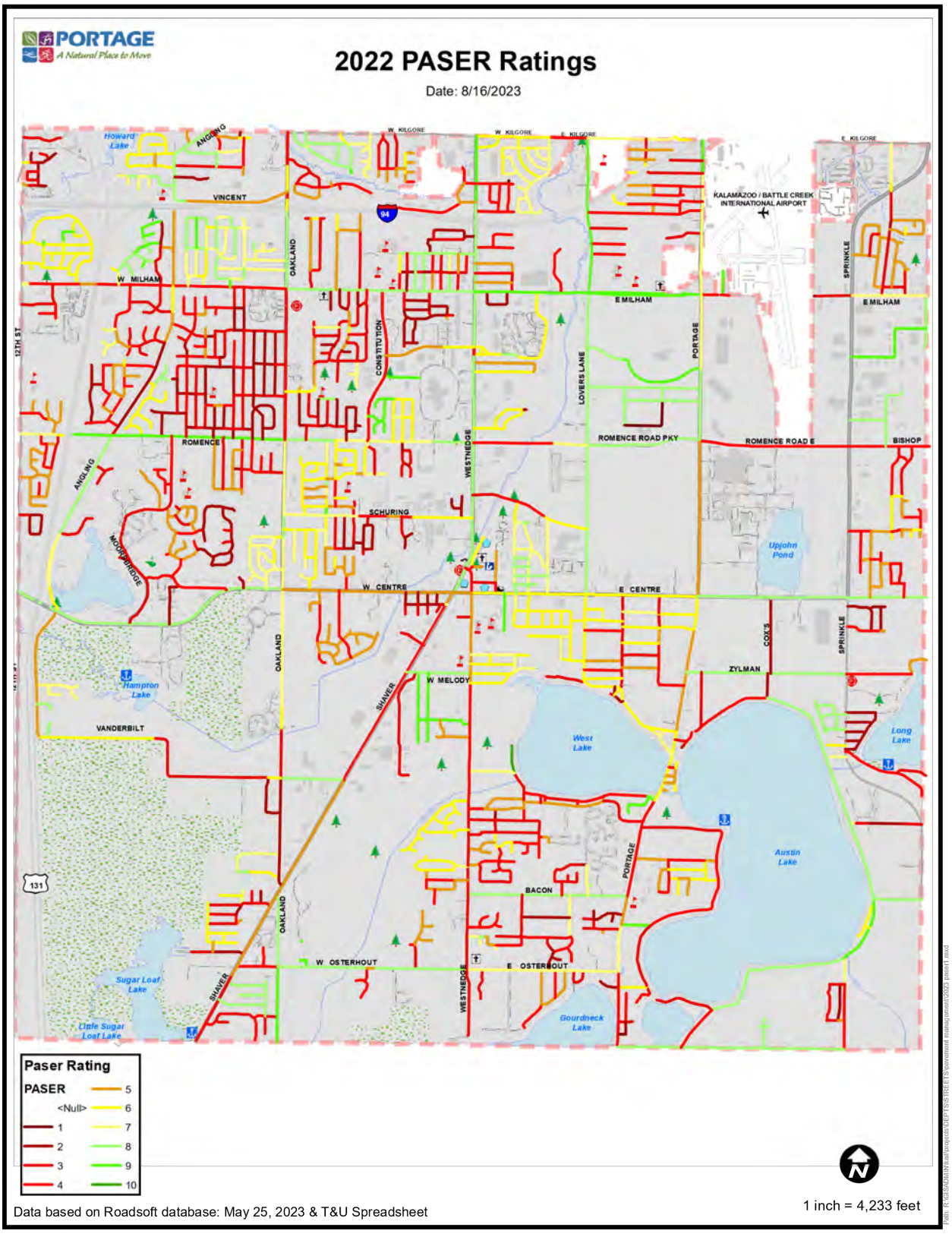

Figure 1: 2022 Portage PASER Ratings

Condition, Goals, and Trend

Paved Roads

Paved roads in Michigan are rated using the Pavement Surface Evaluation and Rating (PASER) system, which is a 1 to 10 scale with 10 being a newly constructed road and 1 being a completely failed road. PASER scores are grouped into TAMC definition categories of "good/green" (8-10), "fair/yellow" (5-7), and "poor/red" (1-4) categories. Portage collects 100 percent of road PASER condition data every two years on all federal-aid-eligible roads in partnership with the Kalamazoo Area Transportation Study. In addition, Portage collects 100 percent of its non-federal-aid-eligible network using its own staff and resources with contracted services every 2 years.

Comparing Portage city major road condition trends with overall statewide condition trends for similarly classified roads shows a different trend locally as compared to the state average, as shown in Figure 2. During 2022, Portage had an average good rating of 41 percent as compared to the statewide average of 25 percent. For the fair rating, Portage scored 33 percent while the statewide average had a 42 percent. Finally, the poor rating for Portage was 26 percent as compared to 33 percent scored by the state. The trend shows Portage placing a fair amount of money towards the improvement of major streets thus achieving better overall ratings than statewide major streets.

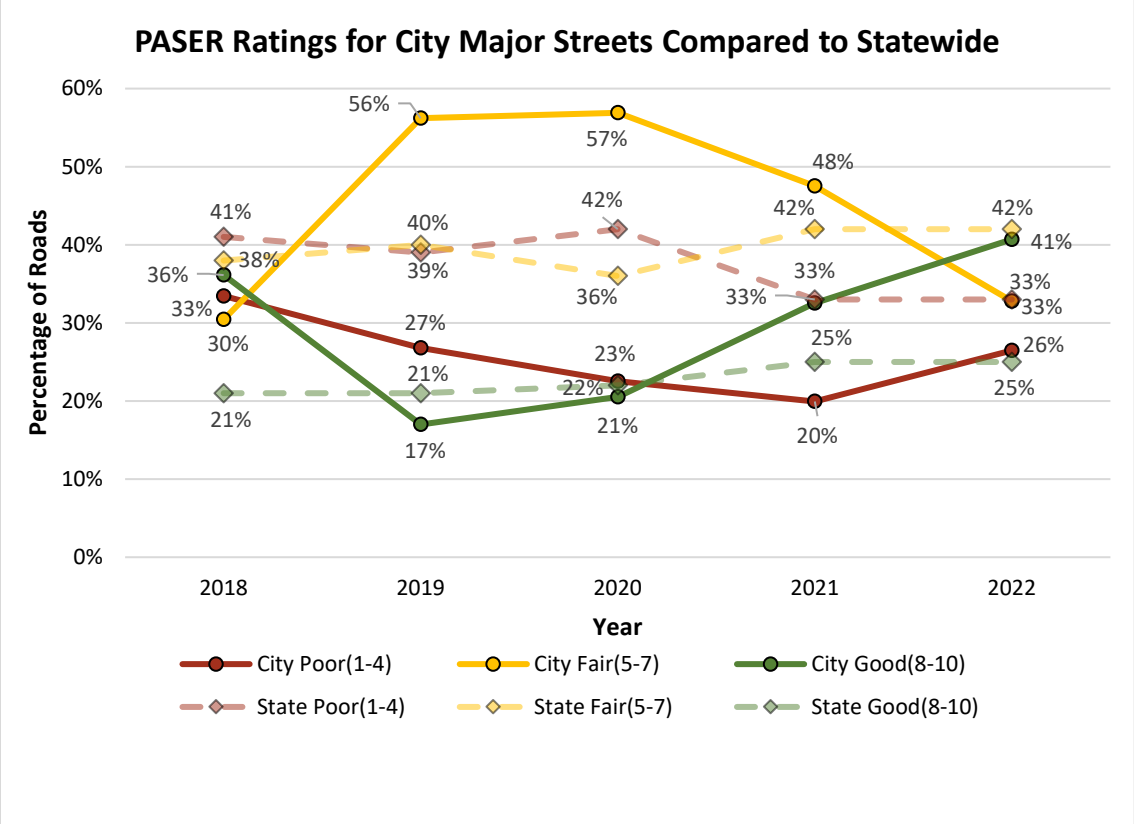

Figure 2: Historical Portage & Statewide Paved Major Road Network Condition Trends

The overall quality of Portage city minor roads has been similar to the statewide minor roads. The city minor road network lacks a source of state and federal funding and therefore must be 100 percent supported locally. Comparing Portage city minor road condition trends illustrated in Figure 3 with overall statewide condition trends for all city minor roads indicates a slightly worse trend locally as compared to the rest of the state. During 2022, Portage had an average good rating of 10 percent as compared to the statewide average of 20 percent. For the fair rating, Portage scored 40 percent while the statewide average had a 35 percent. Finally, the poor rating for Portage was 50 percent as compared to 45 percent scored by the state.

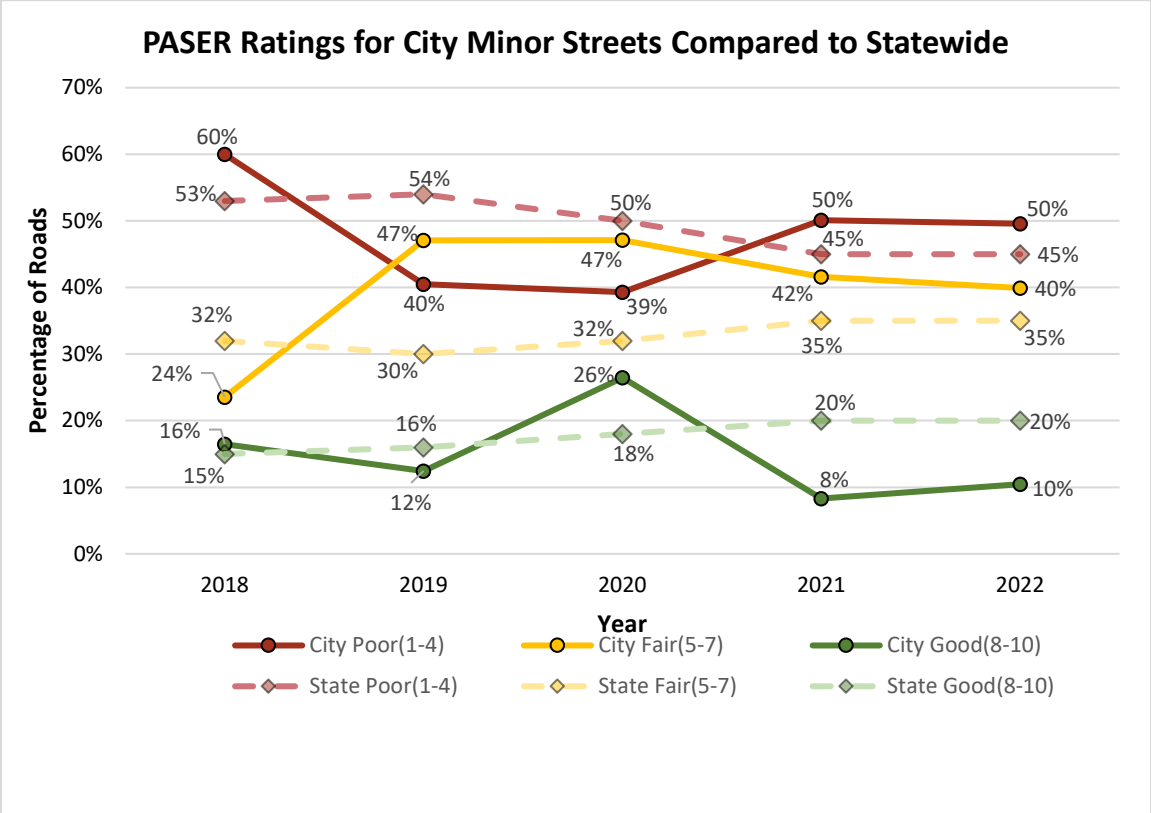

Figure 3: Historical Portage & Statewide Paved Minor Road Network Condition Trends

Planned Projects

Portage has several projects planned for the next three years. Major projects are identified in Figure 4 and minor projects are identified in Figure 5, color-coded by year of construction.

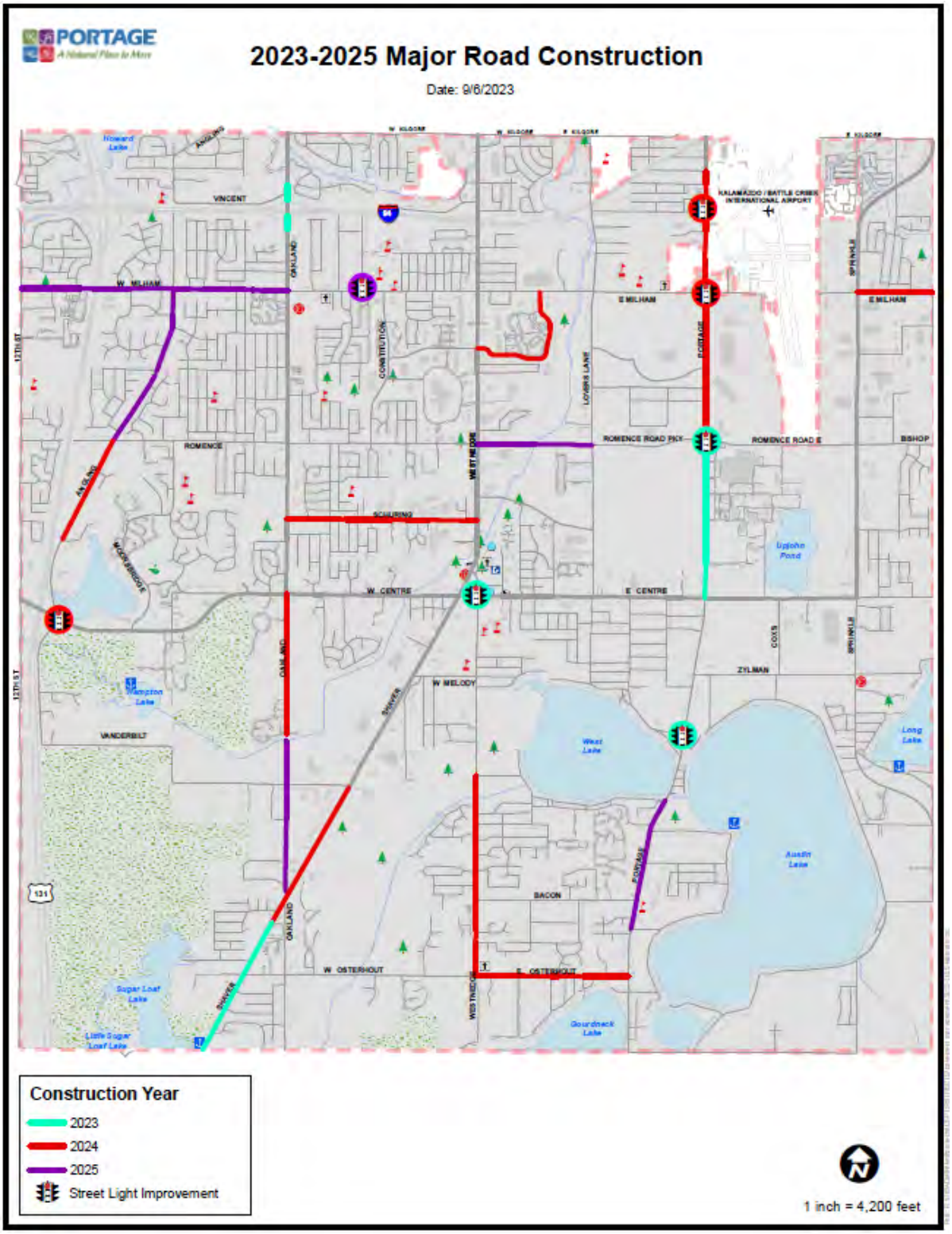

Figure 4: Map Showing Paved City Major Road Projects Planned for 2023 – 2025

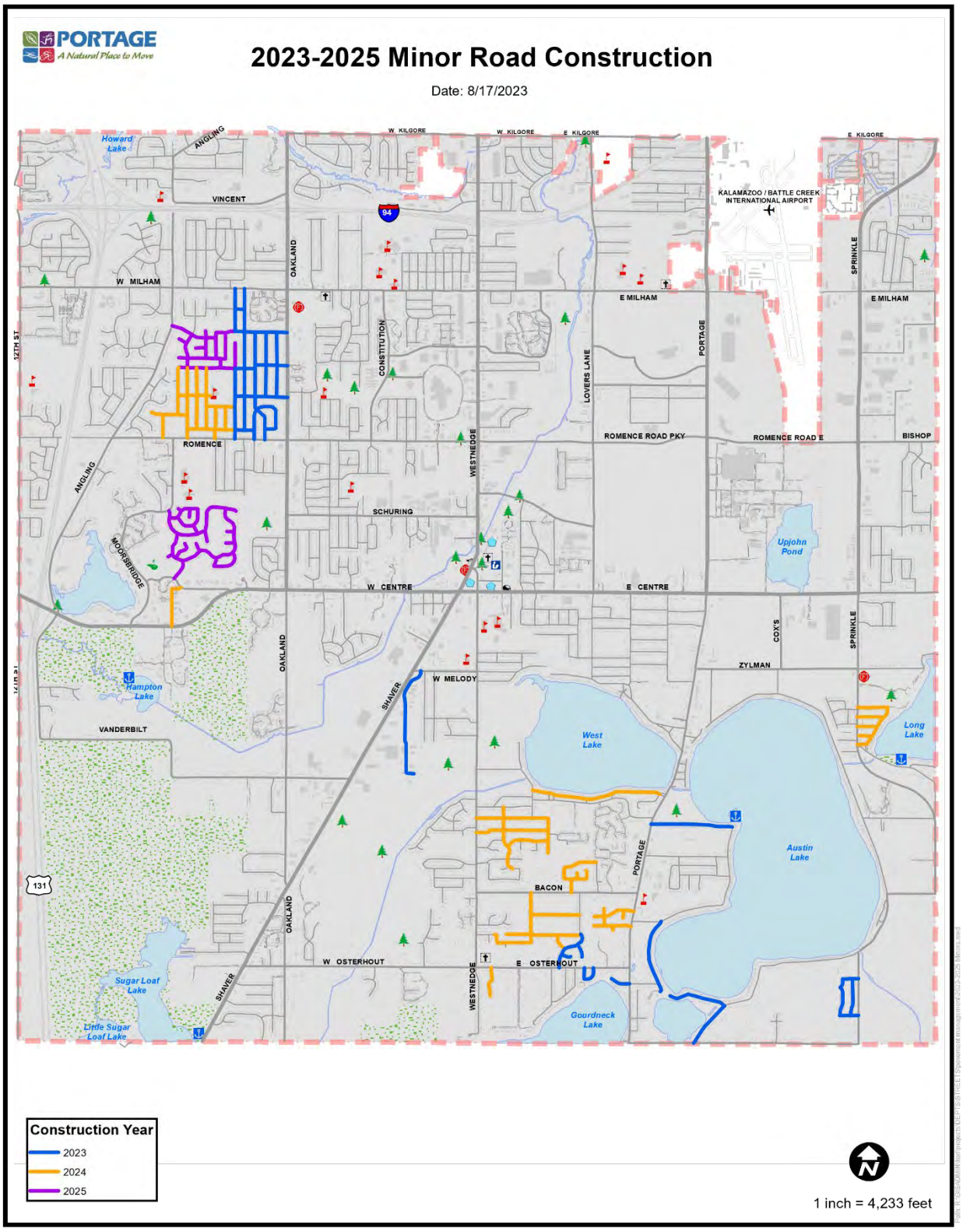

Figure 5: Map Showing Paved City Minor Road Projects Planned for 2023-2025

2. BRIDGE ASSETS

Inventory of Assets

Portage is responsible for three bridges that provide safe service to road users across the agency network. Portage seeks to implement a cost-effective program of preventive maintenance to maximize the useful service life and safety of the local bridges under its jurisdiction.

The three Portage bridges connect various points of the road network, as illustrated in Figure 6. These bridge structures can be summarized by type, size, and condition, which are detailed in Table 1. More information about each of these structures can be found in the Bridge Asset Management Plan in Appendix B, in the Portage MiBRIDGE database or by contacting the Portage Department of Transportation & Utilities.

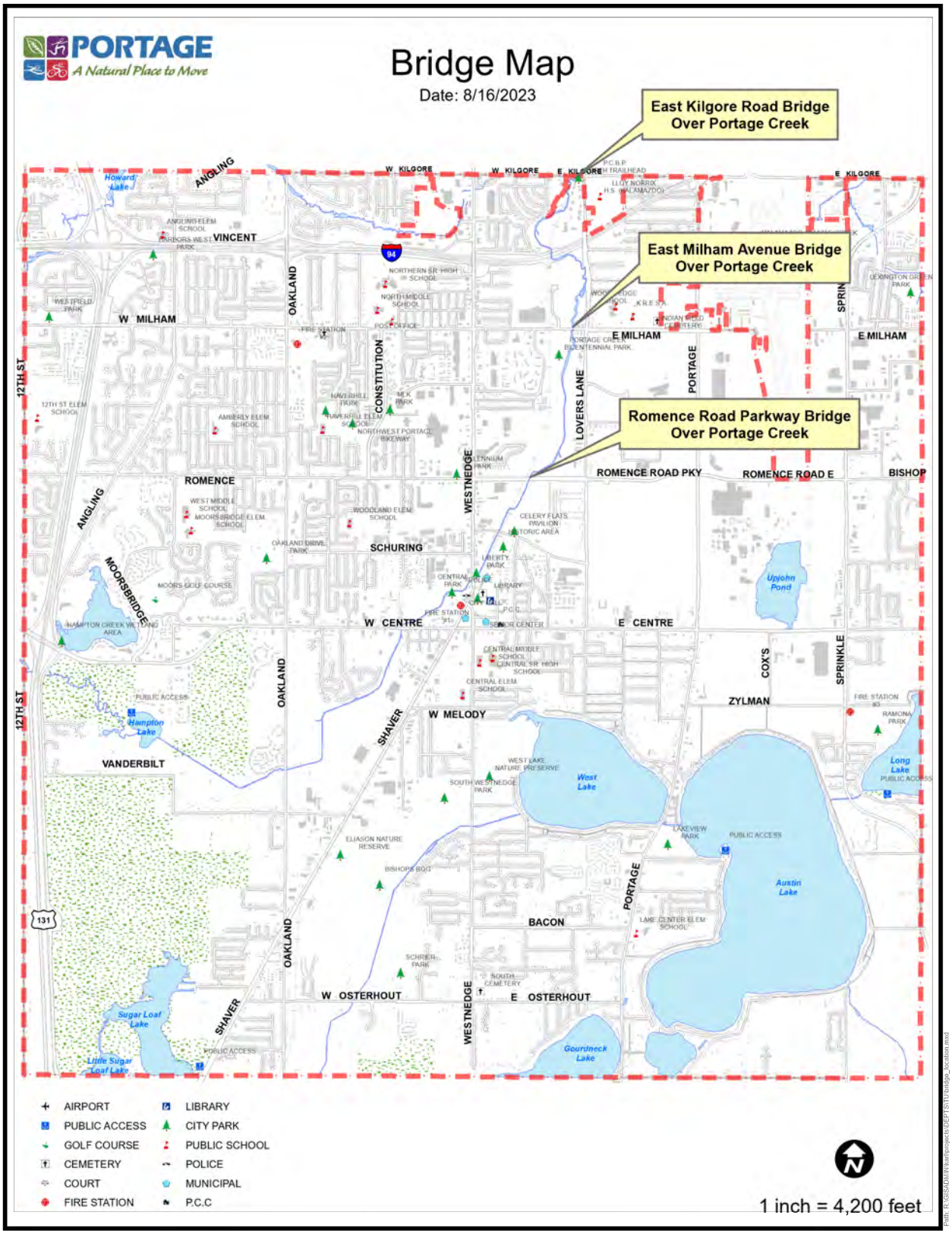

Figure 6: Map Illustrating Locations of Portage Bridge Assets

Bridge	Bridge Type	Year Built	Total Deck Area (sq ft)	Condition: Structurally Deficient, Posted, or Closed			2021 Condition		
				Structurally Deficient	Posted	Closed	Poor	Fair	Good
ROMENCE ROAD	Concrete Box Beam	1992	4,862		X				X
MILHAM AVE	Concrete Culvert	1990	1,318						X
KILGORE ROAD	Concrete Culvert	2013	2,428						X

Table 1: Type, Size, and Condition of Portage Bridge Assets

Condition, Goals, and Trend

Bridges in Michigan are given a good, fair, or poor rating based on the National Bridge Inspection Standards (NBIS) rating scale, which was created by the Federal Highway Administration to evaluate a bridge's deficiencies and to ensure the safety of road users. The current condition of the Portage bridge network based on the NBIS is three structures rated good.

Bridges are designed to carry legal loads in terms of vehicles and traffic. Due to a decline in condition, a bridge may be "posted" with a restriction for what would be considered safe loads passing over the bridge. On occasion, posting a bridge may also restrict other load-capacity-related elements like speed and number of vehicles on the bridge, but this type of posting designates the bridge differently. Portage has one structure that is posted for load restriction. Designating a bridge as "posted" has no influence on its condition rating. A "closed" bridge is one that is closed to all traffic. Closing a bridge is contingent upon its ability to carry a set minimum live load. Portage does not have any structures that are closed.

The goal of the program is the preservation and safety of the Portage bridge network.

Programmed/Funded Projects and Planned Projects

Portage recognizes preventive maintenance is a more effective use of funds than the costly alternative of major rehabilitation or replacement and will budget funds as needed for bridge maintenance and improvement projects. Portage will have all bridges inspected bi-annually and will be budget accordingly for proposed preventative maintenance and improvements based on recommendations of each inspection.

Table 2 illustrates the programmed/funded projects that will be undertaken in order to achieve the goal for Portage.

Strategy	2023	2024	2025
New	$0	$0	$0
Replacement	$0	$0	$0
Rehabilitation	$0	$0	$0
Scheduled Maintenance	$1,500	$1,500	$1,500
Preventive Maintenance	$0	$0	$85,000

Table 2: Cost Projection

3. CULVERT ASSETS

Inventory of Assets

Portage tracks inventory and condition data of its culvert assets. Portage has inventoried 164 culverts within the city. Portage owns and maintains 91 culverts, 10 culverts are under the jurisdiction of the Road Commission of Kalamazoo County and 63 are private culverts. Of the inventoried culverts, Portage has 67 culverts rated good, 86 culverts rated fair, and 11 culverts not rated based on the culvert rating system as discussed further in the *Culvert Asset Management Plan Supplement* in Appendix C. The inspection form used to rate culverts is also included in Appendix C.

In the fall of 2021, Portage conducted more detailed inspections on 18 of its larger sized diameter culverts to receive more data on their condition.

More detail about these culvert assets can be found in the Portage Roadsoft database or by contacting Portage.

Goals

The goal of the Portage asset management program is the preservation of its culvert network. Portage is responsible for preserving 91 culverts in the City of Portage.

Planned Projects

Portage policy is to replace or repair culvert assets concurrent with projects affecting road segments carried by the particular culverts. Portage also includes culvert assets in scheduled maintenance projects affecting road segments carried by the particular culverts.

4. TRAFFIC SIGNAL ASSETS

Inventory of Assets

Portage tracks inventory data for traffic signals. Portage has inventoried 65 traffic signals within the City of Portage, of which 54 are owned and maintained by Portage. The other traffic signals are owned and maintained by the Michigan Department of Transportation (4), the Road Commission of Kalamazoo County (5) and the City of Kalamazoo (2).

More detail about these traffic signal assets can be obtained by contacting the Portage Department of Transportation & Utilities.

Goals

The goal of Portage's asset management program is the preservation of its traffic signals. Portage is responsible for maintaining 54 traffic signals. Portage contracts out inspections on all traffic signals and the complete maintenance and upkeep of the city's traffic signal system annually. Maintenance goals include the following:

- Clean all signal lenses and reflectors and replace incandescent signal lamps at least twice annually.
- Inspect all cable clamps, bracket and other equipment used to hold signals, controllers, messenger cables, mast arms or signs in place annually.
- Measure the height of signals at least once a year to ensure all signals are at least sixteen feet in height above roadway.
- Inspect damaged or worn visors on internally illuminated case signs and pedestrian signals annually and replace as needed.
- Inspect and realign twisted vehicular signal heads, pedestrian signal heads, case signs, flashing beacons, speed feedback signs and overhead signs annually or as required by severe weather.
- Inspect permanent traffic count stations and provide traffic count data annually.
- Inspect elbow covers or conduit, steel pole hand-hole cover plates and hand-hole rings and covers annually and replace as needed.
- Inspect steel pole caps, pedestal caps, weather heads and risers annually and tighten/align as needed.
- Conduct routine tests for conflict monitors in service.
- Conduct routine maintenance of speed feedback signs including solar panel clean up.
- Conduct routine maintenance/testing of fiber optic cables, switches, video encoders, media converters traffic operation software, KITS software, video monitoring software, video, data and back-up servers and traffic operation center equipment.
- Voltage checks on each signalized intersection shall be made every six months.

Planned Projects

Portage's policy is to evaluate traffic signal assets based on condition assessment for replacement or repair during any reconstruction or rehabilitation 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. Portage adheres to regular maintenance and servicing policies outlined in the Michigan Manual of Uniform Traffic Control Devices (MMUTCD). The life of a traffic signal is approximately 20 years. Portage budgets to replace two traffic signals annually.

5. FINANCIAL RESOURCES

Public entities must balance the quality and extent of services provided with the tax resources provided by citizens and businesses, all while maximizing how efficiently funds are used. Therefore, Portage will overview its general expenditures and financial resources currently devoted to transportation infrastructure maintenance. This financial information is not intended to be a full financial disclosure or a formal report.

Anticipated Revenues & Expenses

Portage receives funding from the following sources:

- **State funds** – The principal source of Portage transportation funding is received from the Michigan Transportation Fund (MTF). This fund is supported by vehicle registration fees and the state's per-gallon gas tax. Allocations from the MTF are distributed to state and local governmental units based on a legislated formula, which includes factors such as population, miles of certified roads, and vehicle registration fees for vehicles registered in the agency's jurisdiction. Examples of state grants include local bridge grants and economic development funds.

- **Federal and state grants for individual projects** – These are typically competitive funding applications that are targeted at a specific project type to accomplish a specific purpose. These may include safety enhancement projects, economic development projects, or other targeted funding. Examples of federal funds include Surface Transportation Program (STP) funds, Transportation Economic Development Fund (TEDF), and local bridge program.

- **Local government entities or private developer contributions to construction projects for specific improvements** – This category includes funding received to mitigate the impact of commercial developments as a condition of construction of a specific development project and can also include funding from a special assessment district levied by the local government. Examples of contributions from local units include special assessments; bond and note proceeds; city general fund transfers; city municipal street funds; capital improvement funds; and tax millages (see below).

- **Local tax millages** – Many local agencies in Michigan use local tax millages to supplement their road-funding budget. These taxes can provide for additional construction and maintenance for new or existing roads that are also funded using MTF or MDOT funds. Portage has local tax millages in its road-funding budget. Local tax millages are used to create the "Complete Streets" program that repairs asphalt streets, curbs, sidewalks, storm water drainage and pavement markings.

- **Interest** – Interest from invested funds.

- **Permit fees** – Generally, permit fees cover the cost of a permit application review.

- **Other** – Other revenues can be gained through salvage sales, property rentals, land and building sales, sundry refunds, equipment disposition or installation, private sources, and financing.

Portage is required to report transportation fund expenditures to the State of Michigan using a prescribed format with predefined expenditure categories. The definitions of these categories according to Public Act 51 of 1951 may differ from common pavement management nomenclature and practice. For the purposes of reporting under PA 51, the expenditure categories are:

- **Construction/Capacity Improvement Funds** – According to PA 51 of 1951, this financial classification of projects includes new construction of highways, roads, streets, or bridges, a project that increases the capacity of a highway facility to accommodate that part of traffic having neither an origin nor destination within the local area, widening of a lane width or more, or adding turn lanes of more than 1/2 mile in length.

- **Preservation and Structural Improvement Funds** – Preservation and structural improvements are activities undertaken to preserve the integrity of the existing roadway system. Preservation includes items such as a reconstruction of an existing road or bridge or adding structure to an existing road.

- **Routine and Preventive Maintenance Funds** – Routine maintenance activities are actions performed on a regular or controllable basis or in response to uncontrollable events upon a highway, road, street, or bridge. Preventive maintenance activities are planned strategies of cost-effective treatments to an existing roadway system and its appurtenances that preserve assets by retarding deterioration and maintaining functional condition without significantly increasing structural capacity.

- **Winter Maintenance Funds** – Expenditures for snow and ice control.

- **Administrative Funds** – There are specific items that can and cannot be included in administrative expenditures as specified in PA 51 of 1951. The law also states that the amount of MTF revenues that are spent on administrative expenditures is limited to 10 percent of the annual MTF funds that are received.

- **Other Funds** – Expenditures for equipment, capital outlay, debt principal payment, interest expense, contributions to adjacent governmental units, principal, interest and bank fees, and miscellaneous for cities.

6. RISK OF FAILURE ANALYSIS

Transportation infrastructure is designed to be resilient. The system of interconnecting roads and bridges maintained by Portage provides road users with multiple alternate options in the event of an unplanned disruption of one part of the system. There are, however, key links in the transportation system that may cause significant inconvenience to users if they are unexpectedly closed to traffic. Key transportation links include:

- **Geographic divides:** Areas where a geographic feature (river, lake, hilly terrain, or limited access road) limits crossing points of the feature; bridge failures, in particular, can create loss of access to entire regions of the state.

- **Emergency alternate routes for high-volume roads and bridges:** Roads and bridges, that are routinely used as alternate routes for high-volume assets are included in an emergency response plan.

- **Limited access areas:** Roads and bridges that serve remote or limited access areas that result in long detours if closed.

- **Main access to key commercial districts:** Areas with a large concentration of businesses or where large-size business will be significantly impacted if a road is unavailable.

7. 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. Portage communicates with both public and private infrastructure owners to coordinate work in the following ways:

- Roads which are in poor condition that have a subsurface infrastructure project planned which will destroy part of the lane will be rehabilitated or reconstructed per Portage pavement replacement detail SD-165. The entire width of the lane disturbed will be resurfaced.
- Subsurface infrastructure projects which will cause damage to pavements in good condition will be delayed as long as possible or will consider methods that do not require pavement cuts. The city has a policy where newly resurfaced roadways cannot be cut within 5 years of resurfacing except for emergency utility repairs, or in the case of new development; the entire width of the lane disturbed will be resurfaced.
- Subsurface utilities not owned by the city are directed to be installed within the greenspace outside the roadway to avoid road disruption as much as possible.
- Subsurface utility projects will be coordinated with both public and private ownership to allow all underground utility assets to be upgraded in same project.
- Coordination with the Road Commission of Kalamazoo County for street and traffic signal improvement projects.
- Coordination with the Michigan Department of Transportation for street, freeway interchange and traffic signal improvement projects.
- Coordination with the City of Kalamazoo for street and water main projects.
- Coordination with the Kalamazoo Area Transportation Study for major street projects that would include planning, funding, traffic control, and PASER updates.
- Coordination with Metro Transit for the placement of bus routes and bus passenger pickup points.
- Coordination with Portage Public Schools to ensure signage, lighting, sidewalks and bus routes are established for safe transportation of school children.

COORDINATED PLANNING

Portage coordinates with multiple agencies that maintain drinking water, sanitary, and storm sewer assets in addition to transportation assets. Portage follows an asset management process for all of its assets by coordinating the upgrade, maintenance, and operation of all major assets.

Planned projects for sub-surface infrastructure that Portage owns are listed in the following asset management plans: water system asset management plan, and wastewater system asset management plan. These two sub-surface utility plans are coordinated with the transportation infrastructure plans to maximize value and minimize service disruptions and cost to the public.

8. PROOF OF ACCEPTANCE

PUBLIC ACT 325

CERTIFICATION OF TRANSPORTATION ASSET MANAGEMENT PLAN

Certification Year: 2023

Local Road-owning Agency Name: City of Portage

Beginning October 2019 and on a three-year cycle thereafter, certification must be made for compliance to Public Act 325. A local road-owning agency with 100 certified miles or more must certify that it has developed an asset management plan for the road, bridge, culvert, and traffic signal assets. Signing this form certifies that the hitherto referred agency meets with minimum requirements as outlined by Public Act 325 and agency-defined goals and objectives.

This form must be signed by the chairperson of the local road-owning agency or the county executive and chief financial officer of the local road-owning agency.

Signature		Signature	
Printed Name Pat McGinnis		Printed Name Lauren VanderVeen	
Title City Manager	Date 9/25/2023	Title Finance Director	Date 9/22/2023

Due every three years based on agency submission schedule.

Submittal Date: _____

See attached council meeting minutes and/or resolution.

Appendix A

City of Portage
2023 Pavement
Asset Management Plan

Prepared by:

Department of Transportation & Utilities
Jamie Harmon, Deputy Director

Department of Public Works
Nick Haines, Deputy Director

CONTENTS

Figures....A-3

Executive Summary....A-4

Introduction....A-5

Pavement Introduction....*A-5*

1. Pavement Assets....A-15

Inventory....*A-20*
Goals....*A-28*
Planned Projects....*A-33*

2. Financial Resources....A-37

City Major Network....*A-37*
City Minor Network....*A-38*

3. Risk Management....A-42

4. Coordination with Other Entities....A-43

Portage Street Map....*A-44*
Resolution Verifying Plan Acceptance by Governing Body....*A-45*

FIGURES

Figure 1: PASER Ratings…….…….... A-9

Figure 2: Reconstruction Treatments……..... A-10

Figure 3: Structural Improvement Treatments……..…A-11

Figure 4: Capital Preventative Maintenance Treatments…….A-12

Figure 5: Street Index Map…… A-16

Figure 6: Major Roads Map…… A-17

Figure 7: Minor Roads Map……A-18

Figure 8: Roads in the National Highway System…… A-19

Figure 9: Percentage of Roads – Classified Major/Minor…….…… A-20

Figure 10: Percentage of Roads – National Highway System……A-21

Figure 11: Percentage of Roads – NHS PASER Ratings……A-21

Figure 12: Percentage of Roads – Major Roads F Ratings…….....A-23

Figure 13: Percentage of Roads – Minor Roads PASER Ratings…… A-23

Figure 14: Trends of PASER Ratings – Major Roads……A-24

Figure 15: Trends of PASER Ratings – Minor Roads……A-24

Figure 16: Geographic Location – PASER Ratings for Entire Network……A- 25

Figure 17: Historic Trend and Average PASER Ratings……A-26

Figure 18: PASER Ratings for City Major Streets Compared to Statewide……A-27

Figure 19: PASER Ratings for City Minor Streets Compared to Statewide……A-28

Figure 20: Maintenance Strategies – Pavement Condition vs. Time Chart…….A-30

Figure 21: Maintenance Strategies – Pavement Condition vs. Pavement Age Chart…… A-31

Figure 22: Major Road Projects Planned…… …A-34

Figure 23: Minor Road Projects Planned……A- 35

TABLES

Table 1: Service Life Extension…….…….A-32

EXECUTIVE SUMMARY

As conduits for commerce and connections to vital services, roadways are among the most important assets in any community along with other assets like bridges, culverts, traffic signs, traffic signals, and utilities that support and affect roads. City of Portage (Portage) roads, other transportation assets and support systems are also some of the most valuable and extensive public assets, all of which are paid for with taxes collected from residents and businesses. The cost of building and maintaining roadways, their importance to society and the investment made by taxpayers all place a high level of responsibility on local agencies to plan, build and maintain the road network in an efficient and effective manner. This asset management plan is intended to report on how Portage is meeting its obligations to maintain the public assets for which it is responsible.

This plan provides an overview of Portage city road assets and conditions, and explains how Portage works to maintain and improve the overall condition of those assets. These explanations can help answer the following questions:

- What kinds of road assets Portage has in its jurisdiction, who owns them and the different options for maintaining these assets.
- What tools and processes Portage uses to track and manage road assets and funds.
- What condition Portage city road assets are in, compared to statewide averages.
- Why some road assets are in better condition than others and the path to maintaining and improving road asset conditions through proper planning and maintenance.
- How agency transportation assets are funded and where those funds come from.
- How funds are used, and the costs incurred during the normal life cycle of Portage city road assets.
- How changes in funding levels can affect the overall condition of all of Portage city road assets.

Portage maintains 224.02 centerline of roads. This road network can be divided into city major and city minor networks based on the different factors these roads have that influence asset management decisions.

An asset management plan is required by Michigan Public Act 325 of 2018, and this document represents fulfillment of obligations towards meeting these requirements. The Portage asset management plan demonstrates responsible use of public funds by providing elected and appointed officials as well as the general public with inventory and condition information of Portage road assets, and gives City Council the information needed to make informed decisions about investing in its essential transportation infrastructure.

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Portage has adopted an "asset management" business process to overcome the challenges presented by having limited financial, staffing, and other resources while needing to meet road users' expectations. Portage is responsible for maintaining and operating over 220 centerline miles of roads.

This plan outlines how Portage determines its strategy to maintain and upgrade road asset condition given agency goals, priorities of its road users, and resources provided. An updated plan is to be released approximately every three years to reflect changes in road conditions, finances, and priorities.

Questions regarding the use or content of this plan should be directed to Jamie Harmon at (269)-329-4428, harmonj@portagemi.gov, and Nick Haines at (269)-329-4430, hainesn@portagemi.gov, or to their offices located at 7719 S. Westnedge Avenue, Portage, MI 49002. A copy of this plan can be viewed at www.portagemi.gov/301/transportation. Key terms used in the Portage plan are defined in the city's comprehensive transportation asset management plan (also known as the "compliance plan") used for compliance with PA 325 of 2018.

Knowing the basic features of the asset classes is a crucial starting point to understanding the rationale behind an asset management approach. The following section provides an introduction to pavements.

Pavement Introduction

Roads come in two basic forms—paved and unpaved. Paved roads have hard surfaces. These hard surfaces can be constructed from asphalt, concrete, composite (asphalt and concrete), sealcoat, and brick and block materials. On the other hand, unpaved roads have no hard surfaces. Examples of these surfaces are gravel and unimproved earth. All Portage roads are paved roads.

The decision to pave with a particular material as well as the decision to leave a road unpaved allows road-owning agencies to tailor a road to a particular purpose, environment, and budget. Thus, selecting a pavement

type or leaving a road unpaved depends upon purpose, materials available, and budget. Each choice represents a trade-off between budget and costs for construction and maintenance.

Maintenance enables the road to fulfill its particular purpose. To achieve the maximum service for a pavement or an unpaved road, continual monitoring of a road's pavement condition is essential for choosing the right time to apply the right fix in the right place.

Here is a brief overview of the different types of pavements, how condition is assessed, and treatment options that can lengthen a road's service life.

Surfacing

Pavement type is influenced by several different factors, such as cost of construction, cost of maintenance, frequency of maintenance, and type of maintenance. These factors can have benefits affecting asset life and road user experience.

Paved Surfacing

Typical benefits and tradeoffs for hard surface types include:

- **Concrete pavement:** Concrete pavement, which is sometimes called a rigid pavement, is durable and has a long service life when properly constructed and maintained. Concrete pavement can have longer service periods between maintenance activities, which can help reduce maintenance-related traffic disruptions. However, concrete pavements have a high initial cost and can be challenging to rehabilitate and maintain at the end of their service life. A typical concrete pavement design life will provide service for 30 years before major rehabilitation is necessary.

- **Hot-mix asphalt pavement (HMA):** HMA pavement, sometimes known as asphalt or flexible pavement, is currently less expensive to construct than concrete pavement. (This is, in some part, due to the closer link between HMA material costs and oil prices that HMA pavements have in comparison with other pavement types.) However, they require frequent maintenance activities to maximize their service life. A typical HMA pavement design life will provide service for 18 years before major rehabilitation is necessary. The vast majority of local-agency-owned pavements are HMA pavements.
- **Composite pavements:** Composite pavement is a combination of concrete and asphalt layers. Typically, composite pavements are old concrete pavements exhibiting ride-related issues that were overlaid by several inches of HMA in order to gain more service life from the pavement before it would need reconstruction. Converting a concrete pavement to a composite pavement is typically used as a "holding pattern" treatment to maintain the road in usable condition until reconstruction funds become available.

- **Sealcoat pavement:** Sealcoat pavement is a gravel road that has been sealed with a thin asphalt binder coating with stone chips spread on top (not to be confused with a chip seal treatment over HMA pavement). This type of pavement relies on the gravel layer to provide structure to support traffic. The asphalt binder coating and stone chips shed water and eliminate the need for maintenance grading. Nonetheless, sealcoat pavement does require additional maintenance steps that asphalt, and

gravel do not require and does not last as long as HMA pavement. However, sealcoat pavement provides a low-cost alternative for lightly trafficked areas and competes with asphalt for ride quality when properly constructed and maintained. Sealcoat pavement can provide service for ten or more years before the surface layer deteriorates and needs to be replaced.

Unpaved Surfacing

Typical benefits and tradeoffs for non-hard surfacing include:

- **Gravel:** Gravel is a low-cost, easy-to-maintain road surface made from layers of soil and aggregate (gravel). However, there are several potential drawbacks such as dust, mud, and ride smoothness when maintenance is delayed, or traffic volume exceeds design expectations. Gravel roads require frequent low-cost maintenance activities. Gravel can be very cost effective for lower-volume, lower-speed roads. In the right conditions, a properly constructed and maintained gravel road can provide a service life comparable to an HMA pavement and can be significantly less expensive than the other pavement types.

Pavement Condition

Besides traffic congestion, pavement condition is what road users typically notice most about the quality of a road—the better the pavement condition, the more satisfied users are with the service provided by road-owning agencies. Pavement condition is also a major factor in determining the most cost-effective treatment—that is, routine maintenance, capital preventive maintenance, or structural improvement—for a given section of pavement. As pavements age, they transition between "windows" of opportunity when a specific type of treatment can be applied to gain an increase in quality and extension of service life. Routine maintenance is a day-to-day, regularly scheduled, low-cost activity applied to "good" roads to prevent water or debris intrusion. Capital preventive maintenance (CPM) is a planned set of cost-effective treatments for "fair" roads that corrects pavement defects, slows further deterioration, and maintains the functional condition without increasing structural capacity. Portage uses pavement condition and age to anticipate when a specific section of pavement will be a potential candidate for preventive maintenance. More detail on this topic is included in the *Pavement Treatment* section of this primer.

Pavement condition data is also important because it allows road owners to evaluate the benefits of preventive maintenance projects. This data helps road owners to identify the most cost-effective use of road construction and maintenance dollars. Further, historic pavement condition data can enable road owners 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 can help determine how much additional funding is necessary to meet a network's condition improvement goals.

Paved Road Condition Rating System

Portage is committed to monitoring the condition of its road network and using pavement condition data to drive cost-effective decision-making and preservation of valuable road assets. Portage uses the Pavement Surface Evaluation and Rating (PASER) system to assess its paved roads. PASER was developed by the University of Wisconsin Transportation Information Center to provide a simple, efficient, and consistent method for evaluating road condition through visual inspection. The widely used PASER system has specific criteria for assessing asphalt, concrete, sealcoat, and brick and block pavements. Information regarding the

PASER system and PASER manuals may be found on the TAMC website at: https://www.michigan.gov/mic/tamc/training/paser.

The TAMC has adopted the PASER system for measuring statewide pavement conditions in Michigan for asphalt, concrete, composite, sealcoat, and brick-and-block paved roads. Broad use of the PASER system means that data collected by Portage is consistent with data collected statewide. PASER data is collected using trained inspectors in a slow-moving vehicle using GPS-enabled data collection software provided to road-owning agencies at no cost. The method does not require extensive training or specialized equipment, and data can be collected rapidly, which minimizes the expense for collecting and maintaining this data.

The PASER system rates surface condition using a 1-10 scale where 10 is a brand-new road with no defects that can be treated with routine maintenance, 5 is a road with distresses but is structurally sound that can be treated with preventive maintenance, and 1 is a road with extensive surface and structural distresses that is in the need of total reconstruction.

Roads with lower PASER scores generally require costlier treatments to restore their quality than roads with higher PASER scores. The cost effectiveness of treatments generally decreases as the PASER number decreases. In other words, as a road deteriorates, it costs more dollars per mile to fix it, and the dollars spent are less efficient in increasing the road's service life. Nationwide experience and asset management principles tell us that a road that has deteriorated to a PASER 4 or less will cost more to improve and the dollars spent are less efficient. Understanding this cost principle helps to draw meaning from the current PASER condition assessment.

The TAMC has developed statewide definitions of road condition by creating three simplified condition categories— good, fair, and poor —that represent bin ranges of PASER scores having similar contexts with regards to maintenance and/or reconstruction. The definitions of these rating conditions are:

- **Good** roads, according to the TAMC, have PASER scores of 8, 9, or 10. Roads in this category have very few, if any, defects and only require minimal maintenance; they may be kept in this category longer using PPM. These roads may include those that have been recently seal coated or newly constructed. Figure 1 illustrates an example of a road in this category.

- **Fair** roads, according to the TAMC, have PASER scores of 5, 6, or 7. Roads in this category still show good structural support, but their surface is starting to deteriorate. Figure 1 illustrates two road examples in this category. CPM can be cost effective for maintaining the road's "fair" condition or even raising it to "good" condition before the structural integrity of the pavement has been severely impacted. CPM treatments can be likened to shingles on a roof of a house: while the shingles add no structural value, they protect the house from structural damage by maintaining the protective function of a roof covering.

- **Poor** roads, according to the TAMC, have PASER scores of 1, 2, 3, or 4. These roads exhibit evidence that the underlying structure is failing, such as alligator cracking and rutting. These roads must be rehabilitated with treatments like a heavy overlay, crush and shape, or total reconstruction. Figure 1 illustrates a road in this category.

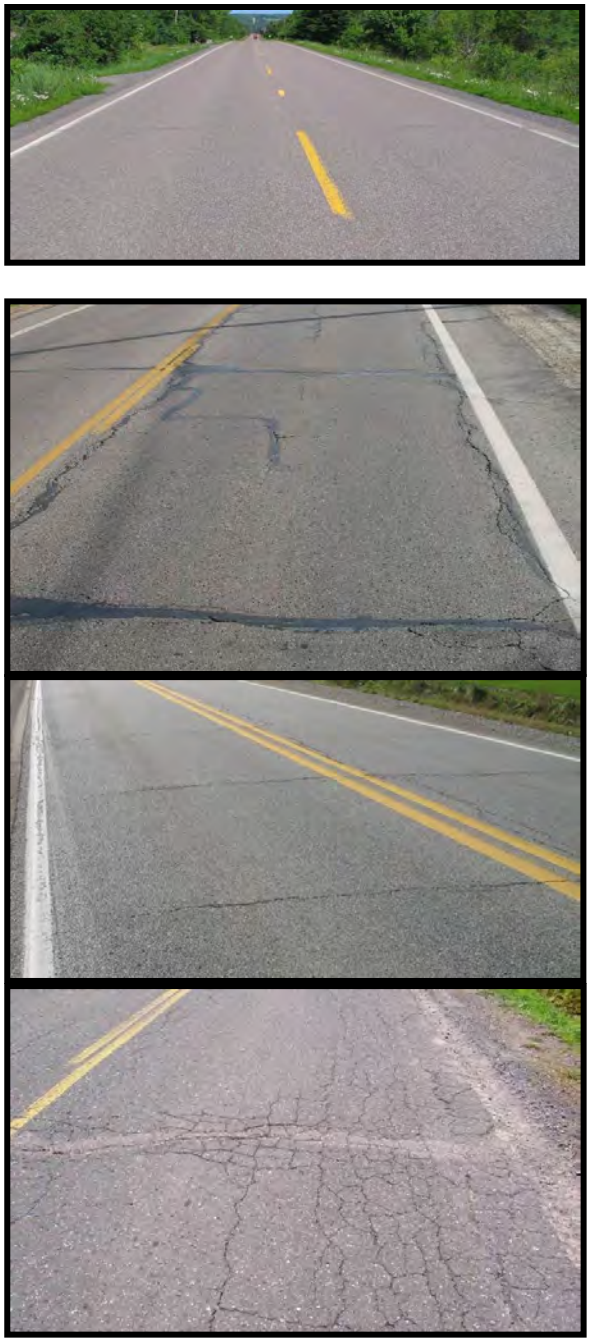


Figure 1: *Top image* – PASER 8 road that is considered "good" by the TAMC exhibit only minor defects. *Second image* – PASER 5 road that is considered "fair" by the TAMC. Exhibiting structural soundness but could benefit from CPM. *Third image* – PASER 6 road that is considered "fair" by the TAMC. *Bottom image* – PASER 2 road that is considered "poor" by the TAMC exhibiting significant structural distress.

The TAMC's good, fair, and poor categories are based solely on the definitions above. Therefore, caution should be exercised when comparing other condition assessments with these categories because other condition assessments may have "good", "fair", or "poor" designations similar to the TAMC condition categories but may not share the same definition. Often, other condition assessment systems define the "good", "fair", and "poor" categories differently, thus

rendering the data of little use for cross-system comparison. The TAMC's definitions provide a statewide standard for all of Michigan's road-owning agencies to use for comparison purposes.

PASER data is collected 100 percent every two years on all federal-aid-eligible roads in Michigan (unless unforeseen circumstances arise whereas the collection of PASER data is not possible). The TAMC dictates and funds the required training and the format for this collection, and it shares the data regionally and statewide. In addition, Portage collects 100 percent of its paved non-federal-aid-eligible network using contractors or city staff and resources.

Pavement Treatments

Selection of repair treatments for roads aims to balance costs, benefits, and road life expectancy. All pavements can be damaged by water, traffic weight, freeze/thaw cycles, and sunlight. Each of the following treatments and strategies—reconstruction, structural improvements, capital preventive maintenance, and others used by Portage—counters at least one of these pavement-damaging forces.

Reconstruction

Pavement reconstruction treats failing or failed pavements by completely removing the old pavement and base and constructing an entirely new road (Figure 2). Every pavement has to eventually be reconstructed and it is usually done as a last resort after more cost-effective treatments are done, or if the road requires significant changes to road geometry, base, or buried utilities. Compared to the other treatments, which are all improvements of the existing road, reconstruction is the most extensive rehabilitation of the roadway and therefore, also the most expensive per mile and most disruptive to regular traffic patterns. Reconstructed pavement will subsequently require one or more of the previous maintenance treatments to maximize service life and performance. A reconstructed road lasts approximately 15 years and costs $250,000 per lane mile for major streets.

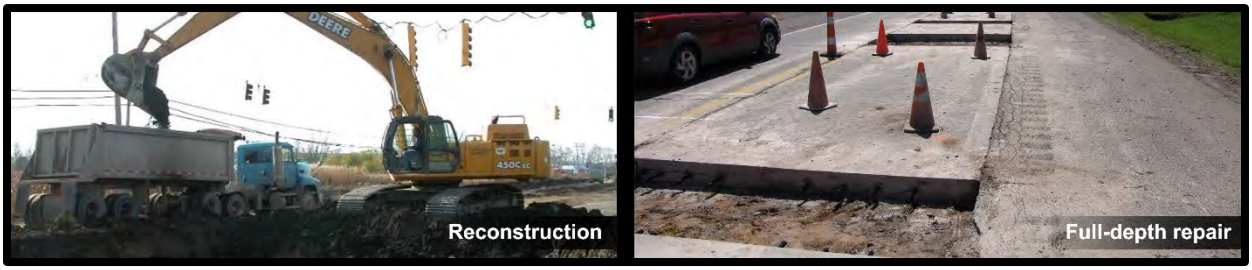


Figure 2: Examples of reconstruction treatments—(left) reconstructing a road and (right) road prepared for full-depth repair.

Structural Improvement

Roads requiring structural improvements exhibit alligator cracking and rutting and are rated poor in the TAMC scale. Road rutting is evidence that the underlying structure is beginning to fail and it must be rehabilitated with a structural treatment. Examples of structural improvement treatments include HMA overlay with or without milling, and crush and shape (Figure 3). The following descriptions outline the main structural improvement treatments used by Portage.

Figure 3: Examples of structural improvement treatments(from left) HMA overlay on an unmilled pavement, milling asphalt pavement, and pulverization of a road during a crush-and-shape project.

Hot-mix Asphalt (HMA) Overlay with/without Milling

An HMA overlay is a layer of new asphalt (liquid asphalt and stones) placed on an existing pavement (Figure 3). Depending on the overlay thickness, this treatment can add significant structural strength. This treatment also creates a new wearing surface for traffic and seals the pavement from water, debris, and sunlight damage. An HMA overlay lasts from five to ten years and costs $50,000 to $100,000 per lane mile. The top layer of severely damaged pavement can be removed by milling, a technique that helps prevent structural problems from being quickly reflected up to the new surface. Milling is also done to keep roads at the same height of existing curb and gutter. Milling adds $10,000 per lane mile to the HMA overlay cost.

Crush and Shape

During a crush and shape treatment, the existing pavement and base are pulverized and then the road surface is reshaped to correct imperfections in the road's profile (Figure 3). An additional layer of gravel is often added along with a new wearing surface such as an HMA overlay or chip seal. Additional gravel and an HMA overlay give an increase in the pavement's structural capacity. This treatment is usually done on rural roads with severe structural distress; Adding gravel and a wearing surface makes it more prohibitive for urban roads if the curb and gutter are not raised. Crush and shape treatments last approximately 14 years and cost $150,000 per lane mile.

Capital Preventive Maintenance

Capital preventive maintenance (CPM) addresses pavement problems of fair-rated roads before the structural integrity of the pavement has been severely impacted. CPM is a planned set of cost-effective treatments applied to an existing roadway that slows further deterioration and that maintains or improves the functional condition of the system without significantly increasing the structural capacity. Examples of such treatments include crack seal, fog seal, chip seal, slurry seal, and microsurface (Figure 4). The purpose of the following CPM treatments is to protect the pavement structure, slow the rate of deterioration, and/or correct pavement surface deficiencies. The following descriptions outline the main CPM treatments that can be applied.

Figure 4: Examples of capital preventive maintenance treatments(from left) crack seal, fog seal, chip seal, and slurry seal/microsurface.

Crack Seal

Water that infiltrates the pavement surface softens the pavement structure and allows traffic loads to cause more damage to the pavement than in normal dry conditions. Crack sealing helps prevent water infiltration by sealing cracks in the pavement with asphalt sealant (Figure 4). Portage seals pavement cracks early in the life of the pavement to keep it functioning as strong as it can and for as long as it can. This can be noted on new pavement applications where the joints are sealed to prolong the pavement life. Crack sealing lasts approximately two years and costs $4,000 per lane mile. Even though it does not last very long compared to other treatments, it does not cost very much compared to other treatments. This makes it a very cost-effective treatment when Portage looks at what crack sealing costs per year of the treatment's life.

Fog Seal

Fog sealing sprays a liquid asphalt coating onto the entire pavement surface to fill hairline cracks and prevent damage from sunlight (Figure 4). Fog seals are best for good to very good pavements and last approximately two years at a cost of $1,000 per lane mile. Fog seal is completed following chip seal projects in the city.

Chip Seal

A chip seal, also known as a sealcoat, is a two-part treatment that starts with liquid asphalt sprayed onto the old pavement surface followed by a single layer of small stone chips spread onto the wet liquid asphalt layer (Figure 4). The liquid asphalt seals the pavement from water and debris and holds the stone chips in place, providing a new wearing surface for traffic that can correct friction problems and help to prevent further surface deterioration. Chip seals are best applied to pavements that are not exhibiting problems with strength, and their purpose is to help preserve that strength. Chipseal treatments last approximately five years and cost

$12,000 per lane mile. Bacon Avenue from South Westnedge Avenue to Portage Road was chip sealed in 2022.

Slurry Seal/Microsurface

The purpose of a slurry seal or microsurface is to protect existing pavement from being damaged by water and sunlight. The primary ingredients are liquid asphalt (slurry seal) or modified liquid asphalt (microsurface), small stones, water and portland cement applied in a very thin (less than a half an inch) layer (Figure 4). The main difference between a slurry seal and a microsurface is that the modified liquid asphalt used in microsurfacing provides different curing and durability properties, which allows microsurfacing to be used for filling pavement ruts. Since the application is very thin, these treatments do not add any strength to the pavement and only serves to protect the pavement's existing strength by sealing the pavement from sunlight and water damage. Slurry seal and microsurface treatments work best when applied before cracks are too wide and too numerous. A slurry seal treatment lasts approximately four years and costs $20,000 per lane mile, while a microsurface treatment tends to last for seven years and costs $25,000 per lane mile. South Westnedge Aveune from Mall Drive to Trade Center Way was microsurfaced in 2022.

Innovative Treatments

Innovative treatments are those newer, unique, non-standard treatments that provide ways of treating pavements using established engineering principles in new and cost-effective ways. Portage strives to be innovative with its pavement treatments by looking for ways to prevent pavement damage and save taxpayer dollars.

Hot in Place Asphalt

The paving contractor in this innovative pavement recycling treatment heats and mills the existing road surface, adds new asphalt binding agent and then reapplies the material onto the street. This paving technique was applied to West Romence Road from Oakland Avenue to Angling Road in 2009.

Geotextile Fabric

During the street paving process, a geotextile fabric can be added to the road surface before the final asphalt layer is applied. The fabric is designed to reduce street surface cracking. This fabric techniques have been applied to the following streets:

- East Romence Road Parkway from Portage Road to Lovers Lane
- Lovers Lane from (East Centre Avenue to Forest Drive
- West Romence Road from South Westnedge Avenue to Constitution
- Angling Road from West Centre Avenue to Squire Heath Lane

Onyx Seal Coating

The mastic surface treatment is a mixture of polymers modified asphalt emulsion, fine aggregates, dark color enhancers and breaking/setting additives. This pavement preservation treatment seals oxidized asphalt pavement and was applied to Ramona Avenue from Lovers Lane to Portage Road in 2016.

Maintenance

Maintenance is the most cost-effective strategy for managing road infrastructure and prevents good and fair roads from reaching the poor category, which require costly rehabilitation and reconstruction treatments to create a year of service life. It is most effective to invest on routine maintenance and CPM treatments first. Then, when all maintenance project candidates are treated, reconstruction and rehabilitation can be performed as funds become available. This strategy is called a “mix-of-fixes” approach to managing pavements.

1. PAVEMENT ASSETS

Building a mile of new road can cost more than $1 million due to the large volume of materials and equipment that is necessary. The high cost of constructing road assets underlines the critical nature of properly managing and maintaining the investments made in this vital infrastructure. The specific needs of every mile of road within an agency's overall road network is a complex assessment, especially when considering rapidly changing conditions and the varying requisites of road users; understanding the need of each road-mile is an essential duty of the road-owning agency.

In Michigan, many different governmental units (or agencies) own and maintain roads, so it can be difficult for the public to understand which is responsible for duties such as planning and funding construction projects, repairs, traffic control, safety, and winter maintenance for any given road. MDOT is responsible for state trunkline roads, which are typically named with "M", "I", or "US" designations regardless of their geographic location in Michigan. Cities and villages are typically responsible for all public roads within their geographic boundary with the exception of the previously mentioned state trunkline roads managed by MDOT. County road commissions (or departments) are typically responsible for all public roads within the county's geographic boundary, with the exception of those managed by cities, villages, and MDOT.

In cases where non-trunkline roads fall along jurisdictional borders, local and intergovernmental agreements dictate ownership and maintenance responsibility. Quite frequently, roads owned by one agency may be maintained by another agency because of geographic features that make it more cost effective for a neighboring agency to maintain the road instead of the actual road owner. Other times, road-owning agencies may mutually agree to coordinate maintenance activities in order to create economies of scale and take advantage of those efficiencies.

Portage is responsible for a total of 224.02 centerline miles of public roads.

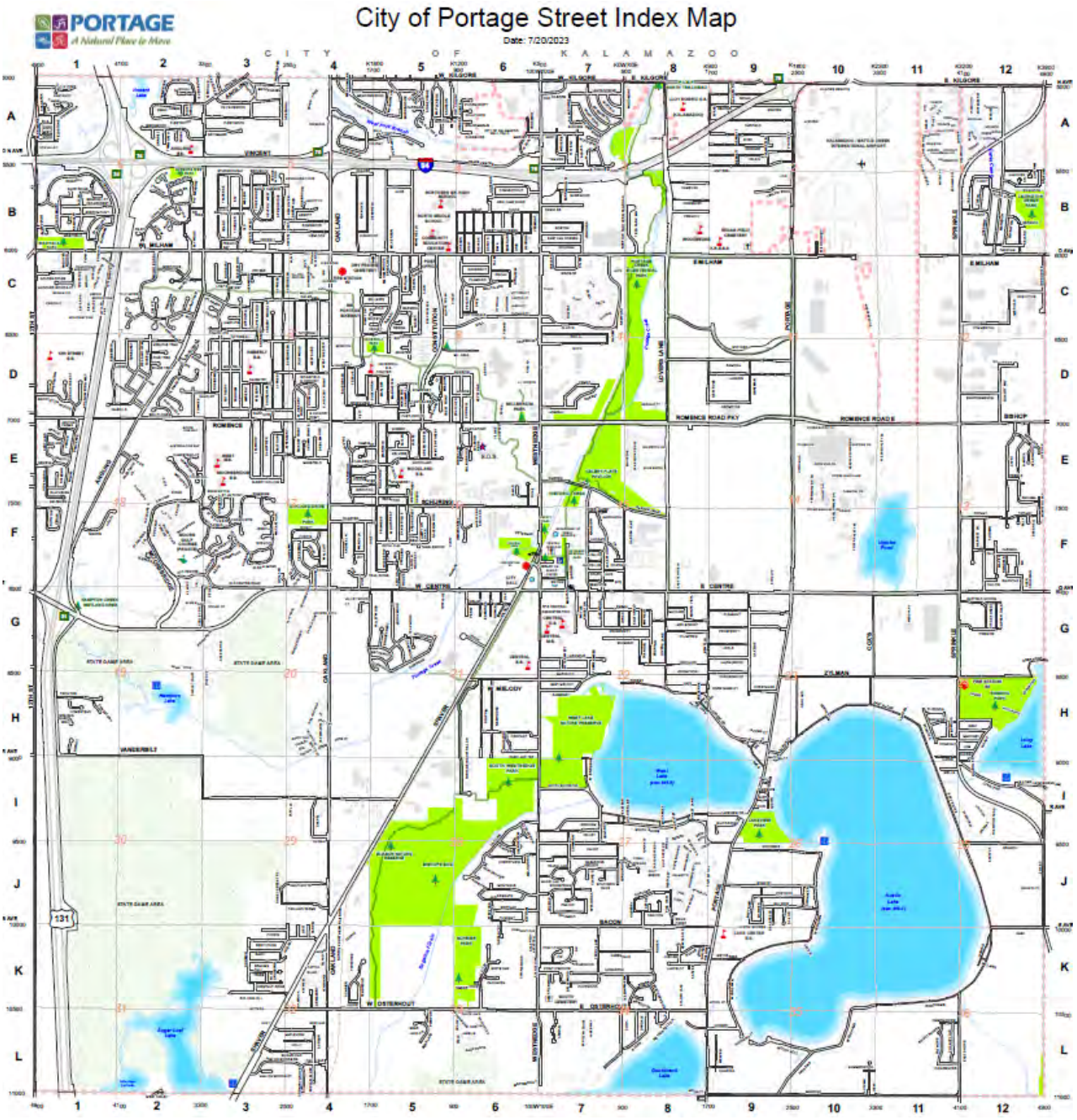


Figure 5: Map Showing Location of Portage's Street Network

The entire Portage street system is shown in figure 5 and a full size version of this map with the street legend is included in Appendix A. A total of 72.90 miles of major roads are shown in Figure 6. Minor roads make up 151.12 miles of roads as shown in Figure 7. There are 19.74 miles of roadways in Portage belonging to the National Highway System (NHS) and are shown in Figure 8.

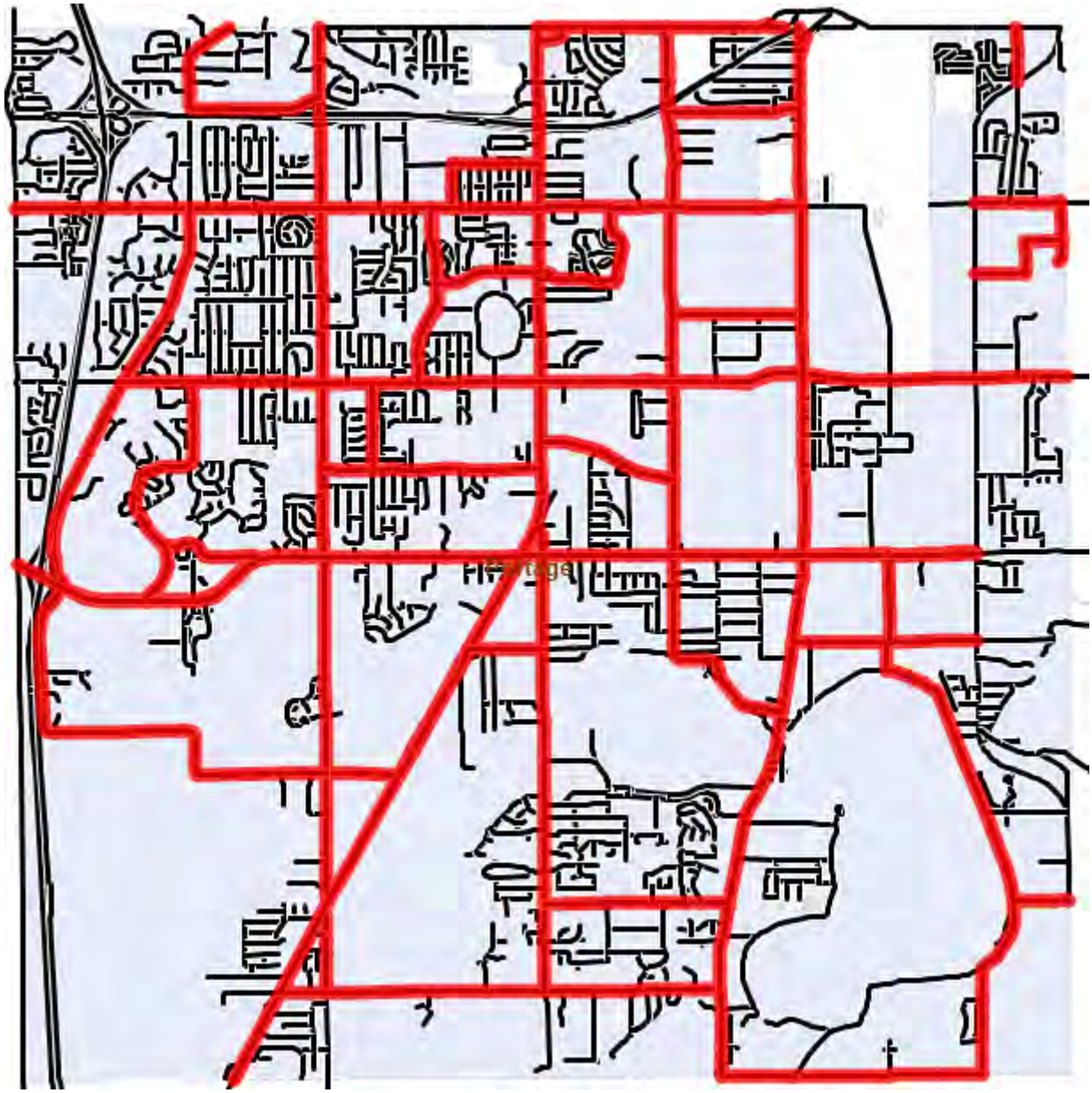


Figure 6: Map showing Location of Portage's Major Roads

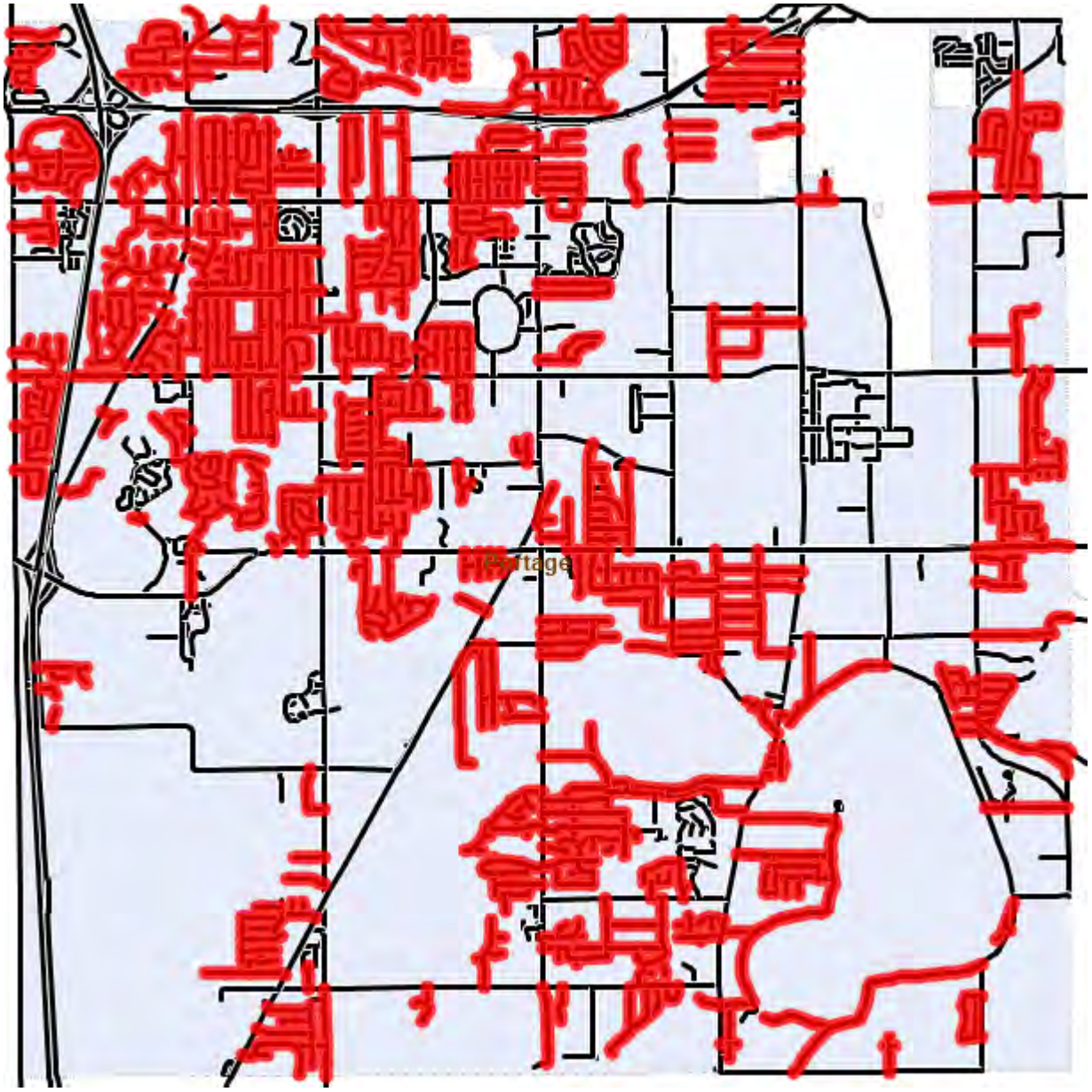


Figure 7: Map Showing Location of Portage's Minor Roads

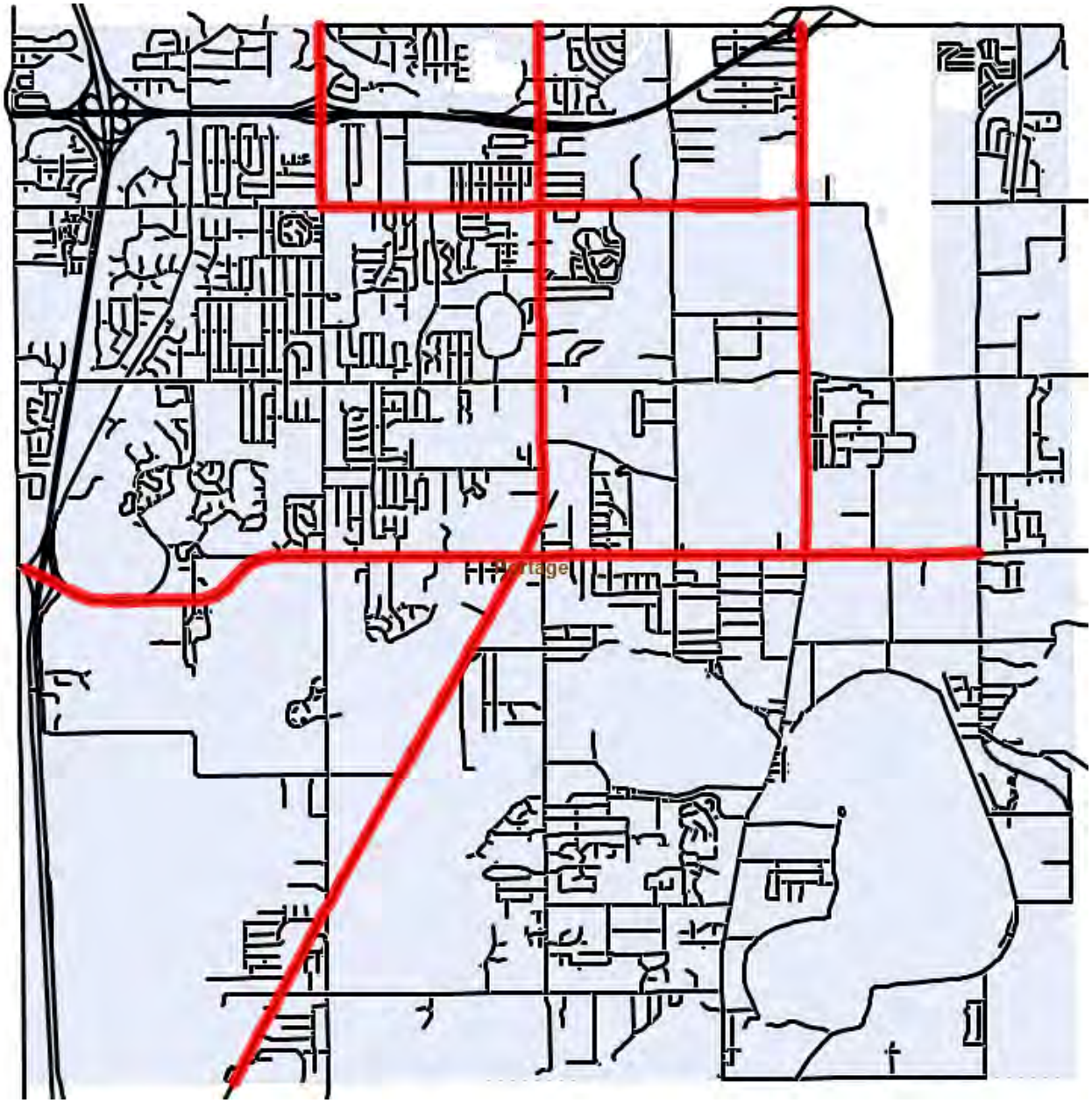


Figure 8: Map Showing Location of Portage's Roads in the National Highway System

Inventory

Michigan Public Act 51 of 1951 (PA 51), which defines how funds from the Michigan Transportation Fund (MTF) are distributed and spent by road-owning agencies, classifies roads owned by Portage as either city major or city minor roads. State statute prioritizes expenditures on the city major road network.

Figure 9 illustrates the percentage of roads owned by Portage that are classified as city major and city minor roads.

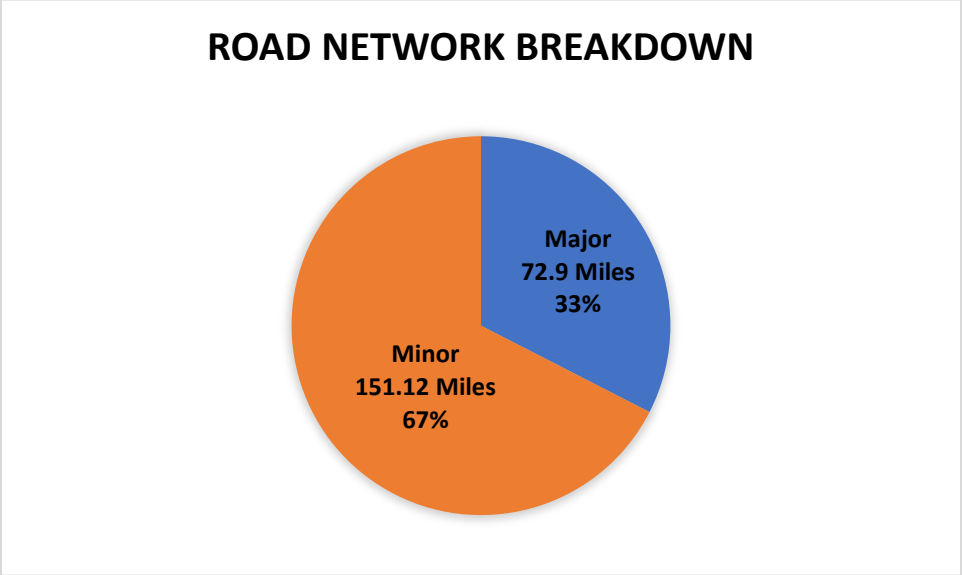


Figure 9: Percentage of City Major and City Minor Roads for Portage.

As previously stated, Portage manages 19.74 miles of roads that are part of the NHS, which are roads that are critical to the nation's economy, defense, and mobility. The NHS is subject to special rules and regulations and has its own performance metrics dictated by the FHWA. While most NHS roads in Michigan are managed by MDOT, Portage manages a percentage of those roads located in its jurisdiction, as shown in Figure 8. All NHS roads maintained by Portage fall within the Portage major road network. The number of NHS miles compared to the entire Portage road network is shown in Figure 10 and a breakdown of PASER ratings of the NHS is shown in Figure 11.

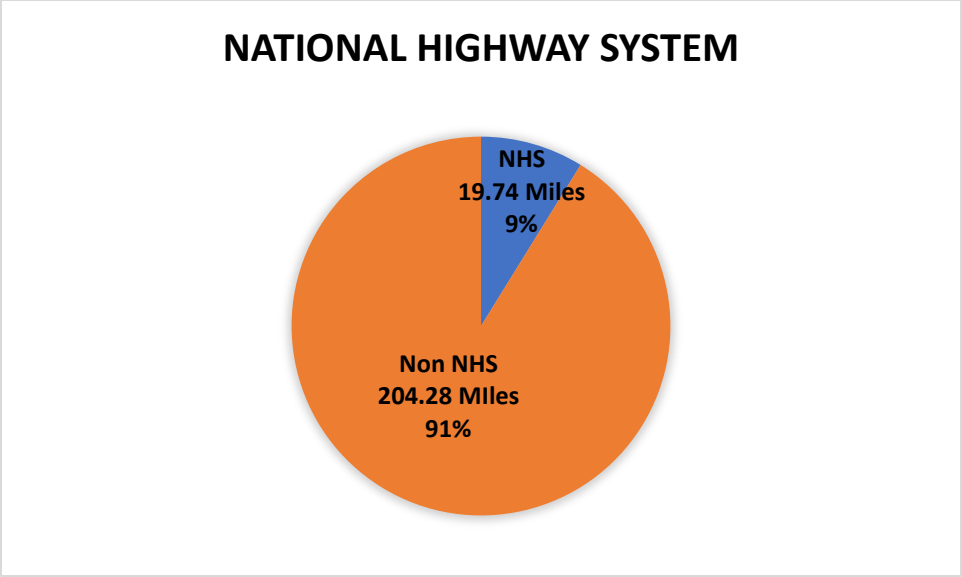


Figure 10: Miles of Roads in Portage that are Part of the National Highway System and Condition.

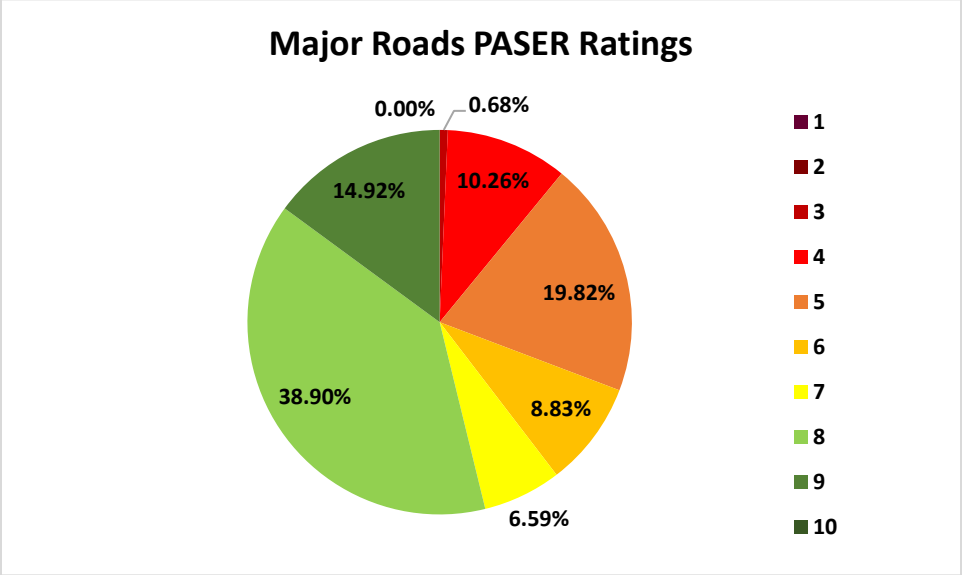


Figure 11: National Highway System Road Condition in Portage.

Types

The Portage street network is entirely asphalt. Factors influencing pavement type include cost of construction, cost of maintenance, frequency of maintenance, type of maintenance, asset life, and road user experience. More information on pavement types is available in the Pavement Introduction.

Locations

Locations and sizes of each asset can be found in the Portage Roadsoft database. For more detail, please contact the Portage Department of Public Works.

Condition

The road characteristic that drivers most readily notice is pavement condition. Pavement condition is a major factor in determining the most cost-effective treatment, be it routine maintenance, capital preventive maintenance, or structural improvement for a given section of pavement. Portage uses pavement condition and age to anticipate when a specific section of pavement will be a potential candidate for preventive maintenance. Pavement condition data enables Portage 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 the condition of a road network 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.

Roads

Portage is committed to monitoring the condition of its road network and using pavement condition data to drive cost-effective decision-making and preservation of valuable road assets. As previously stated, Portage uses the PASER system, which has been adopted by the TAMC for measuring statewide road pavement conditions. The PASER system provides a simple, efficient, and consistent method for evaluating road condition through visual inspection. More information regarding the PASER system can be found in the Pavement Introduction.

Portage collects 100 percent of road PASER condition every two years on all federal-aid-eligible roads in partnership with the Kalamazoo Area Transportation Study. In addition, Portage collects 100 percent of its non-federal-aid-eligible network using its own staff and resources with contracted services.

In previous years, history of aggressive funding has led to a superior road network in Portage when compared to other Michigan communities. In addition, Portage residents approved a road millage for the funding of road reconstruction. With inflation and cost of materials continuing to rise, the funding for minor streets has remained the same and supports fewer miles each year. It will be important to implement a more aggressive funding plan to ensure that street conditions continue to improve.

Figures 12 and 13 show the percentage of PASER ratings for Portage roads expressed in TAMC definition categories for the city major road network and the city minor road network. Portage considers road miles on the transition line between good and fair (PASER 8) and the transition line between fair and poor (PASER 5) as representing parts of the road network where there is a risk of losing the opportunity to apply less expensive treatments that gain significant improvements in service life.

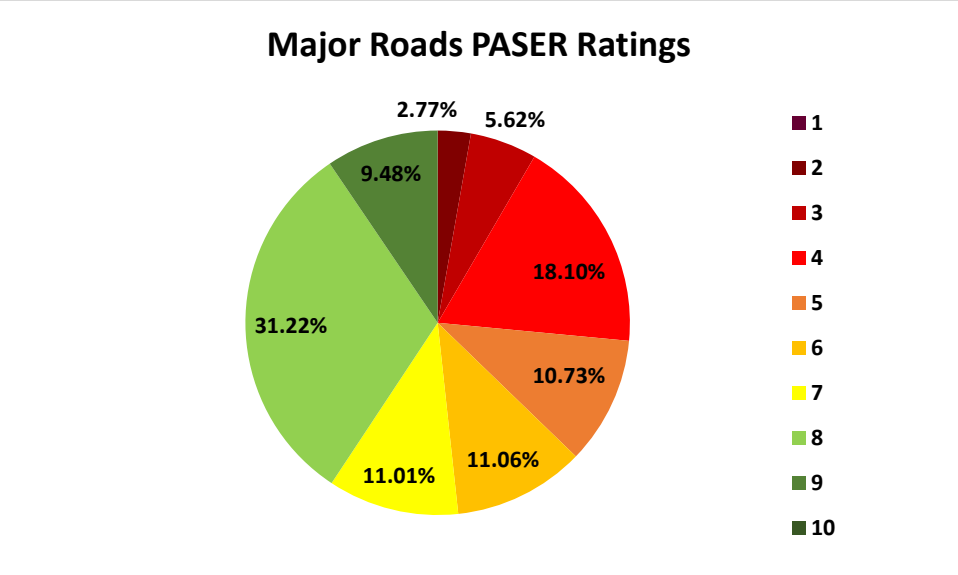


Figure 12: Portage city major road network conditions.

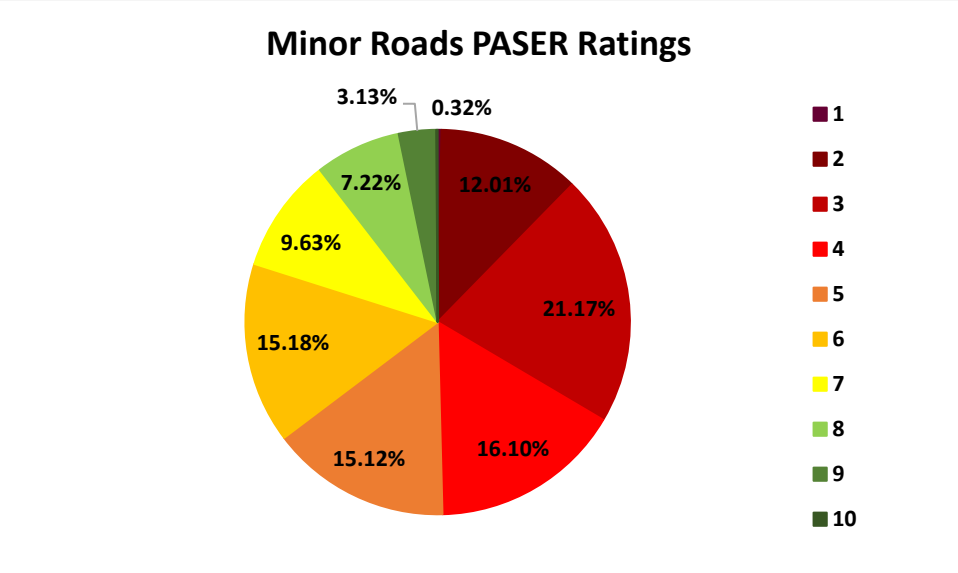


Figure 13: Portage city minor network conditions.

Trends of PASER ratings in the good, fair and poor categories from 2018 - 2022 with average PASER ratings are shown in Figure 14 for the major road network and Figure 15 for the minor road network. Changes in the city's fair and good roads PASER ratings in previous years was due to the implementation of the Crack Sealing Program on completed road projects within 1-2 year of completion to prolong the life of the pavement. This action automatically lowered a road's PASER rating from a 9 or 10 after resurfacing, to a 7 after crack sealing. PASER ratings collected in 2021 and beyond will not penalize streets that are crack sealed following a project as a preventative maintenance measure to seal the pavement joints.

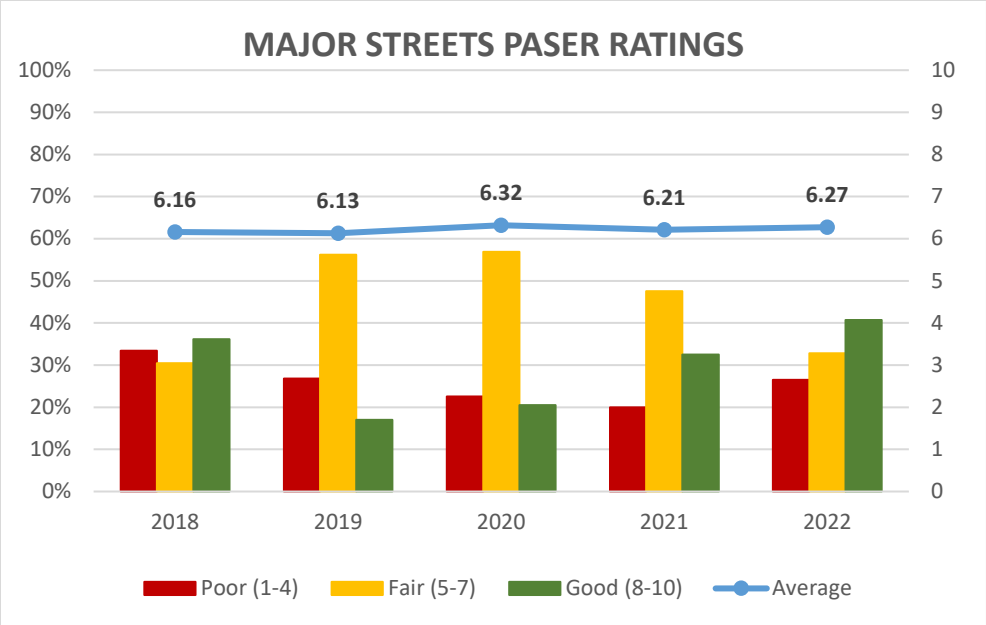


Figure 14: Portage Major Streets PASER Ratings

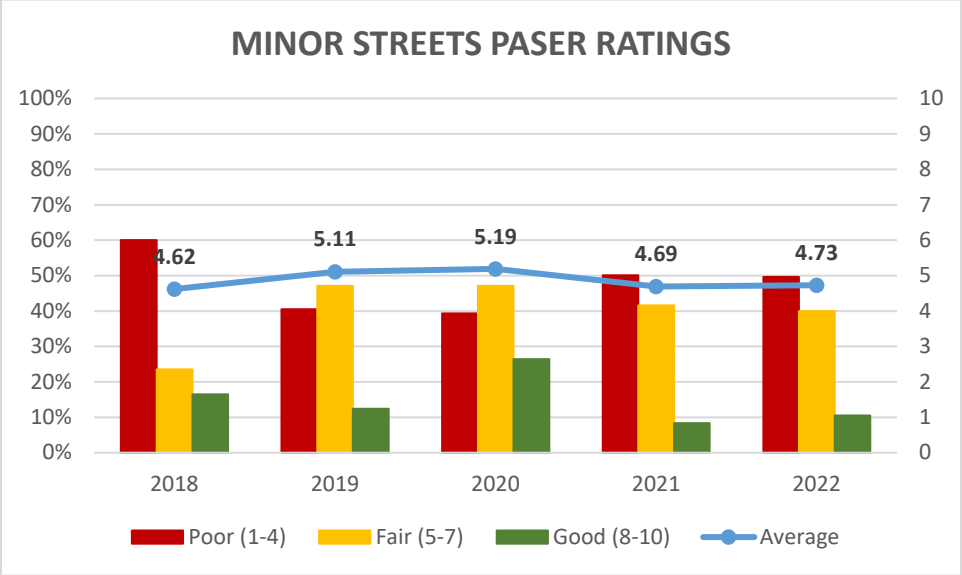


Figure 15: Portage Minor Streets PASER Ratings

An online version of the most recent PASER data is located at https://www.mcgi.state.mi.us/tamcMap/.

Figure 16 provides a map illustrating the geographic location of roads and their respective PASER condition.

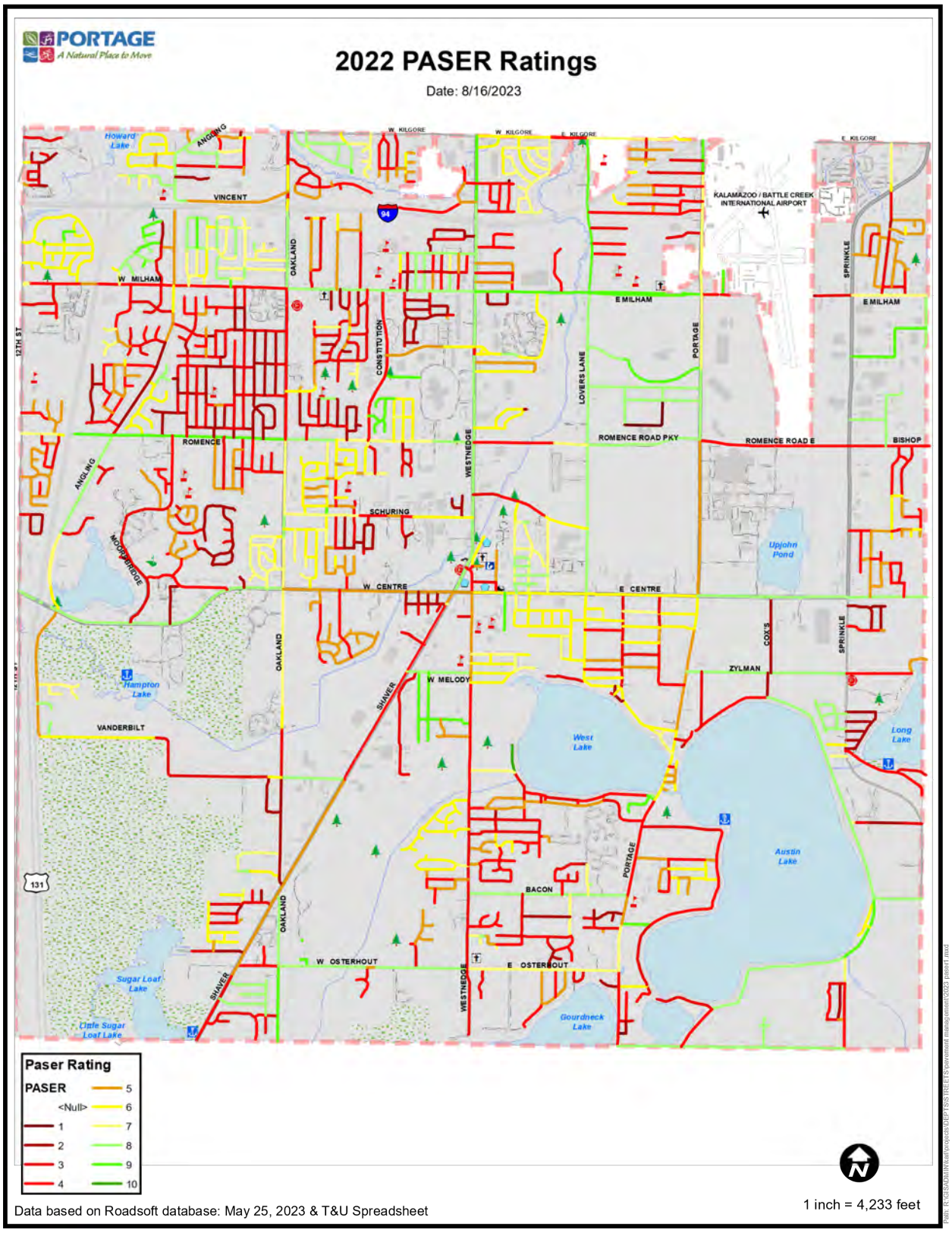


Figure 16: Portage 2022 PASER Ratings for Entire Network

City of Portage Street Network

Historically, the overall quality of Portage city major roads have been fairly steady, as can be observed in Figure 17, which shows the five-year trend and average PASER of the entire Portage road network. City streets are built at great costs and their decline can have reaching effects on business activity, property values and city operating expenditures. Deferring maintenance of such assets can also create significant unfunded liabilities. In general, street maintenance expenditures in constant dollars per mile should remain relatively stable. A declining trend in street maintenance expenditures in constant dollars per mile may be an early warning sign that the city's streets will begin to deteriorate. If the trend is allowed to persist, the deterioration will eventually cause an increase in maintenance expenditures.

Analysis: Maintenance expenditures for the city streets are dependent in large part on Act 51 revenue received from the State of Michigan. These revenues are relatively elastic with respect to economic fluctuations and may be impacted by the COVID-19 virus outbreak. Additional fluctuation in these expenditures is also dependent on winter weather experienced; the severity of the winter will directly affect the cost of snow removal.

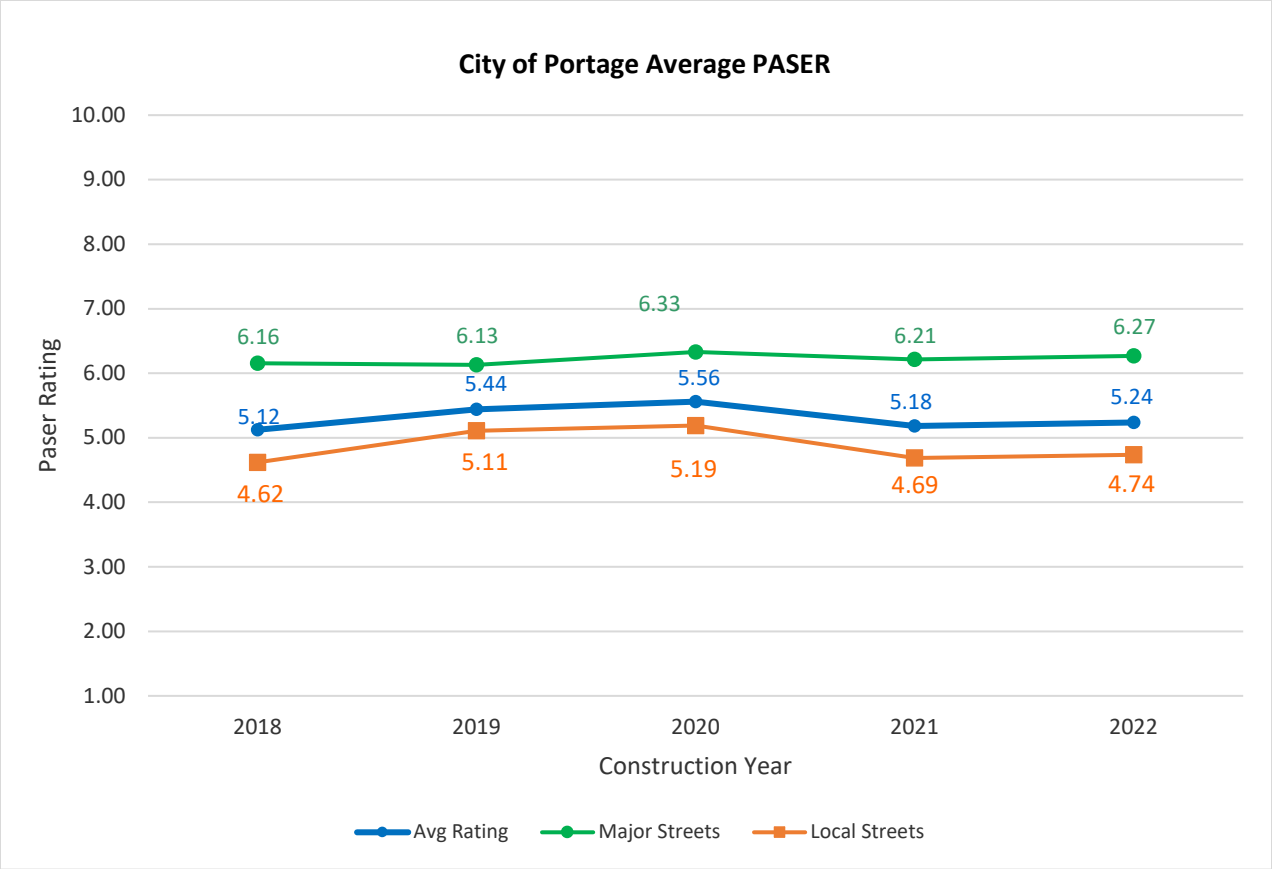


Figure 17: Historical Portage Road Network Condition Trend and Average

A comparison of Portage city major road condition trends with overall statewide condition trends for similarly classified roads is illustrated in Figure 18 and shows a different trend locally as compared to the state average.

During 2022, Portage had an average good rating of 41 percent as compared to the statewide average of 25 percent. For the fair rating, Portage scored 33 percent while the statewide average had a 42 percent rating. Finally, the poor rating for the Portage was 26 percent as compared to 33 percent scored by the state. The trend shows Portage placing a fair amount of money towards the improvement of major streets thus achieving better ratings than statewide major streets.

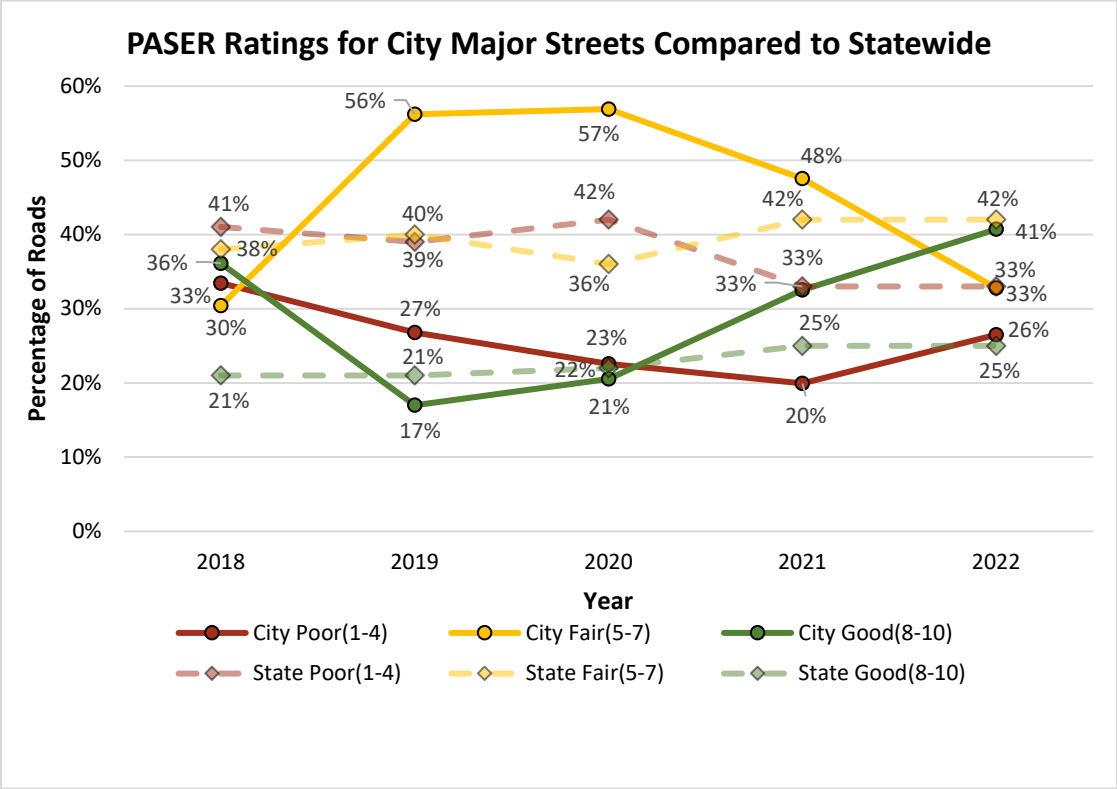


Figure 18: Historical Portage & Statewide Major Road Network Condition Trends

The overall quality of Portage city minor roads has been similar to the statewide minor roads. The city minor road network lacks a source of state and federal funding and therefore must be 100 percent supported locally. Figure 19 illustrates the condition of the city minor road network in Portage as compared to similar roads statewide.

Comparing Portage city minor road condition trends illustrated in Figure 19 with overall statewide condition trends for all city minor roads indicates a slightly worse trend locally as compared to the rest of the state. During 2022, Portage had an average good rating of 10 percent as compared to the statewide average of 20

percent. For the fair rating, the Portage scored 40 percent while the statewide average had a 35 percent rating. Finally, the poor rating for the Portage was 50 percent as compared to 45 percent scored by the state.

The year-to-year variation in the city minor road network is likely because the city's minor road network is collected every 2 years and not annually like the city major road network.

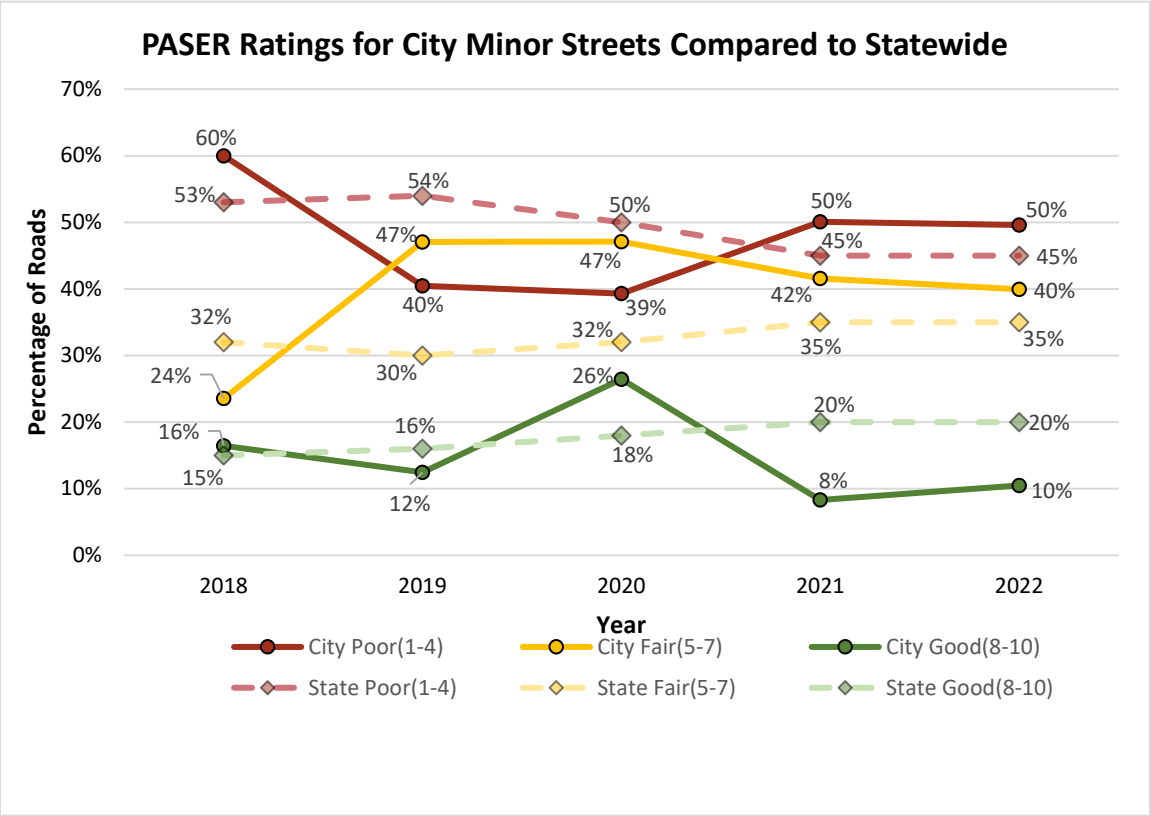


Figure 19: Historical Portage & Statewide Minor Road Network Condition Trends

Goals

Goals help set expectations for how pavement conditions will change in the future. Pavement condition changes are influenced by water infiltration, soil conditions, sunlight exposure, and traffic loading – all uncontrollable factors. Furthermore, the amount of repair work performed is directly tied to budget restrictions. In spite of uncontrollable variables, it is still important to set realistic network condition goals that efficiently use budget resources to build and maintain roads meeting taxpayer expectations.

Goals for City Major Roads

The overall goal for the Portage city major road network is to improve road conditions for all major roads by preventing its good and fair major roads from becoming poor and reducing the percentage of major roads in the poor category.

The Portage network-level pavement condition strategy for city major roads is:

- Crack seal all major roads with PASER rating 9 – 6 annually.
- Microsurface projects on major roads with PASER rating of 7 – 6.
- Mill and fill program used on major roads with PASER rating of 6 – 4.
- Durapatch maintenance used on major roads with PASER rating of 4 – 2.
- Pavement markings on all major roads applied annually.
- Permanent signage replaced with all road reconstruction projects.
- PASER ratings for all major roads collected annually.

Goals for City Minor Roads

The overall goal for the Portage city minor road network is to improve road conditions for all minor roads by preventing its good and fair minor roads from becoming poor and reducing the percentage of minor roads in the poor category.

The Portage network-level pavement condition strategy for city minor roads is:

- Crack seal all minor roads with PASER rating 9 – 6 annually.
- Mill and fill program used on minor roads with PASER rating of 6 – 4.
- Durapatch maintenance used on minor roads with PASER rating of 4 – 2.
- Permanent signage replaced with all road reconstruction projects.
- PASER ratings for all minor roads collected every two years.

Rising construction costs and the addition of "Complete Streets" elements into local neighborhoods have resulted in a decrease in the number of streets resurfaced. The city minor road system is in need of increased funding to increase PASER ratings and decrease the number of city minor roads in the poor (PASER 4-1) category.

Maintenance Strategies

Roads age and deteriorate just like any other asset. All pavement types are damaged by water, traffic weight, freeze/thaw cycles and sunlight. To offset natural deterioration and normal wear and tear on the road, the city must complete treatment projects that either protect and/or add life to its pavements. The condition of the entire network depends on changes or preservation of individual road sections to which preservation treatments have been applied.

The city uses many types of repair treatments for its roads, each selected to balance cost, benefit and road life expectancy. Financial resources influence how much work can be accomplished across the network within agency budget and which treatments and strategies can be afforded.

Treatments and strategies that counter pavement-damaging forces include reconstruction, structural improvement, capital preventive maintenance, innovative treatments and maintenance. For a complete discussion on the pavement treatment tools, refer to the *Pavement Introduction*.

Correlating with each PASER score are specific types of treatments best performed either to protect the pavement (capital preventive maintenance) or add strength back into the pavement (structural improvement). MDOT provides guidance regarding when a specific pavement may be a candidate for a particular treatment. 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 as shown in Figures 20 and 21. The information provided in **Table 1** is a guide for identifying potential projects; however, this table should not be the sole criteria for pavement treatment selection. Other information such as future development, traffic volume, and utility projects play a role in project type selection. Completing a section of a neighborhood as part of the "Complete Streets" plan is also considered. This table should not be a substitute for engineering judgement.

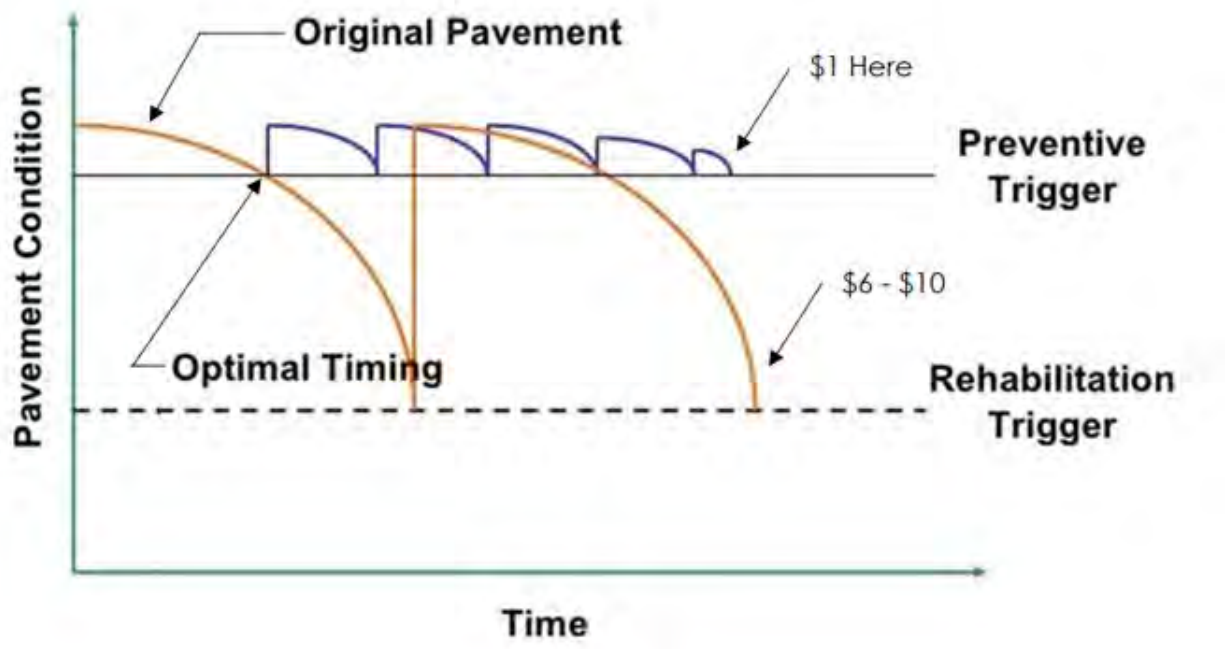


Figure 20: Pavement Condition vs. Time Chart

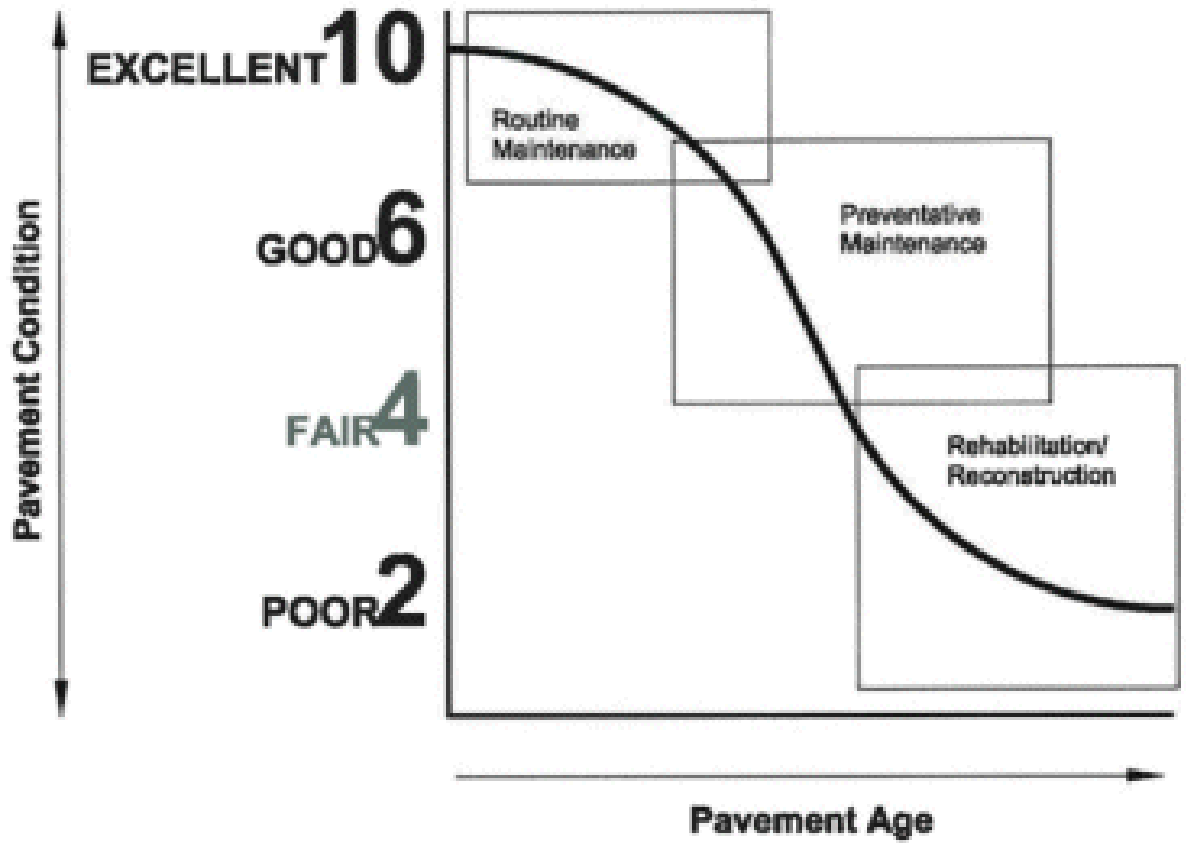


Figure 21: Pavement Condition vs. Pavement Age Chart

Table 1: Service Life Extension (in Years) for Pavement Types Gained by Fix Type[1]

Fix Type	Life Extension (in years) *			
	Flexible	Composite	Rigid	PASER
HMA crack treatment	1-3	1-3	N/A	6-7
Overband crack filling	1-2	1-2	N/A	6-7
One course non-structural HMA overlay	5-7	4-7	N/A	4-5****
Mill and one course non-structural HMA overlay	5-7	4-7	N/A	3-5
Single course chip seal	3-6	N/A	N/A	5-7†
Double chip seal	4-7	3-6	N/A	5-7†
Single course microsurface	3-5	**	N/A	5-6
Multiple course microsurface	4-6	**	N/A	4-6****
Ultra-thin HMA overlay	3-6	3-6	N/A	4-6****
Paver placed surface seal	4-6	**	N/A	5-7
Full-depth concrete repair	N/A	N/A	3-10	4-5***
Concrete joint resealing	N/A	N/A	1-3	5-8
Concrete spall repair	N/A	N/A	1-3	5-7
Concrete crack sealing	N/A	N/A	1-3	4-7
Diamond grinding	N/A	N/A	3-5	4-6
Dowel bar retrofit	N/A	N/A	2-3	3-5***
Longitudinal HMA wedge/scratch coat with surface treatment	3-7	N/A	N/A	3-5****
Flexible patching	**	**	N/A	N/A
Mastic joint repair	1-3	1-3	N/A	4-7
Cape seal	4-7	4-7	N/A	4-7
Flexible interlayer "A"	4-7	4-7	N/A	4-7
Flexible interlayer "B" (SAMI)	4-7	4-7	N/A	3-7
Flexible interlayer "C"	4-7	4-7	N/A	3-7
Fiber reinforced flexible membrane	4-7	4-7	N/A	3-7
Fog seal	**	**	N/A	7-10
GSB 88	**	**	N/A	7-10
Mastic surface treatment	**	**	N/A	7-10
Scrub seal	**	**	N/A	4-8

* The time range is the expected life extending benefit given to the pavement, not the anticipated longevity of the treatment.

** Data is not available to quantify the life extension.

*** The concrete slabs must be in fair to good condition.

**** Can be used on a pavement with a PASER equal to 3 when the sole reason for rating is rutting or severe raveling of the surface asphalt layer.

† For PASER 4 or less providing structural soundness exists and that additional pre-treatment will be required for example, wedging, bar seals, spot double chip seals, injection spray patching or other pre-treatments.

[1] Part of Appendix D-1 from *MDOT Local Agency Programs Guidelines for Geometrics on Local Agency Projects* 2017 Edition Approved Preventive Maintenance Treatments

Planned Projects

Portage plans construction and maintenance projects several years in advance. A multi-year planning process is beneficial due to the time necessary to plan, design, and finance construction and maintenance projects. Furthermore, state and federal agency planning and programming requirements must be met prior to initiating a project and can include studies on environmental and archeological impacts, review of construction and design documents and plans, documentation of right-of-way ownership, planning and permitting for storm water discharges, coordination of utility upgrades, and other regulatory and administrative requirements.

Per PA 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 often require Portage to alter initial plans. Project planning information is used to predict the future condition of the road networks that Portage maintains.

For 2023-2025, Portage plans to perform City Major and City Minor projects, as shown on the following pages.

City Major Projects

Portage is currently planning the construction and maintenance projects listed in Appendix B for the city major road network. The locations of these projects for 2023, 2024 and 2025 are shown in Figure 22. The total estimated cost of these projects is approximately $22,070,310.

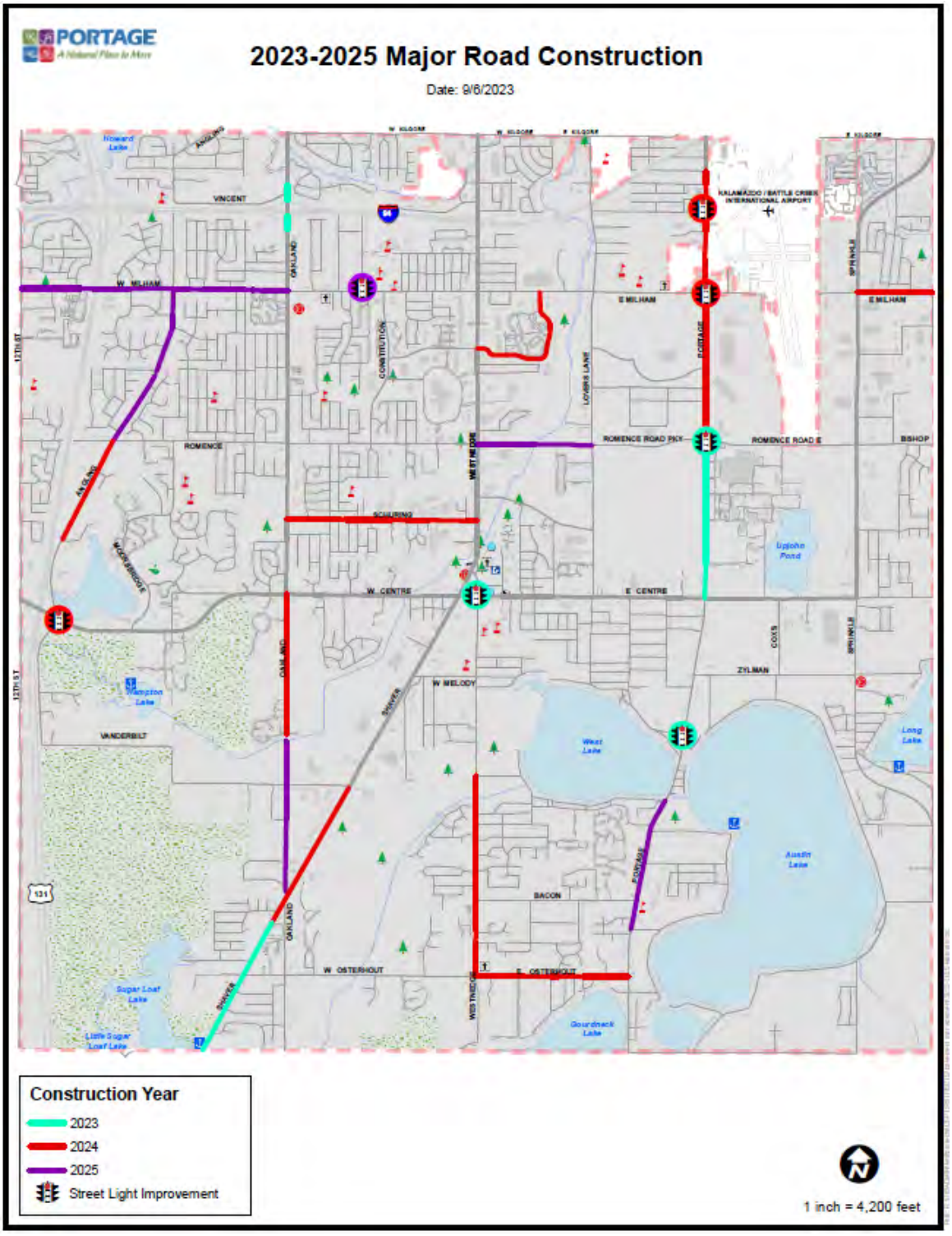


Figure 22: Major Road Projects Planned for 2023 - 2025 Construction

City Minor Projects

Portage is currently planning the construction and maintenance projects listed in Appendix C for the city minor road network. The locations of these projects over the next three years are shown in Figure 23. The total estimated cost of these projects is approximately $11,346,960

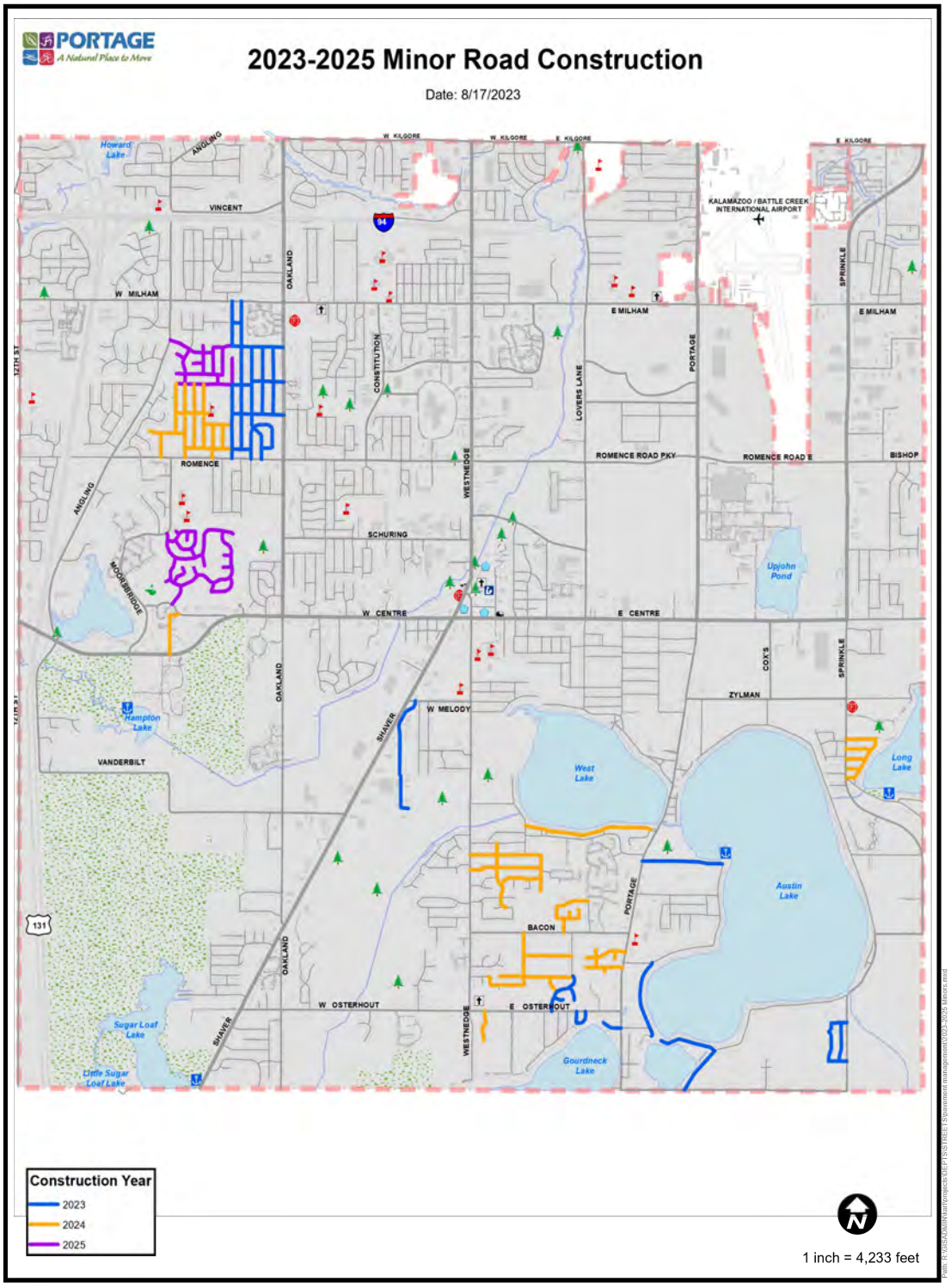


Figure 23: Minor Road Projects Planned for 2023 - 2025 Construction

More information on these projects can be found in the *Financial Resources* section, which begins on page 36.

The current funding levels that the city receives are not sufficient to meet the goals for the city road network. The overall condition of this network can be maintained or improved with additional funding for construction and maintenance.

The Asset Management Plan will help city staff better understand and communicate the consequences of insufficient funds for maintenance items such as crack sealing. Likewise, it will enable the city to apply the funds that are available in a manner that is most beneficial for the overall condition of the street system. Each year that the funding level is not achieved, the overall condition of the street system decreases.

2. FINANCIAL RESOURCES

Public entities must balance the quality and extent of services that can be provided with the tax resources provided by citizens and businesses, all while maximizing how efficiently funds are used. The following financial information is not intended to be a full financial disclosure or a formal report. Michigan agencies are required to submit an Act 51 Report to the Michigan Department of Transportation each year (a full financial report that outlines revenues and expenditures). This report can be obtained by contacting the Portage Department of Public Works.

Portage currently has an estimated $34,417,270 in transportation improvements over the next three years for pavement asset management of the city major and minor network. It should be noted that costs are included in the year of construction and there are some projects that were budgeted in previous years.

City Major Network

Portage historically budgets approximately $550,000 annually on pavement-related maintenance projects for the city major network, which include the mill and fill, chip seal, crack seal and durapatch programs. Reconstruction and heavy maintenance projects for the city major network require engineering design and vary considerably depending on scope of work and the number of lane miles. From 2023 - 2025, Portage plans to invest approximately $22,070,310.

on city major-network projects consisting of, but not limited to, reconstruction, overlay, and preventive maintenance. Expenditures on projects depend on revenue from Michigan Transportation Fund (MTF), bonds, millages, and federal/state programs. The planned major road construction and maintenance projects are listed below.

2023 Planned Major Road Projects

STREET	TO	FROM	PASER	MAINTENANCE	ESTIMATED COST
Shaver Rd	South Limits	Beethoven Ave	3-5	4" Mill/Resurface	$850,000
Portage Rd	Romence Rd	E Centre Ave	5	Reconstruction	$2,900,000
S Westnedge	Melody St	Centre Ave		Traffic Signal/Safety	$1,060,000
Forest Dr				Traffic Signal	$500,000
Oakland Dr	I-94	Vincent Ave	4-6	2" Mill/Resurface	$122,125
Multiple Locations			7-10	Crack Seal	$27,500
Multiple Locations			1-4	Durapatch	$28,000
Total 2023 Planned Major Road Projects					**$5,487,625**

2024 Planned Major Road Projects

STREET	TO	FROM	PASER	MAINTENANCE	ESTIMATED COST
Shaver Rd	Beethoven Ave	Vanderbilt Ave	3-5	4" Mill/Resurface	$850,000
Portage Rd	Fairfield Rd	Romence Rd	7-8	4" Mill/Resurface	$5,500,000
S Westnedge	South Shore Dr	Osterhout Ave	3-4	4" Mill/Resurface	$800,000
Angling Rd	Romence Rd	Squire Heath	2-6	Microsurfacing	$160,000
Angling Rd				Traffic Signal	$600,000
Angling Rd	Squire Heath	Romence Rd	7	Chip & Fog Seal	$36,850
E Osterhout	S Westnedge	Portage Rd	7	Chip & Fog Seal	$56,460
E Milham Ave	Sprinkle Rd	East Limits	7	Chip & Fog Seal	$29,765
Schuring Rd	Oakland Dr	S Westnedge	4-7	Chip & Fog Seal	$77,350
Gladys St	S Westnedge	Newport Ave	6-8	Chip & Fog Seal	$28,190
Newport Ave	Gladys St	E Milham Ave	6	Chip & Fog Seal	$22,085
Oakland Dr	Katie Ct	W Centre Ave	7	Chip & Fog Seal	$47,140
E Osterhout	Westnedge	Portage	7	Chip seal	$56,455
Angling	Squire Heath	W Centre Ave	7	Chip seal	$36,855
Schuring	Oakland	S Westnedge	7	Chip seal	$77,350
Gladys	304 Gladys	S Westnedge	6	Chip seal	$10,810
Gladys	Newport	304 Gladys	6	Chip seal	$17,385
Newport	E.Milham	Gladys	6	Chip seal	$22,085
Oakland	Katie	W Centre Ave	7	Chip seal	$47,140
E Milham Ave	City limit	Sprinkle Rd	7	Chip seal	$29,765
Multiple Locations			7-10	Crack Seal	$28,500
Multiple Locations			1-4	Durapatch	$29,000
Total 2024 Planned Major Road Projects					**$8,563,185**

2025 Planned Major Road Projects

STREET	TO	FROM	PASER	MAINTENANCE	ESTIMATED COST
Romence Rd	Lovers Lane	S Westnedge	4-7	Reconstruction	$1,400,000
W Milham Ave	Oakland Dr	S 12th Street	4	Reconstruction	$2,400,000
Oakland Dr	Katie court	Shaver Rd	2-3	Reconstruction	$950,000
Angling Rd	W Milham Ave	Romence Rd	2-6	Reconstruction	$1,100,000
Portage Rd	Lakeview Dr	Wetherbee Ave	4-5	Reconstruction	$2,110,000
Multiple Locations			7-10	Crack Seal	$29,500
Multiple Locations			1-4	Durapatch	$30,000
Total 2025 Planned Major Road Projects					**$8,019,500**

City Minor Network

Portage historically budgets approximately $2,300,000 annually on pavement-related maintenance projects for the city minor network, which include the local streets program, mill and fill, chip seal, crack seal and durapatch programs. Reconstruction projects for the city minor network are typically utility related projects

that require the road to be reconstructed to install or replace new sanitary sewer or water. In these cases, the projects are funded through the water and sewer fund whichever is appropriate. Over the next three years, Portage plans to invest approximately $11,346,960 on all city minor network projects consisting of, but not limited to, reconstruction, overlay, and preventive maintenance. Expenditures on projects depends on revenue from local tax sources. The planned minor road construction and maintenance projects are listed below.

2023 Planned Minor Road Projects

STREET	TO	FROM	PASER	MAINTENANCE	ESTIMATED COST
Kalarama	Cypress	Oakland	2-4	2" Mill/Resurf.	
Tattersall	Cypress	Oakland	2-5	2" Mill/Resurf.	
Ridgefield	Cypress	Oakland	2-4	2" Mill/Resurf.	
Radcliffe	Cypress	W Hickory Point	3	2" Mill/Resurf.	
Westchester	Ridgefield	Kalarama	2-3	2" Mill/Resurf.	
Westshire	Ridgefield	Kalarama	2-3	2" Mill/Resurf.	$1,500,000
Trotwood	Ridgefield	Kalarama	2-3	2" Mill/Resurf.	
Evergreen	Radcliffe	W Milham	3	2" Mill/Resurf.	
Cypress	Romence	Tattersall	2-3	2" Mill/Resurf.	
Cypress	Kalarama	W Milham	2-3	2" Mill/Resurf.	
W,N,S,E Hickory Po	Romence	Trotwood	2-3	2" Mill/Resurf.	
Portage Industrial	Cul-de-sac	Melody	3	2" Mill/Resurf.	$221,665
Diamondview	Brightwater	E.Shore	3	2" Mill/Resurf.	$18,400
Chancellor	Clearwater	Diamondview	2	2" Mill/Resurf.	$45,910
Brightwater	Biltmore	Diamondview	3	2" Mill/Resurf.	$11,210
Biltmore	Clearwater	Brightwater	4	2" Mill/Resurf.	$36,430
Clearwater	E.Shore	Biltmore	3	2" Mill/Resurf.	$21,810
Andrews	Woody Knoll	Mandigo	4	2" Mill/Resurf.	$65,250
Woody Noll	Cul-de-sac	Andrews	3	2" Mill/Resurf.	$105,675
Woodlawn	S.Cul-de-sac	Wetherbee	3	2" Mill/Resurf.	$74,405
Woodbine	Woodlawn	Portage	3	2" Mill/Resurf.	$107,940
W.Vickery	Dead end	Portage	2	2" Mill/Resurf.	$25,715
Wetherfield	E.Osterhout	E.Osterhout	3	2" Mill/Resurf.	$33,255
Roger	Ludington	E.Osterhout	2	2" Mill/Resurf.	$52,165
Wendover	Dead end	Roger	2	2" Mill/Resurf.	$11,960
Breckenridge way	Dead end	Roger	4	2" Mill/Resurf.	$18,970
Multiple Locations			7-10	Crack Seal	$33,250
Multiple Locations			1-4	Durapatch	$17,000
Total 2023 Planned Minor Road Projects					**$2,401,010**

2024 Planned Minor Road Projects

STREET	TO	FROM	PASER	MAINTENANCE	ESTIMATED COST
Lakeview Dr	S Shore	Lakeview Ct	4-6	Reconstruction	$1,200,000
Cooley Dr	Old Centre Ave	W Centre Ave	3-4	4" Mill/Resurface	$785,000
Gray St	Sprinkle Rd	Waruf Ave	2	Reconstruction	$665,000
Mahoney St	Sprinkle Rd	Waruf Ave	2	Reconstruction	
Lum St	Sprinkle Rd	Waruf Ave	2	Reconstruction	
Hayes	Sprinkle Rd	Waruf Ave	2	Reconstruction	
Waruf Ave	Sprinkle Rd	Gray St	2	Reconstruction	
Camelot	Robinswood	Dead End	2	2" Mill/Resurf.	$1,500,000
Winkfield	Robinswood	Amberly	2-3	2" Mill/Resurf.	
Davcliff	Rothbury	Dead End	2-3	2" Mill/Resurf.	
Radcliffe	Rothbury	Cypress	2-3	2" Mill/Resurf.	
Daventry	Cypress	Amberly	2-3	2" Mill/Resurf.	
Shoreham	Radcliffe	Daventry	2	2" Mill/Resurf.	
Welbury	Romence	Daventry	3	2" Mill/Resurf.	
Amberly	Radcliffe	Tattersall	3	2" Mill/Resurf.	
Brigham	Radcliffe	Tattersall	3	2" Mill/Resurf.	
Rothbury	Radcliffe	Lost Pine	3-4	2" Mill/Resurf.	
Robinswood	Davcliff	Tattersall	3	2" Mill/Resurf.	
Towhee	Romence	Davcliff	3	2" Mill/Resurf.	
Karendale	Terry	Roger	3	2" Mill/Resurf.	$86,225
Ludington	Dead end	Roger	3	2" Mill/Resurf.	$125,985
Westminster	Roger	Ludington	3	2" Mill/Resurf.	$25,280
Lancelot	Dead end	Portage	3	2" Mill/Resurf.	$57,280
Karlee	Dead end	Lancelot	5	2" Mill/Resurf.	$6,380
Newcastle	Dead end	Lancelot	3	2" Mill/Resurf.	$16,720
Auburn Woods	Dead end	Portage	2	2" Mill/Resurf.	$64,380
Doves Hollow	Dead end	Auburn Woods	2	2" Mill/Resurf.	$12,730
Abigail	Dead end	E.Osterhout	3	2" Mill/Resurf.	$47,630
Hilberry	Bacon	Drayton	4	2" Mill/Resurf.	$21,200
Drayton	Dead end	Hilberry	3	2" Mill/Resurf.	$47,630
Defoe	Dead end	Drayton	3	2" Mill/Resurf.	$9,425
Hilberry	Chaucer	Drayton	4	2" Mill/Resurf.	$15,535
Chaucer	Pine view	Hilberry	3	2" Mill/Resurf.	$52,815
Gabardine	Corduroy	Westnedge	3	2" Mill/Resurf.	$108,650
Calico	Corduroy	Westnedge	3	2" Mill/Resurf.	$126,890
Corduroy	Dead end	Calico	3	2" Mill/Resurf.	$54,800
Chambray	Appaloosa	Velvet	3	2" Mill/Resurf.	$117,910
Anchor	Corduroy	Chambray	4	2" Mill/Resurf.	$68,620
Intersection	Karendale	Terry	2	2" Mill/Resurf.	$2,960
Terry	Cliffwood	Bacon	3	2" Mill/Resurf.	$76,070
Intersection North	Terry	Ludington	3	2" Mill/Resurf.	$2,280
Intersection West	Ludington	Terry	3	2" Mill/Resurf.	$2,150
Intersection East	Ludington	Terry	3	2" Mill/Resurf.	$2,325
Intersection South	Westminster	Ludington	3	2" Mill/Resurf.	$2,490
Cliffwood	301 Cliffwood	Ludington	4	2" Mill/Resurf.	$73,995
Intersection South	Cliffwood	Ludington	3	2" Mill/Resurf.	$2,330
Intersection South	Cliffwood	Bellewood	3	2" Mill/Resurf.	$2,200
Meredith	E Kilgore	Sprinkle Rd	7	Chip seal	$21,475
Multiple Locations			7-10	Durapatch	$22,690
Total 2024 Planned Minor Road Projects					**$5,427,050**

2025 Planned Minor Road Projects

STREET	TO	FROM	PASER	MAINTENANCE	ESTIMATED COST
Meredith Street	Sprinkle Rd	E Milham Ave	2-3	Reconstruction	$1,200,000
Coachlite	Cherrywood	Dead End	2-4	2" Mill/Resurf.	$1,500,000
Cherrywood	Coachlite	Kalarama	3	2" Mill/Resurf.	
Shorbury	Tattersall	Coachlite	3	2" Mill/Resurf.	
Applewood	Coachlite	Kalarama	3	2" Mill/Resurf.	
Liteolier	Coachlite	Dead End	4	2" Mill/Resurf.	
Lites-End	Rothbury	Dead End	3-5	2" Mill/Resurf.	
Kalarama	Angling	Cypress	2-3	2" Mill/Resurf.	
Tattersall	Robinswood	Cypress	3	2" Mill/Resurf.	
Heather Ridge	Innisbrook	Old centre	4	2" Mill/Resurf.	$58,595
Innisbrook	MacArthur	Muirfield	5	2" Mill/Resurf.	$143,305
Kilbirnie	Glenalmond	Innisbrook	2	2" Mill/Resurf.	$13,925
Glenalmond	Innisbrook	Kilbirnie	2	2" Mill/Resurf.	$45,270
MacArthur	Dunross	Innisbrook	2	2" Mill/Resurf.	$93,750
Burnock	Dead end	MacArthur	3	2" Mill/Resurf.	$31,885
Jessica	Dead end	MacArthur	3	2" Mill/Resurf.	$14,030
Dunross	E Cul-de-sac	S Cul-de-sac	2	2" Mill/Resurf.	$111,930
Muirfield	Dunross	Moorsbridge	4	2" Mill/Resurf.	$91,315
Carnoustie	Muirfield	St George	5	2" Mill/Resurf.	$41,320
St. George	St Anthony	St Anthony	5	2" Mill/Resurf.	$58,115
St.Anthony	St George	Muirfield	5	2" Mill/Resurf.	$14,865
Turnberry	Dead end circle	St Anthony	5	2" Mill/Resurf.	$23,575
Bennington	Dead end circle	St Anthony	3	2" Mill/Resurf.	$11,250
Troon	Dead end circle	Innisbrook	4	2" Mill/Resurf.	$11,060
Wadsworth	Dead end circle	Innisbrook	5	2" Mill/Resurf.	$37,500
Hillsmoor	Dead end circle	Innisbrook	4	2" Mill/Resurf.	$17,220
Total 2025 Planned Minor Road Projects					**$3,518,910**

3. RISK MANAGEMENT

Transportation infrastructure is designed to be resilient. The system of interconnecting roads and bridges maintained by Portage provides road users with multiple alternate options in the event of an unplanned disruption of one part of the system. There are, however, key links in the transportation system that may cause significant inconvenience to users if they are unexpectedly closed to traffic.

- **Geographic divides:** Areas where a geographic feature (river, lake, mountain or limited access road) limits crossing points of the feature.

- **Emergency alternate routes for high-volume roads:** Roads which are routinely used as alternate routes for high volume roads or roads that are 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 large number or large size business will be significantly impacted if a road is unavailable.

The City of Portage road network includes the following critical assets:

- South Westnedge Avenue
- Portage Road
- Oakland Drive
- Lovers Lane
- Kilgore Road
- Milham Avenue
- Romence Road
- Centre Avenue
- Osterhout Avenue

Other critical assets within the City of Portage that are owned and maintained by other jurisdictions include:

- I-94 (MDOT)
- US-131 (MDOT)
- South Sprinkle Road (RCKC)
- South 12th Street (RCKC)
- Kilgore Road (shared with City of Kalamazoo)

4. COORDINATION WITH OTHER ENTITIES

An asset management plan serves as a platform to engage other infrastructure owners using the same shared right of way space and provides a significant value for infrastructure owners. Portage communicates with both public and private infrastructure owners to coordinate work in the following ways:

The Portage Department of Transportation & Utilities works closely with the Portage Department of Public Works to coordinate upcoming capital improvement plan projects with street maintenance projects. This ensures that funds are utilized efficiently and that problematic areas are identified and addressed before significant road work is initiated. Additionally, storm sewer systems are inspected ahead of project construction, and cast iron water mains are replaced and upsized when appropriate and where recommended by the city's water asset management plan and reliability study.

Portage takes advantage of coordinated infrastructure work to reduce cost and maximize value using the following policies:

- Roads in poor condition that have a subsurface infrastructure project planned that will destroy more than half the lane will be rehabilitated or reconstructed full lane width.
- Subsurface infrastructure projects that will cause damage to pavements in good condition will be delayed as long as possible or will be undertaken with methods that do not require pavement cuts. By city policy, no open-cuts are allowed on roadways for five years following construction/reconstruction, except for emergency utility repairs, or in the case of new development, the entire width of the lane disturbed is resurfaced.
- Subsurface utilities not owned by the city are directed to be installed within the greenspace outside the roadway to avoid road disruption as much as possible.
- Subsurface utility projects will be coordinated with both public and private ownership to allow all underground utility assets to be upgraded in same project.
- Coordination with the RCKC for street and traffic signal improvement projects.
- Coordination with the MDOT for street, freeway interchange and traffic signal improvement projects.
- Coordination with the City of Kalamazoo for street and water main projects.
- Coordination with the Kalamazoo Area Transportation Study for major street projects that would include planning, funding, traffic control, and PASER updates.
- Coordination with Metro Bus for the placement of bus routes and passenger pickup points.
- Coordination with Portage Public Schools in ensure signage, lighting, sidewalks and bus routes are established for safe transportation of school children.

City of Portage Street Index Map

Date: 7/20/2023

PORTAGE
A Natural Place to Move

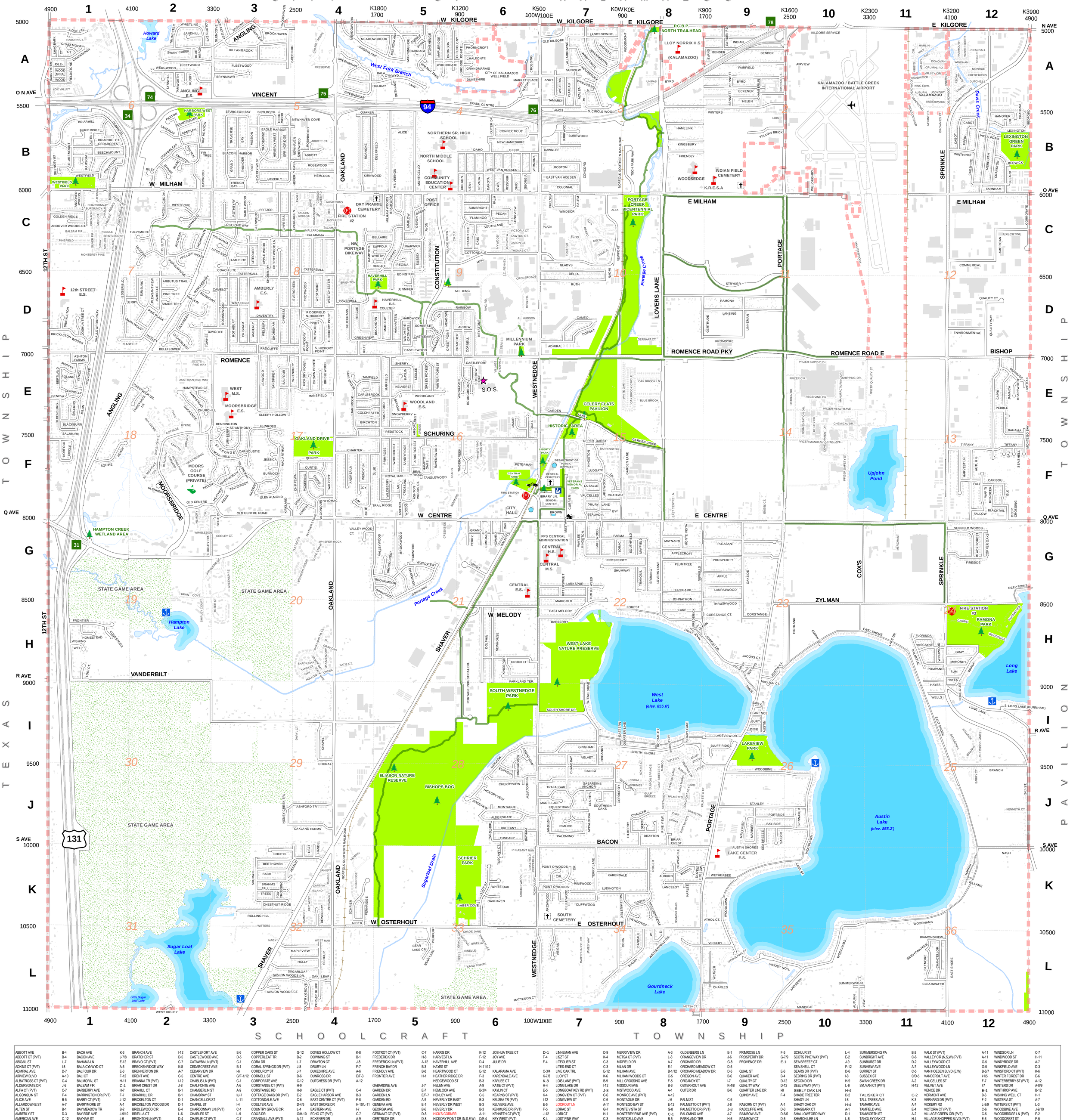
C I T Y O F K A L A M A Z O O

T O W N S H I P S O U T H

P A V I L I O N

S C H O O L C R A F T T O W N S H I P

T E X A S



Legend

- AIRPORT
- PUBLIC ACCESS
- GOLF COURSE
- CEMETERY
- FIRE STATION
- SECRETARY OF STATE (S.O.S.)
- LIBRARY
- CITY PARK
- PUBLIC SCHOOL
- POLICE
- MUNICIPAL
- MULTI USE TRAIL
- PORTAGE COMMUNITY CENTER
- CITY BOUNDARY
- CITY PARKS
- STATE GAME AREA
- CITY OF KALAMAZOO
- EXIT NUMBER
- SECTION LINE & SECTION NUMBER

1,500 750 0

Feet

CITY OF PORTAGE

RESOLUTION

At a regular meeting of the Council of the City of Portage, Kalamazoo County, Michigan, held at the City Hall in said City on the 19 day of September, 2023 at 7:00 p.m., local time.

PRESENT: Mayor Randall, Mayor Pro Tem Pearson, Councilmembers Burns, Knapp, Ledbetter, and Urban

ABSENT: None.

The following resolution was offered by Councilmember Burns and seconded by Councilmember Urban.

WHEREAS, Michigan Public Act 325 of 2018 requires local road agencies to develop and submit asset management plan to the Transportation Asset Management Council including an asset inventory, performance goals, anticipated revenues and expenses and performance outcomes to be submitted to the Transportation Asset Management Council; and

WHEREAS, local road agencies responsible for 100 or more certified miles of road, based on the 2017 PA 51 Mileage Certification, including all 83 Michigan counties and 39 Michigan cities are required to submit their completed asset management plans every three years in designated phases beginning October 1, 2020; and

WHEREAS, the City of Portage staff have completed a Transportation Asset Management Plan containing the required information; and

WHEREAS, the Transportation Asset Management Council requires a resolution accepting the Transportation Asset Management Plan.

NOW, THEREFORE, BE IT RESOLVED, that the City Council hereby accepts the 2023 Transportation Asset Management Plan; and

BE IT FINALLY RESOLVED that a copy of this resolution be added to the Transportation Asset Management Plan before submittal to the Transportation Asset Management Council.

ADOPTED: YEAS: Burns, Knapp, Ledbetter, Pearson, Randall, Urban

NAYS: None.

ABSENT: None.

Erica L. Eklov

Erica L. Eklov, City Clerk

CERTIFICATION

I hereby certify this 20 day of September, 2023 that the foregoing is a true and complete copy of the original on file in my office.

Erica L. Eklov

Erica L. Eklov, City Clerk

APPROVED AS TO FORM FOR CITY OF PORTAGE
BAUCKHAM, THALL, SEEBER,
KAUFMAN & KOCHES, PC
Catherine Kaufman
By: CATHERINE P. KAUFMAN
Date: 9-12-2023

Appendix B

City of Portage
2023 Bridge
Asset Management Plan

Prepared by:

Department of Transportation & Utilities
Jamie Harmon, Deputy Director

CONTENTS

Figures B-3

Tables B-3

Executive Summary B-4

Introduction B-5

Bridge Primer B-6

1. Bridge Assets B-12

Inventory B-13

Goals B-15

Prioritization, Programmed/Funded Projects, and Planned Projects B-16

2. Financial Resources B-23

Anticipated Revenues B-23

Anticipated Expenses B-23

3. Risk Management B-204

4. Bridge Inspections B-26

Appendix 1 ..... B-28

Appendix 2 ..... B-29

Appendix 3 ..... B-30

FIGURES

Figure 1: Girder bridge B-6
Figure 2: Slab bridge B-6
Figure 3: Truss bridge B-6
Figure 4: Three-sided box bridge B-6
Figure 5: Examples of common bridge construction materials used in Michigan B-7
Figure 6: Diagram of basic elements of a bridge B-8
Figure 7: Map illustrating locations COP's of bridge assets B-14

TABLES

Table 1: Summary of the NBI Rating Scale B-7
Table 2: Bridge Assets by Type: Inventory, Size, and Condition B-15
Table 3: Summary of Preservation Criteria B-16
Table 4: Cost Projection Table B-22
Table 5: Scour Critical Bridges B-24
Table 6: Posted/Closed Bridges that are Critical Links B-25

EXECUTIVE SUMMARY

As conduits for commerce and connections to vital services, bridges are among the most important assets in any community along with other assets like roads, culverts, traffic signs, traffic signals, and utilities that support and affect the road network. The City of Portage (Portage) bridges, other road-related assets, and support systems are some of the most valuable and extensive public assets, all of which are paid for with taxes collected from ordinary citizens and businesses. The cost of building and maintaining bridges, their importance to society, and the investment made by taxpayers all place a high level of responsibility on local agencies to plan, build, and maintain the road and bridge network in an efficient and effective manner. This asset management plan is intended to report on how Portage is meeting its obligations to maintain the bridges for which it is responsible.

This plan overviews Portage bridge assets and conditions and explains how Portage works to maintain and improve the overall condition of those assets. These explanations can help answer:

- The types of bridge assets within Portage and the different options for maintaining these assets.
- What tools and processes Portage uses to track and manage bridge assets and funds.
- The condition of Portage bridge assets compared to statewide averages.
- Why some bridge assets are in better condition than others and the path to maintaining and improving bridge asset conditions through proper planning and maintenance.
- How agency bridge assets are funded and the origin of those funds.
- How funds are used and what costs may be incurred during the normal life cycle of bridge assets in Portage.
- The condition Portage can expect of its bridge assets if those assets continue to be funded at the current level.
- How changes in funding levels can affect the overall condition of bridge assets in Portage.

Portage owns and/or manages three bridges and all are rated in good condition.

An asset management plan is required by Michigan Public Act 325 of 2018, and this document represents fulfillment of some of Portage obligations towards meeting these requirements. This asset management plan also helps demonstrate the responsible use of public funds by providing elected and appointed officials, as well as the general public, with inventory and condition information of Portage bridge assets. The report further provides taxpayers with the information they need to make informed decisions about investing in essential transportation infrastructure.

INTRODUCTION

Asset management is defined by Public Act 325 of 2018 as "an ongoing process of maintaining, preserving, upgrading, and operating physical assets cost effectively, based on a continuous physical inventory and condition assessment and investment to achieve established performance goals." In other words, asset management is a process that uses data to manage and track assets, like roads and bridges, in a cost-effective manner using a combination of engineering and business principles. This process is endorsed by leaders in municipal planning and transportation infrastructure, including the Michigan Municipal League, County Road Association of Michigan, the Michigan Department of Transportation (MDOT), and the Federal Highway Administration (FHWA). The City of Portage is supported in its use of asset management principles and processes by the Michigan Transportation Asset Management Council (TAMC), formed by the State of Michigan.

Asset management, in the context of this plan, ensures that public funds are spent as effectively as possible to maximize the condition of the bridges in the Portage road network. Asset management also provides a transparent decision-making process that allows the public to understand the technical and financial challenges of managing infrastructure with a limited budget.

Portage has adopted an "asset management" business process to overcome the challenges presented by having limited financial, staffing, and other resources while needing to meet safety standards and bridge users' expectations. Portage is responsible for maintaining and operating three bridges.

This 2023 plan outlines how Portage determines its strategy to maintain and upgrade bridge asset condition given agency goals, priorities of bridge users, and resources provided. An updated plan is to be released approximately every three years to reflect changes in bridge conditions, finances, and priorities.

Questions regarding the use or content of this plan should be directed to Jamie Harmon at 7719 South Westnedge Avenue, Portage MI 49002, (269) 329-4422, or via email at harmonj@portagemi.gov.

Key terms used in this plan are defined in the Portage comprehensive transportation asset management plan (also known as the "compliance plan") used for compliance with PA 325 or 2018.

Knowing the basic features of an asset class is a crucial starting point to understanding the rationale behind an asset management approach. The following primer provides an introduction to bridges.

Bridge Primer

Bridge Types

Bridges are structures that span 20 feet or more and which can extend across one or multiple spans.

If culverts are placed side by side to form a span of 20 feet or more (for example, three 6-foot culverts with one-foot between each culvert), then this culvert system would be defined as a bridge.

Bridge types are classified based on two features: design and material.

The most common bridge design is the **girder system** (Figure 1). With this design, the bridge deck transfers vehicle loads to girders (or beams) that, in turn, transfer the load to the piers or abutments (see Figure 6).

Figure 1: Girder Bridge

A similar design that lacks girders (or beams) is a **slab bridge** (Figures 2 and 6). A slab bridge transfers the vehicle load directly to the abutments and, if necessary, piers.

Figure 2: Slab Bridge

Truss bridges were once quite common and consist of a support structure that is created when structural members are connected at joints to form interconnected triangles (Figure 3). Structural members may consist of steel tubes or angles connected at joints with gusset plates.

Figure 3: Truss Bridge

Another common bridge design in Michigan is the three-sided pre-cast box or arch bridge (Figure 4).

Michigan is also home to several unique bridge designs.

Adding another layer of complexity to bridge typing is the primary construction materials used (Figure 5). Bridges are generally constructed from concrete, steel, pre-stressed concrete, or timber. Some historical bridges or bridge components in Michigan may be constructed from stone or masonry.

Figure 4: Three-sided Box Bridge

Figure 5: Examples of Common Bridge Construction Materials used in Michigan

Bridge Condition

Michigan inspectors rate bridge condition on a 0-9 scale known as the National Bridge Inventory (NBI) rating scale. (See Table 1 for a summary of the NBI Rating scale.) Elements of a bridge's superstructure, deck, and substructure receive a 9 if they are in excellent condition down to a 0 if they are in failed condition. A complete guide for Michigan bridge condition rating according to the NBI can be found in the MDOT Bridge Field Services' *Bridge Safety Inspection NBI Rating Guidelines* (https://www.michigan.gov/documents/mdot/BIR_Ratings_Guide_Combined_2017-10-30_606610_7.pdf).

Table 1: Summary of the NBI Rating Scale

NBI Rating	General Condition
9-7	Like new/good
6-5	Fair
4-3	Poor/serious
2-0	Critical/failed

Bridge Treatments

Replacement

Replacement work is typically performed when a bridge is in poor condition (NBI rating of 4 or less) and will improve the bridge to good condition (NBI rating of 7 or more). The Local Bridge Program, a part of MDOT's Local Agency Program, defines bridge replacement as full replacement, which removes the entire bridge (superstructure, deck, and substructure) before re-building a bridge at the same location (Figure 6). The decision to perform a total replacement over rehabilitation (see below) should be made based on a life-cycle cost analysis. Generally, replacement is selected if rehabilitation would cost more than two-thirds of the cost of replacement. Replacement is generally the most expensive of the treatment options.

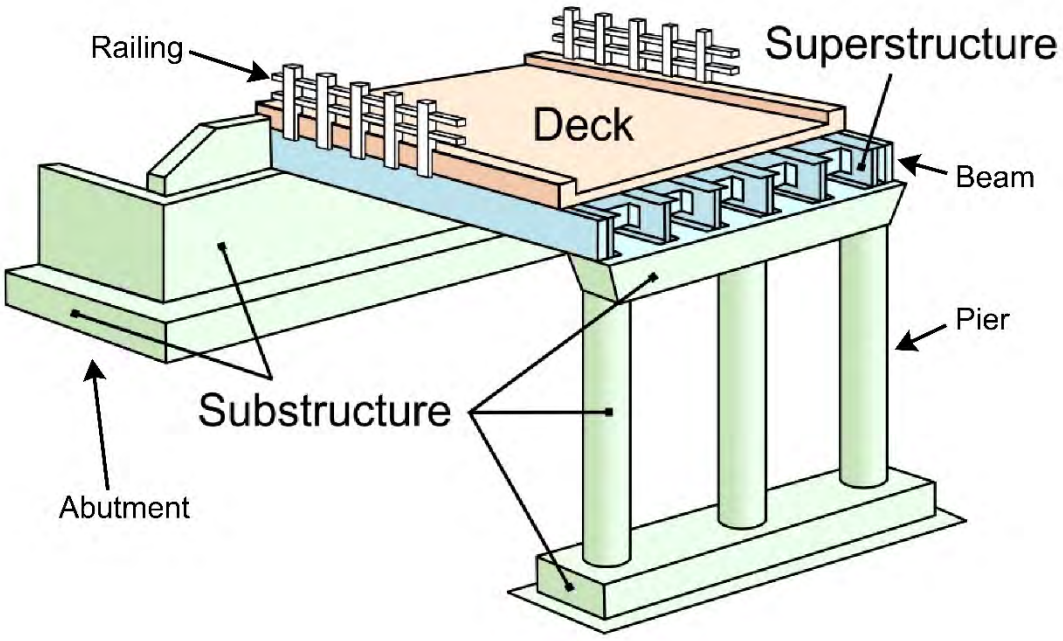


Figure 6: Diagram of Basic Elements of a Bridge

Rehabilitation

Rehabilitation involves repairs that improve the existing condition and extend the service life of the structure and the riding surface. Most often, rehabilitation options are associated with bridges that have degraded beyond what can be repaired with preventive maintenance. Rehabilitation is typically performed on poor-rated elements (NBI rating of 4 or less) to improve them to fair or good condition (NBI rating of 5 or more). Rehabilitation can include superstructure replacement (removal and replacement of beams and deck) or deck replacement. While typically more expensive than general maintenance, rehabilitation treatments may be more cost-effective than replacing the entire structure.

- **Railing retrofit/replacement:** A railing retrofit or replacement either reinforces the existing railing or replaces it entirely (Figure 6). This rehabilitation is driven by a need for safety improvements on poor-rated railings or barriers (NBI rating less than 5).

- **Beam repair:** Beam repair corrects damage that has reduced beam strength (Figure 6). In the case of steel beams, it is performed if there is 25 percent or more of section loss in an area of the beam that affects load-carrying capacity. In the case of concrete beams, this repair is performed if spalling (i.e., loss of material) exists on 50 percent or more of the beam ends.

- **Substructure concrete patching and repair:** Patching and repairing the substructure is essential to keep a bridge in service. These rehabilitation efforts are performed when the abutments or piers are fair or poor (NBI rating of 5 or 4), or if spalling and delamination affect less than 30 percent of the bridge surface.

Preventive Maintenance

The Federal Highway Administration (FHWA) *Bridge Preservation Guide* (2018) defines preventive maintenance as "a strategy of extending service life by applying cost-effective treatments to bridge elements…[that] retard future deterioration and avoid large expenses in bridge rehabilitation or replacements."

Preventive maintenance work is typically performed on bridges rated fair (NBI rating of 5 or 6) in order to slow the rate of deterioration and keep them from falling into poor condition.

- **Concrete deck overlay:** A concrete deck overlay involves removing and replacing the driving surface. Typically, this is done when the deck surface is in poor condition (NBI rating is less than 5) and the underneath portion of the deck is at least fair (NBI rating greater than 4). A shallow or deep concrete overlay may be performed depending on the condition of the bottom of the deck. The MDOT *Bridge Deck Preservation* matrices provide more detail on concrete deck overlays (see https://www.michigan.gov/mdot/0,4616,7-151-9625_24768_24773---,00.html).

- **Deck repairs:** Deck repairs include three common techniques: HMA overlay with or without waterproof membranes, concrete patching, deck sealing, crack sealing, and joint repair/replacement. An HMA overlay with an underlying waterproof membrane can be placed on bridge decks with a surface rating of fair or lower (NBI of 5 or less) and with deficiencies that cover between 15 and 30 percent of the deck surface and deck bottom. An HMA overlay without a waterproof membrane should be used on a bridge deck with a deck surface and deck bottom rating of serious condition or lower (NBI rating of 3 or less) and with deficiencies that cover greater than 30 percent of the deck surface and bottom; this is considered a temporary holdover to improve ride quality when a bridge deck is scheduled to undergo major rehabilitation within five years. All HMA overlays must be accompanied by an updated load rating. Patching of the concrete on a bridge deck is done in response to an inspector's work recommendation or when the deck surface is in good, satisfactory, or fair condition (NBI rating of 7, 6, or 5) with minor delamination and spalling. To preserve a good bridge deck in good condition, a deck sealer can be used.

  Deck sealing should only be done when the bridge deck has surface rating of fair or better (NBI of 5 or more). Concrete sealers should only be used when the top and bottom surfaces of the deck are free from major deficiencies, cracks, and spalling. An epoxy overlay may be used when between 2 and 5 percent of the deck surface has delaminations and spalls, but these deficiencies must be repaired prior to the overlay. An epoxy overlay may also be used to repair an existing epoxy overlay. Concrete crack sealing is an option to maintain concrete in otherwise good condition that has visible cracks with the potential of reaching the steel reinforcement. Crack sealing may be performed on concrete with a surface rating of good, satisfactory, or fair (NBIS rating of 7, 6, or 5) with minor surface spalling and delamination; it may also be performed in response to a work recommendation by an inspector who has determined that the frequency and size of the cracks require sealing.

- **Steel bearing repair/replacement:** Rather than sitting directly on the piers, a bridge superstructure is separated from the piers by bearings. Bearings allow for a certain degree of movement due to temperature changes or other forces. Repairing or replacing the bearings is considered preventive maintenance. Girders and a deck in at least fair condition (NBI of 5 or higher) and bearings in poor condition (NBI rating of 4 or less) identifies candidates for this maintenance activity.

- **Painting:** Re-painting a bridge structure can either be done in totality or in part. Total re-painting is done in response to an inspector's work recommendation or when the paint condition is in serious condition (NBI rating of 3 or less). Partial re-painting can either consist of zone re-painting, which is a preventive maintenance technique, or spot re-painting, which is scheduled maintenance (see below). Zone re-painting is done when less than 15 percent of the paint in a smaller area, or zone, has failed while the rest of the bridge is in good or fair condition. It is also done if the paint condition is fair or poor (NBI rating of 5 or 4).

- **Channel improvements:** Occasionally, it is necessary to make improvements to the waterway that flows underneath the bridge. Such channel improvements are driven by an inspector's work recommendation based on a hydraulic analysis or to remove vegetation, debris, or sediment from the channel and banks (Figure 6).

- **Scour countermeasures:** An inspector's work recommendations or a hydraulic analysis may require scour countermeasures (see the *Risk Management* section of this plan for more information on scour). This is done when a structure is categorized as scour critical and is not scheduled for replacement or when NBI comments in abutment and pier ratings indicate the presence of scour holes.

- **Approach repaving:** The approach to a bridge is the transition area between the roadway leading up to and away from the bridge and the bridge deck. Repaving the approach areas is performed in response to an inspector's work recommendation, when the pavement surface is in poor condition (NBI rating of 4 or less), or when the bridge deck is replaced or rehabilitated (e.g., concrete overlay).

- **Guardrail repair/replacement:** A guardrail is a safety feature on many roads and bridges that prevents or minimizes the effects of lane departure incidents. Keeping bridge guardrails in good condition is important. Repair or replacement of bridge guardrail should be done when a guardrail is missing or damaged, or when it needs a safety improvement.

Scheduled Maintenance

Scheduled maintenance activities are those activities or treatments that are regularly scheduled and intend to maintain serviceability while reducing the rate of deterioration.

- **Superstructure washing:** Washing the superstructure, or the main structure supporting the bridge, typically occurs in response to an inspector's work recommendation or when salt-

contaminated dirt and debris collected on the superstructure is causing corrosion or deterioration by trapping moisture.

- **Drainage system cleanout/repair:** Keeping a bridge's drainage system clean and in good working order allows the bridge to shed water effectively. An inspector's work recommendation may indicate the need for drainage system cleanout/repair. Signs that a drainage system needs cleaning or repair include clogs and broken, deteriorated, or damaged drainage elements.

- **Spot painting:** Spot painting is a form of partial bridge painting. This scheduled maintenance technique involves painting a small portion of a bridge. Generally, this is done in response to an inspector's work recommendation and is used for zinc-based paint systems only.

- **Slope repair/reinforcement:** The terrain on either side of the bridge that slopes down toward the channel is called the slope. At times, it is necessary to repair the slope. Situations that call for slope repair include when the slope is degraded, when the slope has significant areas of distress or failure, when the slope has settled, or if the slope is in fair or poor condition (NBI rating of 5 or less). Other times, it is necessary to reinforce the slope. Reinforcement can be added by installing Riprap, which is a side-slope covering made of stones. Riprap protects the stability of side slopes of channel banks when erosion threatens the surface.

- **Vegetation control and debris removal:** Keeping the area around a bridge structure free of vegetation and debris safeguards the bridge structure from these potentially damaging forces. Removing or restricting vegetation around bridges prevents damage to the structure. Vegetation control is done in response to an inspector's work recommendation or when vegetation traps moisture on structural elements or is growing from joints or cracks. Debris in the water channel or in the bridge can also cause damage to the structure. Removing this debris is typically done in response to an inspector's work recommendation or when vegetation, debris, or sediment accumulates on the structure or channel.

- **Miscellaneous repairs:** These are uncategorized repairs in response to an inspector's work recommendation.

1. BRIDGE ASSETS

Portage seeks to implement an asset management program for its bridge structures. This program balances the decision to perform reconstruction, rehabilitation, preventive maintenance, scheduled maintenance, or new construction, with Portage bridge funding in order to maximize the useful service life and to ensure the safety of the local bridges under its jurisdiction. In other words, the Portage bridge asset management program aims to preserve and/or improve the condition of its local bridge network within the means of its financial resources.

Nonetheless, Portage recognizes that limited funds are available for improving the bridge network. Since preservation strategies like preventive maintenance are generally a more effective use of these funds than costly alternative management strategies like major rehabilitation or replacement, Portage seeks to identify those bridges that will benefit from a planned maintenance program while addressing those bridges that pose usability and/or safety concerns.

The three-fold goal of the Portage asset management program is the preservation and safety of its bridge network, an increase of the useful service life of bridge assets by extending the time that bridges remain in good and fair condition, and reduction of future maintenance costs. To quantify these goals, Portage specifically aims to have to have 100% or more of the agency's local bridges in fair to good condition and to have less than 0% classify as structurally deficient over its five-year plan.

Thus, the Portage asset management plan objectives are:

- To establish the current condition of the Portage bridges
- To develop a “mix of fixes” that will:
    - Program scheduled maintenance actions to impede deterioration of bridges in good condition.
    - Implement selective corrective repairs or rehabilitation for degraded bridge elements order to restore functionality.
    - Identify and program eligible bridges in need of replacement.
- To identify available funding sources, such as:
    - Dedicated city resources
    - Funding through Michigan’s Local Bridge Program
    - Opportunities to obtain other funding
- To prioritize the programmed actions within available funding limitations
- To improve the condition of bridges currently rated poor (4 or lower) and/or preserve bridges currently rated fair (5 or higher) in their current condition in order to extend their useful service life.

Inventory

Portage is responsible for three local bridges. Table 2 summarizes Portage bridge assets by type, sizes by bridge type, and condition by bridge type. Additional inventory data, condition ratings, and proposed preventive maintenance actions for each bridge are contained in the tables in Appendixes 1, 2, and 3. The bridge inventory data was obtained from MDOT MiBRIDGE and other sources, and the 2022 condition data and maintenance actions are taken from the inspector's summary report (see Appendix 2).

Types

All three bridges in Portage are concrete bridges.

Locations and Sizes

Figure 7 illustrates the locations of bridge assets owned by Portage. Details about the locations and sizes of each individual asset can be found in the Portage MiBRIDGE database. For more information, please refer to the agency contact listed in the *Introduction* of this bridge asset management plan.

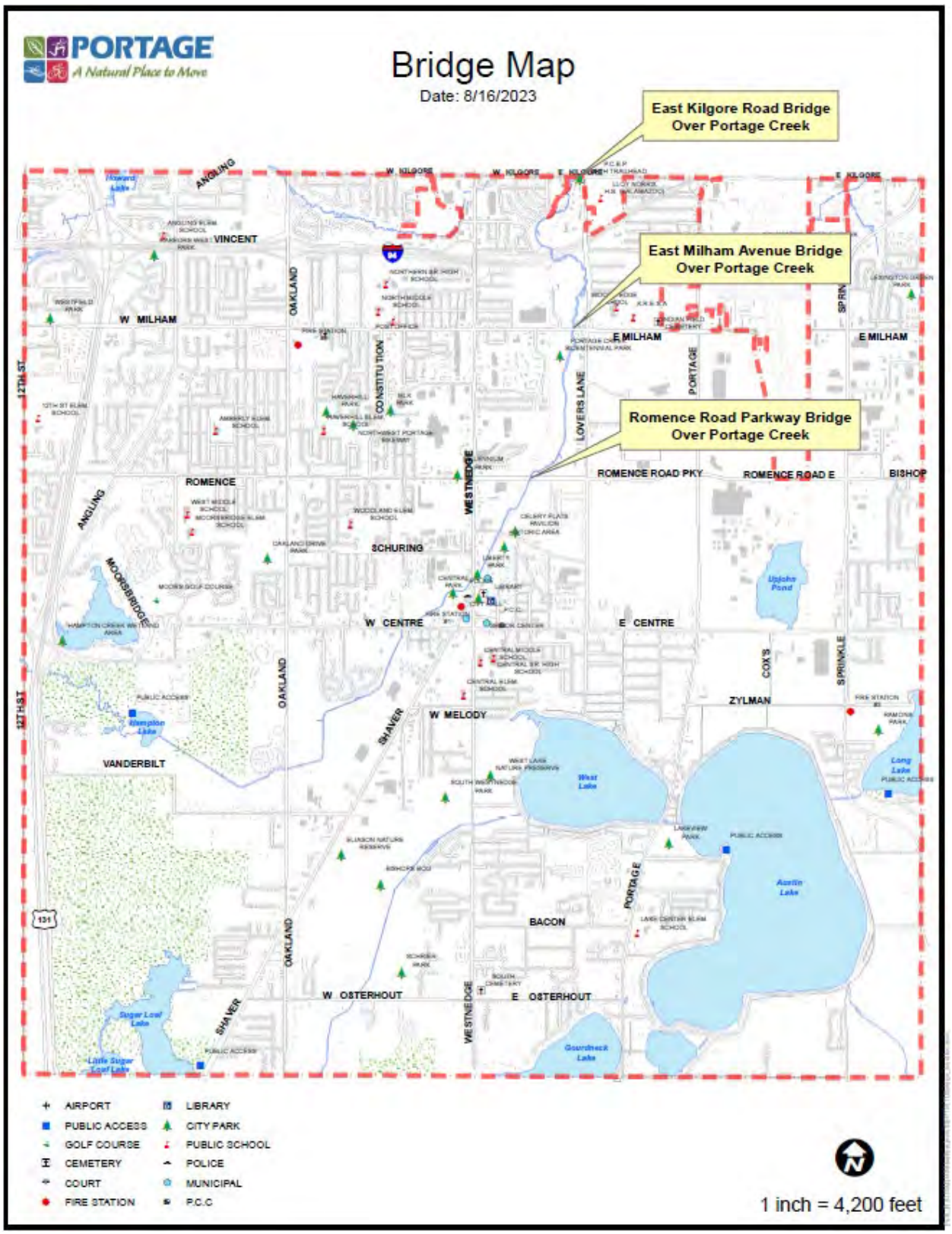


Figure 7: Map Illustrating Locations of Portage Bridge Assets

Condition

Portage evaluates its bridges according to the National Bridge Inspection Standards rating scale, with a rating of 9 to 7 being like new to good condition, a rating of 6 and 5 being fair condition, and a rating of 4 or lower being poor or serious/critical condition. All three bridges (100%) in Portage are in good condition.

Another layer of classification of the Portage bridge inventory classifies 0 (0%) bridges as structurally deficient, one (33%) bridge as posted, and 0 (0%) bridges as closed. Structurally deficient bridges are those with a deck, superstructure, substructure, and/or culvert rated as "poor" according to the NBI rating scale, with a load-carrying capacity significantly below design standards, or with a waterway that regularly overtops the bridge during floods. Posted bridges are those that have declined in condition to a point where a restriction is necessary for what would be considered a safe vehicular or traffic load passing over the bridge; designating a bridge as "posted" has no influence on its condition rating. Closed bridges are those that are closed to all traffic; closing a bridge is contingent upon its ability to carry a set minimum live load.

Table 2: Type, Size, and Condition of Portage Bridge Assets

Bridge	Bridge Type	Year Built	Total Deck Area (sq ft)	Condition: Structurally Deficient, Posted, or Closed			2021 Condition		
				Structurally Deficient	Posted	Closed	Poor	Fair	Good
ROMENCE ROAD	Concrete Box Beam	1992	4,862		X				X
MILHAM AVE	Concrete Culvert	1990	1,318						X
KILGORE ROAD	Concrete Culvert	2013	2,428						X

Statewide, MDOT's statistics for local agency bridges show that 14% are poor and 86% are good/fair, indicating that Portage has a percentage of poor bridges that has not been evaulated compared to the statewide average for local agencies. Correspondingly, Portage has 100% of its bridges in fair/good condition versus the statewide average of 86% for local agency bridges. Statewide, 8% of local agency bridge deck area classifies as structurally deficient compared to 0% of Portage bridge deck area.

Goals

The goal of the Portage asset management program is the preservation and safety of its bridge network; it also aims to extend the period of time that bridges remain in good and fair condition, thereby increasing their useful service life and reducing future maintenance costs.

Specifically, this goal translates into long-range goals of having 100% of its bridges rated fair/good and having less than 0% classified as structurally deficient within five years.

Several metrics will be used to assess the effectiveness of this asset management program. Portage will monitor and report the annual change in the number of its bridges rated fair/good (5 or higher) and the annual change in the number of its bridges classified as structurally deficient.

Based on past inspection records and condition ratings, Portage will establish a baseline of past performance by determining the average period of time that a bridge remains in good or fair condition. The performance

measure will be the increased average amount of time a bridge is in the good or fair condition status after implementation of the asset management strategy when compared to the baseline time before implementation.

Prioritization, Programmed/Funded Projects, and Planned Projects

Prioritization

The Portage asset management program aims to address the structures of critical concern by targeting elements rated as being in poor condition and to improve and maintain the overall condition of the bridge network to good or fair condition through a "mix of fixes" strategy. Portage prioritizes bridges for projects by evaluating five factors and weighting them as follows:

- Condition – 30%
- Load Capacity – 10%
- Traffic – 10%
- Safety – 40%
- Detour – 10%

Several components within each factor determine a score. Each project under consideration is scored, which is then compared with other proposed projects to establish a priority order.

Portage annually reviews the current condition of each of its bridges using the NBIS inspection data contained in the *MDOT Bridge Safety Inspection Report* and the inspector's work recommendations contained in MDOT's *Bridge Inspection Report*. The inspection inventory and condition data are consolidated in spreadsheet format for Portage bridges in Appendix 1. Portage then determines management and preservation needs and corresponding actions for each bridge (Appendix 2), as well as inspection follow-up actions (Appendix 3). The management and preservation actions are selected in accordance with criteria contained in the *Summary of Preservation Criteria* table (below) and adapted to the Portage bridge network.

Table 3: Summary of Preservation Criteria

Preservation Action	Bridge Selection Criteria	Expected Service Life
Replacement		
Total Replacement	• NBI rating of 3 or less [1] [2] • *OR* Cost of rehabilitation exceeds cost of replacement [1] • *OR* Bridge is scour critical with no counter-measures available [1]	70 years
Rehabilitation		

Table 3: Summary of Preservation Criteria		
Preservation Action	**Bridge Selection Criteria**	**Expected Service Life**
Superstructure Replacement	• NBI rating of 4 or less for the superstructure [1] [2] • *OR* Cost of superstructure and deck rehabilitation exceeds cost of replacement [1]	40 years [1]
Deck Replacement Epoxy Coated Steel Black Steel	• Use guidelines in MDOT's Bridge Deck Preservation Matrix [3] [4] • NBI rating of 4 or less for the deck surface and deck bottom [1] [2] • Deck bottom has more than 25% total area with deficiencies [1] • *OR* Replacement cost of deck is competitive with rehabilitation [1]	60+ years [3] [4]
Substructure Replacement (Full or Partial)	• NBI rating of 4 or less for abutments, piers, or pier cap [1] [2] • Has open vertical cracks, signs of differential settlement, or active movement [1] • Pontis rating of 3 or 5 for more than 30 percent of the substructure [1] [5] • *OR* Bridge is scour critical with no counter-measures available	40 years [1*]
Steel Beam Repair	• More than 25% section loss in an area of the beam that affects load carrying capacity [1] • *OR* To correct impact damage that impairs beam strength [1]	40 years [1*]
Prestressed Concrete Beam Repair	• More than 5% spalling at ends of prestressed I-beams [1] • *OR* Impact damage that impairs beam strength or exposes prestressing strands [1]	40 years [1*]
Substructure Concrete Patching and Repair	• NBI rating of 5 or 4 for abutments or piers, and surface has less than 30% area spalled and delaminated [1] [2] • *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 [1] [5] • *OR* In response to inspector's work recommendation for substructure patching [1]	
Abutment Repair/Replacement	• NBI rating of 4 or less for the abutment [1] [2] • *OR* Has open vertical cracks, signs of differential settlement, or active movement	
Railing/Barrier Replacement	• NBI rating greater than 5 for the deck [1] [2] • NBI rating less than 5 for the railing with more than 30% total area having deficiencies [1] [2] • *OR* Pontis rating is 4 for railing [1] [5] • *OR* Safety improvement is needed [1]	
Culvert Repair/Replacement	• 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	• NBI rating is 5 or less for deck surface, and deck surface has more than 15% area with deficiencies [1] [2] • NBI rating of 4 or 5 for deck bottom, and deck bottom has between 5% and 30% area with deficiencies [1] [2] • *OR* In response to inspector's work recommendation [1]	12 years
Deep Concrete Deck Overlay	• NBI rating of 5 or less for deck surface, and deck surface has more than 15% area with deficiencies [1] [2]	25 years

Table 3: Summary of Preservation Criteria		
Preservation Action	**Bridge Selection Criteria**	**Expected Service Life**
	• NBI deck bottom rating is 5 or 6, and deck bottom has less than 10% area with deficiencies [1] [2] • *OR* In response to inspector's work recommendation [1]	
HMA Overlay with Waterproofing Membrane	• NBI rating of 5 or less for deck surface, and both deck surface and bottom have between 15% and 30% area with deficiencies [1] [2] • *OR* Bridge is in poor condition and will be replaced in the near future and the most cost-effective fix is HMA overlay [1]	
HMA Overlay Cap without Membrane	• 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. [1] [2]	3 years
Concrete Deck Patching	• NBI rating of 5, 6, or 7 for deck surface, and deck surface has between 2% and 5% area with delamination and spalling [1] [2] • *OR* In response to inspector's work recommendation [1]	5 years
Steel Bearing Repair/Replacement	• NBI rating of 5 or more for superstructure and deck, and NBI rating 4 or less for bearing [2]	
Deck Joint Replacement	• Always include when doing deep or shallow concrete overlays [1] • NBI rating of 4 or less for joints [1] [2] • *OR* Joint leaking heavily [1] • *OR* In response to inspector's work recommendation for replacement [1]	
Pin and Hanger Replacement	• NBI rating of 4 or less for superstructure for pins and hangers [1] [2] • Pontis rating of 1, 2, or 3 for a frozen or deformed pin and hanger [1] [5] • *OR* Presence of excessive section loss, severe pack rust, or out-of-plane distortion [1]	15 years
Zone Repainting	• NBI rating of 5 or 4 for paint condition, and paint has 3% to 15% total area failing [1] [2] • *OR* During routine maintenance on beam ends or pins and hangers [1] • *OR* less than 15% of existing paint area has failed and remainder of paint system is in good or fair condition [1]	10 years
Complete Repainting	• NBI rating of 3 or less for paint condition [1] [2] • *OR* Painted steel beams that have greater than 15% of the existing paint area failing [1]	
Partial Repainting	• See Zone or Spot Painting	
Channel Improvements	• Removal of vegetation, debris, or sediment from channel and banks to improve channel flow • *OR* in response to inspector's work recommendation	
Scour Countermeasures	• Pontis scour rating of 2 or 3 and is not scheduled for replacement [1] [5] • OR NBI comments in abutment and pier ratings indicate presence of scour holes [1] [2]	

Table 3: Summary of Preservation Criteria		
Preservation Action	**Bridge Selection Criteria**	**Expected Service Life**
Approach Repaving	• 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: o Abutment spalling under bearings [1] o Beam end contact [1] o Closed expansion joints and/or pin and hangers [1] o Damaged railing and deck fascia at joints [1] o Cracking in deck at reference line (45 degree angle) [1]	
Guard Rail Repair/Replacement	• Guard rail missing or damaged [2*] • *OR* Safety improvement is needed [2*]	
Scheduled Maintenance		
Superstructure Washing	• When salt contaminated dirt and debris collected on superstructure is causing corrosion or deterioration by trapping moisture [1] • *OR* Expansion or construction joints are to be replaced and the steel is not to be repainted [1] • *OR* Prior to a detailed replacement [1] • *OR* In response to inspector's work recommendation [1]	2 years
Drainage System Clean-Out/Repair	• When drainage system is clogged with debris [1] • *OR* Drainage elements are broken, deteriorated, or damaged [1] • *OR* NBI rating comments for drainage system indicate need for cleaning or repair [1] [2]	2 years
Spot Repainting	• 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 [1] • *OR* In response to inspector's work recommendation [1]	5 years
Slope Paving Repair	• NBI rating is 5 or less for slope protection [1] [2] • *OR* Slope is degraded or sloughed • *OR* Slope paving has significant areas of distress, failure, or has settled [1]	
Riprap Installation	• To protect surface when erosion threatens the stability of side slopes of channel banks	
Vegetation Control	• When vegetation traps moisture on structural elements [1] • *OR* Vegetation is growing from joints or cracks [1] • *OR* In response to inspector's work recommendation for brush cut [1]	1 year
Debris Removal	• When vegetation, debris, or sediment accumulates on the structure or in the channel • *OR* In response to inspectors work recommendation	1 year
Deck Joint Repair	• Do not repair compression joint seals, assembly joint seals, steel armor expansions joints, and block out expansion joints; these should always be replaced. [1] • NBI rating is 5 for joint [1] [2] • *OR* In response to inspector's work recommendation for repair [1]	
Concrete Sealing	• Top surface of pier or abutments are below deck joints and, when contaminated with salt, salt can collect on the surface [1]	

Table 3: Summary of Preservation Criteria		
Preservation Action	**Bridge Selection Criteria**	**Expected Service Life**
	• *OR* Surface of the concrete has heavy salt exposure. Horizontal surfaces of substructure elements are directly below expansion joints [1]	
Concrete Crack Sealing	• Concrete is in good or fair condition, and cracks extend to the depth of the steel reinforcement [1] • *OR* NBI rating of 5, 6, or 7 for deck surface, and deck surface has between 2% and 5% area with deficiencies [1] [2] • *OR* Unsealed cracks exist that are narrow and/or less than 1/8" wide and spaced more than 8' apart [1] • *OR* In response to inspector's work recommendation [1]	5 years
Minor Concrete Patching	• Repair minor delaminations and spalling that cover less than 30% of the concrete substructure [1] • *OR* NBI rating of 5 or 4 for abutments or piers, and comments indicate that their surface has less than 30% spalling or delamination [1] [2] • *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 [1] [5] • *OR* In response to inspector's work recommendation [1]	
HMA Surface Repair/Replacement	• HMA surface is in poor condition • *OR* In response to inspector's work recommendation	
Seal HMA Cracks/Joints	• 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	• NBI rating of 4 or less for substructure for timber members • *OR* To repair extensive rot, checking, or insect infestation	
Miscellaneous Repair	• Uncategorized repairs in response to inspector's work recommendation	

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

[1] MDOT, *Project Scoping Manual*, MDOT, 2019.

[2] MDOT, *MDOT NBI Rating Guidelines*, MDOT, 2017.

[3] MDOT, *Bridge Deck Preservation Matrix - Decks with Uncoated "Black" Rebar*, MDOT, 2017.

[4] MDOT, *Bridge Deck Preservation Matrix - Decks with Epoxy Coated Rebar*, 2017.

[5] MDOT, *Pontis Bridge Inspection Manual*, MDOT, 2009.

* From source with interpretation added.

In terms of management and preservation actions, the Portage asset management program uses a "mix of fixes" strategy that is made up of preventive maintenance and scheduled maintenance.

> **Replacement** involves substantial changes to the existing structure, such as bridge deck replacement, superstructure replacement, or complete structure replacement, and is intended to improve critical or closed bridges to a good condition rating.

Rehabilitation is undertaken to extend the service life of existing bridges. The work will restore deficient bridges to a condition of structural or functional adequacy and may include upgrading geometric features. Rehabilitation actions are intended to improve the poor or fair condition bridges to fair or good condition.

Preventive maintenance work will improve and extend the service life of fair bridges and will be performed with the understanding that future rehabilitation or replacement projects will contain appropriate safety and geometric enhancements. Preventive maintenance projects are directed at limited bridge elements that are rated in fair condition with the intent of improving these elements to a good rating. Most preventive maintenance projects will be one-time actions in response to a condition state need. Routine preventive work will be performed by the agency's in-house maintenance crews while larger, more complex work will be contracted.

The City of Portage's **scheduled maintenance** program is an integral part of the preservation plan and is intended to extend the service life of fair and good structures by preserving the bridges in their current condition for a longer period of time. Scheduled maintenance is proactive and not necessarily condition driven. In-house maintenance crews often perform much of this work.

Certain of the severely degraded and structurally deficient bridges require replacement or major rehabilitation. Several of the remaining bridges require one-time preventive maintenance actions to repair defects and restore the structure to a higher condition rating. Most bridges are included in a scheduled maintenance plan with appropriate maintenance actions programmed for groups of bridges of similar material and type, bundled by location.

The replacement, rehabilitation, and preventive maintenance projects are generally eligible for funding under the local bridge program, and any requests for funding will be submitted with Portage annual applications.

To achieve its goals, a primary objective of the Portage asset management program is improvement of bridges rated poor (4 or lower) to a rating of fair (5) or higher and/or preservation of bridges currently rated fair (5) or higher in their current condition within a five-year time period through management and/or preservation activities. A bridge-by-bridge preservation—or maintenance—plan is presented in the Appendix 4.

Programmed/Funded Projects

Portage budgets $2,500 in total funding per year for the years 2023-2025. To achieve its goals, Portage plans to invest $1,000-$2,500 per year on preventive maintenance of bridges. The Romence Road Parkway bridge over Portage Creek is scheduled for improvemetns in coordination with the Romence Road Parkway road project in 2025. Bridge improvements include replacement of guardrail, hand chipping, concrete patchwork, surface coating, and epoxy overlay. Portage does not plan to replace any bridges. By performing the aforementioned preventive maintenance and rehabilitation, Portage will meet its overall bridge network condition goals.

Portage 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 counter-measures, and so forth, are computed on a bridge-by-bridge basis. The cost estimates are reviewed and updated annually. A summary of the programmed/funded projects and investments can be found in Table 4, the Cost Projection table, below.

Planned Projects

Portage identifies additional priority projects that remain unfunded. These are identified according to high, medium, and low priority in Table 4.

Table 4: Cost Projection Table

Strategy	2023	2024	2025
New	$0	$0	$0
Replacement	$0	$0	$0
Rehabilitation	$0	$0	$45,000
Scheduled Maintenance	$2,500	$2,500	$2,500
Preventive Maintenance	$0	$0	$0

2. FINANCIAL RESOURCES

Anticipated Revenues

Portage does not plan to submit any projects for funding at this time as the bridges in Portage are in good condition and only preventive maintenance projects are needed at this time.

Anticipated Expenses

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 the agency's annual operating budget.

3. RISK MANAGEMENT

Portage recognizes that the potential risks associated with bridges generally fall into several categories:

- Personal injury and property damage resulting from a bridge collapse or partial failure.
- Loss of access to a region or individual properties resulting from bridge closures, restricted load postings, or extended outages for rehabilitation and repair activities; and
- Delays, congestion, and inconvenience due to serviceability issues, such as poor-quality riding surface, loose expansion joints, or missing expansion joints.

Portage addresses these risks by implementing regular bridge inspections and a preservation strategy consisting of preventive maintenance.

Portage administers the biennial inspection of its bridges in accordance with NBIS and MDOT requirements. The inspection reports document the condition of Portage bridges and evaluates them in order to identify new defects and monitor advancing deterioration. The summary inspection report in Appendix 1 identifies items needing follow-up, special inspection actions, and recommended bridge-by-bridge maintenance activities.

Bridges that are considered "scour critical" pose a risk to the Portage road and bridge network. Scour is the depletion of sediment from around the foundation elements of a bridge commonly caused by fast-moving water. According to MDOT's *Michigan Structure Inventory and Appraisal Coding Guide*, a scour critical bridge is one that has unstable abutment(s) and/or pier(s) due to observed or potential (based on an evaluation study) scour. Bridges receiving a scour rating of 3 or less are considered scour critical. Portage has a scour critical rating of 8 for all three of its bridges, which are listed in Table 5.

Table 5: Scour Critical Bridges

Bridge	Scour Critical Rating
Romence Road	8
Milham Avenue	8
Kilgore Road	8

Portage has one bridge that is posted, meaning it is critical to accessing entire areas or individual properties within its jurisdiction. This bridge is listed in Table 6.

Table 6: Posted/Closed Bridges that are Critical Links

Bridge	P/C	Comments
Milham Avenue	Posted	31 tons/1 unit vehicles 52 tons/2 unit vehicles 70 tons/3 unit vehicles

The preservation strategy identifies actions in the operations and maintenance plan that are preventive or are responsive to specific bridge conditions. The actions are prioritized to correct critical structural safety and traffic issues first, and then to address other needs based on the operational importance of each bridge and the long-term preservation of the network. The inspection results serve as a basis for modifying and updating the operations and maintenance plan annually.

4. BRIDGE INSPECTIONS

Portage 2021 Bridge Inspection Report Summary

General Recommendations

- Update ADT Counts for Milham Avenue and Romence Road
- Romence Road over Portage Creek: Elevations required next in 2026.
- Milham Avenue over Portage Creek: Elevations required next in 2026.
- Kilgore Road over Portage Creek: Elevations required next in 2026.

4688 Romence Road over Portage Creek

Constructed: 1992 **Reconstructed:** N/A **General Condition:** Good

Description: Two-span (54 feet, 26 feet) concrete box beam with concrete deck and bituminous approaches. The box beams bear on elastomeric bearings on a concrete pier and concrete abutments.

Condition:

Nomenclature: Spans numbered west to east; beams numbered north to south by Span-Beam-End-Side-Defect-Details, 20 beams total per span; piers numbered east to west and columns north to south; by Pier-Part-Face-Defect-Details, 1 pier total

- Multiple longitudinal cracking across entire concrete deck surface.
- Deterioration of approach at reference lines was patched.
- Consistent cracking every 3–4 feet across South bridge railing. Crack lines up with bolts in one location of South rail.
- Spall in top of rail in NE Quadrant.
- Slight impact damage to guardrail in Southwest quadrant.
- Guardrail in Northeast & Northwest quadrants too low to ground.
- Minor efflorescence East side between: Beams 14 & 15, 6 FT; Beams 15 & 16, 6 FT; and Beams 16 & 17, 12 FT.
- Spalling/Honeycombing of underside of pier cap at North end.
- Pier cap wet on east side from leakage through beam joints.

Maintenance Recommendations:

- Clean out expansion joint to allow for movement.
- Raise guardrail in Northeast & Northwest quadrants.
- Apply healer sealer to deck to preserve condition.
- Update ADT counts- The SI&A form indicates current ADT year 1993 count 10000 & future ADT year 2015 count 20000.

4689 Milham Avenue over Portage Creek

Constructed: 1990 **Reconstructed:** Resurfaced 2021 **General Condition:** Good

Description: Single 20’ span three-sided concrete Conspan culvert with bituminous overlay

Condition:

Nomenclature: Precast sections numbered north to south. 8 sections total.

- Buried cable and guardrail end section too low in Southeast quadrant.
- Erosion in Northwest quadrant behind storm drain casting.
- Spalling and leakage at the North and South curb lines between sections 1 & 2 and 7 & 8.
- Leakage at all weepholes.

Maintenance Recommendations:

- Review guardrail improvements and make changes as necessary.
- Update ADT counts- The SI&A form indicates current ADT year 1998 count 18009 & future ADT year 2010 count 16000.

4690 Kilgore Road over Portage Creek

Constructed: 2013 **Reconstructed:** N/A **General Condition:** Good

Description: Single 27.5’ span by 88.29’ long three-sided Conspan culvert with 48’ curb to curb bituminous roadway on fill

Condition:

Nomenclature: Sections (12 total) numbered downstream to upstream; by Section-Side-Defect-Details

- Bituminous approach pavement was patched on east side.
- Spall of curb at drain casting in SW quadrant.
- Railing minor cracks in concrete at posts.
- Burn mark on section 10, east side. Speculated to be from cutting torch before placement.

Maintenance Recommendations:

- Patch spall in curb at SW drain casting.
- Remove filter fabric from catch basin in southeast quadrant.

Appendix 1

Inventory Data												Inspection Findings												Appraisal			
Bridge Type	Structure Number	Facility Carried	Features Intersected	Primary or Secondary Route	Structure Type Main Span (Item 43A - Material)	Structure Type Main Span (Item 43B)	Number of Main Span (Item 45)	Total Str Length (Item 49)	Year Built (Item 27)	ADT	Year of ADT	Inspection Date	Operational Status (Item 41)	Deck Rating (Item 58)	Deck Bottom Rating (Item XX)	Super Str Rating (Item 59)	Substr Rating (Item 60)	Channel Rating (Item 61)	Culvert Rating (Item 62)	Surface Rating (Item 58A)	Paint Rtg	Exp Joint Rating (Item XX)	Other Joints	Structure Evaluation	Structurally Deficient	Section Loss	Scour Critical (Item 113)
Concrete Box Beam	4688	ROMENCE ROAD	PORTAGE CREEK	Primary	2	5	2	79.7	1992	10000	1993	9/24/2021	A	8	N	8	8	8	N	7	N	7	G	G	Funct Obs	N	8
Concrete Culvert	4689	MILHAM AVE	PORTAGE CREEK	Primary	1	19	1	21.6	1990	18009	1988	9/24/2021	P	N		N	N	8	7					G	Funct Obs		8
Concrete Culvert	4690	KILGORE ROAD	PORTAGE CREEK	Primary	1	19	1	27.5	2013	15000	2013	9/24/2021	A	N		N	N	7	9					G	Funct Obs		8

Appendix 2

Inventory Data										Rehabilitation	Proposed Scheduled Maintenance							
Bridge Type	Structure Number	Facility Carried	Features Intersected	Structure Type Main Span (Item 43A - Material)	Structure Type Main Span (Item 43B)	Number of Main Span (Item 45)	Total Str Length (Item 49)	Total Str Width (Item 52)	Total Str (sq ft)	Deep Overlay	Vegetation Control	Clean Drainage System	Seal HMA Cracks /Joints	Seal Concrete Cracks/ Joints	Minor Concrete Patching	Repair/ Replace Guardrails	Repair Slopes	Install RipRap
Concrete Box Beam	**4688**	ROMENCE ROAD	PORTAGE CREEK	2	5	2	79.7	61	4862		X	X		X	X	X		
Concrete Culvert	**4689**	MILHAM AVE	PORTAGE CREEK	1	19	1	21.6	61	1318	X	X	X	X	X			X	
Concrete Culvert	**4690**	KILGORE ROAD	PORTAGE CREEK	1	19	1	27.5	88.3	2428		X	X	X	X				X

Appendix 3

Inventory Data										Inspection Items		
Bridge Type	Structure Number	Facility Carried	Features Intersected	Structure Type Main Span (Item 43A - Material)	Structure Type Main Span (Item 43B)	Number of Main Span (Item 45)	Total Str Length (Item 49)	Total Str Width (Item 52)	Total Str (sq ft)	Review Scour Criticality	Load Rating	Update SIA
Concrete Box Beam	**4688**	ROMENCE ROAD	PORTAGE CREEK	2	5	2	79.7	61	4862	X	X	X
Concrete Culvert	**4689**	MILHAM AVE	PORTAGE CREEK	1	19	1	21.6	61	1318	X	X	X
Concrete Culvert	**4690**	KILGORE ROAD	PORTAGE CREEK	1	19	1	27.5	88.3	2428	X		X

Appendix C

Culvert Asset Management Plan Supplement

Culvert Primer

Culverts are structures that lie underneath roads, enabling water to flow from one side of the roadway to the other (Figure C-1 and Figure C-2). The important distinguishing factor between a culvert and a bridge is the size. Culverts are considered anything under 20 feet while bridges, according to the Federal Highway Administration, are 20 feet or more. While similar in function to storm sewers, culverts differ from storm sewers in that culverts are open on both ends, are constructed as straight-line conduits, and lack intermediate drainage structures like manholes and catch basins. Culverts are critical to the service life of a road because of the important role they play in keeping the pavement layers well drained and free from the forces of water building up on one side of the roadway.

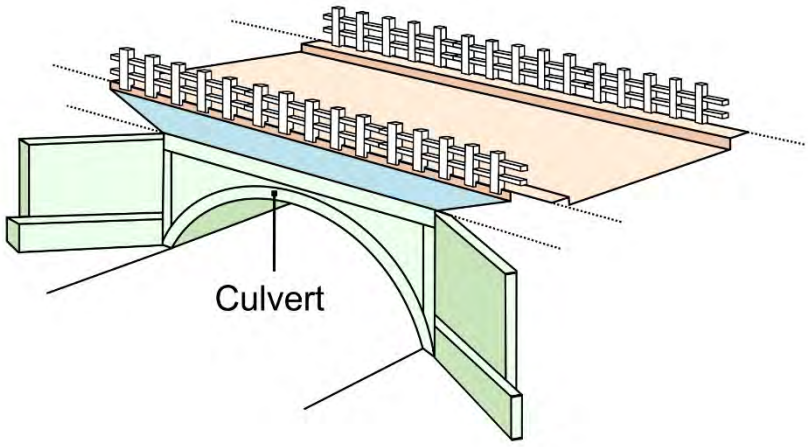


Figure C-1: Diagram of a culvert structure

Figure C-2: Examples of culverts. Culverts allow water to pass under the roadway (left), they are straight-line conduits with no intermediate drainage structures (middle), and they come in various materials (left: metal; middle and right: concrete) and shapes (left: arch; middle: round; right: box).

Culvert Types

Michigan conducted its first pilot data collection on local agency culverts in the state in 2018. Of almost 50,000 culverts inventoried as part of the state-wide pilot project, the material type used for constructing culverts ranged from (in order of predominance) corrugated steel, concrete, plastic, aluminum, and masonry/tile, to timber materials. The shapes of the culverts were (in order of predominance) circular, pipe arch, arch, rectangular, horizontal ellipse, or box. The diameter for the majority of culverts ranged from less than 12 inches to 24 inches; a portion, however, ranged from 30 inches to more than 48 inches.

Culvert Condition

Several culvert condition assessment practices exist. The FHWA has an evaluation method in its 1986 *Culvert Inspection Manual*. In conjunction with descriptions and details in the Ohio Department of Transportation's 2017 *Culvert Inspection Manual* and Wisconsin DOT's *Bridge Inspection Field Manual*, the FHWA method served as the method for evaluating Michigan culverts in the pilot. In 2018, Michigan local agencies participated in a culvert pilot data collection, gathering inventory and condition data; full detail on the condition assessment system used in the data collection can be found at https://www.michigan.gov/documents/tamc/TAMC_2018_Culvert_Pilot_Report_Complete_634795_7.pdf.

The Michigan culvert pilot data collection used a 1 through 10 rating system, where 10 is considered a new culvert with no deterioration or distress and 1 is considered total failure. Each of the different culvert material types requires the assessment of features unique to that material type, including structural deterioration, invert deterioration, section deformation, blockage(s) and scour. Corrugated metal pipe, concrete pipe, plastic pipe, and masonry culverts require an additional assessment of joints and seams. Slab abutment culverts require an additional assessment of the concrete abutment and the masonry abutment. Assessment of timber culverts only relied on blockage(s) and scour. The assessments come together to generate condition rating categories of good (rated as 10, 9, or 8), fair (rated as 7 or 6), poor (rated as 5 or 4), or failed (rated as 3, 2, or 1).

Portage is using the following condition assessment for rating culverts during inspection, which is included on the inspection forms used in the field.

1 Emergency action required, re-route traffic and close.

2 Highest priority, discontinue other work if required, emergency basis.

3 High priority, schedule as soon as possible in current season.

4 Review work plan for relative priority and adjust schedule if possible, for current season.

5 Schedule current season at first reasonable opportunity.

6 Add to work scheduled for completion by end of next season.

7 No immediate plan for repair, examine possibility of increased level of inspection.

8 No repairs needed, list specific items for close inspection during next regular inspection.

9 No repairs needed.

10 New culvert.

In 2021 and 2022, Portage contracted with an engineering firm to do more thorough inspections on 21 culverts in the City. Most of the culverts chosen were large diameter, identified as critical infrastructure based on location and/or part of significant storm drainage features, such as the Consolidated Drain. These culverts and ratings are shown in Table C-1.

Road/Address	Type	Shape	Length (ft.)	Width/ Dia(ft.)	Flowline	Culvert Condition	Culvert ID	Notes
S Westnedge Ave.	MP	Multi	515	Multi	E	3	CU-15-04-004	Consolidated Drain @ Garden Lane
Romence Rd.	MP	C	68	6	SE	6	CU-16-01-001	Consolidated Drain, West of S Westnedge
11602 Graden Lane	MP	C	60	3	N	7	CU-15-04-001	Portage Creek, East of S Westnedge
11602 Graden Lane	MP	A	50	61" X 84"	N	2	CU-15-04-002	Consolidated Drain, East of S Westnedge
11602 Graden Lane	MP	A	150	62" X 86"	E	3	CU-15-04-003	Consolidated Drain, East of S Westnedge
11602 Graden Lane	Multi	Multi	515	6	E	3	CU-15-04-004	Consolidated Drain, East of S Westnedge
S Westnedge Ave.	Slab	Slab	82	17	E	6		Portage Creek, North of Shaver Rd @ Liberty Park
E Centre Ave.	MP	A		8.2" X 6"	N	7	CU-16-02-001	Portage Creek, West of Perry St
Oakland Dr.	BC	R	55	Multi	E	7	CU-20-02-001	Portage Creek, South of Katie Ct
S Westnedge Ave.	BC	R	53	36"	E	N/A	CU-28-01-001	Sugarloaf Drain, South of S Shore
Portage Rd.	Bridge	Br	68	6	SE	4	CU-26-04-001	Connection to Austin Lake, South of Dixie Drive
E Shore Dr.	CP	C	155	5	E	N/A	CU-25-01-001	Connection to Long Lake, North of Branch Ave
E Shore Dr.	Multi	A	100	5'W X 4'H	SE	7	CU-36-01-001	Austin Lake Consolidated Drain, East of E Shore
W Osterhout Ave.	MP	C	67	3	NS	7	CU-33-03-001	East of Oakland drive - Austin Extension Drain
Oakland Dr.	MP	A	110	8	E	8	CU-05-01-001	West Fork, South of Kilgore Rd
W. Fork Xing	BC	R	55	16	E	7	CU-04-01-001	West Fork, North of Market Place
S Westnedge Ave.	BC	R	180	12	E	7	CU-04-01-002	West Fork, South of Old Kilgore
Old Kilgore Rd.	Multi	C	60	6.5	N	7	CU-03-04-001	West Fork, East of S Westnedge
Meredith	BC	R	100	10	W	8	CU-01-02-004	Lexington Green Drain, South of Sprinkle Rd
Vanderbilt Ave.	BC	R	55	12	N	7	CU-19-02-001	Portage Creek, East of Angling Rd
Angling	CP	C	70	4	E	6	CU-19-04-002	Portage Creek, South of W Centre, Adjacent to US-131

Table C-1: Culverts Inspected in 2021 and 2022

Figure C-3 includes a map of the culverts in Portage. A pdf map that can be zoomed in for better visibility can be provided by contacting the Department of Transportation & Utilities.

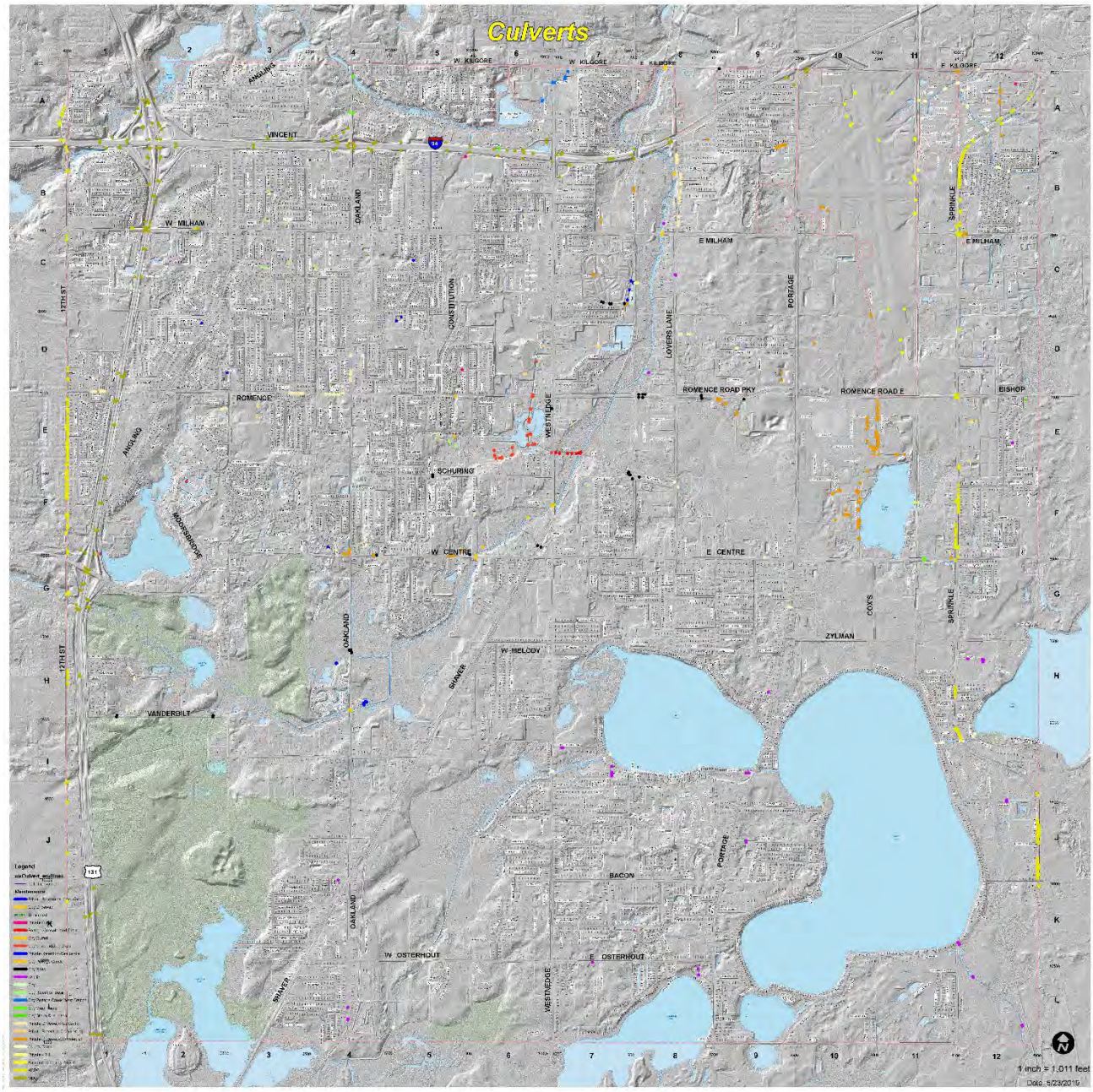


Figure C-3: Map of Culverts in Portage

Culvert Treatments

The *MDOT Drainage Manual* addresses culvert design and treatments. Of most importance to the longevity of culverts is regular cleaning to prevent clogs. More extensive treatments may include re-positioning the pipe to improve its grade and lining a culvert to achieve more service life after structural deterioration has begun.

Appendix D

Traffic Signals Asset Management Plan Supplement

Traffic Signals Primer

Traffic Signal Types

Electronic traffic control devices come in a large array of configurations, which include case signs (e.g., keep right/left, no right/left turn, reversible lanes), controllers, detection (e.g., cameras, push buttons), flashing beacons, interconnects (e.g., DSL, fire station, phone line, radio), pedestrian heads (e.g., hand-man), and traffic signals. The Portage traffic signal system has 54 traffic signals, 26 school/pedestrian flashing beacons, 49 pedestrian signals and 5 speed feedback signs. This asset management plan focuses on traffic signals (Figure D-1) as a functioning unit and does not consider other electronic traffic control devices.

Traffic Signal Condition

Traffic signal assessment considers the functioning of basic tests on a pass/fail basis. These tests include battery backup testing, components testing, conflict monitor testing, radio testing, and underground detection.

Traffic Signal Maintenance

Traffic signals are maintained in accordance with the *Michigan Manual on Uniform Traffic Control Devices*. Maintenance of traffic signals includes regular maintenance of all components, cleaning and servicing to prevent undue failures, immediate maintenance in the case of emergency calls, and provision of stand-by equipment.

Portage has historically contracted with a private contractor annually for the maintenance of its traffic signal system. Maintenance of the city's system includes traffic control signals of all types, poles, mast arms, light emitting diode signal heads, overhead street name signs, pedestrian pushbutton pedestals and signals, underground loop detectors for signal actuation, overhead video detection, fiber optic cable, permanent traffic count stations and battery back-up power systems.

APPENDIX E

GLOSSARY & ACRONYMS

Glossary

Alligator cracking: Cracking of the surface layer of an asphalt pavement that creates a pattern of interconnected cracks resembling alligator hide. This is often due to overloading a pavement, sub-base failure, or poor drainage.[1]

Asset management: A process that uses data to manage and track road assets in a cost-effective manner using a combination of engineering and business principles. Public Act 325 of 2018 provides a legal definition: "an ongoing process of maintaining, preserving, upgrading, and operating physical assets cost effectively, based on a continuous physical inventory and condition assessment and investment to achieve established performance goals".[2]

Biennial inspection: Inspection of an agency's bridges every other year, which happens in accordance with National Bridge Inspection Standards and Michigan Department of Transportation requirements.

Bridge inspection program: A program implemented by a local agency to inspect the bridges within its jurisdiction systematically in order to ensure proper functioning and structural soundness.

Capital preventative maintenance: Also known as CPM, a planned set of cost-effective treatments to address of fair-rated infrastructure before the structural integrity of the system has been severely impacted. These treatments aim to slow deterioration and to maintain or improve the functional condition of the system without significantly increasing the structural capacity. Light capital preventive maintenance is a set of treatments designed to seal isolated areas of the pavement from water, such as crack and joint sealing, to protect and restore pavement surface from oxidation with limited surface thickness material, such as fog seal; generally, application of a light CPM treatment does not provide a corresponding increase in a segment's PASER score. Heavy capital preventive maintenance is a set of surface treatments designed to protect pavement from water intrusion or environmental weathering without adding significant structural strength, such as slurry seal, chip seal, or thin (less than 1.5-inch) overlays for bituminous surfaces or patching or partial-depth (less than 1/3 of pavement depth) repair for concrete surfaces.

Chip seal: An asphalt pavement treatment method consisting of, first, spraying liquid asphalt onto the old pavement surface and then, a single layer of small stone chips spread onto the wet asphalt layer.

City major: A road classification, defined in Michigan Public Act 51, that encompasses the generally more important roads in a city or village. City major roads are designated by a municipality's governing body and are subject to approval by the State Transportation Commission. These roads do not include roads under the jurisdiction of a county road commission or trunkline highways.

City minor: A road classification, defined in Michigan Public Act 51, that encompasses the generally less important roads in a city or village. These roads include all city or village roads that are not city major road and do not include roads under the jurisdiction of a county road commission.

Composite pavement: A pavement consisting of concrete and asphalt layers. Typically, composite pavements are old concrete pavements that were overlaid with HMA in order to gain more service life.

Concrete joint resealing: Resealing the joints of a concrete pavement with a flexible sealant to prevent moisture and debris from entering the joints. When debris becomes lodged inside a joint, it inhibits proper movement of the pavement and leads to joint deterioration and spalling.

Concrete pavement: Also known as rigid pavement, a pavement made from portland cement concrete. Concrete pavement has an average service life of 30 years and typically does not require as much periodic maintenance as HMA.

Cost per lane mile: Associated cost of construction, measured on a per lane, per mile basis. Also see *lane-mile segment*.

[1] https://en.wikipedia.org/wiki/Crocodile_cracking
[2] Inventory-based Rating System for Gravel Roads: Training Manual

County local: A road classification, defined in Michigan Public Act 51, that encompasses the generally less important and low-traffic roads in a county. This includes all county roads that are not classified as county primary roads.

County primary: A road classification, defined in Michigan Public Act 51, that encompasses the generally more important and high-traffic roads in a county. County primary roads are designated by board members of the county road commissions and are subject to approval by the State Transportation Commission.

CPM: See *Capital preventive maintenance*.

Crack and seat: A concrete pavement treatment method that involves breaking old concrete pavement into small chunks and leaving the broken pavement in place to provide a base for a new surface. This provides a new wear surface that resists water infiltration and helps prevent damaged concrete from reflecting up to the new surface.

Crack seal: A pavement treatment method for both asphalt and concrete pavements that fills cracks with asphalt materials, which seals out water and debris and slows down the deterioration of the pavement. Crack seal may encompass the term "crack filling".

Crush and shape: An asphalt pavement treatment method that involves pulverizing the existing asphalt pavement and base and then reshaping the road surface to correct imperfections in the road's profile. Often, a layer of gravel is added along with a new wearing surface such as an HMA overlay or chip seal.

Crust: A very tightly compacted surface on an unpaved road that sheds water with ease but takes time to be created.

Culvert: A pipe or structure used under a roadway that allows crossroad drainage while allowing traffic to pass without being impeded; culverts span up to 20 feet.[3]

Dowel bar retrofit repair: A concrete pavement treatment method that involves cutting slots in a cracked concrete slab, inserting steel bars into the slots, and placing concrete to cover the new bars and fill the slots. It aims to reinforce cracks in a concrete pavement.

Dust control: A gravel road surface treatment method that involves spraying chloride or other chemicals on the gravel surface to reduce dust loss, aggregate loss, and maintenance. This is a relatively short-term fix that helps create a crusted surface.

Expansion joint: Joints in a bridge that allow for slight expansion and contraction changes in response to temperature. Expansion joints prevent the buildup of excessive pressure, which can cause structural damage to the bridge.

Federal Highway Administration: Also known as FHWA, this is an agency within the U.S. Department of Transportation that supports state and local governments in the design, construction, and maintenance of the nation's highway system.[4]

Federal-aid network: Portion of road network that is comprised of federal-aid routes. According to Title 23 of the United States Code, federal-aid-eligible roads are "highways on the federal-aid highways systems and all other public roads not classified as local roads or rural minor collectors".[5] Roads that are part of the federal-aid network are eligible for federal gas-tax monies.

FHWA: See *Federal Highway Administration*.

Flexible pavement: See *hot-mix asphalt pavement*.

[3] Adapted from Inventory-based Rating System for Gravel Roads: Training Manual
[4] Federal Highway Administration webpage https://www.fhwa.dot.gov/
[5] Inventory-based Rating System for Gravel Roads: Training Manual

Fog seal: An asphalt pavement treatment method that involves spraying a liquid asphalt coating onto the entire pavement surface to fill hairline cracks and prevent damage from sunlight and oxidation. This method works best for good to very good pavements.

Full-depth concrete repair: A concrete pavement treatment method that involves removing sections of damaged concrete pavement and replacing it with new concrete of the same dimensions in order to restore the riding surface, delay water infiltration, restore load transfer from one slab to the next, and eliminate the need to perform costly temporary patching.

Geographic divides: Areas where a geographic feature (e.g., river, lake, mountain) limits crossing points of the feature.

Grants: Competitive funding gained through an application process and targeted at a specific project type to accomplish a specific purpose. Grants can be provided both on the federal and state level and often make up part of the funds that a transportation agency receives.

Gravel surfacing: A low-cost, easy-to-maintain road surface made from aggregate and fines.

Heavy capital preventive maintenance: See *Capital preventive maintenance*.

HMA: See *hot-mix asphalt pavement*.

Hot-mix asphalt overlay: Also known as HMA overlay, this a surface treatment that involves layering new asphalt over an existing pavement, either asphalt or concrete. It creates a new wearing surface for traffic and to seal the pavement from water, debris, and sunlight damage, and it often adds significant structural strength.

Hot-mix asphalt pavement: Also known as HMA pavement, this type of asphalt creates a flexible pavement composed of aggregates, asphalt binder, and air voids. HMA is heated for placement and compaction at high temperatures. HMA is less expensive to construct than concrete pavement, however it requires frequent maintenance activities and generally lasts 18 years before major rehabilitation is necessary. HMA makes up the vast majority of local-agency-owned pavements.

IBR: See *IBR element*, *IBR number*, and/or *Inventory-based Rating System*™.

IBR element: A feature used in the IBR System™ for assessing the condition of roads. The system relies on assessing three elements: surface width, drainage adequacy, and structural adequacy.[6]

IBR number: The 1-10 rating determined from assessments of the weighted IBR elements. The weighting relates each element to the intensity road work needed to improve or enhance the IBR element category.[7]

Interstate highway system: The road system owned and operated by each state consisting of routes that cross between states, make travel easier and faster. The interstate roads are denoted by the prefix "I" or "U.S." and then a number, where odd routes run north-south and even routes run east-west. Examples are I-75 or U.S. 2.[8]

Inventory-based Rating System™: Also known as the IBR System™, a rating system designed to assess the capabilities of gravel and unpaved roads to support intended traffic volumes and types year round. It assesses roads based on how three IBR elements, or features—surface width, drainage adequacy, and structural adequacy—compare to a baseline, or "good", road.[9]

Investment Reporting Tool: Also known as IRT, a web-based system used to manage the process for submitting required items to the Michigan Transportation Asset Management Council. Required items include planned and completed maintenance and construction activity for roads and bridges and comprehensive asset management plans.

IRT: See *Investment Reporting Tool*.

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[6] Inventory-based Rating System for Gravel Roads: Training Manual
[7] Inventory-based Rating System for Gravel Roads: Training Manual
[8] https://www.fhwa.dot.gov/interstate/faq.cfm#question3
[9] Adapted from Inventory-based Rating System for Gravel Roads: Training Manual

Jurisdiction: Administrative power of an entity to make decisions for something. In Michigan, the three levels of jurisdiction classification for transportation assets are state highways, county roads, and city and village streets. State highways are under the jurisdiction of the Michigan Department of Transportation, county roads are under the jurisdiction of the road commission for the county in which the roads are located, and city and village streets are under the jurisdiction of the municipality in which the roads are located.

Jurisdictional borders: Borders between two road-owning-agency jurisdictions, or where the roads owned by one agency turn into roads owned by another agency. Examples of jurisdictional borders are township or county lines.

Lane-mile segment: A segment of road that is measured by multiplying the centerline miles of a roadway by the number of lanes present.

Lane-mile-years: A network's total lane-miles multiplied by one year; a method to quantify the measurable loss of pavement life.

Light capital preventive maintenance: See *Capital preventive maintenance*.

Limited access areas: Areas—typically remote areas—serviced by few or seasonal roads that require long detours routes if servicing roads are closed.

Main access to key commercial districts: Areas where large number or large size business will be significantly impacted if a road is unavailable.

Maintenance grading: A surface treatment method for unpaved roads that involves re-grading the road to remove isolated potholes, washboarding, and ruts, and then restoring the compacted crust layer.

MDOT: See *Michigan Department of Transportation*.

MDOT's Local Bridge Program Call for Projects: A call for project proposals for replacement, rehabilitation, and/or preventive maintenance of local bridges that, if granted, receives bridge funding from the Michigan Department of Transportation. The Call for Projects is made by the Local Bridge Program.

MGF: See *Michigan Geographic Framework*.

Michigan Department of Transportation: Also known as MDOT, this is the state of Michigan's department of transportation, which oversees roads and bridges owned by the state or federal government in Michigan.

Michigan Geographic Framework: Also known as MGF, this is the state of Michigan's official digital base map that contains location and road information necessary to conduct state business. The Michigan Department of Transportation uses the MGF to link transportation assets to a physical location.

Michigan Public Act 51 of 1951: Also known as PA 51, this is a Michigan legislative act that served as the foundation for establishing a road funding structure by creating transportation funding distribution methods and means. It has been amended many times.[10]

Michigan Public Act 325 of 2018: Also known as PA 325, this legislation modified PA 51 of 1951 in regards to asset management in Michigan, specifically 1) re-designating the TAMC under Michigan Infrastructure Council (MIC); 2) promoting and overseeing the implementation of recommendations from the regional infrastructure asset management pilot program; 3) requiring local road three-year asset management plans beginning October 1, 2020; 4) adding asset classes that impact system performance, safety or risk management, including culverts and signals; 5) allowing MDOT to withhold funds if no asset management plan submitted; and 6) prohibiting shifting finds from a country primary to a county local, or from a city major to a city minor if no progress toward achieving the condition goals described in its asset plan.[11]

[10] Inventory-based Rating System for Gravel Roads: Training Manual
[11] Inventory-based Rating System for Gravel Roads: Training Manual

Michigan Public Act 499 of 2002: Also known as PA 499, this legislation requires road projects for the upcoming three years to be reported to the TAMC.

Michigan Transportation Asset Management Council: Also known as the TAMC, a council comprised of professionals from county road commissions, cities, a county commissioner, a township official, regional and metropolitan planning organizations, and state transportation department personnel. The council reports directly to the Michigan Infrastructure Council.[12] The TAMC provides resources and support to Michigan's road-owning agencies and serves as a liaison in data collection requirements between agencies and the state.

Michigan Transportation Fund: Also known as MTF, this is a source of transportation funding supported by vehicle registration fees and the state's per-gallon gas tax.

Microsurface treatment: An asphalt pavement treatment method that involves applying modified liquid asphalt, small stones, water, and portland cement for the purpose of protecting a pavement from damage caused by water and sunlight.

Mill and hot-mix asphalt overlay: Also known as a mill and HMA overlay, this is a surface treatment that involves the removal of the top layer of pavement by milling and the replacement of the removed layer with a new HMA layer.

Mix-of-fixes: A strategy of maintaining roads and bridges that includes generally prioritizes the spending of money on routine maintenance and capital preventive maintenance treatments to impede deterioration and then, as money is available, performing reconstruction and rehabilitation.

MTF: See *Michigan Transportation Fund*.

National Bridge Inspection Standards: Also known as NBIS, standards created by the Federal Highway Administration to locate and evaluate existing bridge deficiencies in the federal-aid highway system to ensure the safety of the traveling public. The standards define the proper safety for inspection and evaluation of all highway bridges.[13]

National Center for Pavement Preservation: Also known as the NCPP, a center that offers education, research, and outreach in current and innovative pavement preservation practices. This collaborative effort of government, industry, and academia entities was established at Michigan State University.

National Functional Class: Also known as NFC, a federal grouping system for public roads that classifies roads according to the type of service that the road is intended to provide.

National highway system: Also known as NHS, this is a network of roads that includes the interstate highway system and other major roads managed by state and local agencies that serve major airports, marine, rail, pipelines, truck terminals, railway stations, military bases, and other strategic facilities.

NBIS: See *National Bridge Inspection Standards*.

NCPP: See *National Center for Pavement Preservation*.

NCPP Quick Check: A system created by the National Center for Pavement Preservation that works under the premise that a one-mile road segment loses one year of life each year that it is not treated with a maintenance, rehabilitation, or reconstruction project.

NFC: See *National Functional Class*.

Non-trunkline: A local road intended to be used over short distances but not recommended for long-distance travel.

[12] Inventory-based Rating System for Gravel Roads: Training Manual

[13] https://www.fhwa.dot.gov/bridge/nbis/

Other funds: Expenditures for equipment, capital outlay, debt principal payment, interest expense, contributions to adjacent governmental units, principal, interest and bank fees, and miscellaneous for cities and villages.

PA: See *Michigan Public Act 51*, *Michigan Public Act 325*, and/or *Michigan Public Act 499*.

Partial-depth concrete repair: A concrete pavement treatment method that involves removing spalled or delaminated areas of concrete pavement, usually near joints and cracks, and replacing with new concrete. This is done to provide a new wearing surface in isolated areas, to slow down water infiltration, and to help delay further freeze-thaw damage.

PASER: See *Pavement Surface Evaluation and Rating system*.

Pavement reconstruction: A complete removal of the old pavement and base and construction of an entirely new road. This is the most expensive rehabilitation of the roadway and also the most disruptive to traffic patterns.

Pavement Surface Evaluation and Rating system: Also known as the PASER system, the PASER system rates surface condition on a 1-10 scale, where 10 is a brand new road with no defects, 5 is a road with distress but that is structurally sound and requires only preventative maintenance, and 1 is a road with extensive surface and structural distresses that is in need of total reconstruction. This system provides a simple, efficient, and consistent method for evaluating the condition of paved roads.[14]

Pothole: A defect in a road that produces a localized depression.[15]

Preventive maintenance: Planned treatments to an existing asset to prevent deterioration and maintain functional condition. This can be a more effective use of funds than the costly alternative of major rehabilitation or replacement.

Proactive preventive maintenance: Also known as PPM, a method of performing capital preventive maintenance treatments very early in a pavement's life, often before it exhibits signs of pavement defect.

Public Act 51: See *Michigan Public Act 51 of 1951*

Public Act 325: See *Michigan Public Act 325 of 2018*

Public Act 499: See *Michigan Public Act 499 of 2002*

Reconstruction and rehabilitation programs: Programs intended to reconstruct and rehabilitate a road.

Restricted load postings: A restriction enacted on a bridge structure when is incapable of transporting a state's legal vehicle loads.

Rights-of-way ownership: The owning of the right-of-way, which is the land over which a road or bridge travels. In order to build a road, road agencies must own the right-of-way or get permission to build on it.

Rigid pavement: See *concrete pavement*.

Road infrastructure: An agency's road network and assets necessary to make it function, such as traffic signage and ditches.

Road: The area consisting of the roadway (i.e., the travelled way or the portion of the road on which vehicles are intended to drive), shoulders, ditches, and areas of the right of way containing signage.[16]

Roadsoft: An asset management software suit that enables agencies to manage road and bridge related infrastructure. The software provides tools for collecting, storing, and analyzing data associated with transportation infrastructure. Built on an

[14] Adapted from Inventory-based Rating System for Gravel Roads: Training Manual
[15] Inventory-based Rating System for Gravel Roads: Training Manual
[16] Inventory-based Rating System for Gravel Roads: Training Manual

optimum combination of database engine and GIS mapping tools, Roadsoft provides a quick, smooth user experience and almost unlimited data handling capabilities.[17]

Ruts/rutting: Deformation of a road that usually forms as a permanent depression concentrated under the wheel path parallel to the direction of travel.[18]

Scheduled maintenance: Low-cost, day-to-day activities applied to bridges on a scheduled basis that mitigates deterioration.[19]

Sealcoat pavement: A gravel road that has been sealed with a thin asphalt binder coating that has stone chips spread on top.

Service life: Time from when a road or treatment is first constructed to when it reaches a point where the distresses present change from age-related to structural-related (also known as the critical distress point).[20]

Slurry seal: An asphalt pavement treatment method that involves applying liquid asphalt, small stones, water, and portland cement in a very thin layer with the purpose of protecting an existing pavement from being damaged by water and sunlight.

Structural improvement: Pavement treatment that adds strength to the pavement. Roads requiring structural improvement exhibit alligator cracking and rutting and are considered poor by the TAMC definitions for condition.

Subsurface infrastructure: Infrastructure maintained by local agencies that reside underground, for example, drinking water distribution systems, wastewater collection systems, and storm sewer systems.

TAMC: See *Michigan Transportation Asset Management Council*.

TAMC pavement condition dashboard: Website for viewing graphs of pavement and bridge conditions, traffic and miles travelled, safety statistics, maintenance activities, and financial data for Michigan's cities and villages, counties, and regions, as well as the state of Michigan.

TAMC's good/fair/poor condition classes: Classification of road conditions defined by the Michigan Transportation Asset Management Council based on bin ranges of PASER scores and similarities in defects and treatment options. Good roads have PASER scores of 8, 9, or 10, have very few defects, and require minimal maintenance. Fair roads have PASER scores of 5, 6, or 7, have good structural support but a deteriorating surface, and can be maintained with CPM treatments. Poor roads have PASER scores of 1, 2, 3, or 4, exhibit evidence that the underlying structure is failing, such as alligator cracking and rutting. These roads must be rehabilitated with treatments like heavy overlay, crush and shape, or total reconstruction.

Tax millages: Local tax implemented to supplement an agency's budget, such as road funding.

Thin hot-mix asphalt overlay: Application of a thin layer of hot-mix asphalt on an existing road to re-seal the road and protect it from damage caused by water. This also improves the ride quality and provides a smoother, uniform appearance that improves visibility of pavement markings.[21]

Transportation infrastructure: All of the elements that work together to make the surface transportation system function including roads, bridges, culverts, traffic signals, and signage.

Trigger: When a PASER score gives insight to the preferred timeline of a project for applying the correct treatment at the correct time.

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[17] Inventory-based Rating System for Gravel Roads: Training Manual
[18] Paving Class Glossary
[19] Inventory-based Rating System for Gravel Roads: Training Manual
[20] Inventory-based Rating System for Gravel Roads: Training Manual
[20] [second sentence] http://www.kentcountyroads.net/road-work/road-treatments/ultra-thin-overlay

Trunkline abbreviations: The prefixes *M-*, *I-*, and *US* indicate roads in Michigan that are part of the state trunkline system, the Interstate system, and the US Highway system. These roads consist of anything from 10-lane urban freeways to two-lane rural highways and even one non-motorized highway; they cover 9,668 centerline miles. Most of the roads are maintained by MDOT.

Trunkline bridges: Bridge present on a trunkline road, which typically connects cities or other strategic places and is the recommended rout for long-distance travel.[22]

Trunkline maintenance funds: Expenditures under a maintenance agreement with MDOT for maintenance activities performed on MDOT trunkline routes.

Trunkline: Major road that typically connects cities or other strategic places and is the recommended route for long-distance travel.[23]

Washboarding: Ripples in the road surface that are perpendicular to the direction of travel.[24]

Wedge/patch sealcoat treatment: An asphalt pavement treatment method that involves correcting the damage frequently found at the edge of a pavement by installing a narrow, 2- to 6-foot-wide wedge along the entire outside edge of a lane and layering with HMA. This extends the life of an HMA pavement or chip seal overlay by adding strength to significantly settled areas of the pavement.

Worst-first strategy: Asset management strategy that treats only the problems, often addressing the worst problems first, and ignoring preventive maintenance. This strategy is the opposite of the "mix of fixes" strategy. An example of a worst-first approach would be purchasing a new automobile, never changing the oil, and waiting till the engine fails to address any deterioration of the car.

List of Acronyms

CPM: capital preventive maintenance

FHWA: Federal Highway Administration

HMA: hot-mix asphalt

I: trunkline abbreviation for routes on the Interstate system

IBR: Inventory-based Rating

M: trunkline abbreviation for Michigan state highways

MDOT: Michigan Department of Transportation

MTF: Michigan Transportation Fund

NBIS: National Bridge Inspection Standards

NCPP: National Center for Pavement Preservation

NHS: National Highway System

PA 51: Michigan Public Act 51 of 1951

PASER: Pavement Surface Evaluation and Rating

R&R: reconstruction and rehabilitation programs

[22] https://en.wikipedia.org/wiki/Trunk_road
[23] https://en.wikipedia.org/wiki/Trunk_road
[24] Inventory-based Rating System for Gravel Roads: Training Manual

TAMC: (Michigan) Transportation Asset Management Council

US: trunkline abbreviation for routes on the US Highway system