Village of Lake Orion
2026-2029 Pavement
Asset Management Plan

A plan describing the Village of Lake Orion's roadway assets and conditions

Prepared by:
Nowak and Fraus Engineers
48680 Van Dyke, Suite 200
Shelby Township, MI 48317

6/1/2026

CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

Return to TOC

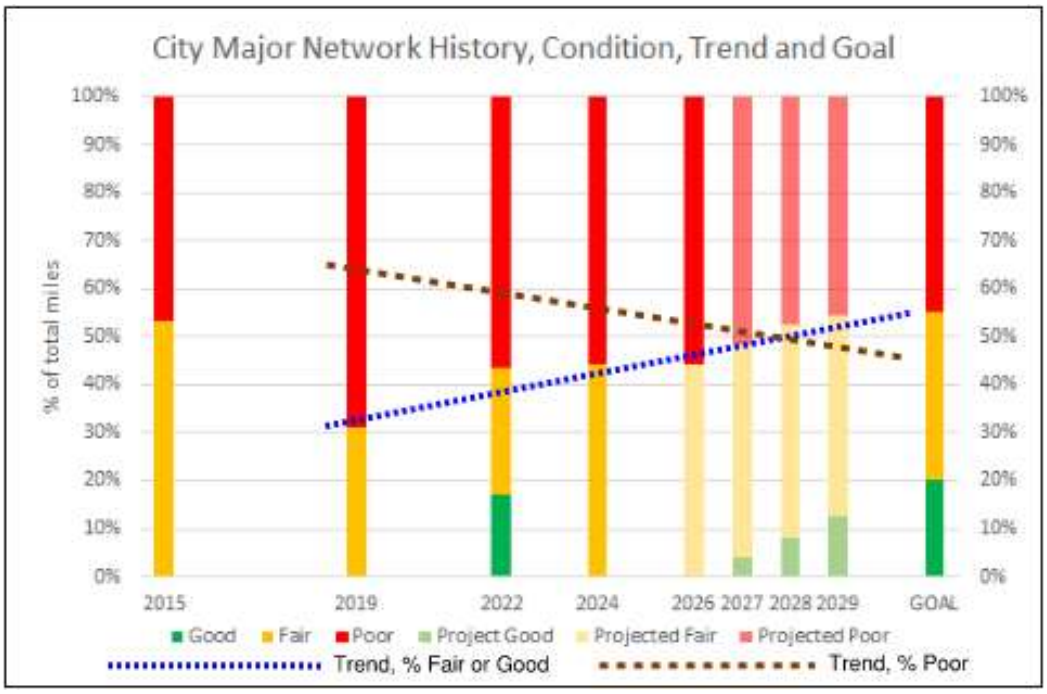
EXECUTIVE SUMMARY

As conduits for commerce and connections to vital services, roads 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. The Village of Lake Orion's (VLO) 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 ordinary citizens and businesses. The cost of building and maintaining roads, 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 plan overviews VLO's road assets and condition and explains how VLO works to maintain and improve the overall condition of those assets. These explanations can help answer the following questions:

- What kinds of road assets VLO has in its jurisdiction, who owns them, and options for maintaining and improving these assets.
- What tools and processes VLO uses to track and manage road assets.
- What condition VLO's road assets are in compared to statewide averages.
- How funds are used and the costs incurred during VLO's road assets' normal life cycle.
- What VLO can expect of its road assets as it works toward achieving its road network condition goals.

VLO owns and/or manages over 11.546 centerline miles of roads. This road network can be divided into the Major Network and the Local Network, based on the different factors these roads have that influence asset management decisions. A summary of VLO historical and current network conditions, projected trends (based on annual street asset management and capital improvement needs of **approximately $600,000** for the next five-year planning window), and goals for Major Network and Local Network can be seen in Figure 1, below:



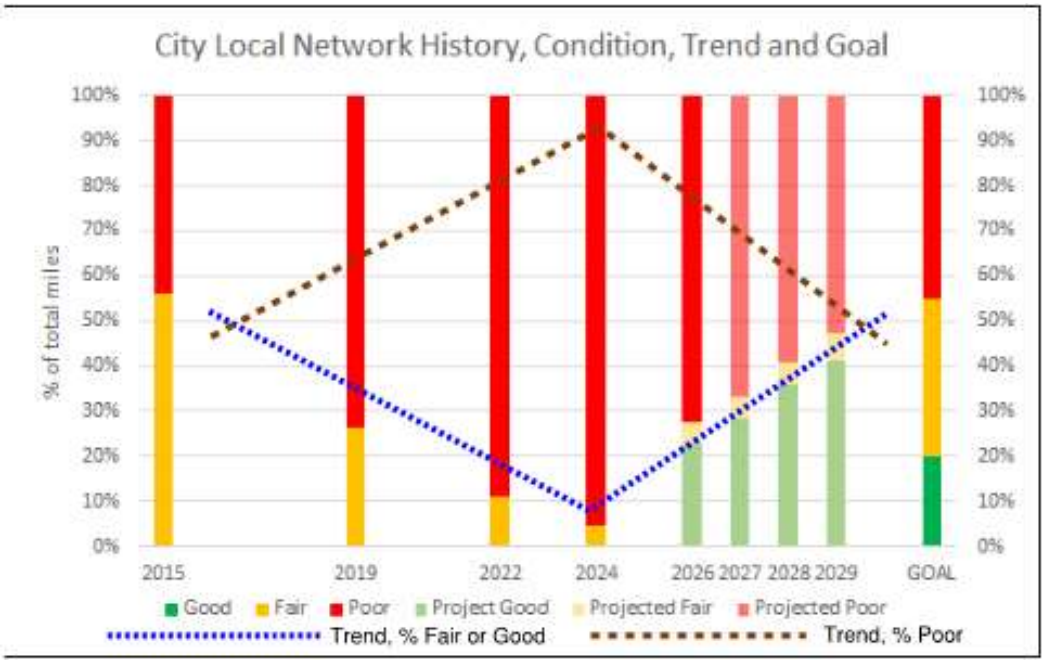


Figure 1: *Top image:* VLO Major Road network condition, trend and goal
Bottom image: VLO Local Road network condition, trend & goal

If the Village wishes to utilize its Act 51 funding without regard to the required percentages reserved for major roads, a Pavement Asset Management Plan (PAMP) is required by Michigan Public Act 325 of 2018, and this document fulfills these requirements. This Asset Management Plan also helps demonstrate VLO's responsible use of public funds by providing elected and

Return to TOC

appointed officials as well as the general public with inventory and condition information of VLO's road assets and gives taxpayers the information they need to make informed decisions about investing in its essential transportation infrastructure.

Key findings of the current conditions and budgetary needs of the Village's streets indicate:

- As of 2024, 95% of Lake Orion's local roads and 56% of Lake Orion's major roads are in Poor condition. Village-owned roads, major and local, are non-federal-aid eligible, with the exception of Flint Street east of M-24. The 2024 statewide average of non-federal-aid roads in Poor condition is 43%.
- To bring the **entire road network up to Fair or Good** condition ratings as defined herein is projected to **cost approximately $11,000,000** in current dollars.
    - This approximate cost is predicated on Reconstruction or Structural Improvement via crushing, shaping and 4" asphalt capping of existing pavements rated PASER 3 or lower; Structural Improvement via milling and 2" asphalt capping pavements rated PASER 4; and Capital Preventive Maintenance via non-structural capping (1" to 1.5") of pavements rated PASER 5 or 6 (Fair). **These assumed treatments are intended to represent a conservative cost; however, actual site conditions may make either higher or lower levels of treatment most appropriate.**
        - Crush and shape with 4" cap is intended to provide roads with at least a 15-year service life, which can be extended by regular maintenance, resulting initially in a Good PASER rating condition.
        - Structural and non-structural capping is intended to extend the service life of treated roads by 5 to 10 years to achieve and maintain a Fair PASER rating condition.
        - Lower-level Capital Preventive Maintenance of roads in Fair condition (crack sealing, chip sealing) may extend service life by 1 to 7 years while maintaining a Fair condition rating.
    - As of 2024, only Flint Street at the Orion Road roundabout was rated as Good condition.
- To meet the **statewide average of 57%** of non-federal-aid roads **in Fair to Good condition** is projected to **cost between $4,500,000 and $6,250,000** in current dollars.

Return to TOC

INTRODUCTION

Public Act 51 of 1951 created the Michigan Transportation Fund to distribute transportation taxes to local agencies for use in maintaining their public road networks, and also specifies how that funding is apportioned between Major and Local road networks. In order to free the Village of Lake Orion to apply Act 51 funding as it best suits the community, the State requires submittal of a Pavement Asset Management Plan (PAMP). The State of Michigan formed the Michigan Transportation Asset Management Council (TAMC) to assist local agencies in the use of asset management principles. This PAMP, as adopted by the Village of Lake Orion following principles outlined by TAMC, is intended to provide a plan to ensure public funds are used as effectively as possible, improve and maintain the condition of the Village roads, and meet the expectations of the users of the road network.

Knowing the basic features of the road asset classes themselves is crucial to understanding the rationale behind an asset management approach. The following primer provides an introduction to pavements.

Pavement Primer

Roads come in two basic forms—paved and unpaved. Paved roads in the Village of Lake Orion are typically constructed of asphalt, some with concrete curb and gutter though the majority are uncurbed. However, Flint Street is composite pavement (asphalt over concrete) and the intersection of Flint Street and Broadway Street is composed of paving brick over concrete. Unpaved roads have no hard surface and are typically gravel, though some thoroughly-degraded asphalt surfaces essentially revert to an unpaved gravel condition; see Cass Avenue for example.

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.

Following 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 classified as rigid pavement, is durable and lasts a long time 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, commonly referred to as asphalt or flexible pavement, is typically less expensive to construct than concrete pavement. However, asphalt requires frequent maintenance activities to maximize service life. A typical HMA pavement will provide service for 18 years before major rehabilitation is necessary. As in the Village of Lake Orion, the vast majority of local-agency-owned roads throughout Michigan 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. Flint Street is an example of a composite pavement in the Village.
- **Sealcoat pavement:** Sealcoat pavement is a gravel road that has been sealed with a thin asphalt binder coating that has 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, and the asphalt binder coating and stone chips shed water and eliminate the need for maintenance grading. No roads in the Village network are currently sealcoat pavement.

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.

Pavement Condition

Besides traffic congestion, pavement condition is what road users typically notice most about the quality of the roads that they regularly use—the better the pavement condition, the more satisfied users are with the service provided by the roadwork performed 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, Structural Improvement, or Reconstruction**—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 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. Lake Orion uses pavement condition and age to anticipate when a specific section of pavement will be a potential candidate for Capital Preventive Maintenance.

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

Lake Orion 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. The Village 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 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 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 created three simplified condition ranks—"**Good", "Fair", and "Poor**"—that represent ranges of PASER scores having similar contexts with regard to maintenance and/or reconstruction. The definitions of these rating ranks 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 2 (top) 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 2 (middle two) illustrates 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.
- "**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 2 (bottom) illustrates a road in this category.

Figure 2: *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 condition rank categories are based solely on the definitions above.

Return to TOC

PASER data is collected 100 percent every two years on all federal-aid-eligible roads in Michigan. In Lake Orion, the only federal-aid-eligible road section owned and maintained by the Village is Flint Street between M-24 and Orion Road. The TAMC dictates and funds the required training and the format for this collection, and it shares the data regionally and statewide. In addition, VLO collects PASER data on its paved non-federal-aid-eligible network and has been assisted at times by the Southeast Michigan Council of Governments (SEMCOG), resulting in historic condition data at points in time from 2015 through 2024, the date of the latest PASER ratings, for all Village roads.

Pavement Treatments

Selection of repair treatments for roads aims to balance costs, benefits, and road life expectancy. All pavements are 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 VLO—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 3). Every pavement must 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 15 to 20 years and costs between $850,000 and $1,100,000 per lane mile. The following description outlines the main reconstruction treatment planned by VLO.

Figure 3: Examples of reconstruction treatments—(left) reconstructing a road and (right) road prepared for full-depth repair.

- ***Reconstruct with areas of Subgrade Undercut, Addition of Underdrain***

Existing asphalt pavement and base are milled and removed (roadways constrained by curb or adjacent sidewalk) or pulverized and reshaped (uncurbed roadways) to correct the road's cross section and profile. Additional base material may be added where the underlying base is inadequate. Areas with excessive deformation may require removal of underlying subgrade materials and placement of engineered fill / geotextile reinforcement. Perforated underdrain may be added along the road alignment to improve drainage. This treatment is reserved for roads with severe structural distress and underlying subgrade failure.

Structural Improvement

Roads requiring structural improvements exhibit alligator cracking and rutting and 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 4). The following descriptions outline the main structural improvement treatments used by VLO.

Figure 4: 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 4). 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 approximately five to ten years and costs $150,000 to $250,000 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 as curb and gutter that is not being raised or reinstalled in the project. Milling adds approximately $20,000 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 4). 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 uncurbed roads with severe structural distress; adding gravel and a wearing surface makes it more prohibitive for roads where curb and gutter is present. Crush and shape treatments last approximately 15 years and costs $500,000 to $550,000 per lane mile.

Capital Preventive Maintenance

Capital Preventive Maintenance (CPM) addresses pavement problems of roads ranked in the Fair category 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, and chip seal (Figure 5). 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 used by VLO.

Figure 5: Examples of capital preventive maintenance treatments—(from left) crack seal, fog seal, chip seal

- ***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 5). VLO 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. Crack sealing lasts approximately two years and costs $10,000 to $12,000 per lane mile. Even though it does not last long compared to some treatments, its lower cost provides a good cost/benefit ratio. This makes it a very cost effective treatment when VLO looks at what crack filling 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 5). Fog seals are best for Good to very good pavements and last approximately two years at a cost of $13,000 to $15,000 per lane mile.

- ***Chip Seal***

A chip seal, sometimes referred to 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 5). 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 helping 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. These treatments last approximately five years and may cost $50,000 to $75,000 per lane mile.

Routine 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 spend money on Routine Maintenance and Capital Preventive Maintenance (CPM) treatments, where possible, to extend pavement service life.

1. PAVEMENT ASSETS

In Michigan, many different governmental units (or agencies) own and maintain roads, so it can be difficult for the public to understand who is responsible for items such as planning and funding construction projects, patching 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.

The Village of Lake Orion is responsible for over 11.546 centerline miles of public roads, as shown in Figure 6.

Return to TOC

Figure 6: Map showing VLO's paved roads and their classification (City Major, City Local). State and County roads also shown.

Return to TOC

Inventory Condition

Figure 7 shows Lake Orion's Pavement Condition Map per TAMC rank categories based on the most recent PASER ratings. All of the street segments were PASER inventoried in 2024 or 2023.

Figure 7: Map of the 2024 paved road condition in Good (PASER 10, 9, 8) shown in green, Fair (PASER 7, 6, 5) shown in yellow, and Poor (PASER 4, 3, 2, 1) shown in red. Only Roads owned by VLO are shown.

The majority of VLO roads in Fair or Good condition are clustered in the downtown core or along Major Road Network segments, reflecting the emphasis placed on maintaining roads with higher anticipated traffic volumes.

In Lake Orion, the only federal-aid-eligible road section owned and maintained by the Village is Flint Street between M-24 and Orion Road. Because the vast majority of VLO's roads lack a dedicated source of state and federal funding beyond the Act 51 revenue sharing, they must be supported locally. Additionally, Act 51 requires that a larger percentage of these funds be utilized for the Major Road network, leaving the Local Road network further underfunded. Preparing and submitting this Asset Management Plan will enable the Village to decide for itself where to prioritize Act 51 funding to best serve the community's needs.

VLO's paved Major Road non-federal-aid network has 0.0 percent of roads in the Good condition category, 44.3 percent in Fair, and 55.7 percent in Poor condition (Figure 8A). The paved Local Road network has 0.0 percent in Good, 4.8 percent in Fair, and 95.2 percent in Poor condition (Figure 8B). As shown previously in Figure 7, only a portion of the federal-aid-elegible Flint Street is in Good condition.

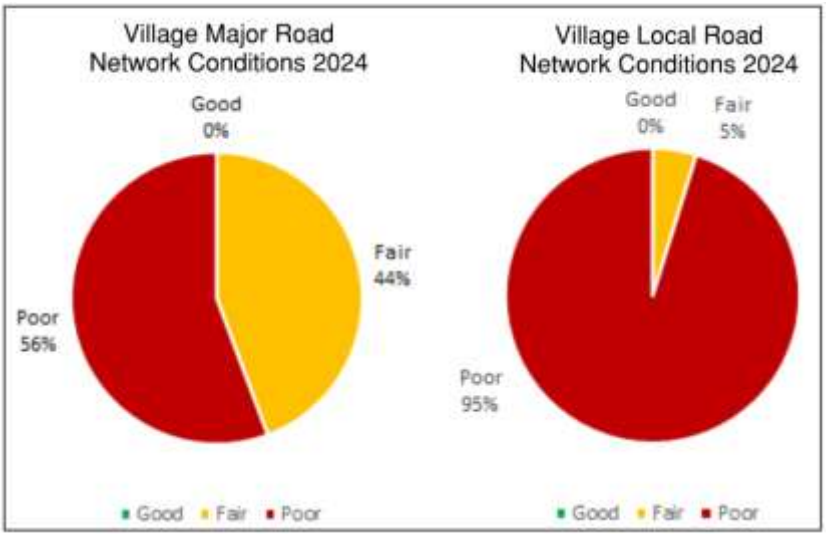


Figure 8: (A) Left: VLO paved Major Road network conditions by percentage of good, fair, or poor, and (B) Right: paved Local Road network conditions by percentage of good, fair, or poor.

By comparison, the 2024 statewide federal aid eligible road network shows 28 percent of roads in the TAMC Good condition category, 40 percent in Fair, and 32 percent in Poor (Figure 9A). The statewide non-federal-aid network has 21 percent in Good, 36 percent in Fair, and 43 percent in Poor condition (Figure 9B). Because Lake Orion's only federal-aid-eligible road (Flint from M-24 to Orion Rd) represents just 14% of the Major Road network, it is better to **compare Village roads to the non-federal-aid statewide average (Figure 9B)**.

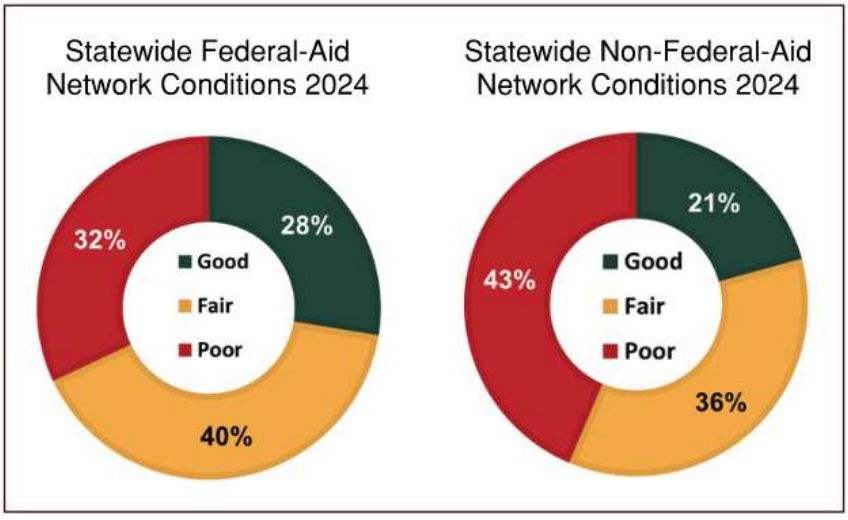


Figure 9: (A) Left - 2024 Statewide paved federal-aid road network conditions by percentage of Good, Fair, or Poor, (B) Right - 2024 Statewide paved non-federal-aid local road network conditions by percentage of Good, Fair, or Poor

Comparing VLO's Major (Figure 8A) and Local (Figure 8B) road network ratings to Figure 9B shows that VLO's road networks are considerably worse than similarly-classified roads in the rest of the state. Thus, **as the Village attains a road network approaching statewide averages for Good and Fair rated roads, it will be imperative to maintain those segments utilizing lower-cost, Capital Preventive and Routine Maintenance practices**.

VLO 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. As noted in Figure 10 below, road segments can and do deteriorate past these transition lines over time, unless maintenance or capital improvements are performed. The map reflects the condition changes from TAMC rank categories Good, Fair, Poor of 2019/2022 to TAMC rankings based on 2023/2024 PASER data. Improved segments are highlighted in blue, deteriorated segments in purple.

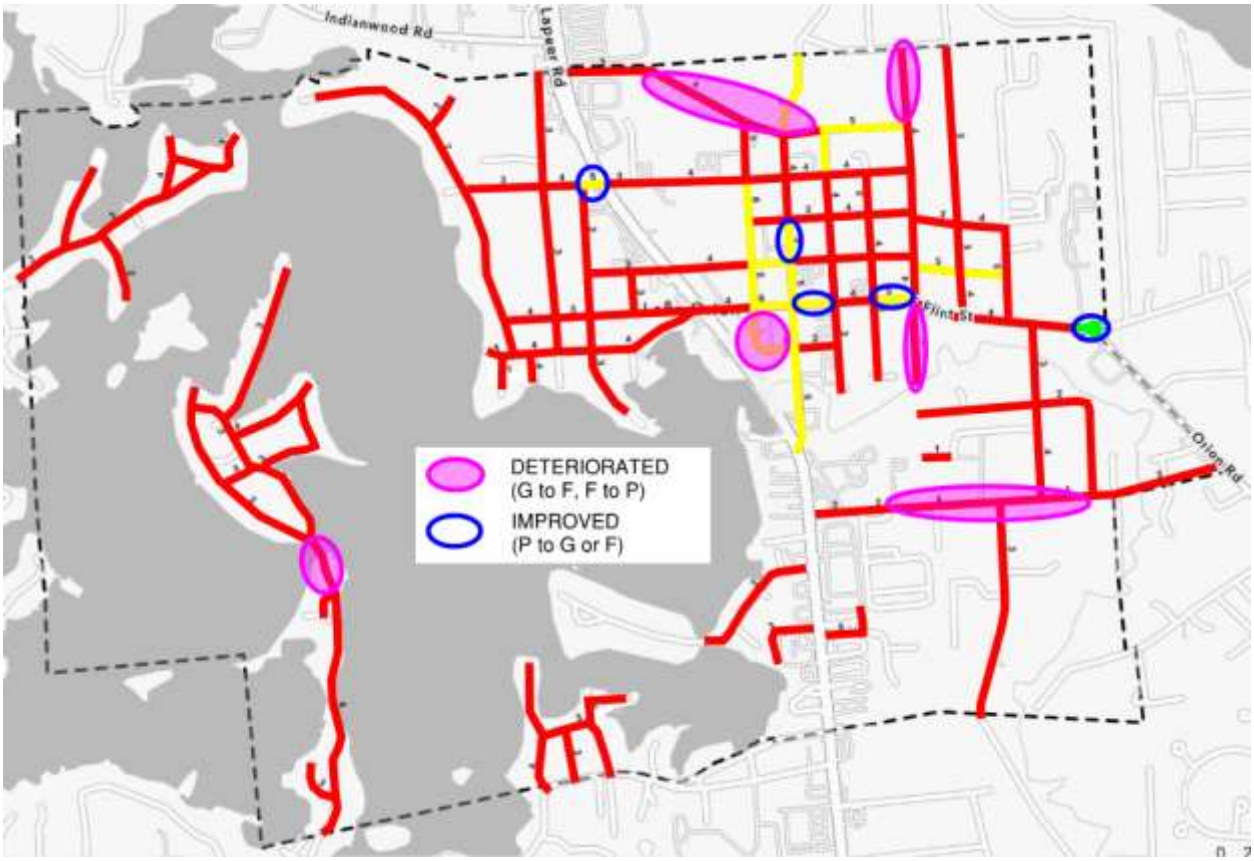


Figure 10: Map of road segments that changed TAMC rank between 2019/22 and 2023/24, Purple highlighted segments fell from Good to Fair or Fair to Poor. Blue circled segments improved from Poor to Fair or Good via capital improvement or maintenance.

Return to TOC

Goals

Goals help set expectations of how pavement conditions will change in the future. Pavement condition changes are influenced by water infiltration, soil conditions, sunlight exposure, traffic loading, and repair work performed. Routine wear and deterioration "remove" years of service life, while repair and routine maintenance "add" years of service life. The intent of goal setting is to achieve and maintain a road network system that best serves the needs of the Village residents utilizing the most cost-effective approach.

Goals for Paved Major Roads

The overall goal for VLO's paved Major Road network is to maintain or improve road conditions network-wide from 2024 levels, with the intent of meeting statewide averages in future. The network condition history, trend and goal are illustrated in Figure 11.

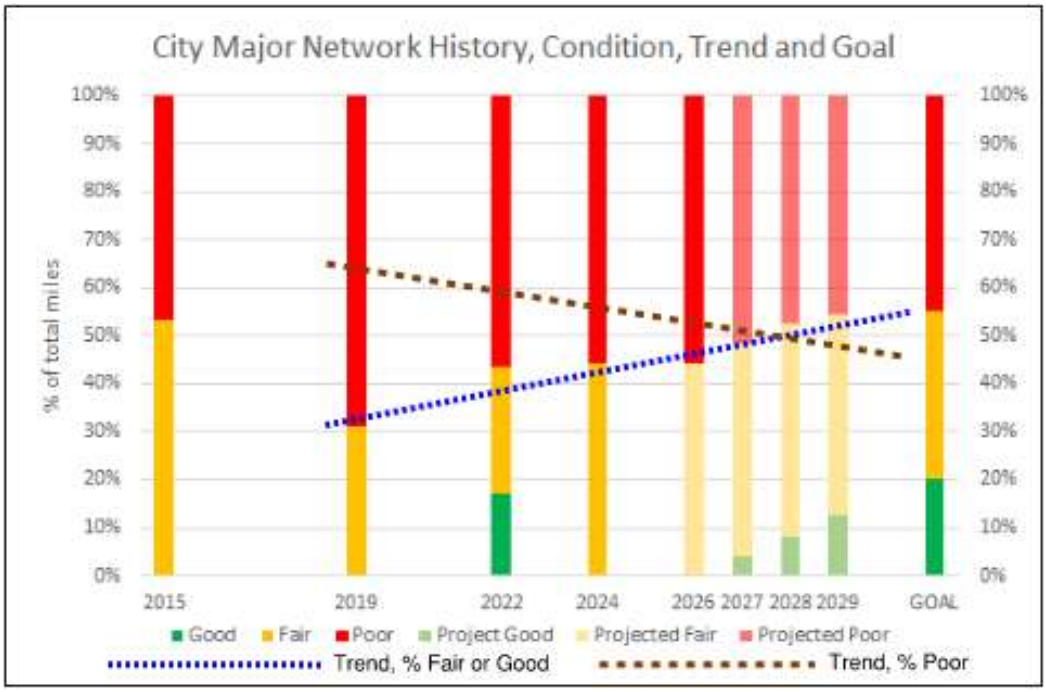


Figure 11: VLO paved Major Road network (non-federal-aid), history, condition, trend and goal

VLO's network-level pavement condition strategy for paved major roads is:

1. Prevent its good and fair (PASER 10 - 5) paved city major from becoming poor (PASER 4 - 1).
2. Move approximately 10 percent of paved city major roads out of the poor category.

Return to TOC

Goals for Paved Local Roads

The overall goal for VLO's paved Local Road network is to improve road conditions network-wide from 2024 levels, again with the intent to meet statewide average, though more time may be necessary to overcome the existing quality deficit. The network condition history, trend and goal are illustrated in Figure 12.

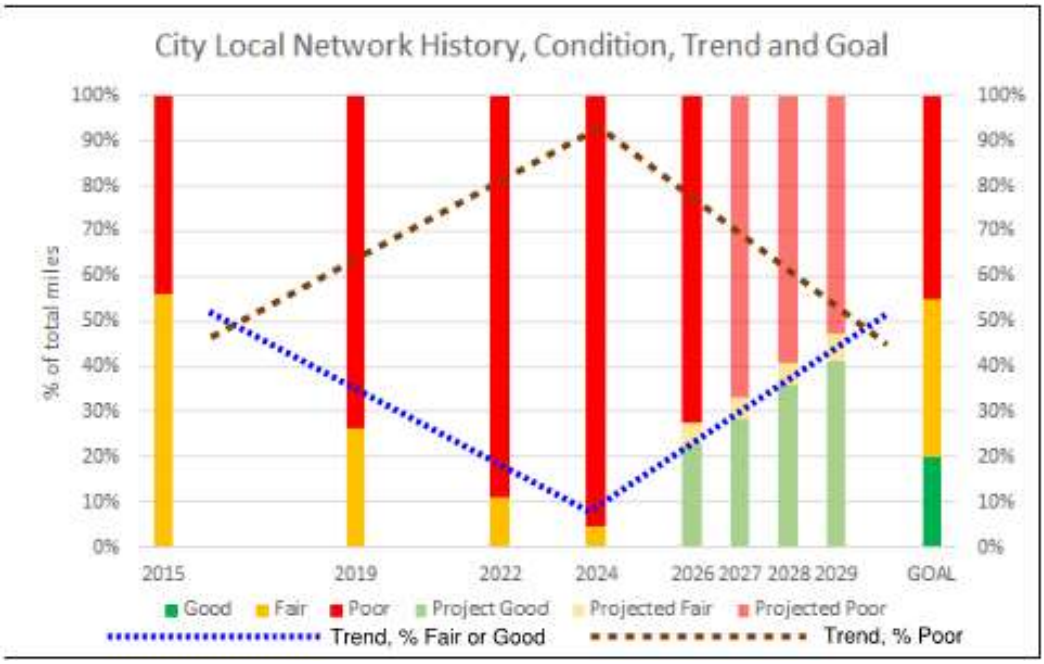


Figure 12: VLO paved Local Road network, history, condition, trend and goal

VLO's network-level pavement condition strategy for paved local roads is:

1. Move approximately 50 percent of paved local roads out of the poor category.
2. Prevent its good and fair (PASER 10 - 5) paved local roads from becoming poor (PASER 4 - 1).

Modelled Trends

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

Return to TOC

VLO must use many types of repair treatments for its roads, each selected to balance costs, benefits, and road life expectancy. Financial resources influence how much work can be accomplished across the network within agency budget and what treatments and strategies can be afforded.

Correlating with each PASER score are specific types of treatments best performed either to protect the pavement (CPM) or to add strength back into the pavement (Structural Improvement) (Table 1). 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.

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, utility projects, and budget play a role in project selection. This table should not be a substitute for engineering judgement.

Factors specific to the decision-making process for the Village should also include the criticality of the road segment in question (are their alternate routes for vehicular traffic, how many properties are isolated if a critical segment fails) and can the project be coordinated with other capital improvements (planned sanitary sewer and water main projects) to minimize cost or duplication of effort.

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

Fix Type	Life Extension (in years)*			PASER
	Flexible	Composite	Rigid	
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

Return to TOC

To meet the Village's Road Network goals outlined above, it is necessary to both maintain current "Fair" or "Good" condition road segments and improve "Poor" segments. Analysis indicates that to accomplish the Village's network goals and offset annual deterioration losses, the total annual budget needs for roadway asset management projects is **approximately $600,000** for the planning period. This approximate budget has been used to guide the preparation of planned projects for the Major Road network and Local Road network, in a series of four annual programs "A" through "D".

In order to perform the work outlined in the Planned Projects below, it will be necessary for the Village to secure funding, either via grants, establishment of a paving millage, special assessment in compliance with the Village's adopted Special Assessment Policy, or some mix of additional sources. Grants through the TEDF program have been prioritized to communities that have not previously received TEDF funds, and the Village of Lake Orion was awarded a TEDF – Category B grant for a portion of the 2026 Road Improvement project. The TEDF grant program has not been funded moving forward; this year's award may be the last barring future funding from the State Legislature.

Planned Projects

VLO plans construction and maintenance projects several years in advance. A multi-year planning threshold is required due to the time necessary to plan, design, and finance construction and maintenance projects. Time requirements may include planning and programming requirements from state and federal agencies that must be met when utilizing state or federal funding or grants and can include studies on environmental and archeological impacts, review of construction and design documents and plans, documentation of rights-of-way ownership, planning and permitting for storm water discharges, and other regulatory and administrative requirements.

For 2026-2029, the Village plans the following road programs:

Paved Major Projects

VLO is currently planning the construction and maintenance projects listed in Appendix A for the Major Road network. The total cost anticipated for these projects is approximately:

- Program "A" - $79,000 (per adopted Capital Improvement Plan, Rev 2/9/26)
- Program "B" - $159,000
- Program "C" - $84,000
- Program "D" - $153,000

Paved Local Projects

VLO is currently planning the construction and maintenance projects listed in Appendix B for the Local Road network. The total cost anticipated for these projects is approximately:

- Program "A" - $1,404,000 (per adopted Capital Improvement Plan, Rev 2/9/26)
- Program "B" - $435,000
- Program "C" - $518,000
- Program "D" - $550,000

See Appendix C for a map of planned projects.

2. RISK OF FAILURE ANALYSIS

Transportation infrastructure should be designed to be resilient. The system of interconnecting roads and bridges maintained by VLO provides road users with 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. Figure 13 illustrates the key transportation links in VLO's road network, including those where a geographic feature (river, lake, or limited access road) impacts the resiliency / interconnectedness of the network.

Lake Orion's road network includes the following critical assets: two bridges regulated under the NBIS requirements (Bellevue Avenue over Lake Orion Canal and Perry Street over Paint Creek); and three Non-NBI culverts (North Shore Drive over Lake Orion Canal; Broadway Street over Paint Creek, and Atwater Street over Paint Creek).

Portions of the Village Local Road network are also impacted by limited access segments, including Bellevue Avenue from the south Village line to the north end of the bridge, and Central Drive from the west Village line to Park Avenue. (see Figure 13). Additionally, portions of the Village's Local Road network are critically dependent upon the road network of the adjoining Orion Township, under Oakland County jurisdiction, including Central Drive to Indianwood Road and Bellevue Avenue from the Village limits to Heights Road.

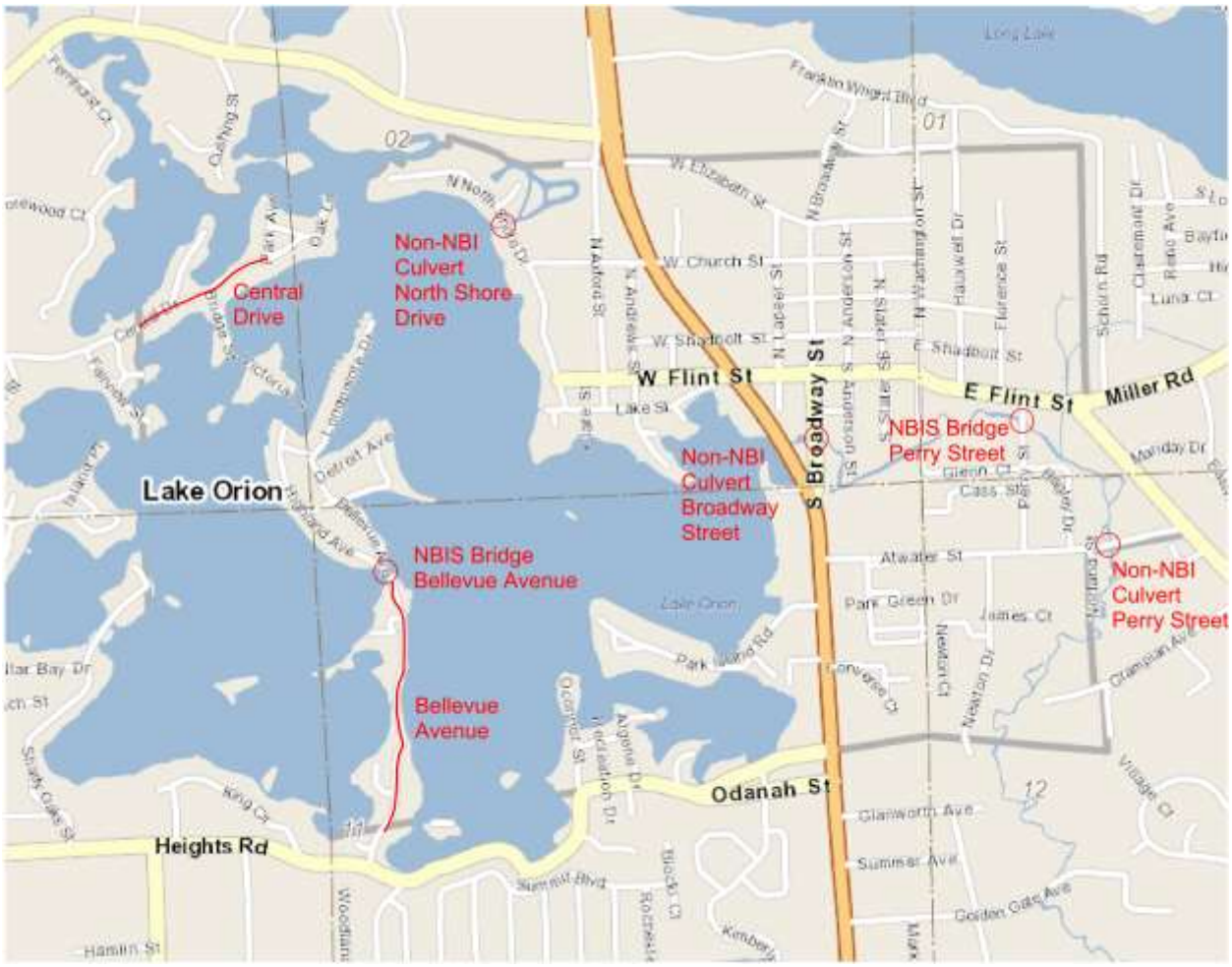


Figure 13: Key transportation links in VLO's road network

Return to TOC

APPENDIX A: VLO 2024-2026 PAVED CITY MAJOR ROAD PLANNED PROJECTS

Treatment Program "A"

- 0.85 lane-miles of Fog Seal/Crack Seal
    - Lapeer Street, Front to Church
    - Front Street, Lapeer to Broadway

Treatment Program "B"

- 0.24 lane-miles Crush and Shape with Overlay
    - Florence Street, Flint to Jackson (or equivalent)

Treatment Program "C"

- 0.22 lane-miles Overlay or Mill and Overlay
    - Broadway Street, Jackson to Elizabeth (or equivalent)

Treatment Program "D"

- 0.30 lane-miles Crush and Shape with Overlay
    - Anderson, Flint to Shadbolt (or equivalent)
    - Shadbolt Street Broadway to Anderson (or equivalent)

APPENDIX B: VLO 2024-2026 PAVED CITY LOCAL ROAD PLANNED PROJECTS

Treatment Program "A"

- 0.23 lane-miles Overlay or Mill and Overlay
    - Clare Street
    - Axford Street, Lake to Flint
    - Andrews Street, Lake to Flint
- 3.8 lane-miles Crush and Shape with Overlay / Heavy Mill and Overlay
    - Church Street, North Shore to Andrews
    - Shadbolt Street, Andrews to M-24
    - Flint Street, North Shore to M-24
    - Lake Street, boat launch to Portside Drive
    - Beebe Street
    - Andrews Street, south end public road to Lake; Flint to Church
    - Axford Street, Flint to Village limit
    - Grove Street
    - North Shore Drive, Lake Street to west dead end

Treatment Program "B"

- 0.73 lane-miles Crush and Shape with Overlay / Heavy Mill and Overlay
    - Hauxwell Street, Shadbolt to Village limit (or equivalent)
    - Jackson Street, Washington to Hauxwell (or equivalent)
- 0.25 lane-miles Overlay or Mill and Overlay
    - Jackson Street, Hauxwell to Florence (or equivalent)
    - Hauxwell Street, Flint to Shadbolt (or equivalent)

Treatment Program "C"

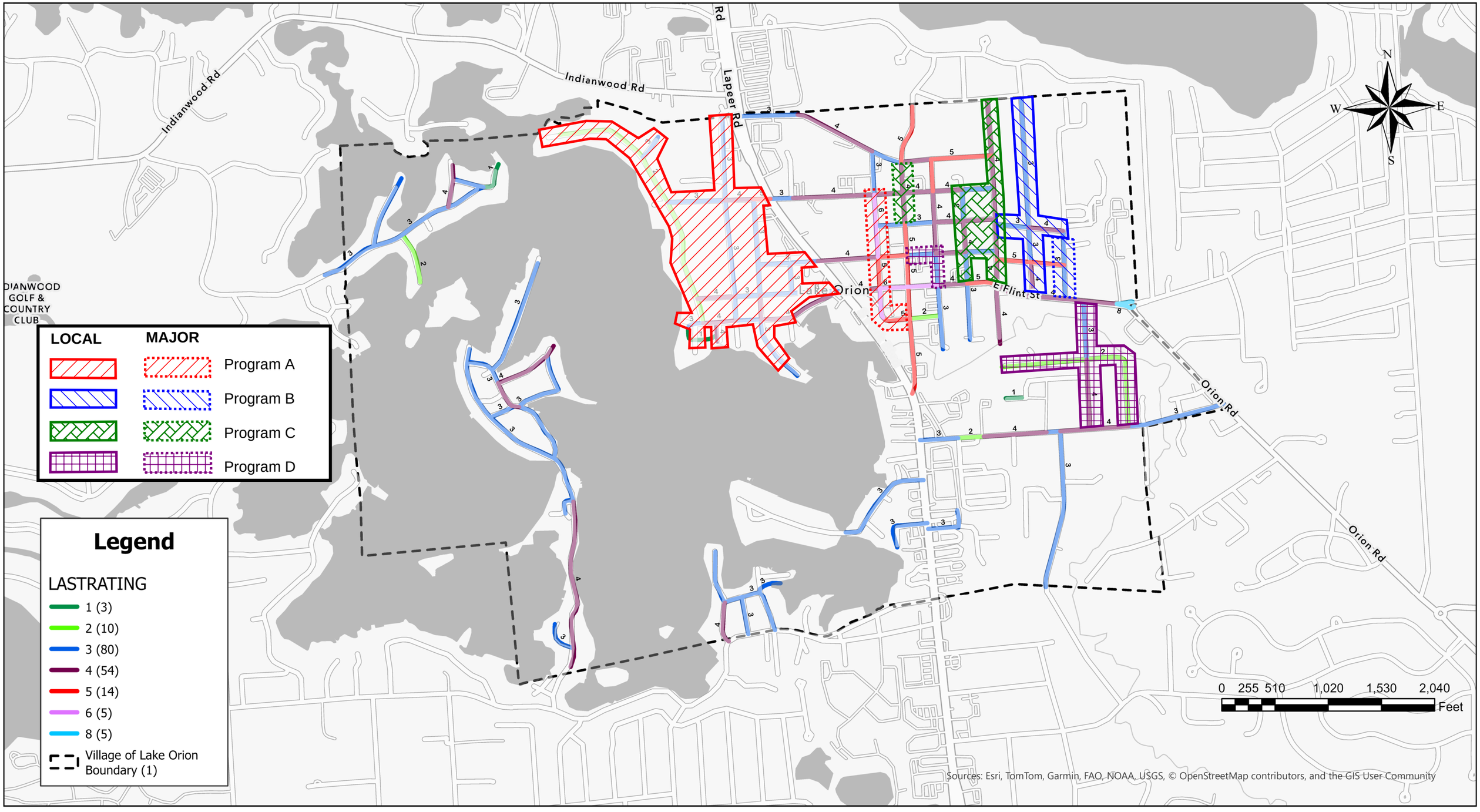
- 0.45 lane-miles Crush and Shape with Overlay / Heavy Mill and Overlay
    - Shadbolt Street, Slater to Washington (or equivalent)

- Church Street, Slater to Washington (or equivalent)
- Slater Street, Flint to Shadbolt, Jackson to Church (or equivalent)

- 0.89 lane-miles Overlay or Mill and Overlay
  - Washington Street, Flint to Village limit (or equivalent)
  - Slater Street, Shadbolt to Jackson (or equivalent)
  - Jackson Street, Slater to Washington (or equivalent)

Treatment Program "D"

- 0.89 lane-miles Crush and Shape with Overlay / Heavy Mill and Overlay
  - Perry Street, Glenn to Flint (or equivalent)
  - Glenn Court, west end to Perry (or equivalent)
  - Bagley Drive, Perry to Atwater (or equivalent)
- 0.25 lane-miles Overlay or Mill and Overlay
  - Perry Street, Atwater to Glenn (or equivalent)



APPENDIX C: VLO Pavement Asset Management Plan 2026 - 2029

Village of Lake Orion

NF ENGINEERS