Road Commission for Oakland County
2021 Transportation Asset Management Plan

A plan describing the The Road Commission for Oakland County's transportation assets and conditions.

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ROAD COMMISSION for OAKLAND COUNTY

QUALITY LIFE THROUGH GOOD ROADS – WE CARE

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EXECUTIVE SUMMARY

As conduits for commerce and connections to vital services, roads and bridges are some of the most important assets in any community, and other assets like culverts, traffic signs, traffic signals, and utilities support and affect roads and bridges. The Road Commission for Oakland County's (RCOC) roads, bridges, 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 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 RCOC is meeting its obligations to maintain the public assets for which it is responsible.

This plan identifies RCOC's assets and condition and how RCOC 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 some of RCOC's 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 RCOC'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 RCOC's assets, and it gives taxpayers the information they need to make informed decisions about investing in RCOC's 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 Road Commission for Oakland County 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.

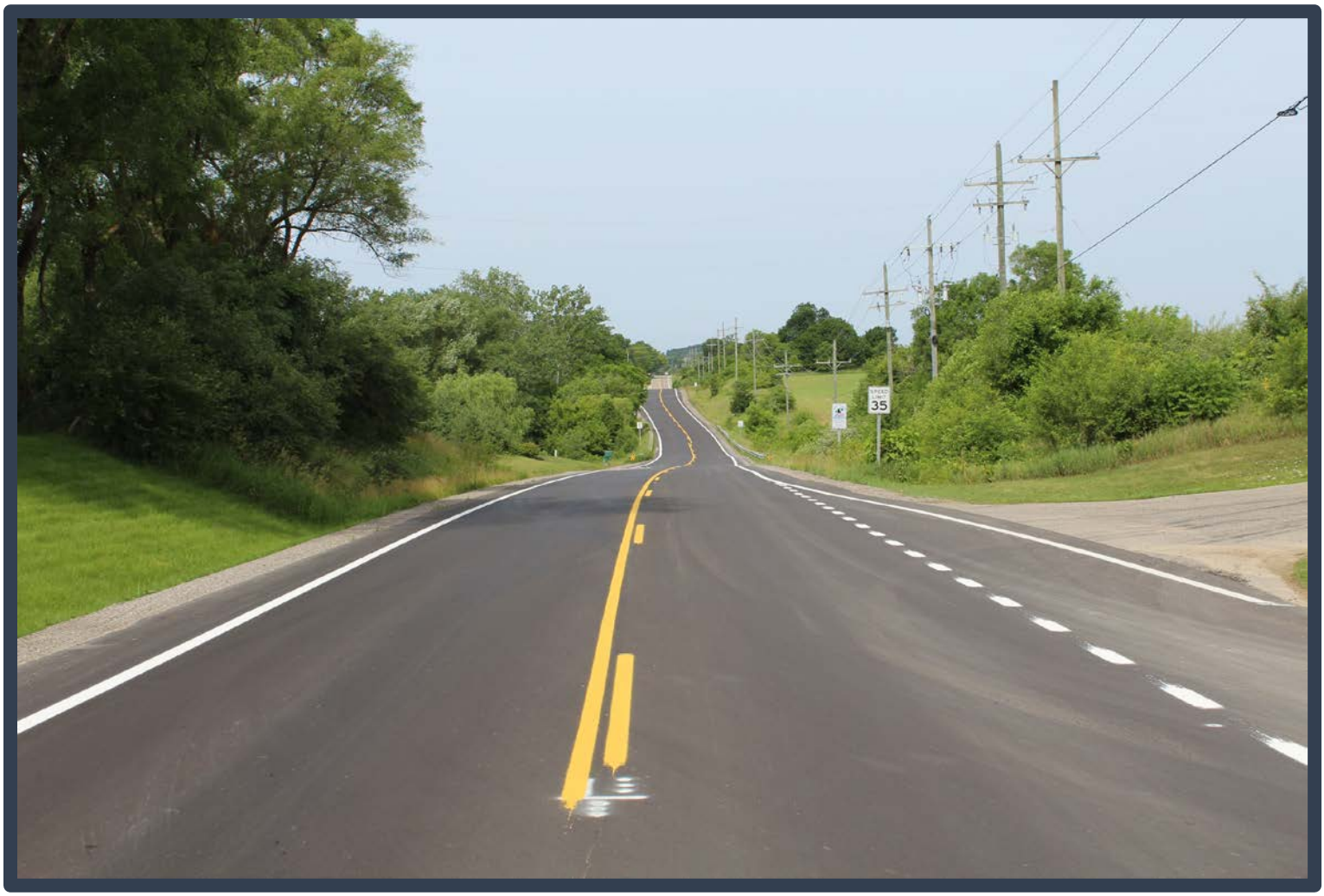
Asset management, in the context of this plan, ensures that public funds are spent as effectively as possible to maximize the condition of the road and bridge network. Asset management also provides a transparent decision-making process that allows the public to understand the technical and financial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

The Road Commission for Oakland County (RCOC) 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. RCOC is responsible for maintaining and operating over 2799.677 centerline miles of roads and 116 bridge structures. It is also responsible for 3500 culverts and 1446 signals.

This 2021 plan identifies RCOC’s transportation assets and their condition as well as the strategy that RCOC uses to maintain and upgrade particular assets given RCOC’s condition goals, priorities of network’s road users, and resources. An updated plan is to be released approximately every three years both to comply with Public Act 325 and to reflect changes in road conditions, finances, and priorities.

Questions regarding the use or content of this plan should be directed to Sarah Plumer at 31001 Lahser Road, Beverly Hills, MI 48025or at (248)-645-2000 and/or splumer@rcoc.org. A copy of this plan can be accessed on the RCOC website at rcocweb.org.

1. PAVEMENT ASSETS



INVENTORY OF ASSETS

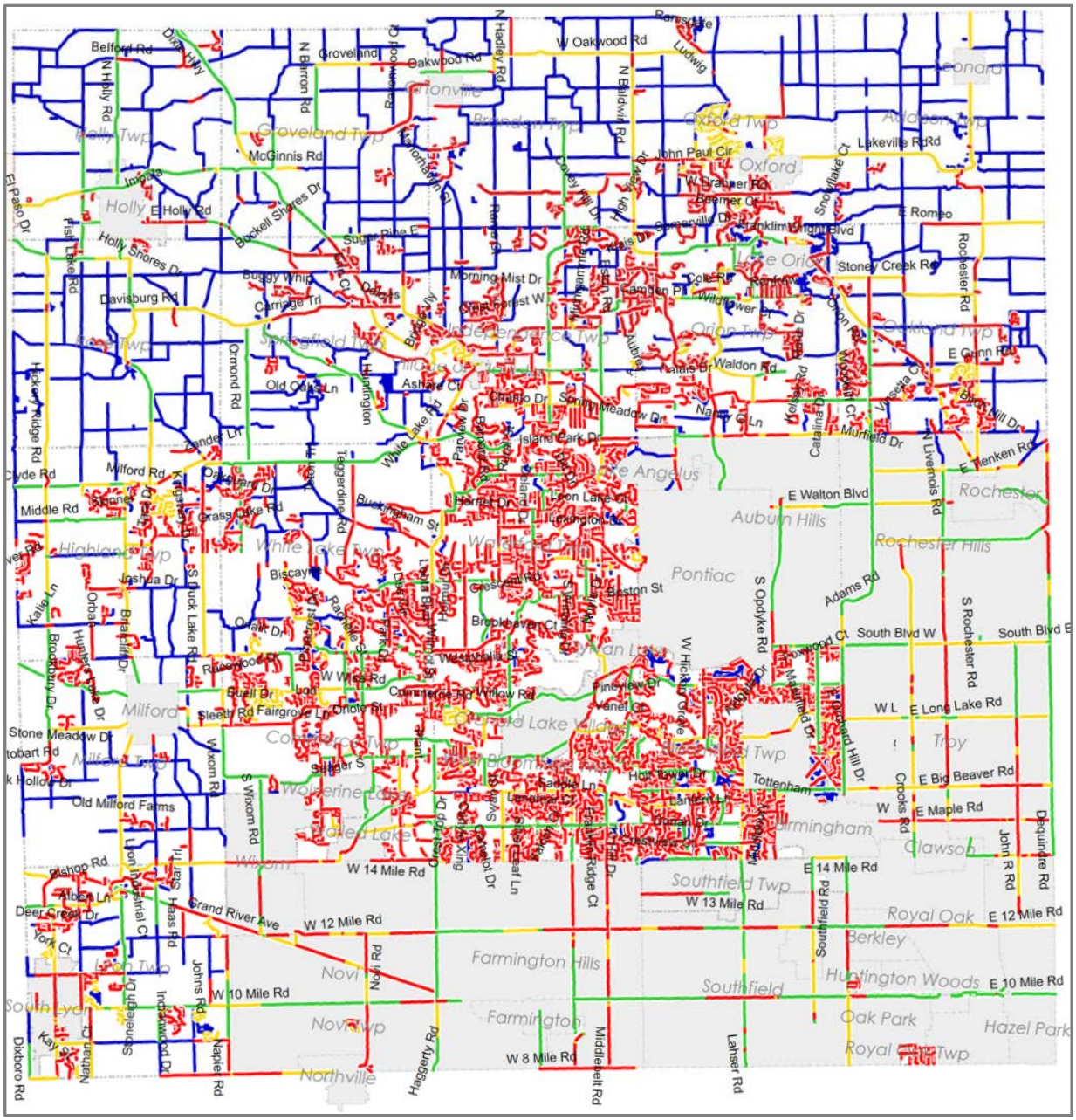


Figure 1: Map showing location or roads managed by RCOC and the current condition for paved roads in green for good (PASER 10, 9, 8), yellow for fair (PASER 7, 6, 5), and red for poor (PASER 4, 3, 2, 1) and for unpaved roads in blue.

Of RCOC's 2799.677 miles of road, 881.071 miles are classified as county primary and 1918.606 miles are classified as county local (Figure 1 identifies these paved roads in green, yellow, and red with the colors being determined based on the road segment's condition). RCOC also manages 237.09 miles that are classified as 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. In addition, RCOC has 663.667 miles of unpaved roads (Figure 1 identifies these unpaved roads in blue).

More detail about these road assets can be found in RCOC's Roadsoft database or by contacting RCOC.

Types

RCOC has multiple types of pavements in its jurisdiction, including asphalt, sealcoat, concrete, brick/block, and undefined; it also has unpaved roads (i.e., gravel and/or earth). Figure 2 shows a breakdown of these pavement types for all of RCOC's road assets.

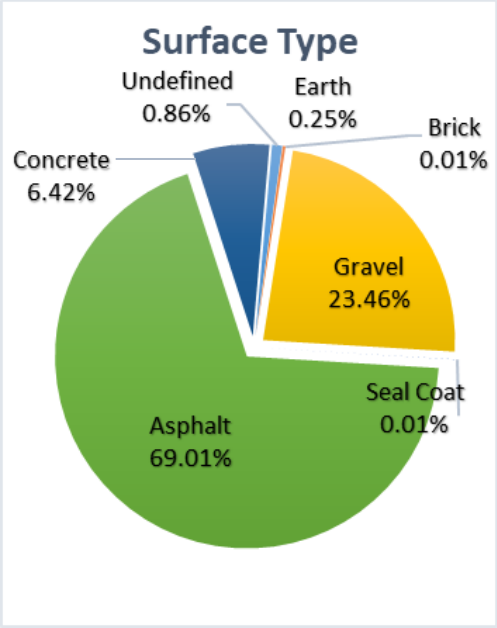


Figure 2: Pavement type by percentage maintained by RCOC. Undefined pavements have not been inventoried in RCOC's asset management system to date but will be included as data becomes available.

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 surface and 1 being a completely failed surface. PASER scores are grouped into TAMC definition categories of good (8-10), fair (5-7), and poor (1-4) categories. RCOC collects PASER data every two years on 100 percent of the federal aid eligible roads. The agency will begin rating 50% of the paved non-federal-aid-eligible network using its own staff and resources in fiscal year (FY) 2022 and forward. It is important to note that due to circumstances

relating to COVID-19, ratings were not collected for any road classification in 2020, therefore the most recent set of ratings were collected in 2019.

Currently, the county primary network has 46% of its roads in good condition, 23% in fair condition, and 32% in poor condition, and the county local network has 6% of its roads in good condition, 29% in fair condition, and 64% in poor condition (Figure 3 and Figure 4). RCOC's long-range goal for the county primary network is to have 50% of roads in good condition, 25% in fair condition, and 25% in poor condition, and for the county local network is to have 30% of roads in good condition, 20% in fair condition, and 50% in poor condition (Figure 3 and Figure 4). Figure 3 and Figure 4 illustrate the historical and current condition (solid bars) of RCOC's county primary and county local networks, respectively; they also illustrate the projected trend (shaded bars), the overall trend in condition (trendlines), and RCOC's goal (final solid bar).

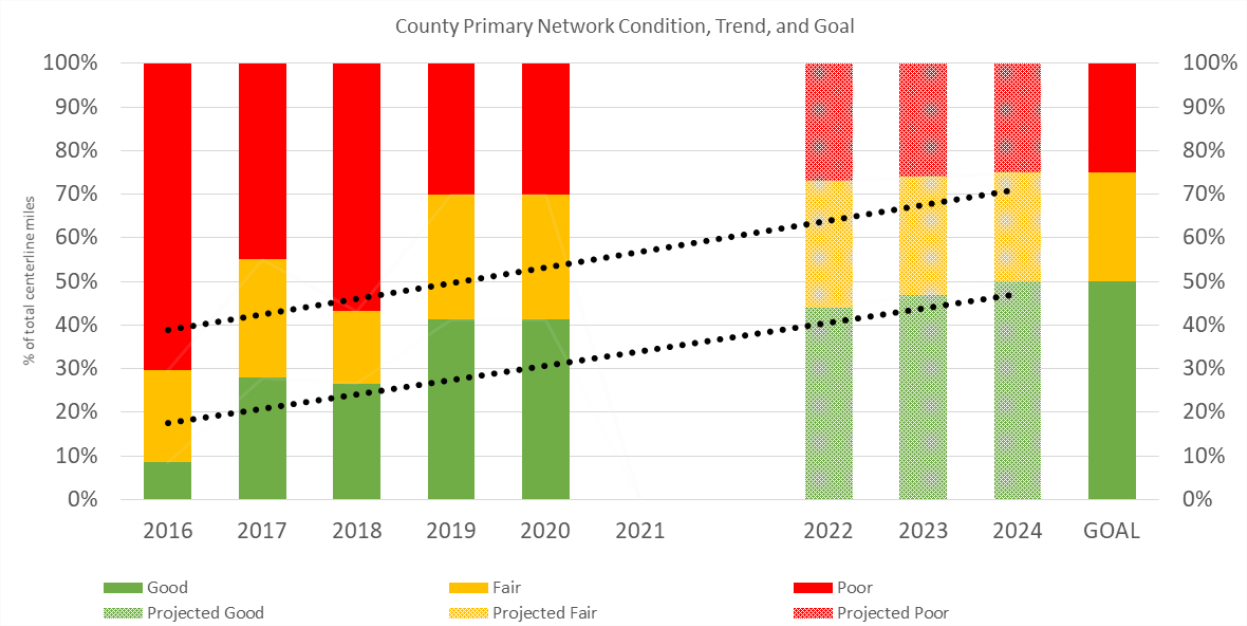


Figure 3: County primary network condition, goals, and trend.

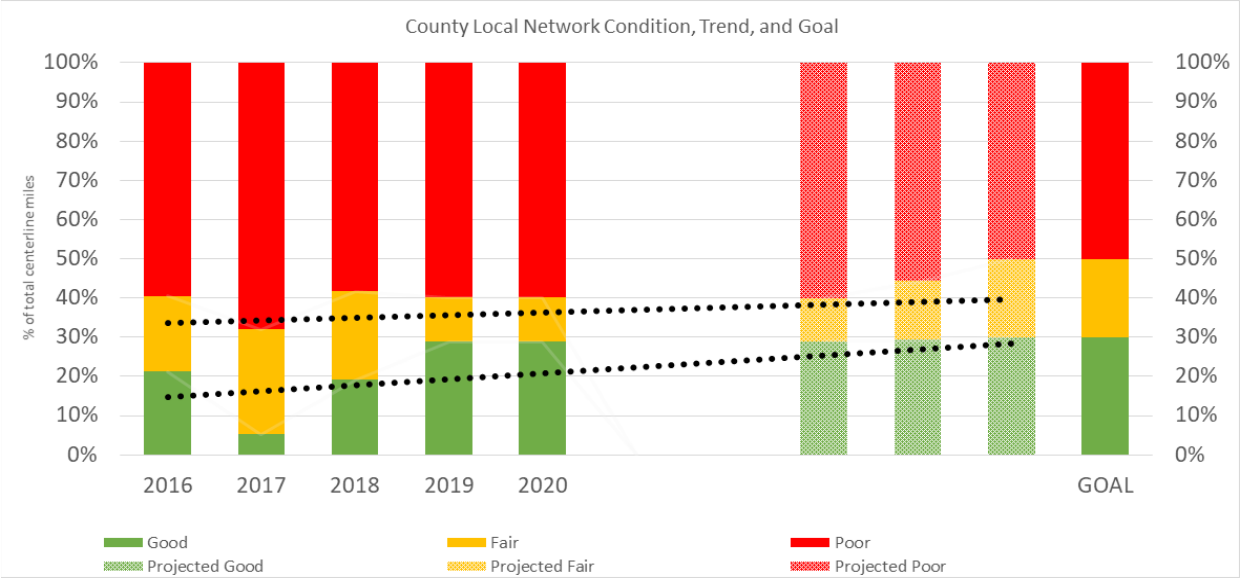


Figure 4: County local network condition, goals, and trend.

Unpaved Roads

Unpaved roads rated with the Inventory-based Rating System™ receive an IBR number ranging from 1 to 10, with a 9 or 10 (less than one year old) having good surface width, good or fair drainage, and good structural adequacy and a 1 having poor surface width, poor drainage, and poor structural adequacy. IBR numbers can be grouped in a similar fashion as the TAMC definitions into good (8-10), fair (5-7), and poor (1-4) categories.

Most unpaved road ratings collected in the past throughout Oakland County were collected using PASER and are now out of date. RCOC will begin using the IBR System™ in 2022 and future years. Figure 5 illustrates the historical and/or current condition using PASER (solid bar), the projected trend (shaded bars), and RCOC's goal (final solid bar).

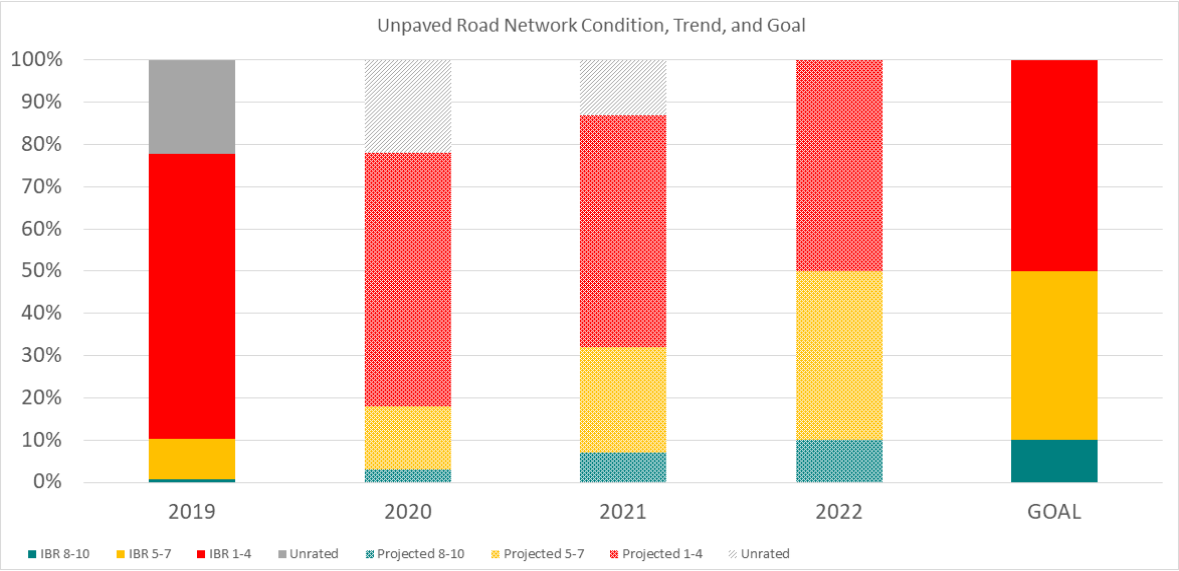


Figure 5: Distribution of PASER ratings in future years. With the goal of rating 100% of unpaved roads.

MODELLED TRENDS, GAP ANALYSIS, AND PLANNED PROJECTS

Table 1: NCPP Modelled Trends, Planned Projects, and Gap Analysis for RCOC's Road Assets

Network 1 (<881.071 miles)

Treatment	Average Yearly Miles of Treatment	Years of Life	Mile-Years	Planned Projects		Additional Work Necessary to Overcome Deficit	
				Average Yearly Miles of Treatment	Mile-Years	Average Yearly Miles of Treatment	Mile-Years
Crack Seal	60	2	120	60	120	5	10
Overlay	64	5	320	60	300	5	25
Concrete Patching	5	5	25	5	25	1	5
Concrete Slab Replacement	5	15	75	5	75	1	15
RRR	8	15	120	9	135	3	45
4R	2	20	40	2	40		
New construsction/pave gravel	1	20	20	1	20		
Total			720		715		100
Gap Analysis: (Deficit)/Surplus			-93		-98		2

Network 2 (1918.606 miles)

Treatment	Average Yearly Miles of Treatment	Years of Life	Mile-Years	Planned Projects		Additional Work Necessary to Overcome Deficit	
				Average Yearly Miles of Treatment	Mile-Years	Average Yearly Miles of Treatment	Mile-Years
Crack Seal							
Overlay	1	5	5	1	5	200	1000
Concrete Patching		5				25	125
Concrete Slab Replacement		15				2	30
RRR	1	15	15	2	30	10	150
4R							
New construsction/pave gravel							
Total			20		35		1305
Gap Analysis: (Deficit)/Surplus			-1278		-1263		42

Modelled Trends & Gap Analysis

Results from the NCPP Quick Check (defined on page 41 of Appendix A) for the paved county primary and county local networks roads indicate the average volume of work that RCOC has been able to afford over the last five years is not keeping up with the natural deterioration of the road network due to age and use. Continuing the current treatment volume on this network will result in an ongoing deficit of 98 mile-years of project benefit needed to stabilize this trend and maintain current conditions.

The NCPP analysis of RCOC's planned projects from RCOC's currently available budget does allow RCOC to head in the direction of its pavement condition goal given the projects planned for the county primary and county local networks over the next three years. More funding in recent years has allowed for more miles of pavement improvement, PASER ratings collected in late 2021 will show an increase in good and fair miles from 2019 ratings.

The NCPP Quick Check method shows that there will be a deficit of 98 mile-years of improvement on the paved county primary road network. The NCPP Quick Check method shows that there will be a deficit of 1263 mile-years of improvement on the paved county local road network. To maintain current road conditions, this deficit must be overcome with a combination of maintenance and construction work. This additional work to make up this deficit would cost approximately $9,458,400 per year on the primary network and $101,960,000 on the local network.

Unpaved Road Condition Trends

There is limited unpaved road condition data available at this time, however, RCOC will initiate the collection of condition data on the local system to gain a better understanding of ratings. After this, RCOC can reassess the current maintenance practices and adjust schedules and fixes accordingly.

Currently, the RCOC follows a dust control schedule on primary gravel roads which includes 5 applications a year of chloride and grading. Local gravel roads are only treated when paid by the township, homeowners or both. Gravel road grading occurs regularly. A grader can grade and spray chloride approximately 5-6 miles a day, the scheduled rotation in each district takes 4-6 weeks. Drainage and brush clearing maintenance activities occur continuously year-round. Every 5 years RCOC resurfaces gravel roads with new material, but this could occur more/less frequently based on community involvement, weather effects and changing conditions.

Ditching, as explained in the primer, requires a full assessment of the road and the area adjacent. First, staff looks at the number and type of obstructions. Obstructions can include trees, foliage, fences, utilities and culverts. Also, an assessment of manpower, time and materials needed play a role in calculating the costs associated with ditching.

Ditching and maintaining gravel roads is an ongoing process that is led in most part by the six highway maintenance district garages throughout the county. The districts have eyes and feet on the ground all day and work with local communities routinely to address concerns on paved and gravel roads.

Planned Projects

The below map (Figure 6) and lists (Table 2, Table 3, and Table 4) show projects for FY 2021-2023. These projects are larger projects with funding sources identified. Funding sources on these lists include

Surface Transportation Program Urban/Rural (STPU/STPR), National Highway Preservation Program (NHPP), Highway Infrastructure Program (HIP Regular and HIP-COVID), Local Federal Fund Exchange Program (LFFE), Transportation Economic Development Fund (TEDF Cat C), Highway Safety Improvement Program (HSIP), Road Commission, Township millages. Projects are added to future years when a source of funding is established. Projects funded through federal aid sources have gone through the Federal Aid Committee project priority scoring process or have been awarded funds based on an application process. Other projects identified on this list that do not have federal funds are funded by local entities or programs but require robust design work. For 2021-2023 RCOC plans to do the following projects:

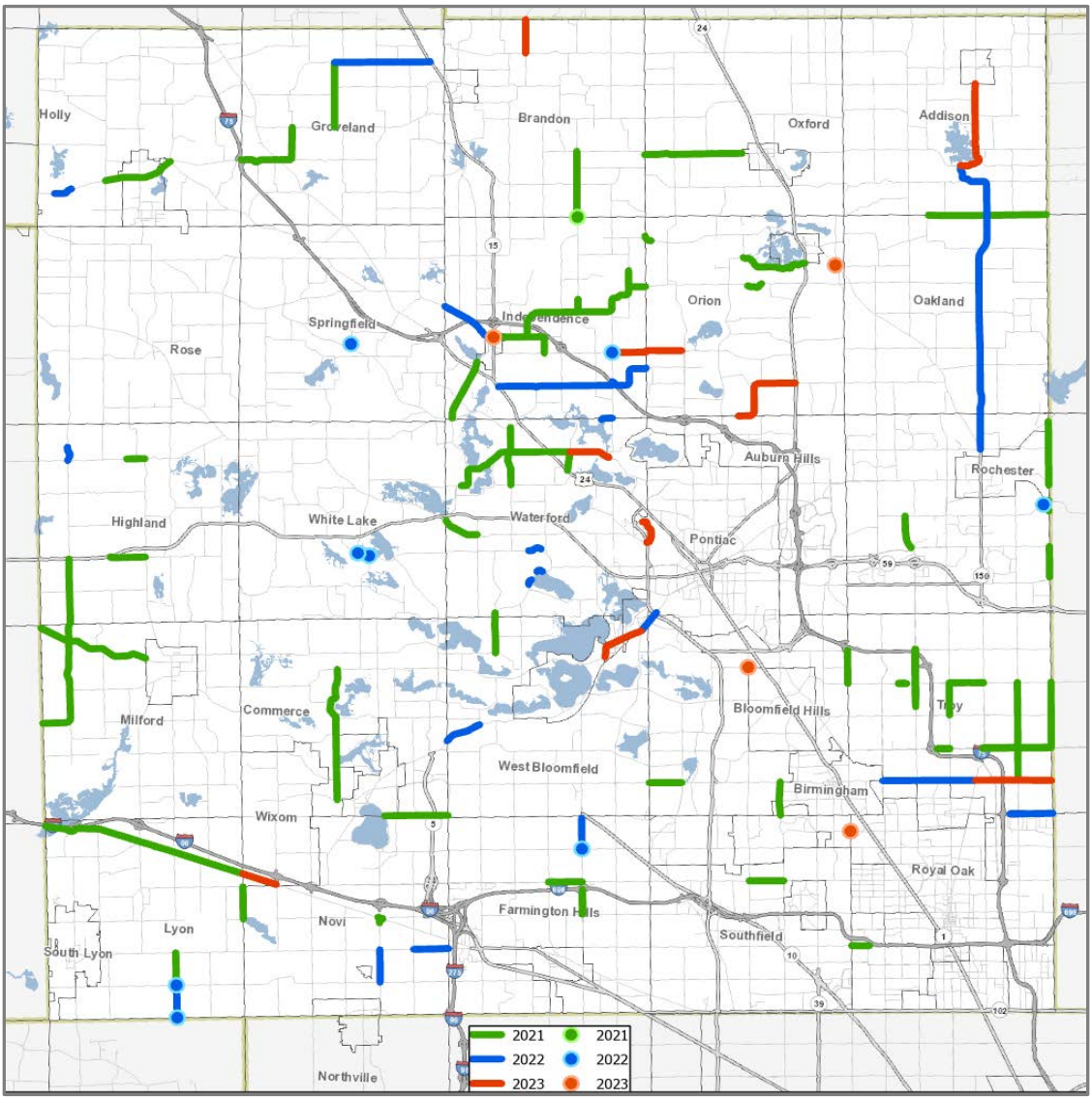


Figure 6: Map illustrating planned projects for pavement assets.

Paved County Primary Projects

RCOC is currently planning the construction projects listed in Table 2, Table 3, and Table 4 for the paved county primary road network. The locations of these projects are shown in Figure 6. The total cost of these projects is in each year is as follows:

- 2021 - $35,875,012
- 2022 - $35,459,353
- 2023 - $21,106,016

Table 2: 2021 Planned Road Projects

Road	From	Community	RCOC Treatment	Funding	Miles	Total Estimate
12 Mile Road	Lahser Road to Evergreen Road	City of Southfield	4R	STPU	1	$5,900,000
Avon Road	at Dequindre Road	City of Rochester Hills	4R	STPU & HIP-Covid	0.1	$4,679,340
FY 2021 Troy Concrete	Various Locations	City of Troy	Concrete Slab Replacement	Cat C & Repurposed Earmarks	8	$8,678,148
Baldwin Road	At Indianwood Road	Orion Township	HFST	HSIP	0.2	$185,194
Clarkston Road	Thistle Valley to Pine Tree Street	Orion Township	Overlay	HSIP	0.48	$303,712
Pine Knob Road	Clarkston Road to N. of Glenview Street	Independence Township	Overlay	Township Millage	0.32	$106,711
Currie Road	at 8 Mile Road	Lyon Township	Roundabout	WCRC	0	$1,500,000
Sashabaw Road	at Oak Hill Road	Brandon/Independence Townships	Roundabout	RCOC/HSIP	0	$1,490,000
12 Mile Road	Farmington Road to Orchard Lake Road	City of Farmington Hills	RRR	STPU & HIP	1.02	$1,830,000
Adams Road	Long Lake Road to Square Lake Road	City of Troy	RRR	NHPP	1	$2,573,000

Clarkston Road	Clarkston village limits to east Independence Township limits	Independence Township	RRR	Township Millage	5.6	$3,410,407
Cranbrook Road	14 Mile Road to Maple Road	Bloomfield Township/ City of Birmingham	RRR	50/50	1	$1,400,000
Pontiac Trail	Haggerty Road to Green Lake Road	West Bloomfield Township	RRR	STPU & HIP-Covid	1.09	$2,600,000
White Lake Road	Andersonville Road to south Clarkston village imits	Independence Township	RRR	Township Millage	2	$1,218,500
				Totals	**21.81**	**$35,875,012**

Table 3: 2022 Planned Road Projects

Road	From	Community	RCOC Treatment	Funding	Miles	Total Estimate
Orchard Lake Road	13 Mile Road to 14 Mile Road	Farmington Hills	4R widening	STPU & NHPP	1	$8,269,044
Cooley Lake Road	Fleet Street to Lake Vista Street	Waterford Township	HFST	HSIP	0.2	$125,000
Cooley Lake Road	south of Pinegrove Street to LaMothe Street	Waterford Township	HFST	HSIP	0.19	$120,000
Elizabeth Lake Road	north of Pinegrove Street to Hickory Street	Waterford Township	HFST	HSIP	1.55	$250,000
Grange Hall Road	at JoAnn Street	Holly Township	HFST	HSIP	1.77	$275,000
Hickory Ridge Road	north of Clyde Road	Highland Township	HFST	HSIP	1.3	$100,000
Groveland Road	Barron Road to M-15	Groveland Township	Overlay	STPR	2.8	$750,000

Rochester Road	Tienken Road to Lakeville Road	Oakland Township/City of Rochester Hills	Overlay	LFFE	9.3	$3,092,309
Elizabeth Lake Road	at Oxbow Lake Road	White Lake Township	Roundabout	RCOC	0	$900,000
Elizabeth Lake Road	at Teggerdine Road	White Lake Township	Roundabout	RCOC	0	$975,000
10 Mile Road	Meadowbrook Road to Haggerty Road	City of Novi	RRR	Local/ACC 2024STPU	1	$4,500,000
14 Mile Road	Barrington Street to Dequindre Road	City of Madison Heights/City of Troy	RRR	STPU & HIP-Covid	1.27	$4,903,000
Holcomb Road	west Independence Township limit to west Clarkston Village limit	Independence Township	RRR	Township Millage	1.5	$850,000
Maple Road	Coolidge Road to Rochester Road	City of Troy	RRR	50/50	2.76	$1,700,000
Maybee Road	Dixie Highway to east Independence Township limit	Independence Township	RRR	Township Millage	4.39	$2,750,000
Novi Road	at 10 Mile Road	City of Novi	RRR	LFFE	0	$650,000
Orchard Lake Road	Middlebelt Road to Old Telegraph Road	Various	RRR	STPU	0.8	$2,000,000
Novi Road	9 Mile Road to 10 Mile Road	City of Novi	RRR/Widening	STPU & HIP-Covid	1	$3,250,000
				Totals	**30.83**	**$35,459,353**

Table 4: 2023 Planned Road Projects

Road	From	Community	RCOC Treatment	Funding	Miles	Total Estimate
Clarkston Road	at M-15	City of the Village of Clarkson	Intersection	RCOC	0	$440,000
Greenfield Road	at Normandy Road	City of Beverly Hills/City of Royal Oak	Intersection	RCOC	0	$750,000
Hadley Road	Oakwood Road to north Oakland County Line	Brandon Township	Overlay	STPR	1.03	$781,250
Rochester Road	Lakeville Road to Village of Leonard limit	Addison Township	Overlay	LFFE	2.98	$750,000
Hickory Grove Road	at Lahser Road	Bloomfield Township/City of Bloomfield Hills	Roundabout	RCOC	0	$350,000
Orion Road	at Stony Creek Road and Conklin Road	Orion Township	Roundabout	STPU	0	$1,634,888
Brown/Giddings/ Silverbell Roads	Jamm Street to M-24	City of Auburn Hills/Orion Township	RRR	STPU	2.6	$5,350,000
County Center (North)	Telegraph Road to eat of Hospital Street	Waterford Township	RRR	Oakland County	0.75	$500,000
Grand River Avenue	Napier Road to Wixom Road	City of Wixom	RRR	STPU	1	$3,500,000
Maple Road	Rochester Road to Dequindre Road	City of Troy	RRR	50/50	2.27	$1,400,000
Orchard Lake Road	Commerce Road to east of Middlebelt Road	Various	RRR	NHPP	1.41	$2,346,878
Walton Road	east of Sashabaw Road to Clintonville Road	Waterford Township	RRR	STPU	1.15	$3,300,000
				Totals	**13.19**	**$21,103,016**

Paved County Local Projects

RCOC is currently planning the construction projects listed in Table 5 for the paved county local road network. The locations of these projects are shown in Figure 6. The total cost of these projects is approximately:

- 2021- $1,348,499
- 2022 - $190,000
- 2023 - TBD

Table 5: 2021-2023 Total Paved Road Project Costs

Year	Road	Limits	Community	RCOC Treatment	Funding	Miles	Total Estimate
2021	Eston Road	Clarkston Road to end of pavement	Independence Township	RRR	Township Millage	.53	$474,750
2021	Flemings Lake/Walters Road	Clarkston Road to Waldon Road	Independence Township	RRR	Township Millage	1	$873,749
2022	Mann Road	Floretta Street to Clintonville Road	Independence Township	Overlay	Township Millage	.25	$190,000
					Totals	**1.78**	**$1,538,499**

Unpaved Road Projects

RCOC is currently planning the construction projects listed in Table 6 for the unpaved road network. The location of these projects is shown in Figure 6. The total cost of these projects is approximately $19,700,000.

- 2021 - $10,800,000
- 2022 - $2,500,000
- 2023 - $3,200,000

Table 6: Total Unpaved Road Project Costs

Year	Road	From	Community	RCOC Treatment	Funding	Miles	Total Estimate
2021	Barron Road	Grange Hall Road to Groveland Road	Groveland Township	Pave Gravel	STPU & HIP	2	$5,500,000
2021	Currie Road	8 Mile Road to 9 Mile Road	Lyon Township	Pave Gravel	STPU & HIP	1	$3,800,000
2021	Currie Road	at 8 Mile Road	Lyon Township	Roundabout	WCRC		$1,500,000
2022	Waldon Road	at Clintonville Road	Independence Township	Pave Gravel/Intersection	STPU		$2,500,000
2023/24	Waldon Road	east of Clintonville Road to Baldwin Road	Independence Township/Orion Township	Pave Gravel	STPU	2.14	$6,400,000
					Totals	**5.14**	**$19,700,000**

The amount budgeted for future years will increase with the addition of other projects and funds from external sources. Additional funding can come from Earmarks, STP Reauthorization, Federal Discretionary Grants, Local Participation and Increase in State Fund distributions. The average budget for construction and maintenance projects is a minimum of $50,000,000 a year. The projects listed above do not include the near-term projects selected by the maintenance department.

Planned Maintenance Projects

Near-term projects include preservation overlays, crack sealing, spot resurfacing, and many gravel maintenance projects. The quantity of projects is determined by available MTF revenue and the location is determined based on immediate need identified by the maintenance department and district staff. Projects for the next fiscal year are selected no more than 1 year in advance. This process allows RCOC to adapt to changing road conditions and apply an immediate and cost-effective treatments at the right time. Road segments selected for maintenance are identified through analysis performed by the Highway Engineer and Highway Maintenance Department. During the early stages of budget development RCOC allocates approximately $5 million for preservation overlays (Mill & Fill with 1.5” HMA), $1 million for spot resurfacing, $250,000 for 24-inch joint repairs and $1.5 million for concrete repairs. The total cost of maintenance projects could grow from an originally planned $8 million to $20 million depending on additional funding availability. Table 7 includes the list of locations identified by maintenance staff for

maintenance fixes. Fixes include crack sealing, preservation overlays, concrete patching, spot resurfacing. Figure 7 is a map of all the maintenance projects in 2021 and longer-term preservation overlays planned for 2022 and 2023.

Table 7: 2021 Road Maintenance Projects

2021 Crack Sealing Locations		
Road	**Limit 1**	**Limit 2**
Cooley Lake Road	Oxbow Lake Road	Union Lake Road
Milford Road	N Milford Village Limits	N Highland Township Limits
Pontiac Trail	S. Commerce Road	Welch Road
Andersonville Road	Farley Road	Davisburg Road
Sashabaw Road	I-75	Clarkston Road
Grange Hall	Van Road	Jossman Road
Sashabaw Road	Sherwood Road	Granger Road
Cass Lake Road	Otter Street	Pontiac Lake Road
Franklin Road	Walnut Lake Road	Lone Pine Road
Lone Pine Road	Orchard Lake Road	Lone Pine Road/Inkster Road
Maple Road	Telegraph Road	Cranbrook Road
Maple Road	East of Middlebelt Road	Inkster Road
Quarton Road	Inkster Road	Franklin Road
Quarton Road	Lahser Road	Woodward Avenue
Adams Road	Square Lake Road	South Boulevard
Square Lake Road	East of I-75 Ramp	Adams Road
Middlebelt Road	Maple Road	Orchard Lake Road
Adams Road	North Birmingham City Limits	Wattles Road
Maple Road	Haggerty Road	Drake Road
Square Lake Road	Middlebelt Road	US-24
Lahser Road	13 Mile Road	Maple Road
12 Mile Road	West of Southfield Road	Red Leaf Lane
13 Mile Road	Telegraph Road	Beverly Hills West Village Limits
Livernois Road	Avon Road	Walton Road
Lahser Road	8.5 Mile Road	10 Mile Road
10 Mile Road	East of I-75	Dequindre Road
10 Mile Service Drive	East of Woodward Avenue	I-75
10 Mile Road	West of Coolidge Road	West of Woodward
South Boulevard	Crooks Road	Livernois Road
Cooley Lake Road	Union Lake Road	Williams Lake Road
2021 Preservation Overlay Locations		
Road	**Limit 1**	**Limit 2**
Flemings Lake Road	Clarkston Road	Walters Road
Walters Road	Flemings Lake Road	Waldon Road
Clarkston Road	Village of Clarkston	Orion Township Line
White Lake Road	Clarkston Village	Andersonville Road
Eston Road	Clarkston Road	End of Pavement
Hickory Ridge Road	Labadie Road	M-59
14 Mile Road	Walled Lake Drive	Haggerty Road

Romeo Road	Kline Road	Dequindre Road
Dequindre Road	Washington Road	Clinton River Trail
Williams Lake Road	East of Gale Road	West of Dixie Hwy
Lochaven Road	Willow Road	Cooley Lake Road
Grange Hall Road	Fish Lake Road	Fagen Road
Commerce Road	Livingston Co Border	Milford Village Limit
Clyde Road	Strathcona Road	Milford Road
Pontiac Lake Road	Hospital Road	Williams Lake Road
Livingston Road	M 59	Milford Road
Sashabaw Road	Walton Boulevard	Dixie Highway
Airport Road	Andersonville Road	Hatchery Road
Pine Knob Road	Clarkston Road	End of Pavement
Seymour Lake Road	Baldwin Road	Oxford Village Limits
Napier Road	11 Mile Road	12 Mile Road
Benstein Road	Maple Road	Sleeth Road
Grand River Avenue	w/o Napier Road	Livingston Co Border
Grange Hall Road	I – 75	Tripp Road
Sashabaw Road	Oak Hill Road	Sherwood Road
Heights Road	Joslyn Road	M-24
10 Mile Road	Greenfield Road	East of Church Street
Dequindre Road	n/o Auburn Road	South of Hamlin Roadd
Crooks Road	Hamlin Road	Avon Road
2022 Preservation Overlays Locations		
Pontiac Trail	Napier Road	to W Maple Road
Harvey Lake	Clyde Road	M-59
8 Mile Road	Currie Road	Napier Road
Kent Lake Road	Silver Lake Road	Grand River Avenue
Elizabeth Lk Road	Oxbow Lake Road	Union Lake Road
Union Lake Road	Elizabeth Lake Road	Cooley Lake Road
12 Mile Road	east of Grand River Avenue	
Sashabaw Road	at Waldon Road Intersection	
Clarkston Road	east of M-15	
Holly Road	Tindall Street	Dixie Highway
Waldon Road	Baldwin Road	Joslyn Road
Maybee Road	Rohr Road	Baldwin Road
Franklin Road	Friendly (Pontiac CL)	Long Lake Road
Parkway Street	Cass Elizabeth Lake Road	Deadend
N Oakland Boulevard	Highland Road	Pontiac Lake Road
Opdyke Road	Hickory Grove Road	South Boulevard
Pine Lake Road	Orchard Lake Road	Middlebelt Road
Green Road	Orchard Lake Road	Walnut Lake Road
8 Mile Road	East of Farmington Road	Grand River Avenue
Middlebelt Road	8 Mile Road	I-696
12 Mile Road	Coolidge Road	to Crooks Road
2023 PROGRAM (but will be first to move to 2022 if extra money becomes available)		

Griswold Road	9 Mile Road	10 Mile Road
Wixom Road	south of Old Wixom Road	north of I96
Oxbow Lake Road	Elizabeth Lake Road	Cooley Lake Road
Seymour Lake Road	Sashabaw Road	Baldwin Road
Drahner Road	Sanders Road	M24
Brown Road	M-24	Squirrel Road
Squirrel Road	Dutton Road	Silver Bell Road
Novi Road	south of 12 Mile Road	Grand River Avenue
Livernois Road	north of Long lake Road	south of Avon Road
Eastways Road	E Long Lake Road	Square Lake Rd Road
Remainder of 2023 PROGRAM		
Napier Road	8 Mile Road	9 Mile Road
9 Mile Road	Chubb Road	Napier Road
8 Mile Road	Napier Road	Taft Road
Martin Road	Pontiac Trail	Richardson Road
Davisburg Road	Eaton Road	Bridge Lake Road
Orion Road	Rochester Road	Flint Street
Academy Road	Fish Road	west to dead end
Belford Road	Holly Road	west to RR tracks
Belford Road	I-75	intersection
East Holly Road	Maple Road	Rood Road
12 Mile Road	Northwestern Highway	Inkster Road
13 Mile Road	Inkster Road	Telegraph Road
Middlebelt Road	I-696	Maple Road
2021 Concrete Patching (no federal funding)		
Road	**Limit 1**	**Limit 2**
Grand River Avenue	West of intersection	East of intersection
Maple Road	West of John R Road	John R Road
Crooks Road	Square Lake Road	Fountain Drive
Long Lake Road	Fountain Parkway	Corporate Drive
Long Lake Road	Livernois Road	Rochester Road
Orchard Lake Road	I-696	11 Mile Road

2021 Roads with Spot Resurfacing Locations	
Road	**Community**
Hatchery Road	Waterford
S Hospital Road	Waterford
13 Mile Road	Franklin
Greenfield Road	Southfield
8 Mile Road	Farmington
12 Mile Road	Farmington Hills
Livernois Road	Rochester Hills
Dequindre Rd	Troy

John R Rd	Madison Heights
Duck Lake Rd	Highland
Wardlow Rd	Highland
Elizabeth Lake Rd	White Lake Twp
Old Plank Rd	Milford Twp
Lone Tree Rd	Highland Twp
Strathcona	Highland Twp
Rowe Rd	Highland Twp
Wardlow Rd	Highland Twp
Davisburg Rd	Springfield Twp
Sloan Dr	Holly Twp
Academy Rd	Holly Twp
Rolling Hills Dr	Holly Twp
Otter Run Rd	Holly Twp
Beaver Run Rd	Holly Twp
River Rock Dr	Holly Twp
Joslyn Rd	Auburn Hills
Adams Rd	Oakland Twp
N Hadley Rd	Brandon Twp

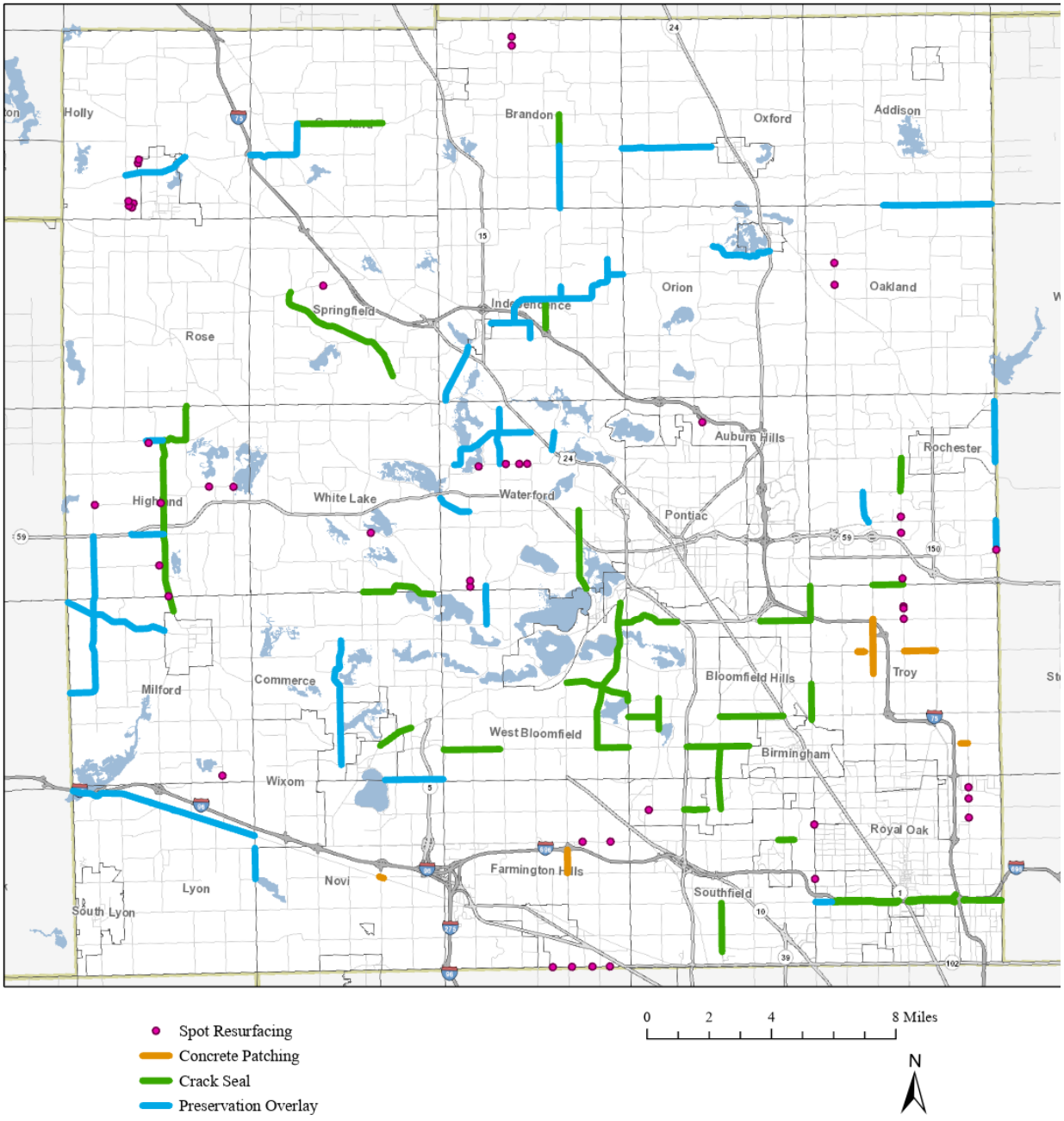


Figure 7: Map of Maintenance Projects for FY2021.

2. BRIDGE ASSETS

INVENTORY OF ASSETS

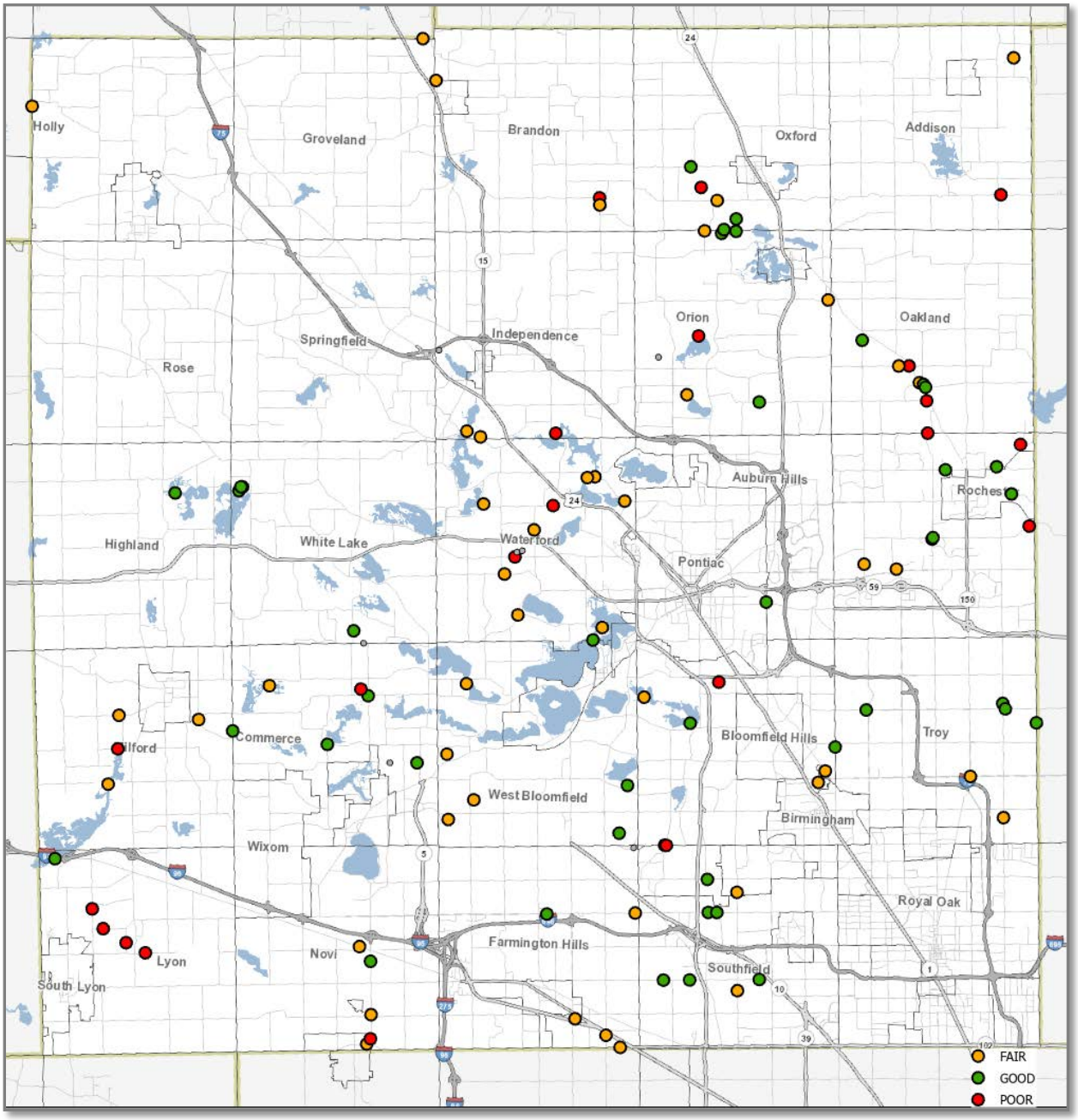


Figure 8: Map illustrating locations of RCOC's bridge assets.

The defintion of a bridge is a structure that span 20 feet or more across one or multiple spans. The RCOC has 116 total bridges in its road and bridge network; these bridges connect various points of the road network, as illustrated in Figure 8. These bridge structures can be summarized by type, size, and condition, which are detailed in Table 8. More information about each of these structures can be found in RCOC's MiBRIDGE database or by contacting RCOC.

Table 8: Type, Size, and Condition of RCOC's Bridge Assets

Bridge Type	Total Number of Bridges	Total Deck Area (sq ft)	Condition: Structurally Deficient, Posted, or Closed			2021 Condition		
			Struct. Deficient	Posted	Closed	Poor	Fair	Good
Concrete – Culvert	23	55813	0	0	0	0	6	17
Concrete – Slab	1	614	0	1	0	0	0	1
Concrete – Tee beam	2	8795	1	2	0	1	1	0
Concrete continuous – Slab	3	19127	0	2	0	0	1	2
Prestressed concrete – Box beam/girders—multiple	33	69941	7	6	0	7	20	6
Prestressed concrete – Box beam/girders—single/spread	4	20281	0	0	0	0	0	4
Prestressed concrete – Multistringer	8	53013	0	0	0	0	2	6
Steel – Culvert	28	51951	7	11	0	15	6	1
Timber – Girder and floorbeam	1	1456	0	1	0	0	1	0
Timber – Slab	13	20605	3	2	0	3	4	6
Total SD/Posted/Closed			**26**	**25**	**0**			
Total	**116**	**301596**				**26**	**47**	**43**
Percentage (%)			**22%**	**22%**	**0**	**22%**	**41%**	**37%**

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 RCOC's bridge network based on the NBIS is 43 (37%) structures rated good, 47 (41%) structures rated fair, and 26 (22%) structures rated poor (Table 8).

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. RCOC has 25 structures that are posted for load restriction (Table 8). 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. RCOC has 0 structures that are closed (Table 8).

The goal of the program is the preservation and safety of RCOC's bridge network. RCOC overall goal is to maintain or improve bridge conditions network-wide at or above 2020 levels. Specifically, the goal is to achieve 82% or higher of bridges in good or fair condition and 22% or lower of bridge poor/structurally deficient condition by 2024. Figure 9 illustrates the baseline condition, projected trend, and goal that RCOC has for its good/fair and its structurally deficient bridges.

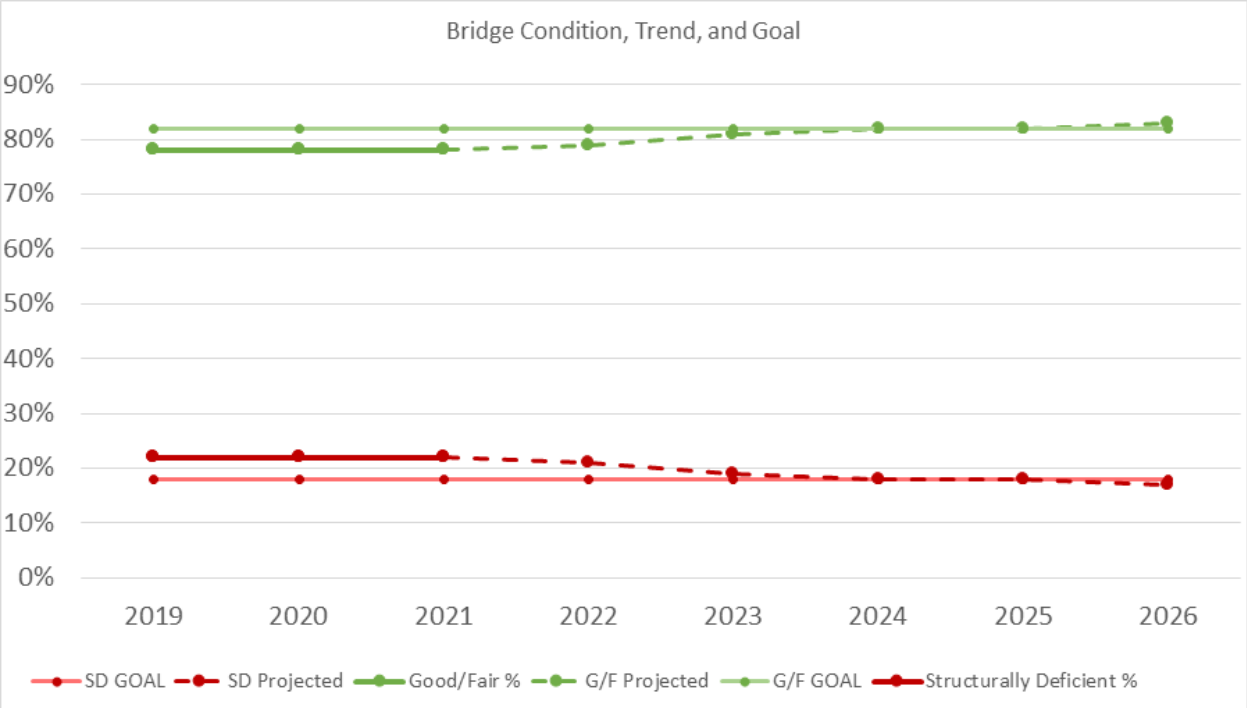


Figure 9: Condition, projected trend, and goal for RCOC's good/fair and structurally deficient bridges.

PROGRAMMED/FUNDED PROJECTS, GAP ANALYSIS, AND PLANNED PROJECTS

The NBIS rating conditions of good/fair/poor (Table 8) are essential asset management information to identify bridge work needed (preventive mainenance, rehabilitation, replacement) and the funding required.

RCOC receives appromately $5,000,000 per year total funding. The largest portion of this bridge funding comes from the MDOT's Local Bridge Program (LBP). RCOC will submit applications every year for bridge improvments funding. Typcially, this funding is used for total bridge replacments on the worse condition bridges with high traffic volume and other critical factors. RCOC plans to replace five bridges from 2021-2023 at a total cost of nearly $11,000,000. RCOC plans to replace one to six bridges in 2024 at a total cost ranging from $2,000,000 to $12,000,000. The number of bridges to be replaced in 2024 will be determined on the MDOT's LBP applications that are selected to be funded and other funding opptorunities that may become available.

RCOC 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. Preventive maintenance will use RCOC funding from the agency's annual operating budget, a detailed explanation of RCOC's financial resources can be found in the *5. Financial Resources* section. RCOC plans to spend on average $150,000 per year on preventive maintenance of bridges (not shown in Table 9).

By performing the aforementioned preventive maintenance and replacement of bridge structures, RCOC will achieve its bridge network goals.

Table 9 shows the 2021-2023 programmed/funded projects and the 2024 to be determined (TBD) projects that will be undertaken in order to achieve RCOC's goal. These programmed/funded projects are juxtaposed with priority projects that remain unfunded (gap).

More detailed information can be found in the attached bridge asset management plan in Appendix B.

Table 9: Planned Projects and Gap Analysis

Strategy	2021 (Programmed)	2022 (Programmed)	2023 (Programmed)	2024 (TBD)	GAP (LBP Application Year)
Replacement					
8182	$2,900,000				
8183		$1,997,000			
14036		$1,788,000			
8211			$1,981,000		
8194			$2,196,000		
13648				$1,832,000	
8207				$2,197,000	
13810				$2,213,000	
8201				$1,897,000	
13934				$2,043,000	
8200				$1,812,000	
13648					$1,746,000 (FY 2021)
8207					$1,755,000 (FY 2022)
13810					$1,953,000 (FY 2023)
8201					$1,690,000 (FY 2023)
8144					$1,778,000 (FY 2023)
Subtotal	***$2,900,000***	***$3,785,000***	***$4,177,000***	***$11,994,000***	***$8,922,000***
Rehabilitation					
8167	$2,200,000				
8192		$250,000			
8184		$250,000			
Subtotal	***$2,200,000***	***$500,000***	$0	$0	$0
Preventive Maintenance					
8171		$250,000			
13506		$250,000			
Subtotal	***$0***	***$500,000***	$0	$0	$0

3. CULVERT ASSETS

INVENTORY OF ASSETS

The culvert inventory process began in 2018 after stormwater structure inventory and condition data collection was complete. RCOC began to employ interns with the task of collecting data on culverts under the roadway. Culverts under driveways are not recorded or rated at this time. RCOC anticipates collection of all culverts to be complete by the end of fiscal year 2022.

At present, RCOC tracks inventory and condition data of its culvert assets. RCOC has inventoried 2825 culverts, which is 81 percent of the estimated 3500 culverts that RCOC owns, as illustrated in Figure 11. Of RCOC's 2825 tracked and rated culverts RCOC has 2260 (80%) culverts considered good, 367 (13%) culverts considered fair, 112 (4%) culverts considered poor, and 86 (3%) culverts considered failed (Figure 10), based on the culvert rating system that RCOC uses (see Appendix C *Culvert Asset Management Plan Supplement*).

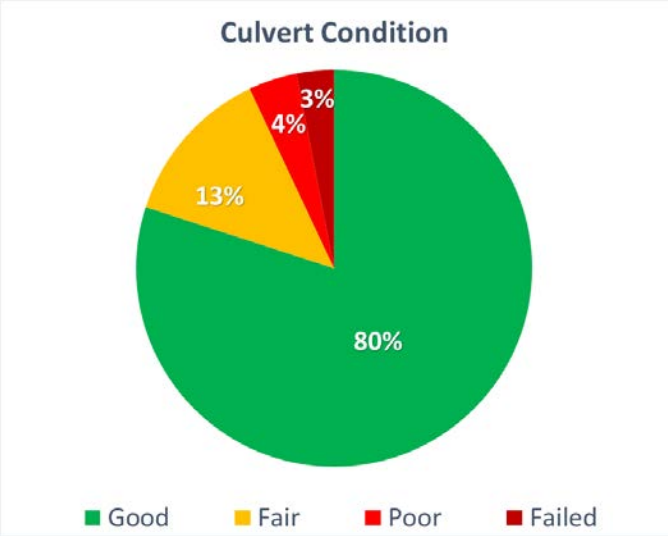


Figure 10: Culvert Condition

GOALS

A goal of RCOC's asset management program is the preservation of its culvert network. The first step in reaching this goal is having an accurate and detailed inventory of culvert locations and condition. RCOC is responsible for preserving at a minimum 2825 inventoried culverts and it is anticipated that there are approximately another 600-700 more culverts to be found and recorded under RCOC roads. Once the data is complete, RCOC will begin to monitor culvert condition and track upgrades to culverts as repair/replacement occurs.

Larger culverts identified as B bridges.

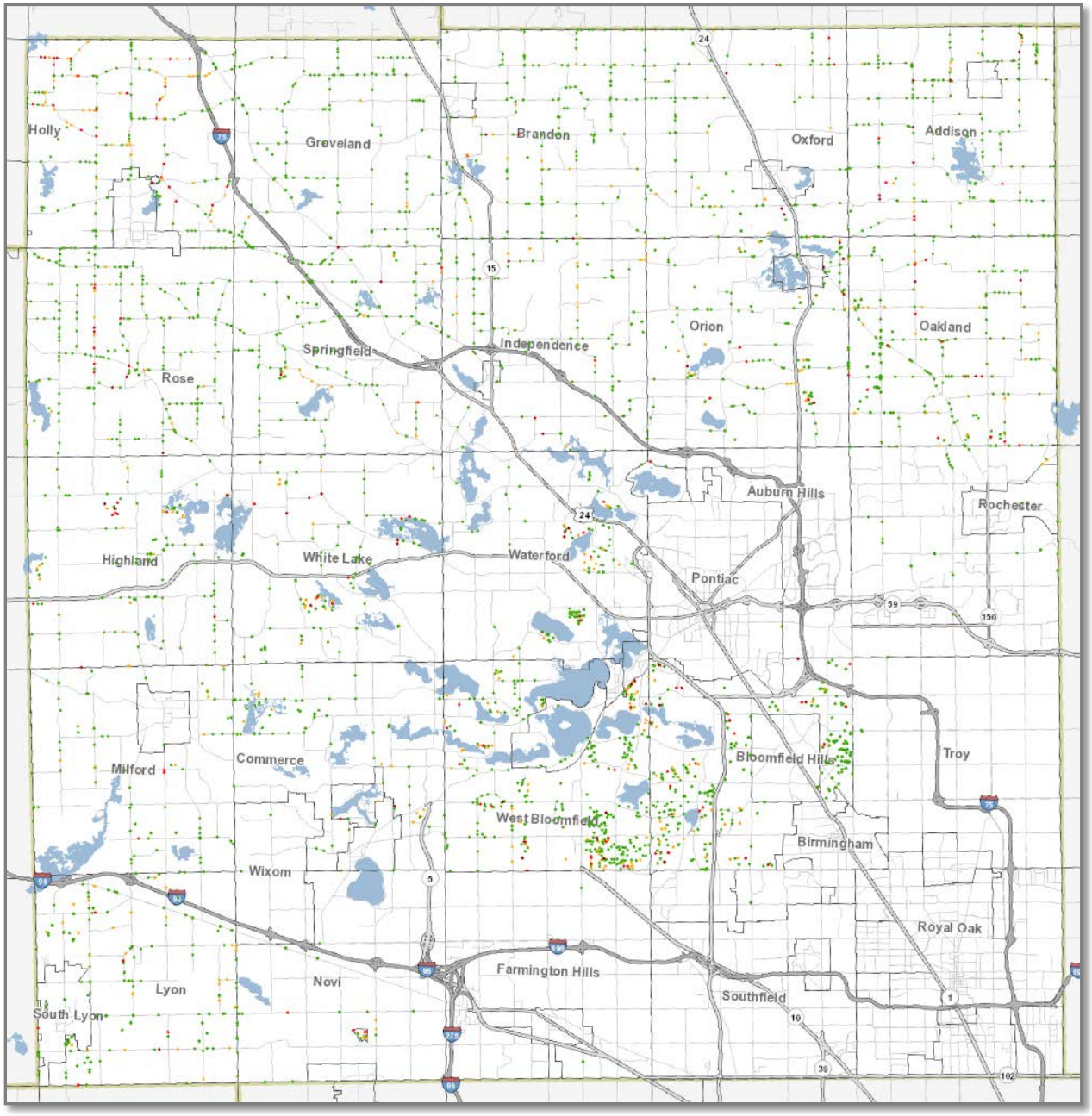


Figure 11: Map illustrating locations of RCOC's culvert assets.

More detail about these culvert assets can be found by contacting RCOC GIS Lead, Aaron Verhelle at averhelle@rcoc.org.

PLANNED PROJECTS

RCOC's policy is to replace or repair culvert assets concurrent with projects or when they have failed. RCOC includes culvert assets in scheduled maintenance projects affecting road segments. Maintenance districts also assesses culvert performance and condition during/after heavy rain events or relating to resident/community concerns or requests. Culvert location and condition data can also help in providing more accurate project cost estimates when Engineering is scoping a project for improvements.

Many planned projects do have culverts that will need to be repaired or replaced while the road is being improved. Culverts that have been identified for repair or replacements projects separate from road projects are selected due to critical need and funding availability. An example program of culvert replacement projects includes addressing culverts that if not fixed would landlock small populations of people. Examples can include a culvert over a small waterway or drain separating a house at the end of a cul-de-sac from the rest of the neighborhood. Table 10 below shows a list of culvert repair or replacement projects includes landlocked culverts and other culverts in critical need of replacement. Figure 12 is a map of these locations. Total amount budgeted each year is as follows:

- 2021 - $4,040,174
- 2022 - $2,600,000
- 2023 - $2,400,000
- 2024 - $2,350,000
- Unmet Needs (funding source and year not identified) - $5,000 0000

Table 10: Culvert Projects

Road	Location	Community	Budget	Road Classification	Treatment	Landlocked
FY2021						
Orchard Lake	Over Rouge River	Farmington Hills	$850,000	Primary	Replace	
Milford	Over Buckhorn Creek	Rose	$750,000	Primary	Replace	
Fish Lake	Over Patterson/Holly Drain	Holly	$728,646	Primary	Replace	
Fish Lake	Over Shiawassee Drain	Holly	$1,711,528	Primary	Replace	
FY2022						
Cass Lake	Over Cass/Otter Canal	Waterford	$850,000	Primary	Replace	
11 Mile	Over Novi-Lyon Drain	Lyon	$1,000,000	Local	Replace	
Pontiac Trail	Over Norton Drain	Commerce	$750,000	Primary	Replace	
Pine Valley Way	Over Rouge River	Bloomfield	$0	Local	Repair	
Mann	Over Sashabaw Creek	Independence	$0	Local	Replace	√
FY2023						
Oxbow Lake	Over Huron River	White Lake	$750,000	Primary	Replace	
Middlebelt	Over Shiawassee Drain	Farmington	$900,000	Primary	Replace	
Indianwood	Over Lake Orion	Orion	$750,000	Primary	Replace	√
FY2024						

McGinnis	Over Stewart Lake	Groveland	$750,000	Primary	Replace	
Gallagher	Over Paint Creek Tributary	Oakland	$750,000	Primary	Replace	
Cedar Shores	Over Cedar Lake Canal	White Lake	$0	Local	Replace	√
10 Mile	Over Rouge River	Farmington Hills	$850,000	Primary	Replace	
Future						
Lone Pine	Over Tributary to Walnut Lake	West Bloomfield	$800,000	Primary	Replace	
Square Lake	Over Daly Drain	Bloomfield	$850,000	Primary	Replace	
Commerce	Over Green Lake	West Bloomfield	$750,000	Primary	Replace	
Orion	Paint Creek	Oakland	$850,000	Primary	Replace	
Wise	Over Huron River	Commerce	$900,000	Primary	Replace	
Haggerty	Over Seeley Drain	Commerce/ Farmington Hills	$850,000	Primary	Replace	
Balmony	Over Bass Lake Canal	Commerce	$0	Local	Replace	√
Perry Lake	Over Clinton River	Independence	$0	Local	Replace	
Rossdale	Over Cass Lake Canal	Waterford	$0	Local	Replace	√
Clearwater	Over Round Lake Canal	White Lake	$0	Local	Repair	√

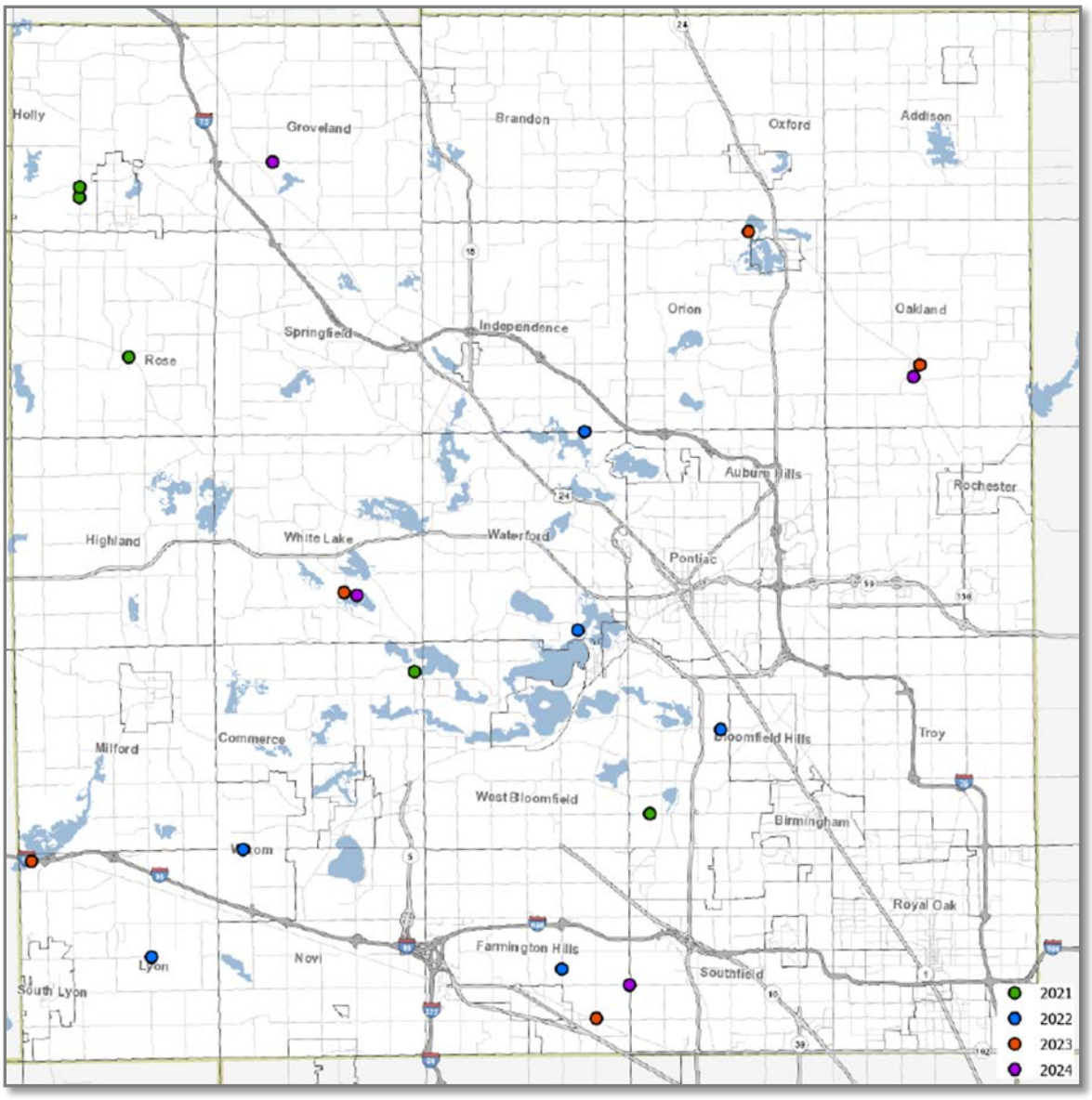


Figure 12: Map of Culvert Projects.

4. SIGNAL ASSETS

INVENTORY OF ASSETS

RCOC's signal systems division developed a traffic signal management system that provides an inventory of the traffic signals maintained by RCOC located on county, MDOT and city roads that allows staff to quickly obtain asset information such as equipment, approach photos, signal timings, layouts and other signal related information.

RCOC has inventoried 1446 traffic signals, which is 100 percent of the actual 1446 traffic signals that RCOC maintains. Traffic signals at intersections and High-Intensity Activated Crosswalk (HAWK) beacons at roundabouts and mid-block pedestrian crossings are included in this inventory.

RCOC maintains traffic signals that are owned by RCOC, MDOT, Cities, Villages, and Private institutions (e.g., businesses, churches, schools). Table 11 shows RCOC traffic signal inventory information. Figure 13 illustrates the locations of traffic signal inventory.

Table 11: Traffic Signal Inventory

Signal Owner	Number of Signals
RCOC Signals	
Signals Owned & Inventoried	• 637
MDOT Signals	
Signals Owned & Inventoried	• 359
Other (Cities, Villages, Private) Signals	
Signals Owned & Inventoried	• 450
Total Signals	
Signals Owned & Inventoried	• 1446

More detail about these traffic signal assets can be obtained by contacting RCOC.

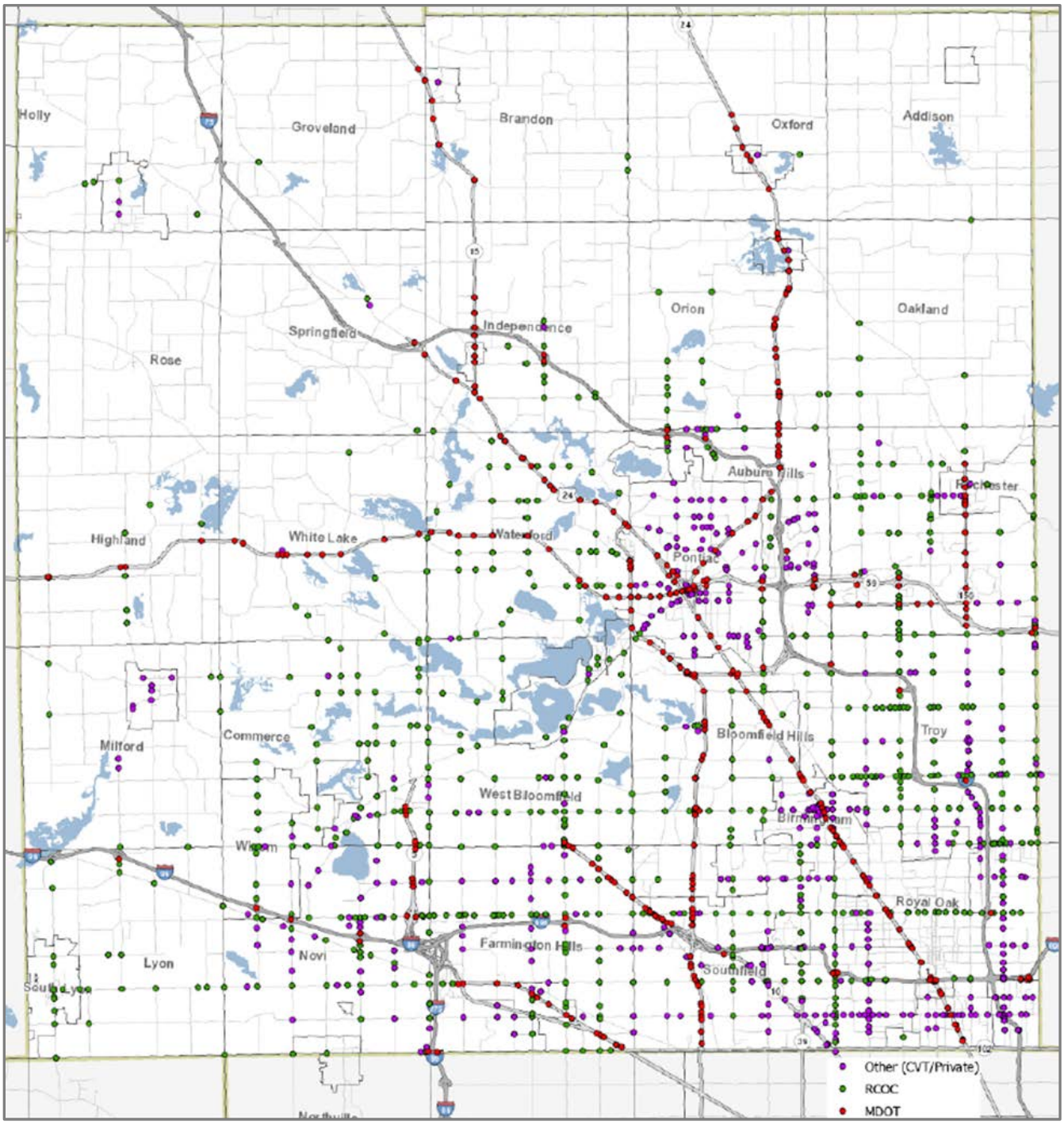


Figure 13: Map illustrating locations of RCOC's signal assets.

GOALS

The goal of RCOC's traffic signal asset management program is the continued operation and preservation of all 1446 of its traffic signals along the entire road network.

PLANNED PROJECTS

RCOC's policy is to evaluate traffic signal assets based on condition assessment for replacement or repair during any reconstruction, rehabilitation, preventive maintenance, or scheduled maintenance activities on the roadway. It also repairs those traffic signal assets reported as non-functional or as performing with reduced function. RCOC adheres to regular maintenance and servicing policies outlined in the *Michigan Manual of Uniform Traffic Control Devices*.

RCOC's Faster and Safer Travel through Traffic Routing and Advanced Controls (FAST-TRAC) project includes deployment of high-tech "adaptive" traffic signals that utilizes several types of vehicle detection. As of August 2021, there are approximately 800 intersections equipped with FAST-TRAC technologies.

RCOC's Signal Project Programs will receive roughly $3.2 million for FY 2020-2021 and $4.6 million in FY 2021-2022. The program of Signal Projects includes:

- Funding to operate the Traffic Operations Center (TOC).
- Federal safety projects (e.g., installation of signal backplates).
- Wireless communications for the FAST-TRAC program.
- LED (Light Emitting Diodes) signal re-lamping. The LED signal lowers operating costs as a result of their long life (approximately 15 years) and significantly lowers electricity usage (uses over 85% less electricity than incandescent light bulbs).

RCOC plans to modernize an average 8 to 10 traffic signals a year. Signal modernization includes upgrading diagonal span wire configuration to the preferred box span configuration and other work including but not limited to: signal heads, poles and span wire, foundations, cabinet and controller, video detection and pedestrian push buttons, wireless communications, closed-circuit television (CCTV) equipment, Americans with Disabilities Act (ADA) complaint crosswalks, and backplates. RCOC current planned projects (Table 12) and future planned projects (Table 13) are shown below.

Table 12: FY 2020-2021 Traffic Signal Modernization Projects		
County Signal Number	**Intersection**	
9	Crooks Road	Maple Road
11	John R Road	Maple Road
12	Grand River Avenue	Wixom Road
26	10 Mile Road	Novi Road
53	Maple Road	Rochester Road
130	Southfield Road	Mt. Vernon Road Street
253	Coolidge Highway	Long Lake Road
357	Commerce Road	Hiller Road
1004	Josyln Road	Flintridge Street

Table 13: FY 2021-2022 Traffic Signal Modernization Projects		
County Signal Number	**Intersection**	
80	Dequindre Road	Maple Road
85	Coolidge Highway	Square Lake Road
96	Cooley Lake Road	Union Lake Road (North)
97	Cooley Lake Road	Union Lake Road (South)
117	Beverly Road	Southfield Road
125	Coolidge Highway	Maple Road
179	Dequindre Road	Long Lake Road
203	Elizabeth Lake Road	Williams Lake Road
210	Green Road	Orchard Lake Road
223	Orchard Lake Road	Walnut Lake Road
362	Richardson Road	Union Lake Road
540	12 Mile Road	Rollcrest Road
702	13 Mile Road	Haggerty Road
991	8 Mile Road	Haggerty Road
1089	Maceday Lake Road	Williams Lake Road
1551	9 Mile Road	Griswold Road

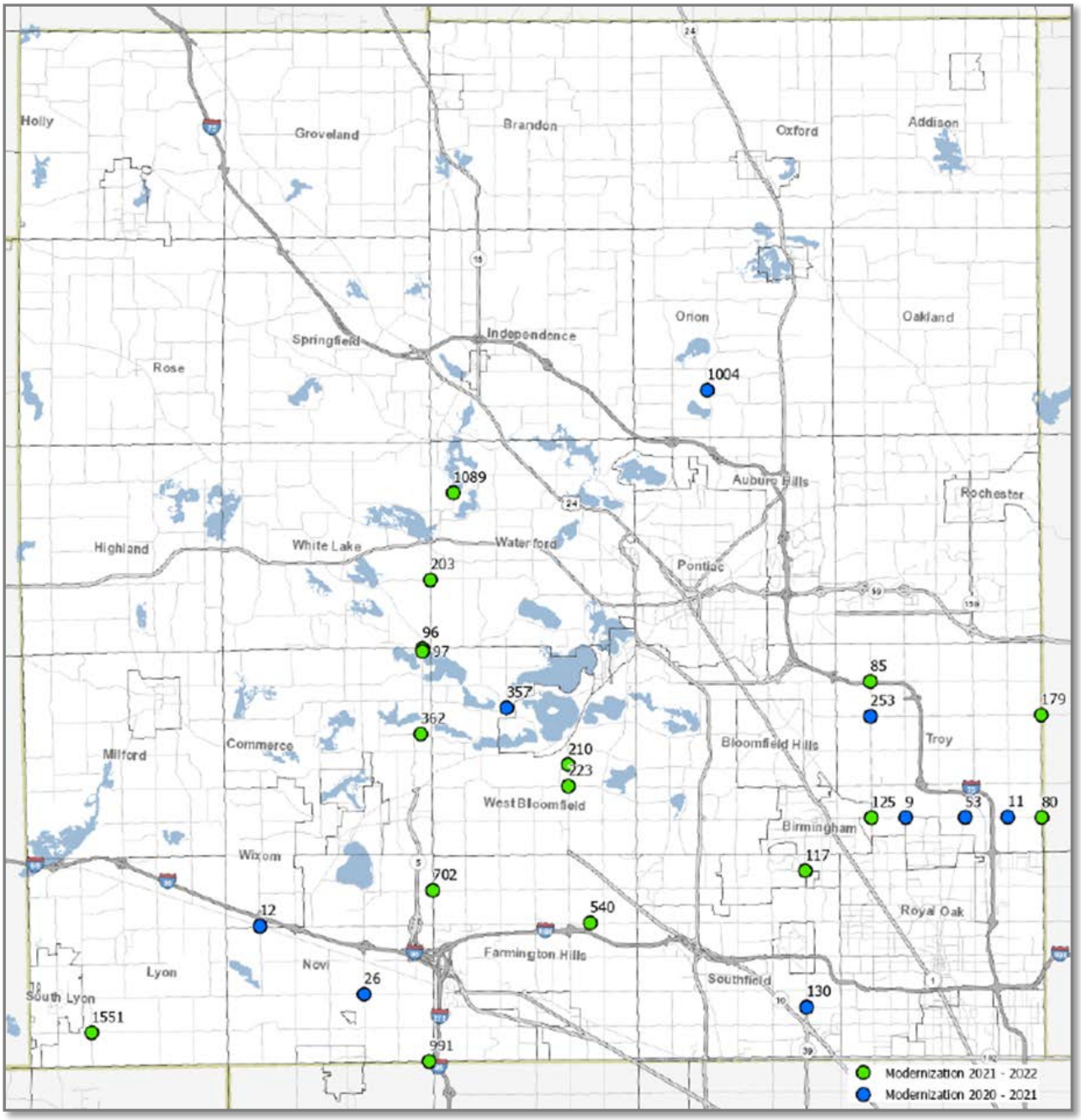


Figure 14: Map of Signal Modernization Projects.

5. FINANCIAL RESOURCES

Public entities must balance the quality and extent of services they can provide with the tax resources provided by citizens and businesses, all while maximizing how efficiently funds are used. Therefore, RCOC 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. Full details of RCOC's financial status can be found on our website at rcocweb.org or by request submitted to our agency contact (listed in this plan).

ANTICIPATED REVENUES & EXPENSES

RCOC receives funding from the following sources:

- **State funds** – RCOC's principal source of 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. RCOC also receives revenue from the Michigan Department of Transportation to maintain (e.g. plow, patch, mow) the state trunklines within its jurisdictional boundary. Revenue from these maintenance contracts are received on a time and materials basis as resources are expended to maintain the State's roads. While these contracts do not allow for capital gain (profit) and only bring in revenue to cover the cost of the work, they do provide a benefit to RCOC by allowing an economy of scale that enables us to provide better service at a lower cost for RCOC's roads while allowing the same for the State of Michigan. Examples of state grants also include local bridge grants, economic development funds, and metro 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 (urban, rural and flex purchased funds), C and D funds, bridge funds, Highaway Safety Improvement Funds, MDOT payments to private contractors, and negotiated contracts.
- **Local government entities or private developer contributions to construction projects for specific improvements** – This category includes cost participation or coverage by developers to ensure improvements needed on to the network meet RCOC standards and benefit the community, and can also include funding from a special assessment district levied by another

governmental unit. Examples of contributions from local units include city, village, and township contributions to the county; special assessments; county appropriations; bond and note proceeds; contributions from counties to cities and villages; 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. RCOC does not have local tax millages in its road-funding budget. There have been millages that local communities pass just for roads, for example, Independence Township voters approved a tax levy of up to two mills for four years. The tax will raise about $3 million per year and RCOC will contribute $4.5 million worth of design and construction management services. These funds will allow for the resurfacing of all primary roads in the township over four years.

- **Tri-Party Program** – The Tri-Party program is unique to Oakland County and provides an additional $6 million in funds allocated for roads throughout the county. The popular Tri-Party Program, is a three-way funding initiative for road improvements on Road Commission for Oakland County (RCOC) roads. The program began in the early 1970s to address rough gravel roads. Over time, it grew to include addressing a variety of issues on both paved and gravel roads. The program is available to every community in Oakland County that opts-in. It involves funding from three sources: The Oakland County Board of Commissioners, the Road Commission for Oakland County (RCOC) and the cities, villages and townships in the county. For a number of years, the program has been set at $3 million, with $1 million from each of the parties. For 2016, the parties agreed to double the program, for a total of $6 million available. Each year, half the money available through the program is committed for RCOC roads in townships and the other half is dedicated to RCOC roads in cities and villages. One of the most popular elements of the program is that the communities get to choose the Tri-Party Program projects, so long as they meet program criteria and are on RCOC roads. How much Tri-Party funding each community receives is determined by formula. For cities and villages, the formula is based on the number of miles of county roads in the city or village and the number of crashes on those roads. In townships, the same factors are used, but township population is added to the formula as well. Eligible projects for Tri-Party funds include road resurfacing and reconstructing, drainage improvements, gravel road re-graveling or paving, signal installation, curb and lane additions and shoulder paving. Additionally, communities can choose to use Tri-Party funds as their local match for larger, federally funded road projects (for most federally funded projects, 80 percent of the money comes from federal funds, 10 percent from RCOC and 10 percent from the local community).

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

- **Permit fees** – Generally, permit fees cover the cost of a permit application review or from other work within the ROW.

- **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.

- **Charges for services** – Funds from partner agencies who contract with RCOC to construct or maintain its roads, or roads under joint or neighboring jurisdictions, including state trunkline maintenance and non-maintenance services and preservation.

RCOC 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."[1]

- **Preservation and Structural Improvement Funds** – Preservation and structural improvements are "activit[ies] undertaken to preserve the integrity of the existing roadway system."[2] 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".[3] Preventive maintenance activities are "planned strategy[ies] 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".[4]

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

- **Trunkline Maintenance Funds** – Expenditures spent under RCOC's maintenance agreement with MDOT for maintenance it performs on MDOT trunkline routes.

- **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 and villages.

Table 14 (below) details the revenues and expenditures for RCOC in FY 2021.

[1] Public Act 51 of 1951, 247.660c Definitions
[2] Public Act 51 of 1951, 247.660c Definitions
[3] Public Act 51 of 1951, 247.660c Definitions
[4] Public Act 51 of 1951, 247.660c Definitions

Table 14: Annual Fiscal-Year Revenues & Expenditures in FY2021

Revenues		**Expenditures**		
Item	**Estimate $**	**Item**	**Estimate $**	**Percent of Total (Estimated)**
State Funds	$114,283,893	Construction & capacity improvement (CCI)	$36,084,371	17.00%
Federal Funds	$36,123,577	Preservation & structural improvement (PSI)	$80,659,183	38.00%
Contributions from local units	$23,205,576	Routine maintenance	$42,452,201	20.00%
Interest, rents, and other	$350,000	Winter maintenance	$10,613,050	5.00%
Charges for Services	$750,000	Trunkline maintenance	$21,226,101	10.00%
License & Permits	$1,400,000	Administrative	$10,613,050	5.00%
Fund Balance	$36,004,940	Other	$10,613,050	5.00%
Other	$141,000			
TOTAL	$212,258,986		$212,258,986	

6. RISK OF FAILURE ANALYSIS

Transportation infrastructure is designed to be resilient. The system of interconnecting roads and bridges maintained by RCOC 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. Table 15 and Table 16 lists the road segments and bridges that were identified as critical links in the Road Commission for Oakland County's network based on various criteria. For pavement critical links criteria included long detour alternatives, criticality to commerce, and significance as a regional route. Figure 15 illustrates the key transportation links in RCOC's road network. For Critical Bridges criteria included, traffic volumes, long detour routes, proximity to large origin and/or destinations, and the type of crossing the bridge provided. Figure 16 illustrates the key transportation links in RCOC's bridge network.

In most cases, any single road segment or bridge contributes to more than one of these criteria.

These criteria were developed based on TAMC's Risk of Failure Analysis guidelines as well as RCOC's internal priorities. Below are descriptions of these criteria:

Long Detour – If the closure of a road segment would likely lead to significant delays and no reasonable alternative route exists, then the segment was considered to have potential to create long detours. This could also have significant impacts to congestion and safety of the rest of the network of roads.

Critical to Commerce – For the purposes of this analysis, commerce was used primarily to refer to industrial and retail commercial areas. A road segment that currently provides connection to an area of economic significance was evaluated for how it would negatively impact the productivity of that area in the event of a road failure.

Regional Route – Roads were evaluated for their role in facilitating travel across the county and considered important to the broader regional network if they support the efficient movement of vehicles. In some cases, these are roads that serve as alternatives to when major highways are impacted.

Traffic Volumes – It was determined that the more traffic that a road/bridge carries daily was a key indicator of its importance to the network. Roads that convey volumes over 10,000 trips per day are more critical to the system and serve more motorists.

Bridge Crossing – Structures that cross a major waterway such as branches of the Huron, Clinton, Shiawassee or Rouge River.

Table 15: RCOC road network includes the following critical links:

Road	Limit 1	Limit 2	Classification	Traffic
Southfield Road	MC Clung	14 Mile	Principal Arterial	30-55k
Orchard Lake Road	I696	City of Pontiac Limits	Principal Arterial	30-45k
Holly Road	Grange Hall	N County Limits	Minor Arterial	10k
Milford Road	10 Mile Road	General Motors	PA in Lyon, MA Milford	12-18k
Milford Road	Commerce Road	M-59	Minor Arterial	14-15k
Pontiac Trail	M-5	Orchard Lake Road	Principal Arterial	20-27k
Pontiac Trail	Wixom Road	Maple Road	Principal Arterial	10-15k
Pontiac Trail	8 Mile	9 Mile	Minor Arterial	10-15k
Williams Lake Road	M-59	Dixie Highway	Principal Arterial	11-22k
Walton Boulevard	Sashabaw	Pontiac City Limits	Principal Arterial	18-25k
Grange Hall Road	West County Line	M-15	Minor Arterial	3-16k
Oakwood Road	M-15	M-24	Minor Arterial	6k
Baldwin Road	I-75	Clarkston Road	Minor Arterial	13-21k
Adams Road	Auburn Road	Walton Boulevard	Principal Arterial	10-22k
Big Beaver Road	Woodward Avenue	E County Limit	Principal Arterial	14-34k
12 Mile Road	Beck Road	Woodward Avenue	Principal Arterial	6-32k
12 Mile Road	Royal Oak Limits	Dequindre	Principal Arterial	17-29k
Rochester Road	City of Rochester Limits	N County Limits	Minor Arterial	4-34k
Grand River Avenue	City of Farmington Limit	Milford Road	Minor Arterial	10-20k
Clarkston Road	Village of Clarkston Limits	M-15	Minor Arterial	5-9k
White Lake Road	Milford Road	Andersonville Road	Minor Arterial	3-11k
White Lake Road	Andersonville Road	Dixie Highway	Principal Arterial	20k
Opdyke Road	Hickory Grove	Lapeer Road	Minor Arterial	5-27k
10 Mile Road	S Lafayette Street	Milford Road	Minor Arterial	9-14k
Haggerty Road	8 Mile Road	Richardson Road	Principal Arterial	16-26k
Union Lake Road	Richardson Road	Cooley Lake Road	Principal Arterial	30-34k
Walton Boulevard	City of Pontiac	Livernois Avenue	Principal Arterial	9-35k
Cooley Lake Road	Union Lake Road	Elizabeth Lake Road	Principal Arterial	15-30k
Commerce Road	Union Lake Road	Orchard Lake Road	Principal Arterial	12-19k
Belford Rd	Holly Road	Newark Rd/Cemetary	Major Collector	300
Dixie Hwy	County Limits	I-75	Minor Arterial	6-21k
Davisburg Road	Eaton Road	Dixie Highway	Major Collector	6k
Sashabaw Road	Clarkston Road	I-75	Minor Arterial	20k
Dequindre Road	E Avon Road	M-59	Principal Arterial	10-18k
John R Road	E Big Beaver Road	12 Mile Road	Minor Arterial	18-32k
Martin Rd / Richardson Rd	N Pontiac Trail	Haggerty Road	MA / PA	12-18k
Novi Road	W 12 Mile Road	Grand River Avenue	Principal Arterial	26-37k
Greenfield Road	W 10 Mile Road	8 Mile Road	Principal Arterial	17-31k
Farmington Road	Grand River Avenue	8 Mile Road	Minor Arterial	15-21k
Brown Rd/Giddings Rd/Silverb	Joslyn Road	M-24	Minor Arterial	7-18k

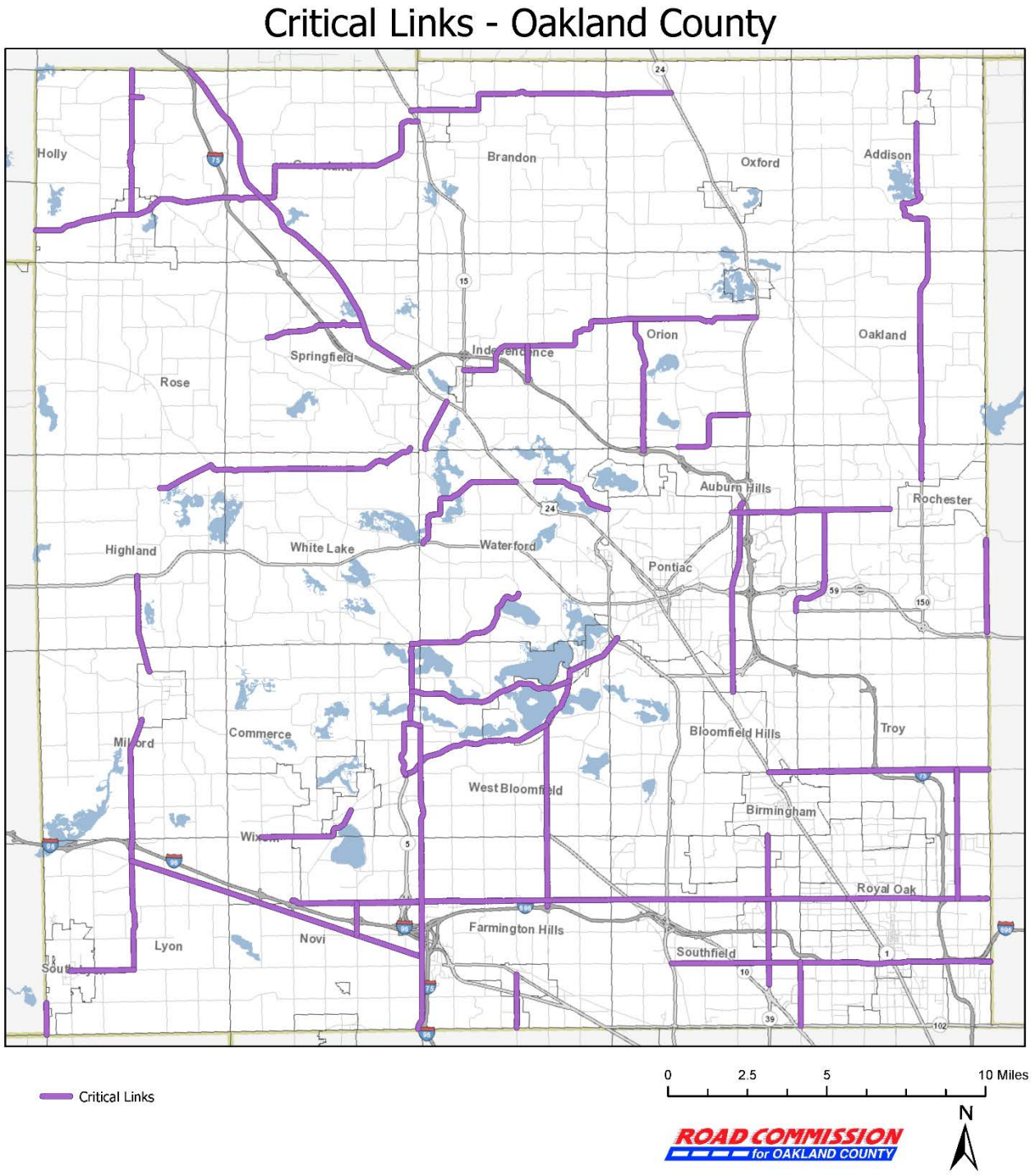


Figure 15: Key transportation links in RCOC's road network.

Table 16: RCOC bridge network includes the following critical links:

Bridges that are Critical Links					
Bridge Structure Number	**Year Built**	**Condition**	**Load Posted**	**Location**	**Comments/Remarks**
8143	2007	Good	No	Cass Lake Road over Clinton River	NHS Primary Rd, AADT 15,600 (2018).
8144	1928	Poor	Yes	Sashabaw Road over Clinton River	Primary Rd, AADT 14,400 (2018), Unfunded/Gap Project (2023 Application Year).
8149	2018	Good	No	Opdyke Road over Clinton River	Primary Rd, AADT 22,800 (2018).
8151	1959	Fair	No	Adams Road over Clinton River	NHS Primary Rd, AADT 21,400 (2018).
8153	1987	Fair	No	Crooks Road over Clinton River	Primary Rd, AADT 16,600 (2019).
8161	2012	Good	No	Livernois Road over Clinton River	Primary Rd, AADT 21,300 (2018).
8167	2004	Fair	No	Grand River Ave over CSX RR	Primary Rd, AADT 15,900 (2014), 2021 Rehabilitation.
8171	2009	Good	No	Grand River Ave over Kent Lake	Primary Rd, AADT 5,000 (2019), 2022 Preventive Maintenance.
8173	1959	Poor	No	Novi Road over Rouge River	NHS Primary Rd, AADT 13,300 (2016).
8178	1985	Fair	No	General Motors Road over Huron River	Primary Rd, AADT 11,400 (2016).
8179	1994	Fair	No	Cooley Lake Road over Clinton River	NHS Primary Rd, AADT 21,300 (2017).
8182	1962	Poor	Yes	Avon Road over Clinton River	NHS Primary Rd, AADT 22,400 (2014), 2021 Replacement Project.
8183	1962	Poor	Yes	Hatchery Road over Clinton River	Primary Rd, AADT 8,700 (2017), 2022 Replacement Project.
8184	2011	Good	No	Parkdale Road over Stoney Creek	Primary Rd, AADT 11,300 (2016), 2022 Rehabilitation.
8187	1992	Fair	No	Walton Blvd over Clinton River	NHS Primary Rd, AADT 18,300 (2018).
8191	2010	Good	No	Silverbell Road over GTW RR	Primary Rd, AADT 7,200 (2018).
13423	1940	Fair	Yes	Buno Road over Huron River	Secondary Rd, AADT 750 (2000).
13506	2011	Good	No	Novi Road over CSX RR & Middle Rouge River	NHS Primary Rd, AADT 21,900 (2014), 2022 Preventive Maintenance.
13810	1985	Poor	Yes	Pontiac Lake Road over Clinton River	Primary Rd, ADT 10,400 (2017), 2024 LBP Application Submitted.

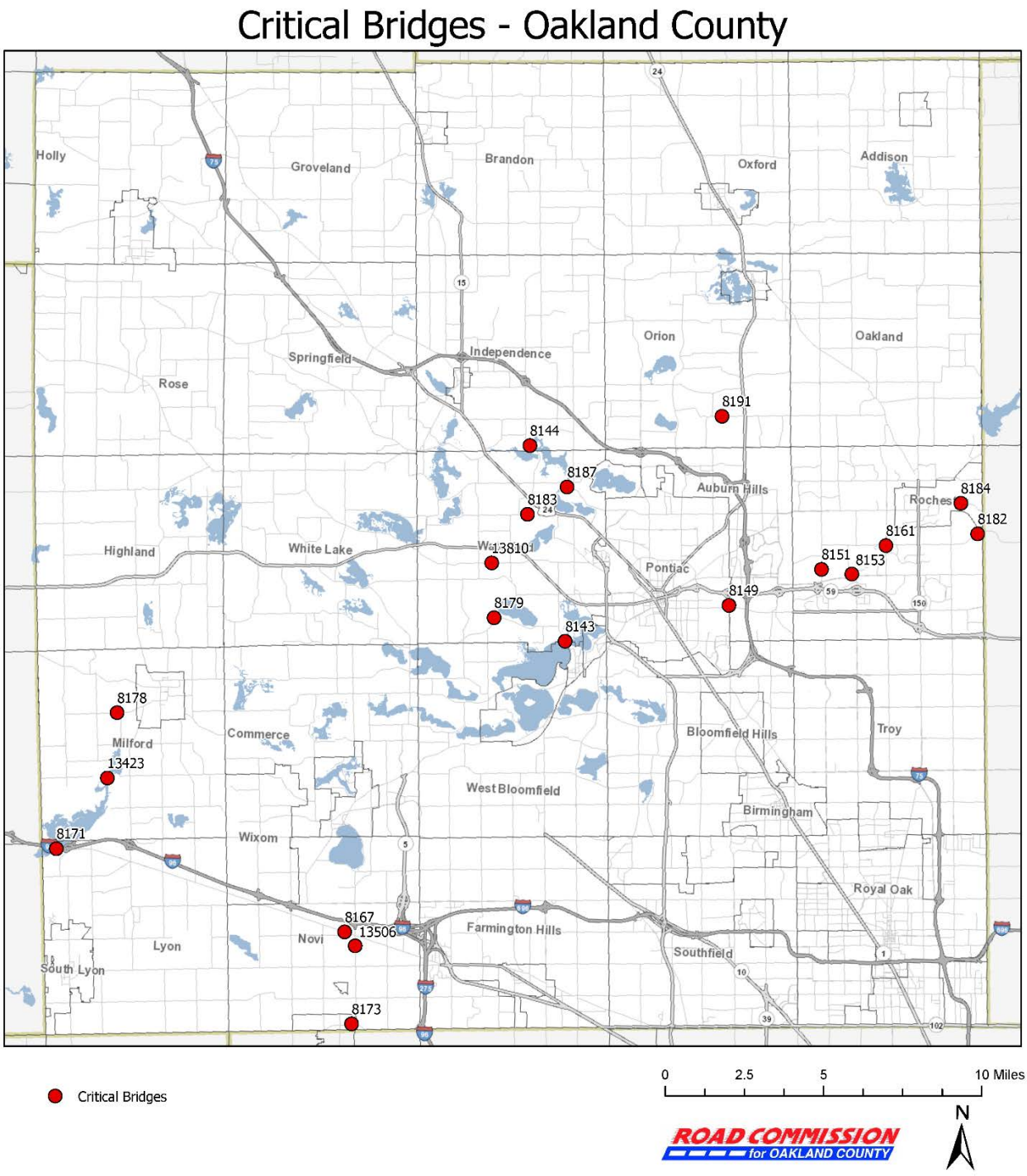


Figure 16: Key transportation links in RCOC's bridge network.

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

Planning Level Coordination

The planning and project selection process begins with RCOC's Strategic Planning meetings. Biennially, RCOC leadership meets with each of the 64 communities in Oakland County to discuss local developments and transportation priorities. These meetings also provide an opportunity for RCOC to share future projects and the status of current projects. Local municipalities as asset owners use these meetings as an opportunity to talk about any new developments in their communities, improvements to their infrastructure assets and how to coordinate future improvements. At the end of the Strategic Planning meetings, RCOC has a list of transportation priorities throughout the county and uses this as a list from which to select future projects.

The Highway Maintenance Department annually conducts coordination meetings within each district and involves the communities in those districts. This is a forum for communities in their district to express any concerns they might have regarding maintenance activities on their roadways.

Staff throughout the agency are involved in regional and local utility coordination meetings. Higher level meetings provide context and early knowledge of future projects planned by other agencies and asset owners. Some of these meetings include:

- Southeast Michigan Council of Governments (SEMCOG): Transportation Coordinating Council and Executive Committee
- American Public Works Association (APWA)
- Michigan Infrastructure & Transportation Association (MITA)
- Institute of Transportation Engineers (ITE)
- Great Lakes Water Authority (GLWA) Stake holder Advisory Committee
- Oakland County Federal Aid Committee (FAC)
- Consumers Energy Annual Coordination Meetings

RCOC has a specific staff position called 'Utilities Coordinator' at the agency. The responsibility of this position is to coordinate with any agency or company that may have infrastructure assets within the right-of-way. The utility coordinator initiates communications and provides insight on projects to gas, electric, telecommunications, fiber optics, transit, cable and other infrastructure asset owners. Annually, this person will attend coordination meetings held by these companies and will also distribute and share future project lists and information.

Project Level Coordination

After projects are identified, the Design Engineering team begins the process of survey and drafting plans. A large part of this process includes identifying obstacles or utilities that may be disrupted in the process of construction. Before plans are finalized, coordination meetings with the required asset owners are scheduled. Coordination can also include on-site visits, Grade Inspection meetings and pre-construction meetings.

Other departments such as Traffic Safety and the Traffic Operations Center coordinate with utility companies on signal projects and sign placements. Environmental Concerns Division also works with the Design Engineering team to coordinate stormwater and storm sewer system upgrades, interruptions and connections. Storm sewer assets such as culverts included in stream crossings or work located in wetlands/floodplains are coordinated through the Michigan Department of Environment, Great Lakes and Energy (EGLE)/ United States Army Corps of Engineers (USACE) Joint Permit Application.

On the job coordination is the responsibility of all construction staff as well as the Utility Coordinator. Many decisions must be made quickly onsite and staff have created relationships with the utility companies such that decisions and/or mitigation can be made quickly.

Some Companies and Agencies that RCOC commonly coordinate with include:

- AT&T
- Consumers Energy
- DTE
- Comcast and WOW Cable
- ITC
- MISS DIG
- Buckeye
- Great Lakes Water Authority
- Water Resources Commission
- Fiber Optic Companies
- Cities, Villages, Townships in Oakland County
- Neighboring County, Regional, State and Federal Agencies

Maintenance Level Coordination

RCOC performs routine maintenance on MDOT's infrastructure throughout the county which may include signal operations, clearing drainage structures, pothole patching and winter snow and ice removal. Other interagency agreements may include RCOC maintenance or operations management on City signals or roads.

Public Involvement

Coordinating with the public is a very important part of any road agency's process. It is imperative that the residents and visitors of Oakland County are kept informed on projects in their community. RCOC's public information office manages the day to day communication with stakeholders and the public by distributing press releases and speaking with media sources. The PIO also updates and manages the website and all social media platforms and content.

RCOC also has a Department of Customer Services that fields calls and emails around the clock. Requests, inquiries or comments are received by a DCS representative and then recorded in a program called Cityworks, which then distributes requests to the correct department or division. Staff address each request and track the progress in the program. This system provides an organized method when responding to public inquiries as well as ensuring accountability.

Other efforts to inform the public and provide public involvement are project specific meetings, surveys, press releases, social media posts and attendance at community led meetings.

8. PROOF OF ACCEPTANCE

PUBLIC ACT 325

CERTIFICATION OF TRANSPORTATION ASSET MANAGEMENT PLAN

Certification Year: 2021

Local Road-owning Agency Name: Road Commission for Oakland County

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 Andrea LaLonde	Printed Name Melissa Williams
Title Chair of the Board	Title Director of Finance
Date SEP 23 2021	Date SEP 23 2021

Due every three years based on agency submission schedule

Submittal Date: 9/27/2021

See attached council meeting minutes and/or resolution.

COPY OF RESOLUTION ADOPTED BY THE BOARD OF COUNTY ROAD COMMISSIONERS OF THE COUNTY OF OAKLAND, MICHIGAN UNDER DATE OF SEPTEMBER 23, 2021

WHEREAS, the Road Commission for Oakland County is required by law to certify its compliance with Public Act (PA) 325 of 2018; and

WHEREAS, the Road Commission for Oakland County has more than 100 certified miles; and

WHEREAS, the Road Commission for Oakland County has developed a Transportation Asset Management Plan (TAMP) for its road, bridge, culvert and traffic signal assets per Public Act 325; and

WHEREAS, the Road Commission for Oakland County has met the minimum requirements as outline by PA 325 and agency-defined goals and objectives;

NOW, THEREFORE, BE IT RESOLVED that the Board of County Road Commissioners of the County of Oakland approves and adopts the TAMP.

BE IT FURTHER RESOLVED that the Chair of the Board and the Director of Finance are hereby authorized to sign the Certification form.

I hereby certify that the above is a true and correct copy of a resolution adopted by the Board of County Road Commissioners of the County of Oakland, State of Michigan under date of September 23, 2021

Shannon Miller Digitally signed by Shannon Miller Date: 2021.09.23 11:27:36 -04'00'

Shannon J. Miller, Deputy-Secretary/Clerk of the Board

STATE OF MICHIGAN

GRETCHEN WHITMER
GOVERNOR

JOANNA I. JOHNSON
CHAIR

Michigan Transportation Asset Management Council

January 26, 2022

Ms. Sarah Plumer, Transportation Planning Coordinator
Road Commission of Oakland County
31001 Lahser Road
Beverly Hills, Michigan 48025

Dear Ms. Plumer:

The Transportation Asset Management Council (TAMC) has reviewed the Transportation Asset Management Plan (TAMP) submitted by the Road Commission of Oakland County on September 30, 2021 and has determined it contains the seven elements as required in Public Act 325.

The due date of the next submittal for the Road Commission of Oakland County TAMP is October 1, 2024.

If you have any questions, please contact Gloria M. Strong, TAMC Departmental Technician, at (517) 402-3599, or strongg@michigan.gov. Thank you for all your efforts supporting asset management.

Sincerely,

Joanna I. Johnson, Chair
Michigan Transportation Asset Management Council

CC: David Wearsch, Manager
Michigan Department of Transportation, Bureau of Finance and Administration

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www.michigan.gov/tamc • (517) 230-8192

A. PAVEMENT ASSET MANAGEMENT PLAN

An attached pavement asset management plan follows.

Appendix A

2021 Pavement Asset Management Plan

Prepared by: *Planning and Environmental Concerns Department*

Contact information Sarah Plumer, Planning Coordinator, (248)-645-2000 and/or splumer@rcoc.org

ROAD COMMISSION for OAKLAND COUNTY

QUALITY LIFE THROUGH GOOD ROADS – WE CARE

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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 Road Commission for Oakland County's (RCOC) 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 asset management plan is intended to report on how RCOC is meeting its obligations to maintain the public assets for which it is responsible.

This plan overviews RCOC's road assets and condition and explains how RCOC works to maintain and improve the overall condition of those assets. These explanations can help answer the following questions:

- What kinds of road assets RCOC has in its jurisdiction, who owns them, and the different options for maintaining these assets.
- What tools and processes RCOC uses to track and manage road assets and funds.
- What condition RCOC's 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 utilized and the costs incurred during RCOC's road assets' normal life cycle.
- What condition RCOC can expect its road assets if those assets continue to be funded at the current funding levels
- How changes in funding levels can affect the overall condition of all of RCOC's road assets.

RCOC has jurisdiction of 2799.677 centerline miles of roads. This road network can be divided into the county primary network, the county local network, the unpaved road network, and the National Highway System (NHS) network based on the different factors these roads have that influence asset management decisions. A summary of RCOC historical and current network conditions, projected trends, and goals for county primary network and county local network can be seen in the Figure 1 and Figure 2.

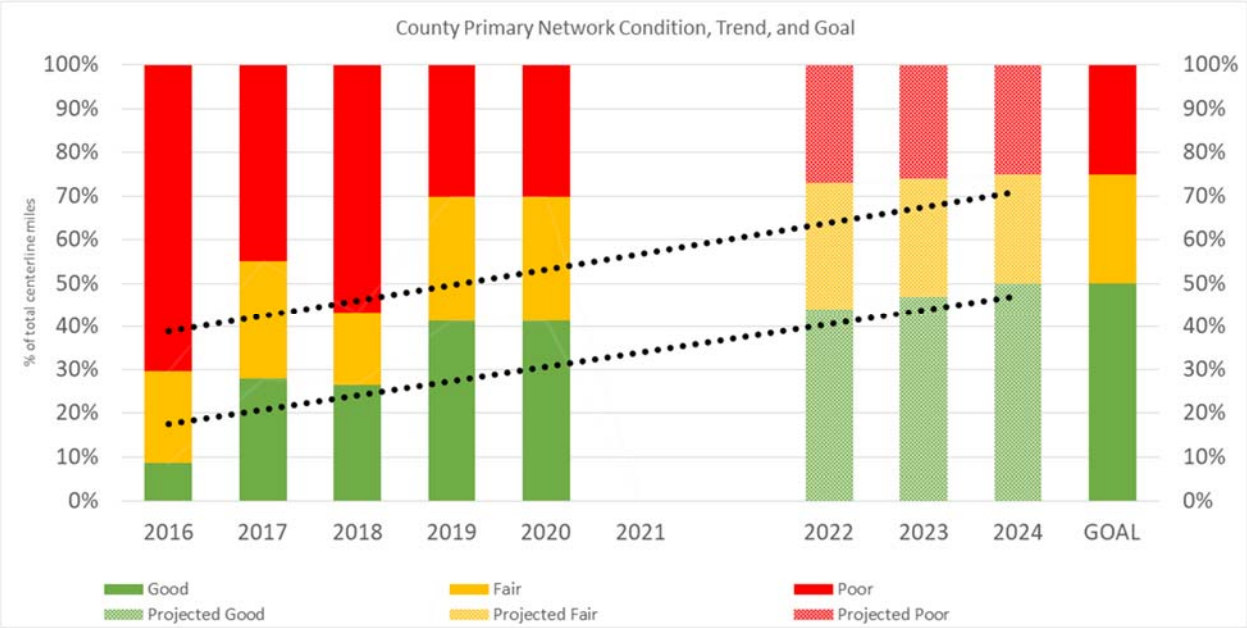


Figure 1: County Primary Network Condition, Trend, and Goal.

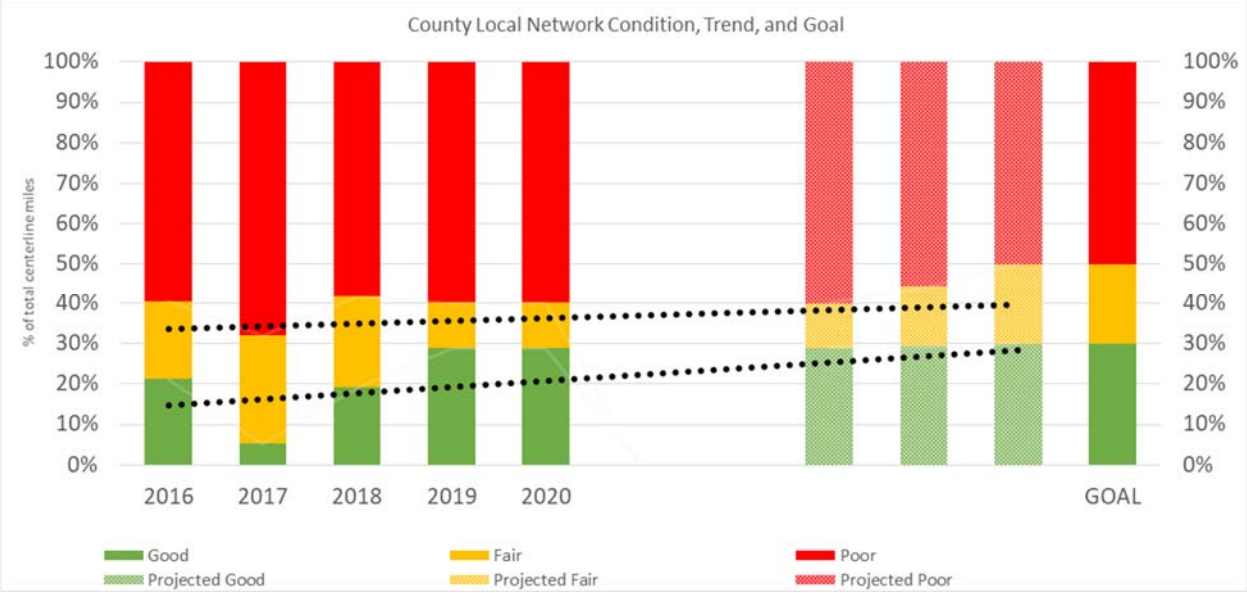


Figure 2: County Local Network Condition, Trend, and Goal.

An estimated summary of RCOC historical and current network conditions, projected trend and goal for the unpaved road network can be seen in the Figure 3, below:

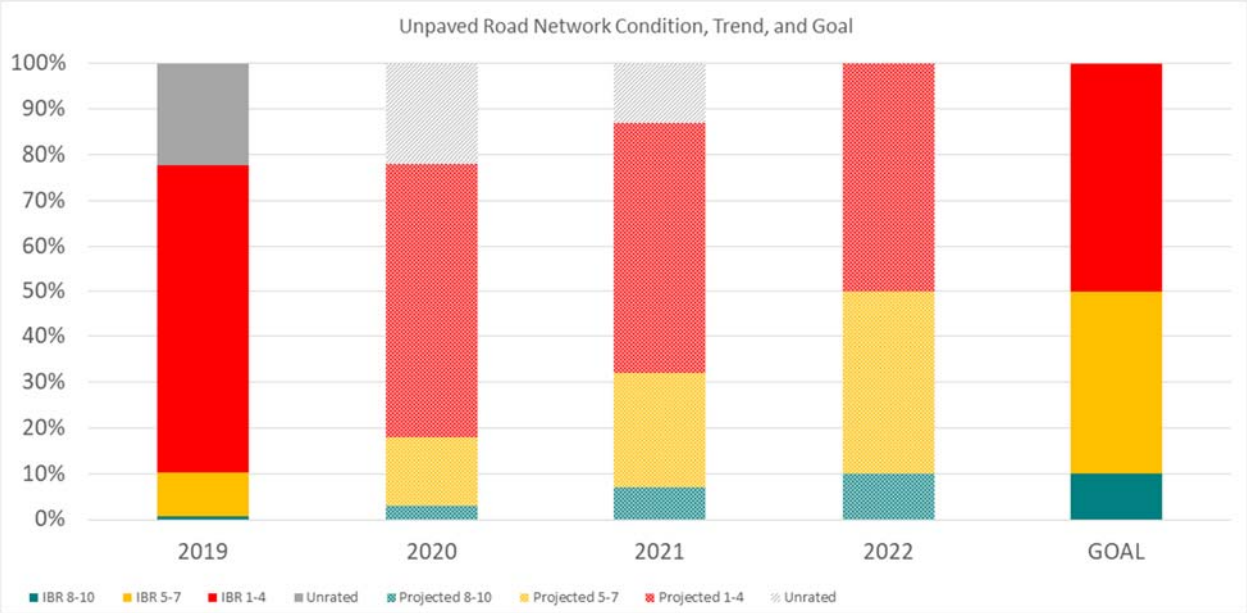


Figure 3: Unpaved Road Network Condition, Trend, and Goal.

An asset management plan is required by Michigan Public Act 325 of 2018, and this document represents fulfillment of some of RCOC's obligations towards meeting these requirements. This asset management plan also helps demonstrate RCOC's responsible use of public funds by providing elected and appointed officials as well as the general public with inventory and condition information of RCOC's road assets, and gives taxpayers the information they need to make informed decisions about investing in its 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). RCOC 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 network. Asset management also provides a transparent decision-making process that allows the public to understand the technical and financial challenges of managing road infrastructure with a limited budget.

The Road Commission for Oakland County (RCOC) 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. RCOC is responsible for maintaining and operating over 2799.677 centerline of roads.

This plan outlines how RCOC 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 RCOC Transportation Planning Coordinator, Sarah Plumer, at 31001 Lahser Road, Beverly Hills, MI 48025 or at 248-645-2000, splumer@rcoc.org. Key terms used in this plan are defined in RCOC's comprehensive transportation asset management plan (also known as the "compliance plan") used for compliance with PA 325 or 2018.

Knowing the basic features of the asset classes themselves is a crucial starting point 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 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.

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 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 20 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 20 years before major rehabilitation is necessary. The 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.

Unpaved Surfacing

- **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 exceed 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 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, 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 day-to-day, regularly scheduled, low-cost activity applied to 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. RCOC 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

RCOC 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. RCOC 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: http://www.michigan.gov/tamc/0,7308,7-356-82158_82627---,00.html.

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 at RCOC 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 to them. 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 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 regard 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 Pavement Preventative Maintenance (PPM). These roads may include those that have been recently seal coated or newly constructed. Figure 4 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 4 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 4 illustrates a road in this category.

Figure 4: *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. The TAMC dictates and funds the required training and the format for this collection, and it shares the data regionally and statewide. In addition, RCOC will begin rating the paved non-federal-aid-eligible network annually using its own staff and resources starting in fiscal year 2022. It is important to note that due to circumstances relating to COVID-19, ratings were not collected in 2020, therefore the most recent set of ratings were collected in 2019.

Unpaved Road Condition Rating System (IBR System™)

The condition of unpaved roads can be rapidly changing, which makes it difficult to obtain a consistent surface condition rating over the course of weeks or even days. The PASER system works well on most paved roads, which have a relatively stable surface condition over several months, but it is difficult to adapt to unpaved roads. To address the need for a reliable condition assessment system for unpaved roads, the TAMC adopted the Inventory Based Rating (IBR) System™, however, RCOC only has 20% of its unpaved roads rated using this system. Most unpaved road ratings collected in the past throughout Oakland County were collected using PASER and are now out of date. RCOC will begin using the IBR System™ starting in 2022 and moving forward. Information about the IBR System™ can be found at http://ctt.mtu.edu/inventory-based-rating-system.

Figure 5: *Top,* Road with IBR number of 1 road that has poor surface width, poor drainage adequacy, and poor structural adequacy. *Middle,* Road IBR number of 7 that has fair surface width, fair drainage adequacy, and fair structural adequacy. *Bottom,* Road with IBR number of 9 road that has good surface width, good drainage adequacy, and good structural adequacy.

The IBR System™ gathers reliable condition assessment data for unpaved road by evaluating three features—surface width, drainage adequacy, and structural adequacy—in comparison to a baseline, or generally considered "good", road. These three assessments come together to generate an overall 1-10 IBR number. A high IBR number reflects a road with wide surface width, good drainage, and a well-designed and well-constructed base, whereas a low IBR number reflects a narrow road with no ditches and little gravel. A good, fair, or poor assessment of each feature is not an endorsement or indictment of a road's suitability for use but simply provides context on how these road elements compare to a baseline condition.

Figure 5 illustrates the range over which features may be assessed. The top example in Figure 5 shows an unpaved road with a narrow surface width, little or no drainage, and very little gravel thickness. Using the IBR System™, these assessments would yield an IBR number of "1" for this road. The middle example in Figure 5 shows a road with fair surface width, fair drainage adequacy, and fair structural adequacy. These assessments would yield an IBR number of "7" for this road. The bottom example in Figure 5 shows a road with good surface width, good drainage adequacy, and good structural adequacy. These assessments would yield an IBR number of "9" for this road.

Unpaved roads are constructed and used differently throughout Michigan. A narrow, unpaved road with no ditches and very little gravel (low IBR number) may be perfectly acceptable in a short, terminal end of the road network, for example, on a road segment that ends at a lake or serves a limited number of unoccupied private properties. However, high-volume unpaved roads that serve agricultural or other

industrial activities with heavy trucks and equipment will require wide surface width, good drainage, and a well-designed and well-constructed base structure (high IBR number). Where the unpaved road is and how it is used determines how the road must be constructed and maintained: just because a road has a low IBR number does not necessarily mean that it needs to be upgraded. The IBR number are not an endorsement or indictment of the road's suitability for use but rather, an indication of a road's capabilities to support different traffic volumes and types in all weather.

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 RCOC—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 6). 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 20 years and costs $3,200,000 per centerline mile.

Full-depth Concrete Repair or Concrete Slab Replacement

A full-depth concrete repair removes sections of damaged concrete pavement and replaces it with new concrete of the same dimensions (Figure 6). It is usually performed on isolated deteriorated joint locations or entire slabs that are much further deteriorated than adjacent slabs. The purpose is 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. This repair lasts approximately 12 years and typically costs $2,100,000 a centerline mile

Figure 6: Examples of reconstruction treatments, (left) reconstructing a road and (right) road prepared for full-depth repair.

New Construction

New construction projects include paving gravel roads, widening, adding turn lanes or roundabouts. Paving a gravel road costs approximately $3,200,000 per centerline mile and will last 20 years as it is similar to a general reconstruction project. The cost to widen a road varies on width, length and material and configuration and service life can reach up to 20 years with new pavement. Table 1 shows the estimated costs of various widening project scopes, the cost may go up or down depending on various factors that can include materials used, drainage or hefty right-of-way acquisition.

Table 1: Widening Project Costs

Widen Intersection for signalization	$1,275,000/each
Widen to 3 lanes	$3,200,000/mile
Widen to 5 lanes	$8,100,000/mile
Widen to 4 lane boulevard	$12,750,000/mile
Widen to 6 lane boulevard	$15,750,000/mile

Intersection improvements such as roundabouts are new constructions with the life span of 15-20 years and cost $1,200,000 for a single-lane or $2,200,000 for a two-lane configuration.

Ditching (for Unpaved Roads)

Water needs to drain away from any roadway to delay softening of the pavement structure, and proper drainage is critical for unpaved roads where there is no hard surface on top to stop water infiltration into the road surface and base. To improve drainage, new ditches are dug or old ones are cleaned out. Ditching requires a full assessment of the road and the area adjacent. First, staff looks at the number and type of obstructions. Obstructions can include trees, foliage, fences, utilities and culverts. Also, an assessment of manpower, time and materials needed play a role in calculating the costs associated with ditching. Roads are ditched as often as possible and as needed, with costs varying depending on the above listed factors.

Gravel Overlay (for Unpaved Roads)

Unpaved roads will exhibit gravel loss over time due to traffic, wind, and rain. Gravel on an unpaved road provides a wear surface and contributes to the structure of the entire road. RCOC's gravel haul program rotates gravel overlays on primary gravel roads every 3-5 years. Depending on the width of the road, one mile of gravel overlay will require 1,600-2,000 tons of material and approximately $25 a ton. RCOC's annual budget for the primary gravel haul program ranges between $200,000-$245,000. Local gravel roads receiving overlays are requested, coordinated and paid for by local communities. Tri-Party funds are commonly used for this purpose. More information on Tri-Party can be found in the *Financial Resources* section of the Compliance Plan.

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 either rehabilitated with a structural treatment. Examples of structural improvement treatments include HMA overlay with or without milling, and crush and shape (Figure 7). The following descriptions outline the main structural improvement treatments used by RCOC.

Figure 7: 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 milled pavement (Figure 7). 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 curb and gutter that is not being raised or reinstalled in the project. 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. A 2-inch HMA overlay can last approximately five to ten years and costs $175,000-$200,00 per lane mile. This is a cost effective and medium-term fix for roads rated fair on the PASER scale. RCOC's annual Preservation Overlay program has performed this fix on an average 60 miles of road a year for the past 4 years.

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 7). 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. Crush and shape treatments last approximately 15 years and cost $2,100,000 per centerline mile. Also referred to as a 3R or RRR, (Rehabilitate, Resurface, Replace) RCOC uses this fix on roads declining from fair to poor, and seeks primarily federal funds for these improvements.

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, concrete patching, joint repair and spot resurfacing. 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 RCOC.

Figure 8: 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 8). RCOC 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 RCOC budgets $500,000 annually towards the program of fixes. Even though it does not last very long compared to other treatments, it does not cost very much and is a common RCOC practice to extend the surface life of roads paved 2-3 years prior. This makes it a very cost-effective treatment when RCOC looks at what crack filling costs per year of the treatment's life.

Concrete Patching

A partial-depth concrete repair involves removing spalled (i.e., fragmented) or delaminated (i.e., separated into layers) areas of concrete pavement and replacing with new concrete (Figure 9). 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. Partial depth patches are often used on areas of concrete where the full slab or the full depth of the concrete is not damaged. Concrete patching can last approximately 5 years and cost $90 per square yard.

Joint Repair

The RCOC developed a joint repair program for concrete roads in poor condition. Work consists of milling joints and then filling them with hot mix asphalt. Roads that receive this fix in most cases are slated for robust improvements in the future, but repairing the worn and deteriorating joints is a critical improvement required to provide a reliable and safe surface for vehicles in the interim. When adding joint repair to a work program, RCOC will budget approximately $500,000 which will cover approximately 18 miles and will extend the service life of the pavement by 3 years. This makes it a very cost-effective treatment when RCOC looks at what joint repair costs per year of the treatment's life.

Spot Resurfacing

Spot Resurfacing is the milling and patching of a particular spot on heavier traveled roads. While the road may still be in good to fair condition, specific spots have been identified as needing an immediate fix. The District Garages under the Highway Maintenance Department, as experts of roads in their district will make recommendations for locations based on past years maintenance activities. Areas where water is not draining, or where there have been multiple pothole patching are the usual recommended areas. Sections identified are then milled and surfaced with asphalt. Work is done while maintaining traffic under flag control when necessary. Spot Resurfacing extends the service life of the pavement by 3 years. RCOC budgets approximately $1,000,000 annually towards this program. Spot resurfacing can help to extend the surface life of a corridor, and since it is performed on small areas of roadway it is a very cost-effective treatment.

Maintenance Grading and Dust Control (for Unpaved Roads)

Maintenance grading involves regrading an unpaved road to remove isolated potholes, washboarding, and ruts then restoring the compacted crust layer (Figure 9). Crust on an unpaved road is a very tightly compacted surface that sheds water with ease but takes time to be created, so destroying a crusted surface with maintenance grading requires a plan to restore the crust.

Dust control typically involves spraying chloride or other chemicals on a gravel surface to reduce dust loss, aggregate loss, and maintenance (Figure 9). This is a relatively short-term fix that helps create a crusted surface. Chlorides work by attracting moisture from the air and existing gravel. This fix is not effective if the surface is too dry or heavy rain is imminent, so timing is very important. RCOC dust and grading are done simultaneously every 4-6 weeks. RCOC's highway maintenance department budgets $3,200,000-$4,400,00 a year on salt, sand and chloride. Local road maintenance contracts are estimated to add up to $1.6 million a year.

Figure 9: Examples of capital preventive maintenance treatments, cont'd, (from left) concrete road prepared for partial-depth repair, gravel road undergoing maintenance grading, and gravel road receiving dust control application (dust control photo courtesy of Weld County, Colorado, weldgov.com).

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. RCOC strives to be innovative with its pavement treatments by looking for ways to improve safety, prevent pavement damage and save taxpayer dollars.

High-Friction Surface Treatment

Applying a high friction surface treatment is a technique that provides a coarse, sandpaper-like surface designed to improve friction and reduce the likelihood of traffic running off the road. The process will begin with cleaning the road surface. An epoxy will then be applied followed by the application of small, coarse gravel to the road's surface. This treatment is generally applied on curves and on roads that are in good condition. The RCOC has begun applying for federal safety funds to apply this treatment on roads with curves that have been overlaid within the past 1-2 years. This treatment has a service life of 5 years and can cost $100,000-$200,000 per curve.

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 CPM treatments, first; then, when all maintenance project candidates are treated, reconstruction and rehabilitation can be performed as money is available. This strategy is called a "mix-of-fixes" approach to managing pavements. Maintenance activities can include patching, drainage clearing, brush clearing, short notice fixes when issues arise.

1. Pavement Assets

Building a mile of new road can cost over $2 million due to the large volume of materials and equipment that are 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 each road-mile's needs 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 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.

Road ownership in Oakland County is different than most Counties in Michigan because the RCOC does have jurisdiction over some primary roads through Cities and Villages. RCOC has jurisdiction over all public roads located in Townships, and then larger, high classification roads in Cities and Villages. The agency also maintains many MDOT roads and contracts services such as signals and winter maintenance to the state and other municipalities.

The RCOC is responsible for a total of 2799.677 centerline of public roads, as shown in Figure 10.

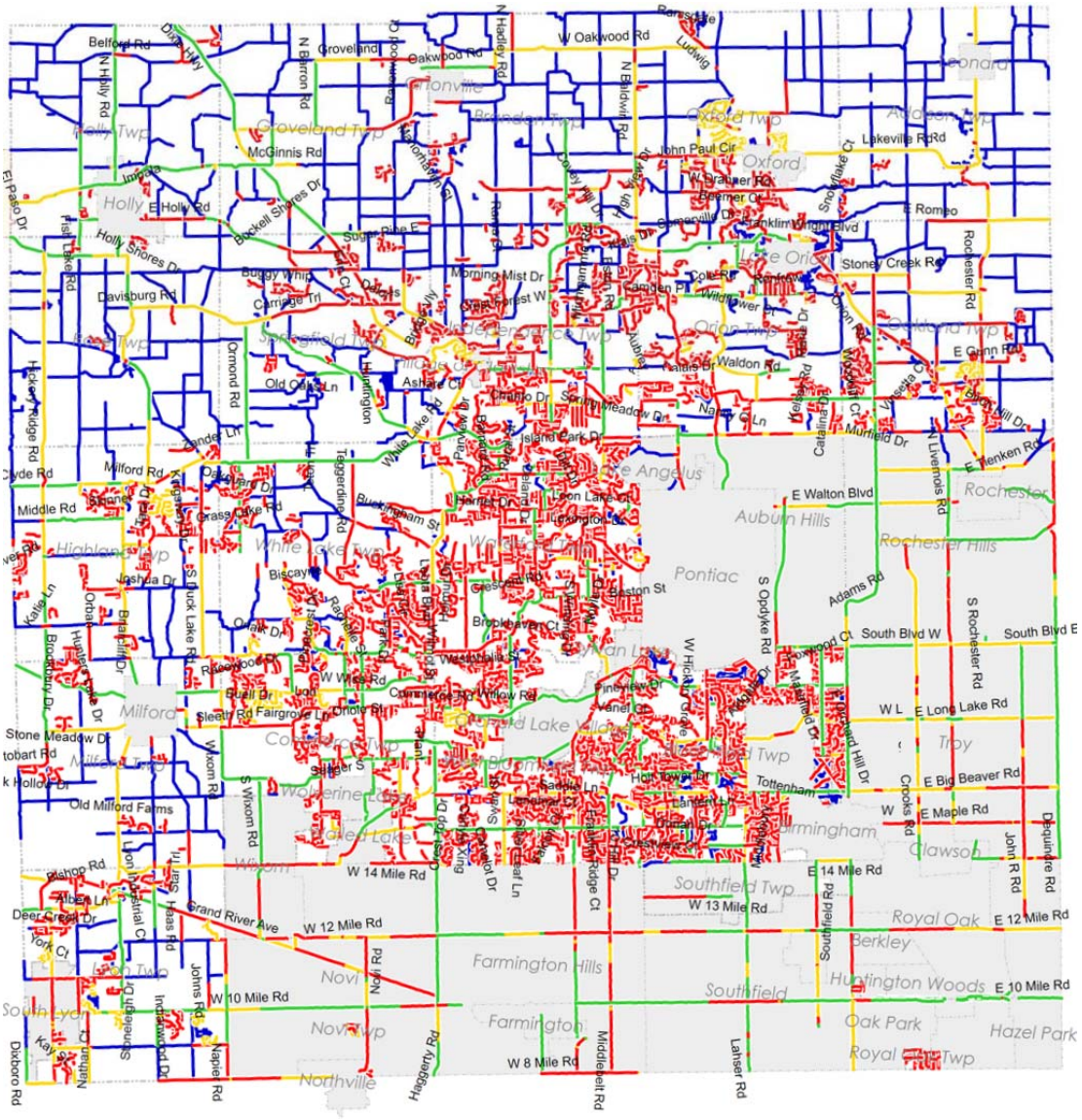


Figure 10: Map showing location of RCOC's paved roads (i.e., those managed by RCOC) and their current condition for paved roads with green for good (i.e., PASER 10, 9, 8), yellow for fair (i.e., PASER 7, 6, 5), and red for poor (i.e., PASER 4, 3, 2, 1), as well as the location of RCOC's unpaved roads in blue.

Inventory

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

Of the 2799.677 centerline of public roads owned and/or managed by RCOC, approximately 82% of all County Primary roads are classified as federal aid eligible, which allows RCOC to utilize availablefederal funding for their maintenance and construction. Only 1% of County Local roads are considered federal aid eligible, which means state and local funds are used to manage these roads.

Figure 12 illustrates the percentage of roads owned by RCOC that are classified as county primary and county local roads. Figure 11 illustrates this breakdown of these road networks by township boundary within RCOC's jurisdiction.

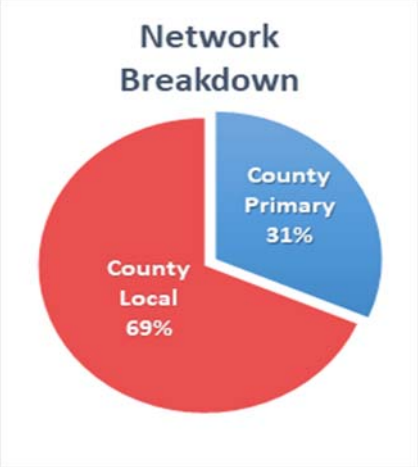


Figure 12: Percentage of county primary and county local roads for RCOC.

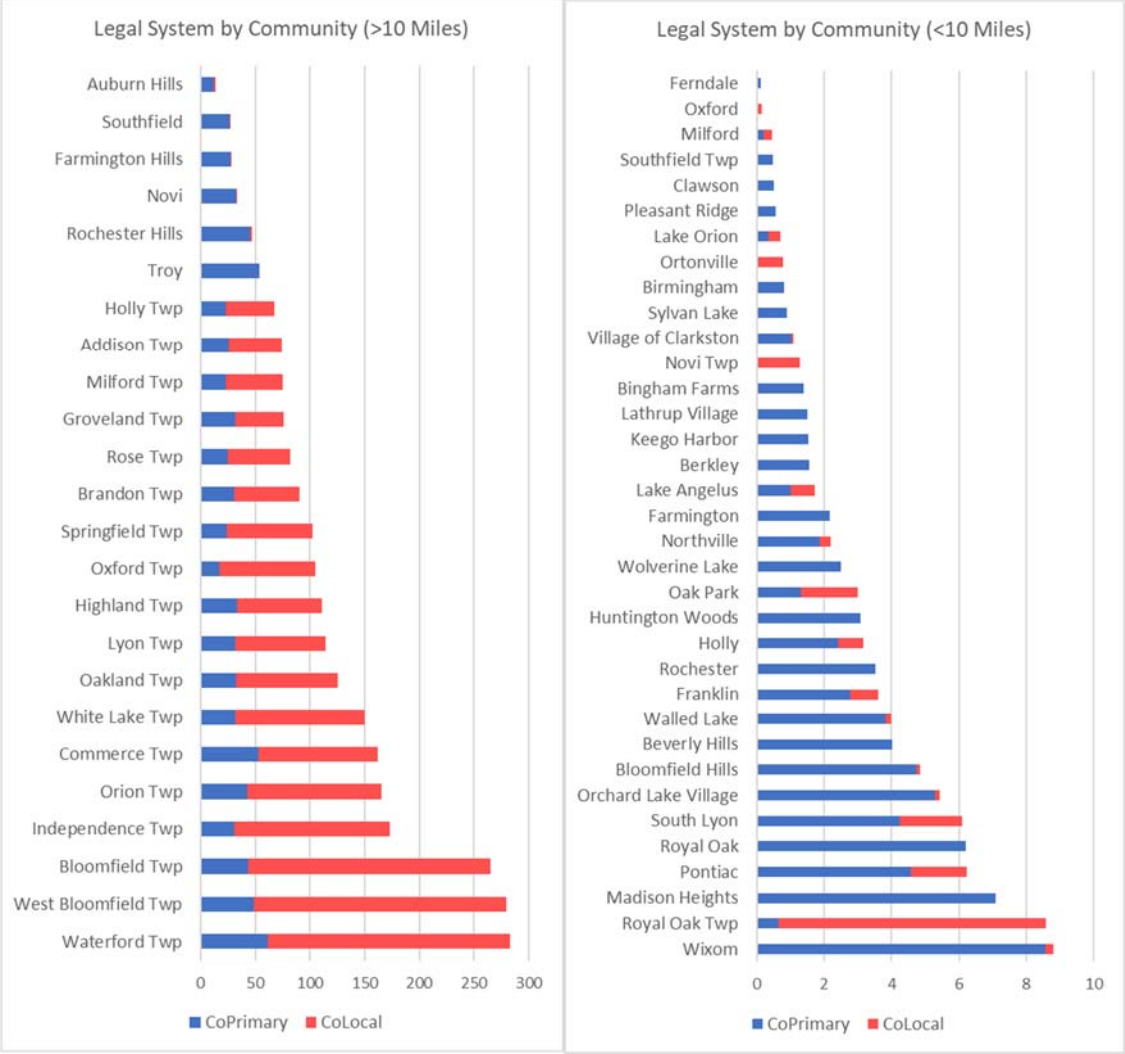


Figure 11: County primary and county local roads by township for RCOC's jurisdiction.

RCOC manages 237.09 miles of roads that are part of the National Highway System (NHS)—in other words, those roads that are critical to the nation's economy, defense, and mobility—and monitors and maintains their condition. 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, RCOC manages a percentage of those roads located in its jurisdiction, as shown in Figure 13.

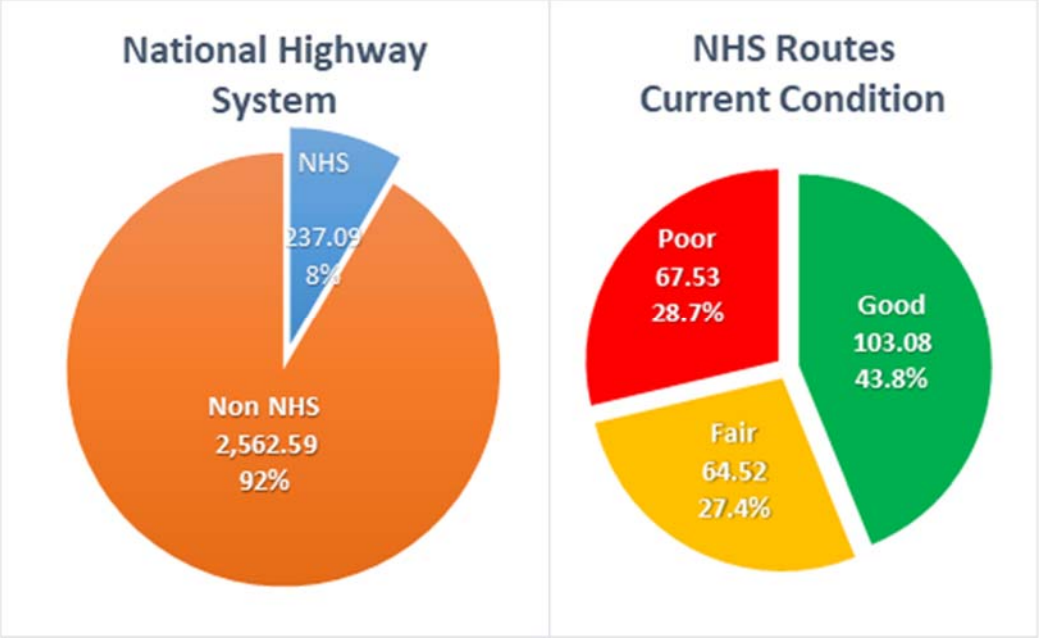


Figure 13: Miles of roads managed by RCOC that are part of the National Highway System and condition.

RCOC also owns and manages 663.667 miles of certified unpaved roads. Of these unpaved roads 68.359 miles are designated as primary and 619.297 are designated as local. Also, out of the total miles of certified unpaved roads, only 119.197 are federal aid eligible. Of all the federal aid eligible unpaved certified roads 66.924 miles are of primary designation and 52.273 are of local designation.

Types

RCOC has multiple types of pavements in its jurisdiction, including asphalt, sealcoat, concrete, brick/block, and undefined; it also has unpaved roads (i.e., gravel and/or earth). 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 Introduction's Pavement Primer.

Figure 14 illustrates the percentage of various pavement types that RCOC has in its network. Figure 15 shows the pavement type by Community boundary for RCOC's jurisdiction.

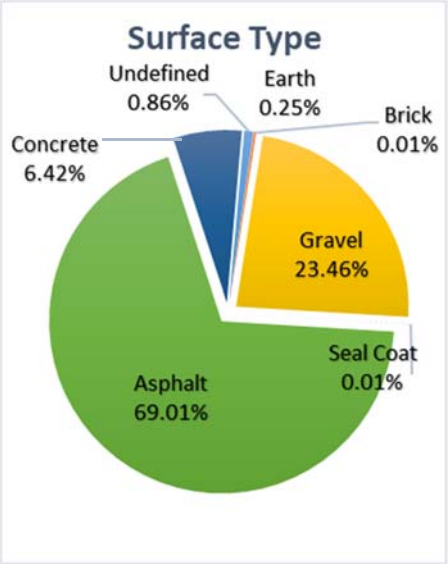


Figure 14: Pavement type by percentage maintained by RCOC. Undefined pavements have not been inventoried in RCOC's asset management system to date but will be included as data becomes available.

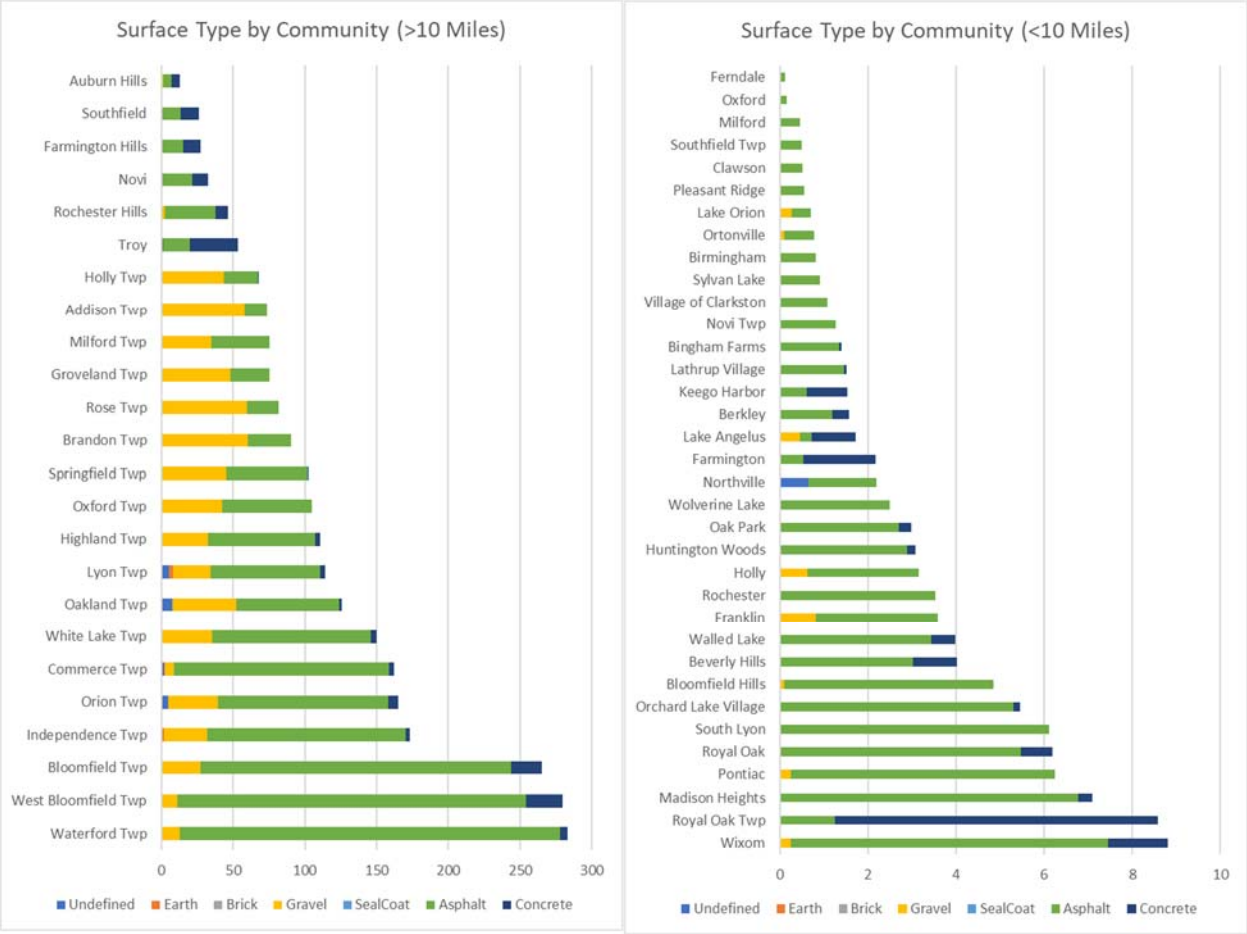


Figure 15: Pavement type by township within RCOC's jurisdiction. Undefined pavements have not been inventoried in RCOC's asset management system to date but will be included as data becomes available.

Locations

Locations and sizes of each asset can be found in RCOC's Roadsoft database. For more detail, please refer to the agency contact listed in the *Introduction* of this pavement asset management plan.

Condition

The road characteristic that road users most readily notice is pavement condition. Pavement condition is 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. RCOC 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 RCOC to evaluate the benefits of preventive maintenance projects and to identify the most cost-effective use of road construction and maintenance dollars. Historic pavement condition data can be used to predict future road conditions based on budget constraints and to determine if a road network's condition will improve, stay the same, or degrade at the current or planned investment level. This analysis helps to determine how much additional funding is necessary to meet a network's condition improvement goals. More detail on this topic is included in the Introduction's *Pavement Primer*.

Paved Roads

RCOC 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. RCOC uses the Pavement Surface Evaluation and Rating (PASER) system, which has been adopted by the TAMC for measuring statewide pavement conditions, to assess its paved roads. 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 Introduction's Pavement Primer.

RCOC collects 100 percent of its PASER data every two years on all federal-aid-eligible roads in Michigan. It is important to note that due to circumstances relating to COVID-19, ratings were not collected in 2020, therefore the most recent set of ratings were collected in 2019. RCOC will be collecting a percentage of its paved non-federal-aid-eligible network using its own staff and resources. With more staff recently trained to collect data, the agency will soon be collecting non-federal aid eligible road pavement ratings annually. The amount collected each year cannot be estimated until the process begins in fiscal year 2022.

RCOC's ratings collected in 2019 show that the paved county primary road network has 46 percent of roads in the TAMC good condition category, 23 percent in fair, and 32 percent in poor (

Figure 16). The paved county local road network has 6 percent in good, 29 percent in fair, and 64 percent in poor (Figure 17).

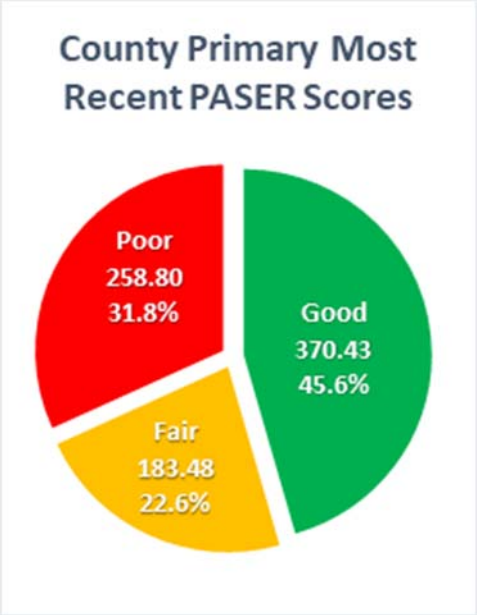


Figure 16: RCOC paved county primary road network conditions by percentage of good, fair, or poor.

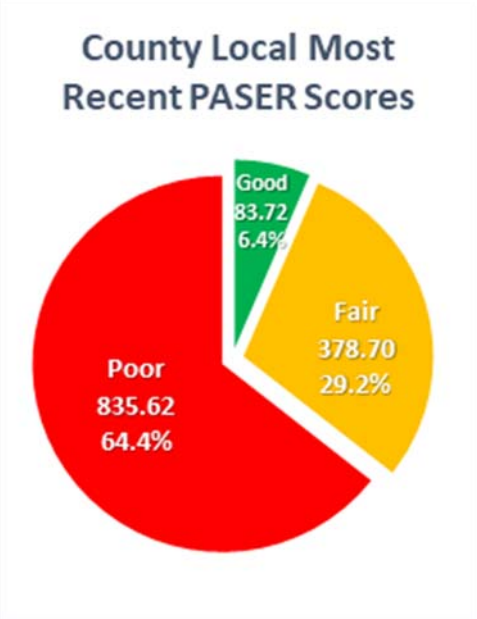


Figure 17: Paved county local road network conditions by percentage of good, fair, or poor.

In comparison, the statewide paved county primary road network has 521 percent of roads in the TAMC good condition category, 40 percent in fair, and 39 percent in poor (Figure 18). The statewide paved county local road network has 16 percent in good, 30 percent in fair, and 54 percent in poor (Figure 19). Comparing Figure 16 and Figure 18 shows that RCOC's paved county primary road network is better than similarly classified roads in the rest of the state, while Figure 17 and Figure 19 show that RCOC's paved county local road network is than similarly classified roads in the rest of the state. Other road condition graphs can be viewed on the TAMC pavement condition dashboard at: http://www.mcgi.state.mi.us/mitrp/Data/PaserDashboard.aspx.

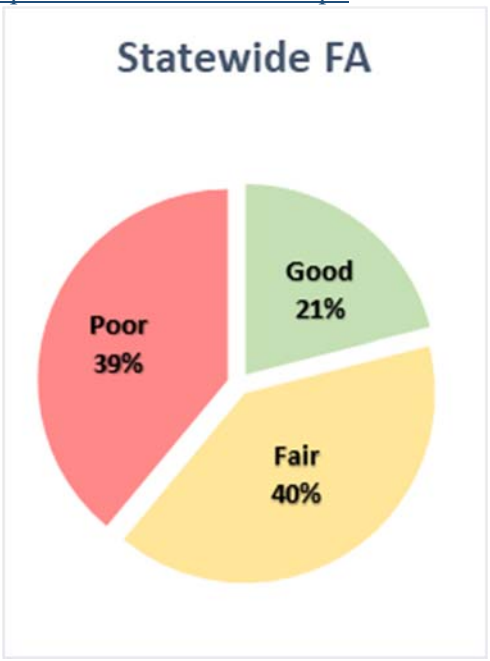


Figure 18: Statewide paved county primary road network conditions by percentage of good, fair, or poor.

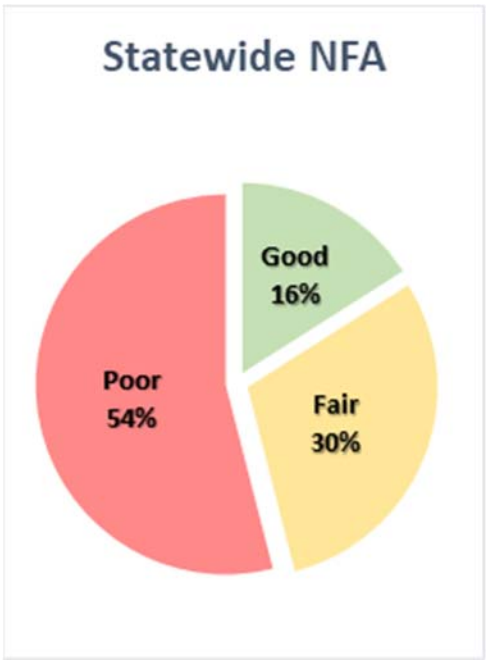


Figure 19: Paved county local road network conditions by percentage of good, fair, or poor.

Figure 20 and Figure 21 show the number of miles for RCOC's roads with PASER scores expressed in TAMC definition categories for the paved county primary road network (Figure 20) and the paved county local road network (Figure 21). RCOC 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.

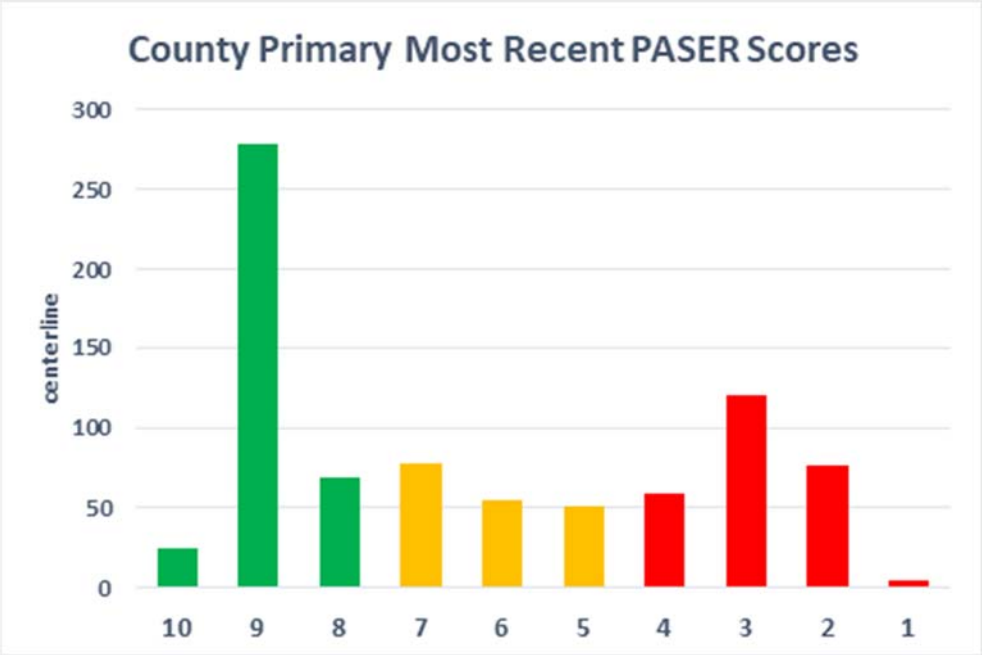


Figure 20: RCOC paved county primary road network conditions. Bar graph colors correspond to good/fair/poor TAMC designations.

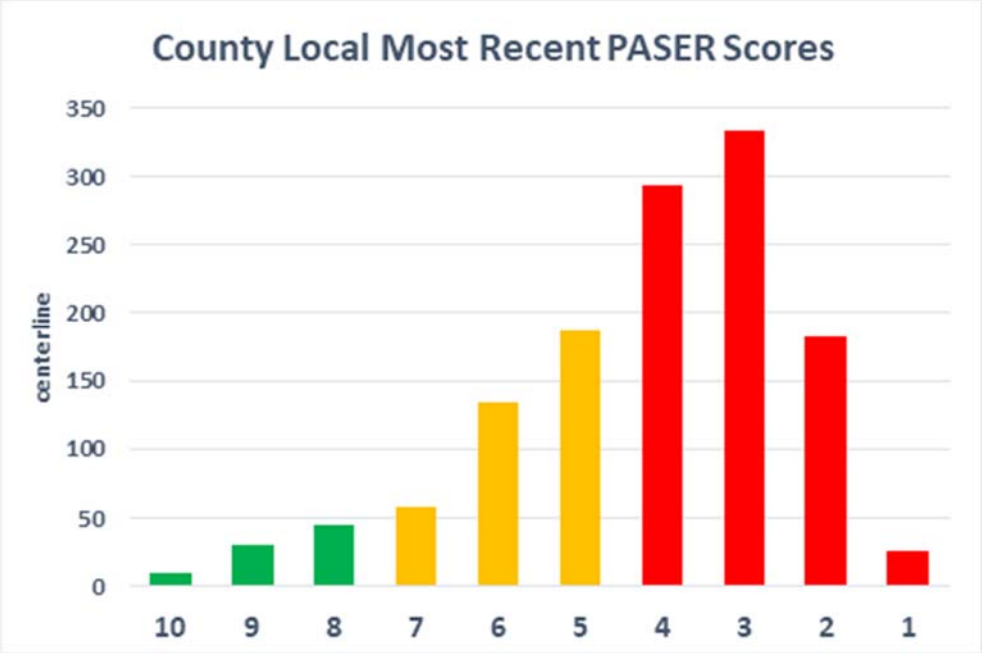


Figure 21: RCOC paved county local network condition by PASER rating. Bar graph colors correspond to good/fair/poor TAMC.

Figure 22 illustrates RCOC's entire paved road network divided by Community into the TAMC good/fair/poor designations.

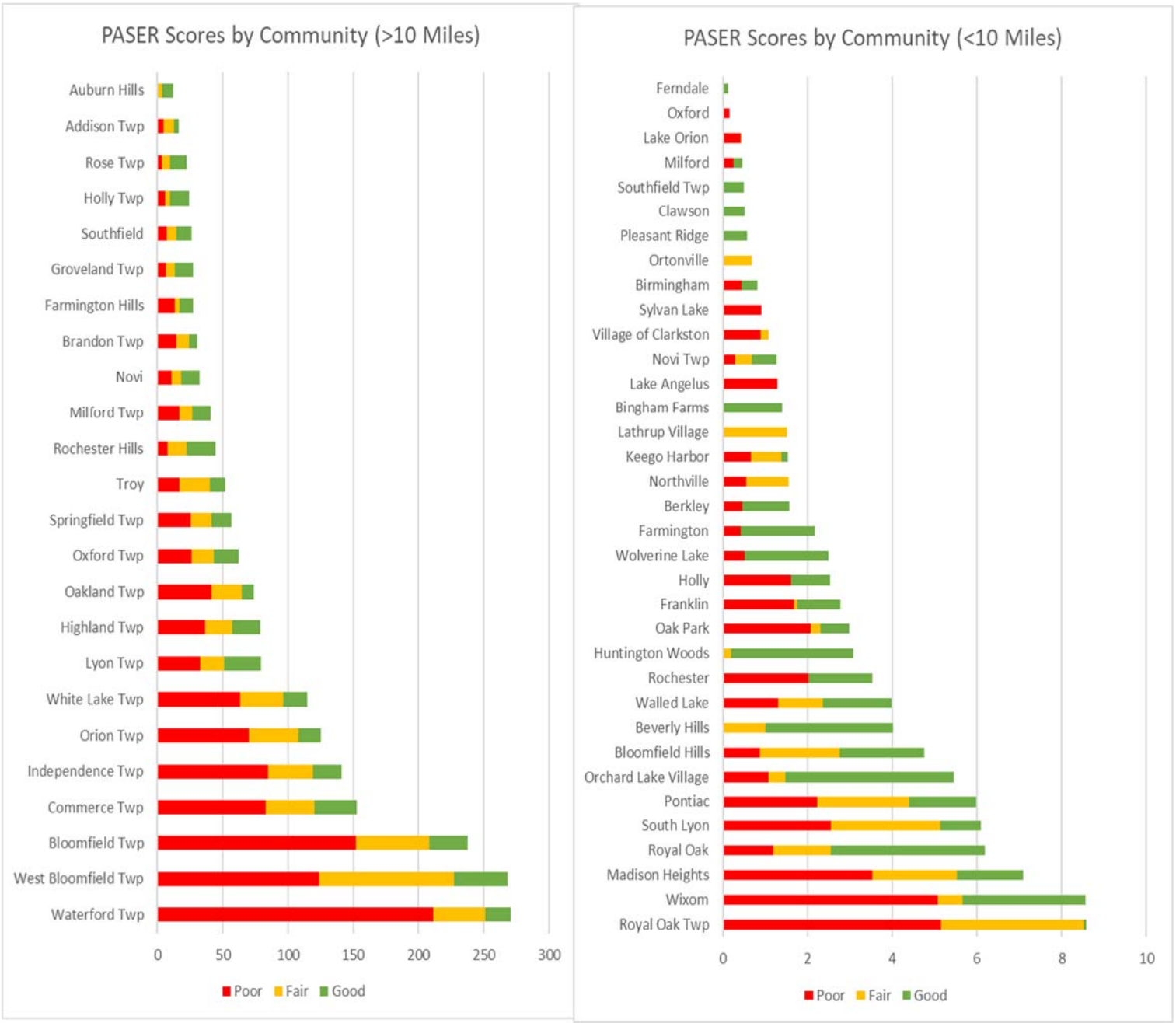


Figure 22: Number of miles of paved road in each Community divided in categories of good (PASER 10, 9, 8), fair (PASER 7, 6, 5), and poor (PASER 4, 3, 2, 1).

Figure 23 provides a map illustrating the geographic location of paved roads and their respective PASER condition. An online version of the most recent PASER data is located at https://www.mcgi.state.mi.us/tamcMap/.

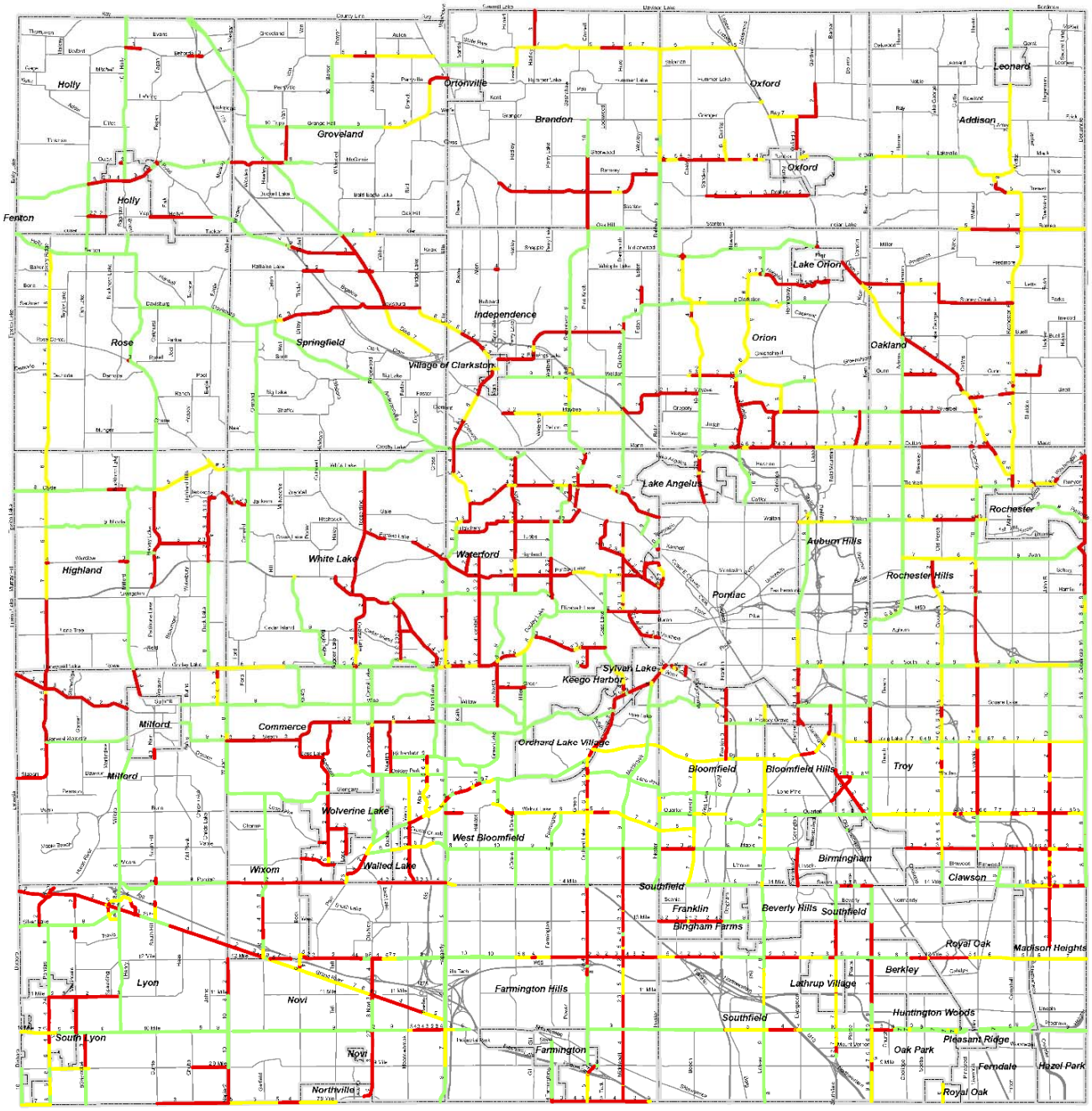


Figure 23: Map of the current paved road condition in good (PASER 10, 9, 8) shown in green, fair (PASER 7, 6, 5) shown in yellow, and poor (PASER 4, 3, 2, 1) shown in red. Only Roads owned by RCOC are shown.

RCOC has made a large effort to leverage the additional, but limited funding received after the 2015 Road Funding package. The agency has directed this funding to preventative maintenance programs such as the preservation overlays, crack sealing and concrete patching. These maintenance programs have stretched limited funding further and after 4 years of performing these programs we have seen an increase in good/fair ratings. RCOC will continue allocating resources and funding to these maintenance programs in future years and it is anticipated the percentage of roads in good condition will exceed 50% by 2024. After this time, if additional revenue is not collected and distributed, conditions will begin to decline once again. It is critical that identifying a long-term transportation funding package is made a priority by policy makers and the State of Michigan. Historically, the overall quality of RCOC's paved county primary roads has been increasing, as can be observed in Figure 24. Four years of additional funding from the MTF, has led to an increase in the percentage of roads rated good and fair roads and a decrease in the percentage of roads rated poor.

Comparing RCOC's paved county primary road condition trends illustrated in Figure 24 with overall statewide condition trends for similarly classified roads, which are illustrated in Figure 25, shows a similar trend locally as in the rest of the state. The trends show an increase in the number of roads rated in good condition with a corresponding decrease in the percentage of roads rated poor.

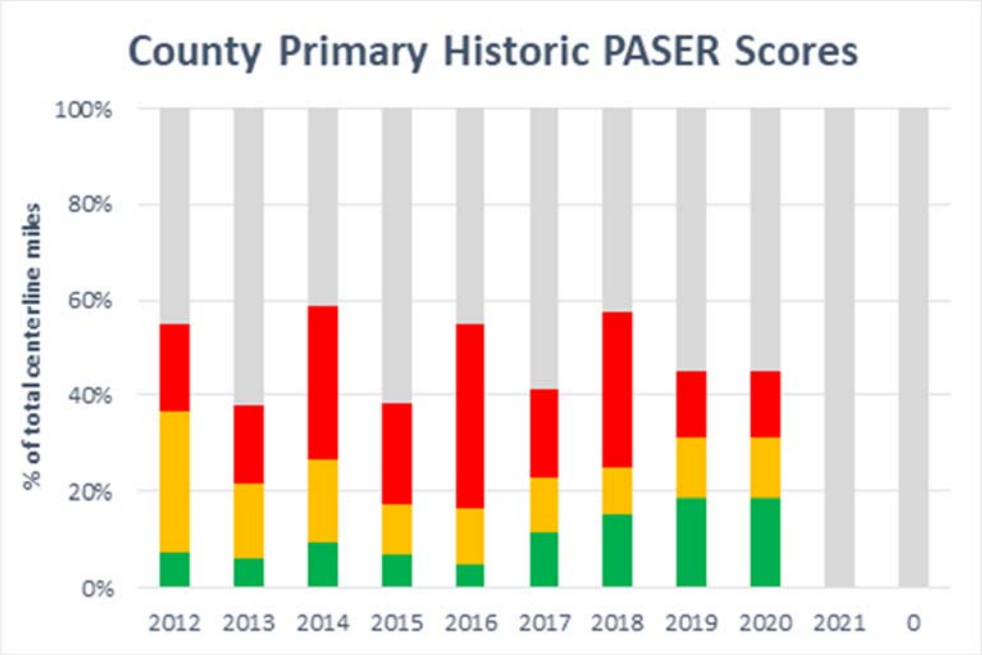


Figure 24: Historical RCOC paved county primary road network condition trend.

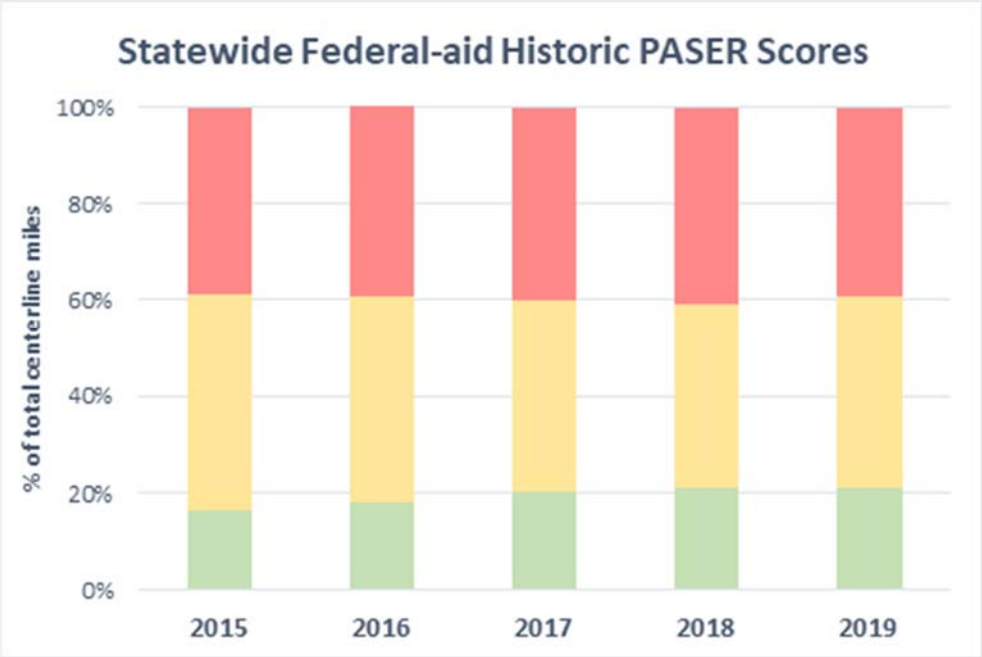


Figure 25: Historical statewide county primary road network condition trend.

Historically, the overall quality of RCOC's paved county local roads has been decreasing opposed to the paved county primary road network. This is because the local network lacks an adequate source of state and federal funding and therefore must be supported locally. Figure 26 illustrates the condition of the paved county local road network in RCOC while Figure 27 illustrates these conditions statewide.

Comparing RCOC's paved county local road condition trends illustrated in Figure 26 with overall statewide condition trends for all paved county local roads illustrated in Figure 27 indicates a different trend locally as in the rest of the state. The year-to-year variation in the paved county local road network is likely due to the fact that only a portion of the network is collected each year, both locally and statewide. This variation is likely a result of reporting bias since a representative sample of roads is not collected each year. The RCOC will be implementing new efforts to collect ratings on local roads moving forward.

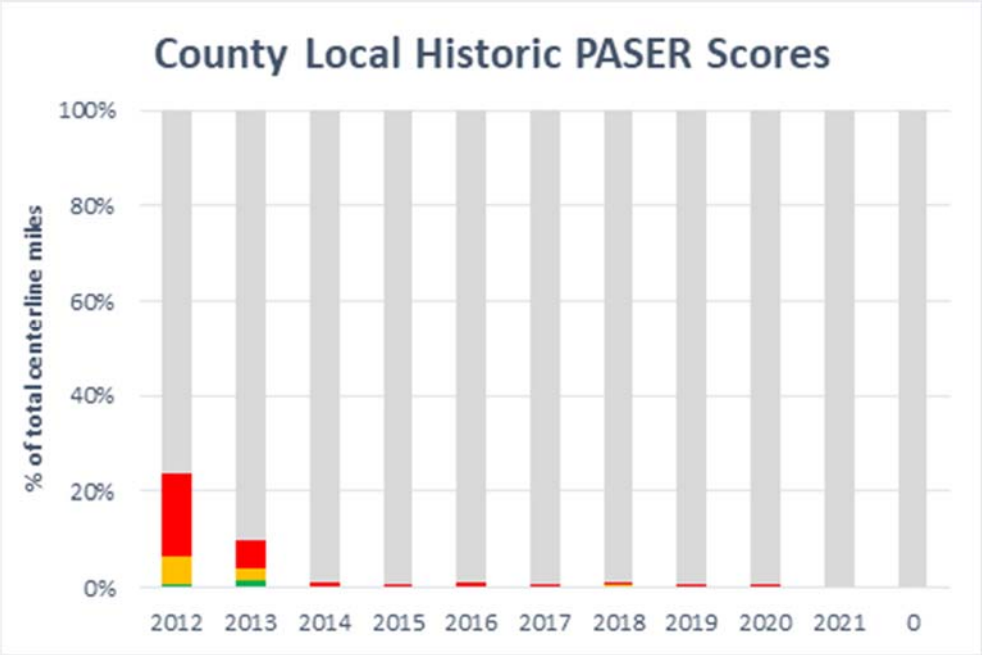


Figure 26: Historical RCOC paved county local road network condition trend.

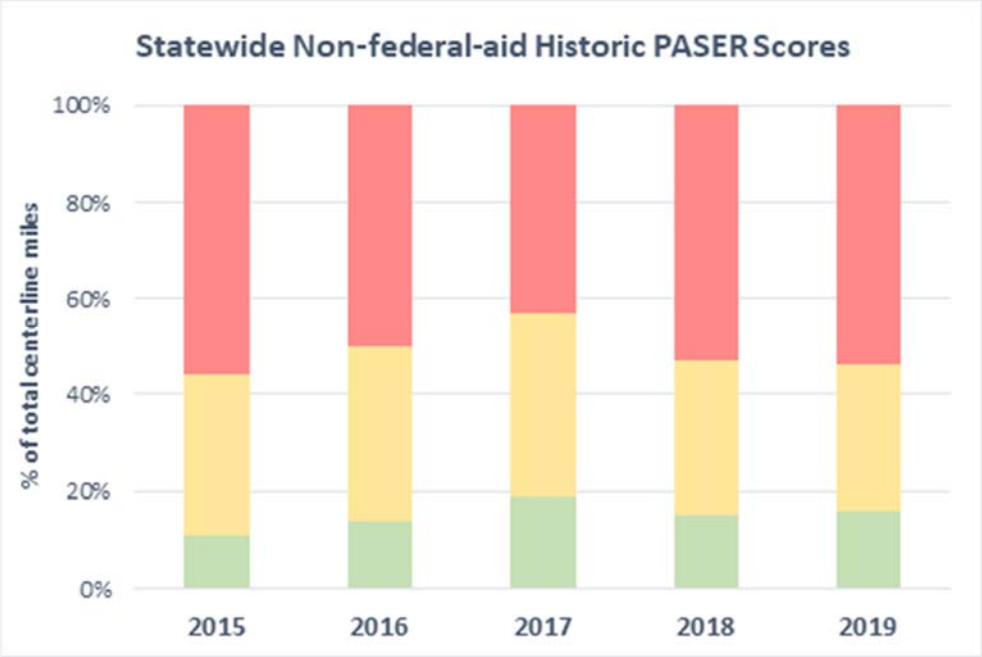


Figure 27: Historical statewide paved county local road network condition trend.

Unpaved Roads

The unpaved network of roads in Oakland County serve mostly residential and agricultural properties. The network does not follow a strict grid system, instead roads were built to provide connectivity between properties, trunklines and commercial/industrial districts. Many gravel roads are east-west or north-south thouroughfares, however, there are also many unpaved roads that travel diagonally and/or around natural features such as lakes, protected land and properties.

The condition of unpaved roads can be rapidly changing, which makes it difficult to obtain a consistent surface condition rating over the course of weeks or even days. The TAMC adopted the Inventory Based Rating (IBR) System™ for rating unpaved roads, and RCOC staff are now trained to use the IBR System™ for rating its unpaved roads. Past ratings on gravel roads have been collected with the use of the IBR System™ as well as the PASER system. RCOC gravel roads will be rated in the future using the IBR System™. RCOC elected to run reports using both data collection systems in this plan since all ratings are dated or incomplete.

There were more road miles collected in the past using PASER than using the IBR System™. Approximately 515.802 miles of unpaved roads were rated between 2013 and 2017, which is 77.72% of the unpaved network.

Figure 28 shows the percentage of unpaved roads in each PASER number ranges of good 10-8; fair 7-5: and poor 4-1, for all roads. Figure 29 illustrates the miles of unpaved roads in PASER number ranges of good 10-8; fair 7-5; and poor 4-1, for each community.

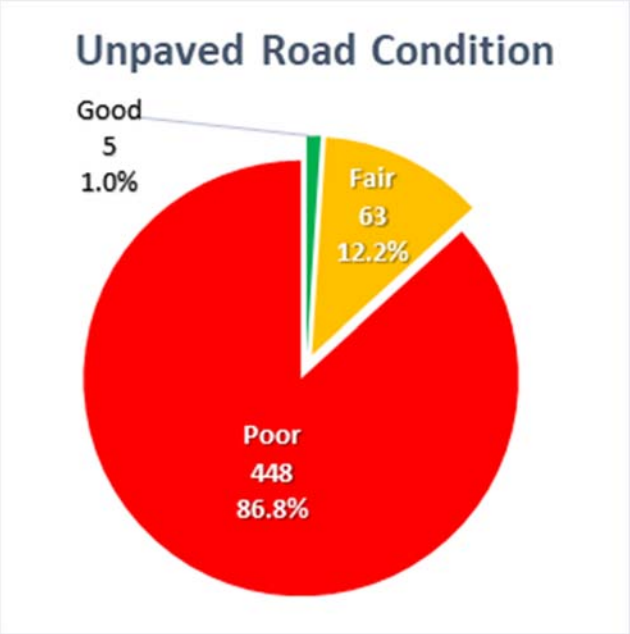


Figure 28: RCOC's unpaved road network condition by percentage of roads with PASER number ranges of good 10-8; fair 7-5; and poor 4-1.

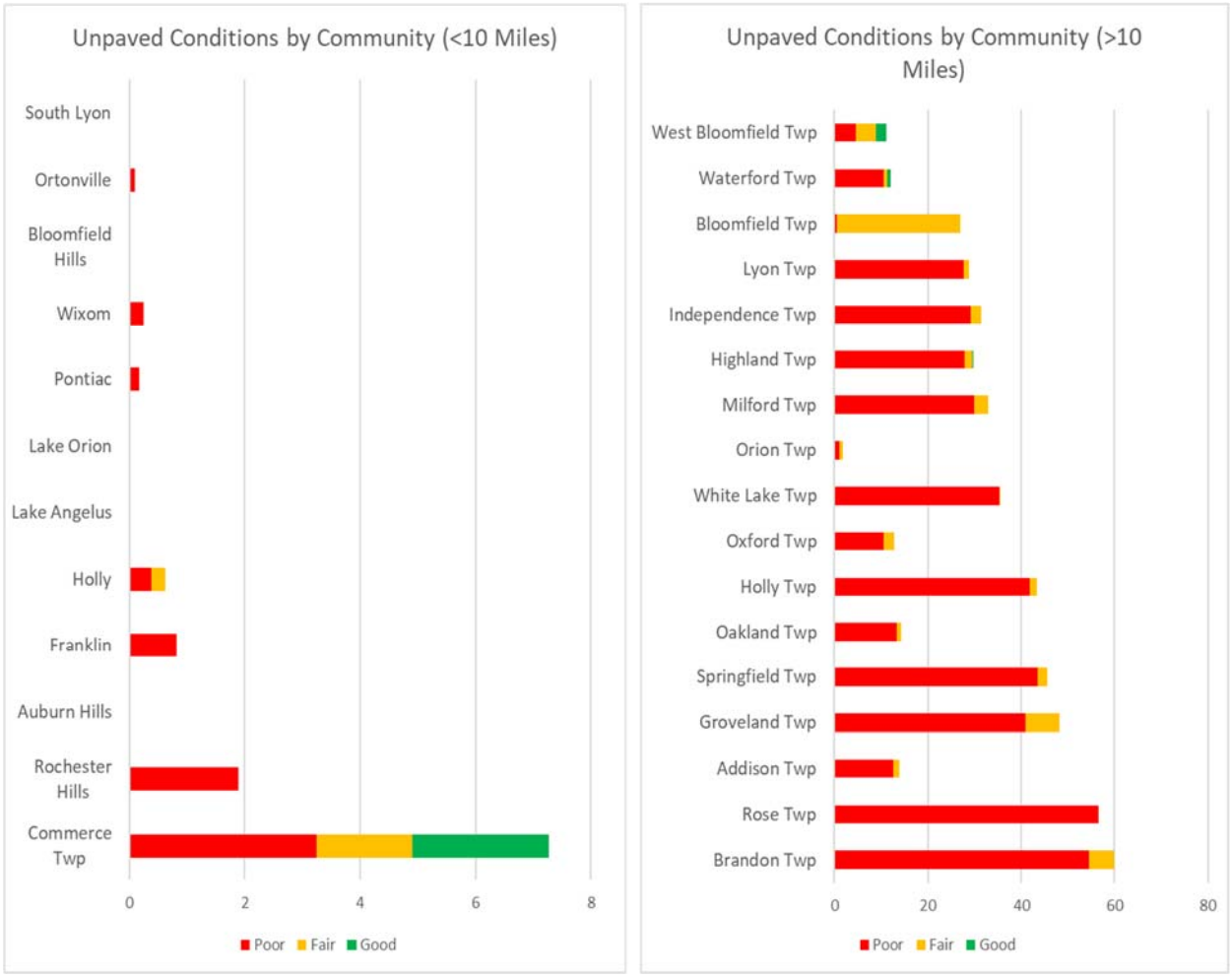


Figure 29: Number of miles of unpaved road in each community divided in categories of roads with PASER number ranges of good 10-8; fair 7-5; and poor 4-1.

Figure 30 is a map illustrating the unpaved network and condition using the PASER rating system.

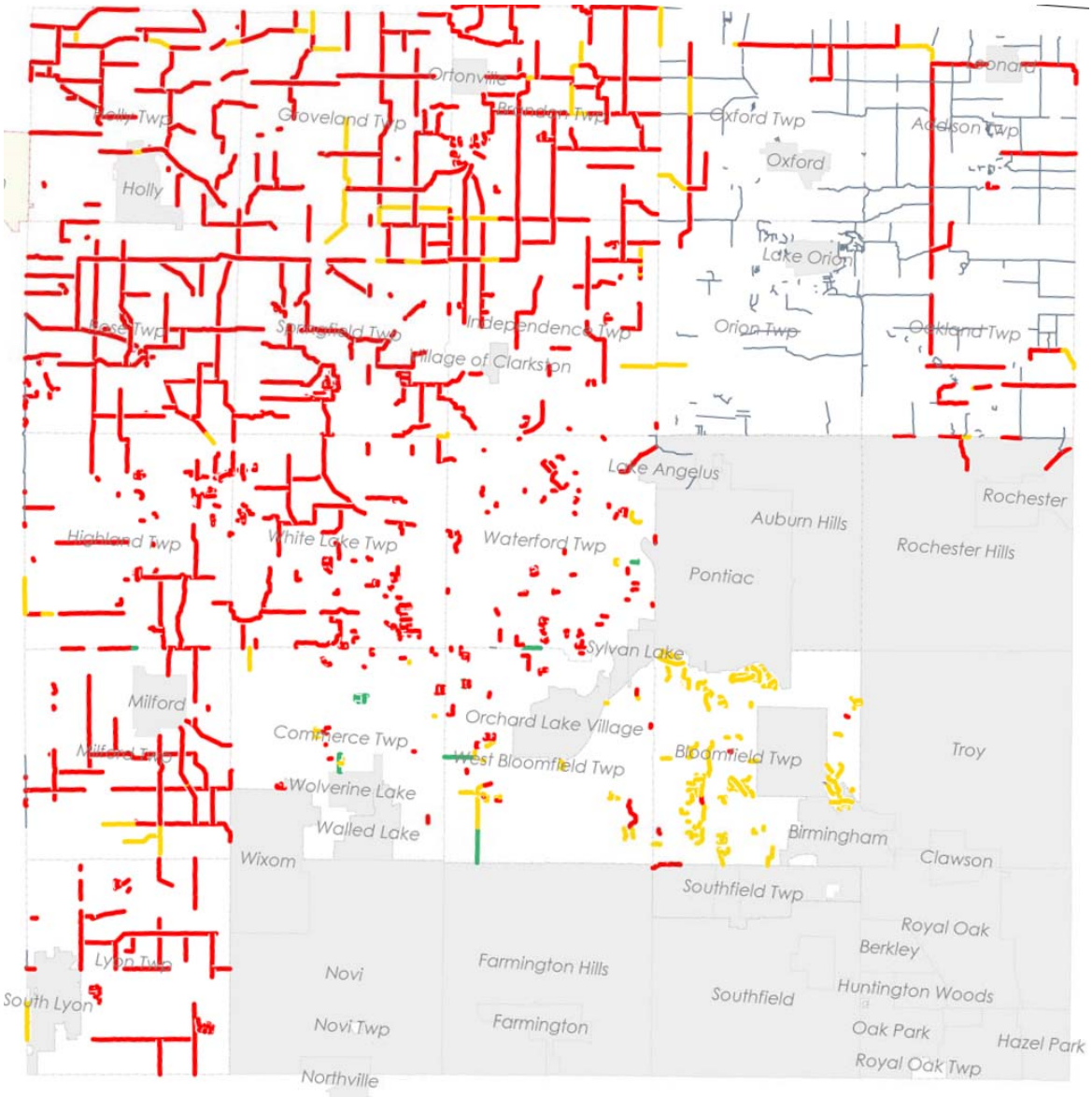


Figure 30: Map of the existing PASER ratings on the unpaved network. PASER number ranges of good 10-8 in green; fair 7-5 in yellow; and poor 4-1 in red.

Approximately 110.877 miles or just 16.71% of the unpaved network was rated from 2018-2019 using the IBR System™.

Figure 31 shows the percentage of unpaved roads in each IBR System™ ranges of good 10-8; fair 7-5: and poor 4-1, for all roads. Figure 32 illustrates the miles of unpaved roads in each IBR System™ number range of good 10-8; fair 7-5; and poor 4-1, for each community.

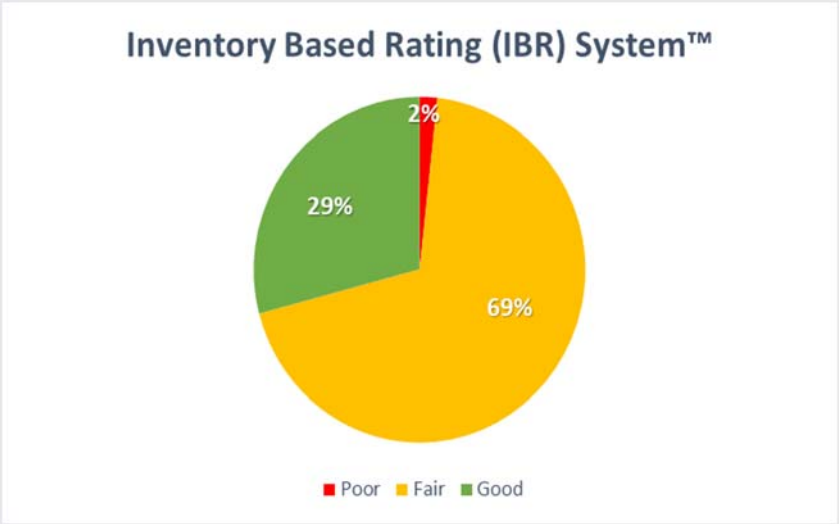


Figure 31: RCOC's unpaved road network condition by percentage of roads with IBR System ™ range of good 10-8; fair 7-5; and poor 4-1.

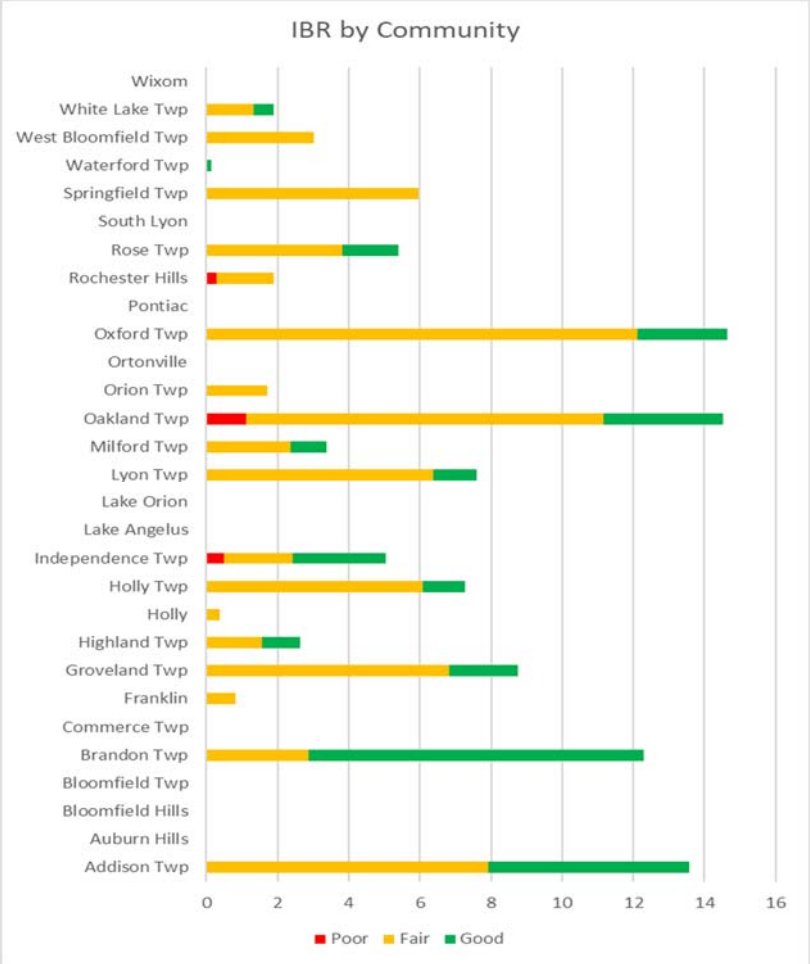


Figure 32: RCOC's unpaved road network condition by percentage of roads with IBR System ™ range of good 10-8; fair 7-5; and poor 4-1 in each community.

Figure 33, Figure 34, and Figure 35 are maps illustrating the geographic location of unpaved roads and the assessment of the IBR elements, respectively: surface width, drainage adequecy, and structural adequecy.

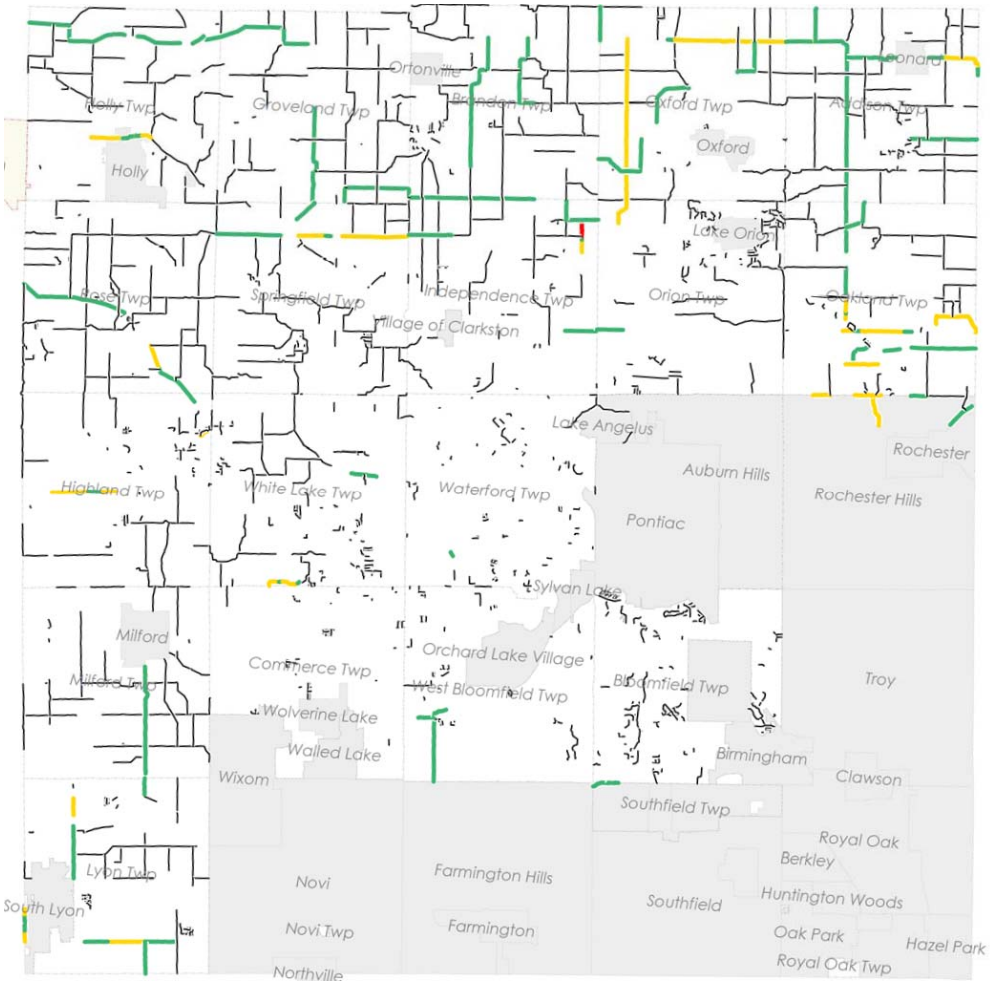


Figure 33: Map of the current IBR for SURFACE width with good (22’ and greater) shown in green, fair (16’ to 21’) shown in yellow, and poor (15’ or less) shown in red. Only unpaved roads owned by RCOC are shown.

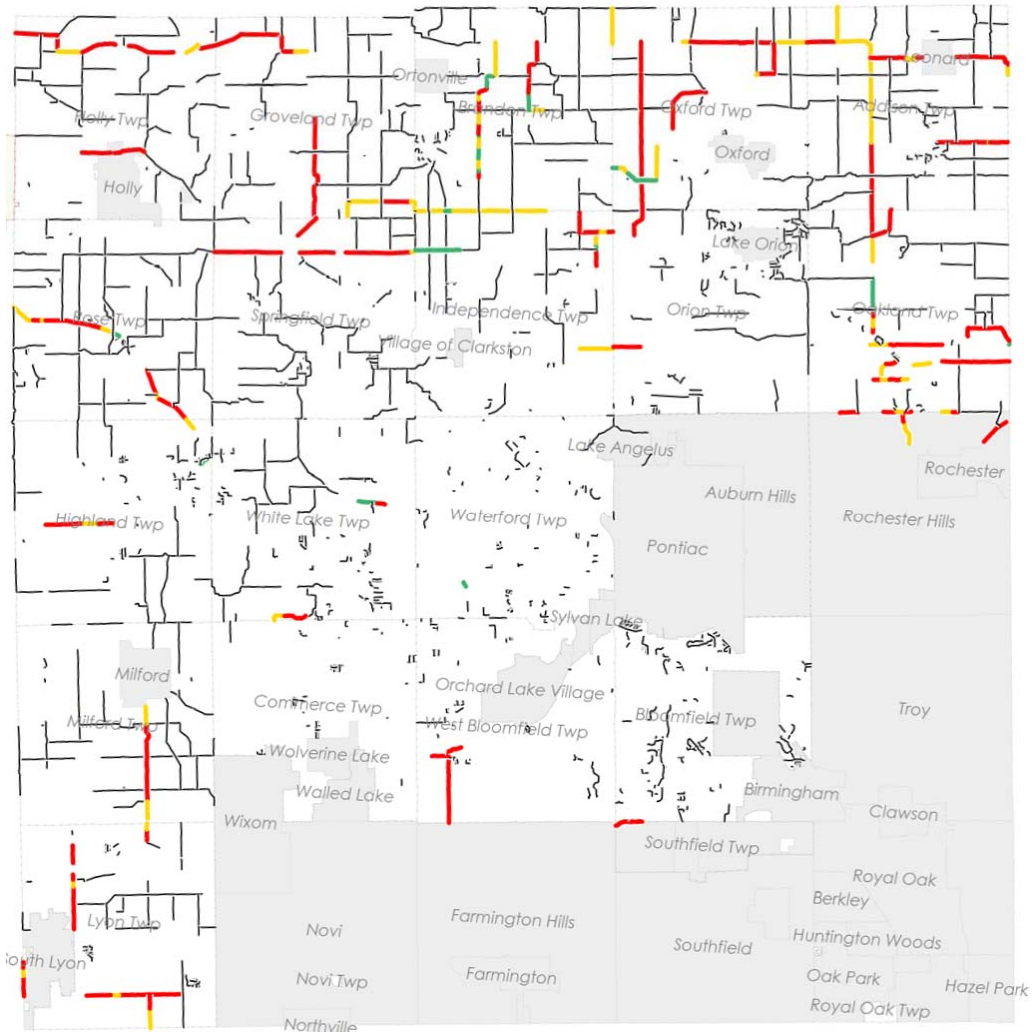


Figure 34: Map of the current IBR for DRAINAGE adequacy with good (2’ or more) shown in green, fair (0.5’ to less than 2’) shown in yellow, and poor (less than 0.5’) shown in red. Only unpaved roads owned by RCOC are shown.

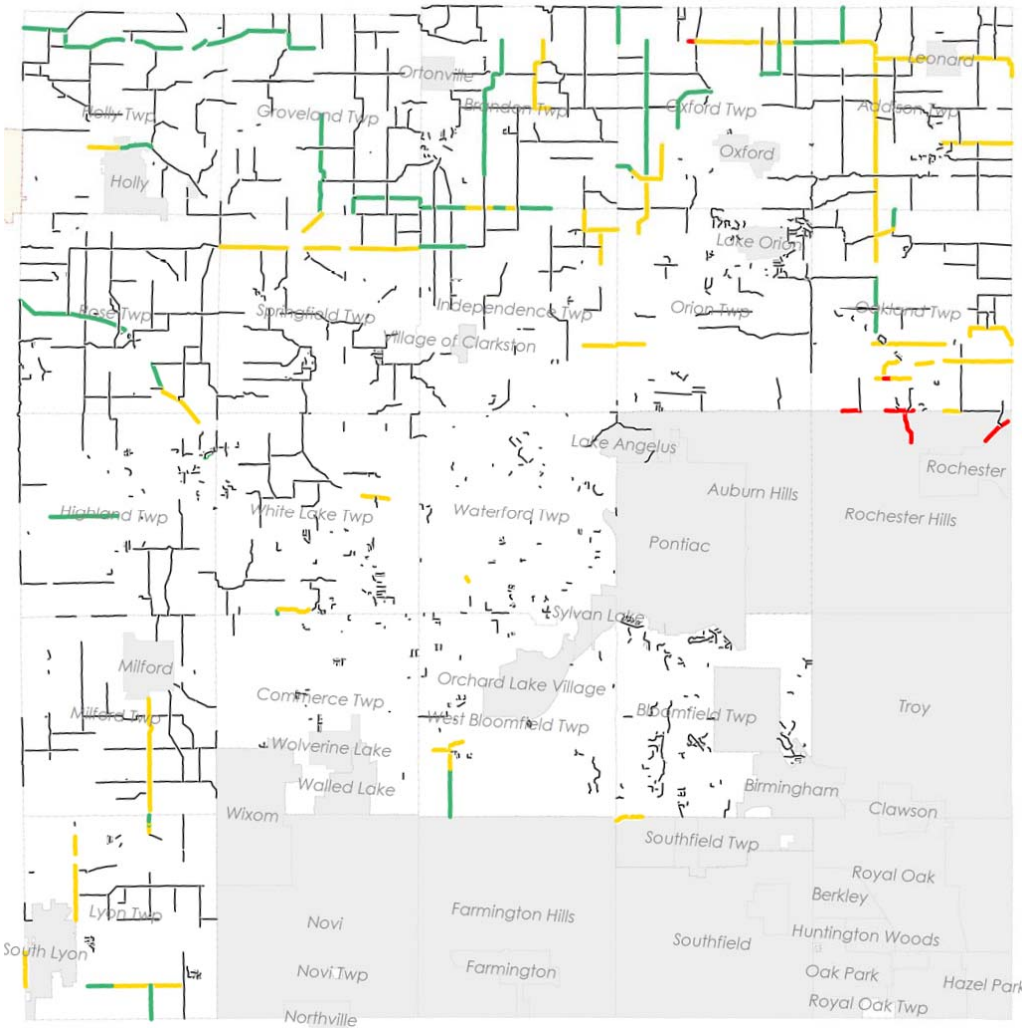


Figure 35: Map of the current IBR STRUCTURAL adequacy good (greater than 7") shown in green, fair (4" to 7") shown in yellow, and poor (less than 4") shown in red. Only unpaved roads owned by RCOC are shown.

Since the unpaved network is everchanging and unpredictable, RCOC has created a program of gravel road maintenance activities to keep up with changing conditions. Currently, The RCOC follows a dust control schedule on primary gravel roads which includes 5 applications a year of chloride and grading. Local gravel roads are only treated when paid by the township, homeowners or both. Gravel road grading occurs regularly. A fleet of graders, grading and spraying chloride 5-6 miles a day, the scheduled rotation in each district takes 4-6 weeks. Drainage and brush clearing maintenance activities occur continuously year-round. Every 5 years RCOC resurfaces gravel roads with new material, but this could occur more/less frequently based on community involvement, weather effects and changing conditions. Ditching, as explained in the primer, requires a full assessment of the road and the area adjacent. First, staff looks at the number and type of obstructions. Obstructions can include trees, foliage, fences, utilities and culverts. Also, an assessment of manpower, time and materials needed play a role in calculating the costs associated with ditching.

Ditching and maintaining gravel roads is an ongoing process that is led in most part by the seven highway maintenance district garages throughout the county. The districts have eyes and feet on the ground all day and work with local communities routinely to address concerns on paved and gravel roads. The process of selecting unpaved roads for future paving is outlined in the planned projects section of this document.

Goals

Goals help set expectations to 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. RCOC is not able to control any of these factors fully due to seasonal weather changes, traffic pattern changes, and its limited budget. In spite of the 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. An assessment of the progress toward these goals is provided in the *1. Pavement Assets*: *Gap Analysis* section of this plan.

Goals for Paved County Primary Roads

The overall goal for RCOC's paved county primary road network is to maintain or improve road conditions network-wide at 2019 levels. The baseline condition for this goal is illustrated in Figure 36.

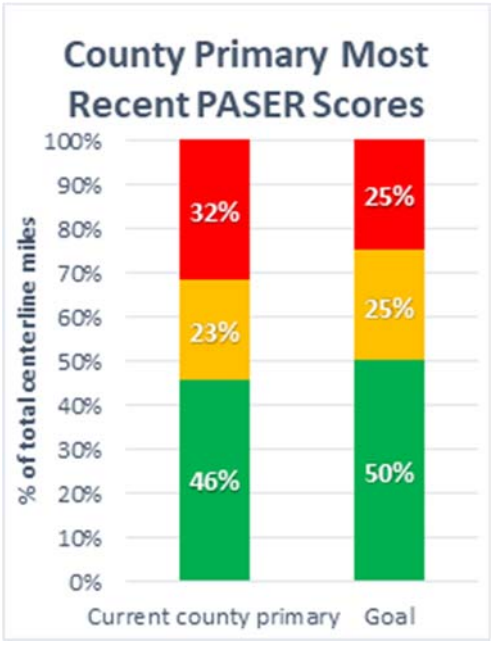


Figure 36: RCOC's 2019 county primary road network condition by percentage of good/fair/poor.

RCOC's network-level pavement condition strategy for paved county primary roads is:

1. Prevent its good and fair (PASER 10-5) paved county primary from becoming poor (PASER 4-1).
2. Move 8% of paved county primary roads out of the poor category.
3. Continue maintenance practices to keep condition on a positive or stable trend.

Goals for Paved County Local Roads

The overall goal for RCOC's paved county local road network is to maintain or improve road conditions network-wide at 2019 levels. The baseline condition for this goal is illustrated in Figure 37.

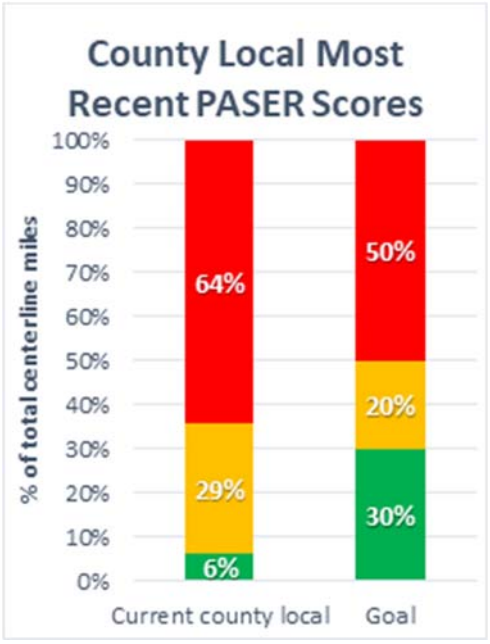


Figure 37: RCOC 2019 paved county local road network condition by percentage of good/fair/poor.

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

1. Prevent its good and fair (PASER 10-5) paved county local roads from becoming poor (PASER 4-1).
2. Move 14% of paved county local roads out of the poor category.
3. Rate 100% of the county local network every 3 years to gain a better understanding of successful/deficient practices.

Goals for Unpaved Roads

The overall goal for RCOC's unpaved road network is to maintain or improve road conditions network-wide at 2019 levels. The baseline condition for this goal is illustrated in Figure 38.

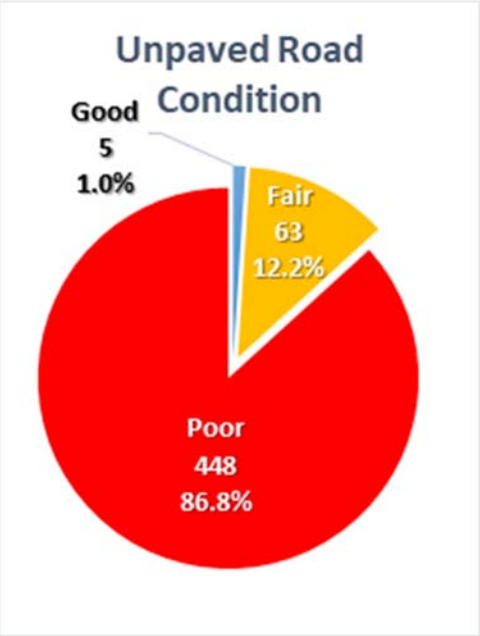


Figure 38: RCOC's 2019 unpaved road network condition by percentage of good/fair/poor.

Our unpaved roads will be maintained at their current structural and drainage adequacy for roads where these two IBR elements are assessed as good or fair. Currently, RCOC does not have adequate IBR data to determine what percentage of unpaved roads have good or fair structural or drainage adequacy. However, RCOC unpaved road maintenance practices will continue and the effort to rate these roads moving forward will provide us a better understanding of the network. Existing maintenance practices focus on drainage, grading, dust control and gravel overlays. Efforts to rate the unpaved network will begin in fiscal year 2022 and it is anticipated these roads will be rated entirely in one year and updated every 3 years unless the process to do so takes less or more time.

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, RCOC must complete treatment projects that either protect and/or add life to its pavements. The year-end condition of the whole network depends upon changes or preservation of individual road section condition that preservation treatments have affected.

RCOC uses many types of repair treatments for its roads, each selected to balance costs, benefits, and road life expectancy. When agency trends are modelled, any gap between goals and accomplishable work

becomes evident. Financial resources influence how much work can be accomplished across the network within agency budget and what treatments and strategies can be afforded; a full discussion of RCOC's financial resources can be found in the *5. Financial Resources* section.

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 *1. Introduction*'s *Pavement Primer*.

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 2). 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 2 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.

Pavement condition while very important when selecting locations and the scope of work, it is not RCOC's sole criterium for project selection. Other key factors include safety, community need and involvement, coordination, corridor continuity and funding source.

RCOC makes safety a priority, and if the surface condition of a road or the configuration of a road is contributing to crashes, the agency will prioritize the location for improvements. Corridor continuity is also important when selecting projects, if there is a segment of road along a regional corridor that is poor and the rest of the corridor is in good or fair condition, those locations will be considered a high priority.

A very significant factor when selecting projects is the level of community involvement when planning and funding projects. RCOC works with each community in identifying transportation needs, and communities with the ability to make fiscal contributions to those priorities may be given priority based on need and applicability.

Funding sources also play a fundamental role in project selection. Federal aid eligible roads due to their size and traffic volumes are considered priority, and therefore more funding sources are available. Many federal funding sources are not transferable from year to year, so it is important to spend any available funds when and where applicable. Projects that are funded using Federal Surface Transportation Program (STP) funds are selected through a scoring system based on criteria that includes: traffic volumes, pavement condition, road classification, scheduling, community participation and continuity. This scoring system helps to prioritize a list of future projects and then the Oakland Federal Aid Committee (FAC) approves the list.

Table 2: 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

NCPP Network Quick Check to Forecast Future Trends

The National Center for Pavement Preservation (NCPP) has developed an analysis method that gives an overall indicator of likely future road network condition trends. An example of this method along with a description is included as Appendix D.

The NCPP Quick Check 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. For example, a 100-mile network loses 100 mile-years' worth of life each year that it is not treated. Construction and maintenance projects add life to a road network, offsetting the steady yearly loss. For example, an overlay project that is expected to last 10 years and constructed on 5 miles of pavement will add 10-years x 5 miles = 50 mile-years of improvement, which is about half the value lost in one year on the example 100-mile network. In order for the network to remain stable, an agency would need to complete projects every year that offset all of the mile-years of loss, for this example 100 mile-years.

Paved County Primary Roads

Table 3 illustrates the calculations for the NCPP Quick Check method of RCOC's paved county primary road network. The treatments outlined in Table 3 are the average treatment volume of planned projects scheduled to be completed in 2021-2023. The *1. Pavement Assets*: *Planned Projects* section of this plan provides further detail. Results from the NCPP Quick Check for the paved county primary roads indicate the average volume of work that RCOC has been able to afford over the last five years is keeping up with the natural deterioration of the road network due to age and use. Although the gap analysis identifies a deficit, the volume of work has been increasing year to year and is rapidly closing the gap. RCOC could see a surplus of 30-40 mile-years in 2022 due to additional state and federal funding sources available in late fiscal year 2021. With additional funding, there could be an additional 20 miles of overlays or crack sealing and 2 miles of RRR which would equal up to 130 mile-years.

Table 3: NCPP Modelled Trends, Planned Projects, and Gap Analysis for 's Road Assets—Modelled Trends: NCPP Quick Check Method for Paved County Primary Road Network (881.071 miles)

Treatment Name	Average Yearly Miles of Treatment	Years of Life	Mile-Years
Crack Seal	60	2	120
Overlay	64	5	320
Concrete Patching	5	5	25
Concrete Slab Replacement	5	15	75
RRR	8	15	120
4R	2	20	40
New construction/pave gravel	1	20	20
Total			**720**
Gap Analysis: (Deficit)/Surplus			**-93**

The NCPP analysis of RCOC planned projects from its currently available budget does allow RCOC to reach its pavement condition goal given the projects planned for the next three years of 2021-2023. The increase in funding we have received in the past few years has provided Oakland County the opportunity to rapidly improve conditions on the primary network. It is anticipated that with updated ratings in 2021 and additional work completed, the percentage of good and fair roads will increase by 2-3% a year.

Paved County Local Road

Table 4 illustrates the calculations for the NCPP Quick Check method of RCOC's paved county local road network. The treatments outlined in Table 4 are the average treatment volume of planned projects scheduled to be completed in 2021-2023. The *1. Pavement Assets*: *Planned Projects* section of this plan provides further detail. Results from the NCPP Quick Check for the paved county local roads indicate the average volume of work that RCOC has been able to afford over the last five years is not keeping up with the natural deterioration of the road network due to age and use. Continuing the current treatment volume on this network will result in an ongoing deficit of 1,278 mile-years of project benefit to stabilize this trend and maintain current conditions.

Table 4: NCPP Modelled Trends, Planned Projects, and Gap Analysis for 's Road Assets—Modelled Trends: NCPP Quick Check Method for Paved County Local Road Network (1918.606 miles)

Treatment Name	Average Yearly Miles of Treatment	Years of Life	Mile-Years
Crack Seal			
Overlay	1	5	5
Concrete Patching		5	
Concrete Slab Replacement		15	
RRR	1	15	15
4R			
New construsction/pave gravel			20
Total			**20**
Gap Analysis: (Deficit)/Surplus			**-1278**

The NCPP analysis of RCOC's planned projects from its currently available budget does not allow RCOC to reach its pavement condition goals given the projects planned for the next three years. In order to prevent good and fair roads from becoming poor, more improvements must be made to this system. However, a lack of funding available for local roads does not permit the work required. The more attainable goal in regard to the local network would be to initiate the collection of condition data on the local system to gain a better understanding of ratings networkwide. When this data is available RCOC will plan accordingly to move 14% of paved county local roads out of the poor category.

It is important to note that some locals as reported in Roadsoft are internally designated at RCOC as sub-locals or subdivision roads in Townships. Improvements to the subdivision street network are not funded through any federal or state sources. The Subdivision Improvement and Development Division at RCOC manages the Special Assessment District (SAD) process. A SAD is a designated area where RCOC is requested to levy an assessment in exchange for road rehabilitation services. Over the past 10 years the SID has assisted with 54 SADs on sub-local streets totally 63.48 miles of work and $40,359,452 in repairs. These efforts to improve the local network have not yet been reflected in any condition rating system, however, as mentioned, RCOC will begin the process of collecting data on the non-federal aid local system. This data will help to provide a better understanding on the affect the SAD process has on the condition of the network.

Unpaved Road Condition Trends

There is limited unpaved road condition data available at this time, however, RCOC will initiate the collection of condition data on the local system to begin forecasting efforts. Currently, RCOC can continue the current maintenance practices and adjust schedules and fixes accordingly.

Planned Projects

RCOC plans construction projects several years in advance. A multi-year planning threshold is required due to the time necessary to plan, design, and finance construction projects on the paved county primary road network. This includes planning and programming requirements from state and federal agencies that must be met prior to starting a project and can include studies on environmental and archeological impacts, review of construction and design documents and plans, documentation of rights-of-way ownership, planning and permitting for storm water discharges, and other regulatory and administrative requirements. Maintenance improvements are near-term projects and may be selected a year or less in advance due to critical need and changing conditions after spring frost and thaw.

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 may require RCOC to alter initial plans. Project planning information is used to predict the future condition of the road networks that RCOC maintains. The *1. Pavement Assets*: *Modelled Trends* section of this plan provides a detailed analysis of the impact of the proposed projects on their respective road networks.

For 2021-2023 RCOC plans to do the following projects:

Paved County Primary Projects

RCOC is currently planning the construction and maintenance projects listed in Appendix A for the paved county primary road network. The locations of these projects are shown in Figure 39. The total cost of these projects is in each year is as follows:

- 2021 - $35,875,012
- 2022 - $35,459,353
- 2023 - $21,106,016

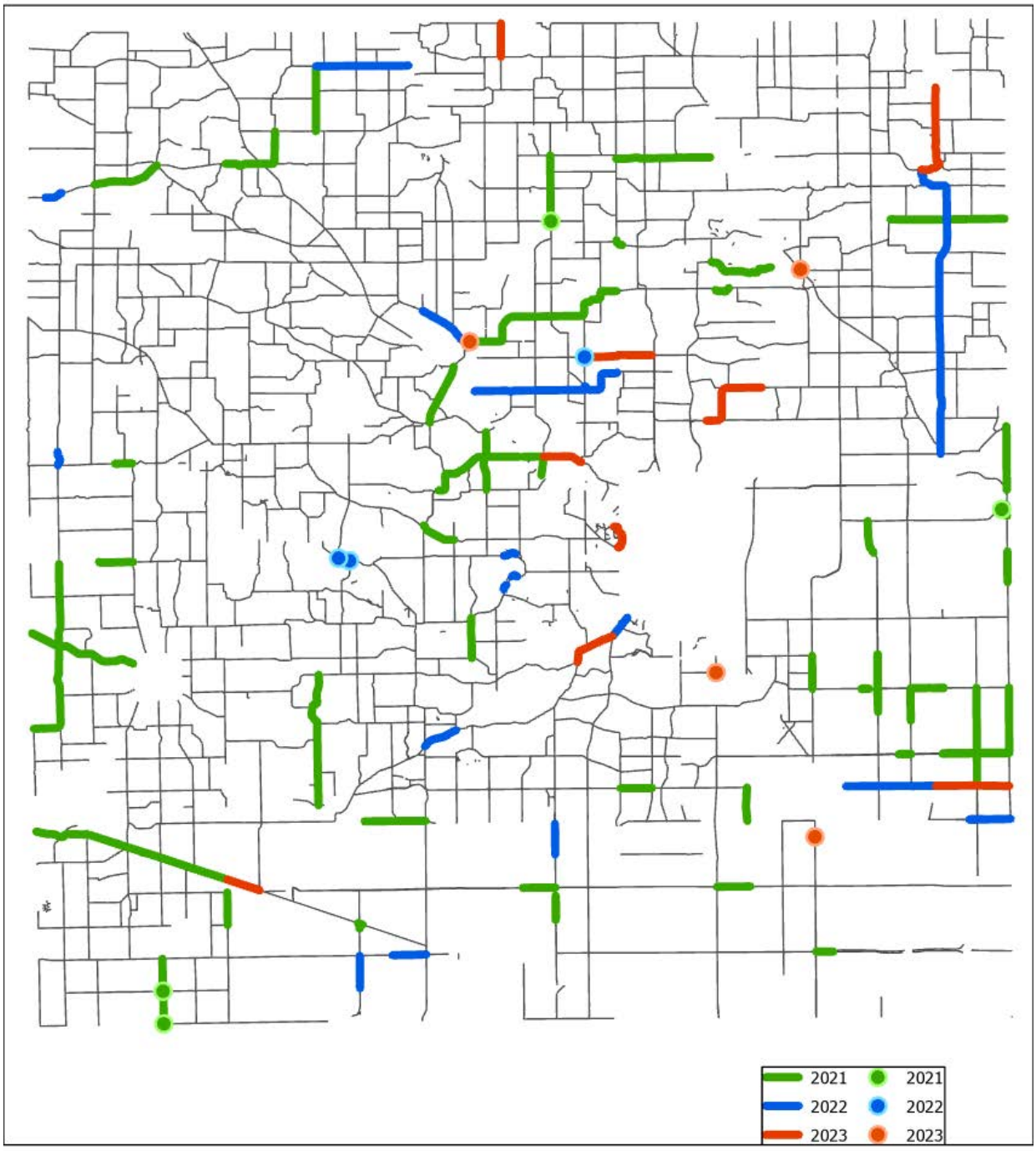


Figure 39: Map showing paved county primary road projects planned for 2021-2023.

Paved County Local Projects

RCOC is currently planning the construction and maintenance projects listed in Appendix B for the paved county local road network. The locations of these projects are shown in. The total cost of these projects is approximately:

- 2021- $1,348,499
- 2022 - $190,000
- 2023 – TBD

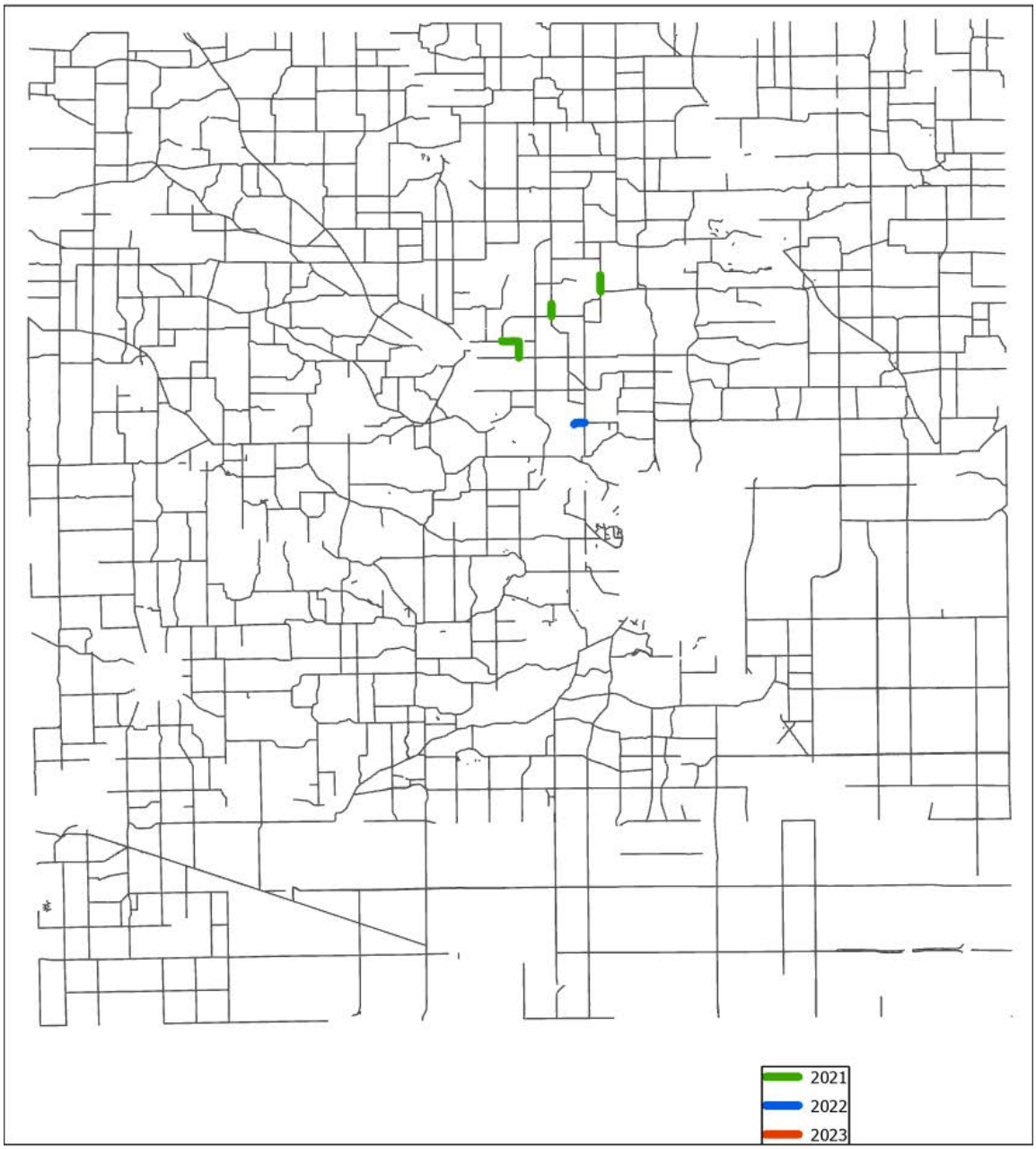


Figure 40: Map showing paved county local road projects planned for 2021-2023

Unpaved Road Projects

RCOC is currently planning the construction and maintenance projects listed in Appendix C for the unpaved road network. The location of these projects is shown in Figure 41.The total cost of these projects is approximately:

- 2021 - $10,800,000
- 2022 - $2,500,000
- 2023 - $3,200,000

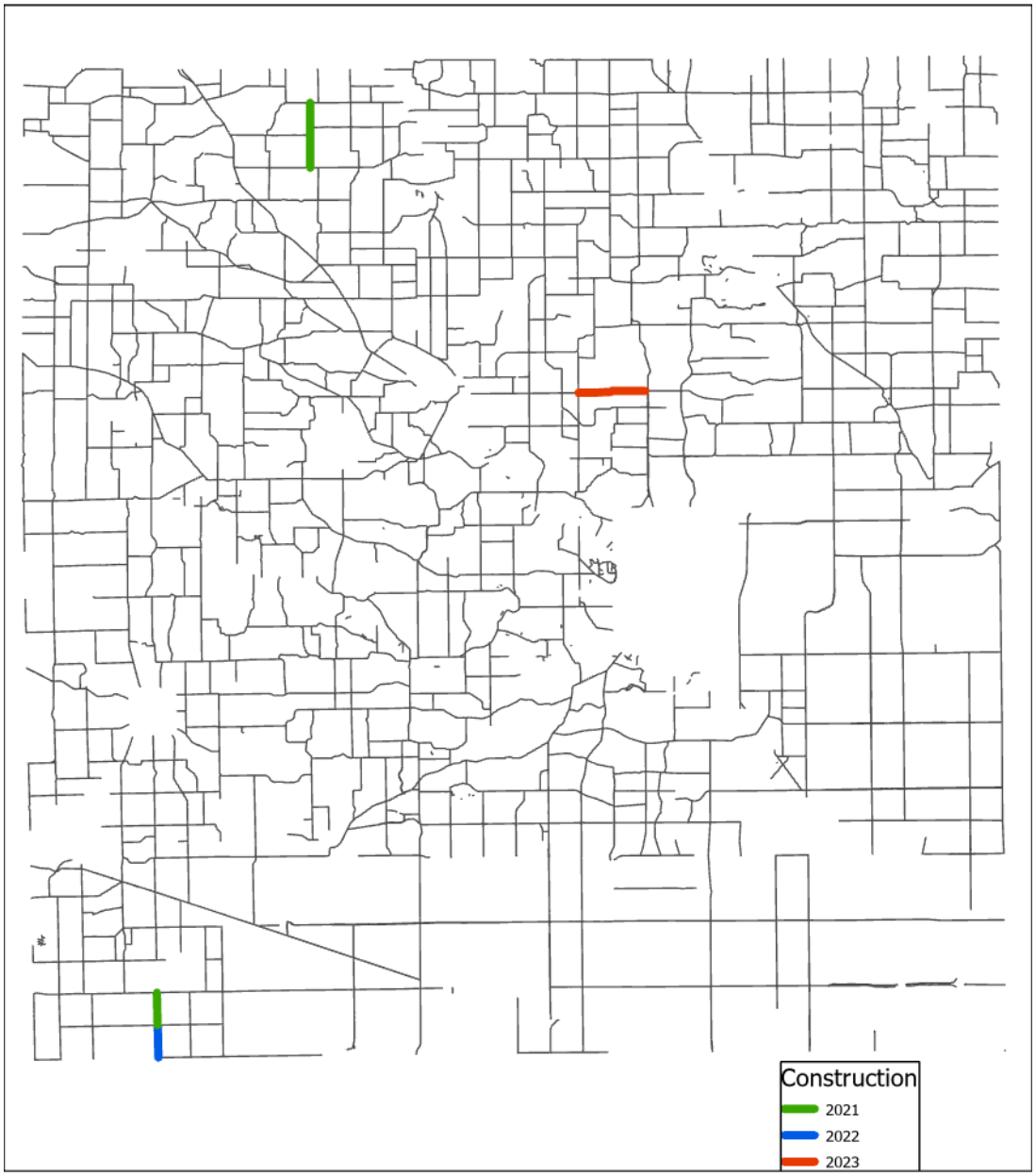


Figure 41: Map showing paving gravel road projects planned for 2021-2023.

Gravel road paving projects are identified biennially when RCOC reaches out to the 29 communities in Oakland County that have gravel roads in their boundaries. Each community can submit a list of gravel roads they would like to add to the list for future paving. The list of locations is then added to the Gravel Road Paving Plan, where locations requested are separated into federal aid eligible and non-federal aid eligible.

Federal Surface Transportation Program funds are set aside annually to fund gravel road paving projects. The RCOC, per the Oakland County Federal Aid Committee's Rules of Procedure state that $2,000,000 of the total STP funds available to the county will be allocated for the paving of the federal aid eligible gravel road network. When a community can provide a financial commitment to their match, the project is then added to the next year of available funding. Table 5 shows a list of federal aid eligible gravel road paving projects through fiscal year 2028. Sometimes projects may take more than one year to complete and funding in multiple years or from different sources may be identified.

Table 5: Gravel Road Paving Projects

YEAR OF CONSTRUCTION		
Year	**Project**	**Limits**
2021	Barron Road	Grange Hall to Groveland
2021	Currie	9 Mile to 10 Mile
2022	Currie	8 Mile to 9 Mile
2023	Waldon	Clintonville to Baldwin
2025	Oak Hill	Ellis to M-15
2026	Rose Center	Tipsico Lake to Hickory Ridge
2027	Pontiac Lake	Margie to Kingston
2028	Walnut Lake	W. of Haggerty to Halsted

More detailed information on construction projects programmed in fiscal years 2021-2023 can be found in Appendix A-C.

Planned Maintenance Projects

Near-term projects include preservation overlays, crack sealing, spot resurfacing, and many gravel maintenance projects. The quantity of projects is determined by available MTF revenue and the location is determined based on immediate need identified by the maintenance department and district staff. Projects for the next fiscal year are selected no more than 1 year in advance. This process allows RCOC to adapt to changing road conditions and apply an immediate and cost-effective treatments at the right time. Road segments selected for maintenance are identified through analysis performed by the Highway Engineer and Highway Maintenance Department. During the early stages of budget development RCOC allocates approximately $5 million for preservation overlays (Mill & Fill with 1.5" HMA), $1 million for spot resurfacing, $250,000 for 24-inch joint repairs and $1.5 million for concrete repairs. The total cost of maintenance projects could grow from an originally planned $8 million to $20 million depending on additional funding availability. Table 6 includes the list of locations identified by maintenance staff for

maintenance fixes. Fixes include crack sealing, preservation overlays, concrete patching, spot resurfacing. **Error! Reference source not found.** is a map of all the maintenance projects in 2021 and longer term preservation overlays planned for 2022 and 2023..

Table 6: 2021 Road Maintenance Projects

2021 Crack Sealing Locations		
Road	**Limit 1**	**Limit 2**
Cooley Lake Road	Oxbow Lake Road	Union Lake Road
Milford Road	N Milford Village Limits	N Highland Township Limits
Pontiac Trail	S. Commerce Road	Welch Road
Andersonville Road	Farley Road	Davisburg Road
Sashabaw Road	I-75	Clarkston Road
Grange Hall	Van Road	Jossman Road
Sashabaw Road	Sherwood Road	Granger Road
Cass Lake Road	Otter Street	Pontiac Lake Road
Franklin Road	Walnut Lake Road	Lone Pine Road
Lone Pine Road	Orchard Lake Road	Lone Pine Road/Inkster Road
Maple Road	Telegraph Road	Cranbrook Road
Maple Road	East of Middlebelt Road	Inkster Road
Quarton Road	Inkster Road	Franklin Road
Quarton Road	Lahser Road	Woodward Avenue
Adams Road	Square Lake Road	South Boulevard
Square Lake Road	East of I-75 Ramp	Adams Road
Middlebelt Road	Maple Road	Orchard Lake Road
Adams Road	North Birmingham City Limits	Wattles Road
Maple Road	Haggerty Road	Drake Road
Square Lake Road	Middlebelt Road	US-24
Lahser Road	13 Mile Road	Maple Road
12 Mile Road	West of Southfield Road	Red Leaf Lane
13 Mile Road	Telegraph Road	Beverly Hills West Village Limits
Livernois Road	Avon Road	Walton Road
Lahser Road	8.5 Mile Road	10 Mile Road
10 Mile Road	East of I-75	Dequindre Road
10 Mile Service Drive	East of Woodward Avenue	I-75
10 Mile Road	West of Coolidge Road	West of Woodward
South Boulevard	Crooks Road	Livernois Road
Cooley Lake Road	Union Lake Road	Williams Lake Road
2021 Preservation Overlay Locations		
Road	**Limit 1**	**Limit 2**
Flemings Lake Road	Clarkston Road	Walters Road
Walters Road	Flemings Lake Road	Waldon Road
Clarkston Road	Village of Clarkston	Orion Township Line
White Lake Road	Clarkston Village	Andersonville Road
Eston Road	Clarkston Road	End of Pavement
Hickory Ridge Road	Labadie Road	M-59
14 Mile Road	Walled Lake Drive	Haggerty Road

Romeo Road	Kline Road	Dequindre Road
Dequindre Road	Washington Road	Clinton River Trail
Williams Lake Road	East of Gale Road	West of Dixie Hwy
Lochaven Road	Willow Road	Cooley Lake Road
Grange Hall Road	Fish Lake Road	Fagen Road
Commerce Road	Livingston Co Border	Milford Village Limit
Clyde Road	Strathcona Road	Milford Road
Pontiac Lake Road	Hospital Road	Williams Lake Road
Livingston Road	M 59	Milford Road
Sashabaw Road	Walton Boulevard	Dixie Highway
Airport Road	Andersonville Road	Hatchery Road
Pine Knob Road	Clarkston Road	End of Pavement
Seymour Lake Road	Baldwin Road	Oxford Village Limits
Napier Road	11 Mile Road	12 Mile Road
Benstein Road	Maple Road	Sleeth Road
Grand River Avenue	w/o Napier Road	Livingston Co Border
Grange Hall Road	I – 75	Tripp Road
Sashabaw Road	Oak Hill Road	Sherwood Road
Heights Road	Joslyn Road	M-24
10 Mile Road	Greenfield Road	East of Church Street
Dequindre Road	n/o Auburn Road	South of Hamlin Roadd
Crooks Road	Hamlin Road	Avon Road
2022 Preservation Overlays Locations		
Pontiac Trail	Napier Road	to W Maple Road
Harvey Lake	Clyde Road	M-59
8 Mile Road	Currie Road	Napier Road
Kent Lake Road	Silver Lake Road	Grand River Avenue
Elizabeth Lk Road	Oxbow Lake Road	Union Lake Road
Union Lake Road	Elizabeth Lake Road	Cooley Lake Road
12 Mile Road	east of Grand River Avenue	
Sashabaw Road	at Waldon Road Intersection	
Clarkston Road	east of M-15	
Holly Road	Tindall Street	Dixie Highway
Waldon Road	Baldwin Road	Joslyn Road
Maybee Road	Rohr Road	Baldwin Road
Franklin Road	Friendly (Pontiac CL)	Long Lake Road
Parkway Street	Cass Elizabeth Lake Road	Deadend
N Oakland Boulevard	Highland Road	Pontiac Lake Road
Opdyke Road	Hickory Grove Road	South Boulevard
Pine Lake Road	Orchard Lake Road	Middlebelt Road
Green Road	Orchard Lake Road	Walnut Lake Road
8 Mile Road	East of Farmington Road	Grand River Avenue
Middlebelt Road	8 Mile Road	I-696
12 Mile Road	Coolidge Road	to Crooks Road
2023 PROGRAM (but will be first to move to 2022 if extra money becomes available)		

Griswold Road	9 Mile Road	10 Mile Road
Wixom Road	south of Old Wixom Road	north of I96
Oxbow Lake Road	Elizabeth Lake Road	Cooley Lake Road
Seymour Lake Road	Sashabaw Road	Baldwin Road
Drahner Road	Sanders Road	M24
Brown Road	M-24	Squirrel Road
Squirrel Road	Dutton Road	Silver Bell Road
Novi Road	south of 12 Mile Road	Grand River Avenue
Livernois Road	north of Long lake Road	south of Avon Road
Eastways Road	E Long Lake Road	Square Lake Rd Road
Remainder of 2023 PROGRAM		
Napier Road	8 Mile Road	9 Mile Road
9 Mile Road	Chubb Road	Napier Road
8 Mile Road	Napier Road	Taft Road
Martin Road	Pontiac Trail	Richardson Road
Davisburg Road	Eaton Road	Bridge Lake Road
Orion Road	Rochester Road	Flint Street
Academy Road	Fish Road	west to dead end
Belford Road	Holly Road	west to RR tracks
Belford Road	I-75	intersection
East Holly Road	Maple Road	Rood Road
12 Mile Road	Northwestern Highway	Inkster Road
13 Mile Road	Inkster Road	Telegraph Road
Middlebelt Road	I-696	Maple Road
2021 Concrete Patching (no federal funding)		
Road	**Limit 1**	**Limit 2**
Grand River Avenue	West of intersection	East of intersection
Maple Road	West of John R Road	John R Road
Crooks Road	Square Lake Road	Fountain Drive
Long Lake Road	Fountain Parkway	Corporate Drive
Long Lake Road	Livernois Road	Rochester Road
Orchard Lake Road	I-696	11 Mile Road

2021 Roads with Spot Resurfacing Locations	
Road	**Community**
Hatchery Road	Waterford
S Hospital Road	Waterford
13 Mile Road	Franklin
Greenfield Road	Southfield
8 Mile Road	Farmington
12 Mile Road	Farmington Hills
Livernois Road	Rochester Hills

Dequindre Rd	Troy
John R Rd	Madison Heights
Duck Lake Rd	Highland
Wardlow Rd	Highland
Elizabeth Lake Rd	White Lake Twp
Old Plank Rd	Milford Twp
Lone Tree Rd	Highland Twp
Strathcona	Highland Twp
Rowe Rd	Highland Twp
Wardlow Rd	Highland Twp
Davisburg Rd	Springfield Twp
Sloan Dr	Holly Twp
Academy Rd	Holly Twp
Rolling Hills Dr	Holly Twp
Otter Run Rd	Holly Twp
Beaver Run Rd	Holly Twp
River Rock Dr	Holly Twp
Joslyn Rd	Auburn Hills
Adams Rd	Oakland Twp
N Hadley Rd	Brandon Twp

Gap Analysis

The current funding levels that RCOC receives are not sufficient to meet the goals for the paved county primary road network, the paved county local road network, and the unpaved road network. The *1. Pavement Assets*: *Goals* section of this plan provides further detail about the goals and the *1. Pavement Assets*: *Modelled Trends* section provides further detail on the shortfall given the current budget. However, RCOC believes that the overall condition of this network can be maintained or improved with additional funding for construction and maintenance. An alternate strategy may be used to overcome the current shortfall and meet the goals on the paved county primary road network, the paved county local road network, and the unpaved road network:

NCPP Network Quick Check to Meet Goals on the Paved County Primary and County Local Network

The NCPP Quick Check can be used as an indicator of potential change in future pavement conditions based on the planned maintenance and construction work and the network size. This method is described in the *1. Pavement Assets*: *Modelled Trends* section of this plan and further detailed in Appendix D.

Table 7 and Table 8 illustrate the results of the NCPP Quick Check method. Table 7 shows that the paved county primary road network will have a deficit of 98 mile-years of improvement. Table 8 shows that the paved county local road network will have a deficit of 1263 mile-years of improvement. To maintain current road conditions, the deficit must be overcome with a combination of maintenance and construction work.

Table 7: NCPP Modelled Trends, Planned Projects, and Gap Analysis for 's Road Assets—Planned Projects and Gap Analysis: NCPP Quick Check Method for Paved County Primary Road Network (881.071 miles)

Additional Annual Work Necessary To Overcome Deficit			
Treatment Name	**Average Yearly Miles of Treatment**	**Years of Life**	**Mile-Years**
Crack Seal	60	2	120
Overlay	60	5	300
Concrete Patching	5	5	25
Concrete Slab Replacement	5	15	75
RRR	9	15	135
4R	2	20	40
New construsction/pave gravel	1	20	20
Total			**715**
Gap Analysis: (Deficit)/Surplus			**-98**

Treatment	**Average Yearly Miles of Treatment**	**Years of Life**	**Mile-Years**
Crack Seal	5	2	10
Overlay	5	5	25
Concrete Patching	1	5	5
Concrete Slab Replacement	1	15	15
RRR	3	15	45
4R		20	
New construsction/pave gravel		20	
Total			**100**
Gap Analysis: (Deficit)/Surplus			**2**

Table 7 outlines the additional project work for the paved county primary road network that would be required in order to meet its goal of maintaining 2019 road conditions. The additional work on the paved county primary road network is anticipated to cost approximately $9,458,400 per year.

Table 8: NCPP Modelled Trends, Planned Projects, and Gap Analysis for 's Road Assets—Planned Projects and Gap Analysis: NCPP Quick Check Method for Paved County Local Road Network (1918.606 miles)

Planned Projects			
Treatment	**Average Yearly Miles of Treatment**	**Years of Life**	**Mile-Years**
Crack Seal			
Overlay	1	5	5
Concrete Patching		5	
Concrete Slab Replacement		15	
RRR	2	15	30
4R			
New construsction/pave gravel			
Total			**35**
Gap Analysis: (Deficit)/Surplus			**-1263**

Additional Work Necessary to Overcome Deficit			
Treatment	**Average Yearly Miles of Treatment**	**Years of Life**	**Mile-Years**
Crack Seal			
Overlay	200	5	1000
Concrete Patching	25	5	125
Concrete Slab Replacement	2	15	30
RRR	10	15	150
4R			
New construsction/pave gravel			
Total			**1305**
Gap Analysis: (Deficit)/Surplus			**42**

Table 8 outlines the additional project work for the paved local road network that would be required in order to meet its goal of maintaining 2019 road conditions. The additional work on the paved county local road network would cost approximately $101,960,000 to apply the identified fixes to all local roads over three years.

2. Financial Resources

Public entities must balance the quality and extent of services they can provide with the tax resources provided by citizens and businesses, all while maximizing how efficiently funds are used. RCOC will overview its general expenditures and financial resources currently devoted to pavement maintenance and construction. This 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; this is a full financial report that outlines revenues and expenditures. This report can be obtained on our website at rcocweb.org or by request submitted to our agency contact (listed in this plan).

RCOC has an estimated budget for pavement asset management of $57,350,000. The amount budgeted may increase or decrease depending on available funding and after a more detailed budget analysis.

County Primary Network

RCOC has historically spent an average of $50,619,874 annually (2016-2020) on pavement-related projects on the primary network. Over the next three years, RCOC plans to spend a minimum of $50,000,000 on county primary-network projects consisting of, but not limited to, reconstruction, overlay, culvert replacement, and preventive maintenance. Spending on projects depends on revenue from Michigan Transportation Fund (MTF), township contributions, and federal/state programs.

County Local Network

RCOC has historically spent $7,565,242 annually (2016-2020) on pavement-related projects on the local network. Over the next three years, RCOC plans to spend a minimum of $1,500,000 on county local-network projects consisting of, but not limited to, reconstruction, overlay, culvert replacement, and preventive maintenance. Spending on projects depends on revenue from Michigan Transportation Fund (MTF), and local community contributions.

3. Risk of Failure Analysis

Transportation infrastructure is designed to be resilient. The system of interconnecting roads and bridges maintained by RCOC 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.

Figure 42 illustrates the key transportation links in RCOC's road network.

Table 9 shows the list of road segments were identified as critical links in the Road Commission for Oakland County's network based on three criteria: long detour alternatives, criticality to commerce, and significance as a regional route. In most cases, any single road segment contributes to more than one of these criteria.

These criteria were developed based on TAMC's Risk of Failure Analysis guidelines as well as RCOC's internal priorities. Below are descriptions of these criteria:

Long Detour – If the closure of a road segment would likely lead to significant delays and no reasonable alternative route exists, then the segment was considered to have potential to create long detours. This could also have significant impacts to congestion and safety of the rest of the network of roads.

Critical to Commerce – For the purposes of this analysis, commerce was used primarily to refer to industrial and retail commercial areas. A road segment that currently provides connection to an area of economic significance was evaluated for how it would negatively impact the productivity of that area in the event of a road failure.

Regional Route – Roads were evaluated for their role in facilitating travel across the county and considered important to the broader regional network if they support the efficient movement of vehicles. In some cases, these are roads that serve as alternatives to when major highways are impacted.

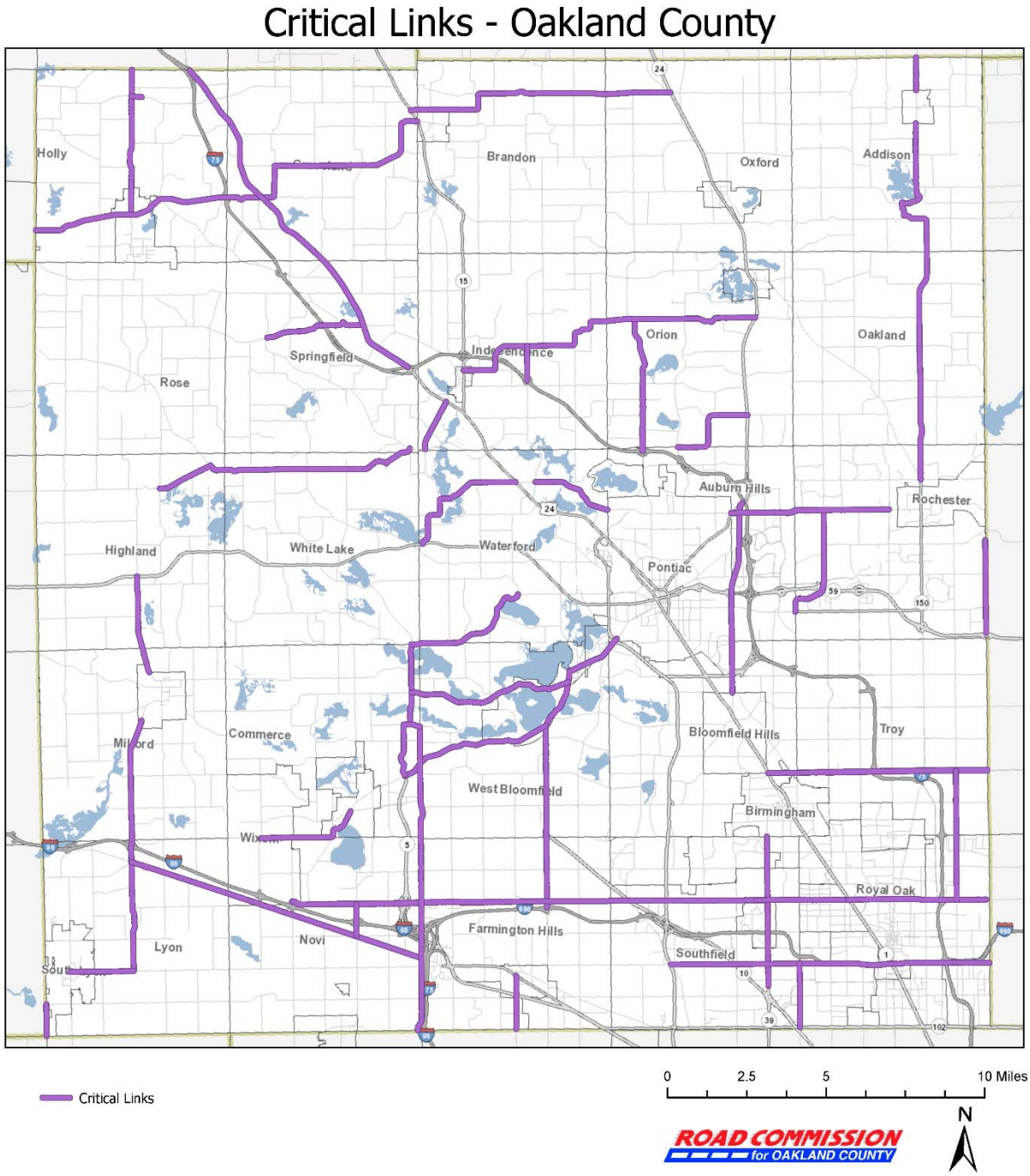


Figure 42: Key transportation links in RCOC's road network.

Table 9: RCOC's Critical Links in the Road Network.

Road	Limit 1	Limit 2	Classification	Traffic
Southfield Road	MC Clung	14 Mile	Principal Arterial	30-55k
Orchard Lake Road	I696	City of Pontiac Limits	Principal Arterial	30-45k
Holly Road	Grange Hall	N County Limits	Minor Arterial	10k
Milford Road	10 Mile Road	General Motors	PA in Lyon, MA Milford	12-18k
Milford Road	Commerce Road	M-59	Minor Arterial	14-15k
Pontiac Trail	M-5	Orchard Lake Road	Principal Arterial	20-27k
Pontiac Trail	Wixom Road	Maple Road	Principal Arterial	10-15k
Pontiac Trail	8 Mile	9 Mile	Minor Arterial	10-15k
Williams Lake Road	M-59	Dixie Highway	Principal Arterial	11-22k
Walton Boulevard	Sashabaw	Pontiac City Limits	Principal Arterial	18-25k
Grange Hall Road	West County Line	M-15	Minor Arterial	3-16k
Oakwood Road	M-15	M-24	Minor Arterial	6k
Baldwin Road	I-75	Clarkston Road	Minor Arterial	13-21k
Adams Road	Auburn Road	Walton Boulevard	Principal Arterial	10-22k
Big Beaver Road	Woodward Avenue	E County Limit	Principal Arterial	14-34k
12 Mile Road	Beck Road	Woodward Avenue	Principal Arterial	6-32k
12 Mile Road	Royal Oak Limits	Dequindre	Principal Arterial	17-29k
Rochester Road	City of Rochester Limits	N County Limits	Minor Arterial	4-34k
Grand River Avenue	City of Farmington Limit	Milford Road	Minor Arterial	10-20k
Clarkston Road	Village of Clarkston Limits	M-15	Minor Arterial	5-9k
White Lake Road	Milford Road	Andersonville Road	Minor Arterial	3-11k
White Lake Road	Andersonville Road	Dixie Highway	Principal Arterial	20k
Opdyke Road	Hickory Grove	Lapeer Road	Minor Arterial	5-27k
10 Mile Road	S Lafayette Street	Milford Road	Minor Arterial	9-14k
Haggerty Road	8 Mile Road	Richardson Road	Principal Arterial	16-26k
Union Lake Road	Richardson Road	Cooley Lake Road	Principal Arterial	30-34k
Walton Boulevard	City of Pontiac	Livernois Avenue	Principal Arterial	9-35k
Cooley Lake Road	Union Lake Road	Elizabeth Lake Road	Principal Arterial	15-30k
Commerce Road	Union Lake Road	Orchard Lake Road	Principal Arterial	12-19k
Belford Rd	Holly Road	Newark Rd/Cemetary	Major Collector	300
Dixie Hwy	County Limits	I-75	Minor Arterial	6-21k
Davisburg Road	Eaton Road	Dixie Highway	Major Collector	6k
Sashabaw Road	Clarkston Road	I-75	Minor Arterial	20k
Dequindre Road	E Avon Road	M-59	Principal Arterial	10-18k
John R Road	E Big Beaver Road	12 Mile Road	Minor Arterial	18-32k
Martin Rd / Richardson Rd	N Pontiac Trail	Haggerty Road	MA / PA	12-18k
Novi Road	W 12 Mile Road	Grand River Avenue	Principal Arterial	26-37k
Greenfield Road	W 10 Mile Road	8 Mile Road	Principal Arterial	17-31k
Farmington Road	Grand River Avenue	8 Mile Road	Minor Arterial	15-21k
Brown Rd/Giddings Rd/Silverb	Joslyn Road	M-24	Minor Arterial	7-18k

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

Planning Level Coordination

The planning and project selection process begins with RCOC's Strategic Planning meetings. Biennially, RCOC leadership meets with each of the 61 communities in Oakland County to discuss local developments and transportation priorities. These meetings also provide an opportunity for RCOC to share future projects and the status of current projects. Local municipalities as asset owners use these meetings as an opportunity to talk about any new developments in their communities, improvements to their infrastructure assets and how to coordinate future improvements. At the end of the Strategic Planning meetings, RCOC has a list of transportation priorities throughout the county and uses this as a list from which to select future projects.

The Highway Maintenance Department annually conducts coordination meetings within each district and involves the communities in those districts. This is a forum for communities in their district to express any concerns they might have regarding maintenance activities on their roadways.

Staff throughout the agency are involved in regional and local utility coordination meetings. Higher level meetings provide context and early knowledge of future projects planned by other agencies and asset owners. Some of these meetings include:

- Southeast Michigan Council of Governments (SEMCOG): Transportation Coordinating Council and Executive Committee
- American Public Works Association (APWA)
- Michigan Infrastructure & Transportation Association (MITA)
- Institute of Transportation Engineers (ITE)
- Great Lakes Water Authority (GLWA) Stake holder Advisory Committee
- Oakland County Federal Aid Committee (FAC)
- Consumers Energy Annual Coordination Meetings

RCOC has a specific staff position called 'Utilities Coordinator' at the agency. The responsibility of this position is to coordinate with any agency or company that may have infrastructure assets within the right-of-way. The utility coordinator initiates communications and provides insight on projects to gas, electric, telecommunications, fiber optics, transit, cable and other infrastructure asset owners. Annually, this

person will attend coordination meetings held by these companies and will also distribute and share future project lists and information

Project Level Coordination

After projects are identified, the Design Engineering team begins the process of survey and drafting plans. A large part of this process includes identifying obstacles or utilities that may be disrupted in the process of construction. Before plans are finalized, coordination meetings with the required asset owners are scheduled. Coordination can also include on-site visits, Grade Inspection meetings and pre-construction meetings.

Other departments such as Traffic Safety and the Traffic Operations Center coordinate with utility companies on signal projects and sign placements. Environmental Concerns Division also works with the Design Engineering team to coordinate stormwater and storm sewer system upgrades, interruptions and connections. Storm sewer assets such as culverts included in stream crossings or work located in wetlands/floodplains are coordinated through the Michigan Department of Environment, Great Lakes and Energy (EGLE)/United States Army Corps of Engineers (USACE) Joint Permit Application.

On the job coordination is the responsibility of all construction staff as well as the Utility Coordinator. Many decisions must be made quickly onsite and staff have created relationships with the utility companies such that decisions and/or mitigation can be made quickly.

Some Companies and Agencies that RCOC commonly coordinate with include:

- AT&T
- Consumers Energy
- DTE
- Comcast and WOW Cable
- ITC
- MISS DIG
- Buckeye
- Great Lakes Water Authority
- Water Resources Commission
- Fiber Optic Companies
- Cities, Villages, Townships in Oakland County
- Neighboring County, Regional, State and Federal Agencies

Maintenance Level Coordination

RCOC performs routine maintenance on MDOT's infrastructure through-out the county which may include signal operations, clearing drainage structures, pothole patching and winter snow and ice removal. Other interagency agreements may include RCOC maintenance or signal operations and management.

Public Involvement

Coordinating with the public is a very important part of any road agency's process. It is imperative that the residents and visitors of Oakland County are kept informed on projects in their community. RCOC's public information office manages the day to day communication with stakeholders and the public by distributing press releases and speaking with media sources. The Public Information Office also updates and manages the website and all social media platforms and content.

RCOC also has a Department of Customer Services that fields calls and emails around the clock. Requests, inquiries or comments are received by a DCS representative and then recorded in a program called Cityworks, which then distributes requests to the correct department or division. Staff address each request and track the progress in the program. This system provides an organized method when responding to public inquiries as well as ensuring accountability.

Other efforts to inform the public and provide public involvement are project specific meetings, surveys, press releases, social media posts and attendance at community led meetings.

APPENDIX A: 2021-2023 PAVED COUNTY PRIMARY ROAD PLANNED PROJECTS

2021

Road	From	Community	RCOC Treatment	Funding	Miles	Total Estimate
12 Mile Road	Lahser Road to Evergreen Road	City of Southfield	4R	STPU	1	$5,900,000
Avon Road	at Dequindre Road	City of Rochester Hills	4R	STPU & HIP-Covid	0.1	$4,679,340
FY 2021 Troy Concrete	Various Locations	City of Troy	Concrete Slab Replacement	Cat C & Repurposed Earmarks	8	$8,678,148
Baldwin Road	At Indianwood Road	Orion Township	HFST	HSIP	0.2	$185,194
Clarkston Road	Thistle Valley to Pine Tree Street	Orion Township	Overlay	HSIP	0.48	$303,712
Pine Knob Road	Clarkston Road to N. of Glenview Street	Independence Township	Overlay	Township Millage	0.32	$106,711
Currie Road	at 8 Mile Road	Lyon Township	Roundabout	WCRC	0	$1,500,000
Sashabaw Road	at Oak Hill Road	Brandon/Independence Townships	Roundabout	RCOC/HSIP	0	$1,490,000
12 Mile Road	Farmington Road to Orchard Lake Road	City of Farmington Hills	RRR	STPU & HIP	1.02	$1,830,000
Adams Road	Long Lake Road to Square Lake Road	City of Troy	RRR	NHPP	1	$2,573,000
Clarkston Road	Clarkston village limits to east Independence Township limits	Independence Township	RRR	Township Millage	5.6	$3,410,407
Cranbrook Road	14 Mile Road to Maple Road	Bloomfield Township/ City of Birmingham	RRR	50/50	1	$1,400,000

Pontiac Trail	Haggerty Road to Green Lake Road	West Bloomfield Township	RRR	STPU & HIP-Covid	1.09	$2,600,000
White Lake Road	Andersonville Road to south Clarkston village imits	Independence Township	RRR	Township Millage	2	$1,218,500
				Totals	**21.81**	**$35,875,012**

2022

Road	From	Community	RCOC Treatment	Funding	Miles	Total Estimate
Orchard Lake Road	13 Mile Road to 14 Mile Road	Farmington Hills	4R widening	STPU & NHPP	1	$8,269,044
Cooley Lake Road	Fleet Street to Lake Vista Street	Waterford Township	HFST	HSIP	0.2	$125,000
Cooley Lake Road	south of Pinegrove Street to LaMothe Street	Waterford Township	HFST	HSIP	0.19	$120,000
Elizabeth Lake Road	north of Pinegrove Street to Hickory Street	Waterford Township	HFST	HSIP	1.55	$250,000
Grange Hall Road	at JoAnn Street	Holly Township	HFST	HSIP	1.77	$275,000
Hickory Ridge Road	north of Clyde Road	Highland Township	HFST	HSIP	1.3	$100,000
Groveland Road	Barron Road to M-15	Groveland Township	Overlay	STPR	2.8	$750,000
Rochester Road	Tienken Road to Lakeville Road	Oakland Township/City of Rochester Hills	Overlay	LFFE	9.3	$3,092,309
Elizabeth Lake Road	at Oxbow Lake Road	White Lake Township	Roundabout	RCOC	0	$900,000
Elizabeth Lake Road	at Teggerdine Road	White Lake Township	Roundabout	RCOC	0	$975,000

10 Mile Road	Meadowbrook Road to Haggerty Road	City of Novi	RRR	Local/ACC 2024STPU	1	$4,500,000
14 Mile Road	Barrington Street to Dequindre Road	City of Madison Heights/City of Troy	RRR	STPU & HIP-Covid	1.27	$4,903,000
Holcomb Road	west Independence Township limit to west Clarkston Village limit	Independence Township	RRR	Township Millage	1.5	$850,000
Maple Road	Coolidge Road to Rochester Road	City of Troy	RRR	50/50	2.76	$1,700,000
Maybee Road	Dixie Highway to east Independence Township limit	Independence Township	RRR	Township Millage	4.39	$2,750,000
Novi Road	at 10 Mile Road	City of Novi	RRR	LFFE	0	$650,000
Orchard Lake Road	Middlebelt Road to Old Telegraph Road	Various	RRR	STPU	0.8	$2,000,000
Novi Road	9 Mile Road to 10 Mile Road	City of Novi	RRR/Widening	STPU & HIP-Covid	1	$3,250,000
				Totals	**30.83**	**$35,459,353**

2023

Road	From	Community	RCOC Treatment	Funding	Miles	Total Estimate
Clarkston Road	at M-15	City of the Village of Clarkson	Intersection	RCOC	0	$440,000
Greenfield Road	at Normandy Road	City of Beverly Hills/City of Royal Oak	Intersection	RCOC	0	$750,000

Hadley Road	Oakwood Road to north Oakland County Line	Brandon Township	Overlay	STPR	1.03	$781,250
Rochester Road	Lakeville Road to Village of Leonard limit	Addison Township	Overlay	LFFE	2.98	$750,000
Hickory Grove Road	at Lahser Road	Bloomfield Township/City of Bloomfield Hills	Roundabout	RCOC	0	$350,000
Orion Road	at Stony Creek Road and Conklin Road	Orion Township	Roundabout	STPU	0	$1,634,888
Brown/Giddings/ Silverbell Roads	Jamm Street to M-24	City of Auburn Hills/Orion Township	RRR	STPU	2.6	$5,350,000
County Center (North)	Telegraph Road to eat of Hospital Street	Waterford Township	RRR	Oakland County	0.75	$500,000
Grand River Avenue	Napier Road to Wixom Road	City of Wixom	RRR	STPU	1	$3,500,000
Maple Road	Rochester Road to Dequindre Road	City of Troy	RRR	50/50	2.27	$1,400,000
Orchard Lake Road	Commerce Road to east of Middlebelt Road	Various	RRR	NHPP	1.41	$2,346,878
Walton Road	east of Sashabaw Road to Clintonville Road	Waterford Township	RRR	STPU	1.15	$3,300,000
				Totals	**13.19**	**$21,103,016**

APPENDIX B: 2021-2023 PAVED COUNTY LOCAL ROAD PLANNED PROJECTS

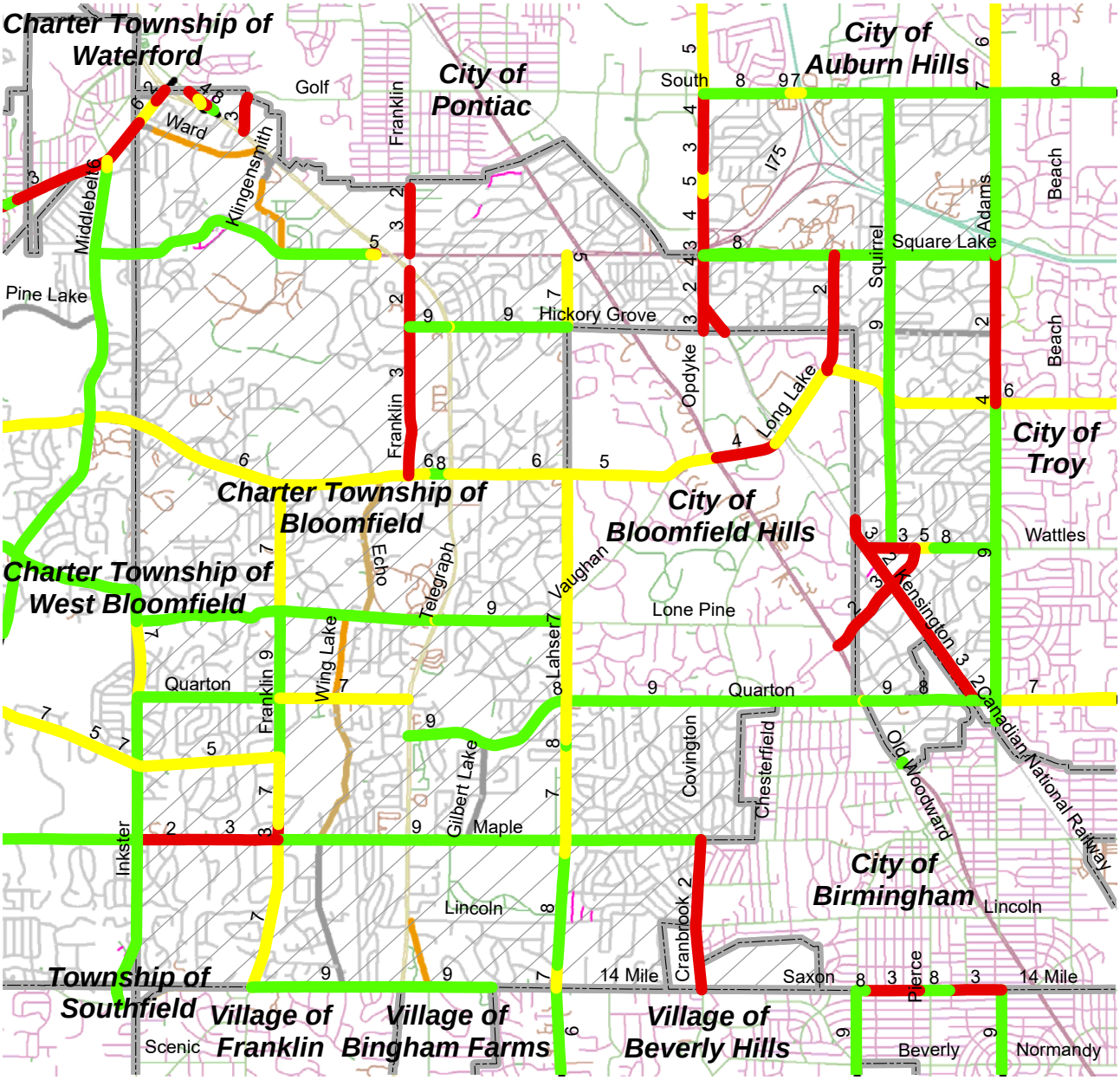
Year	Road	Limits	Community	RCOC Treatment	Funding	Miles	Total Estimate
2021	Eston Road	Clarkston Road to end of pavement	Independence Township	RRR	Township Millage	.53	$474,750
2021	Flemings Lake/Walters Road	Clarkston Road to Waldon Road	Independence Township	RRR	Township Millage	1	$873,749
2022	Mann Road	Floretta Street to Clintonville Road	Independence Township	Overlay	Township Millage	.25	$190,000
					Totals	**1.78**	**$1,538,499**

APPENDIX C: 2021-2023 UNPAVED ROAD PLANNED PROJECTS

Year	Road	From	Community	RCOC Treatment	Funding	Miles	Total Estimate
2021	Barron Road	Grange Hall Road to Groveland Road	Groveland Township	Pave Gravel	STPU & HIP	2	$5,500,000
2021	Currie Road	8 Mile Road to 9 Mile Road	Lyon Township	Pave Gravel	STPU & HIP	1	$3,800,000
2021	Currie Road	at 8 Mile Road	Lyon Township	Roundabout	WCRC		$1,500,000
2022	Waldon Road	at Clintonville Road	Independence Township	Pave Gravel/Intersection	STPU		$2,500,000
2023/24	Waldon Road	east of Clintonville Road to Baldwin Road	Independence Township/Orion Township	Pave Gravel	STPU	2.14	$6,400,000
					Totals	**5.14**	**$19,700,000**

APPENDIX D: PASER MAPS BY TOWNSHIP RANGE

2020 PAVEMENT CONDITION
RCOC PAVED PRIMARY AND LOCAL ROADS



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ROAD COMMISSION for OAKLAND COUNTY

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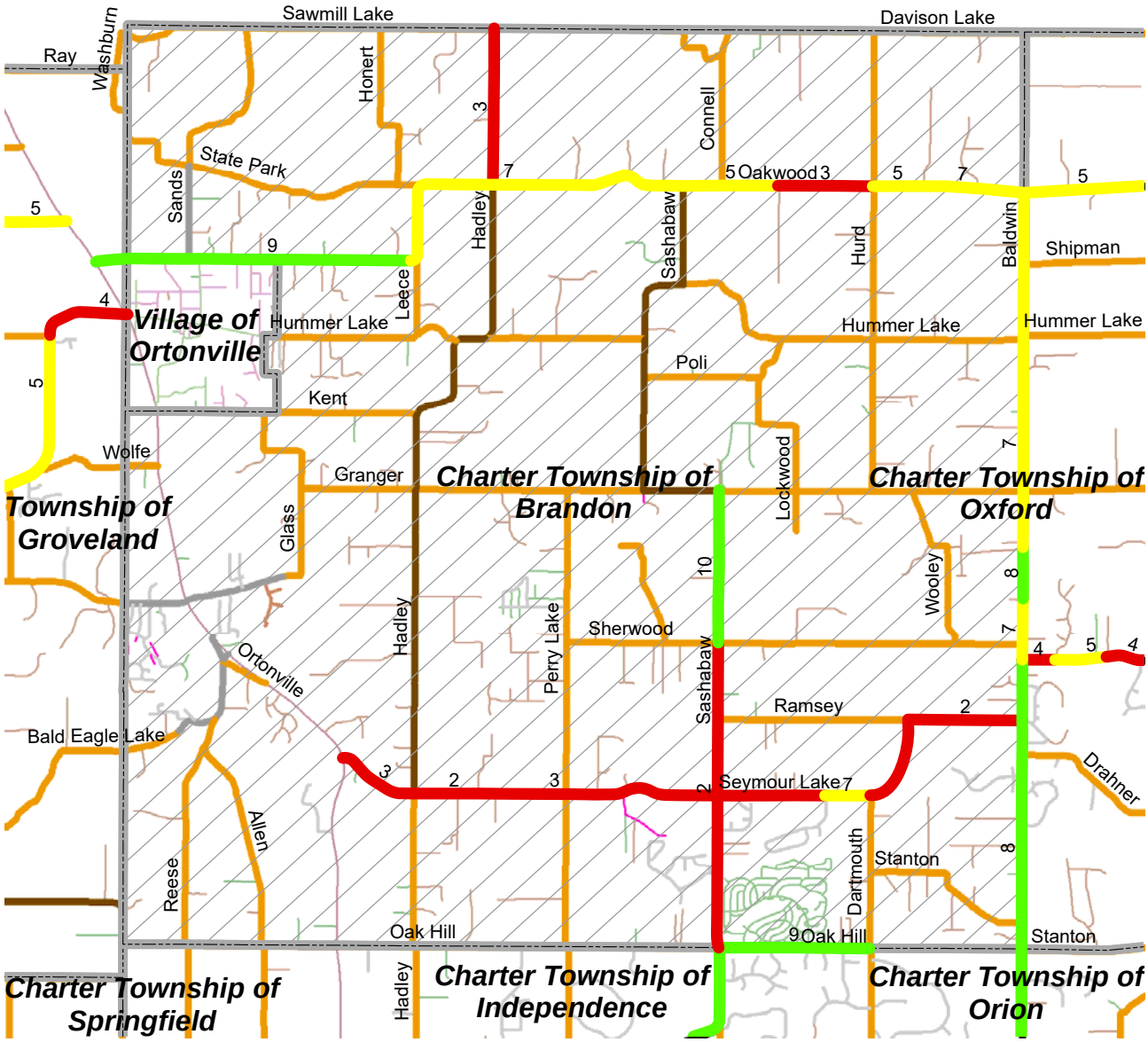

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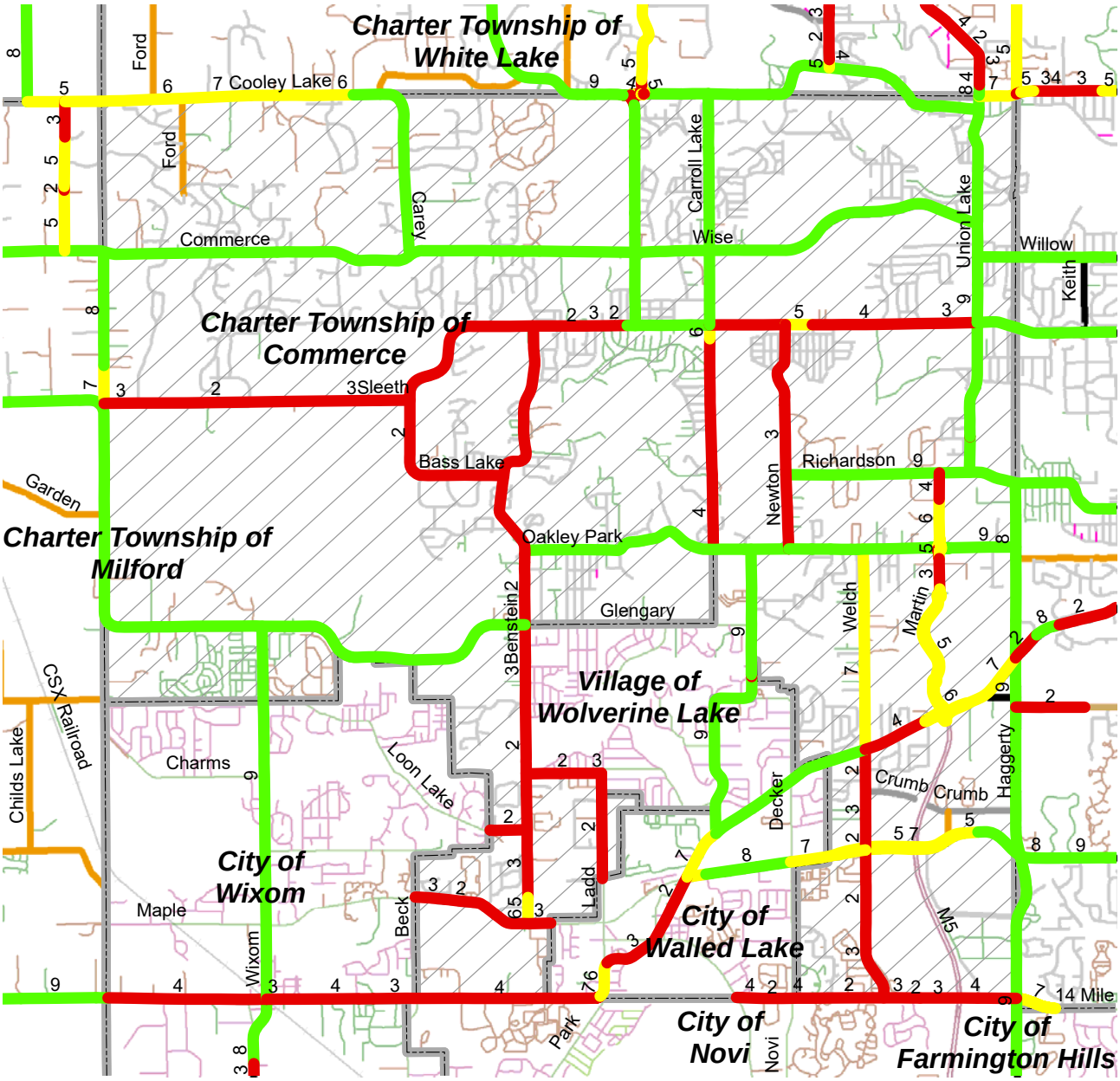

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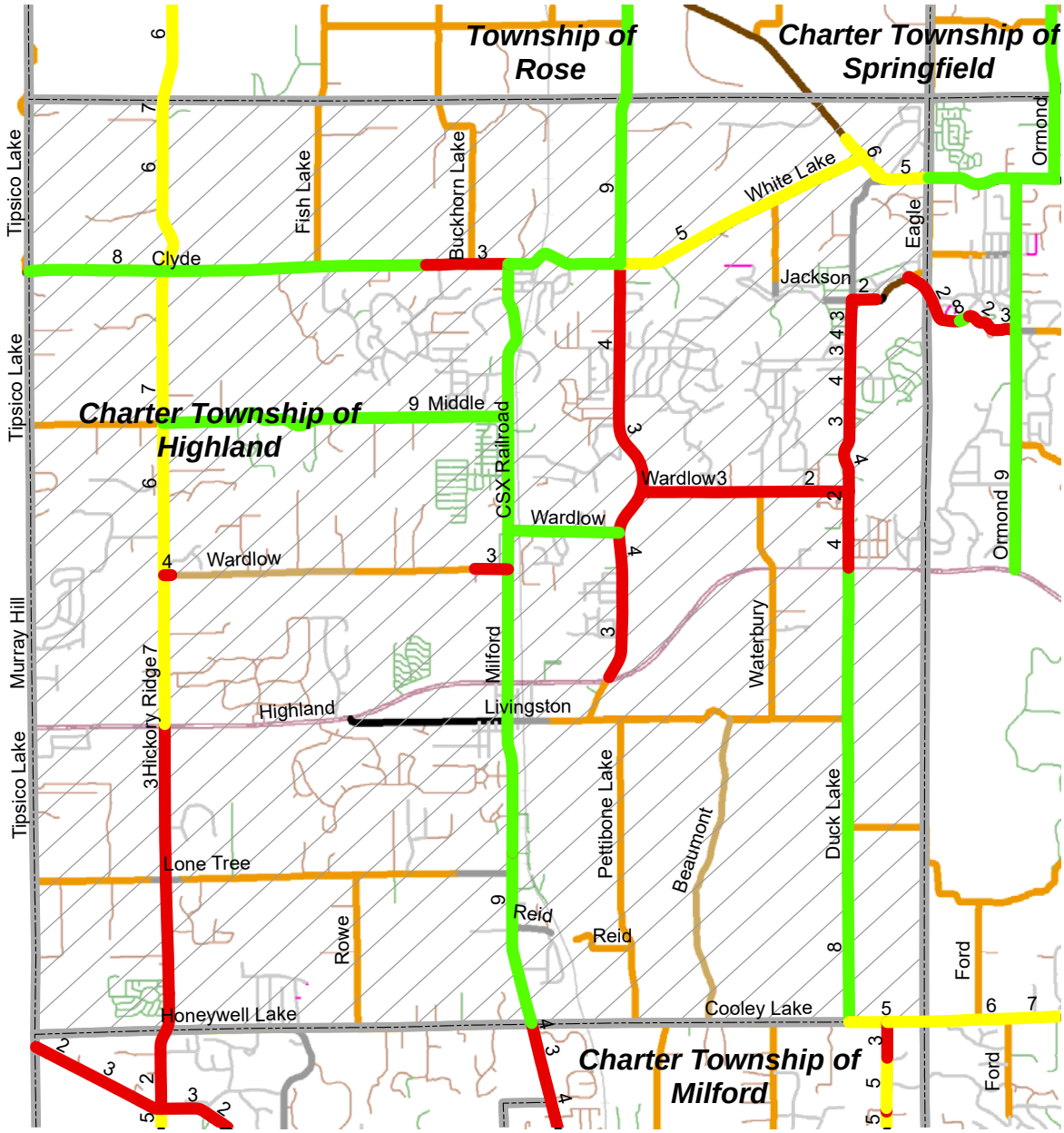

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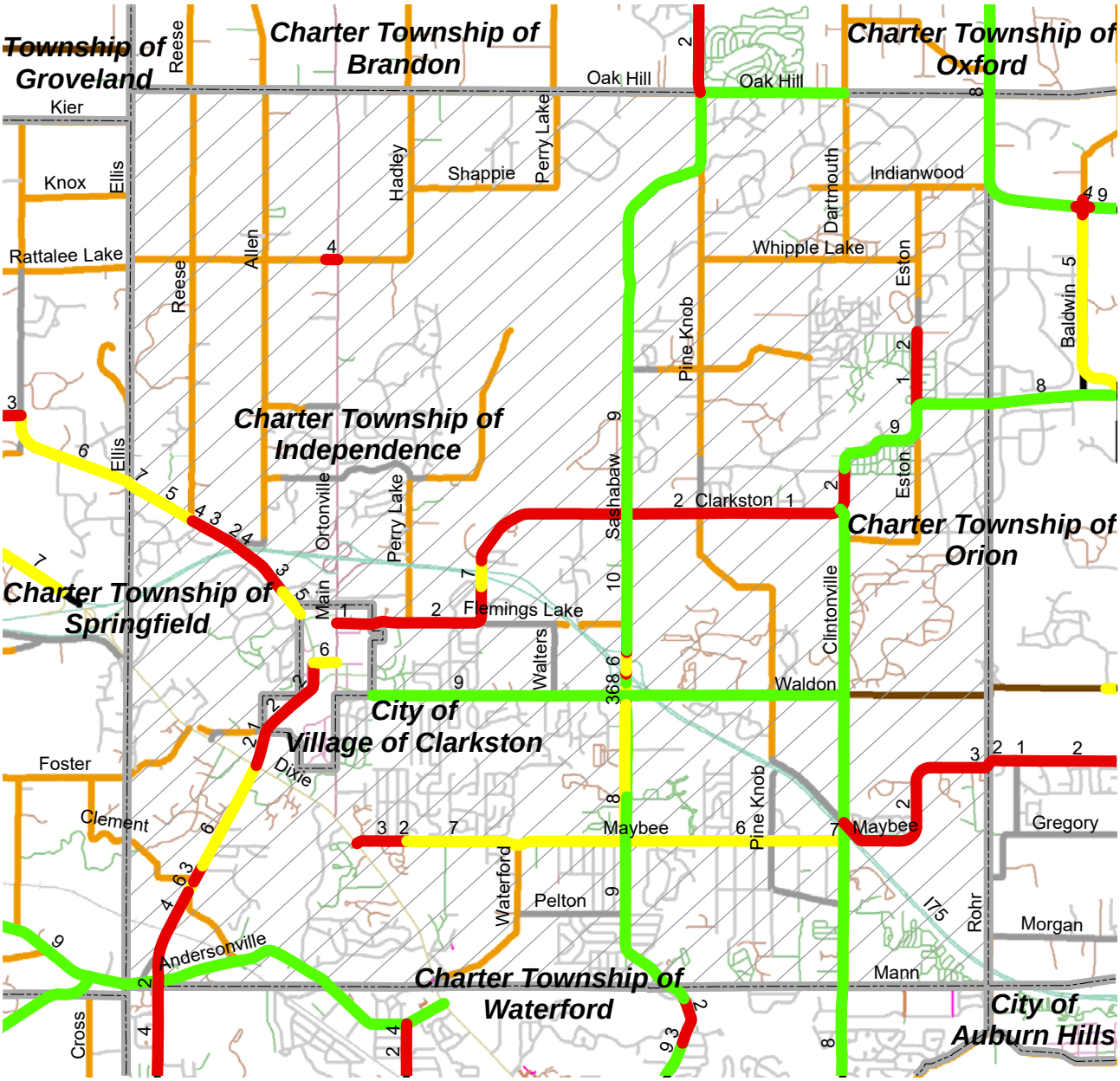

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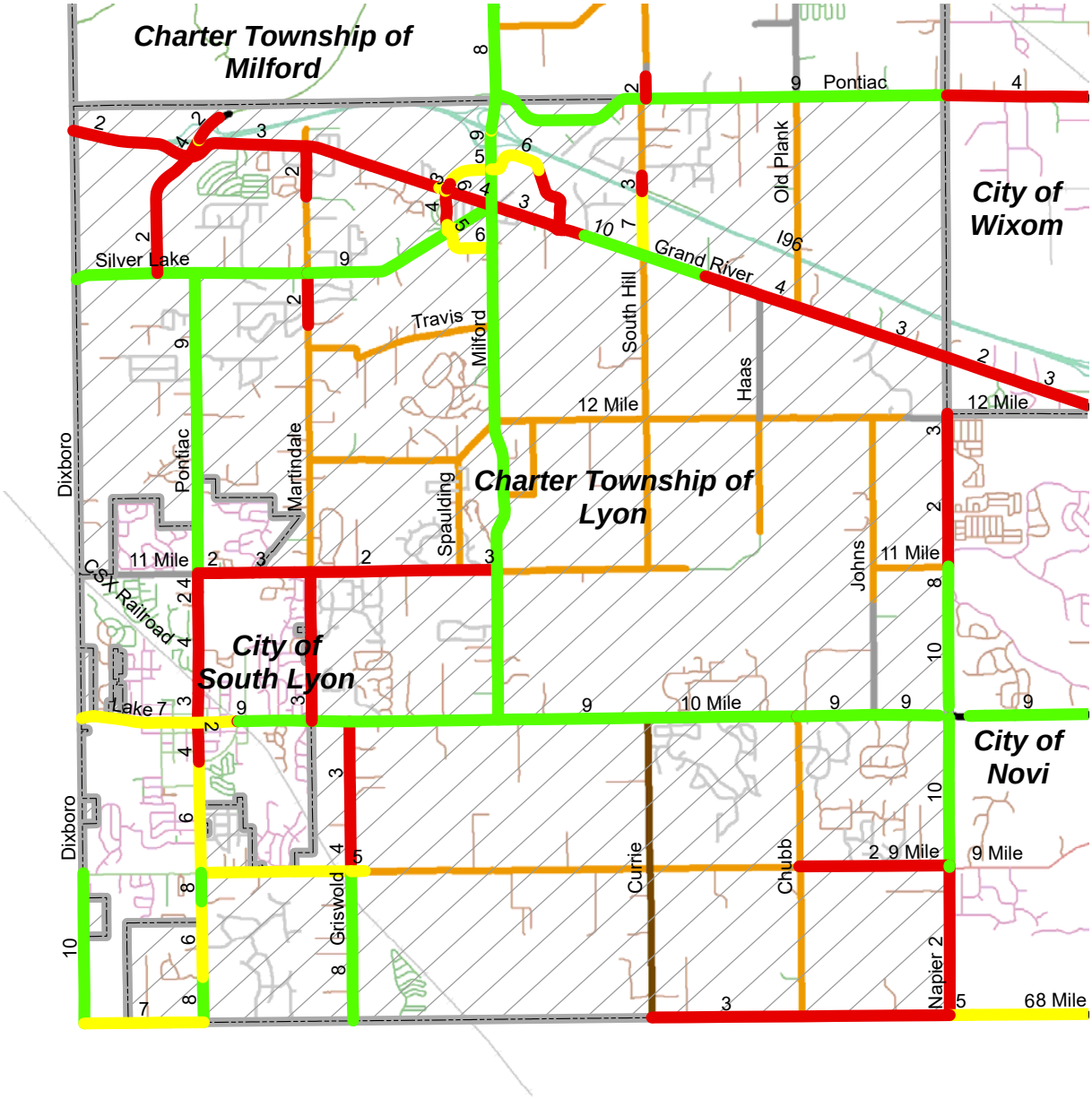

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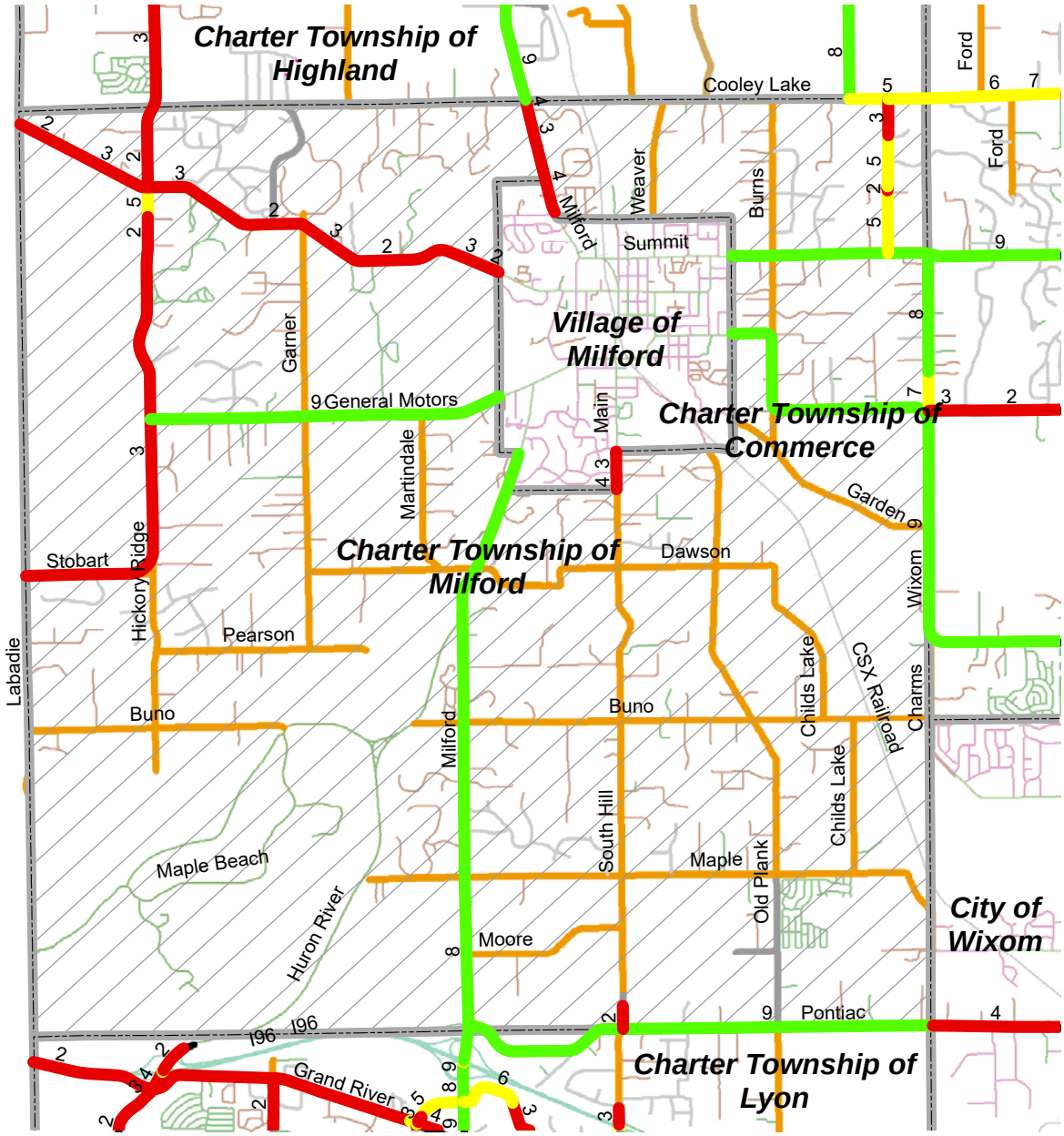

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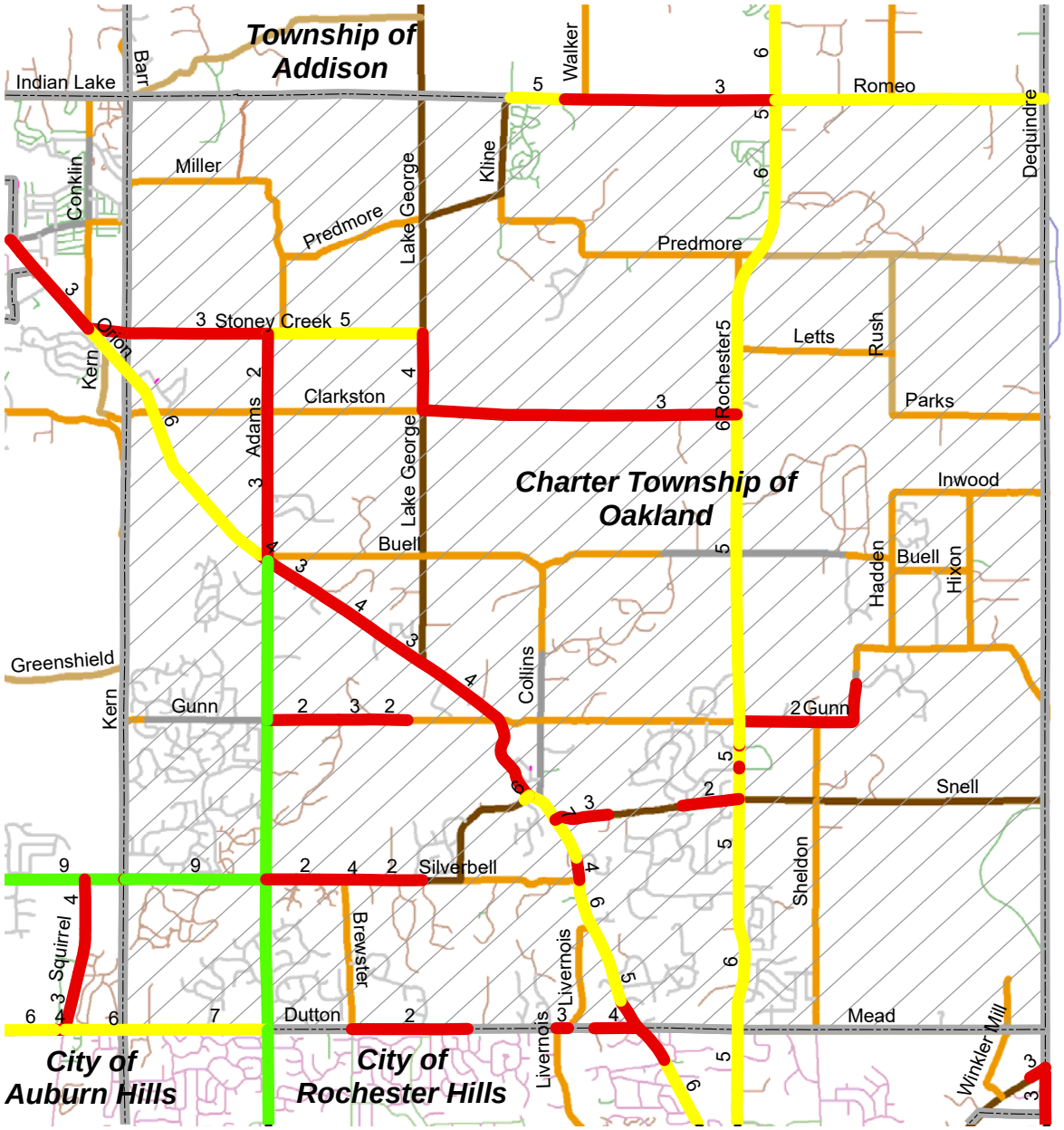

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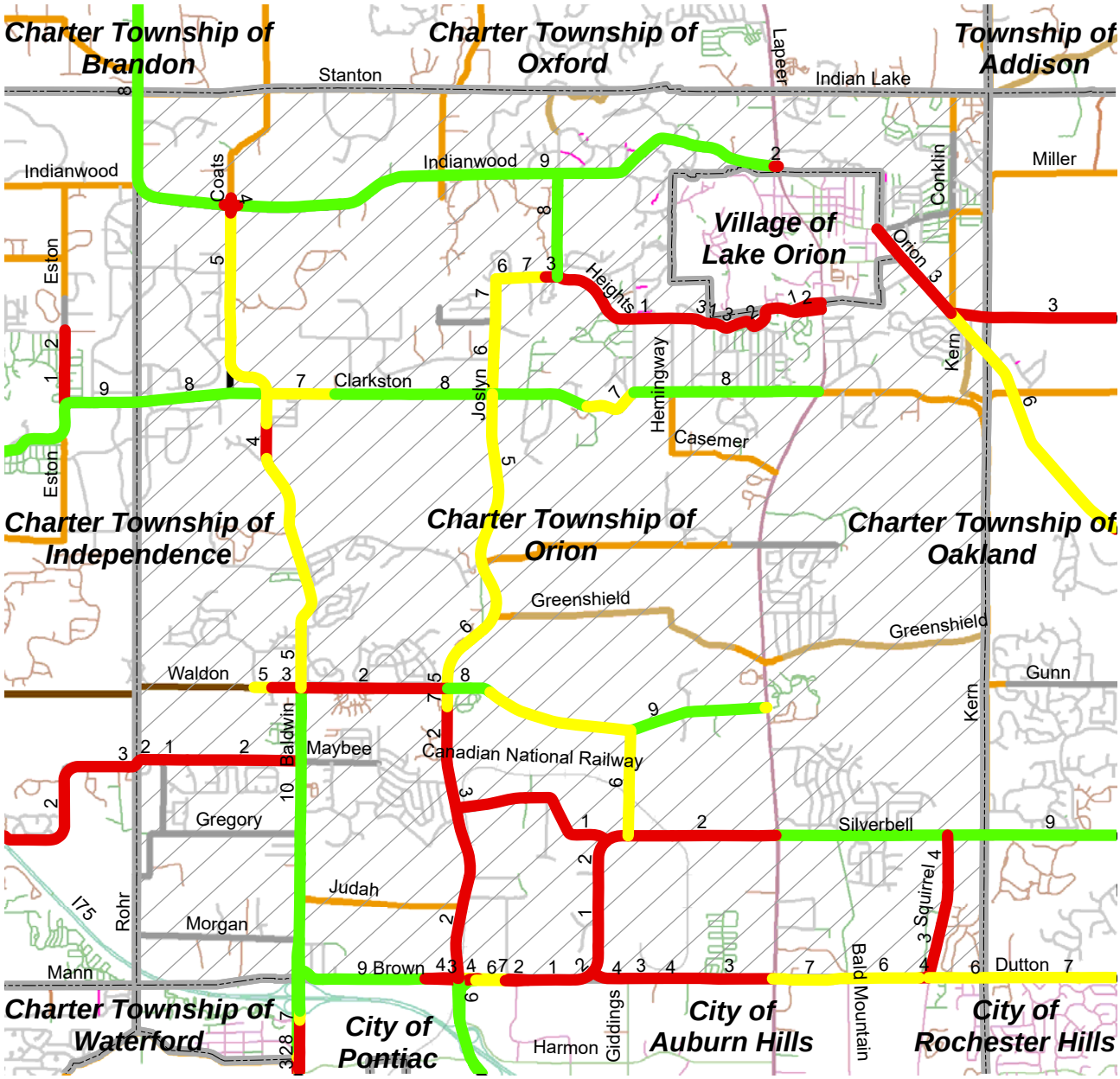

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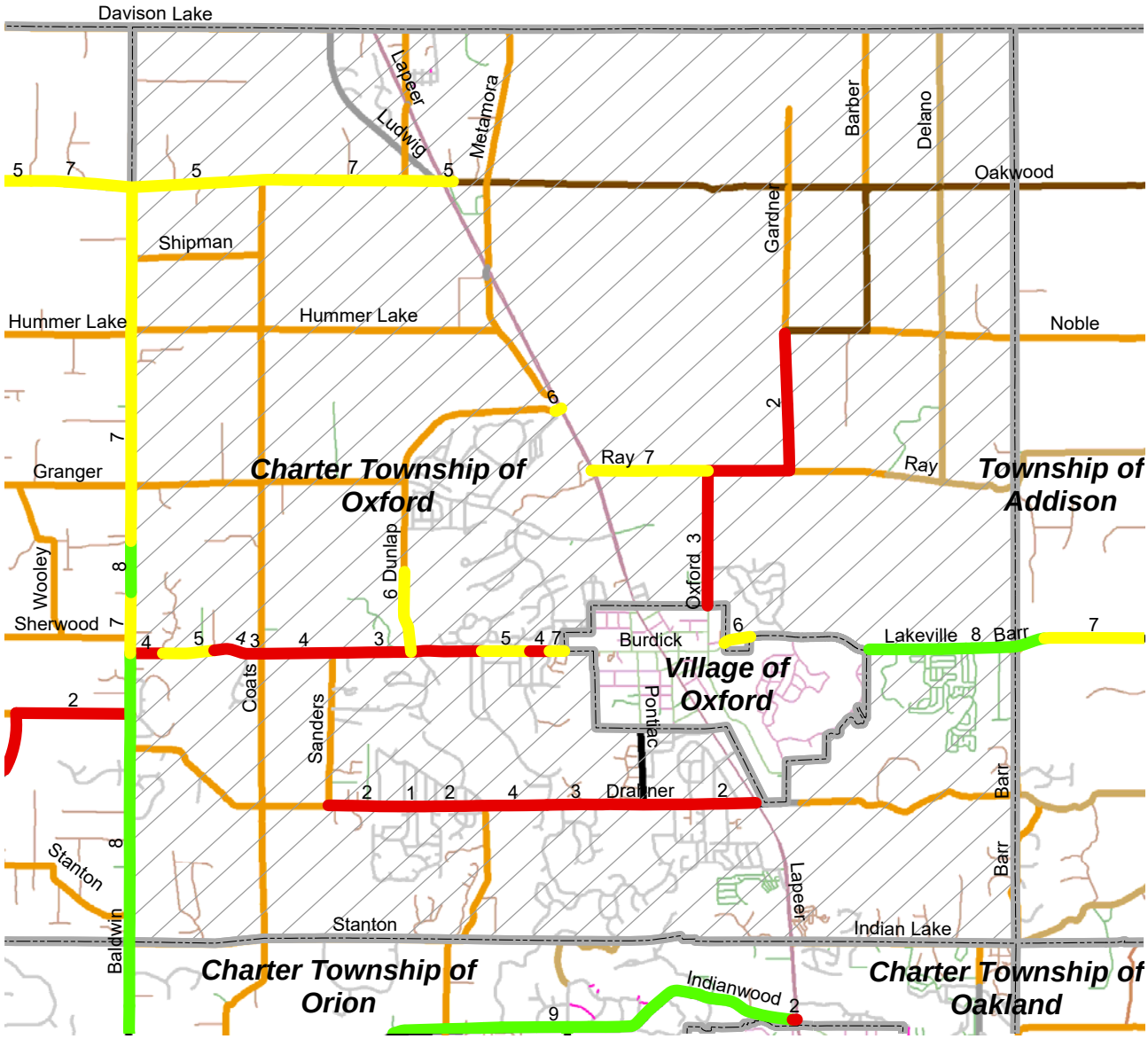

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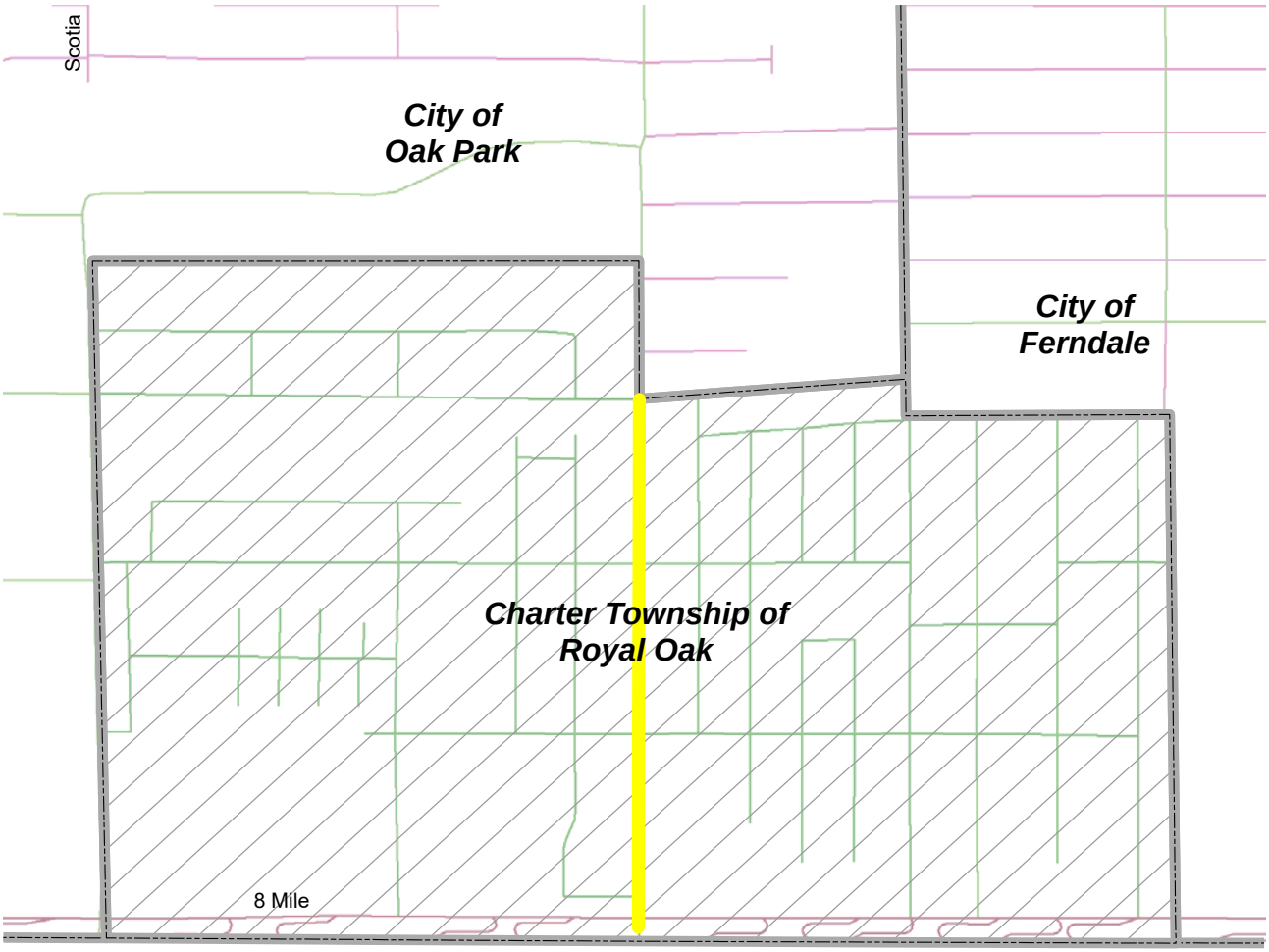

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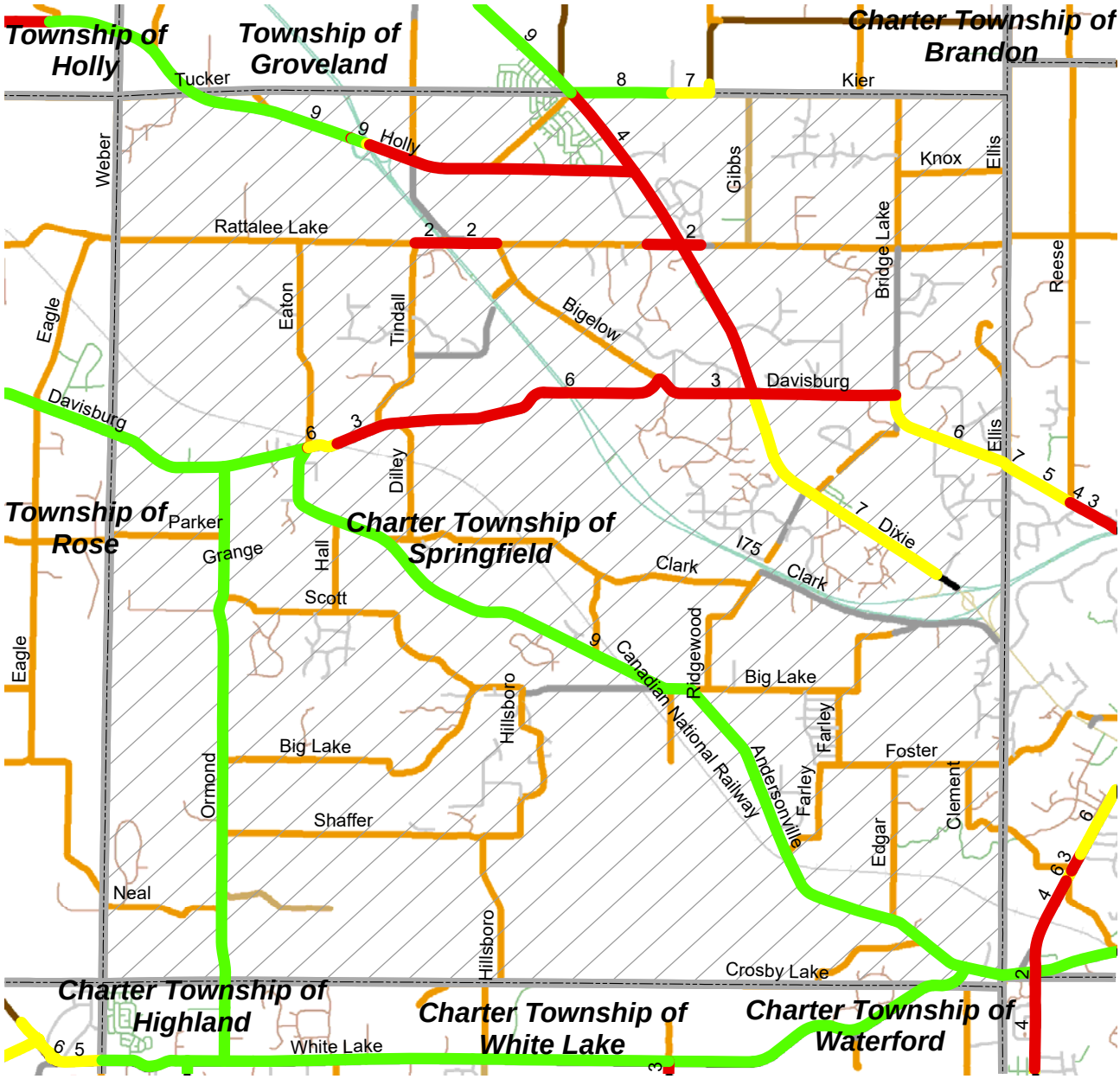

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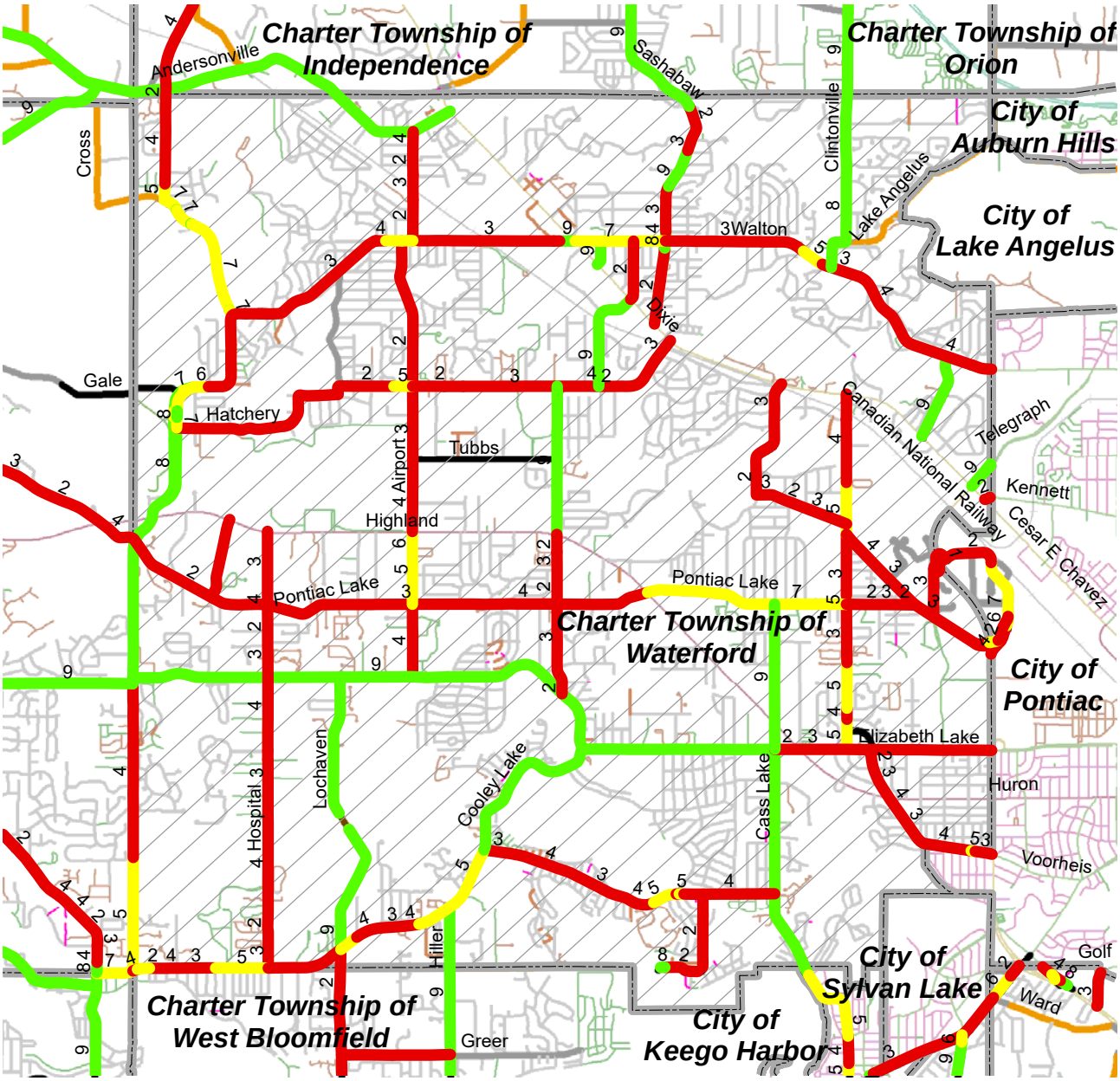

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ROAD COMMISSION for OAKLAND COUNTY

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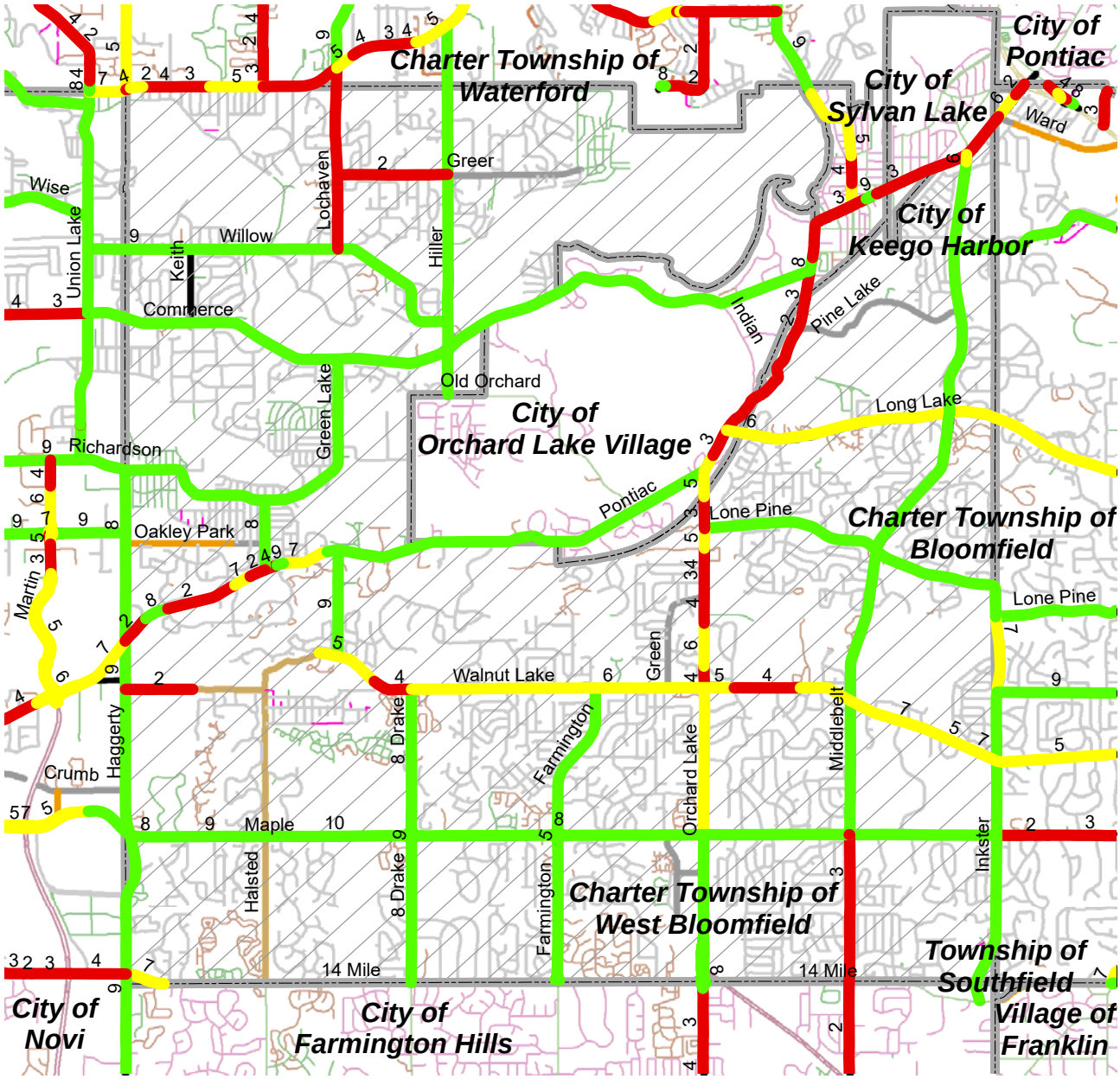

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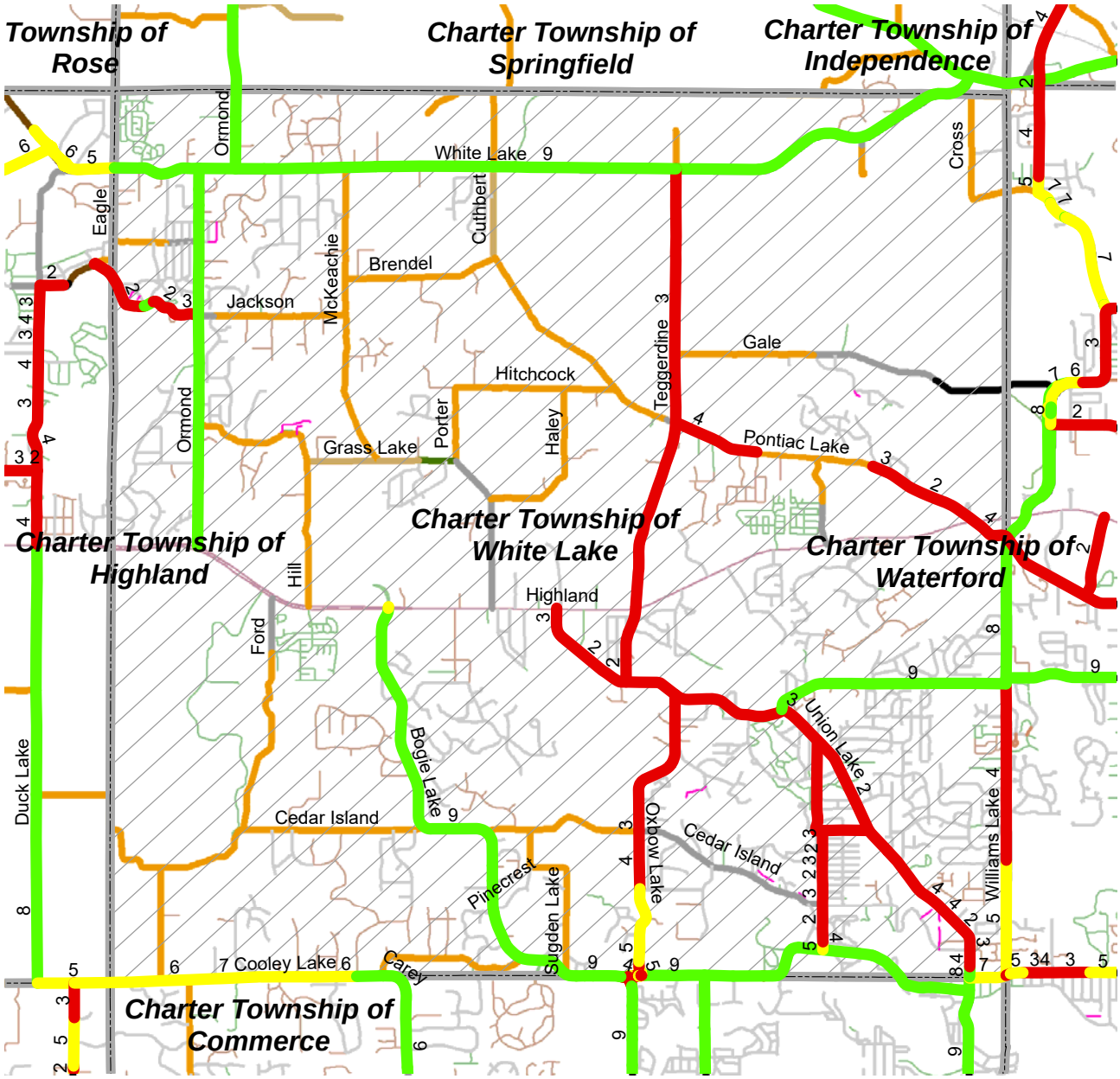
ROAD COMMISSION for OAKLAND COUNTY

2020 PAVEMENT CONDITION
RCOC PAVED PRIMARY AND LOCAL ROADS



Legend
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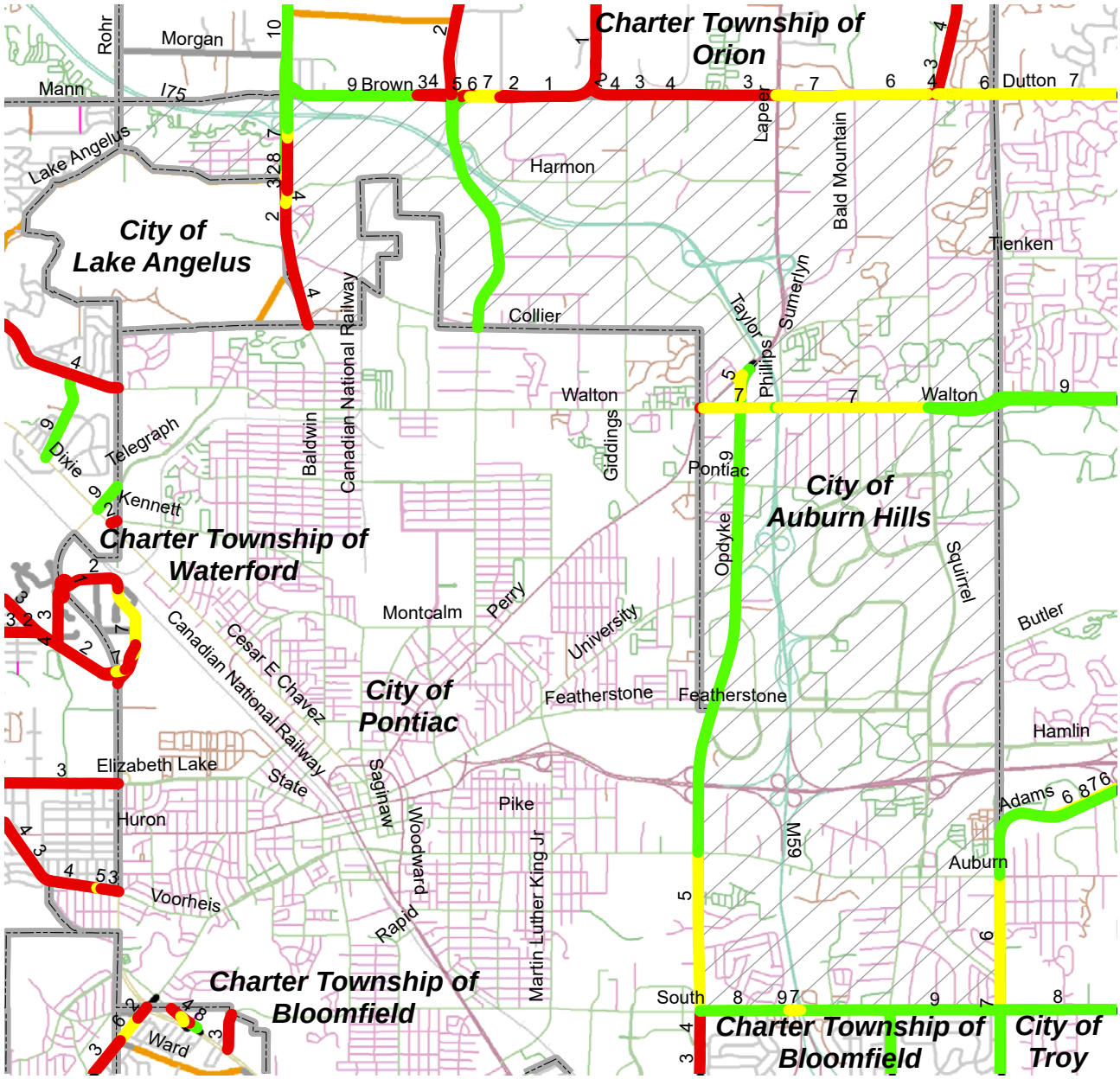

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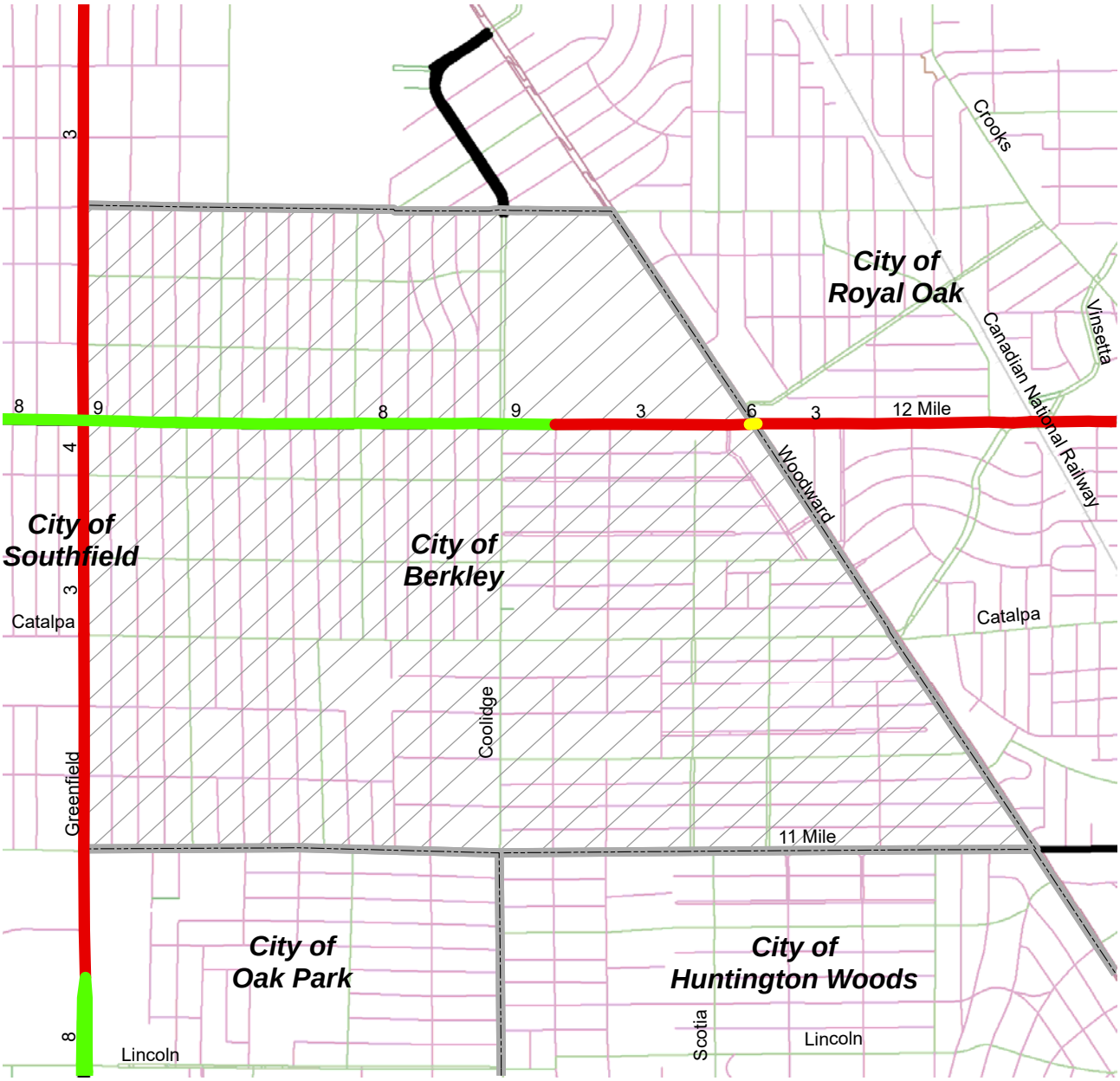

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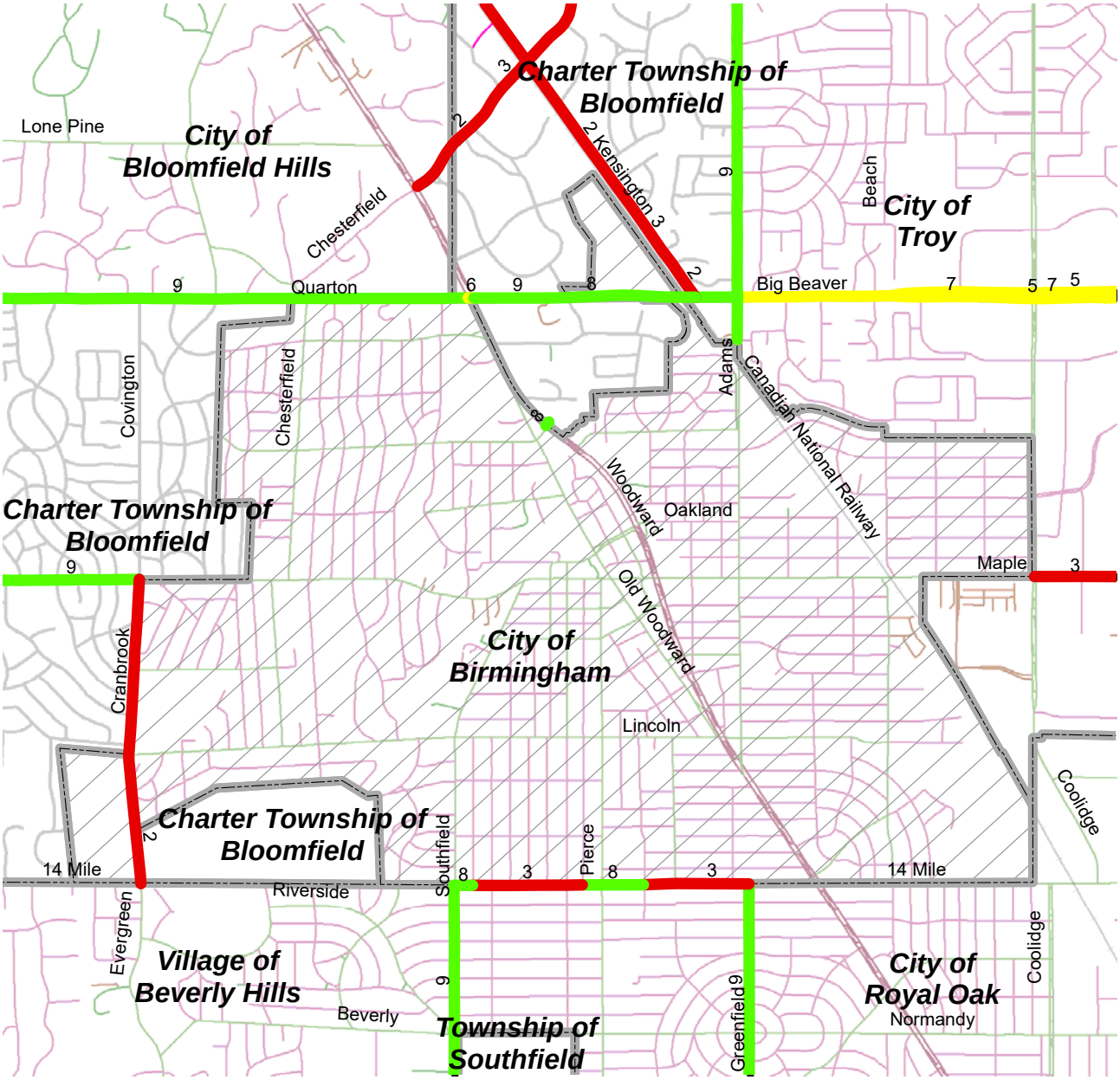

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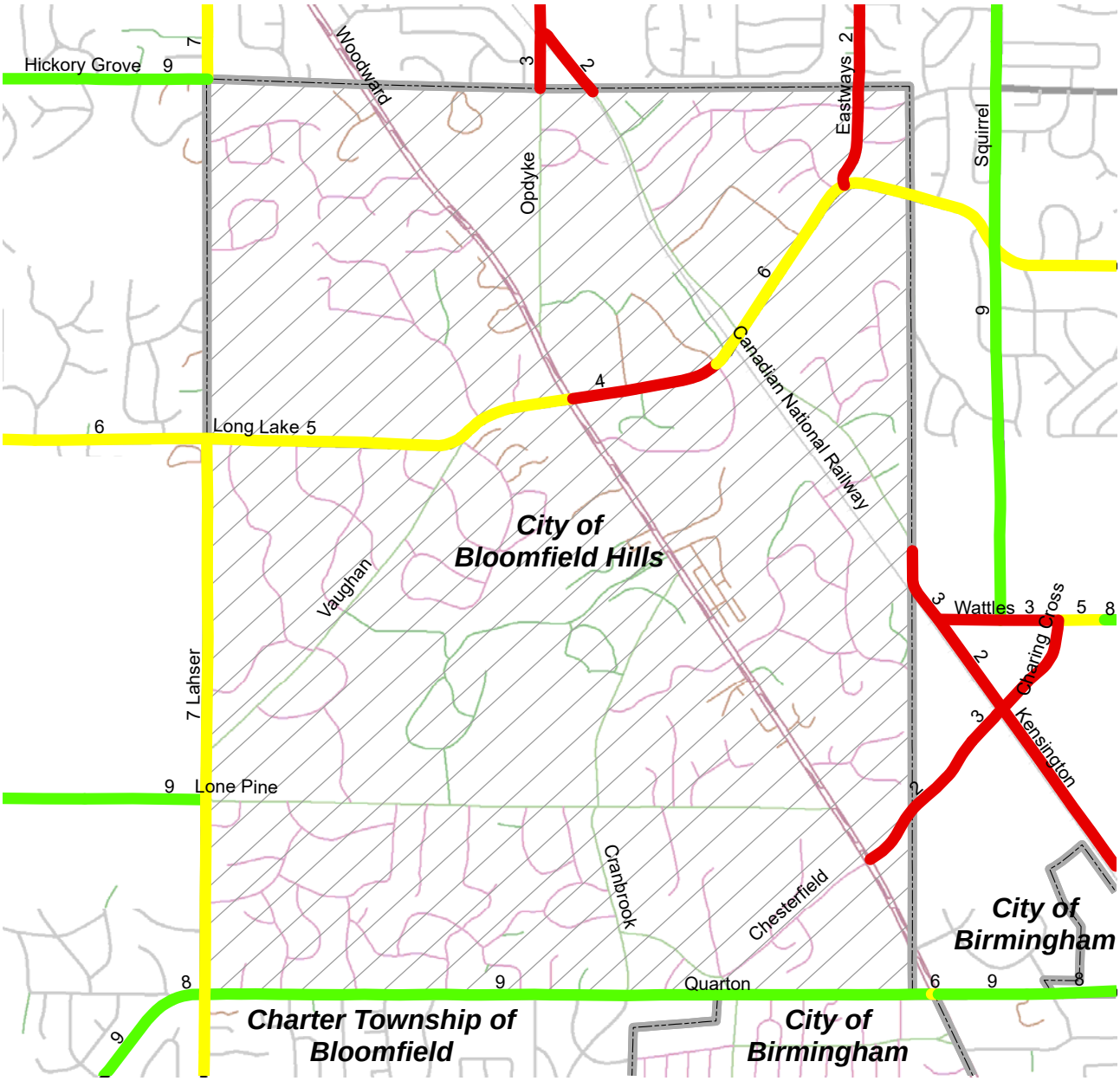

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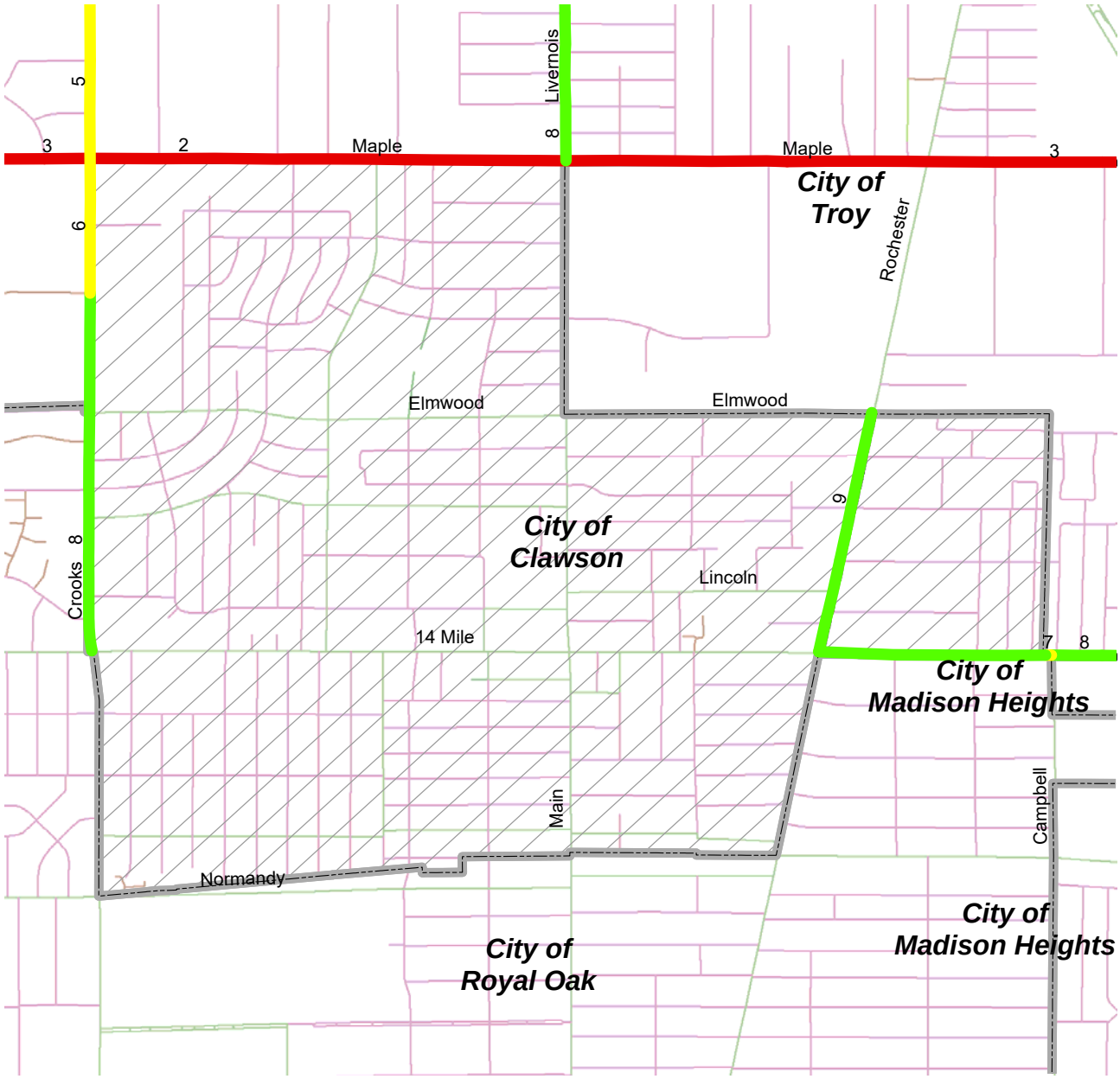

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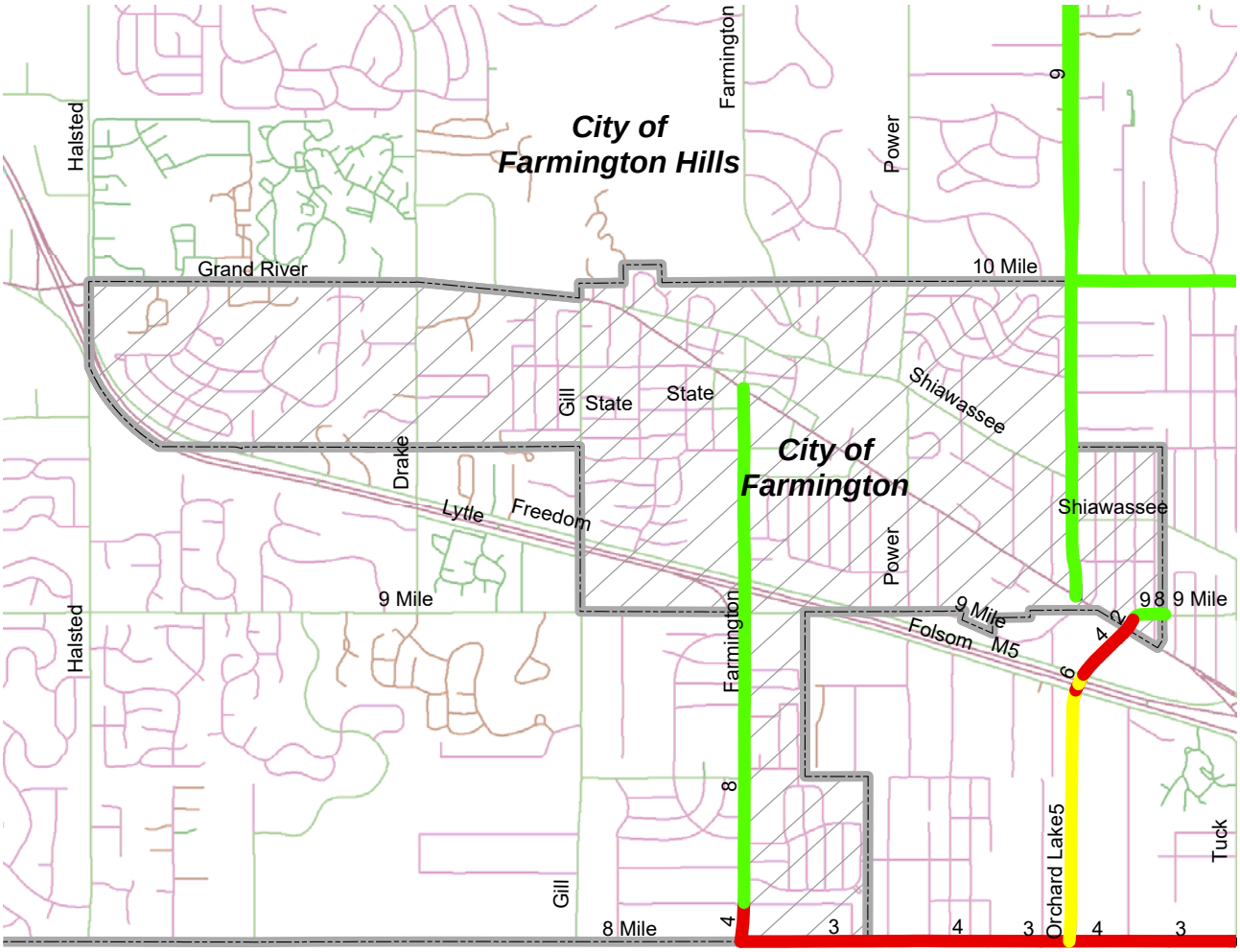

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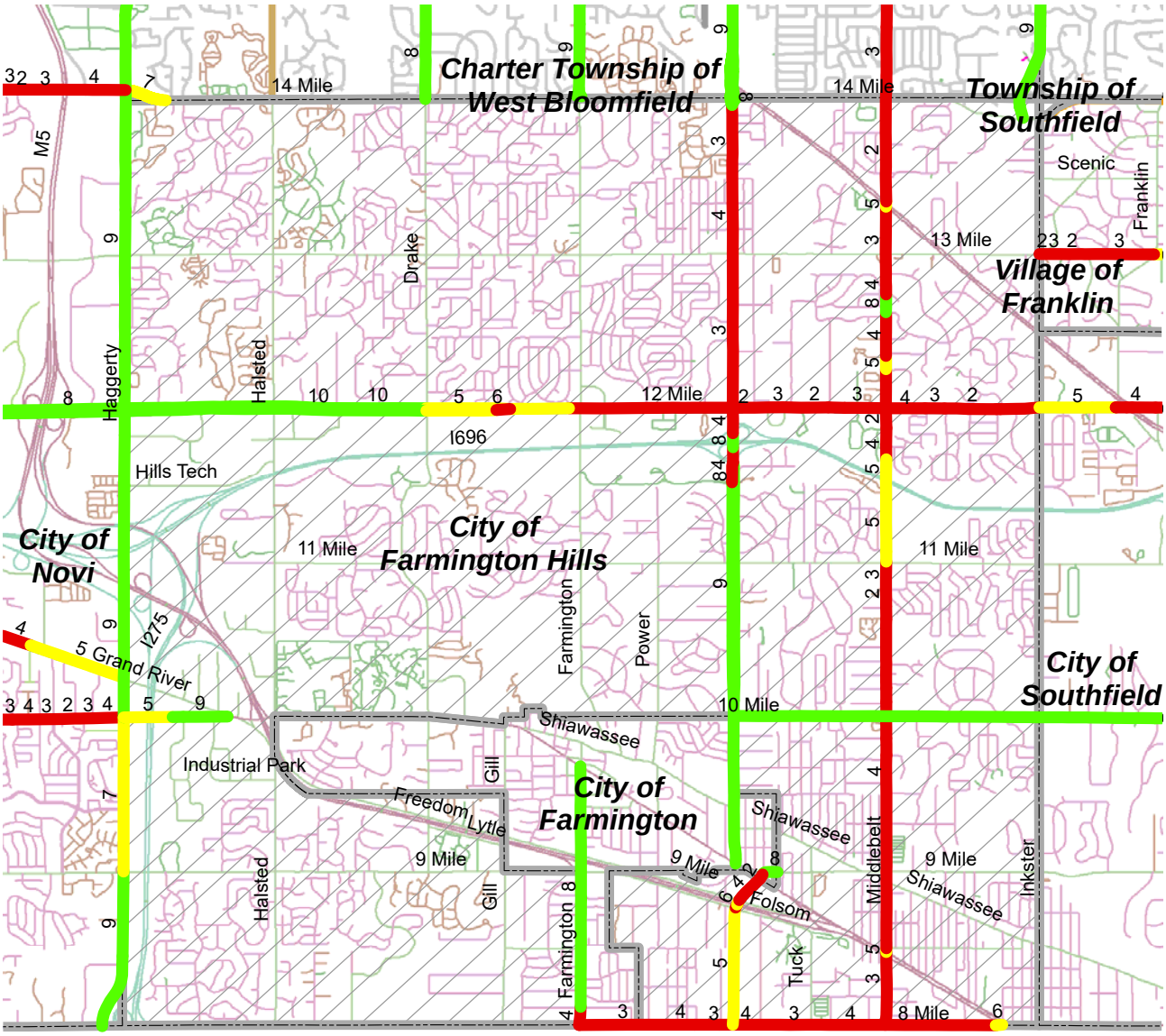

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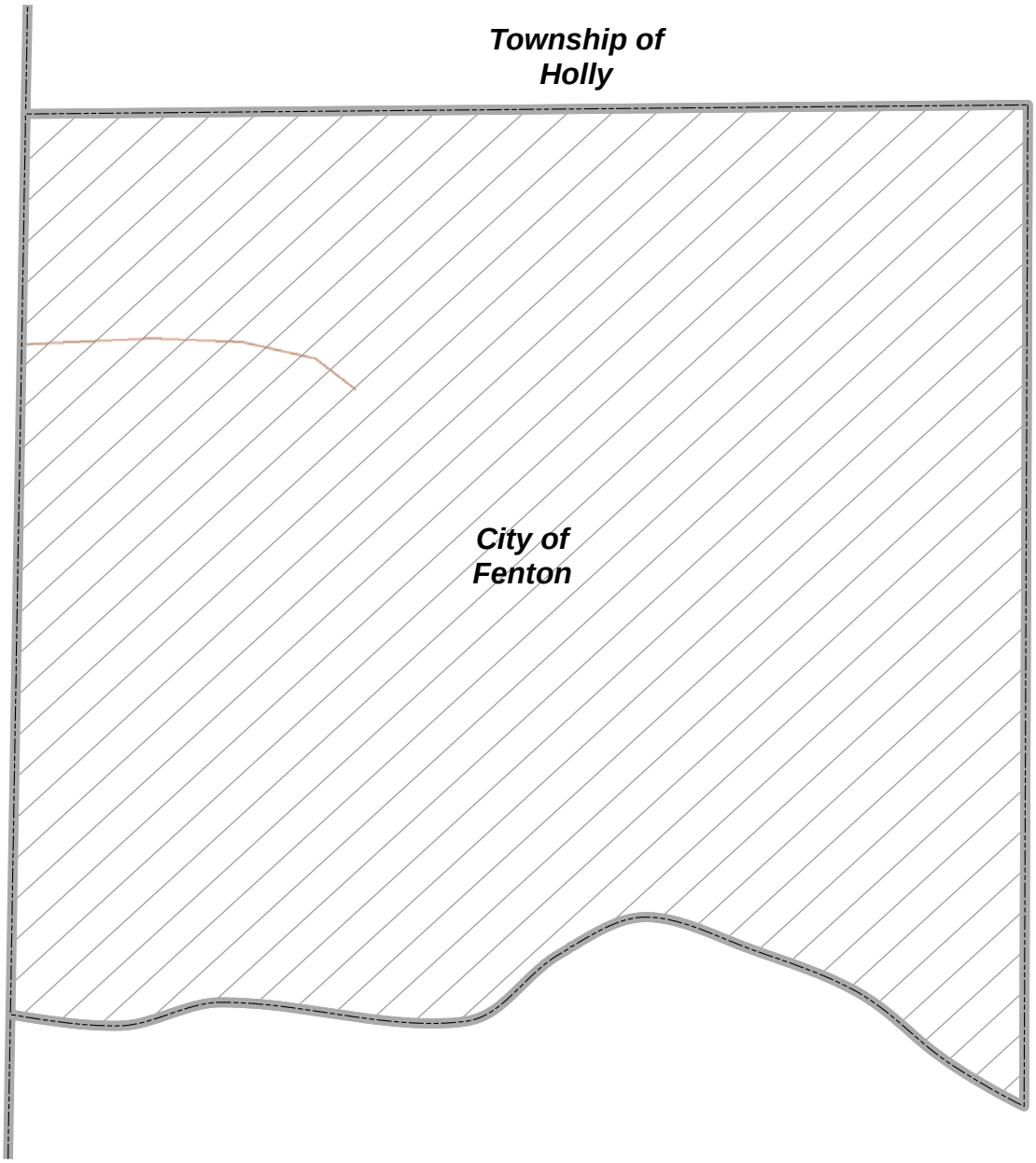

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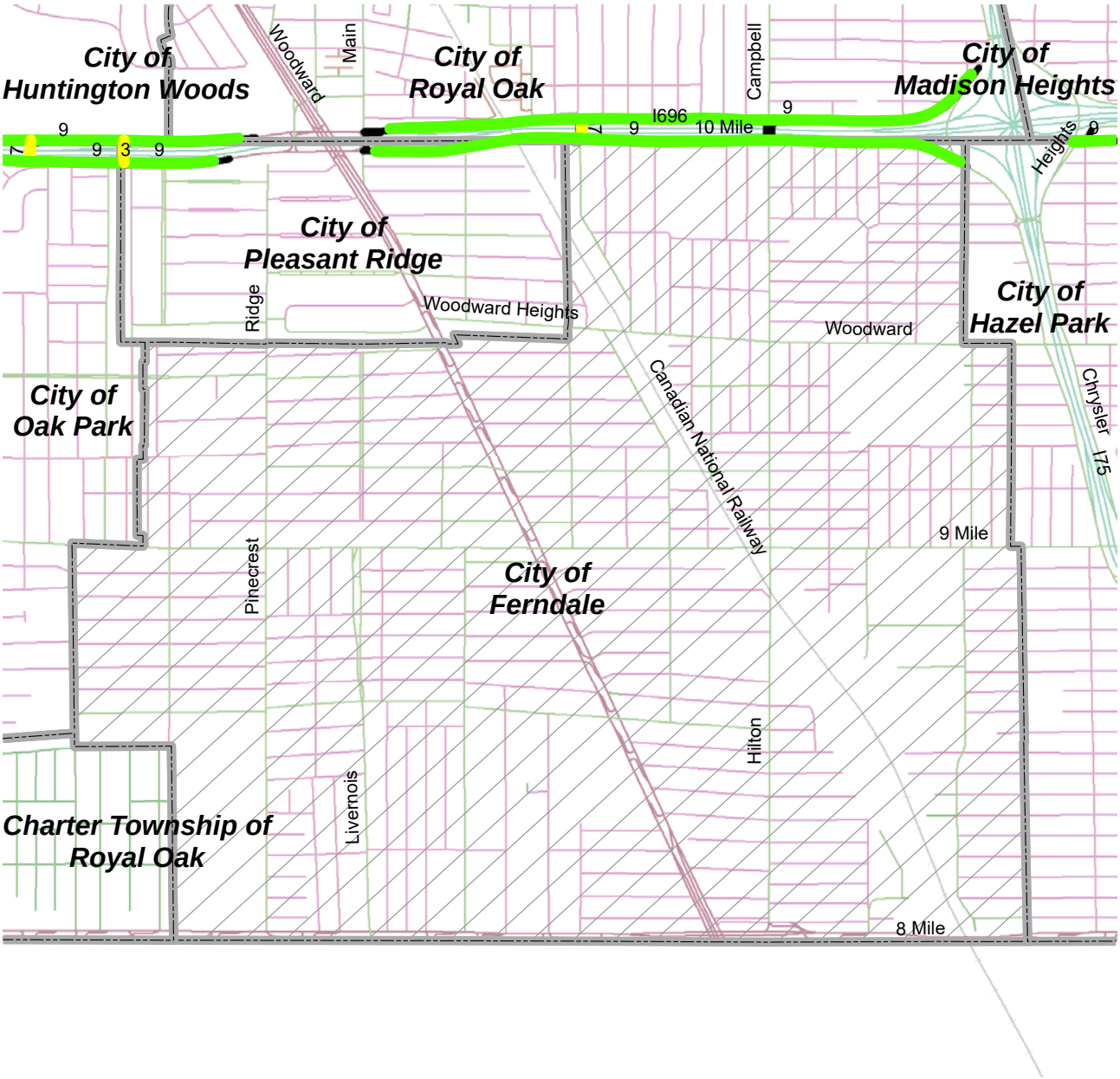

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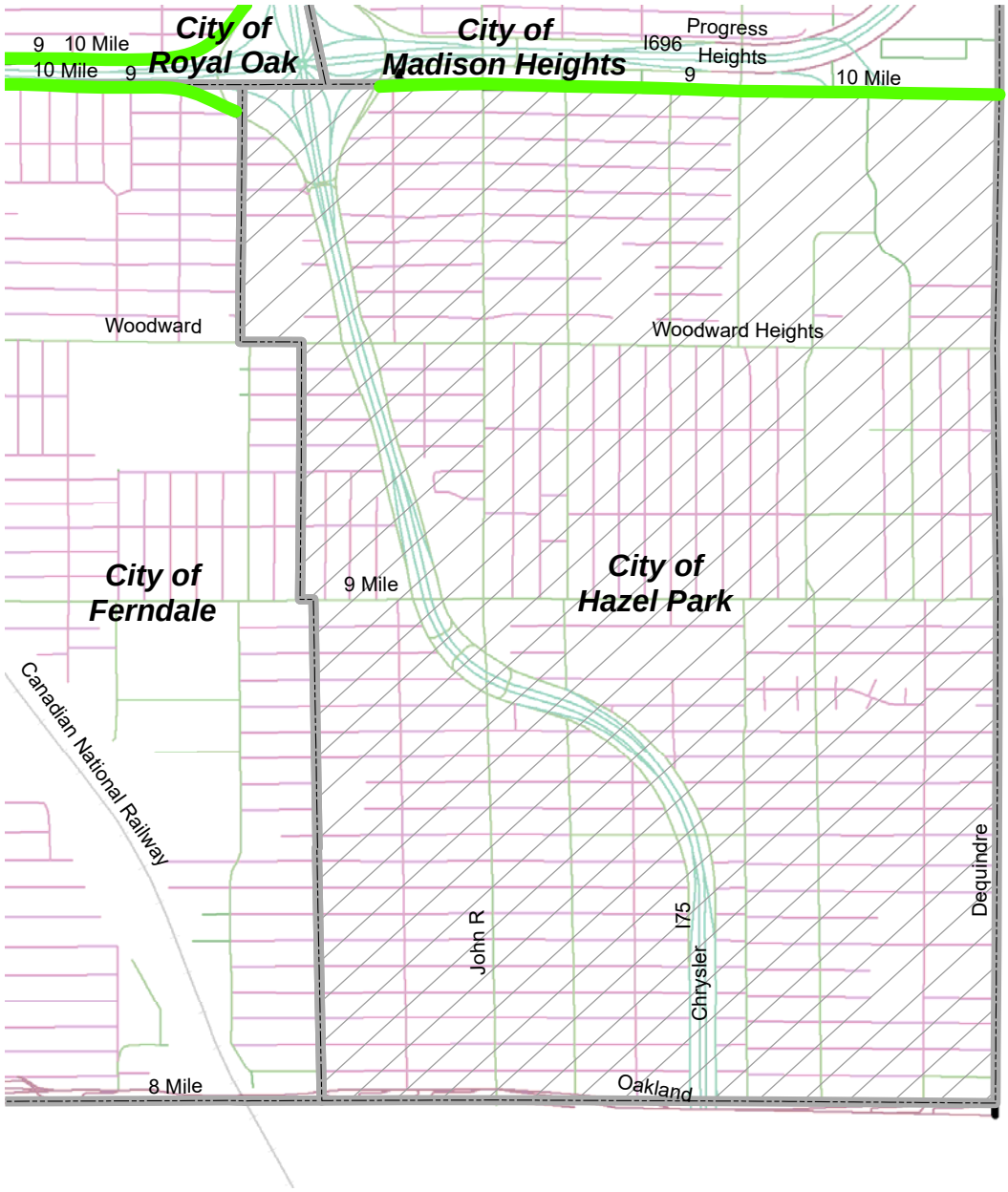

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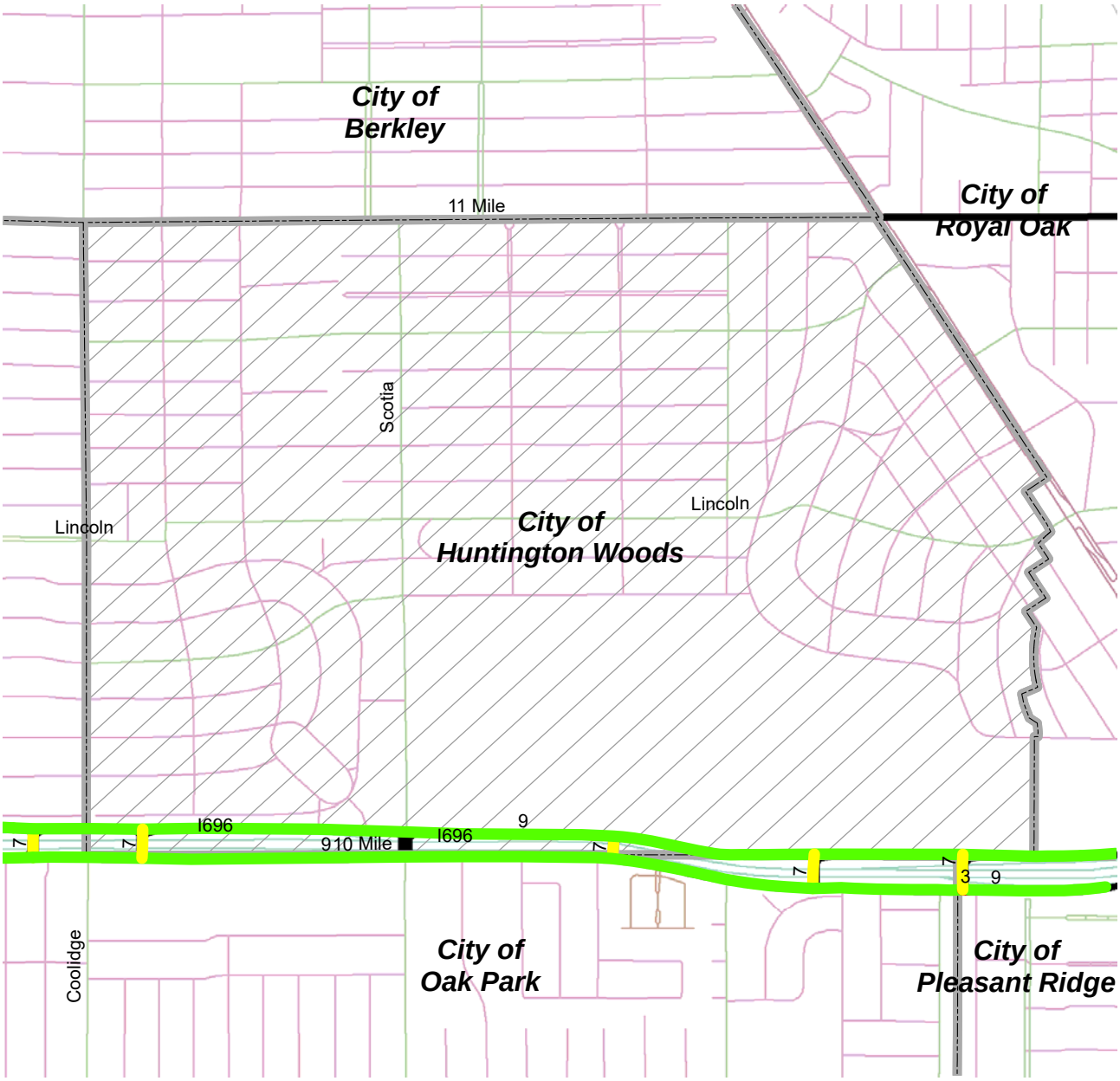

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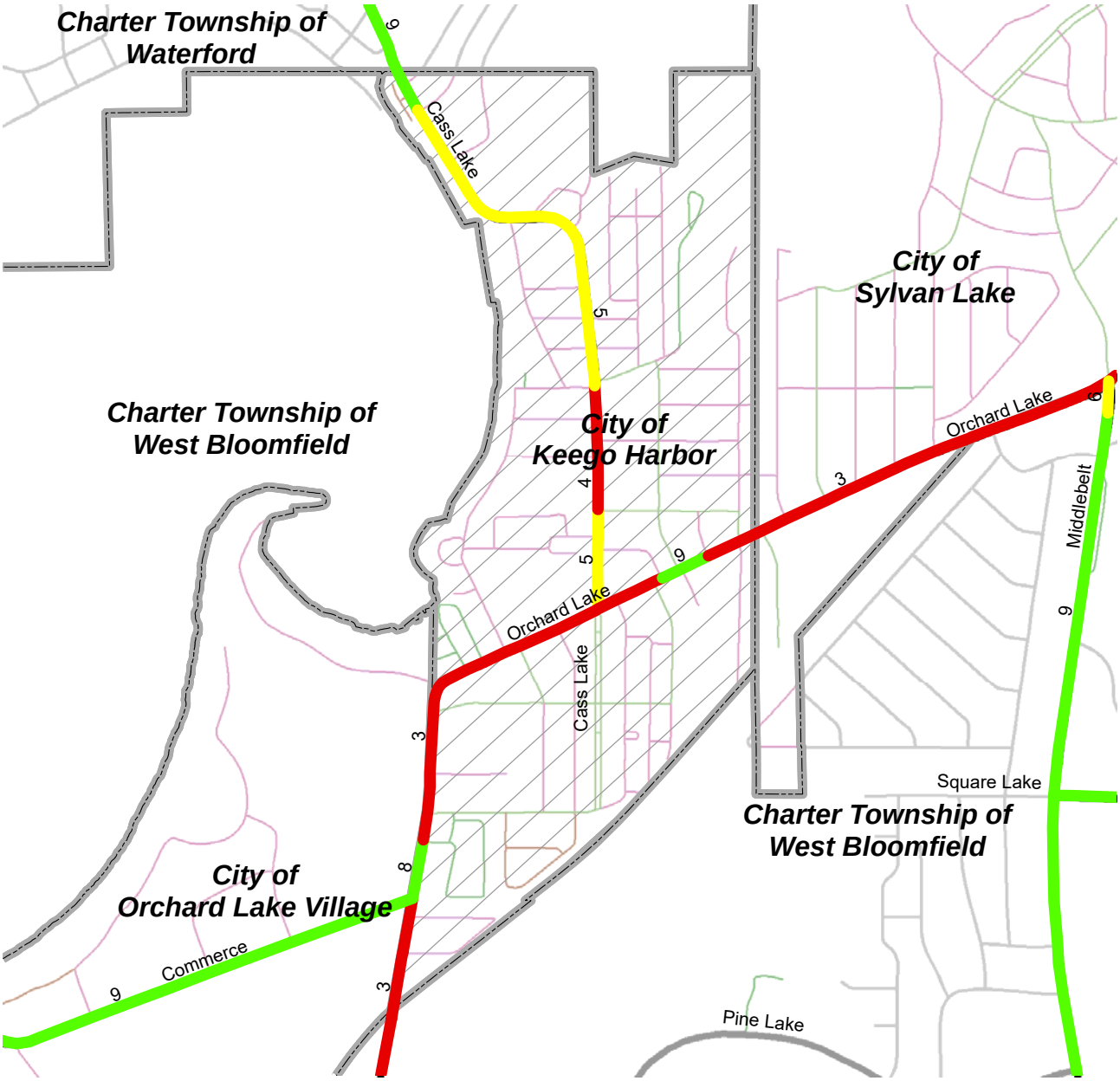

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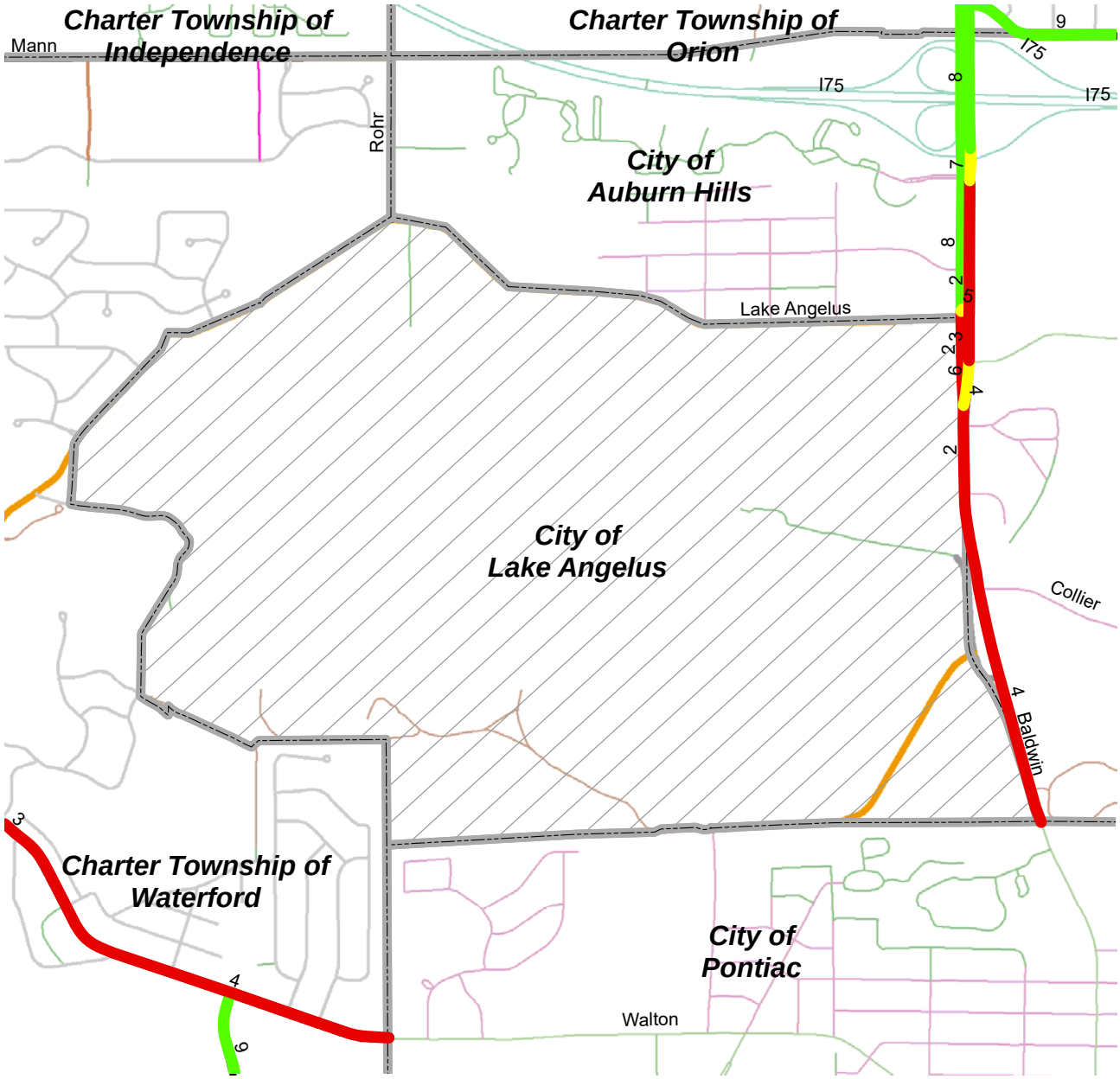

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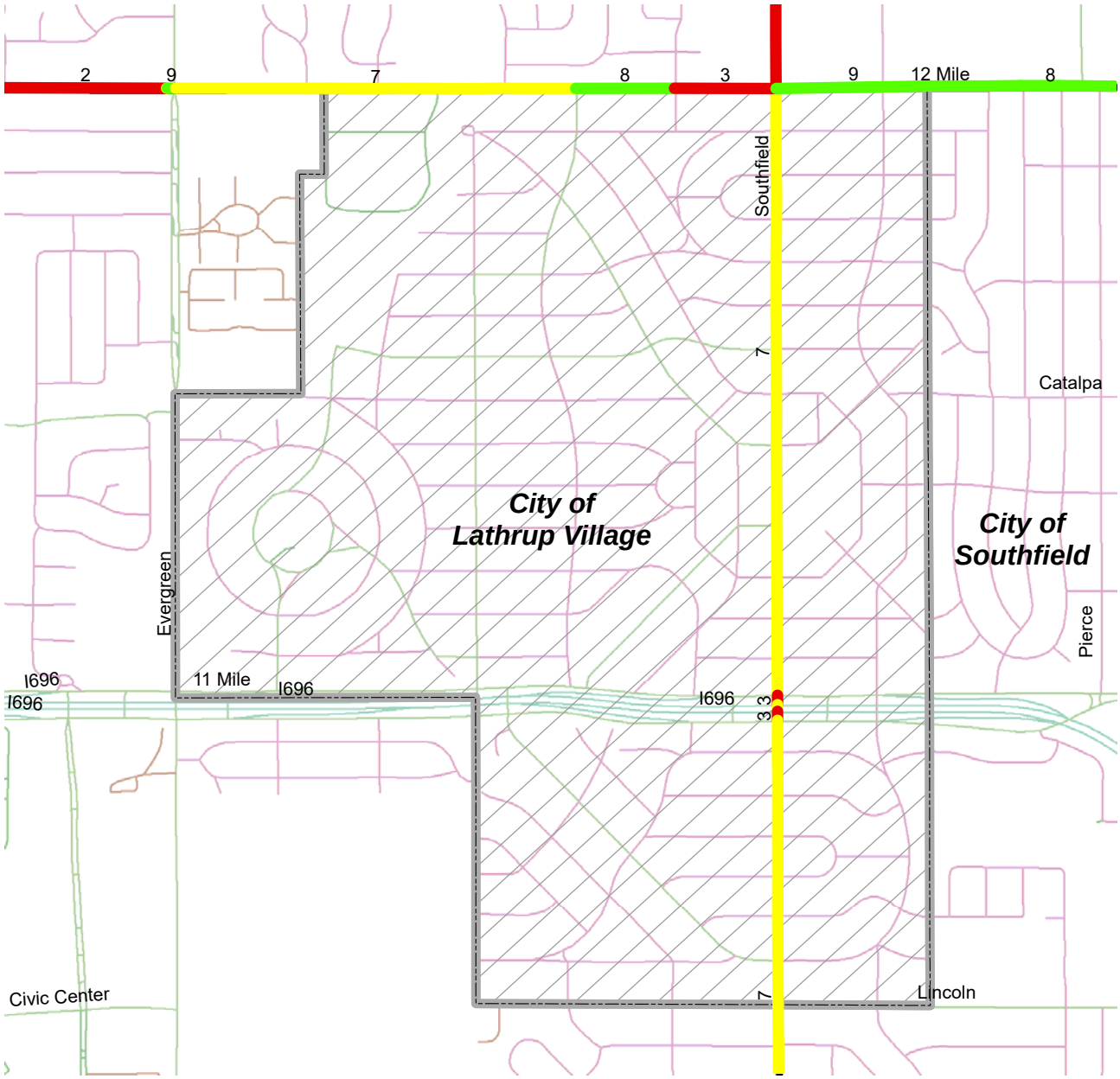

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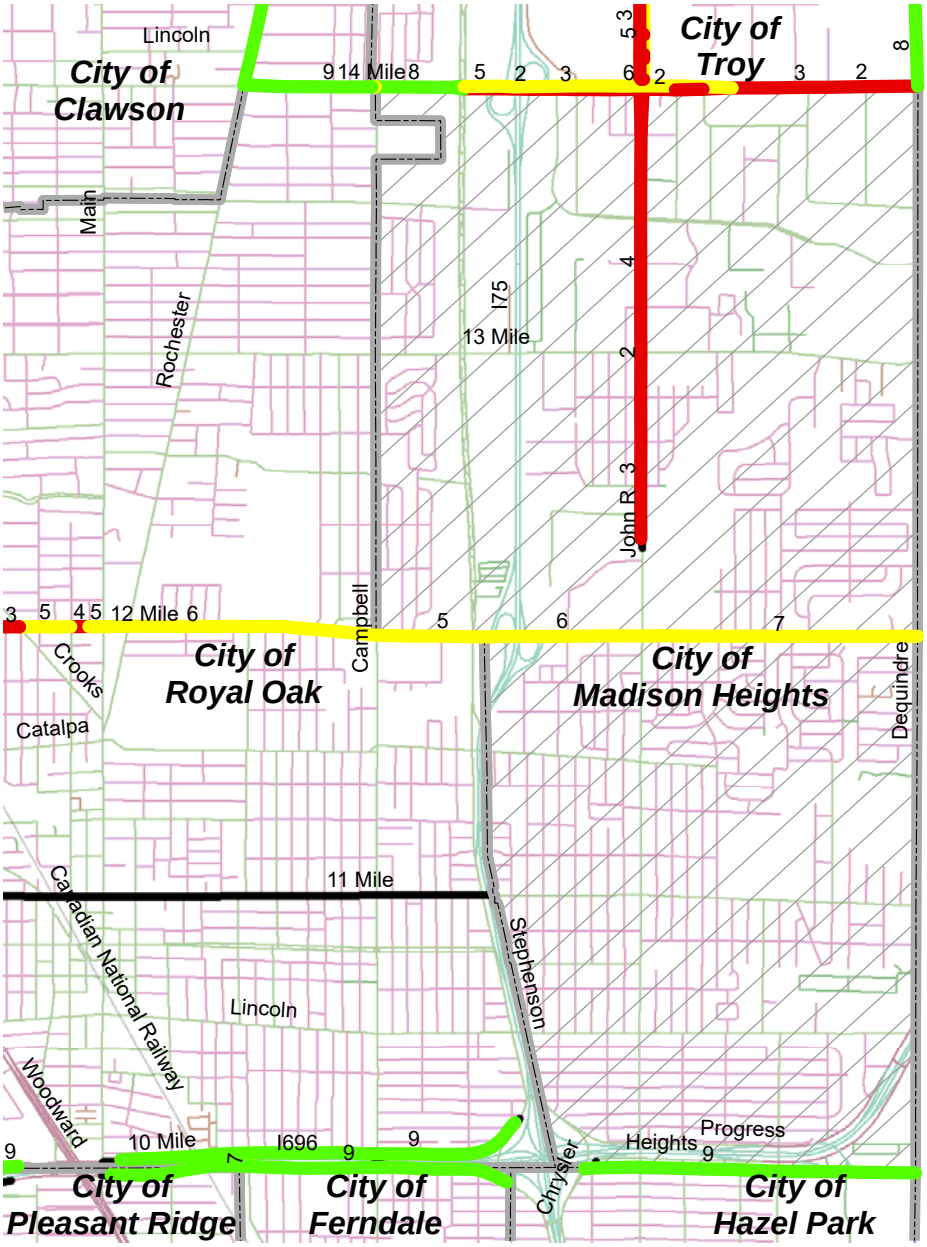

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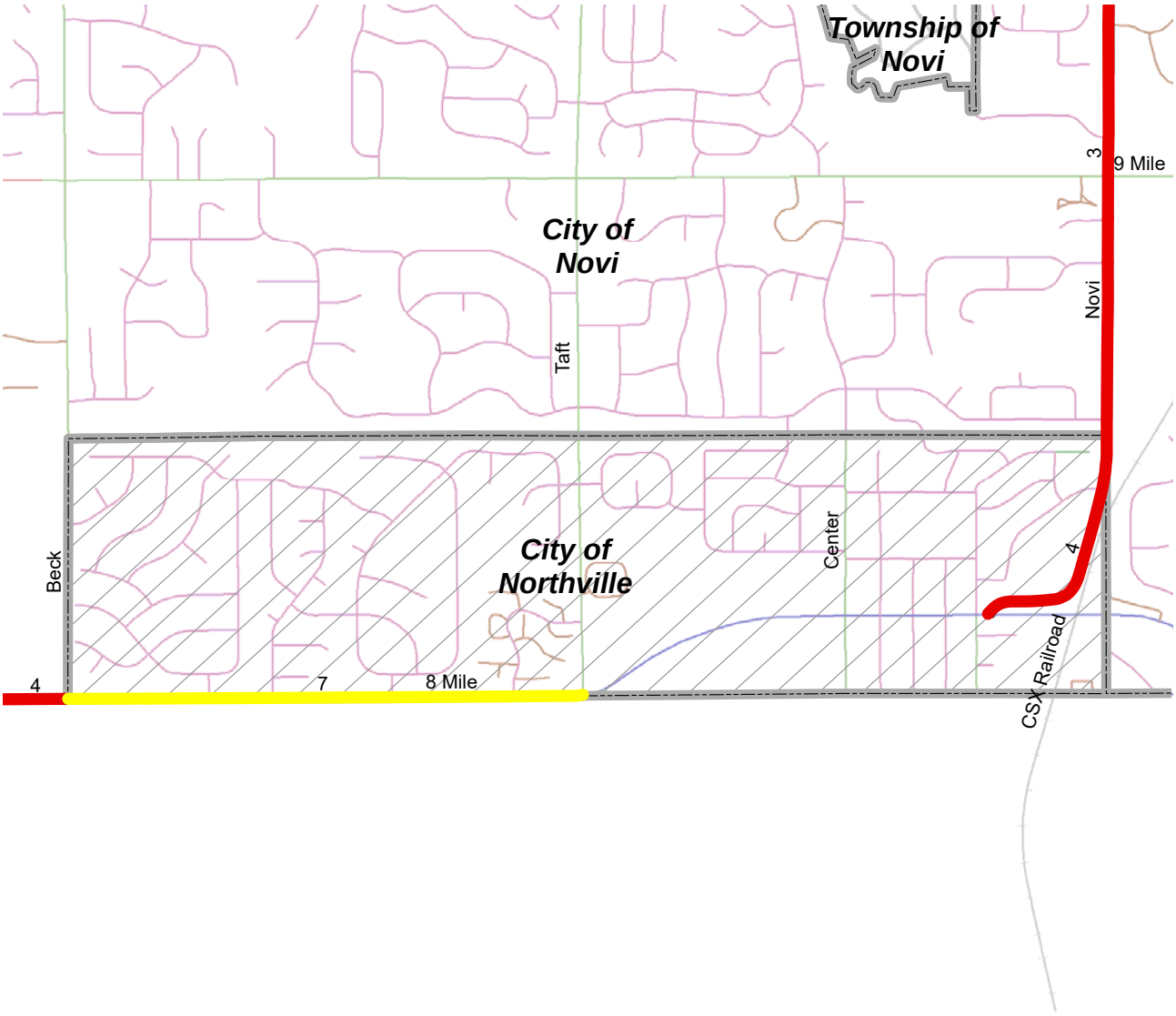

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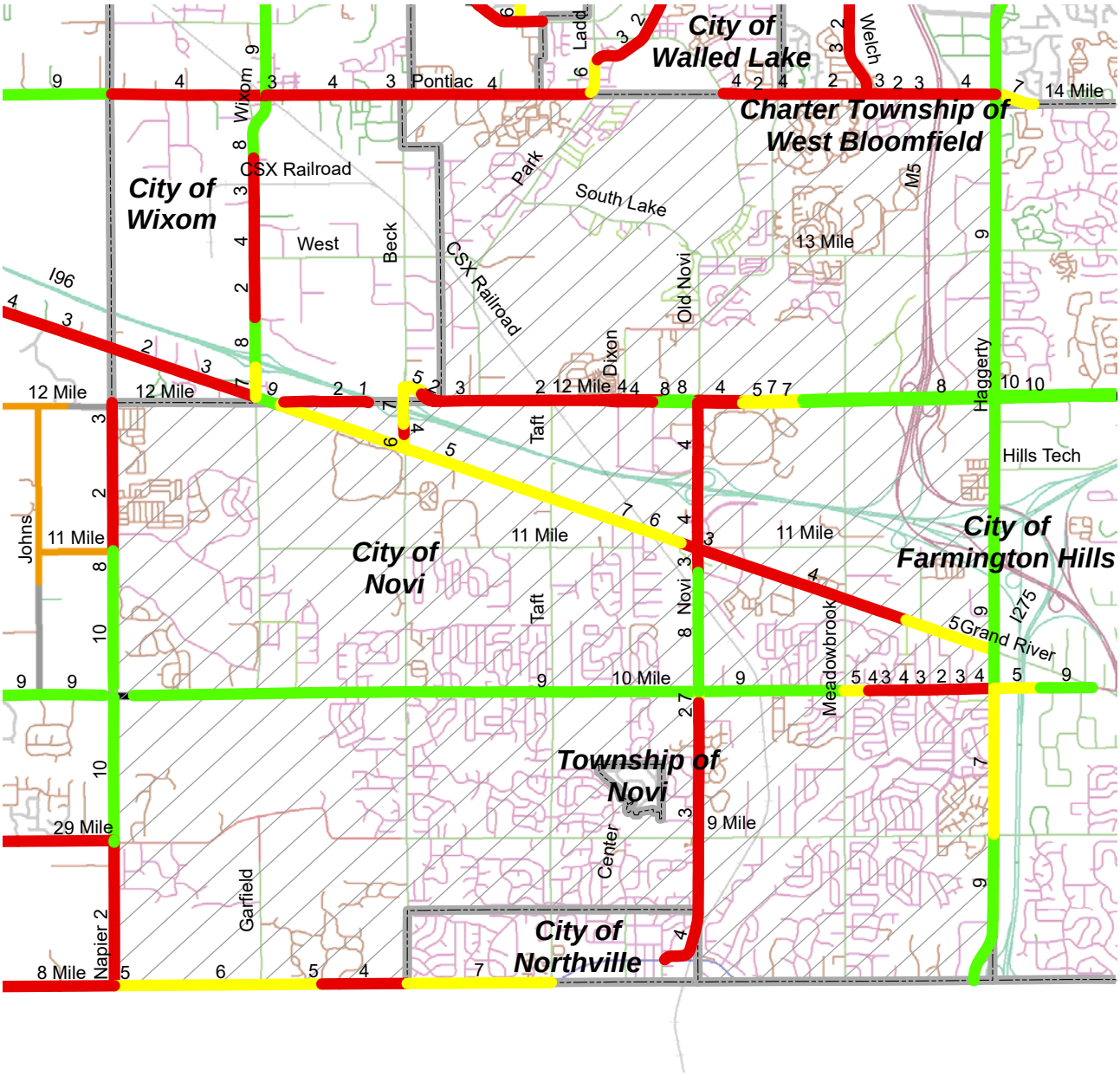

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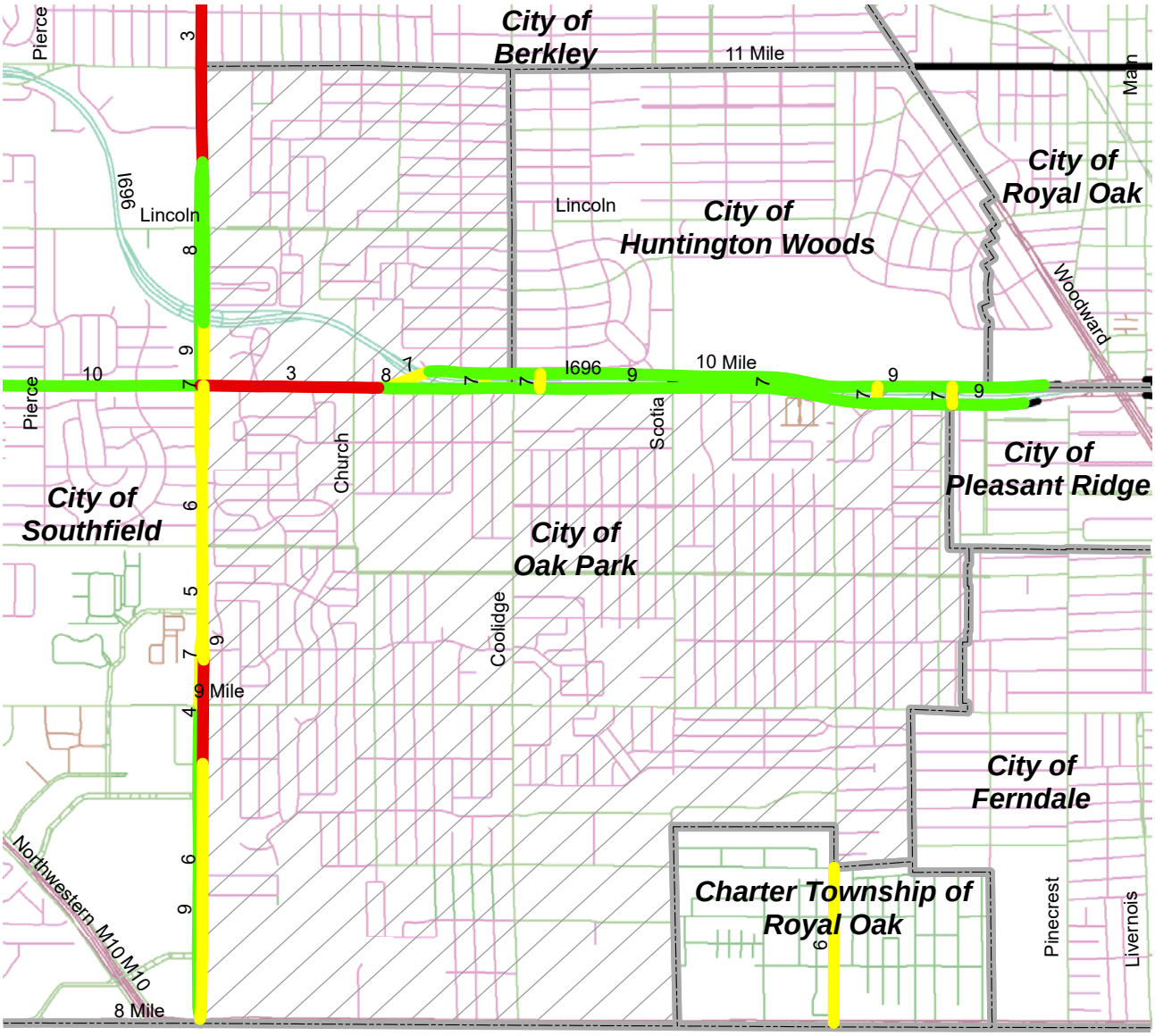

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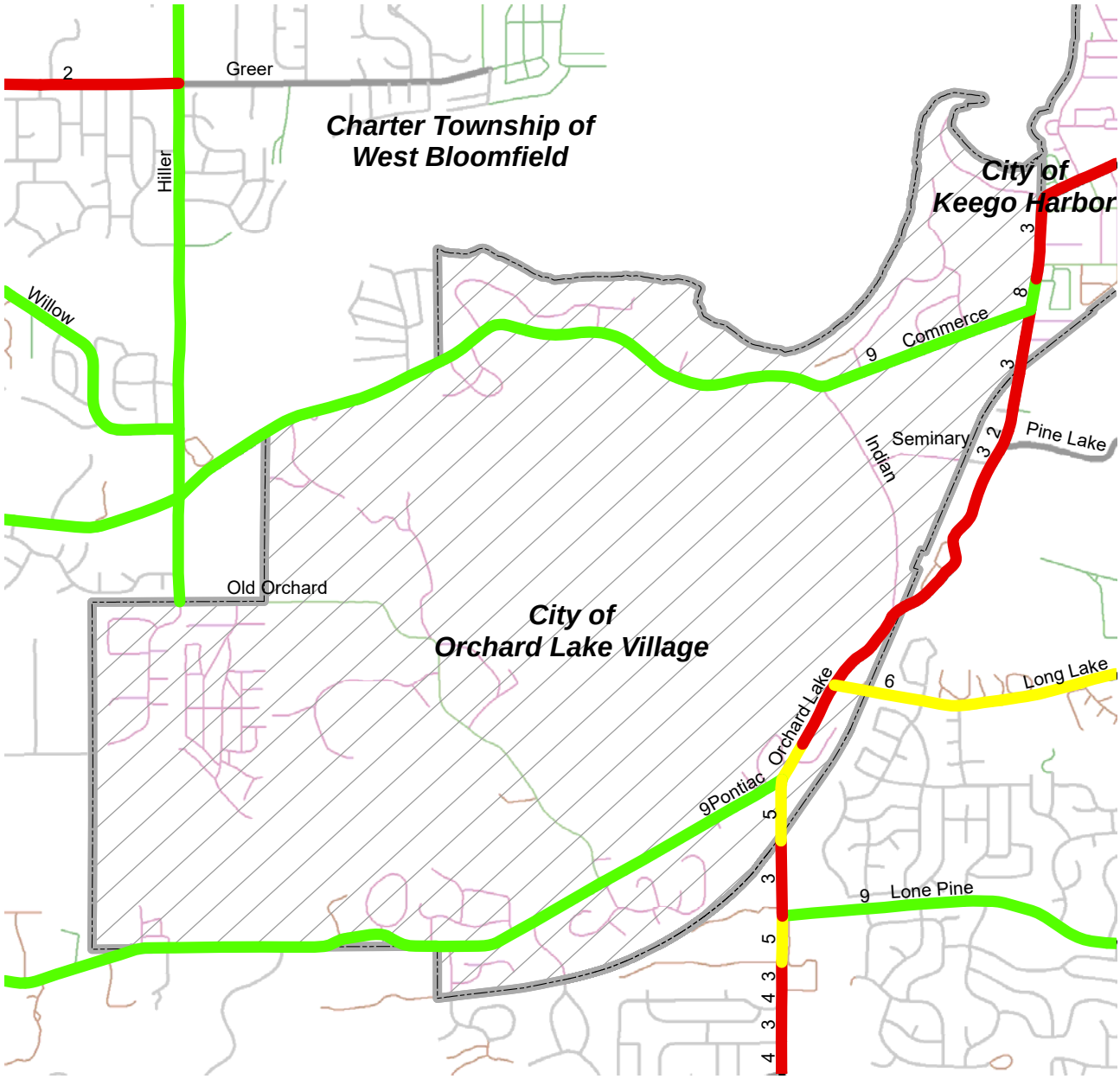

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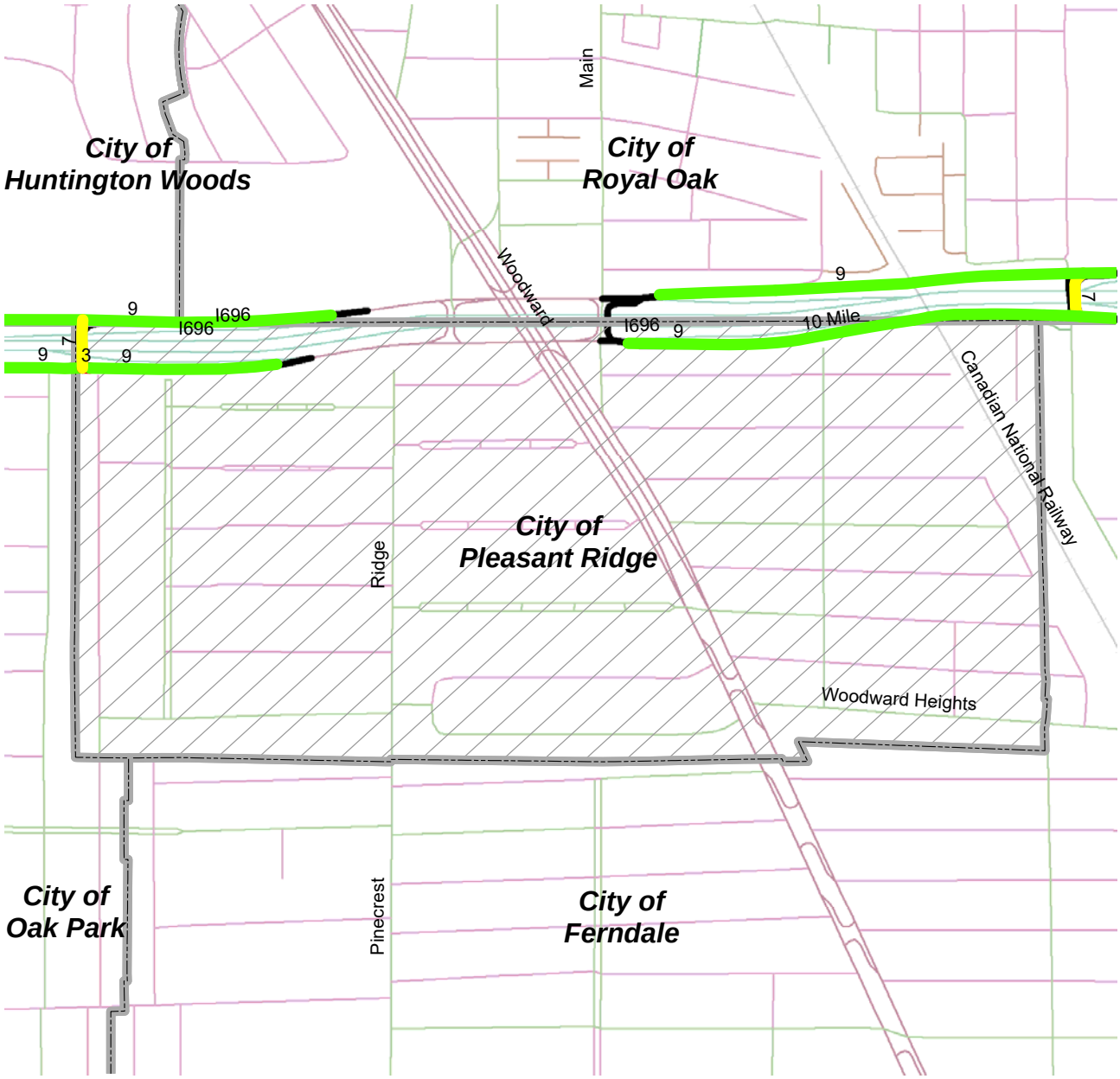
ROAD COMMISSION for OAKLAND COUNTY

2020 PAVEMENT CONDITION
RCOC PAVED PRIMARY AND LOCAL ROADS



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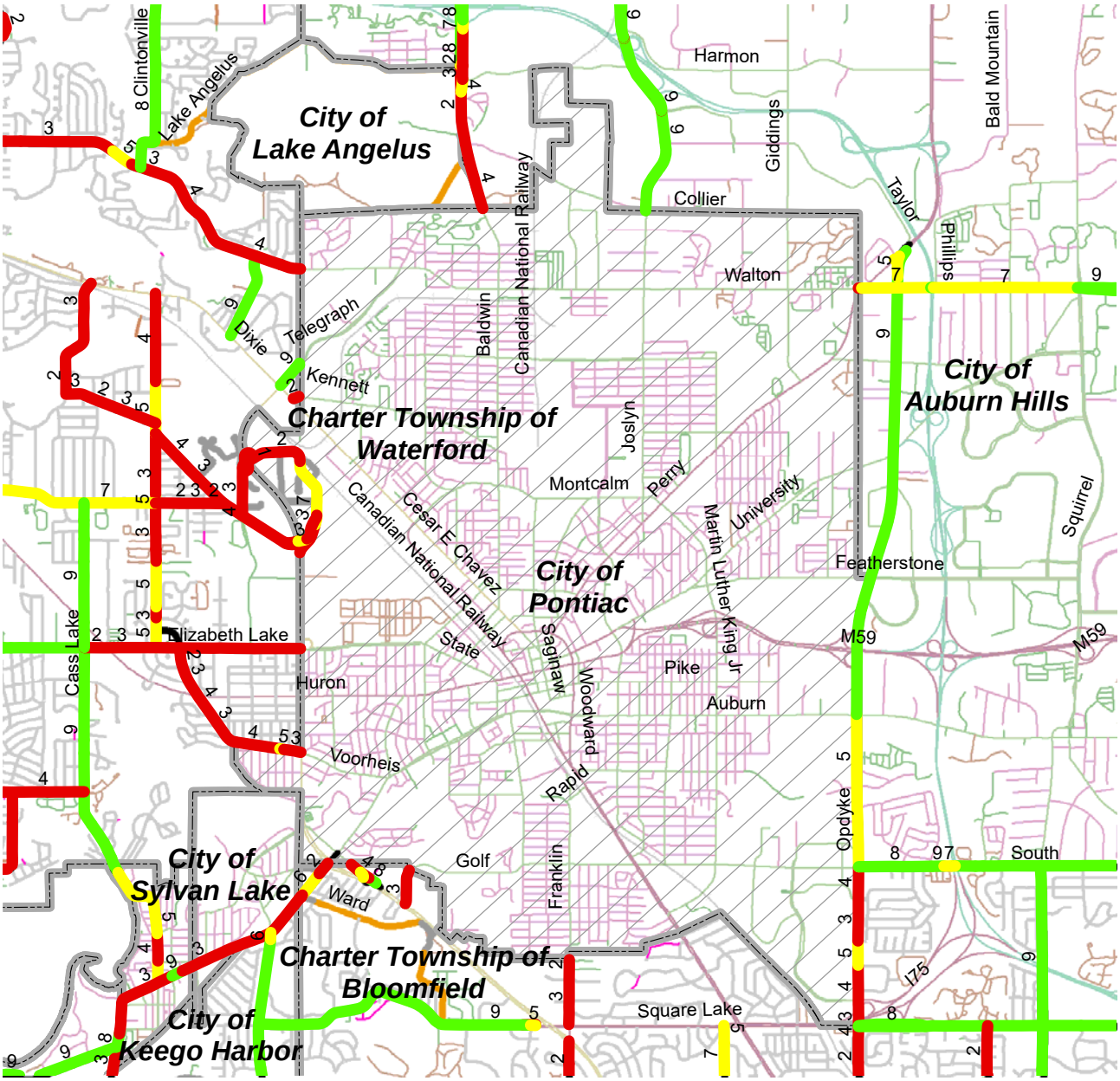

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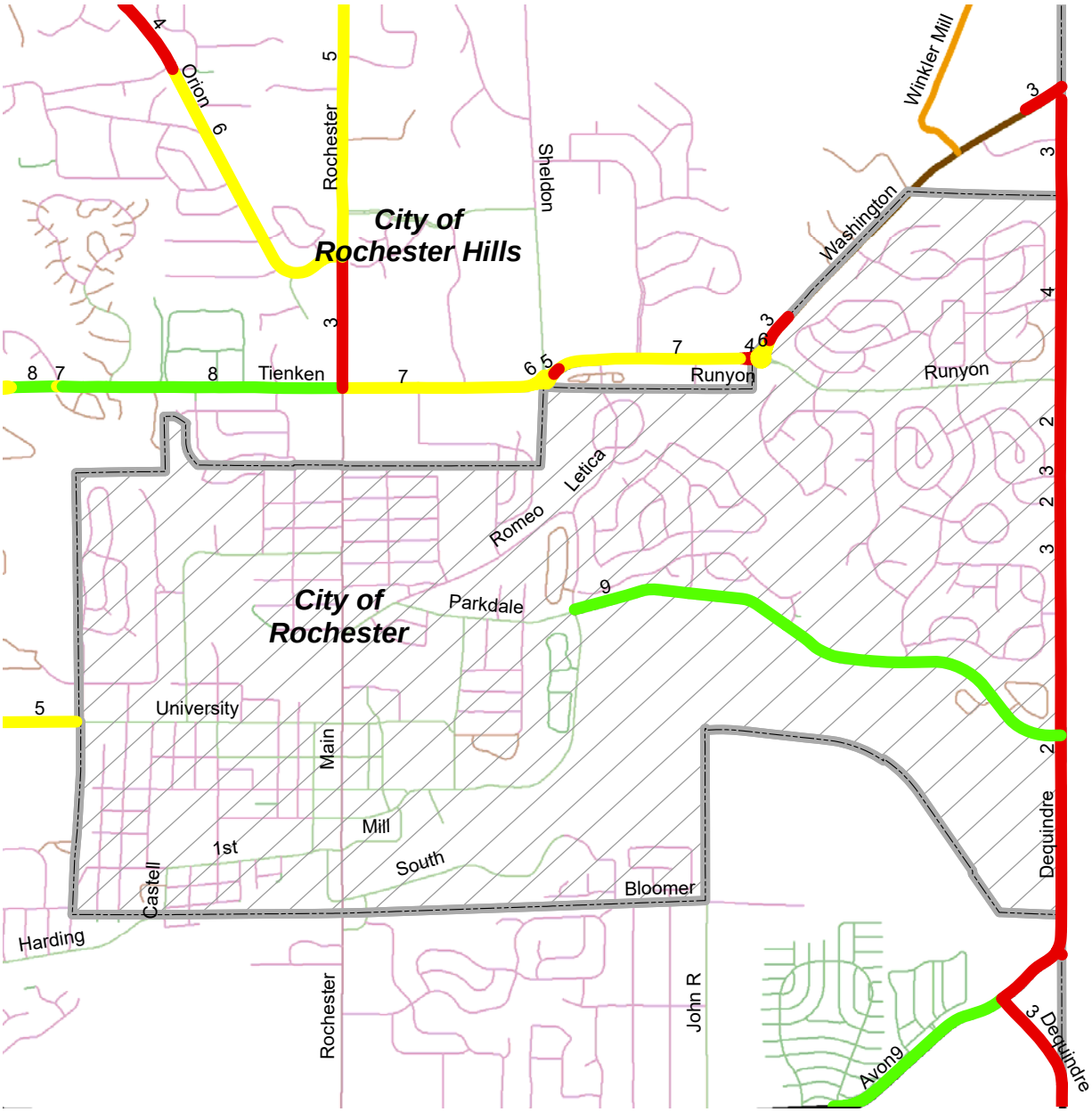

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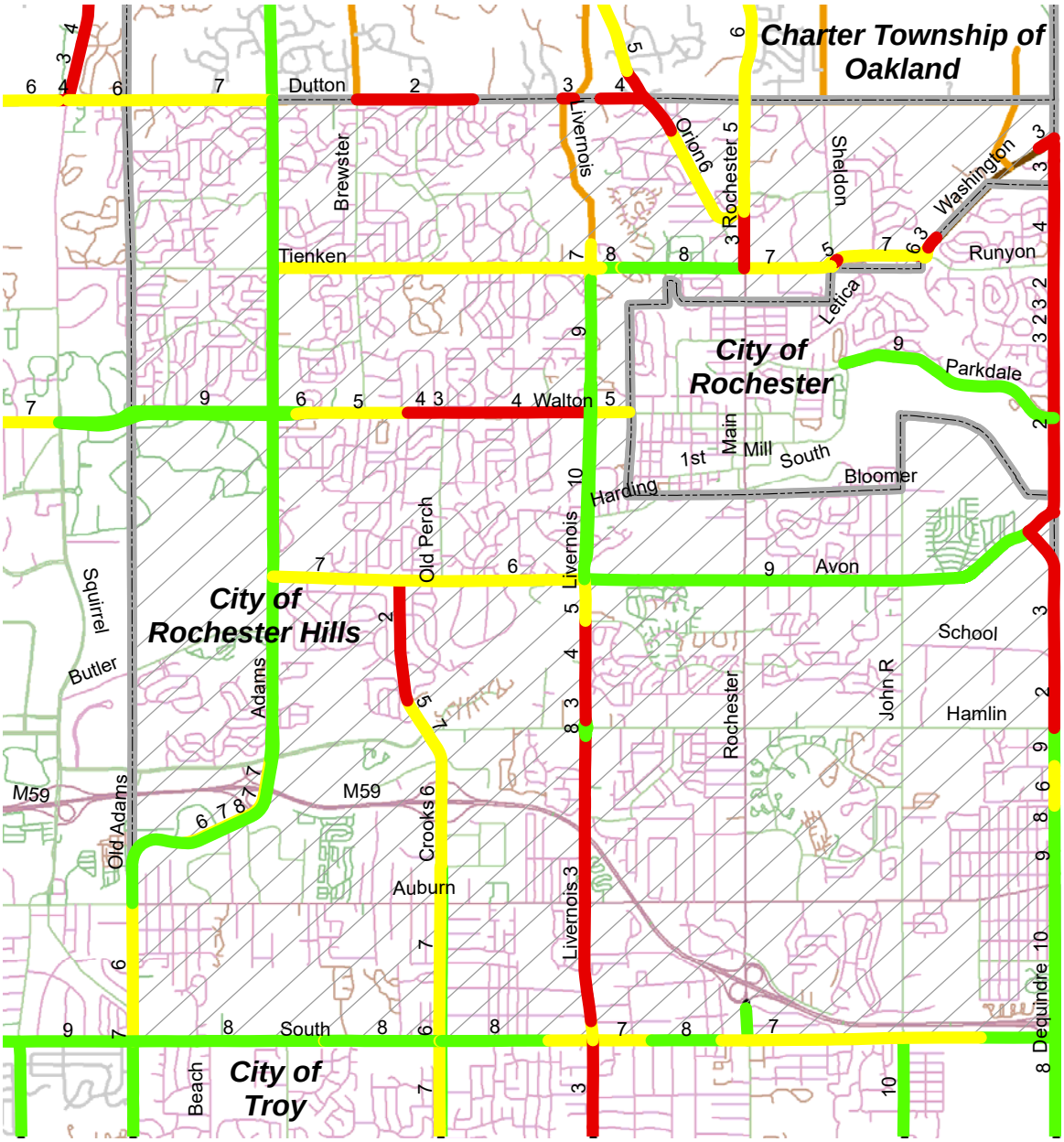

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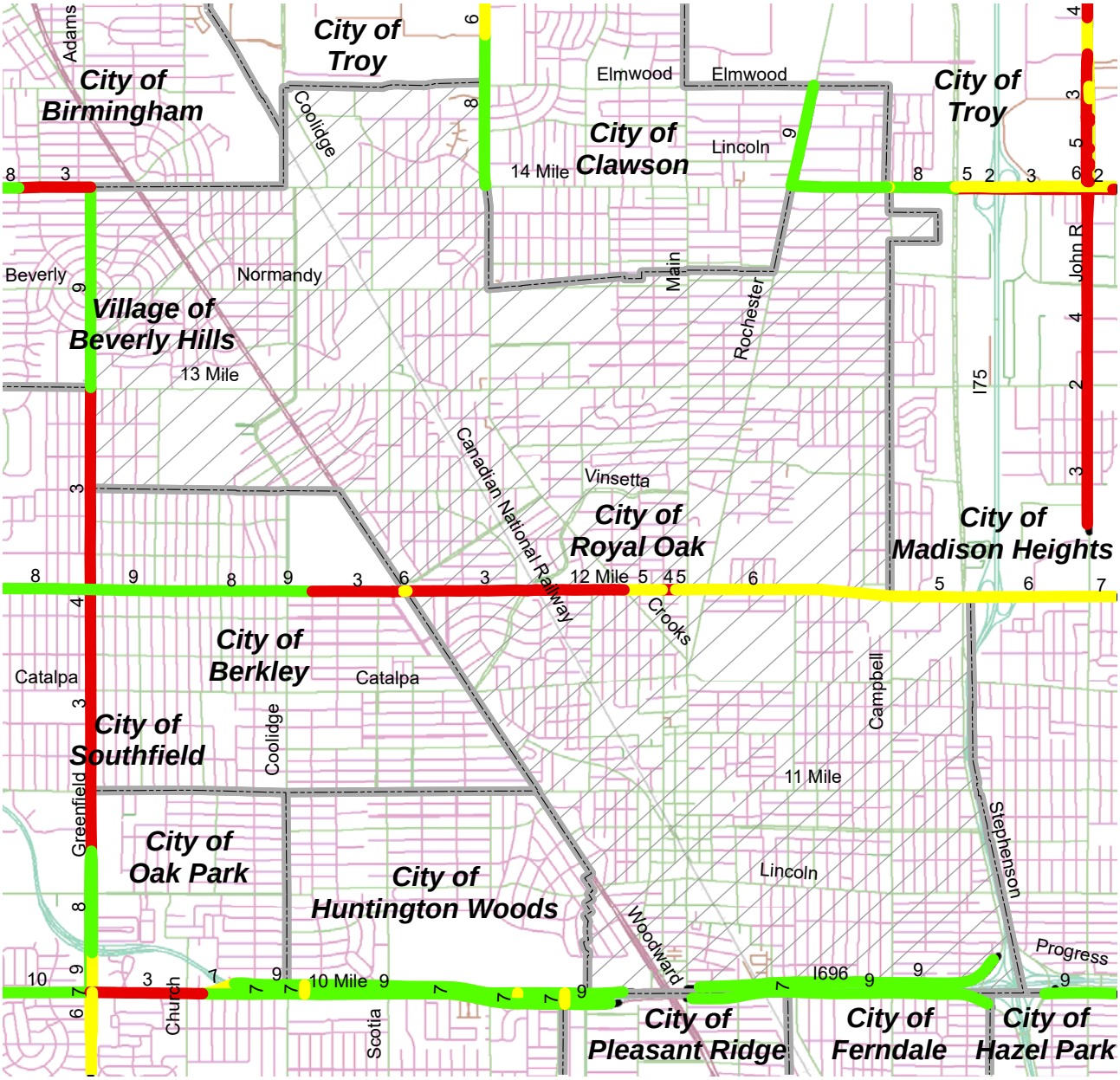

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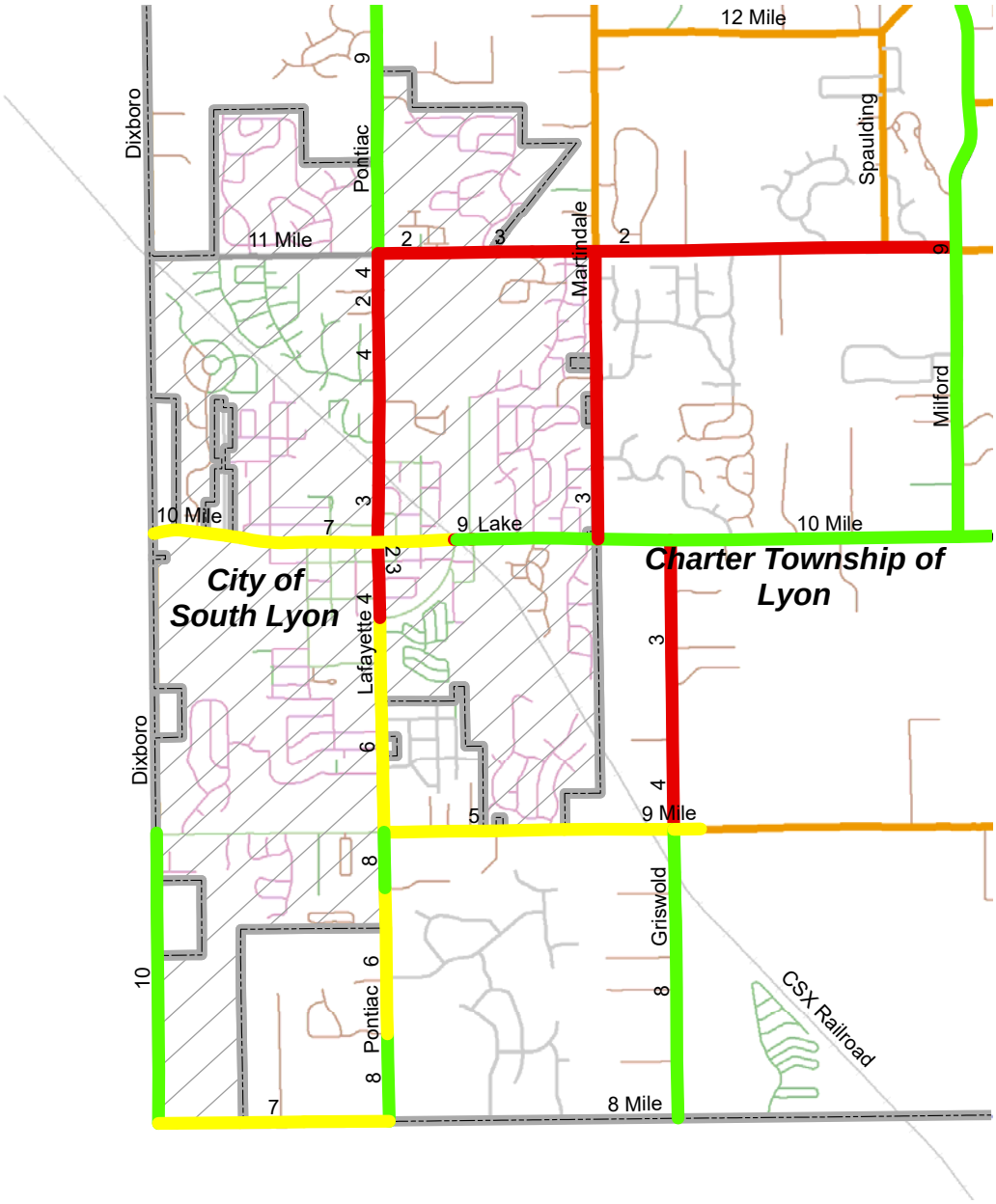

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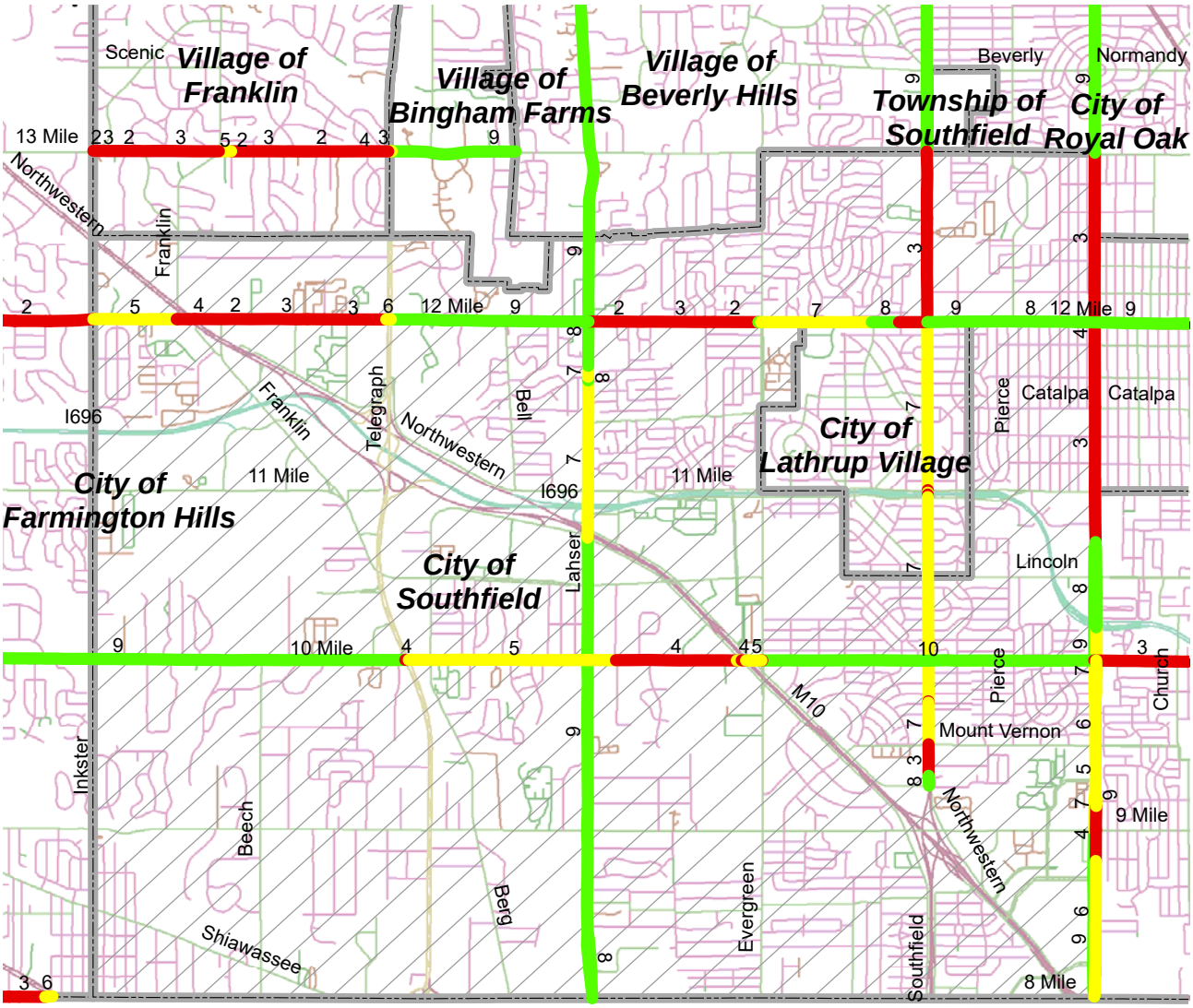

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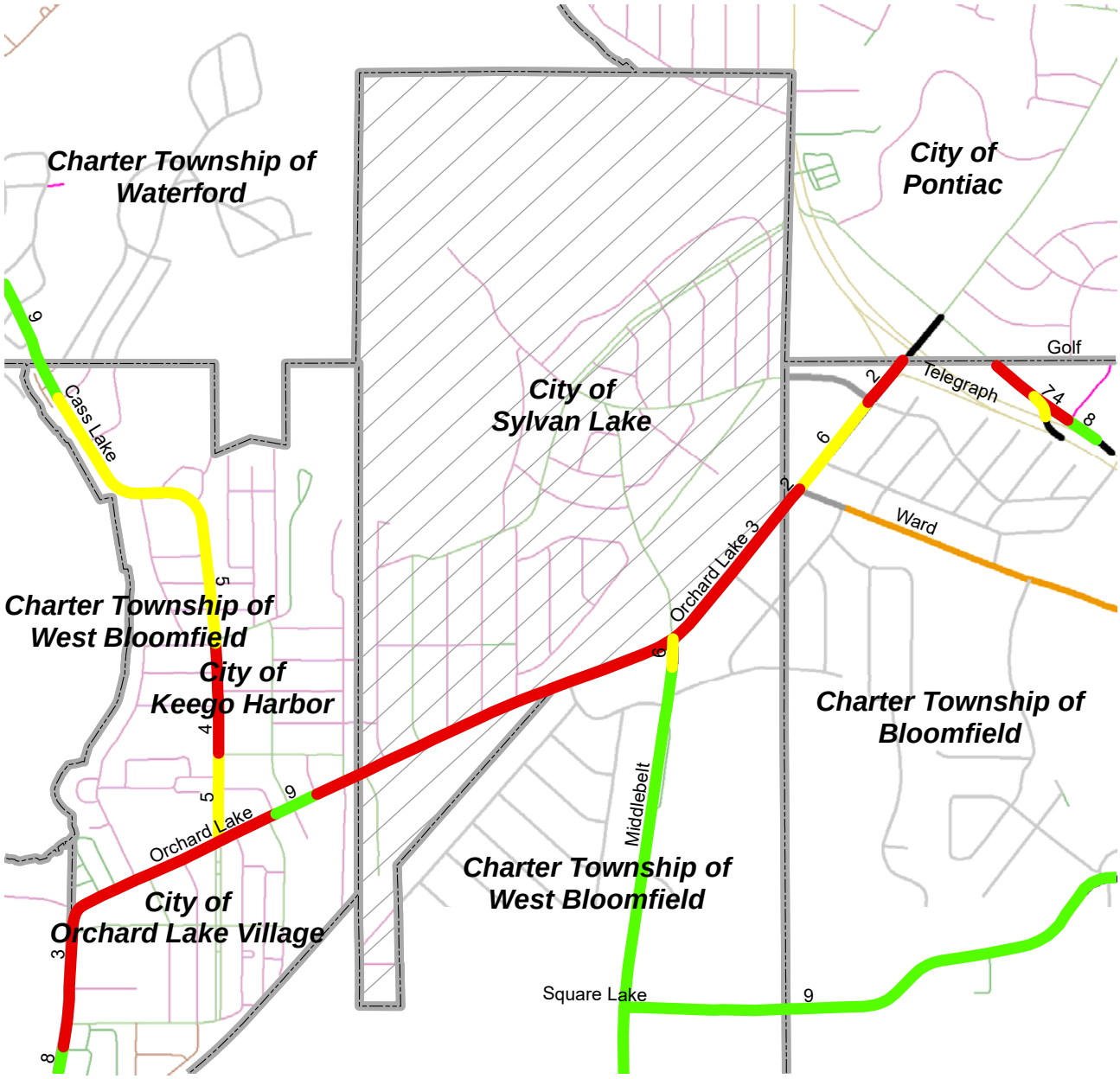

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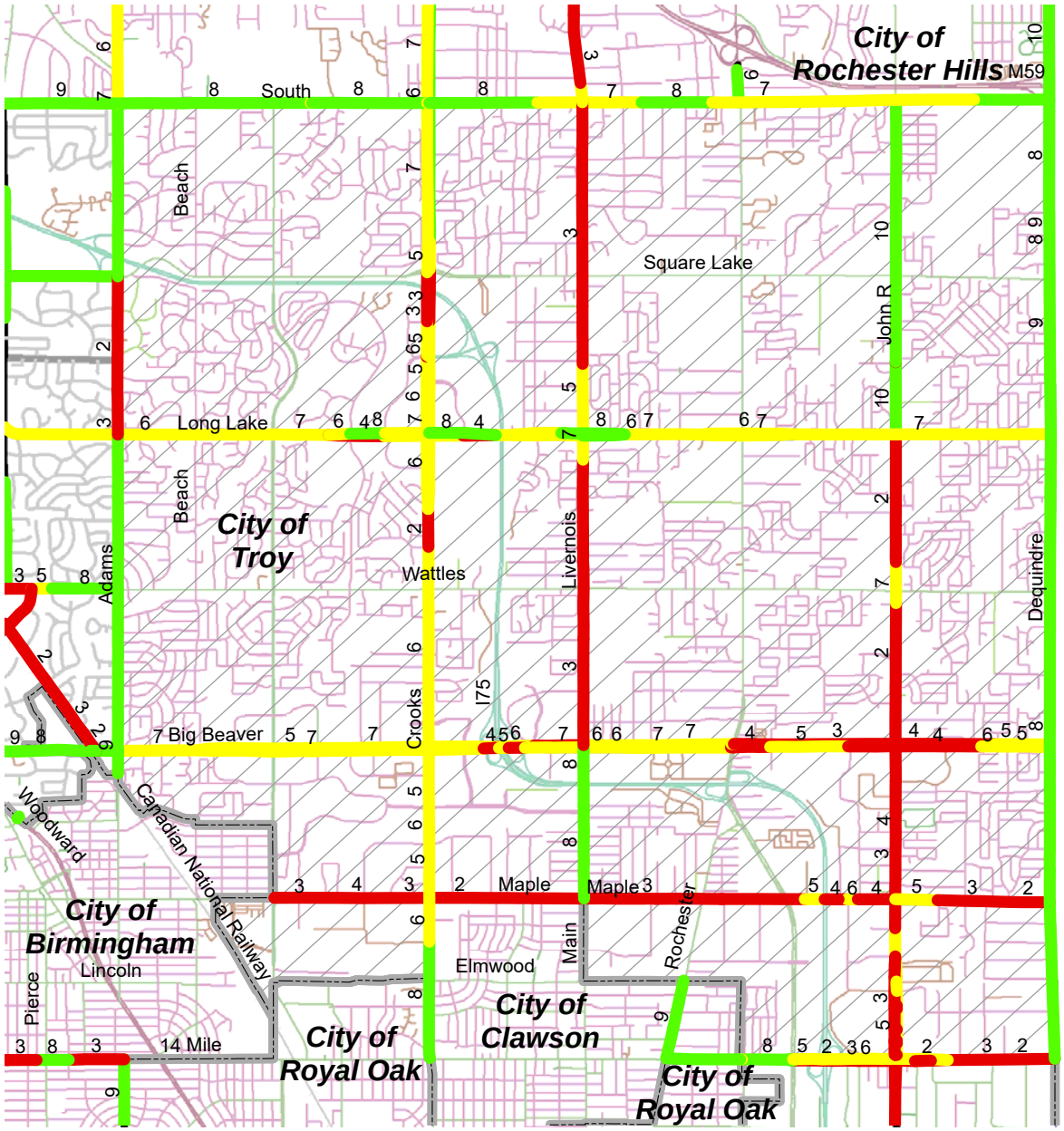

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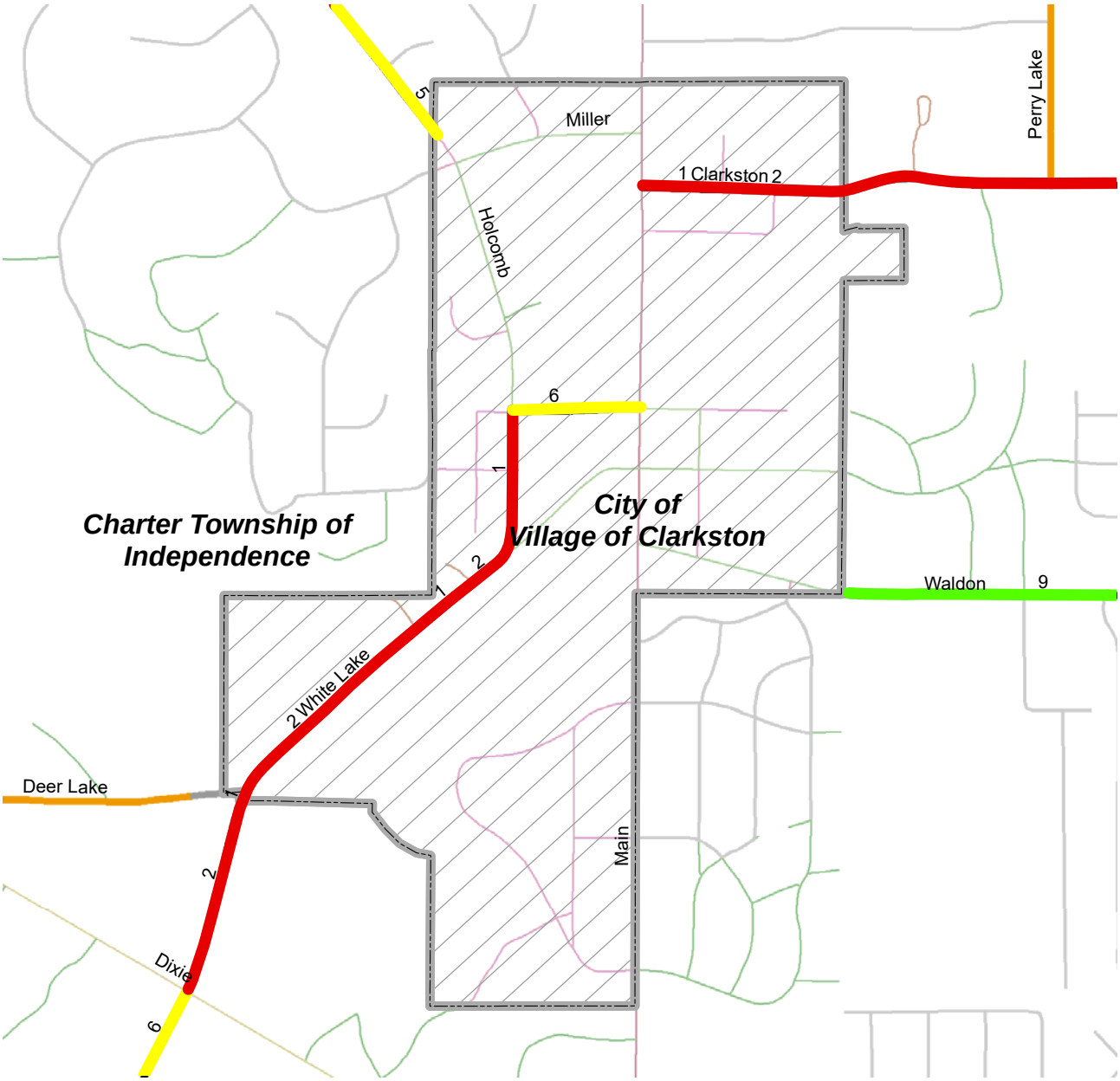

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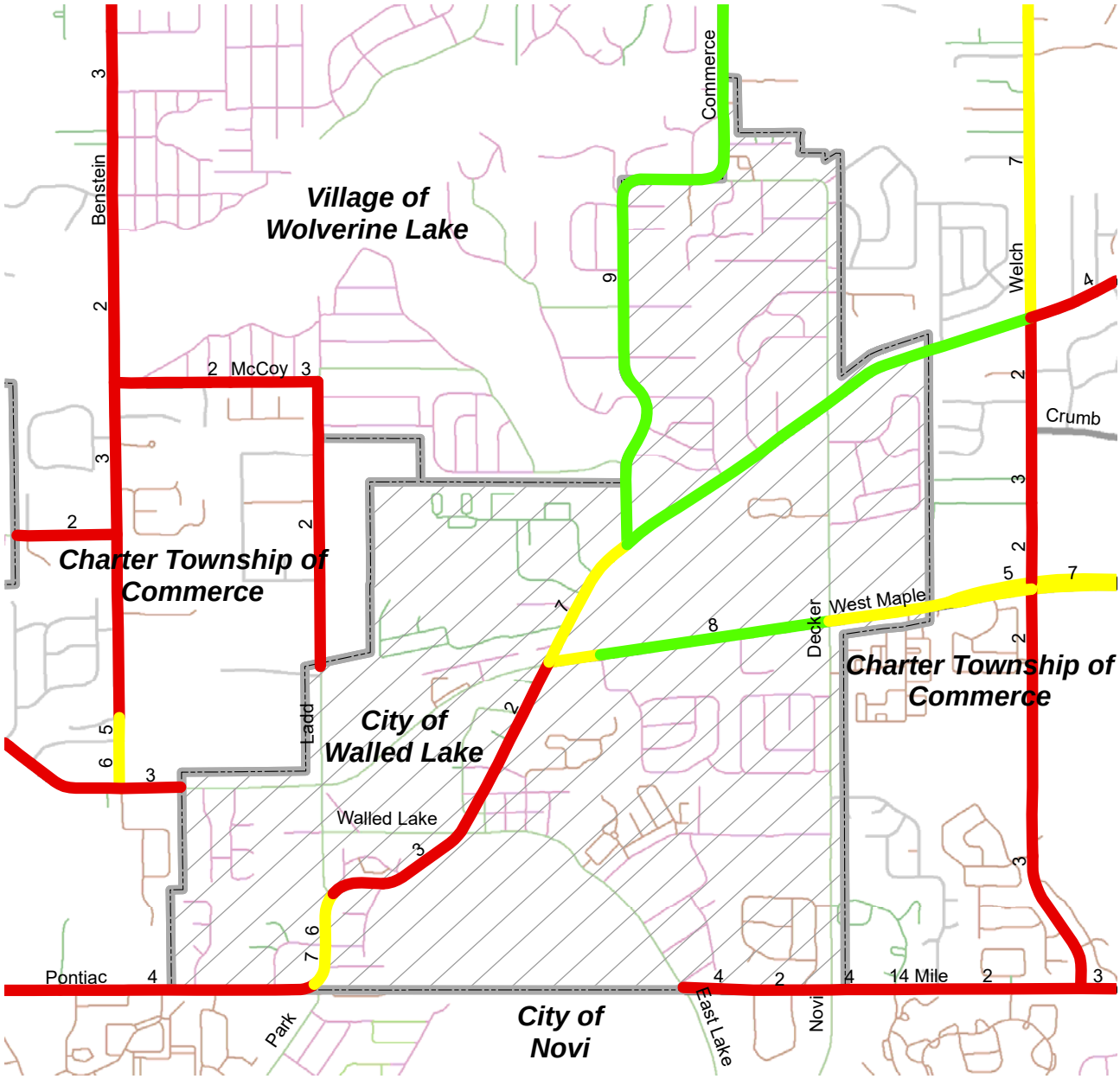

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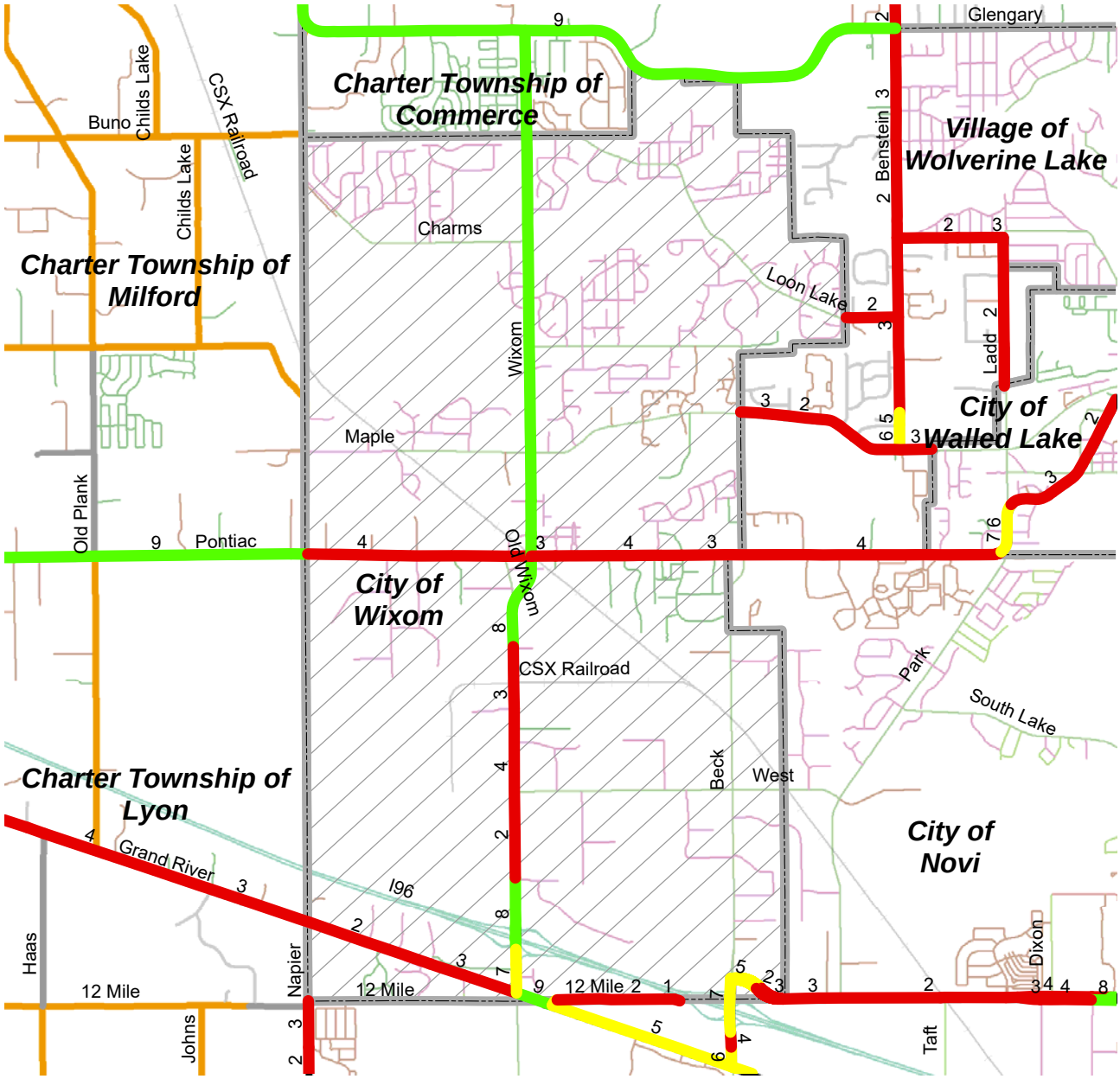

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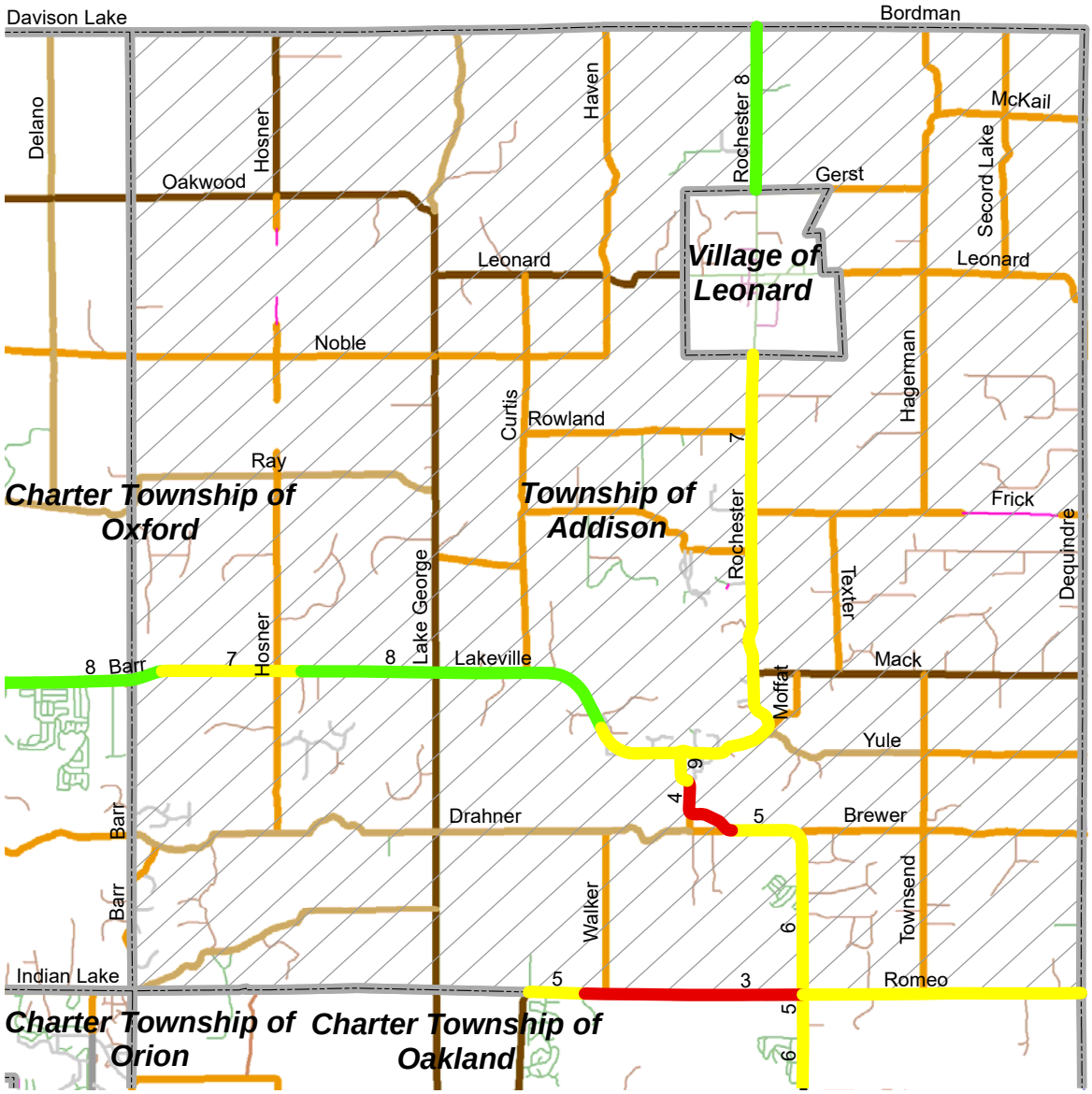

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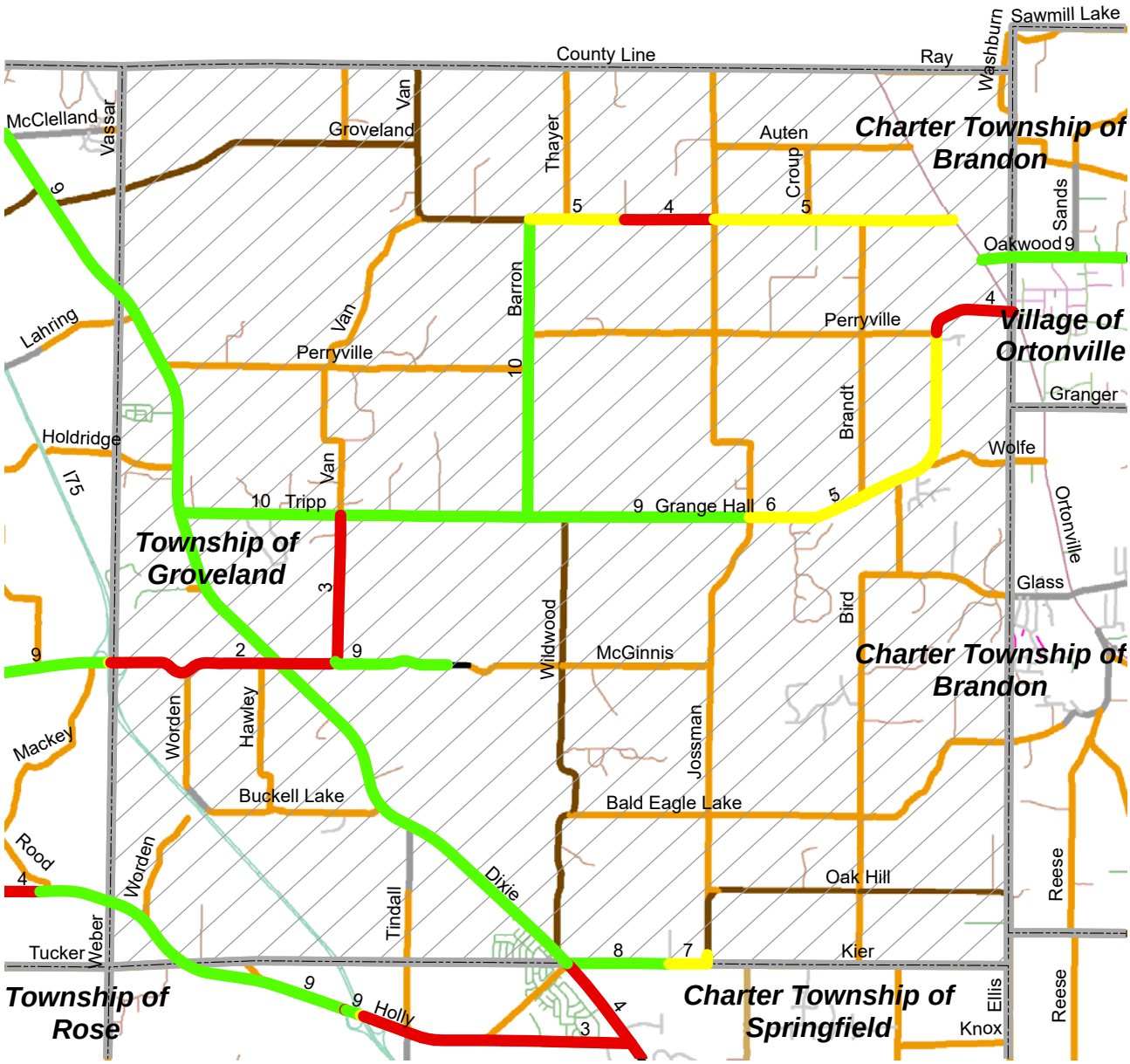

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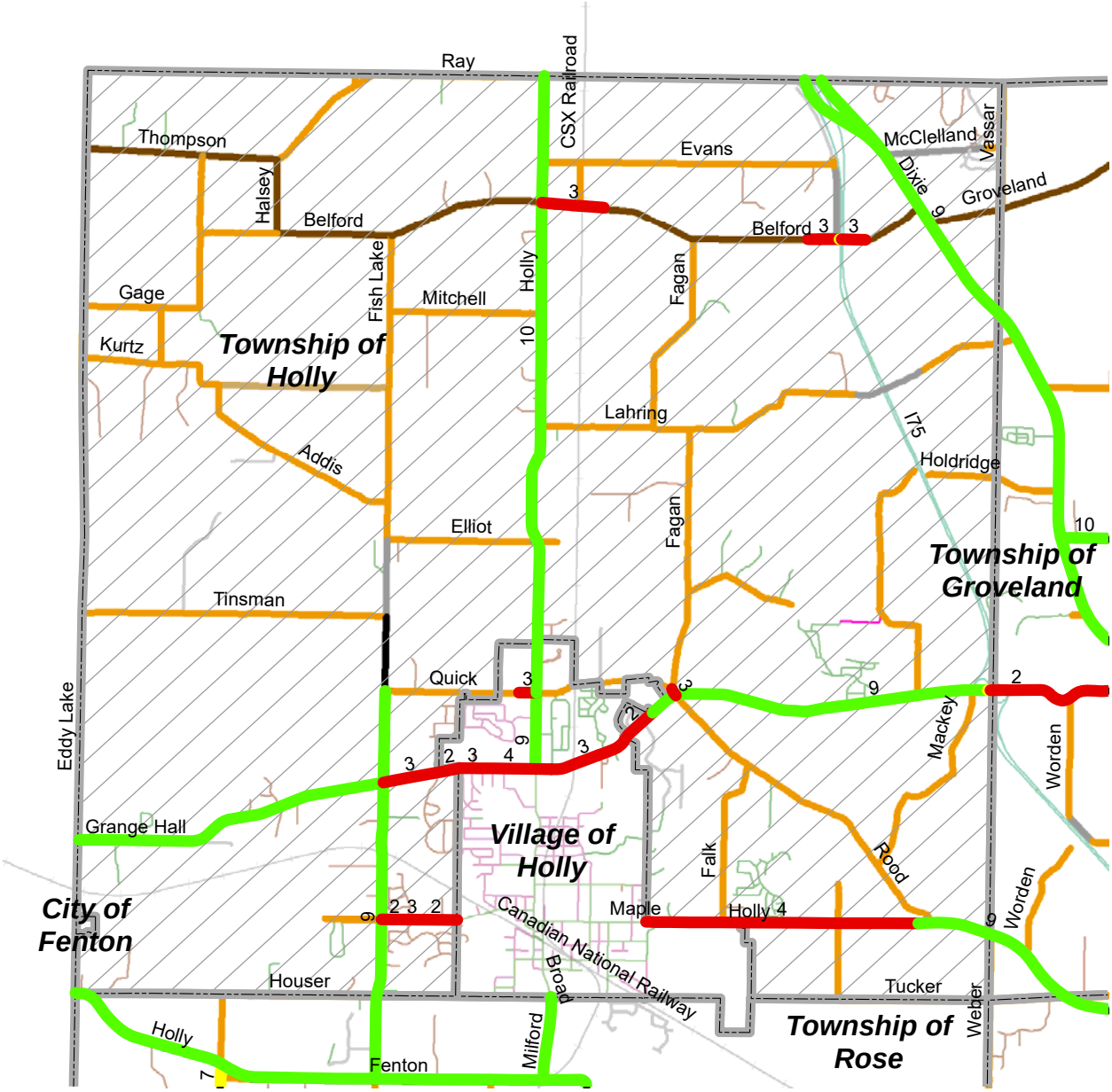

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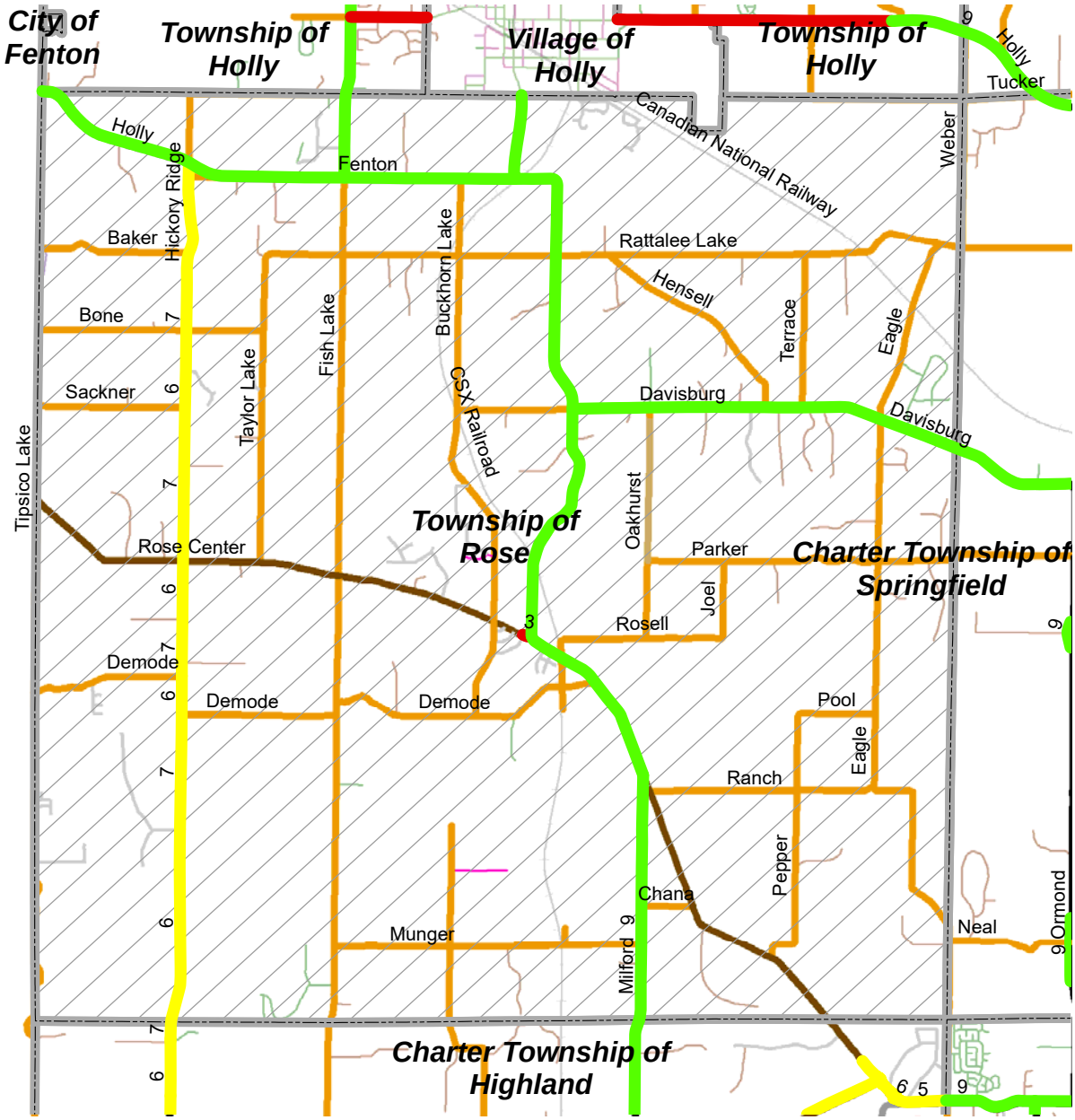

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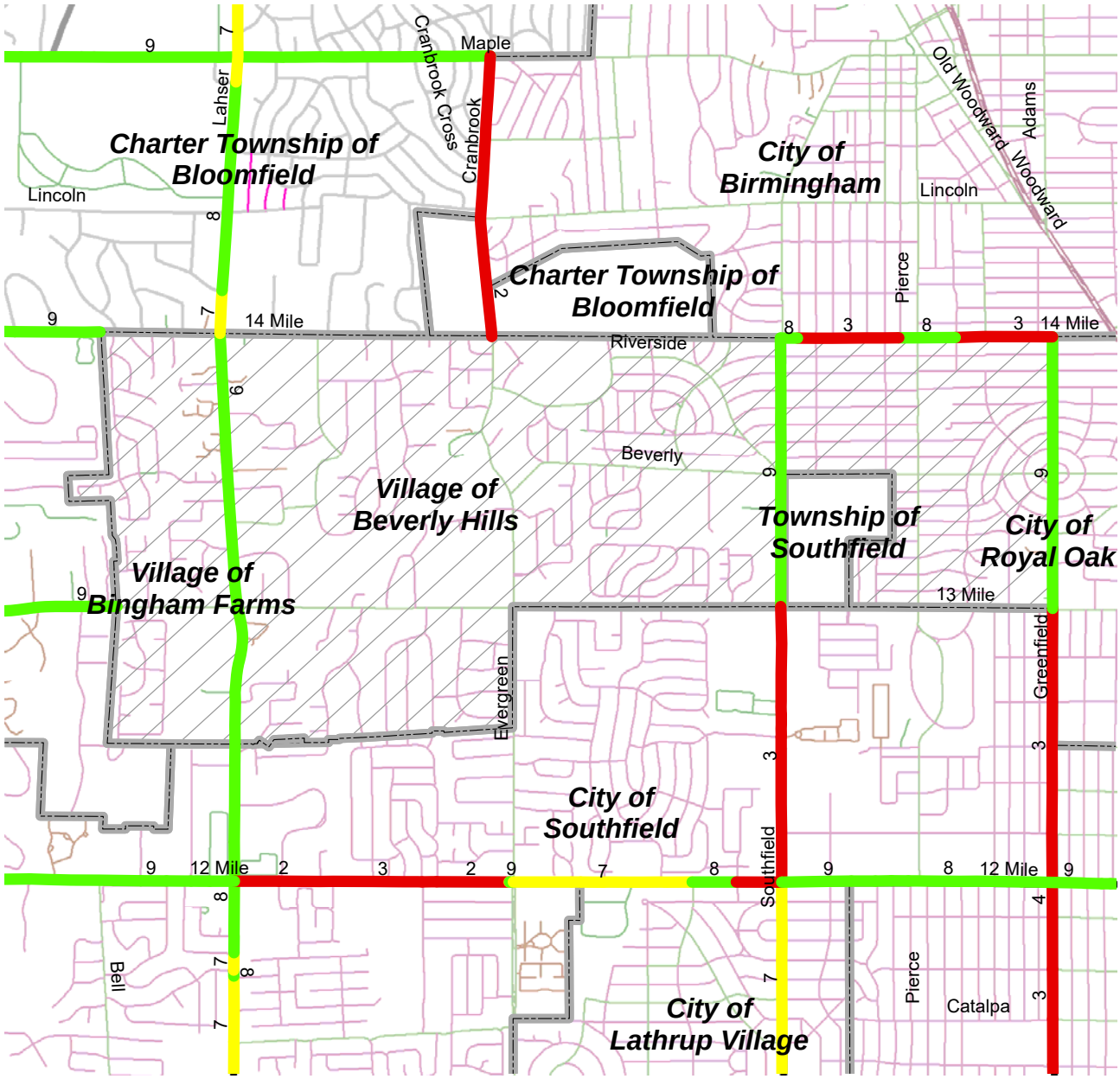

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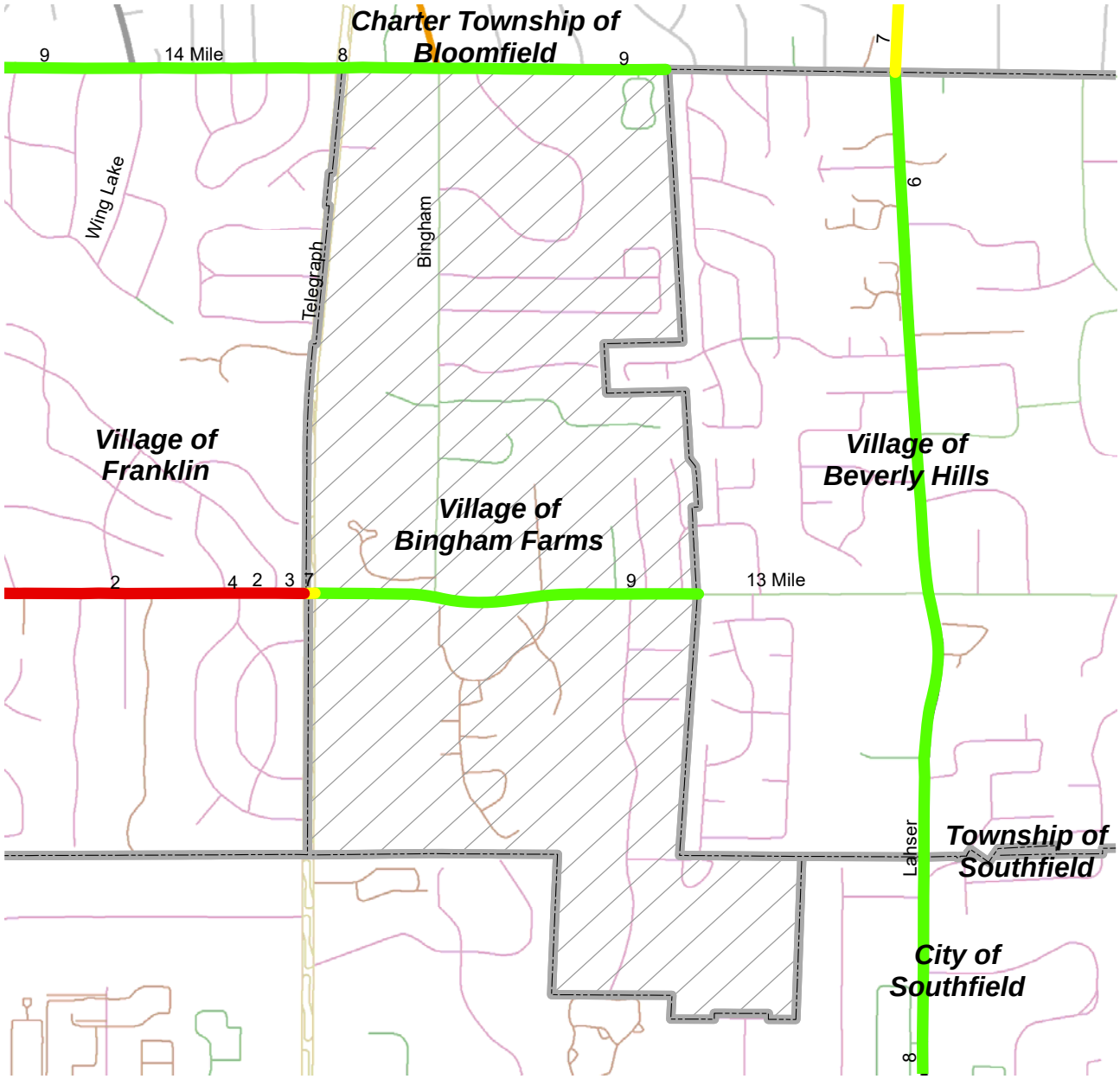

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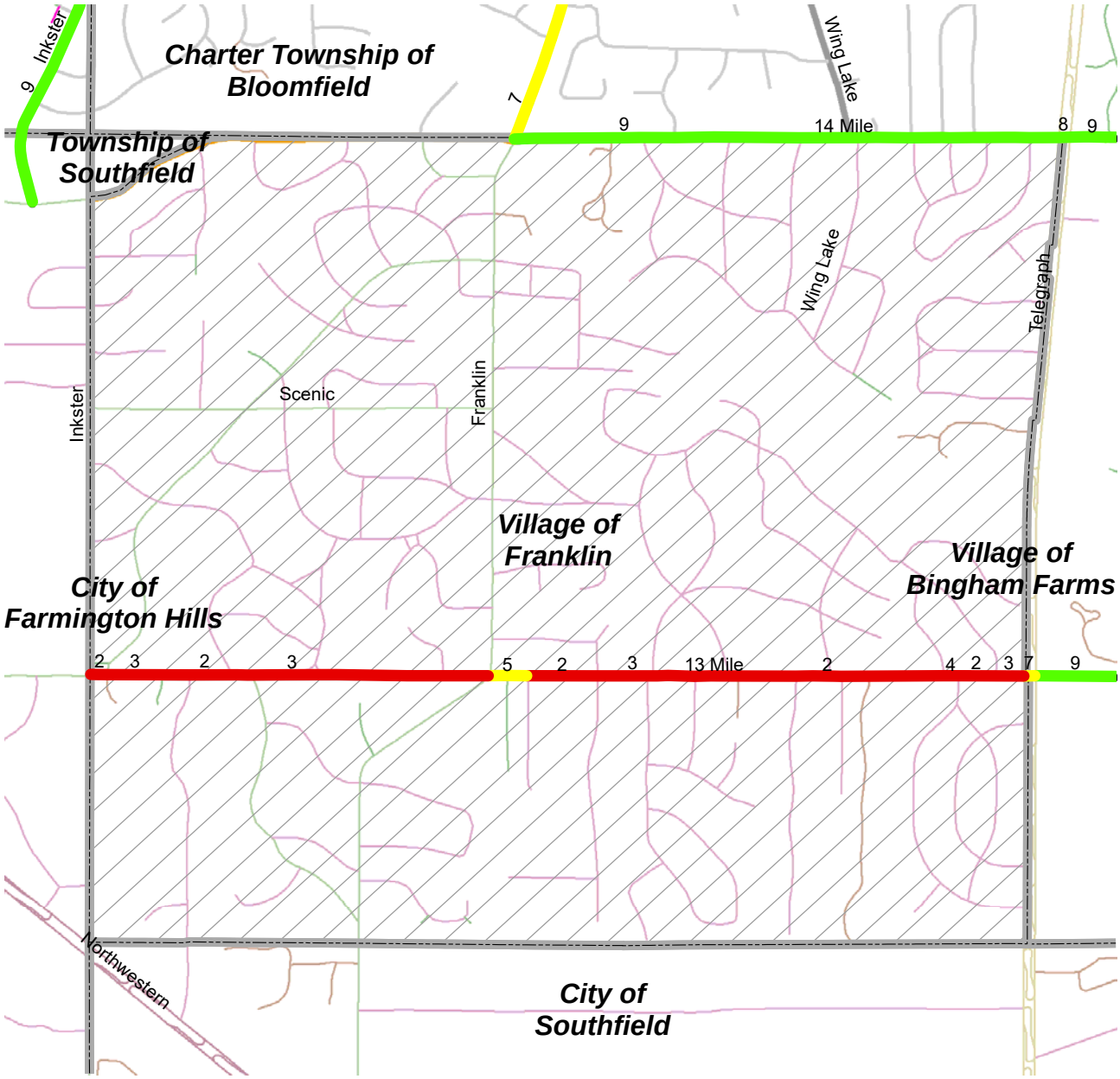

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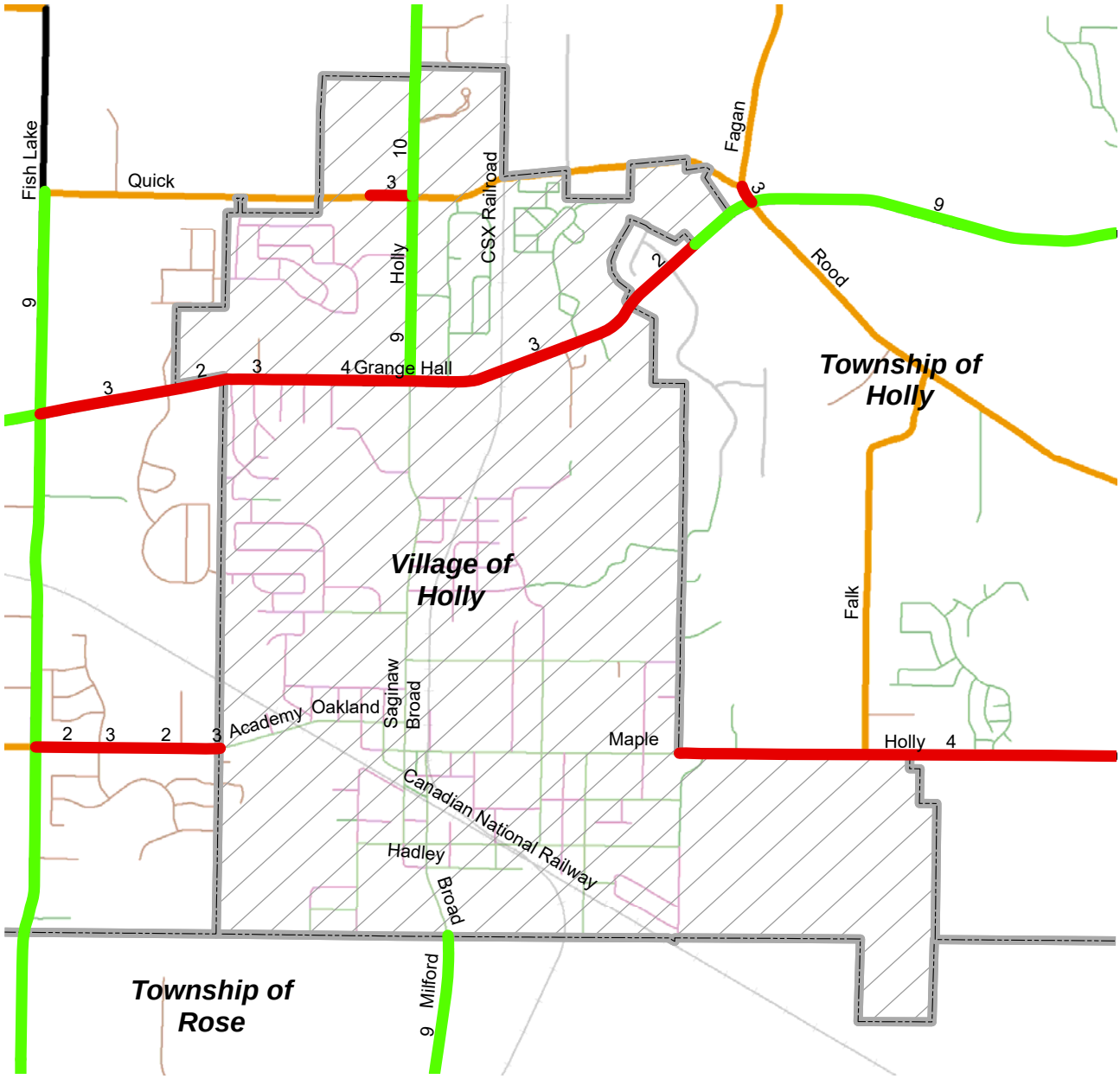

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- Park Roads
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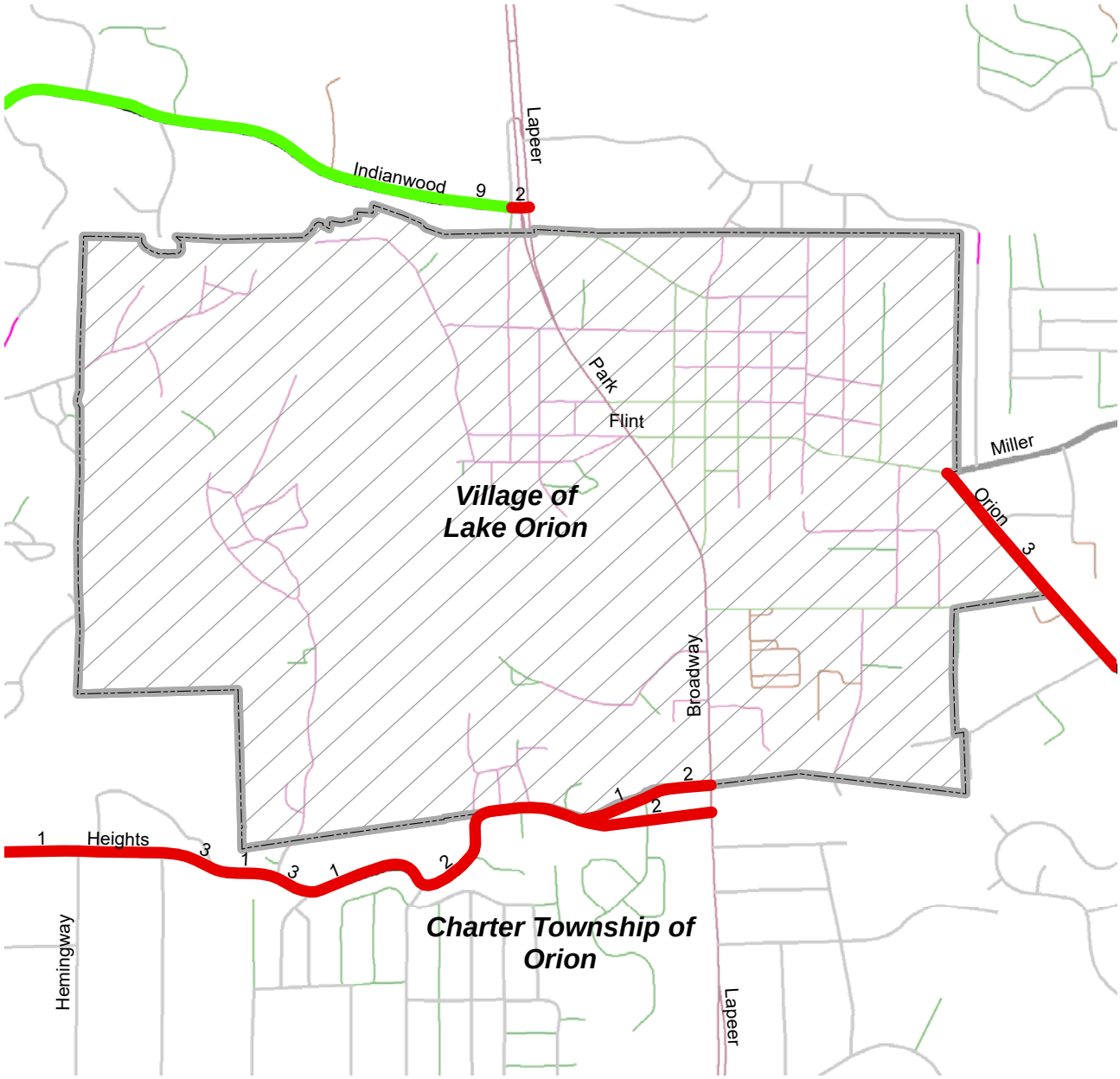
- Unknown

N

ROAD COMMISSION for OAKLAND COUNTY

2020 PAVEMENT CONDITION
RCOC PAVED PRIMARY AND LOCAL ROADS



Legend
RCOC Paved Primary and Local Roads

LASTRATING
- 8 - 10 (Good)
- 5 - 7 (Fair)
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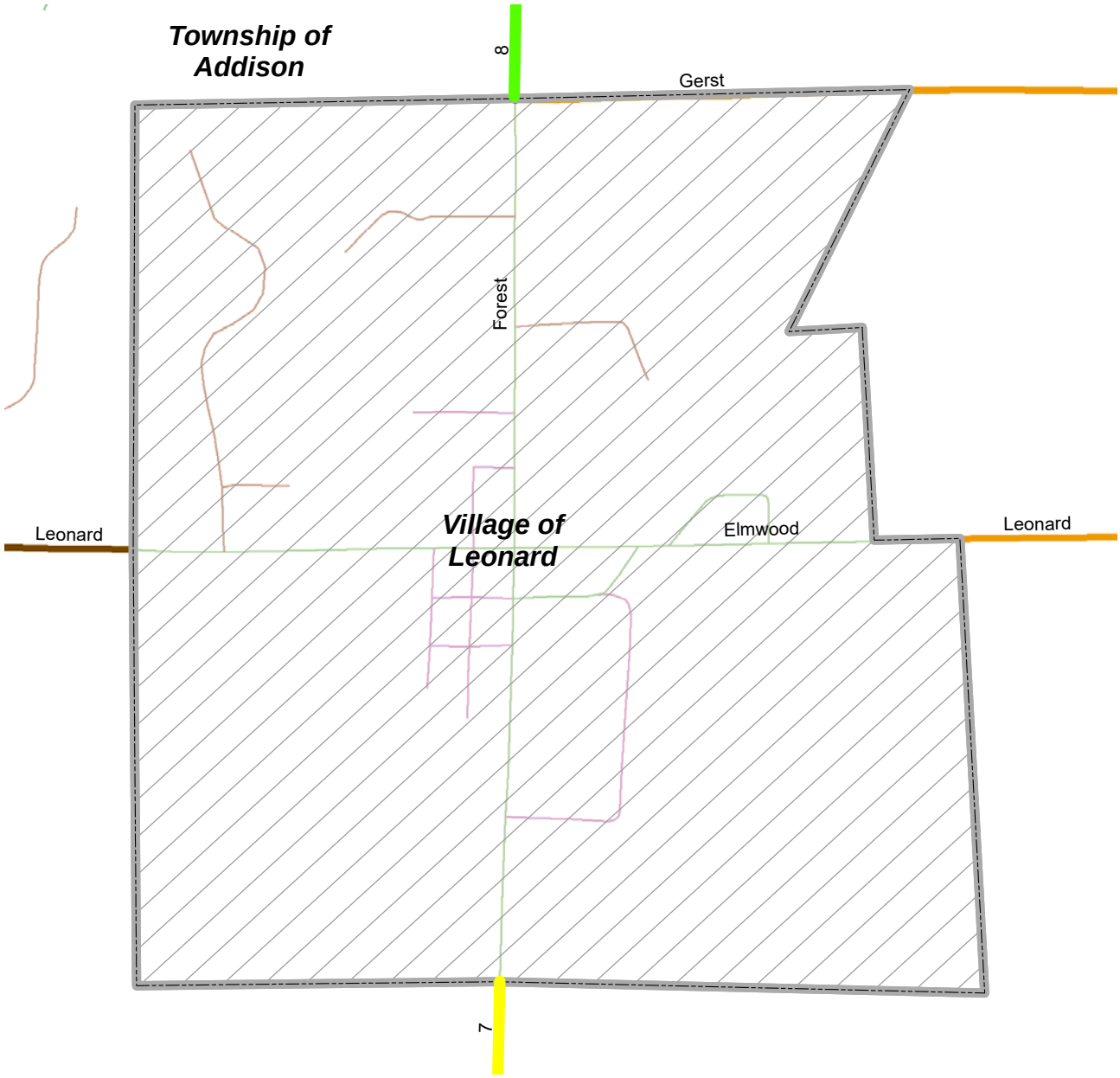

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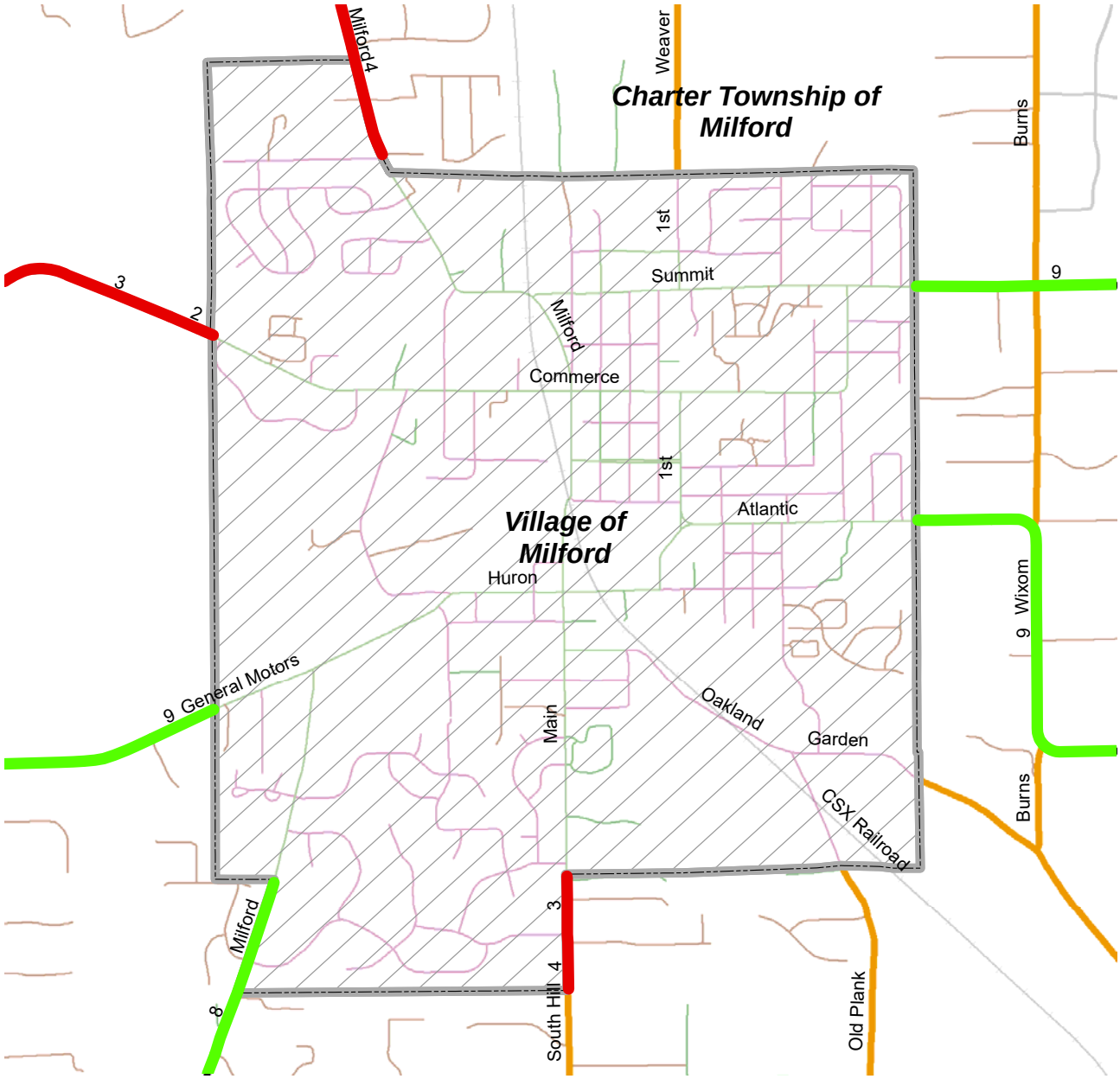

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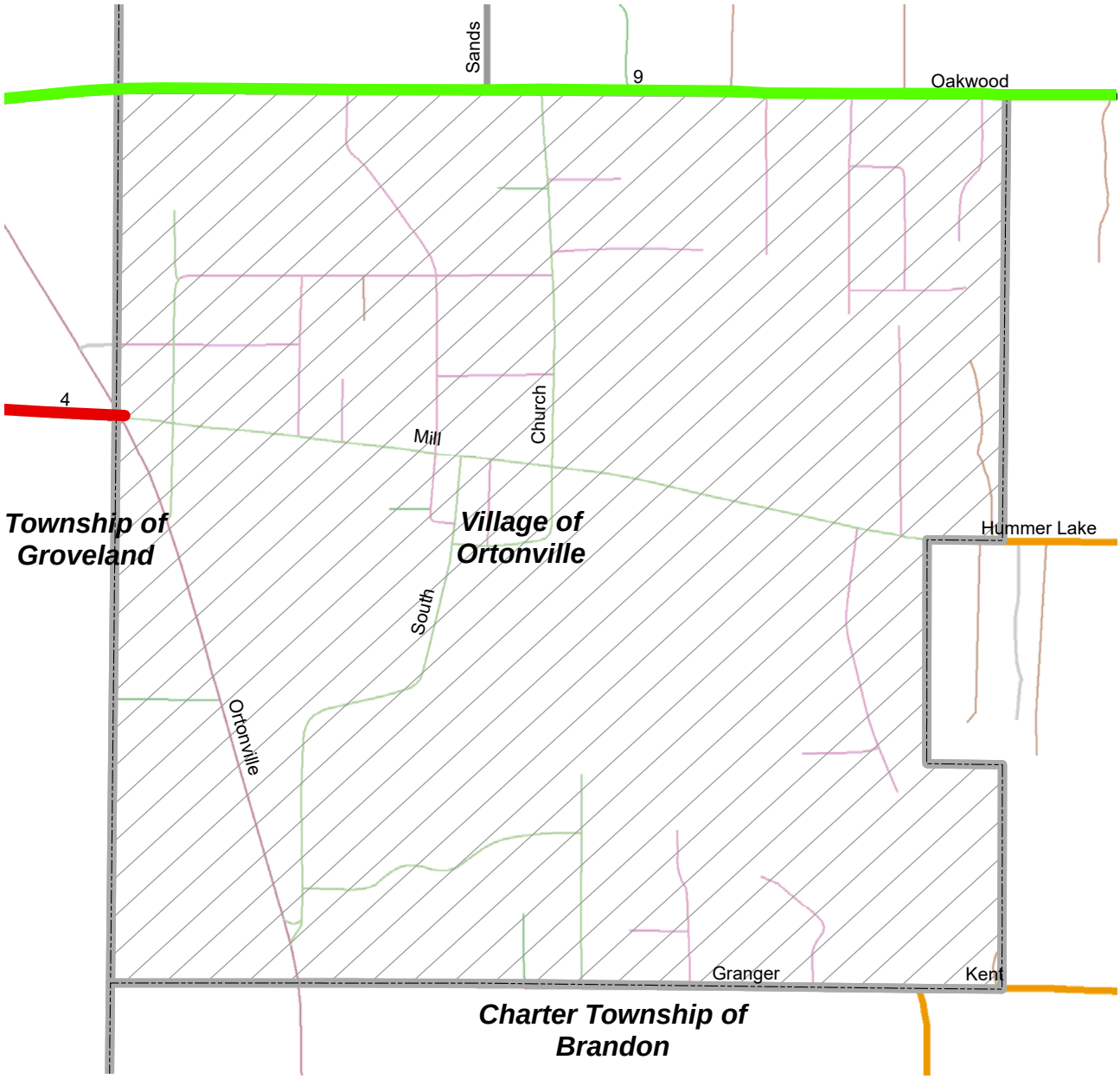

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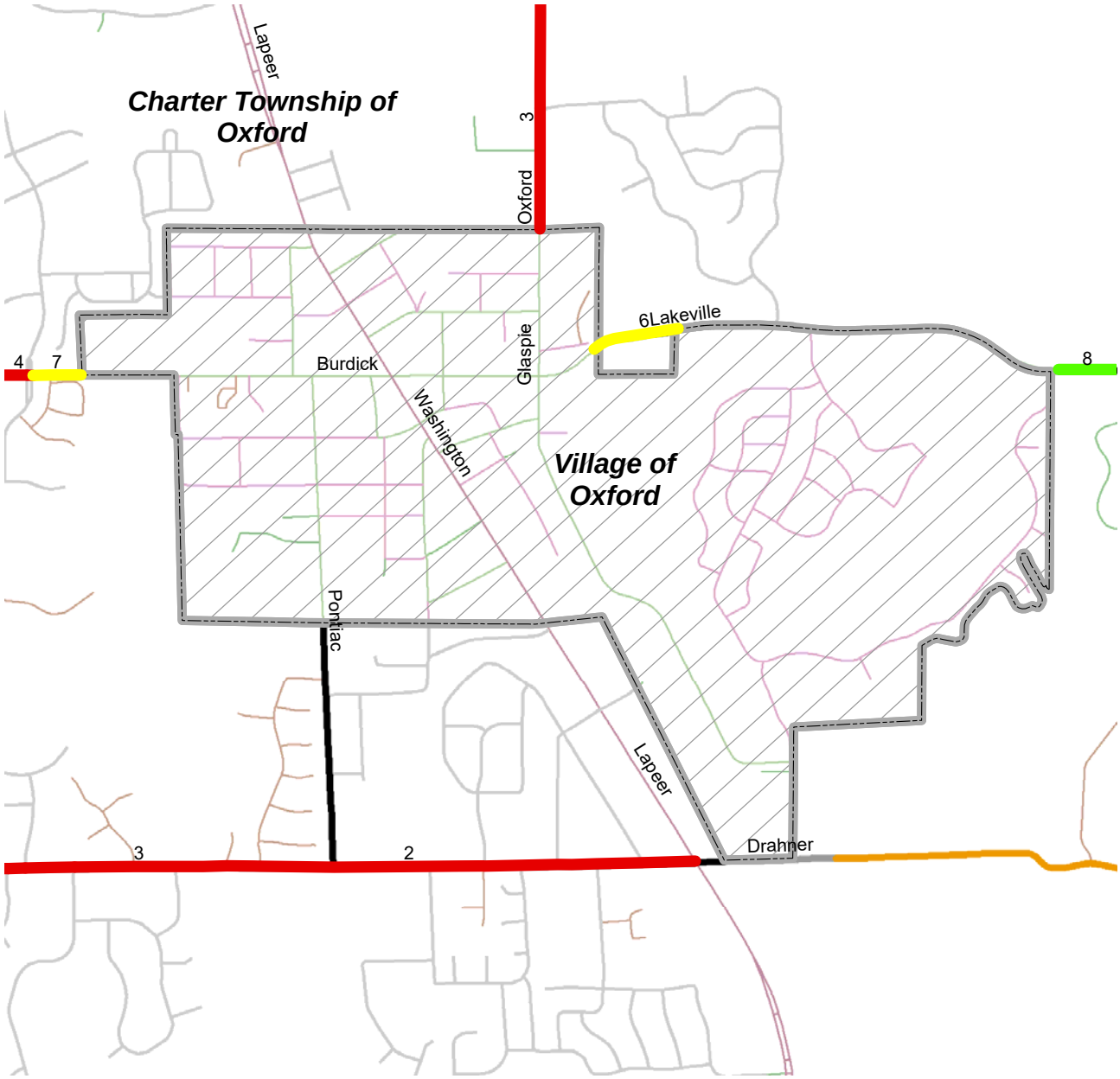

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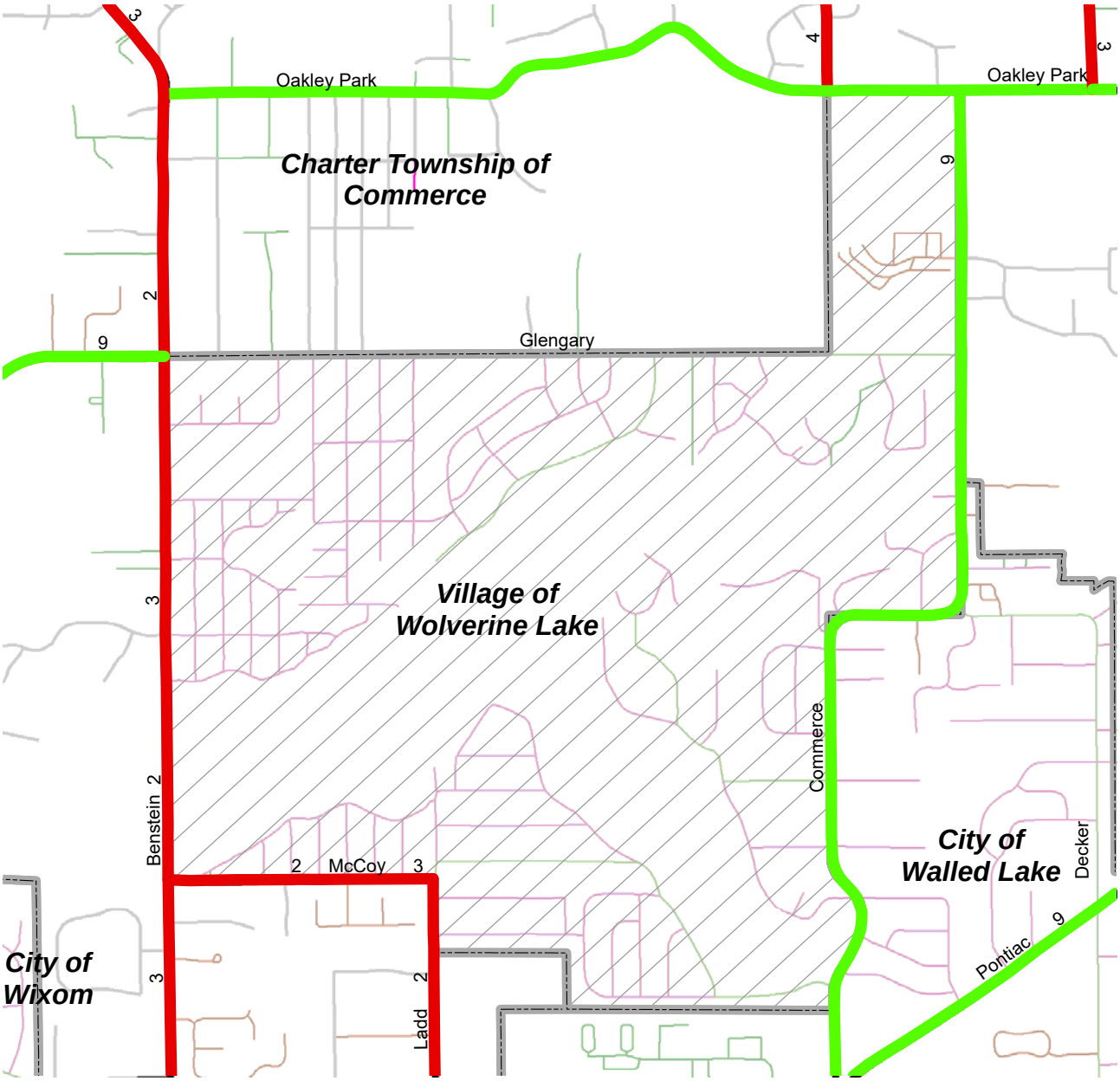

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ROAD COMMISSION for OAKLAND COUNTY

APPENDIX E: MEETING MINUTES VERIFYING PLAN ACCEPTANCE BY GOVERNING BODY

COPY OF RESOLUTION ADOPTED BY THE BOARD OF COUNTY ROAD COMMISSIONERS OF THE COUNTY OF OAKLAND, MICHIGAN UNDER DATE OF SEPTEMBER 23, 2021

WHEREAS, the Road Commission for Oakland County is required by law to certify its compliance with Public Act (PA) 325 of 2018; and

WHEREAS, the Road Commission for Oakland County has more than 100 certified miles; and

WHEREAS, the Road Commission for Oakland County has developed a Transportation Asset Management Plan (TAMP) for its road, bridge, culvert and traffic signal assets per Public Act 325; and

WHEREAS, the Road Commission for Oakland County has met the minimum requirements as outline by PA 325 and agency-defined goals and objectives;

NOW, THEREFORE, BE IT RESOLVED that the Board of County Road Commissioners of the County of Oakland approves and adopts the TAMP.

BE IT FURTHER RESOLVED that the Chair of the Board and the Director of Finance are hereby authorized to sign the Certification form.

I hereby certify that the above is a true and correct copy of a resolution adopted by the Board of County Road Commissioners of the County of Oakland, State of Michigan under date of September 23, 2021

Shannon Miller Digitally signed by Shannon Miller Date: 2021.09.23 11:27:36 -04'00'

Shannon J. Miller, Deputy-Secretary/Clerk of the Board

B. BRIDGE ASSET MANAGEMENT PLAN

An attached bridge asset management plan follows.

Appendix B

2021 BRIDGE Asset Management Plan

Prepared by: *Planning and Environmental Concerns Department*

Contact information: Sarah Plumer, Planning Coordinator (248)-645-2000, splumer@rcoc.org

ROAD COMMISSION for OAKLAND COUNTY

QUALITY LIFE THROUGH GOOD ROADS – WE CARE

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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 Road Commission for Oakland County's (RCOC) bridges, other road-related assets, and support systems are some of the most valuable and extensive public assets. The cost of building and maintaining bridges, their importance to society, 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 RCOC is meeting its obligations to maintain the bridges for which it is responsible.

This plan overviews RCOC's bridge assets and conditions and explains how the Road Commission for Oakland County works to maintain and improve the overall condition of those assets. These explanations can help answer:

- What kinds of bridge assets RCOC has in its jurisdiction and the different options for maintaining these assets.
- What tools and processes RCOC uses to track and manage bridge assets and funds.
- What condition RCOC's bridge assets are in 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 where those funds come from.
- How funds are used, and the costs incurred during RCOC's bridge assets' normal life cycle.
- What condition RCOC can expect of its bridge assets if those assets continue to be funded at the current funding levels.
- How changes in funding levels can affect the overall condition of RCOC's bridge assets.

RCOC owns and manages 116 bridges. A summary of its historical and current bridge asset conditions, projected trends, and goals can be seen in the Figure 1, below.

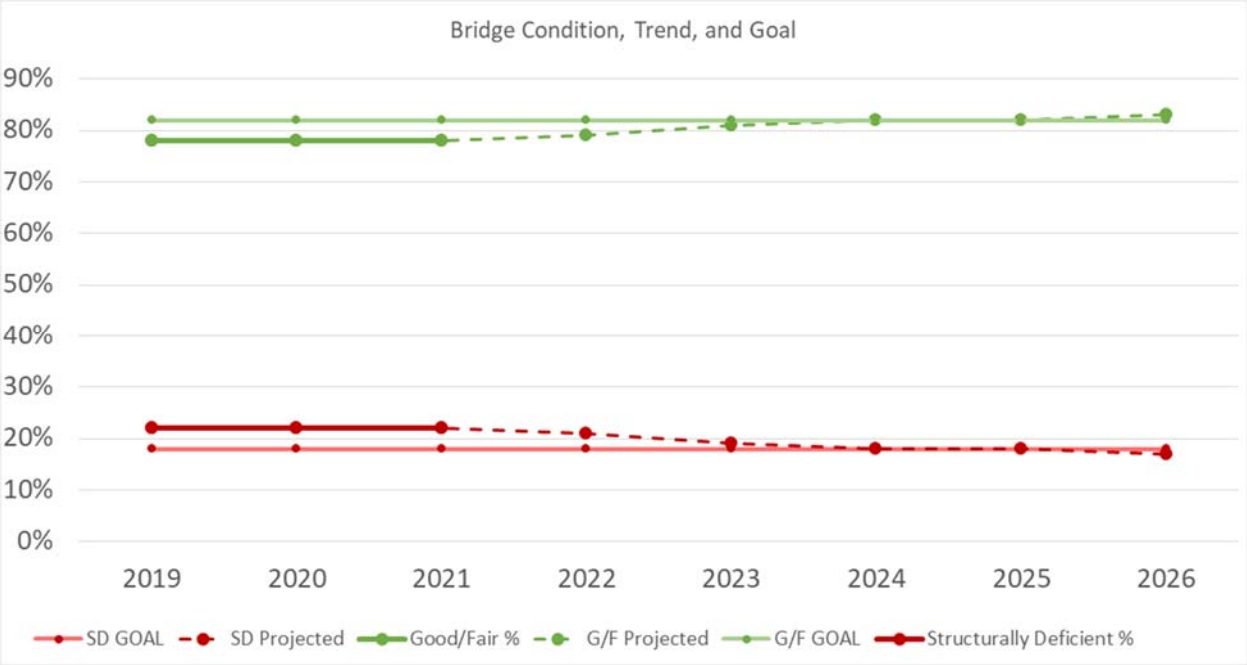

Figure 1: Bridge Condition, Trend, Goal.

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

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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 Road Commission for Oakland County 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 Road Commission for Oakland County’s 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.

The Road Commission for Oakland County (RCOC) 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. RCOC is responsible for maintaining and operating 116 bridges.

This 2021 plan outlines how RCOC determines its strategy to maintain and upgrade bridge asset condition given agency goals, priorities of its 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 Sarah Plumer at 31001 Lahser Road, Beverly Hills, MI 48025or at (248)-645-2000 and/or splumer@rcoc.org. A copy of this plan can be accessed on our website at rcocweb.org.

Key terms used in this plan are defined in RCOC’s 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. These bridges can extend across one or multiple spans.

Figure 2: Girder Bridge

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. (Note: The Compliance Plan Appendix C contains a primer on culverts not defined as bridges.)

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

The most common bridge design is the **girder system** (Figure 2, RCOC's bridge on Novi Road over CSX Railroad). 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 7).

Figure 3: Slab Bridge

A similar design that lacks girders is a **slab bridge** (Figure 3, RCOC's bridge on Dutton Road over Paint Creek). A slab bridge transfers the vehicle load directly to the abutments and, if necessary, piers.

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 4, RCOC does not have any truss bridges as of August 2021). Structural members may consist of steel tubes or angles connected at joints with gusset plates.

Figure 4: Truss Bridge

Another common bridge design in Michigan is the **three-sided pre-cast box** or arch bridge (Figure 5, RCOC's bridge on Kirkway Road over Lower Long Lake).

Michigan is also home to several unique bridge designs.

Adding another layer of complexity to bridge typing is the primary construction materials used (Figure 6). 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 5: Three-sided Box Bridge

Figure 6: 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 the 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 7). 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 costs more than two-thirds of the cost of replacement. Replacement is generally the most expensive of the treatment options.

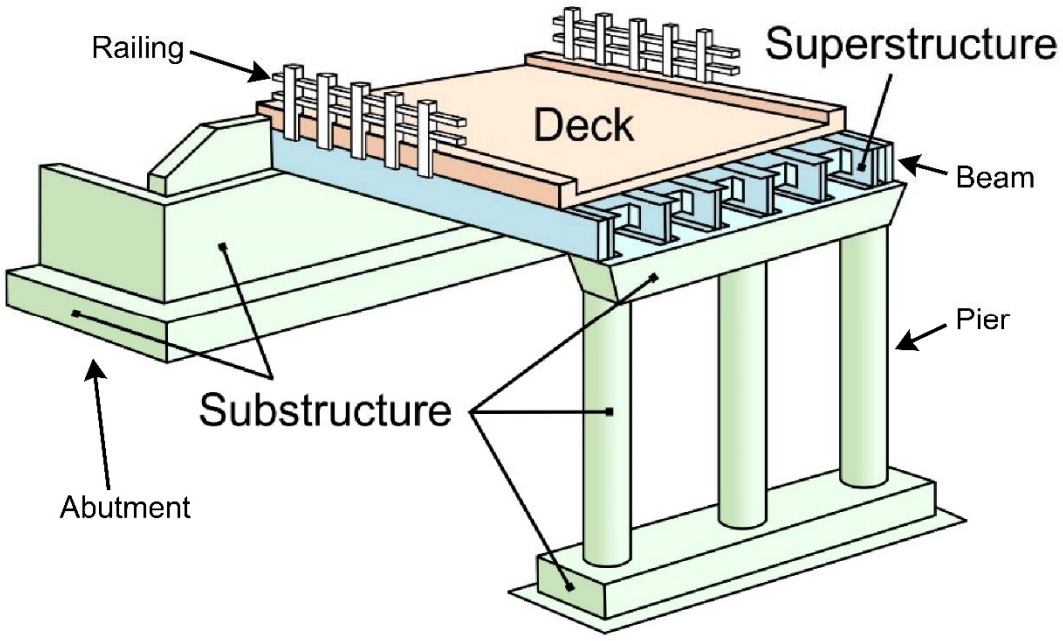

Figure 7: Diagram of basic elements of a bridge.

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 fixed 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 7). 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 7). 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 is performed if there is 50 percent or more spalling (i.e., loss of material) at the ends of beams.
- **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's (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 done 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 poor (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 need to 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.

Preventive Maintenance (Continued)

- **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 7).

- **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:** A bridge's approach 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 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

RCOC follows 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 RCOC's 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, RCOC's 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, RCOC 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, RCOC identifies 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 RCOC's asset management program is the preservation and safety of its bridge network, increase of its bridge assets' useful service life by extending of the time that bridges remain in good and fair condition, and reduction of future maintenance costs. Overall, RCOC goal is to maintain or improve bridge conditions network-wide at or above 2020 levels. To quantify this goal, RCOC specifically aims to have to have 82% or more of the agency's local bridges in fair to good condition and to have less than 18% classify as structurally deficient over its four-year plan.

Thus, RCOC's asset management plan objectives are:

- To establish the current condition of the county's 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 those eligible bridges in need of replacement.
- To identify available funding sources, such as:
    - Dedicated county resources.
    - County 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 preserve bridges currently rated fair (5) or higher in their current condition in order to extend their useful service life.

INVENTORY

RCOC is responsible for 116 local bridges. Table 2 summarizes RCOC's 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 3, 4, and 5. The bridge inventory data was obtained from MDOT MiBRIDGE and other sources, and the 2021 condition data and maintenance actions are taken from the inspector's summary report (see Appendix 2).

Types

Of the RCOC's 116 structures, 29 are concrete bridges, 28 are steel bridges, 45 are pre-stressed concrete bridges, and 14 are timber bridges.

Locations and Sizes

Figure 8 illustrates the locations of bridge assets owned by RCOC and the bridge condition. Details about the locations and sizes of each individual asset can be found in RCOC's MiBRIDGE database. For more information, please refer to the agency contact listed in the *Introduction* of this bridge asset management plan.

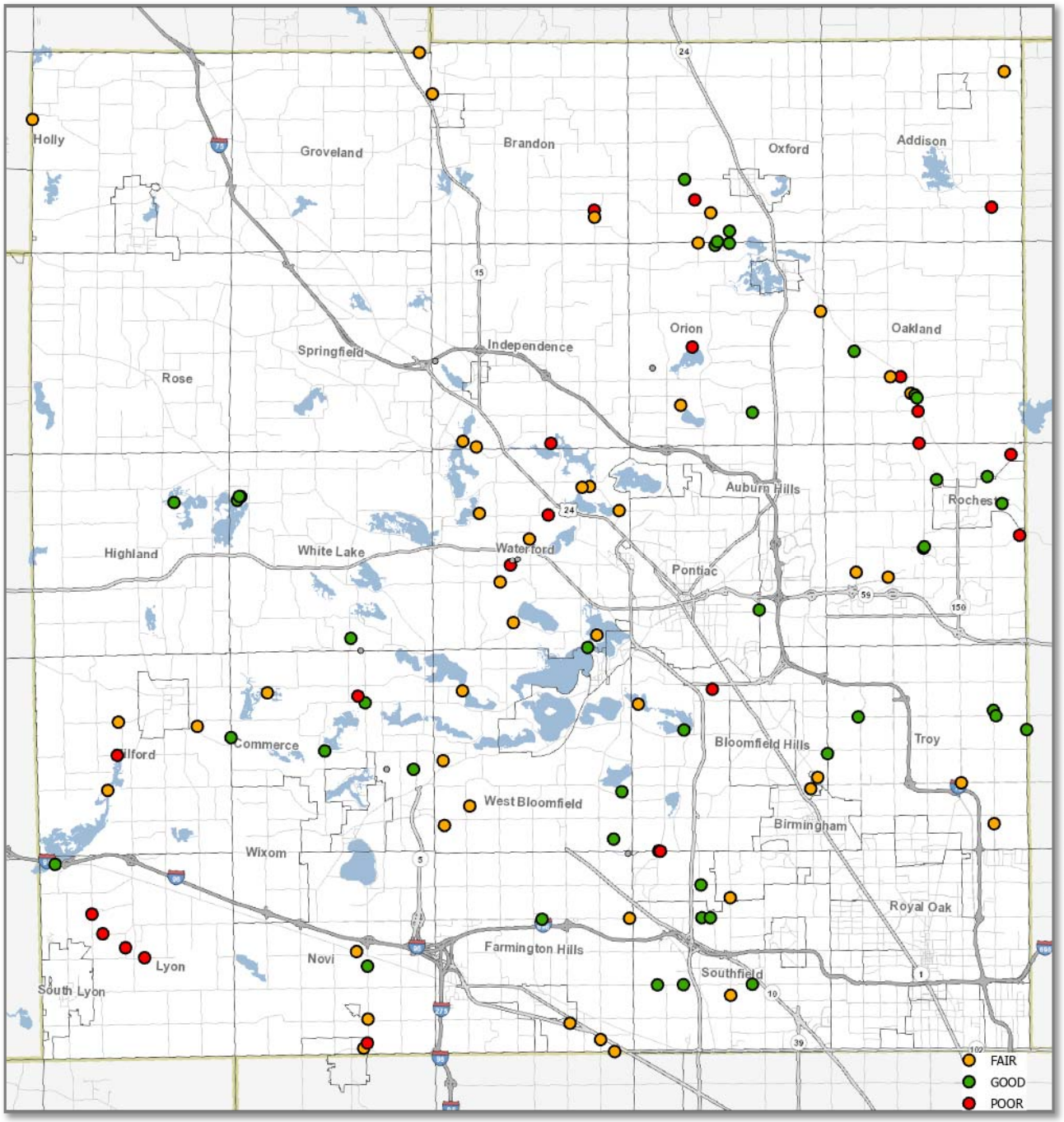

Figure 8: Map illustrating locations RCOC's of bridge assets.

Condition

RCOC 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. The current condition of RCOC's bridge network is 43 (37%) are good, 47 (41%) are fair, and 26 (22%) are poor or lower (Table 2).

Another layer of classification of RCOC's bridge inventory classifies 26 (22%) bridges as structurally deficient, 25 (22%) bridges as posted, and 0 (0%) bridges as closed (Table 2). 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: Bridge Assets by Type: Inventory, Size, and Condition

Bridge Type	Total Number of Bridges	Total Deck Area (sq ft)	Condition: Structurally Deficient, Posted, Closed			2021 Condition		
			Struct. Defic	Posted	Closed	Poor	Fair	Good
Concrete – Culvert	23	55,813	0	0	0	0	6	17
Concrete – Slab	1	614	0	1	0	0	0	1
Concrete – Tee beam	2	8,795	1	2	0	1	1	0
Concrete continuous – Slab	3	19,127	0	2	0	0	1	2
Prestressed concrete – Box beam/girders—multiple	33	69,941	7	6	0	7	20	6
Prestressed concrete – Box beam/girders—single/spread	4	20,281	0	0	0	0	0	4
Prestressed concrete – Multistringer	8	53,013	0	0	0	0	2	6
Steel – Culvert	28	51,951	7	11	0	15	6	1
Timber – Girder and floorbeam	1	1,456	0	1	0	0	1	0
Timber – Slab	13	20,605	3	2	0	3	4	6
Total SD/Posted/Closed			**26**	**25**	**0**			
Total	**116**	**301,596**				**26**	**47**	**43**
Percentage (%)			**22%**	**22%**	**0**	**22%**	**41%**	**37%**

Statewide, MDOT's statistics for local agency bridges show that 14% are poor and 86% are good/fair, indicating that the RCOC has a greater percentage of poor bridges compared to the statewide average for local county agencies. Correspondingly, RCOC has 78% of its bridges in fair/good condition versus the statewide average of 86% for local county agency bridges. Statewide, 14% of local county agency bridge deck area classifies as structurally deficient compared to 22% of RCOC's bridge deck area.

GOALS

The goal of RCOC's 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 82% of its bridges rated fair/good and having less than 18% classify as structurally deficient within four years. These goals are juxtaposed with the historic and current condition and the projected trend in Figure 9.

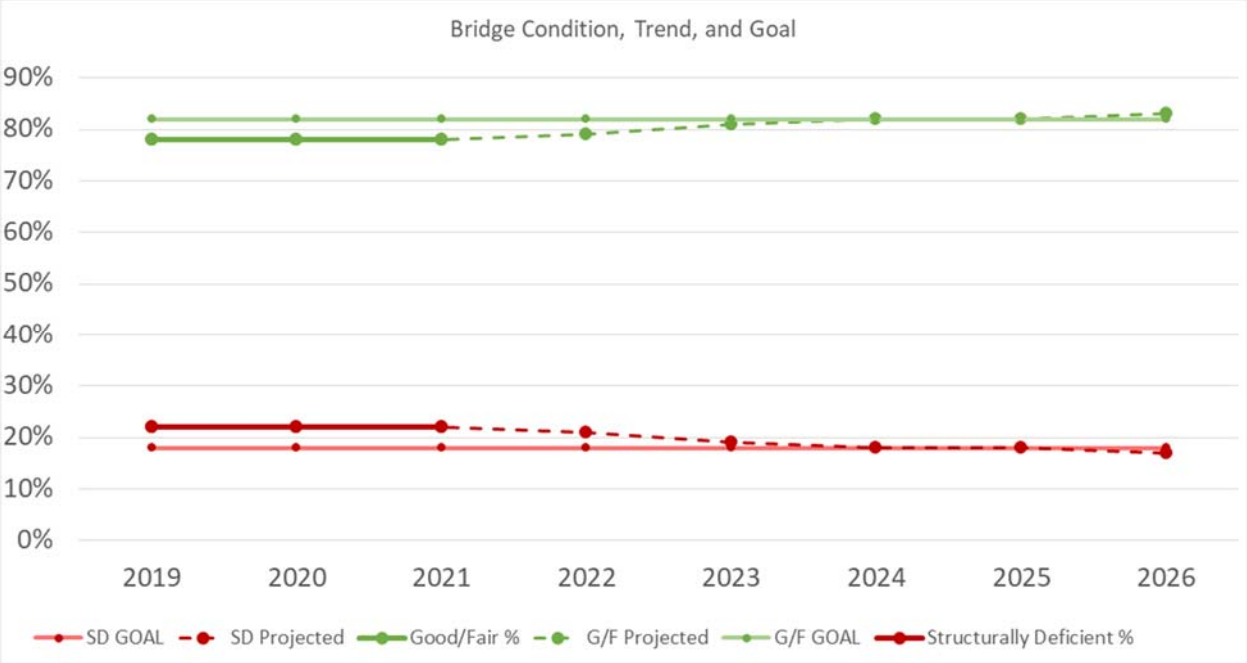

Figure 9: Progress tracking graph indicating RCOC's historic and current bridge conditions, projected trends, and goals.

Several metrics will be used to assess the effectiveness of this asset management program. RCOC 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.

PRIORITIZATION, PROGRAMMED/FUNDED PROJECTS, AND PLANNED PROJECTS

Prioritization

RCOC's 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. Therefore, RCOC prioritizes bridges for projects by evaluating five factors and weighting them as follows: condition –30%, load capacity –25%, traffic –20%, safety –15%, and detour –10%. There are several components within each factor, including, but not limited to structural adequacy, functional adequacy, annual average daily traffic (AADT), road classification, posted load restriction, and economic importance. Each project under consideration is prioritized based on these factors and components.

RCOC annually reviews the current condition of each of the 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 RCOC's bridges in Appendix 3. RCOC then determines management and preservation needs and corresponding actions for each bridge (Appendix 4). As well as inspection follow-up actions (Appendix 5). The management and preservation actions are selected in accordance with criteria contained in the Table 3 (below) and adapted to RCOC's specific 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		
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] • *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*]

Table 3: Summary of Preservation Criteria		
Preservation Action	**Bridge Selection Criteria**	**Expected Service Life**
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 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]	40 years [6]
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	40 years [6]
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* Safety improvement is needed [1]	40 years [6]
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	40 years [6]
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] • 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]	25 years
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]	5 years [6]
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]	20 years [6]

Table 3: Summary of Preservation Criteria		
Preservation Action	**Bridge Selection Criteria**	**Expected Service Life**
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]	15 years [6]
Pin and Hanger Replacement	• NBI rating of 4 or less for superstructure for pins and hangers [1] [2] • *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]	20 years [6]
Partial Repainting	• See Zone or Spot Painting	10 years [6]
Channel Improvements	• Removal of vegetation, debris, or sediment from channel and banks to improve channel flow • *OR* in response to inspector's work recommendation	10 years [6]
Scour Countermeasures	• OR NBI comments in abutment and pier ratings indicate presence of scour holes [1] [2]	15 years [6]
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]	20 years [6]
Guard Rail Repair/Replacement	• Guard rail missing or damaged [2*] • *OR* Safety improvement is needed [2*]	20 years [6]
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]	2 years

Table 3: Summary of Preservation Criteria		
Preservation Action	**Bridge Selection Criteria**	**Expected Service Life**
	• *OR* NBI rating comments for drainage system indicate need for cleaning or repair [1] [2]	
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]	5 years [6]
Riprap Installation	• To protect surface when erosion threatens the stability of side slopes of channel banks	10 years [6]
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]	10 years [6]
Concrete Sealing	• Top surface of pier or abutments are below deck joints and, when contaminated with salt, salt can collect on the surface [1] • *OR* Surface of the concrete has heavy salt exposure. Horizontal surfaces of substructure elements are directly below expansion joints [1]	5 years [6]
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 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]	5 years [6]

Table 3: Summary of Preservation Criteria		
Preservation Action	**Bridge Selection Criteria**	**Expected Service Life**
HMA Surface Repair/Replacement	• HMA surface is in poor condition • *OR* In response to inspector's work recommendation	15 years [6]
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	5 years [6]
Timber Repair	• NBI rating of 4 or less for substructure for timber members • *OR* To repair extensive rot, checking, or insect infestation	15 years [6]
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.

Additional information from the following source:

[6] RCOC

In terms of management and preservation actions, RCOC's asset management program uses a "mix of fixes" strategy that is made up of replacement, rehabilitation, 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.

RCOC'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 will 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 RCOC's annual applications.

To achieve its goals, a primary objective of RCOC's asset management program is to repair and/or replace least 5 bridges rated poor (4 or lower) to a rating of fair (5) or higher within a four-year time period through management and/or preservation activities. The primary work activities that will be used to meet this improvement objective include replacement, rehabilitation, preventive maintenance, and scheduled maintenance. The work has been prioritized by considering each individual bridge's needs, its importance, the present costs of improvements, and the impact of deferral (i.e., cost increase due to increased degradation). Additionally, RCOC's asset management program incorporates preservation of bridges currently rated fair (5) or higher in their current condition in order to extend their useful service life. The primary work activities used to meet this preservation objective include rehabilitation, preventive maintenance, and scheduled maintenance. A bridge-by-bridge preservation or maintenance plan is presented in Appendix 4.

Programmed/Funded Projects

RCOC receives appromately $5,000,000 total funding per year for bridge improvements. To achieve its goals, RCOC plans to spend on average $150,000 per year on scheduled and/or preventive maintenance of bridges. Five bridges will be replaced from 2021-2023 at a total cost of nearly $11,000,000. One to six bridges will be replaced in 2024 at a total cost ranging from $2,000,000 to $12,000,000. The number of bridges to be replaced in 2024 will be determined based on which applications submitted to MDOT's Local Bridge Program (LBP) are selected to be funded and what other funding opportunities become available. By performing the aforementioned preventive maintenance and replacement of bridge structures, RCOC will meet its overall bridge network condition goals.

RCOC 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 such as maintenance of traffic, staged construction, scour countermeasures, and so forth, are computed on a bridge-by-bridge basis. The cost estimates are reviewed and updated annually. The list of RCOC 2021-2024 bridge projects can be found in Table 4, below, and Figure 10 illustrates the locations of these bridge projects. A summary of programmed/funded projects and investments can be found in the Cost Projection table (Table 5).

Table 4: 2021-2024 Bridge Projects			
Bridge Structure #	**Location**	**Project Type**	**Project Cost**
2021 Projects (Programmed)			
8167	Grand River Avenue over CSX	Rehabilitation (Wall Replacement)	$2,200,000
8182	Avon Road over Clinton River	Replacement (Total)	$2,900,000
2022 Projects (Programmed)			
8171	Grand River Avenue over Kent Lake	Preventive Maintenance (Epoxy Overlays)	$250,000
8183	Hatchery Road over Clinton River	Replacement (Total)	$1,997,000
8184	Parkdale Road over Stony Creek	Rehabilitation (HMA Overlay w/Membrane)	$250,000
8192	Tienken Road over Stony Creek	Rehabilitation (HMA Overlay w/Membrane)	$250,000
13506	Novi Road over CSX	Preventive Maintenance (Epoxy Overlays)	$250,000
14036	Cooley Lake Road over Huron River	Replacement (Total)	$1,788,000
2023 Projects (Programmed)			
8194	Dutton Road over Paint Creek	Replacement (Total)	$2,196,000
8211	Maloney Street over Clear Long Lake Canal	Replacement (Total)	$1,981,000
2024 Projects (TBD)			
8200	12 Mile Road over Novi-Lyon Drain	Replacement (Total)	$1,812,000
8201	Martindale Road over Novi-Lyon Drain	Replacement (Total)	$1,897,000
8207	Gunn Road over Paint Creek	Replacement (Total)	$2,197,000
13648	11 Mile Road over Novi-Lyon Drain	Replacement (Total)	$1,832,000
13810	Pontiac Lake Road over Clinton River	Replacement (Total)	$2,213,000
13934	Farr Road over Huron River	Replacement (Total)	$2,043,000

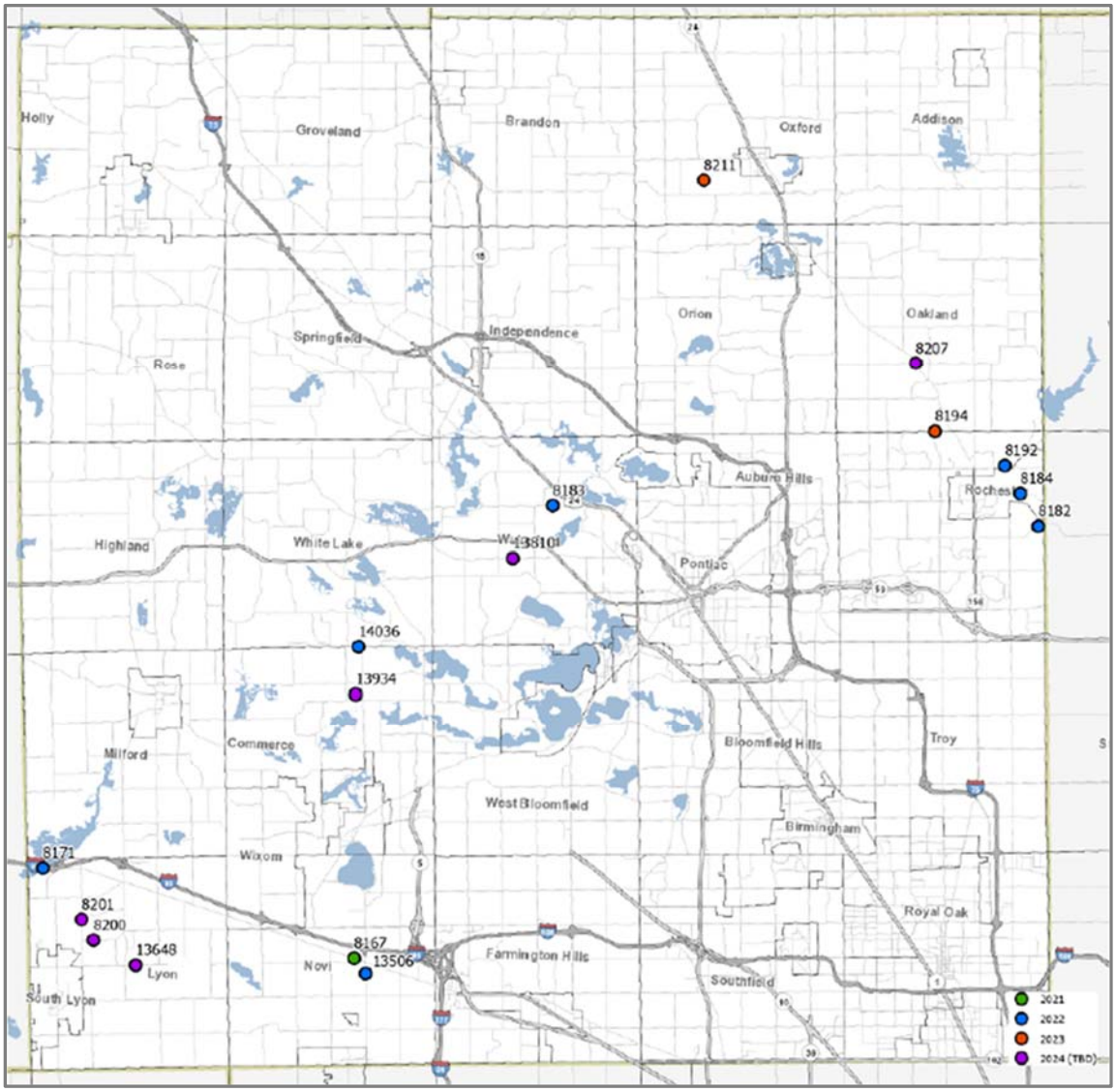

Figure 10: Map illustrating locations RCOC's of bridge projects for 2021-2024.

Planned Projects

RCOC also identifies priority projects that remain unfunded in Table 5. These are identified as GAP projects and involve applications that were submitted to the LBP but not selected for funding. The 2024 planned projects still need to be determined (TBD) based on LBP funding and other funding opptorunities that may become available.

GAP ANALYSIS

When RCOC compares its funding and its programmed/funded projects with all of its prioritized projects as shown in Table 5, RCOC believes it should be able to achieve all of its asset management goals for the period of this plan. For projects that it is unable to complete, RCOC will continue to monitor those bridge assets and take any necessary steps within its budget to prevent or mitigate a condition decline or a need to post or close the structure.

Table 5: Cost Projection Table

Strategy	2021 (Programmed)	2022 (Programmed)	2023 (Programmed)	2024 (TBD)	GAP (LBP Application Year)
Replacement					
8182	$2,900,000				
8183		$1,997,000			
14036		$1,788,000			
8211			$1,981,000		
8194			$2,196,000		
13648				$1,832,000	
8207				$2,197,000	
13810				$2,213,000	
8201				$1,897,000	
13934				$2,043,000	
8200				$1,812,000	
13648					$1,746,000 (FY 2021)
8207					$1,755,000 (FY 2022)
13810					$1,953,000 (FY 2023)
8201					$1,690,000 (FY 2023)
8144					$1,778,000 (FY 2023)
Subtotal	***$2,900,000***	***$3,785,000***	***$4,177,000***	***$11,994,000***	***$8,922,000***
Rehabilitation					
8167	$2,200,000				
8192		$250,000			
8184		$250,000			
Subtotal	***$2,200,000***	***$500,000***	$0	$0	$0
Preventive Maintenance					
8171		$250,000			
13506		$250,000			
Subtotal	***$0***	***$500,000***	$0	$0	$0

2. Financial Resources

ANTICIPATED REVENUES

RCOC has programmed projects that uses RCOC funding for bridge preservation for the purpose of rehabilitation and preventive maintenane, for the following bridge(s): 8171, 8184, 8192, and 13506. This funding is intended for use in the 2022. RCOC funding comes from several annual revenue sources, such as fuel and vehicle taxes, federal and state revenue, local government revenue, fees and other revenues. More information on RCOC funding can be found in the *Financial Resources* section of the Compliance Plan.

RCOC has programmed projects that uses MDOT local-aid funding, RCOC funding, and federal funding for the purpose of replacement and rehabilitation, for the following bridge(s): 8167, 8182, 8183, 8194, 8211, and 14036. This funding is intended for use in the year(s) 2021, 2022, and 2023.

RCOC applied for MDOT local-aid funding and federal funding that includes local match from RCOC funding. This funding was requested in the application year of 2024, for the purpose of replacement, for the following bridge(s): 8200, 8201, 8207, 13648, 13810, and 13934. This funding is intended for use in the 2024.

RCOC foresees doing or desires to do unplanned, unfunded (gap) projects with MDOT local-aid funding, federal funding, and RCOC funding. This funding would likely be requested in the application year(s) 2024 and 2025, for the purpose of replacement, for the following bridge(s): 8144, 8201, 8207, 13648, and 13810.

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

RCOC 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.

RCOC manages these risks by performing regular bridge inspections and implementing a preventative maintenance strategy when necessary.

RCOC administers the biennial inspection of its bridges in accordance with NBIS and MDOT requirements. The inspection reports document the condition of RCOC's bridges and evaluates them for defects and progress of deterioration. The summary inspection report in Appendix 2 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 RCOC's 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. RCOC has scour critical bridges, which are listed in Table 6.

Table 6: Bridges that are Considered Scour Critical

Scour Critical Bridges	
Bridge Structure Number	**Scour Critical Rating**
8151	3
8163	3
8182	3
8193	3
12683	3
13423	3
13941	3

RCOC has posted or closed bridges that are critical to accessing entire areas or individual properties within its jurisdiction. These bridges that are critical links are listed in Table 7.

Table 7: Posted or Close Bridges that are Critical Links

Posted/Closed Bridges that are Critical Links		
Bridge Structure Number	**Posted/ Closed**	**Comments**
8144	Posted	Sashabaw Road over Clinton River (Unfunded/Gap Project, 2023 Application Year)
8182	Posted	Avon Road over Clinton River (2021 Replacement Project)
8183	Posted	Hatchery Road over Clinton River (2022 Replacement Project)
13423	Posted	Buno Road over Huron River
13810	Posted	Pontiac Lake Road over Clinton River (2024 LBP Application Submitted)

The preservation strategy identifies actions in the operations and maintenance plan that are preventive or that are in response 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.

APPENDIX 1: ADDITIONAL INSPECTION RECOMMENDATIONS

ROAD COMMISSION FOR OAKLAND COUNTY 2021 Bridge Inspection Report
Summary of Additional Inspection Recommendations

No outstanding inspection recommendations as of August 2021.

APPENDIX 2: INSPECTION REPORT EXECUTIVE SUMMARY

ROAD COMMISSION FOR OAKLAND COUNTY 2021 Bridge Inspection Report Executive Summary

Specific Recommendations as of August 2021.

13648 11 Mile Road over Novi-Lyon Drain
Constructed: 1972 **Reconstructed:** N/A **General Condition:** Poor
Description: Update posted load rating due to increased deterioration.
Recommendations: Budget for replacement.

8201 Martindale Road over Novi-Lyon Drain
Constructed: 1970 **Reconstructed:** N/A **General Condition:** Poor
Description: Update posted load rating due to increased deterioration.
Recommendations: Budget for replacement.

8211 Maloney Street over Clear-Long Lake Channel
Constructed: 1973 **Reconstructed:** N/A **General Condition:** Poor
Description: Posting sign should be moved to within 50’ of reference lines. Cracked deck boards marked with nail and steel washers in deck bottom.
Recommendations: Replace bridge. Replace missing nut on north end of spread beam and tighten nuts on spreader beam and rest of bridge. Monitor cracked deck boards.

APPENDIX 3: INVENTORY AND CONDITION

Inventory Data														Inspection Findings												Appraisal				
Bridge Type	Structure Number	Bridge ID	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)	Year Reconstr (Item 106)	ADT	Year of ADT	Inspection Date	Operational Status (Item 41)	Deck Rating (Item 58)	Deck Bottom Rating (Item XX)	SuperStr 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	Sufficiency Rating	Section Loss	Scour Critical (Item 113)
Prestressed concrete – Multistringer	8141	63200064000B010	WIXOM ROAD	HURON RIVER	Primary	5	2	1	62	2018		9900	2017	6/19/2020	A	8	8	8	8	8	N	8	N	8	N	G			N	5
Concrete continuous – Slab	8142	63200068000B010	NOVI RD	ROUGE RIVER	Primary	2	1	1	52.8	1959		23351	1989	6/2/2020	A	6	6	6	6	4	N	6	N	N	N	F	Funct Obs		N	8
Concrete – Culvert	8143	63200172000B010	CASS LAKE ROAD	CLINTON RIVER	Primary	1	19	1	35.7	2007		17800	2006	7/24/2020	A	N		N	N	7	8					G				5
Concrete – Tee beam	8144	63200176000B010	SASHABAW RD	CLINTON RIVER	Primary	1	4	1	33.8	1928		15800	2014	3/5/2020	P	3	3	3	4	7	N	4	N	N	N	P	Struct Def		N	5
Prestressed concrete – Box beam/girders—multiple	8145	63200184000B010	MIDDLEBELT RD	ROUGE RIVER	Primary	5	5	1	35	1964	2005	20809	1991	7/28/2020	A	8	N	7	5	6	N	7	N	7	N	F	Funct Obs		N	5
Steel – Culvert	8146	63200210000B010	FRANKLIN	ROUGE RIVER	Primary	3	19	2	29.9	1959		8740	1993	8/20/2020	A	N		N	N	6	4					P	Struct Def			8
Prestressed concrete – Multistringer	8147	63200230000B010	LAHSER RD	ROUGE RIVER	Primary	5	2	1	71.9	1983		17080	1994	7/21/2020	A	6	6	7	7	6	N	6	N	5	N	F			N	5
Prestressed concrete – Box beam/girders—multiple	8148	63200235000B010	LAHSER RD	ROUGE RIVER	Primary	5	5	1	64	1985		14766	1994	7/21/2020	A	6	N	7	8	6	N	6	N	4	N	F			N	5
Prestressed concrete – Box beam/girders—single/spread	8149	63200250000B010	OPDYKE RD	CLINTON RIVER	Primary	5	6	1	62	2018		19996	2018	2/17/2021	A	8	8	8	8	7	N	8	N	8	8	G			N	8
Concrete – Culvert	8150	63200278000B010	ADAMS ROAD	ROUGE RIVER	Primary	1	19	1	40	2004		16577	1991	8/20/2020	A	N		N	N	8	7					G				5
Prestressed concrete – Box beam/girders—multiple	8151	63200286000B010	ADAMS ROAD	CLINTON RIVER	Primary	5	5	1	35.8	1959		15351	1991	9/9/2020	A	8	N	5	5	5	N	8	N	N	N	F	Funct Obs		2	3
Prestressed concrete – Multistringer	8152	63200292000B010	ADAMS ROAD	PAINT CREEK	Primary	5	2	1	68.9	1986		7495	1991	9/3/2020	A	7	6	8	7	7	N	8	N	N	7	G			3	8
Prestressed concrete – Box beam/girders—multiple	8153	63200307000B010	CROOKS ROAD	CLINTON RIVER	Primary	5	5	1	52	1987		24769	2016	9/9/2020	A	6	N	7	7	7	N	6	N	N	6	F			2	5
Timber – Slab	8154	63200308000B010	GALLAGHER RD	PAINT CREEK	Primary	7	1	1	62	1989		350	1997	9/4/2020	A	6	6	6	7	6	N	6	N	N	N	F			N	5
Concrete – Culvert	8155	63200329000B010	ORION RD	PAINT CREEK	Primary	1	19	1	37.7	2014		8437	2011	9/4/2020	A	N		N	N	7	8					G				8
Prestressed concrete – Box beam/girders—multiple	8156	63200329000B020	ORION RD	PAINT CREEK	Primary	5	5	1	41	1996		9781	2016	9/4/2020	A	7	N	7	7	7	N	6	N	N	6	G			N	5
Concrete – Culvert	8157	63200348000B010	JOHN R	BARNARD DRAIN	Primary	1	19	2	34.8	1976		33632	1994	8/20/2020	A	N		N	N	5	6					F				4
Prestressed concrete – Box beam/girders—single/spread	8158	63200352000B010	JOHN R ROAD	GIBSON DRAIN	Primary	5	6	1	40	1988	2019	16870	2018	8/26/2020	A	8	8	9	7	6	N	8	N	8	N	G			N	5
Concrete – Culvert	8159	63200361000B010	DEQUINDRE ROAD	GIBSON DRAIN	Primary	1	19	1	30.1	2003		22495	1998	8/26/2020	A	N		N	N	6	8					G				7

Concrete – Culvert	8160	63200383000B010	BENSTEIN	HURON RIVER	Primary	1	19	1	30	2008		12380	2007	6/5/2020	A	N		N	N	7	8					G				8
Prestressed concrete – Box beam/girders—single/spread	8161	63200416000B010	LIVERNOIS ROAD	CLINTON RIVER	Primary	5	6	1	69.3	2012		15959	2012	9/9/2020	A	8	8	8	8	7	N	8	N	7	N	G			3	8
Steel – Culvert	8162	63200425000B010	KENSINGTON	ROUGE RIVER	Primary	3	19	3	32.8	1974		2406		8/20/2020	A	N		N	N	4	6					F	Funct Obs			8
Prestressed concrete – Multistringer	8163	63200507000B010	8 MILE RD	ROUGE RIVER	Primary	5	2	1	30.8	1966		20809	1991	7/21/2020	A	6	6	7	5	4	N	7	N	5	N	F	Funct Obs		3	3
Prestressed concrete – Box beam/girders—multiple	8164	63200536000B010	10 MILE RD	PEBBLE CREEK	Primary	5	5	1	44	1984		10737	1990	7/21/2020	A	7	N	7	7	4	N	7	N	N	N	G			N	5
Prestressed concrete – Box beam/girders—multiple	8165	63200537000B010	10 MILE RD	ROUGE RIVER	Primary	5	5	1	70.9	1995		16418	1995	7/21/2020	A	7	N	7	7	5	N	6	N	8	N	G			N	8
Concrete – Culvert	8166	63200539000B010	10 MILE ROAD	CLAIRE DRAIN	Primary	1	19	2	40	1982		1997	1997	7/21/2020	A	N		N	N	4	7					G				U
Prestressed concrete – Box beam/girders—multiple	8167	63200562000R010	GRAND RIVER AVE	CSX RR	Primary	5	5	1	91.2	2004		15740	2012	6/2/2020	A	6	N	6	7	N	N	6	N	7	4	F			N	N
Prestressed concrete – Box beam/girders—multiple	8168	63200577000B010	12 MILE RD	PEBBLE CREEK	Primary	5	5	1	51.8	1987		17358	1990	7/21/2020	A	6	N	7	7	6	N	5	N	N	N	F			N	8
Concrete continuous – Slab	8169	63200580000B010	12 MILE RD (WEST)	ROUGE RIVER	Primary	2	1	3	115	1972		19870	2012	3/5/2020	P	7	6	7	7	5	N	7	N	N	6	G	Funct Obs		N	5
Concrete continuous – Slab	8170	63200580000B020	12 MILE RD (EAST)	ROUGE RIVER	Primary	2	1	3	115	1972		19870	2012	3/5/2020	P	7	6	7	7	5	N	8	N	N	7	G	Funct Obs		N	5
Prestressed concrete – Box beam/girders—single/spread	8171	63200592000B010	GRAND RIVER AVE	KENT LAKE	Primary	5	6	2	131.5	2009		4517	2007	6/19/2020	A	7	7	8	7	7	N	6	N	6	N	G			N	5
Concrete – Culvert	8172	63200605000B010	THIRTEEN MILE	ROUGE RIVER	Primary	1	19	1	44.3	2013		13420	2013	7/21/2020	A	N		N	N	8	8					G				5
Steel – Culvert	8173	63200670000B010	NOVI	ROUGE RIVER	Primary	3	19	3	40	1959		10882	1997	6/2/2020	A	N		N	N	5	4					P	Struct Def			5
Prestressed concrete – Box beam/girders—multiple	8174	NOVI	ROUGE RIVER	WHITE LAKE CANAL	Primary	5	5	1	37.8	1981		1570	2014	6/19/2020	A	7	N	7	7	7	N	7	N	6	N	G			N	8
Steel – Culvert	8175	63200686000B010	BIG BEAVER	STURGIS DRAIN	Primary	3	19	2	31.6	1975		26470	1996	8/20/2020	A	N		N	N	5	6					F				8
Concrete – Culvert	8176	63200701000B010	LONG LAKE RD	ROUGE RIVER	Primary	1	19	1	44	1984		19700	1996	8/26/2020	A	N		N	N	5	7					G				5
Concrete – Culvert	8177	63200706000B010	LONG LAKE RD	GIBSON DRAIN	Primary	1	19	1	26.3	2004		22575		8/26/2020	A	N		N	N	6	7					G	Funct Obs			8
Prestressed concrete – Box beam/girders—multiple	8178	63200710000B010	GENERAL MOTORS RD	HURON RIVER	Primary	5	5	1	64.1	1985		12300	2014	6/19/2020	A	6	N	7	7	7	N	6	N	6	N	F			N	5
Prestressed concrete – Box beam/girders—multiple	8179	63200731000B010	COOLEY LAKE ROAD	CLINTON RIVER	Primary	5	5	1	47.9	1994		19500	2015	7/24/2020	A	7	N	7	6	7	N	7	N	6	6	F			N	5
Prestressed concrete – Box beam/girders—multiple	8180	63200746000B010	ELIZABETH LAKE RD	CLINTON RIVER	Primary	5	5	1	42	1986		8250	2015	7/24/2020	A	6	N	7	7	6	N	6	N	5	N	F			N	5
Prestressed concrete – Multistringer	8181	63200762000B010	AVON ROAD	CLINTON RIVER	Primary	5	2	1	67.6	2012		15959	2011	9/9/2020	A	8	8	8	8	7	N	7	N	6	N	G			3	8
Prestressed concrete – Box	8182	63200764000B010	AVON ROAD	CLINTON RIVER	Primary	5	5	1	49.9	1962		18054	2014	4/30/2020	P	6	N	4	4	4	N	6	N	4	N	P	Struct Def		N	3

beam/girders—multiple																													
Prestressed concrete – Box beam/girders—multiple	8183	63200772000B010	HATCHERY ROAD	CLINTON RIVER	Primary	5	5	1	40	1962		9200	2016	3/5/2020	P	4	N	3	4	8	N	3	N	N	N	P	Struct Def		N	5
Prestressed concrete – Box beam/girders—multiple	8184	63200782000B010	PARKDALE RD	STONY CREEK	Primary	5	5	1	52	2011		15500	2010	9/9/2020	A	7	N	7	8	7	N	6	N	6	N	G			3	5
Prestressed concrete – Box beam/girders—multiple	8185	63200793000B010	ANDERSONVILLE RD	CLINTON RIVER	Primary	5	5	1	27.9	1990		6250	2015	7/17/2020	A	6	N	7	8	7	N	6	N	N	N	F			N	8
Prestressed concrete – Box beam/girders—multiple	8186	63200793000B020	ANDERSONVILLE RD	CLINTON RIVER	Primary	5	5	1	27.9	1990		6250	2015	7/17/2020	A	6	N	7	7	6	N	6	N	N	N	F			3	8
Prestressed concrete – Box beam/girders—multiple	8187	63200796000B010	WALTON BLVD	CLINTON RIVER	Primary	5	5	1	36.7	1992		15000	2015	7/24/2020	A	7	N	6	6	6	N	8	N	N	6	F			N	5
Prestressed concrete – Box beam/girders—multiple	8188	63200854000B010	SEYMOUR LAKE RD	PAINT CREEK	Primary	5	5	1	37	2006		8304	2016	7/10/2020	A	7	N	8	7	7	N	7	N	6	N	G			N	5
Prestressed concrete – Multistringer	8189	63200897000B010	TIENKEN ROAD	PAINT CREEK	Primary	5	2	1	78.2	2006		23921	2005	9/9/2020	A	7	7	8	7	7	N	7	N	6	N	G			N	5
Steel – Culvert	8190	63200981000B010	OAKWOOD	KEARSLEY DRAIN	Primary	3	19	2	27.9	1974		3833	1997	7/17/2020	A	N		N	N	5	6					F	Funct Obs			8
Prestressed concrete – Multistringer	8191	63280103000R010	SILVER BELL	GTW RR	Primary	5	2	1	96.6	2010		13220	2010	7/24/2020	A	8	8	8	7	N	N	7	N	8	8	G	Funct Obs		3	N
Concrete – Culvert	8192	63302H00034B010	TIENKEN RD	STONY CREEK	Secondary	1	19	1	52	2010		17000	2010	9/9/2020	A	N		N	N	7	6					F	Funct Obs			5
Timber – Slab	8193	63302H00035B010	WINKLER MILL	STONY CREEK	Secondary	7	1	1	22	1967		107	1985	9/9/2020	A	5	5	5	4	5	N	7	N	N	N	P	Struct Def		N	3
Prestressed concrete – Box beam/girders—multiple	8194	63302H00038B010	DUTTON	PAINT CREEK	Secondary	5	5	1	29.9	1964		5000	2015	9/4/2020	A	5	N	4	4	5	N	5	N	N	N	P	Struct Def		N	5
Steel – Culvert	8195	63303H00002B010	FOURTEEN MILE	FRANKLIN RIVER	Secondary	3	19	2	29.9	1961		7158	1993	8/20/2020	A	N		N	N	4	4					P	Struct Def			8
Concrete – Culvert	8196	63303H17421B010	KIRKWAY RD	LOWER LONG LAKE	Secondary	1	19	1	30.3	2004		900	2002	8/20/2020	A	N		N	N	8	7					G	Funct Obs			8
Prestressed concrete – Box beam/girders—multiple	8197	63305H89110B010	LEDGEWOOD	LAKE SHERWOOD	Secondary	5	5	1	62.3	1966		1000	1986	6/19/2020	A	7	N	5	7	7	N	6	N	N	N	F			N	8
Concrete – Slab	8198	63308H11411B990	CHEVRON ST	DUCK LAKE	Secondary	1	1	1	22	1967		320	1986	6/15/2020	P	7	7	7	7	7	N	8	N	N	N	G			N	5
Steel – Culvert	8199	63309H00002B010	GAGE RD	SWARTZ CREEK	Secondary	3	19	2	26.9	1979		304	1997	6/15/2020	A	N		N	N	6	5					F				8
Steel – Culvert	8200	63311H00012B010	TWELVE MILE	NOVI-LYON DRAIN	Secondary	3	19	2	24.9	1961		300	1997	6/15/2020	P	N		N	N	5	3					P	Struct Def			8
Steel – Culvert	8201	63311H00021B010	MARTINDALE	NOVI-LYON DRAIN	Secondary	3	19	2	28.9	1970		1080	2016	6/15/2020	P	N		N	N	5	3					P	Struct Def			8
Steel – Culvert	8202	63311H00024B010	SPALDING	NOVI-LYON DRAIN	Secondary	3	19	2	24.9	1961		250	1996	6/15/2020	P	N		N	N	5	3					P	Struct Def			8
Prestressed concrete – Box beam/girders—multiple	8203	63312H00014B010	DAWSON	HURON RIVER	Secondary	5	5	1	40	1964		750	2014	6/19/2020	A	7	N	6	4	5	N	8	N	8	N	P	Struct Def		N	5
Prestressed concrete – Box beam/girders—multiple	8205	63312H00036B010	BURNS	HURON RIVER	Secondary	5	5	1	29.9	1964		680	2014	6/19/2020	A	6	N	6	5	6	N	7	N	8	N	F	Funct Obs		N	5
Prestressed concrete – Box	8206	63314H00006B010	SILVER BELL	PAINT CREEK	Secondary	5	5	1	40	1961		326	1983	9/4/2020	P	5	N	6	4	5	N	6	N	N	N	P	Struct Def		N	5

beam/girders—multiple																													
Prestressed concrete – Box beam/girders—multiple	8207	63314H00008B020	GUNN	PAINT CREEK	Secondary	5	5	1	34.8	1958		1750	2015	3/5/2020	P	4	N	4	4	4	N	4	N	N	N	P	Struct Def		N	5
Timber – Slab	8208	63314H00008R010	GUNN ROAD	PENN CENTRAL RAILROAD	Secondary	7	1	1	89.9	1989		352	1997	9/4/2020	A	5	6	6	6	N	N	5	N	N	N	F			N	N
Prestressed concrete – Box beam/girders—multiple	8209	63315H00016B010	CLARKSTON RD	PAINT CREEK	Secondary	5	5	1	26.9	1958	1985	3761	1986	7/10/2020	A	6	N	5	5	5	N	5	N	N	N	F	Funct Obs		N	U
Timber – Slab	8210	63315H03221B010	NAKOMIS	INDIANWOOD LAKE CANAL	Secondary	7	1	1	27.5	1930	2012	150	2012	7/10/2020	A	8	8	8	8	6	N	7	N	N	7	G			N	U
Timber – Slab	8211	63316H28221B010	MALONEY STREET	CLEAR-LONG LAKE CHANNEL	Secondary	7	1	1	24.9	1973		200	2019	1/29/2021	P	3	3	3	5	8	N	4	N	N	N	P	Struct Def		N	5
Prestressed concrete – Box beam/girders—multiple	8212	63323H00029B010	LANSDOWNE RD	WILLIAMS LAKE CANAL	Secondary	5	5	1	24.9	1990		1200	2016	7/17/2020	A	6	N	5	7	8	N	8	N	N	8	F			3	8
Prestressed concrete – Box beam/girders—multiple	8214	63324H07431B010	WARNER STREET	GREEN LAKE CANAL	Secondary	5	5	1	46.9	1961		200	1994	6/5/2020	P	6	N	5	6	6	N	6	N	N	N	F	Funct Obs		N	U
Timber – Slab	8215	63325H07211B010	NAVARRA CT	WHITE LAKE CANAL	Secondary	7	1	1	30	2004		75	2002	6/15/2020	A	7	7	7	7	8	N	7	N	N	N	G			N	5
Timber – Slab	8216	63325H07211B020	LAKE GROVE DR	WHITE LAKE CANAL	Secondary	7	1	1	30	2002		400	2002	6/19/2020	A	7	7	7	7	8	N	7	N	N	N	G			N	5
Concrete – Culvert	12683	63200077000B010	SOUTH COMMERCE RD	HAYES CREEK	Primary	1	19	1	22	1993		11950	1994	6/5/2020	A	N		N	N	7	7					G				3
Prestressed concrete – Box beam/girders—multiple	12684	63303H00021B010	MANOR ROAD	ROUGE RIVER	Secondary	5	5	1	23	1987		200	2016	10/7/2020	A	7	N	6	7	6	N	9	N	N	9	F	Funct Obs		N	4
Concrete – Culvert	12685	63315H00004B010	NEWMAN ROAD	PAINT CREEK	Secondary	1	19	1	22	1994		677	1989	7/10/2020	A	N		N	N	6	6					F				5
Prestressed concrete – Box beam/girders—multiple	12725	63323H35221B010	BEACHLAND BLVD	OTTER SYLVAN LAKE CANAL	Secondary	5	5	1	64	1997		120	1997	7/24/2020	A	6	N	6	7	8	N	6	N	N	N	F			N	5
Timber – Girder and floorbeam	12728	63303H07411B010	LONG LK SHORES DR	LONG LAKE CANAL	Secondary	7	3	2	52	1930	2002	300	1997	8/20/2020	P	7	7	7	5	6	N	6	N	N	N	F			N	U
Concrete – Culvert	13170	63200203000B010	SILVER LAKE RD	SILVER LAKE CANAL	Primary	1	19	1	20	2003		11583	2003	7/24/2020	A	N		N	N	8	6					F				8
Concrete – Tee beam	13423	63312H00009B010	BUNO ROAD	HURON RIVER	Secondary	1	4	3	126	1940		750	2000	6/19/2020	P	6	5	5	5	7	N	7	N	4	N	F			3	3
Prestressed concrete – Multistringer	13506	63200071000R010	NOVI RD	CSX RR & MID ROUGE RIVER	Primary	5	2	2	217.3	2011		19810	2010	6/2/2020	A	7	7	8	7	8	N	7	N	7	7	G			N	8
Concrete – Culvert	13592	63200147000C010	ORCHARD LAKE ROAD	UPPER ROUGE RIVER	Primary	1	19	4	52.1	1955		12500	2010	7/28/2020	A	N		N	N	4	6					F				8
Prestressed concrete – Box beam/girders—multiple	13593	63301H00039B010	SECORD LAKE ROAD	EAST CREEK	Secondary	5	5	1	30	1990		120	2016	9/4/2020	A	6	N	5	6	6	N	8	N	N	6	F			N	5
Timber – Slab	13594	63303H00309B010	MEADOWWOOD ROAD	DEVONSHIRE DRAIN	Secondary	7	1	1	24.3	1986		500	2010	8/26/2020	P	4	4	4	5	6	N	7	N	N	N	P	Struct Def		N	5
Steel – Culvert	13595	63315H01507C010	CEDAR KEY DRIVE	VOORHEIS LAKE	Secondary	3	19	3	40	1985		500	2010	7/17/2020	A	N		N	N	4	4					P	Struct Def			8
Timber – Slab	13596	63315H01508B010	INDIAN TRAIL	POLLY ANN TRAIL	Secondary	7	1	1	27.4	1999		500	2010	7/10/2020	A	7	7	7	7	N	N	7	N	N	N	G			N	N
Timber – Slab	13597	63316H01605B010	DEER PATH TRAIL	INDIAN LAKE CANAL	Secondary	7	1	5	120	1999		500	2010	7/10/2020	A	7	8	8	7	7	N	6	N	N	N	G			N	5
Concrete – Culvert	13598	63316H01606C010	DEER PATH TRAIL	PAINT CREEK DRAIN	Secondary	1	19	1	22	1999		500	2010	7/10/2020	A	N		N	N	7	7					G				5

Timber – Slab	13599	63324H02409B010	LAKE CREST DRIVE	ROSEWOOD LAKE CANAL	Secondary	7	1	5	121	1998		500	2010	6/2/2020	A	6	7	7	7	7	N	6	N	N	N	F			N	5
Timber – Slab	13600	63324H02410B010	BRIDGEWATER DRIVE	MINNOW POND	Secondary	7	1	5	114	1995		500	2010	6/2/2020	A	6	7	7	5	7	N	5	N	N	N	F			N	5
Concrete – Culvert	13601	63325H00041C010	OXBOW LAKE ROAD	CLINTON RIVER	Secondary	1	19	1	33	2007		4540	2010	6/5/2020	A	N		N	N	8	8					G				5
Concrete – Culvert	13636	63200432000C010	MARTIN PARKWAY	WETLANDS	Primary	1	19	1	44.3	2011		30950	2010	6/2/2020	A	N		N	N	8	8					G	Funct Obs			8
Steel – Culvert	13644	63200007000C010	NOVI ROAD	TRIB TO INGERSOL CREEK	Primary	3	19	2	23.3	1960		19500	2011	6/2/2020	A	N		N	N	5	6					F				8
Concrete – Culvert	13645	63200574000C010	12 MILE ROAD	MINNOW POND DRAIN	Primary	1	19	1	26	1994		16074	2010	6/2/2020	A	N		N	N	7	7					G				8
Steel – Culvert	13647	63200852000C010	SEYMOUR LAKE ROAD	PAINT CREEK	Primary	3	19	2	21	1962		8000	2011	7/17/2020	P	N		N	N	6	3					P	Struct Def			8
Steel – Culvert	13648	63311H00008C010	11 MILE ROAD	NOVI-LYON DRAIN	Secondary	3	19	2	25	1972		800	2011	6/15/2020	P	N		N	N	5	3					P	Struct Def			8
Steel – Culvert	13649	63324H01121C010	GOLDEN LANE	UNKNOWN CHANNEL	Secondary	3	19	3	29	1997		500	2010	6/5/2020	A	N		N	N	6	6					F				5
Steel – Culvert	13808	63323H11210C010	INDIAN VIEW DRIVE	CLINTON RIVER	Secondary	3	19	2	31.3	1995		20	2012	7/24/2020	A	N		N	N	6	6					F				8
Steel – Culvert	13809	63200145000C010	CRESENT LAKE ROAD	CLINTON RIVER	Primary	3	19	2	30	1992		300	2000	7/24/2020	A	N		N	N	5	5					F				8
Steel – Culvert	13810	63200987000C010	PONTIAC LAKE ROAD	CLINTON RIVER	Primary	3	19	3	35	1985		11000	2016	7/24/2020	P	N		N	N	5	3					P	Struct Def			8
Steel – Culvert	13811	63307H00019C010	COUNTY LINE ROAD	KEARSLEY DRAIN	Secondary	3	19	2	26	1995		340	2012	7/17/2020	A	N		N	N	5	5					F				4
Steel – Culvert	13814	63200996000C010	DRAHNER ROAD	LONG LAKE OUTLET	Primary	3	19	2	20	1960		8305	2012	7/10/2020	A	N		N	N	6	6					F	Funct Obs			8
Steel – Culvert	13815	63304H00017C010	DARTMOUTH ROAD	PAINT CREEK	Secondary	3	19	2	21.5	2000		350	2012	7/17/2020	A	N		N	N	6	6					F				8
Steel – Culvert	13934	63305H10421C010	FARR STREET	HURON RIVER	Secondary	3	19	2	21	1970		500	2016	6/19/2020	P	N		N	N	6	3					P	Struct Def			8
Prestressed concrete – Box beam/girders—multiple	13941	63301H00006B020	BREWER ROAD	STONEY CREEK	Secondary	5	5	1	23	1984		50	2016	9/4/2020	P	5	N	5	3	4	N	5	N	N	N	P	Struct Def		N	3
Timber – Slab	13957	63324H25210B010	PUTNUAM DRIVE	WALNUT LAKE CANAL	Secondary	7	1	1	26	2017		50	2017	6/18/2019	A	8	8	8	7	7	N	8	N	N	N	G		97	N	8
Steel – Culvert	14030	63306H01000C010	INKSTER ROAD	ROUGE RIVER	Secondary	3	19	2	23.5	1963		500	2017	7/21/2020	A	N		N	N	6	5					F				8
Steel – Culvert	14031	63319H19210C010	DEER HILL DRIVE	DEER LAKE CREEK	Secondary	3	19	3	36.1	1977		200	2017	7/17/2020	P	N		N	N	4	4					P	Struct Def			8
Steel – Culvert	14036	63200725000C010	COOLEY LAKE ROAD	HURON RIVER	Primary	3	19	2	25.5	1975		9000	2015	10/7/2020	P	N		N	N	6	3					P	Struct Def			8
Steel – Culvert	14037	63315H19210C010	SHADOW CREEK BLVD	SASHABAW CREEK	Secondary	3	19		22.5	1996		500	2015	10/9/2019	A	N		N	N	6	7					G	Funct Obs			8
Steel – Culvert	14038	63323H21410C010	EDGEORGE STREET	CLINTON RIVER	Secondary	3	19	2	26	1956		200	2017	10/7/2020	P	N		N	N	6	3					P	Struct Def			8
Steel – Culvert	14039	63323H21410C020	EMBURKE BLVD	CLINTON RIVER	Secondary	3	19	2	28	1959		200	2017	10/7/2020	P	N		N	N	6	3					P	Struct Def			8
Concrete – Culvert	14272	63315H29410C010	MUELLER RD	BROWN DRAIN	Secondary	1	19	3	22	1998		500	2018	7/10/2020	A	N		N	N	6	6					F				8
Concrete – Culvert	14276	63324H36210C010	TEN HILL ROAD	FRANKLIN SUBWATERSHD DRN	Secondary	1	19	2	21.3	1975		50	2018	10/7/2020	A	N		N	N	6	7					G				8
Concrete – Culvert	14345	63305H23410C010	SPRUCE DR	TRIB TO HURON RIVER	Secondary	1	19	3	24.5	1994		100	2019	12/20/2019	A	N		N	N	5	7					G				8

APPENDIX 4: MAINTENANCE PLAN

Inventory Data											Replacement				Rehabilitation												Proposed Preventive Maintenance										Proposed Scheduled Maintenance																			
Bridge Type	Structure Number	Bridge ID	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)	Total	Superstructure	Deck	Substructure	Deep Overlay	Shallow Overlay	HMA Overlay w/ Membrane	HMA Cap	Replace/Retrofit Railing	Steel Beam Repairs	P/S Conc Beam Repairs	Repair/Replace Culvert	Repair/Replace Retaining Wall	Geometric Upgrades	Patch Substruct Concrete	Repair/Replace Deck	Repair/Replace Steel Bearings	Complete Painting	Zone Painting	Epoxy Overlays	HMA Cap w/o Membrane	Concrete Deck Patching	Channel Improvements	Scour Counter Measures	Superstruc Washing	Concrete Surface Washing	Vegetation Control	Debris Removal	Clean Drainage System	Spot Painting	Repair/Replace HMA Surface	Seal HMA Cracks/Joints	Seal Concrete Cracks/Joints	Minor Concrete Patching	Timber Repairs	Repair/Replace Guardrails	Repave Approaches	Repair Slopes	Install RipRap
Prestressed concrete – Multistringer	8141	63200064000B010	WIXOM ROAD	HURON RIVER	5	2	1	62	43.3	2685																																											
Concrete continuous – Slab	8142	63200068000B010	NOVI RD	ROUGE RIVER	2	1	1	52.8	37.7	1991																													H			M								M			
Concrete – Culvert	8143	63200172000B010	CASS LAKE ROAD	CLINTON RIVER	1	19	1	35.7	52.4	1871																																											
Concrete – Tee beam	8144	63200176000B010	SASHABAW RD	CLINTON RIVER	1	4	1	33.8	43.6	1474	H																																								H		
Prestressed concrete – Box beam/girders—multiple	8145	63200184000B010	MIDDLEBELT RD	ROUGE RIVER	5	5	1	35	59.7	2090																													L														
Steel – Culvert	8146	63200210000B010	FRANKLIN	ROUGE RIVER	3	19	2	29.9	20	598												M																															
Prestressed concrete – Multistringer	8147	63200230000B010	LAHSER RD	ROUGE RIVER	5	2	1	71.9	80.4	5781																								H											H							
Prestressed concrete – Box beam/girders—multiple	8148	63200235000B010	LAHSER RD	ROUGE RIVER	5	5	1	64	43.3	2771																								L											L							
Prestressed concrete – Box beam/girders—single/sprea	8149	63200250000B010	OPDYKE RD	CLINTON RIVER	5	6	1	62	84.3	5227																																											
Concrete – Culvert	8150	63200278000B010	ADAMS ROAD	ROUGE RIVER	1	19	1	40	44.6	1784																													M				M	M							
Prestressed concrete – Box beam/girders—multiple	8151	63200286000B010	ADAMS ROAD	CLINTON RIVER	5	5	1	35.8	33.8	1210									H																																	
Prestressed concrete – Multistringer	8152	63200292000B010	ADAMS ROAD	PAINT CREEK	5	2	1	68.9	43.3	2983																													M					H							
Prestressed concrete – Box beam/girders—multiple	8153	63200307000B010	CROOKS ROAD	CLINTON RIVER	5	5	1	52	81	4212																							H												M							
Timber – Slab	8154	63200308000B010	GALLAGHER RD	PAINT CREEK	7	1	1	62	31.2	1934																													M													
Concrete – Culvert	8155	63200329000B010	ORION RD	PAINT CREEK	1	19	1	37.7	66.2	2496																																											
Prestressed concrete – Box beam/girders—multiple	8156	63200329000B020	ORION RD	PAINT CREEK	5	5	1	41	59.3	2431																																											
Concrete – Culvert	8157	63200348000B010	JOHN R	BARNARD DRAIN	1	19	2	34.8	79.7	2774												M																														H		
Prestressed concrete – Box beam/girders—single/sprea	8158	63200352000B010	JOHN R ROAD	GIBSON DRAIN	5	6	1	40	81	3240																																											
Concrete – Culvert	8159	63200361000B010	DEQUINDRE ROAD	GIBSON DRAIN	1	19	1	30.1	118	3552																													M													
Concrete – Culvert	8160	63200383000B010	BENSTEIN	HURON RIVER	1	19	1	30	82	2460																																		M							
Prestressed concrete – Box	8161	63200416000B010	LIVERNOIS ROAD	CLINTON RIVER	5	6	1	69.3	88.5	6133																																				L							

beam/girders —single/sprea																																																	
Steel – Culvert	8162	63200425000B010	KENSINGTON	ROUGE RIVER	3	19	3	32.8	37.7	1237																												H				M							
Prestressed concrete – Multistringer	8163	63200507000B010	8 MILE RD	ROUGE RIVER	5	2	1	30.8	76.4	2353															L												L	M					H						
Prestressed concrete – Box beam/girders —multiple	8164	63200536000B010	10 MILE RD	PEBBLE CREEK	5	5	1	44	87.3	3841																							M																
Prestressed concrete – Box beam/girders —multiple	8165	63200537000B010	10 MILE RD	ROUGE RIVER	5	5	1	70.9	78.1	5537																											L												
Concrete – Culvert	8166	63200539000B010	10 MILE ROAD	CLAIRE DRAIN	1	19	2	40	105.6	4224																																L		L					
Prestressed concrete – Box beam/girders —multiple	8167	63200562000R010	GRAND RIVER AVE	CSX RR	5	5	1	91.2	90.7	8272									M																								H	H					
Prestressed concrete – Box beam/girders —multiple	8168	63200577000B010	12 MILE RD	PEBBLE CREEK	5	5	1	51.8	74.8	3875																											H				M	M						H	
Concrete continuous – Slab	8169	63200580000B010	12 MILE RD (WEST)	ROUGE RIVER	2	1	3	115	74.5	8568																																	L	L					
Concrete continuous – Slab	8170	63200580000B020	12 MILE RD (EAST)	ROUGE RIVER	2	1	3	115	74.5	8568																																							
Prestressed concrete – Box beam/girders —single/sprea	8171	63200592000B010	GRAND RIVER AVE	KENT LAKE	5	6	2	131.5	43.2	5681													H																				H						
Concrete – Culvert	8172	63200605000B010	THIRTEEN MILE	ROUGE RIVER	1	19	1	44.3	44	1949																																							
Steel – Culvert	8173	63200670000B010	NOVI	ROUGE RIVER	3	19	3	40	240.1	9604																												L				L							
Prestressed concrete – Box beam/girders —multiple	8174	NOVI	ROUGE RIVER	WHITE LAKE CANAL	5	5	1	37.8	37.4	1414																																							
Steel – Culvert	8175	63200686000B010	BIG BEAVER	STURGIS DRAIN	3	19	2	31.6	144	4550																																							
Concrete – Culvert	8176	63200701000B010	LONG LAKE RD	ROUGE RIVER	1	19	1	44	58.4	2570																											M												
Concrete – Culvert	8177	63200706000B010	LONG LAKE RD	GIBSON DRAIN	1	19	1	26.3	120	3156															L																								
Prestressed concrete – Box beam/girders —multiple	8178	63200710000B010	GENERAL MOTORS RD	HURON RIVER	5	5	1	64.1	43.8	2808																											L						L						
Prestressed concrete – Box beam/girders —multiple	8179	63200731000B010	COOLEY LAKE ROAD	CLINTON RIVER	5	5	1	47.9	77	3688																																	L			M			
Prestressed concrete – Box beam/girders —multiple	8180	63200746000B010	ELIZABETH LAKE RD	CLINTON RIVER	5	5	1	42	43.6	1831																																	H						
Prestressed concrete – Multistringer	8181	63200762000B010	AVON ROAD	CLINTON RIVER	5	2	1	67.6	88.4	5976																																	H					H	
Prestressed concrete – Box beam/girders —multiple	8182	63200764000B010	AVON ROAD	CLINTON RIVER	5	5	1	49.9	35.4	1766	H												H																										
Prestressed concrete – Box	8183	63200772000B010	HATCHERY ROAD	CLINTON RIVER	5	5	1	40	36.4	1456	H																														H								

beam/girders —multiple																																																	
Prestressed concrete – Box beam/girders —multiple	8184	63200782000B010	PARKDALE RD	STONY CREEK	5	5	1	52	44.1	2293																						M																	
Prestressed concrete – Box beam/girders —multiple	8185	63200793000B010	ANDERSON VILLE RD	CLINTON RIVER	5	5	1	27.9	49.9	1392																																							
Prestressed concrete – Box beam/girders —multiple	8186	63200793000B020	ANDERSON VILLE RD	CLINTON RIVER	5	5	1	27.9	49.9	1392																																							
Prestressed concrete – Box beam/girders —multiple	8187	63200796000B010	WALTON BLVD	CLINTON RIVER	5	5	1	36.7	72	2642																																							
Prestressed concrete – Box beam/girders —multiple	8188	63200854000B010	SEYMOUR LAKE RD	PAINT CREEK	5	5	1	37	43.9	1624																																							
Prestressed concrete – Multistringer	8189	63200897000B010	TIENKEN ROAD	PAINT CREEK	5	2	1	78.2	82.2	6428																																	L	H					
Steel – Culvert	8190	63200981000B010	OAKWOOD	KEARSLEY DRAIN	3	19	2	27.9	56.4	1574																											M											
Prestressed concrete – Multistringer	8191	63280103000R010	SILVER BELL	GTW RR	5	2	1	96.6	63.8	6163									L																														
Concrete – Culvert	8192	63302H00034B010	TIENKEN RD	STONY CREEK	1	19	1	52	40.3	2096																																							
Timber – Slab	8193	63302H00035B010	WINKLER MILL	STONY CREEK	7	1	1	22	29.9	658																											H											
Prestressed concrete – Box beam/girders —multiple	8194	63302H00038B010	DUTTON	PAINT CREEK	5	5	1	29.9	33.5	1002																											M				M							
Steel – Culvert	8195	63303H00002B010	FOURTEEN MILE	FRANKLIN RIVER	3	19	2	29.9	33	987																																							
Concrete – Culvert	8196	63303H17421B010	KIRKWAY RD	LOWER LONG LAKE	1	19	1	30.3	30	909									H																	H					H							
Prestressed concrete – Box beam/girders —multiple	8197	63305H89110B010	LEDGEWO OD	LAKE SHERWOOD	5	5	1	62.3	36.1	2249																																							
Concrete – Slab	8198	63308H11411B990	CHEVRON ST	DUCK LAKE	1	1	1	22	27.9	614																										L												
Steel – Culvert	8199	63309H00002B010	GAGE RD	SWARTZ CREEK	3	19	2	26.9	37.7	1014																																							
Steel – Culvert	8200	63311H00012B010	TWELVE MILE	NOVI-LYON DRAIN	3	19	2	24.9	40	996																										H									M			
Steel – Culvert	8201	63311H00021B010	MARTINDA LE	NOVI-LYON DRAIN	3	19	2	28.9	44.9	1298																										M												
Steel – Culvert	8202	63311H00024B010	SPALDING	NOVI-LYON DRAIN	3	19	2	24.9	40	996																										L									H			
Prestressed concrete – Box beam/girders —multiple	8203	63312H00014B010	DAWSON	HURON RIVER	5	5	1	40	33	1320																																					L	
Prestressed concrete – Box beam/girders —multiple	8205	63312H00036B010	BURNS	HURON RIVER	5	5	1	29.9	27	807																																							
Prestressed concrete – Box beam/girders —multiple	8206	63314H00006B010	SILVER BELL	PAINT CREEK	5	5	1	40	33.1	1324	L																										H											
Prestressed concrete – Box	8207	63314H00008B020	GUNN	PAINT CREEK	5	5	1	34.8	27.9	971	H																										L										M	

beam/girders —multiple																																																	
Timber – Slab	8208	63314H00008R010	GUNN ROAD	PENN CENTRAL RAILROAD	7	1	1	89.9	31.2	2805																											H											
Prestressed concrete – Box beam/girders —multiple	8209	63315H00016B010	CLARKSTON RD	PAINT CREEK	5	5	1	26.9	18	484																											L								H		H	
Timber – Slab	8210	63315H03221B010	NAKOMIS	INDIANWOOD LAKE CANAL	7	1	1	27.5	26.2	721																																					M	
Timber – Slab	8211	63316H28221B010	MALONEY STREET	CLEAR-LONG LAKE CHANNEL	7	1	1	24.9	22	548	H																																				M	
Prestressed concrete – Box beam/girders —multiple	8212	63323H00029B010	LANSDOWNE RD	WILLIAMS LAKE CANAL	5	5	1	24.9	37.4	931																																						
Prestressed concrete – Box beam/girders —multiple	8214	63324H07431B010	WARNER STREET	GREEN LAKE CANAL	5	5	1	46.9	11.8	553									H																												H	
Timber – Slab	8215	63325H07211B010	NAVARRA CT	WHITE LAKE CANAL	7	1	1	30	24	720																															L							
Timber – Slab	8216	63325H07211B020	LAKE GROVE DR	WHITE LAKE CANAL	7	1	1	30	28	840												M														M					M							
Concrete – Culvert	12683	63200077000B010	SOUTH COMMERCE RD	HAYES CREEK	1	19	1	22	59.7	1313																																						
Prestressed concrete – Box beam/girders —multiple	12684	63303H00021B010	MANOR ROAD	ROUGE RIVER	5	5	1	23	23	529																																						
Concrete – Culvert	12685	63315H00004B010	NEWMAN ROAD	PAINT CREEK	1	19	1	22	41	902																																						
Prestressed concrete – Box beam/girders —multiple	12725	63323H35221B010	BEACHLAND BLVD	OTTER SYLVAN LAKE CANAL	5	5	1	64	34.1	2182																										M					H							
Timber – Girder and floorbeam	12728	63303H07411B010	LONG LK SHORES DR	LONG LAKE CANAL	7	3	2	52	28	1456																										M	L				M							
Concrete – Culvert	13170	63200203000B010	SILVER LAKE RD	SILVER LAKE CANAL	1	19	1	20	59.5	1190																																						
Concrete – Tee beam	13423	63312H00009B010	BUNO ROAD	HURON RIVER	1	4	3	126	58.1	7321											H				M																	L					H	
Prestressed concrete – Multistringer	13506	63200071000R010	NOVI RD	CSX RR & MID ROUGE RIVER	5	2	2	217.3	95	20644																																						
Concrete – Culvert	13592	63200147000C010	ORCHARD LAKE ROAD	UPPER ROUGE RIVER	1	19	4	52.1	112	5835													H														H								M			
Prestressed concrete – Box beam/girders —multiple	13593	63301H00039B010	SECORD LAKE ROAD	EAST CREEK	5	5	1	30	21	630																															L							
Timber – Slab	13594	63303H00309B010	MEADOWWOOD ROAD	DEVONSHIRE DRAIN	7	1	1	24.3	42	1021			L																							H									H			
Steel – Culvert	13595	63315H01507C010	CEDAR KEY DRIVE	VOORHEIS LAKE	3	19	3	40	52	2080																															L							
Timber – Slab	13596	63315H01508B010	INDIAN TRAIL	POLLY ANN TRAIL	7	1	1	27.4	27	740									H																						L							
Timber – Slab	13597	63316H01605B010	DEER PATH TRAIL	INDIAN LAKE CANAL	7	1	5	120	29	3480																																						
Concrete – Culvert	13598	63316H01606C010	DEER PATH TRAIL	PAINT CREEK DRAIN	1	19	1	22	29	638																										L												
Timber – Slab	13599	63324H02409B010	LAKE CREST DRIVE	ROSEWOOD LAKE CANAL	7	1	5	121	26	3146																															L							
Timber – Slab	13600	63324H02410B010	BRIDGEWATER DRIVE	MINNOW POND	7	1	5	114	30	3420																														H	H							

Concrete – Culvert	13601	63325H00041C010	OXBOW LAKE ROAD	CLINTON RIVER	1	19	1	33	76	2508																																						
Concrete – Culvert	13636	63200432000C010	MARTIN PARKWAY	WETLANDS	1	19	1	44.3	126	5582																																						
Steel – Culvert	13644	63200007000C010	NOVI ROAD	TRIB TO INGERSOL CREEK	3	19	2	23.3	80	1864																															M	M							
Concrete – Culvert	13645	63200574000C010	12 MILE ROAD	MINNOW POND DRAIN	1	19	1	26	124	3224																																M							
Steel – Culvert	13647	63200852000C010	SEYMOUR LAKE ROAD	PAINT CREEK	3	19	2	21		1092																																						
Steel – Culvert	13648	63311H00008C010	11 MILE ROAD	NOVI-LYON DRAIN	3	19	2	25	30.5	763																																						
Steel – Culvert	13649	63324H01121C010	GOLDEN LANE	UNKNOWN CHANNEL	3	19	3	29	70	2030																																						
Steel – Culvert	13808	63323H11210C010	INDIAN VIEW DRIVE	CLINTON RIVER	3	19	2	31.3	29.7	930																															M					M			
Steel – Culvert	13809	63200145000C010	CRESENT LAKE ROAD	CLINTON RIVER	3	19	2	30	27	810																																						
Steel – Culvert	13810	63200987000C010	PONTIAC LAKE ROAD	CLINTON RIVER	3	19	3	35	31.1	1089																																						
Steel – Culvert	13811	63307H00019C010	COUNTY LINE ROAD	KEARSLEY DRAIN	3	19	2	26	29	754																										H	H								H			
Steel – Culvert	13814	63200996000C010	DRAHNER ROAD	LONG LAKE OUTLET	3	19	2	20	54	1080																										H									L			
Steel – Culvert	13815	63304H00017C010	DARTMOUTH ROAD	PAINT CREEK	3	19	2	21.5	44	946																										H									H			
Steel – Culvert	13934	63305H10421C010	FARR STREET	HURON RIVER	3	19	2	21	30	630																										M									H		M	
Prestressed concrete – Box beam/girders —multiple	13941	63301H00006B020	BREWER ROAD	STONEY CREEK	5	5	1	23	18	414	H																																					
Timber – Slab	13957	63324H25210B010	PUTNUAM DRIVE	WALNUT LAKE CANAL	7	1	1	26	22	572																																						
Steel – Culvert	14030	63306H01000C010	INKSTER ROAD	ROUGE RIVER	3	19	2	23.5	102	2397																																						
Steel – Culvert	14031	63319H19210C010	DEER HILL DRIVE	DEER LAKE CREEK	3	19	3	36.1	101.5	3664																																						
Steel – Culvert	14036	63200725000C010	COOLEY LAKE ROAD	HURON RIVER	3	19	2	25.5	48	1224																																						
Steel – Culvert	14037	63315H19210C010	SHADOW CREEK BLVD	SASHABAW CREEK	3	19		22.5	220	4950																																						
Steel – Culvert	14038	63323H21410C010	EDGEORGE STREET	CLINTON RIVER	3	19	2	26	52	1352																																						
Steel – Culvert	14039	63323H21410C020	EMBURKE BLVD	CLINTON RIVER	3	19	2	28	51.5	1442																																						
Concrete – Culvert	14272	63315H29410C010	MUELLER RD	BROWN DRAIN	1	19	3	22	78	1716																																						
Concrete – Culvert	14276	63324H36210C010	TEN HILL ROAD	FRANKLIN SUBWATERS HD DRN	1	19	2	21.3	70	1491																																						
Concrete – Culvert	14345	63305H23410C010	SPRUCE DR	TRIB TO HURON RIVER	1	19	3	24.5	64.2	1573																																						

APPENDIX 5: INSPECTION FOLLOW-UP

Inventory Data											Inspection Items							
Bridge Type	Structure Number	Bridge ID	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)	Initial Inspection	In Depth Steel Inspection	Pin and Hanger Inspection	Diving Inspection	Provide Monitoring	Review Scour Criticality	Load Rating	Update SIA
Prestressed concrete – Multistringer	8141	63200064000B010	WIXOM ROAD	HURON RIVER	5	2	1	62	43.3	2685								
Concrete continuous – Slab	8142	63200068000B010	NOVI RD	ROUGE RIVER	2	1	1	52.8	37.7	1991								
Concrete – Culvert	8143	63200172000B010	CASS LAKE ROAD	CLINTON RIVER	1	19	1	35.7	52.4	1871					X		X	
Concrete – Tee beam	8144	63200176000B010	SASHABAW RD	CLINTON RIVER	1	4	1	33.8	43.6	1474								
Prestressed concrete – Box beam/girders—multiple	8145	63200184000B010	MIDDLEBELT RD	ROUGE RIVER	5	5	1	35	59.7	2090								
Steel – Culvert	8146	63200210000B010	FRANKLIN	ROUGE RIVER	3	19	2	29.9	20	598								
Prestressed concrete – Multistringer	8147	63200230000B010	LAHSER RD	ROUGE RIVER	5	2	1	71.9	80.4	5781								
Prestressed concrete – Box beam/girders—multiple	8148	63200235000B010	LAHSER RD	ROUGE RIVER	5	5	1	64	43.3	2771								
Prestressed concrete – Box beam/girders—multiple	8149	63200250000B010	OPDYKE RD	CLINTON RIVER	5	6	1	62	84.3	5227							X	
Prestressed concrete – Box beam/girders—single/spread																		
Concrete – Culvert	8150	63200278000B010	ADAMS ROAD	ROUGE RIVER	1	19	1	40	44.6	1784								
Prestressed concrete – Box beam/girders—multiple	8151	63200286000B010	ADAMS ROAD	CLINTON RIVER	5	5	1	35.8	33.8	1210								
Prestressed concrete – Multistringer	8152	63200292000B010	ADAMS ROAD	PAINT CREEK	5	2	1	68.9	43.3	2983								
Prestressed concrete – Box beam/girders—multiple	8153	63200307000B010	CROOKS ROAD	CLINTON RIVER	5	5	1	52	81	4212								
Timber – Slab	8154	63200308000B010	GALLAGHER RD	PAINT CREEK	7	1	1	62	31.2	1934								
Concrete – Culvert	8155	63200329000B010	ORION RD	PAINT CREEK	1	19	1	37.7	66.2	2496								
Prestressed concrete – Box beam/girders—multiple	8156	63200329000B020	ORION RD	PAINT CREEK	5	5	1	41	59.3	2431								
Concrete – Culvert	8157	63200348000B010	JOHN R	BARNARD DRAIN	1	19	2	34.8	79.7	2774								
Prestressed concrete – Box beam/girders—single/spread	8158	63200352000B010	JOHN R ROAD	GIBSON DRAIN	5	6	1	40	81	3240								

Concrete – Culvert	8159	63200361000B010	DEQUINDRE ROAD	GIBSON DRAIN	1	19	1	30.1	118	3552								
Concrete – Culvert	8160	63200383000B010	BENSTEIN	HURON RIVER	1	19	1	30	82	2460								
Prestressed concrete – Box beam/girders—single/spread	8161	63200416000B010	LIVERNOIS ROAD	CLINTON RIVER	5	6	1	69.3	88.5	6133								
Steel – Culvert	8162	63200425000B010	KENSINGTON	ROUGE RIVER	3	19	3	32.8	37.7	1237								
Prestressed concrete – Multistringer	8163	63200507000B010	8 MILE RD	ROUGE RIVER	5	2	1	30.8	76.4	2353								
Prestressed concrete – Box beam/girders—multiple	8164	63200536000B010	10 MILE RD	PEBBLE CREEK	5	5	1	44	87.3	3841								
Prestressed concrete – Box beam/girders—multiple	8165	63200537000B010	10 MILE RD	ROUGE RIVER	5	5	1	70.9	78.1	5537							X	
Concrete – Culvert	8166	63200539000B010	10 MILE ROAD	CLAIRE DRAIN	1	19	2	40	105.6	4224								
Prestressed concrete – Box beam/girders—multiple	8167	63200562000R010	GRAND RIVER AVE	CSX RR	5	5	1	91.2	90.7	8272								
Prestressed concrete – Box beam/girders—multiple	8168	63200577000B010	12 MILE RD	PEBBLE CREEK	5	5	1	51.8	74.8	3875								
Concrete continuous – Slab	8169	63200580000B010	12 MILE RD (WEST)	ROUGE RIVER	2	1	3	115	74.5	8568								
Concrete continuous – Slab	8170	63200580000B020	12 MILE RD (EAST)	ROUGE RIVER	2	1	3	115	74.5	8568								
Prestressed concrete – Box beam/girders—single/spread	8171	63200592000B010	GRAND RIVER AVE	KENT LAKE	5	6	2	131.5	43.2	5681								
Concrete – Culvert	8172	63200605000B010	THIRTEEN MILE	ROUGE RIVER	1	19	1	44.3	44	1949								
Steel – Culvert	8173	63200670000B010	NOVI	ROUGE RIVER	3	19	3	40	240.1	9604								
Prestressed concrete – Box beam/girders—multiple	8174	NOVI	ROUGE RIVER	WHITE LAKE CANAL	5	5	1	37.8	37.4	1414								
Steel – Culvert	8175	63200686000B010	BIG BEAVER	STURGIS DRAIN	3	19	2	31.6	144	4550								
Concrete – Culvert	8176	63200701000B010	LONG LAKE RD	ROUGE RIVER	1	19	1	44	58.4	2570								
Concrete – Culvert	8177	63200706000B010	LONG LAKE RD	GIBSON DRAIN	1	19	1	26.3	120	3156								
Prestressed concrete – Box beam/girders—multiple	8178	63200710000B010	GENERAL MOTORS RD	HURON RIVER	5	5	1	64.1	43.8	2808								
Prestressed concrete – Box beam/girders—multiple	8179	63200731000B010	COOLEY LAKE ROAD	CLINTON RIVER	5	5	1	47.9	77	3688								
Prestressed concrete – Box beam/girders—multiple	8180	63200746000B010	ELIZABETH LAKE RD	CLINTON RIVER	5	5	1	42	43.6	1831								

Prestressed concrete – Multistringer	8181	63200762000B010	AVON ROAD	CLINTON RIVER	5	2	1	67.6	88.4	5976								
Prestressed concrete – Box beam/girders—multiple	8182	63200764000B010	AVON ROAD	CLINTON RIVER	5	5	1	49.9	35.4	1766							X	
Prestressed concrete – Box beam/girders—multiple	8183	63200772000B010	HATCHERY ROAD	CLINTON RIVER	5	5	1	40	36.4	1456							X	
Prestressed concrete – Box beam/girders—multiple	8184	63200782000B010	PARKDALE RD	STONY CREEK	5	5	1	52	44.1	2293								
Prestressed concrete – Box beam/girders—multiple	8185	63200793000B010	ANDERSONVILLE RD	CLINTON RIVER	5	5	1	27.9	49.9	1392								
Prestressed concrete – Box beam/girders—multiple	8186	63200793000B020	ANDERSONVILLE RD	CLINTON RIVER	5	5	1	27.9	49.9	1392								
Prestressed concrete – Box beam/girders—multiple	8187	63200796000B010	WALTON BLVD	CLINTON RIVER	5	5	1	36.7	72	2642								
Prestressed concrete – Box beam/girders—multiple	8188	63200854000B010	SEYMOUR LAKE RD	PAINT CREEK	5	5	1	37	43.9	1624								
Prestressed concrete – Multistringer	8189	63200897000B010	TIENKEN ROAD	PAINT CREEK	5	2	1	78.2	82.2	6428								
Steel – Culvert	8190	63200981000B010	OAKWOOD	KEARSLEY DRAIN	3	19	2	27.9	56.4	1574								
Prestressed concrete – Multistringer	8191	63280103000R010	SILVER BELL	GTW RR	5	2	1	96.6	63.8	6163								
Concrete – Culvert	8192	63302H00034B010	TIENKEN RD	STONY CREEK	1	19	1	52	40.3	2096								
Timber – Slab	8193	63302H00035B010	WINKLER MILL	STONY CREEK	7	1	1	22	29.9	658								
Prestressed concrete – Box beam/girders—multiple	8194	63302H00038B010	DUTTON	PAINT CREEK	5	5	1	29.9	33.5	1002								
Steel – Culvert	8195	63303H00002B010	FOURTEEN MILE	FRANKLIN RIVER	3	19	2	29.9	33	987								
Concrete – Culvert	8196	63303H17421B010	KIRKWAY RD	LOWER LONG LAKE	1	19	1	30.3	30	909								
Prestressed concrete – Box beam/girders—multiple	8197	63305H89110B010	LEDGEWOOD	LAKE SHERWOOD	5	5	1	62.3	36.1	2249								
Concrete – Slab	8198	63308H11411B990	CHEVRON ST	DUCK LAKE	1	1	1	22	27.9	614								
Steel – Culvert	8199	63309H00002B010	GAGE RD	SWARTZ CREEK	3	19	2	26.9	37.7	1014					X			
Steel – Culvert	8200	63311H00012B010	TWELVE MILE	NOVI-LYON DRAIN	3	19	2	24.9	40	996							X	
Steel – Culvert	8201	63311H00021B010	MARTINDALE	NOVI-LYON DRAIN	3	19	2	28.9	44.9	1298							X	
Steel – Culvert	8202	63311H00024B010	SPALDING	NOVI-LYON DRAIN	3	19	2	24.9	40	996								

Prestressed concrete – Box beam/girders—multiple	8203	63312H00014B010	DAWSON	HURON RIVER	5	5	1	40	33	1320								
Prestressed concrete – Box beam/girders—multiple	8205	63312H00036B010	BURNS	HURON RIVER	5	5	1	29.9	27	807								
Prestressed concrete – Box beam/girders—multiple	8206	63314H00006B010	SILVER BELL	PAINT CREEK	5	5	1	40	33.1	1324								
Prestressed concrete – Box beam/girders—multiple	8207	63314H00008B020	GUNN	PAINT CREEK	5	5	1	34.8	27.9	971								
Timber – Slab	8208	63314H00008R010	GUNN ROAD	PENN CENTRAL RAILROAD	7	1	1	89.9	31.2	2805								
Prestressed concrete – Box beam/girders—multiple	8209	63315H00016B010	CLARKSTON RD	PAINT CREEK	5	5	1	26.9	18	484								
Timber – Slab	8210	63315H03221B010	NAKOMIS	INDIANWOOD LAKE CANAL	7	1	1	27.5	26.2	721								
Timber – Slab	8211	63316H28221B010	MALONEY STREET	CLEAR-LONG LAKE CHANNEL	7	1	1	24.9	22	548					X		X	
Prestressed concrete – Box beam/girders—multiple	8212	63323H00029B010	LANSDOWNE RD	WILLIAMS LAKE CANAL	5	5	1	24.9	37.4	931								
Prestressed concrete – Box beam/girders—multiple	8214	63324H07431B010	WARNER STREET	GREEN LAKE CANAL	5	5	1	46.9	11.8	553								
Timber – Slab	8215	63325H07211B010	NAVARRA CT	WHITE LAKE CANAL	7	1	1	30	24	720								
Timber – Slab	8216	63325H07211B020	LAKE GROVE DR	WHITE LAKE CANAL	7	1	1	30	28	840								
Concrete – Culvert	12683	63200077000B010	SOUTH COMMERCE RD	HAYES CREEK	1	19	1	22	59.7	1313								
Prestressed concrete – Box beam/girders—multiple	12684	63303H00021B010	MANOR ROAD	ROUGE RIVER	5	5	1	23	23	529								
Concrete – Culvert	12685	63315H00004B010	NEWMAN ROAD	PAINT CREEK	1	19	1	22	41	902								
Prestressed concrete – Box beam/girders—multiple	12725	63323H35221B010	BEACHLAND BLVD	OTTER SYLVAN LAKE CANAL	5	5	1	64	34.1	2182								
Timber – Girder and floorbeam	12728	63303H07411B010	LONG LK SHORES DR	LONG LAKE CANAL	7	3	2	52	28	1456								
Concrete – Culvert	13170	63200203000B010	SILVER LAKE RD	SILVER LAKE CANAL	1	19	1	20	59.5	1190								
Concrete – Tee beam	13423	63312H00009B010	BUNO ROAD	HURON RIVER	1	4	3	126	58.1	7321					X			
Prestressed concrete – Multistringer	13506	63200071000R010	NOVI RD	CSX RR & MID ROUGE RIVER	5	2	2	217.3	95	20644								
Concrete – Culvert	13592	63200147000C010	ORCHARD LAKE ROAD	UPPER ROUGE RIVER	1	19	4	52.1	112	5835					X			
Prestressed concrete – Box beam/girders—multiple	13593	63301H00039B010	SECORD LAKE ROAD	EAST CREEK	5	5	1	30	21	630								

Timber – Slab	13594	63303H00309B010	MEADOWWOOD ROAD	DEVONSHIRE DRAIN	7	1	1	24.3	42	1021							X	
Steel – Culvert	13595	63315H01507C010	CEDAR KEY DRIVE	VOORHEIS LAKE	3	19	3	40	52	2080								
Timber – Slab	13596	63315H01508B010	INDIAN TRAIL	POLLY ANN TRAIL	7	1	1	27.4	27	740								
Timber – Slab	13597	63316H01605B010	DEER PATH TRAIL	INDIAN LAKE CANAL	7	1	5	120	29	3480								
Concrete – Culvert	13598	63316H01606C010	DEER PATH TRAIL	PAINT CREEK DRAIN	1	19	1	22	29	638								
Timber – Slab	13599	63324H02409B010	LAKE CREST DRIVE	ROSEWOOD LAKE CANAL	7	1	5	121	26	3146								
Timber – Slab	13600	63324H02410B010	BRIDGEWATER DRIVE	MINNOW POND	7	1	5	114	30	3420								
Concrete – Culvert	13601	63325H00041C010	OXBOW LAKE ROAD	CLINTON RIVER	1	19	1	33	76	2508								
Concrete – Culvert	13636	63200432000C010	MARTIN PARKWAY	WETLANDS	1	19	1	44.3	126	5582								
Steel – Culvert	13644	63200007000C010	NOVI ROAD	TRIB TO INGERSOL CREEK	3	19	2	23.3	80	1864								
Concrete – Culvert	13645	63200574000C010	12 MILE ROAD	MINNOW POND DRAIN	1	19	1	26	124	3224								
Steel – Culvert	13647	63200852000C010	SEYMOUR LAKE ROAD	PAINT CREEK	3	19	2	21		1092							X	
Steel – Culvert	13648	63311H00008C010	11 MILE ROAD	NOVI-LYON DRAIN	3	19	2	25	30.5	763								
Steel – Culvert	13649	63324H01121C010	GOLDEN LANE	UNKNOWN CHANNEL	3	19	3	29	70	2030								
Steel – Culvert	13808	63323H11210C010	INDIAN VIEW DRIVE	CLINTON RIVER	3	19	2	31.3	29.7	930								
Steel – Culvert	13809	63200145000C010	CRESENT LAKE ROAD	CLINTON RIVER	3	19	2	30	27	810								
Steel – Culvert	13810	63200987000C010	PONTIAC LAKE ROAD	CLINTON RIVER	3	19	3	35	31.1	1089							X	
Steel – Culvert	13811	63307H00019C010	COUNTY LINE ROAD	KEARSLEY DRAIN	3	19	2	26	29	754								
Steel – Culvert	13814	63200996000C010	DRAHNER ROAD	LONG LAKE OUTLET	3	19	2	20	54	1080								
Steel – Culvert	13815	63304H00017C010	DARTMOUTH ROAD	PAINT CREEK	3	19	2	21.5	44	946								
Steel – Culvert	13934	63305H10421C010	FARR STREET	HURON RIVER	3	19	2	21	30	630							X	
Prestressed concrete – Box beam/girders—multiple	13941	63301H00006B020	BREWER ROAD	STONEY CREEK	5	5	1	23	18	414								
Timber – Slab	13957	63324H25210B010	PUTNUAM DRIVE	WALNUT LAKE CANAL	7	1	1	26	22	572								
Steel – Culvert	14030	63306H01000C010	INKSTER ROAD	ROUGE RIVER	3	19	2	23.5	102	2397								
Steel – Culvert	14031	63319H19210C010	DEER HILL DRIVE	DEER LAKE CREEK	3	19	3	36.1	101.5	3664								
Steel – Culvert	14036	63200725000C010	COOLEY LAKE ROAD	HURON RIVER	3	19	2	25.5	48	1224							X	

Steel – Culvert	14037	63315H19210C010	SHADOW CREEK BLVD	SASHABAW CREEK	3	19		22.5	220	4950								
Steel – Culvert	14038	63323H21410C010	EDGEORGE STREET	CLINTON RIVER	3	19	2	26	52	1352								
Steel – Culvert	14039	63323H21410C020	EMBURKE BLVD	CLINTON RIVER	3	19	2	28	51.5	1442							X	
Concrete – Culvert	14272	63315H29410C010	MUELLER RD	BROWN DRAIN	1	19	3	22	78	1716								
Concrete – Culvert	14276	63324H36210C010	TEN HILL ROAD	FRANKLIN SUBWATERSHD DRN	1	19	2	21.3	70	1491								
Concrete – Culvert	14345	63305H23410C010	SPRUCE DR	TRIB TO HURON RIVER	1	19	3	24.5	64.2	1573								

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.

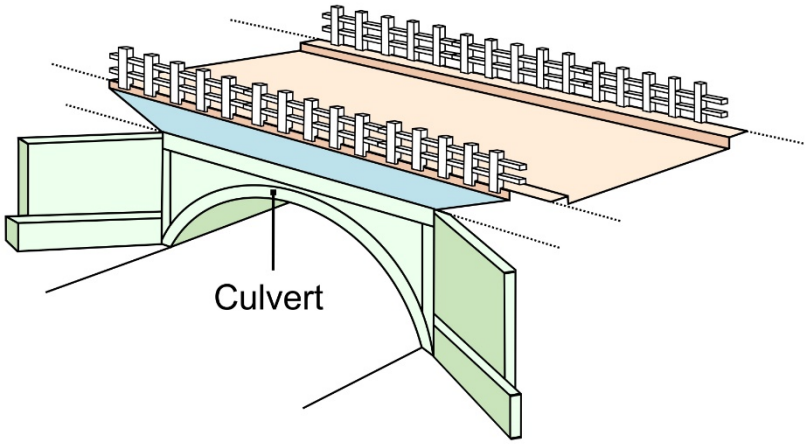

Figure C-1: Diagram of a culvert structure.

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 in Appendix G of the final report (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).

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.

D. TRAFFIC SIGNALS ASSET MANAGEMENT PLAN SUPPLEMENT

TRAFFIC SIGNALS PRIMER

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. This asset management plan is only concerned with traffic signals (Figure D-1) as a functioning unit and does not consider other electronic traffic control devices.

Figure D-1: Example of traffic signals.

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.

Treatments

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. Timing changes are restricted to authorized personnel only.

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.[5]

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".[6]

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.

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

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.*

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 cross-road drainage while allowing traffic to pass without being impeded; culverts span up to 20 feet.[7]

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.

[7] Adapted from Inventory-based Rating System for Gravel Roads: Training Manual

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 build up of excessive pressure, which can cause structural damage to the bridge.

Federal-Aid Committee (FAC): Representatives of local units of government, including: RCOC, 62 Oakland county cities, villages and townships, MDOT, and Suburban Mobility Authority for Regional Transportation (SMART), that allocates federal road funding coming to Oakland County. FAC meets to discuss, select, and approve road projects that will receive the federal dollars in coming years, which are submitted to Southeast Michigan Council of Governments (SEMCOG) for inclusion in the 2045 Reginal Transportation Plan (RTP) project list.

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.[8]

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".[9] 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*.

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 Road Paving Plan (GRPP): A multi-year plan to pave the gravel roads.

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

[8] Federal Highway Administration webpage https://www.fhwa.dot.gov/
[9] Inventory-based Rating System for Gravel Roads: Training Manual

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.[10]

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.[11]

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.[12]

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.[13]

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*.

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.

[10] Inventory-based Rating System for Gravel Roads: Training Manual
[11] Inventory-based Rating System for Gravel Roads: Training Manual
[12] https://www.fhwa.dot.gov/interstate/faq.cfm#question3
[13] Adapted from Inventory-based Rating System for Gravel Roads: Training Manual

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.

Local Federal Fund Exchange (LFFE): Program developed by County Road Association (CRA) that allows a county road agency to sell its highly-regulated federal Surface Transportation Program Rural (STPR) funds for more flexible non-federal dollars to another county road agency at a mutually agreed upon rate.

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.[14]

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

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

local, or from a city major to a city minor if no progress toward achieving the condition goals described in its asset plan.[15]

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.[16] 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.[17]

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*.

[15] Inventory-based Rating System for Gravel Roads: Training Manual
[16] Inventory-based Rating System for Gravel Roads: Training Manual
[17] https://www.fhwa.dot.gov/bridge/nbis/

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.

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.[18]

Pothole: A defect in a road that produces a localized depression.[19]

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.

[18] Adapted from Inventory-based Rating System for Gravel Roads: Training Manual
[19] Inventory-based Rating System for Gravel Roads: Training Manual

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

Rights-of-way: 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.[20]

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 optimum combination of database engine and GIS mapping tools, Roadsoft provides a quick, smooth user experience and almost unlimited data handling capabilities.[21]

Ruts/rutting: Deformation of a road that usually forms as a permanent depression concentrated under the wheel path parallel to the direction of travel.[22]

Scheduled maintenance: Low-cost, day-to-day activities applied to bridges on a scheduled basis that mitigates deterioration.[23]

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).[24]

Strategic Planning Meeting: Meeting held biennially with Oakland County community officials from cities, villages and townships to discuss transportation topics, including: transportation funding, road improvement needs, safety and capacity concerns, long-term priority road projects, evolving technology, RCOC services and programs, to meet the road needs and improve the conditions of the road network.

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*.

[20] Inventory-based Rating System for Gravel Roads: Training Manual
[21] Inventory-based Rating System for Gravel Roads: Training Manual
[22] Paving Class Glossary
[23] Inventory-based Rating System for Gravel Roads: Training Manual
[24] Inventory-based Rating System for Gravel Roads: Training Manual

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.[25]

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.

Tri-Party: Program that consists of one-third matching funding from the county general government's contribution and supplemented by equal amounts from RCOC and the local communities for road improvement projects. For FY 2021-2022, the Tri-Party Program includes $2 million contribution from Oakland County and corresponding matches from RCOC and the communities for a total of $6 million.

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.[26]

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.[27]

Washboarding: Ripples in the road surface that are perpendicular to the direction of travel.[28]

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

[25] [second sentence] http://www.kentcountyroads.net/road-work/road-treatments/ultra-thin-overlay
[26] https://en.wikipedia.org/wiki/Trunk_road
[27] https://en.wikipedia.org/wiki/Trunk_road
[28] Inventory-based Rating System for Gravel Roads: Training Manual

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

EGLE: Environment, Great Lakes, Energy

FAC: Federal-Aid Committee

FHWA: Federal Highway Administration

GWLA: Great Lakes Water Authority

HIP: Highway Improvement Program

HMA: Hot-mix asphalt

I: Trunkline abbreviation for routes on the Interstate system

IBR: Inventory-based Rating

LFFE: Local Federal Fund Exchange

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

NHPP: National Highway Preservation Program

NHS: National Highway System

PA 51: Michigan Public Act 51 of 1951

PASER: Pavement Surface Evaluation and Rating

RCOC: Road Commission for Oakland County

RIP: Road Improvement Program

RRR: Rehabilitation, Restoration, Resurface

4R: Rehabilitation, Restoration, Resurface, Reconstruct

SEMCOG: Southeastern Michigan Council of Governments

STP: Surface Transportation Program

TAMC: (Michigan) Transportation Asset Management Council

TIP: Transportation Improvement Program

US: Trunkline abbreviation for routes on the US Highway system

WRC: Water Resource Commission