

Pavement Management Technical Report



Pavement Management Technical Report

Pavement Management System Technical Report.....	1
What is a Pavement Management System?.....	1
PMS and the Relationship to Planning.....	1
Genesee County Pavement Management System.....	2
What is the PASER System?.....	2
What do PASER Ratings Actually Mean?	3
Genesee County Road Network.....	4
Locally-Owned Road Network.....	4
MDOT's Genesee County Federal-Aid Network.....	5
Genesee County Local Federal-Aid Network.....	5
Condition.....	8
Pavement Treatments.....	14
In Comparison.....	15
Pavement Funding.....	16
MDOT Pavement Preservation.....	18
Local Federal-Aid Network.....	18
Locally-Owned Roadways.....	18
Pavement Listening Session.....	19
Summary of Appendix A--Pavement--Future Analysis... ..	20
MAP-21 Performance Measures.....	21
Appendix A 2035 Genesee County Long Range Transportation Plan-- Pavement--Future Analysis.....	23
Appendix B PASER Comparison Charts.....	37

List of Charts

PASER Rating Scale.....	2
Genesee County 2013 PASER Lane Miles by Jurisdiction.....	5
Genesee County 2013 PASER Lane Miles by Surface Type.....	6
Genesee County 2013 PASER Ratings.....	8
Genesee County 2013 PASER Ratings in Lane Miles.....	9
Genesee County PASER Road Condition 2009-2013.....	9
Obligated State and Federal Funding for FYs '07-'12.....	10
2013 PASER Rating by Cities and Villages.....	12
2013 PASER Rating by Townships.....	13
2013 PASER Rating by Jurisdiction.....	13
Approved Preventive Maintenance Treatments.....	14
2012 PASER Comparison (Percentages).....	15
2012 PASER Comparison (Lane Miles).....	15
Federal Aid Transportation Spending by Category ('08-'12).....	16
FY 2012 ACT 51 Funds.....	17
Genesee County Pavement Funding Breakdown.....	17

List of Maps

2013 Paved Roads.....	7
2013 PASER Survey of Genesee County Federal-Aid Network.....	11

Pavement Management System Technical Report

The Genesee County Pavement Technical Report is a supporting document and building block for Genesee County's 2040 Long Range Transportation Plan, "GeneSEE the Future: Mobility 2040". Roads are the foundation of any transportation system, and the condition of the road network is an important part of the transportation planning process.

What is a Pavement Management System (PMS)?

The Pavement Management System (PMS) is a set of tools or methods that can assist decision makers in finding cost effective strategies for providing, evaluating, and maintaining pavements in a serviceable condition. It provides the information necessary to make these decisions. PMS consists of two basic components: A comprehensive database, which contains current and historical information on pavement condition, pavement structure and traffic; and another component that consists of a set of tools that allows us to determine existing and future pavement conditions, predict financial needs and identify and prioritize pavement preservation projects.



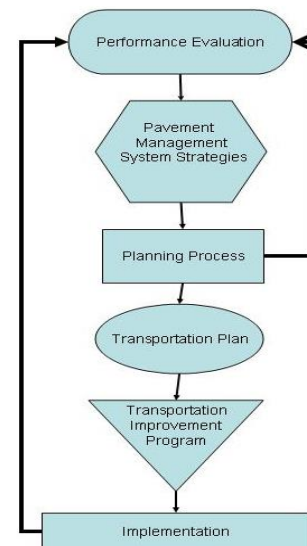
PMS and the Relationship to Planning

A basic relationship between the planning process and the pavement management system is illustrated in the flow chart shown. FHWA's and FTA's Final Rule on Management and Monitoring Systems stresses that



all of the management systems are designed to operate within, or in conjunction with, the planning process. The management systems develop strategies to be evaluated within the planning process for

inclusion in the transportation plan and the TIP/STIP.



Genesee County Pavement Management System

The Genesee County Metropolitan Planning Commission utilizes a pavement management system consisting of PASER and RoadSoft (maintained by the Michigan Technological University) that was developed by the University of Wisconsin-Madison Transportation Information Center and approved by the Michigan Asset Management Council for use in asset management reporting.

GCMPC utilizes the PASER program to collect road data and RoadSoft to evaluate and analyze the collected data. RoadSoft provides pavement management capabilities that:

- Develop and organize the pavement inventory
- Assess the current condition of pavement
- Develop models to predict future conditions
- Report on past and future pavement performance
- Develop scenarios for pavement maintenance based on budget or condition requirements

What is the PASER system?

PASER Rating	Pavement Quality
1	Poor
2	
3	
4	
5	
6	
7	
8	
9	
10	Excellent

PASER is an acronym for “Pavement Surface Evaluation and Rating” system and is used to evaluate the surface condition of concrete and asphalt roadway pavement.

PASER is a “windshield” road rating system that uses a 1 to 10 rating scale, with a value of 10 representing a new road and a value of 1 representing a failed road. Condition ratings are assigned by monitoring the type and amount of visual defects along a road segment while driving the segment. The PASER system interprets these observations into a condition

rating.

The key to a useful evaluation is identifying different types of pavement distress and linking them to a cause. Understanding the cause for current conditions is important in



selecting an appropriate maintenance or rehabilitation technique.

The rating system categories are listed in the 2013 Asset Management Road Rating report for Genesee County.

Pavement deterioration has two general causes: environmental causes due to weathering and aging; and structural causes due to repeated traffic loadings.

Obviously, most pavement deterioration results from both environmental and structural causes. However, it is important to try to distinguish between the two in order to select the most effective rehabilitation techniques.

The rate at which pavement deteriorates depends on its environment, traffic loading conditions, original construction quality, and interim maintenance procedures. Poor quality materials or poor construction procedures can significantly reduce the life of a pavement. As a result, two sections of pavement constructed at the same time may have significantly different lives, or certain portions of a pavement may deteriorate more rapidly than others. On the other hand, timely and effective maintenance can extend a pavement's life. Crack sealing and surface treatments (such as slurry seal) can reduce the aging effect that moisture has on asphalt pavement.

With all of these variables, it is easy to see why pavements deteriorate at various rates and why we find them in various stages of disrepair. Recognizing defects and understanding their causes helps us rate pavement condition and select cost-effective repairs. The pavement defects shown on the following pages provide a background for this process.

Periodic inspection is necessary to provide current and useful evaluation data. It is recommended that PASER ratings be updated every year.

What do PASER ratings actually mean?

A roadway given the rating of "1" represents the poorest roadway condition possible. The pavement surface with this rating displays visible signs of distress and extensive loss of surface integrity; the roadway surface is failing and needs total reconstruction. A rating of "10" indicates the pavement surface is in excellent condition, displaying no visible signs of distress, and having a quality rating of "new construction". In 2013, nearly 69% of Genesee County federal-aid road segments surveyed was found to be "fair" with a rating of five or better.

Roads with PASER ratings of 8-10 require routine maintenance. Routine maintenance is the combined day-to-day maintenance activities that are scheduled, such as street sweeping, drainage clearing, shoulder gravel grading, and sealing cracks. Crack sealing prevents standing water and water penetration.

Roads with PASER ratings of 5-7 require capital preventive maintenance. Capital preventive maintenance is a planned set of cost-effective treatments provided to an existing roadway system and its appurtenances that preserves, retards future deterioration and maintains or improves the functional condition of the system without significantly increasing structural capacity. The purpose of capital preventive maintenance fixes is to protect the pavement structure, slow the rate of pavement deterioration and/or correct pavement surface deficiencies. Surface treatments are targeted at pavement surface defects primarily caused by the environment and by pavement material deficiencies.

Roads with PASER ratings of 1-4 require structural improvements. This category includes work identified as rehabilitation and reconstruction, which address the structural integrity of a road.

Genesee County Road Network

There are approximately 5,483 paved lane miles in the Genesee County Road Network. This network includes all classes of roads such as federal-aid segments, state trunklines, highways and expressways, and locally-owned roads. Within this network, two main networks exist: the federal-aid network, and the locally-owned network. The federal-aid network is composed of: MDOT-owned roads; Genesee County Road Commission roads; and city and village roads. City and village roads are identified as the Genesee County Local Federal-Aid Road Network. This federal-aid network consists of approximately 2,696 lane miles. The funds allocated to the Genesee County Metropolitan Alliance are to be used to maintain the federal-aid network, and cannot be used on locally-owned road segments. Each local unit of government is allocated funds through Michigan's Public Acts of 1951, commonly known as "Act 51" funds, where a portion of the state gas tax is given to each local road agency in the state to be used for transportation-related purposes.

Locally-Owned Road Network

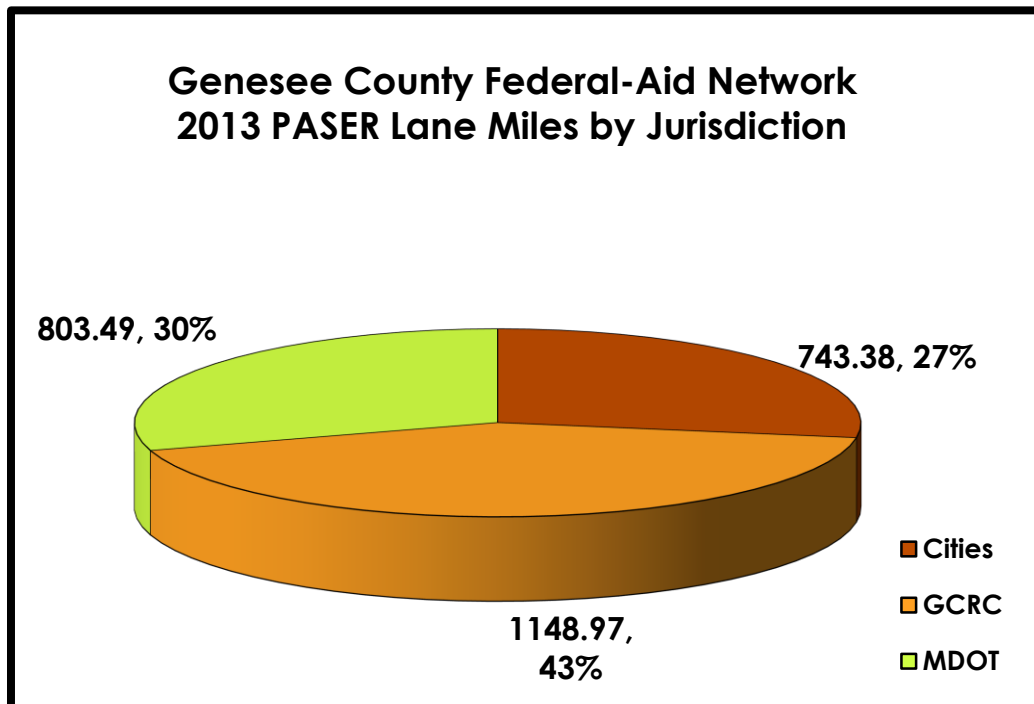
The locally-owned road network is made up of approximately 2,787 lane miles of paved roadway. These roads are not eligible for federal funds.

MDOT's Genesee County Federal-Aid Network

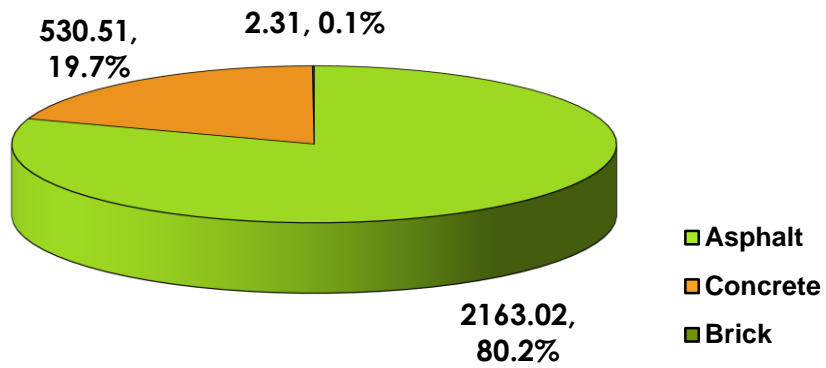
In Genesee County, the interstates and state trunklines are mostly controlled by the Michigan Department of Transportation. Refer to www.MDOT.gov for the 2013 -2017 Five Year Transportation Program. This network is made up of approximately 803 lane miles.

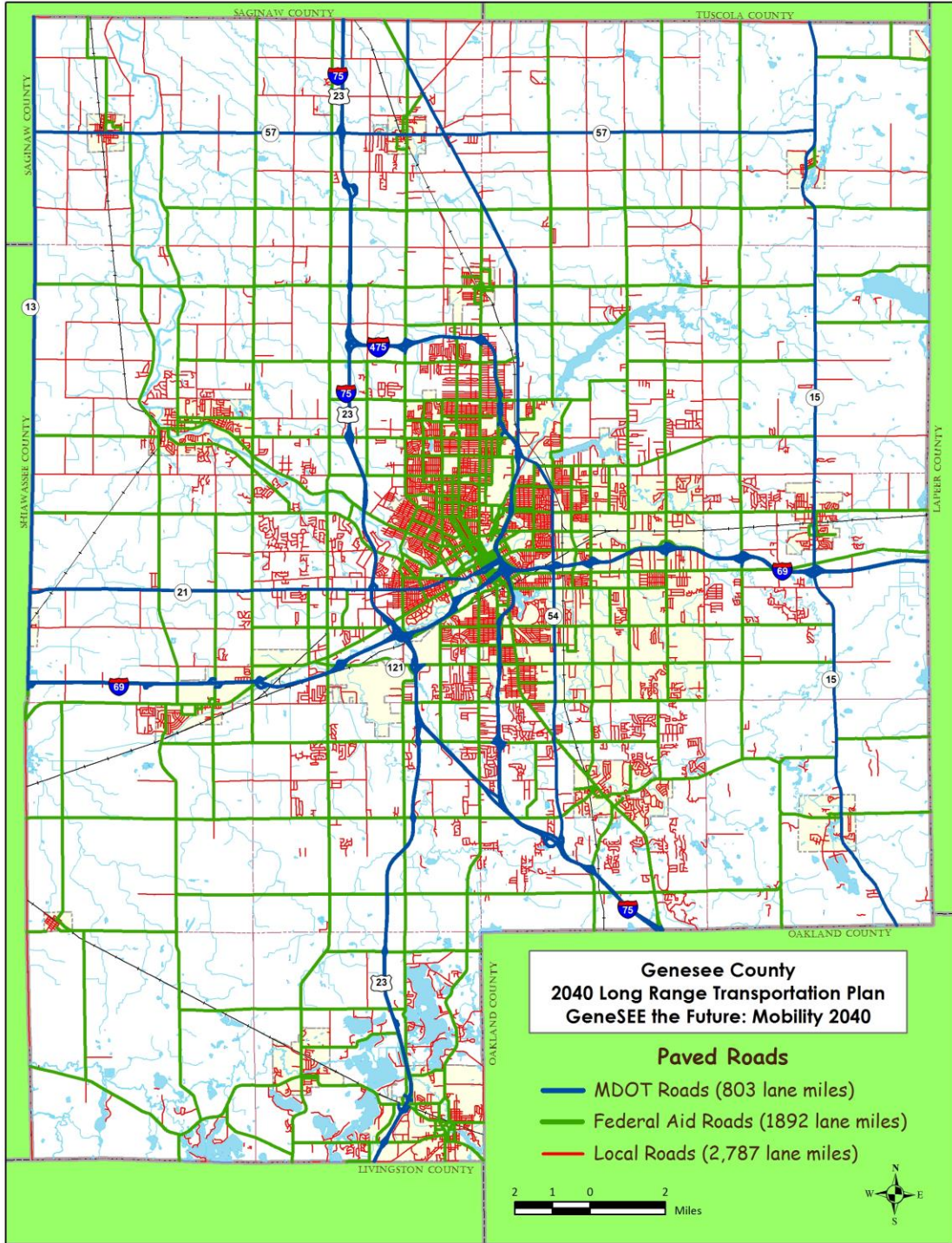
Genesee County Local Federal-Aid Network

In the Genesee County local federal-aid network, which excludes any federal-aid MDOT owned roads, there are approximately 1,892 lane miles of public roads. As shown in the chart on the following page, the large majority of roads in Genesee County are asphalt, while concrete makes up roughly 20% of the system. Brick roads make up about 0.1% of the road network. The local federal-aid system consists of 1,149 within the townships, which are under the jurisdiction of the Genesee County Road Commission (GCRC), and 743 lane miles within cities and villages. Local road agencies with the greatest amount of federal-aid miles within their jurisdiction are the GCRC with 1,149 lane miles, the City of Flint with 422 lane miles, the City of Burton with 155 lane miles, and the City of Fenton with 47 lane miles of federal aid roads.



Genesee County Federal-Aid Network 2013 PASER Lane Miles by Surface Type





Condition

The Genesee County Metropolitan Planning Commission with the assistance of the Genesee County Road Commission, Michigan Department of Transportation, City of Flint and the City of Burton has surveyed the federal aid network annually since 2003. In 2013, the pavement condition survey found roughly 69% of Genesee County road segments to be "fair" with a rating of five, or better. The table below illustrates the PASER rating distribution by categories. It also shows that there are a large percentage of roads that require structural improvements throughout the county.

Genesee County 2013 PASER Ratings			
PASER Rating	Prescribed Fix	Total Lane Miles	Percentage of PASER Lane Miles
1 to 4	Structural Improvements	825.36	31%
5 to 7	Capital Preventative Maintenance	1385.11	51%
8 to 10	Routine Maintenance	485.36	18%

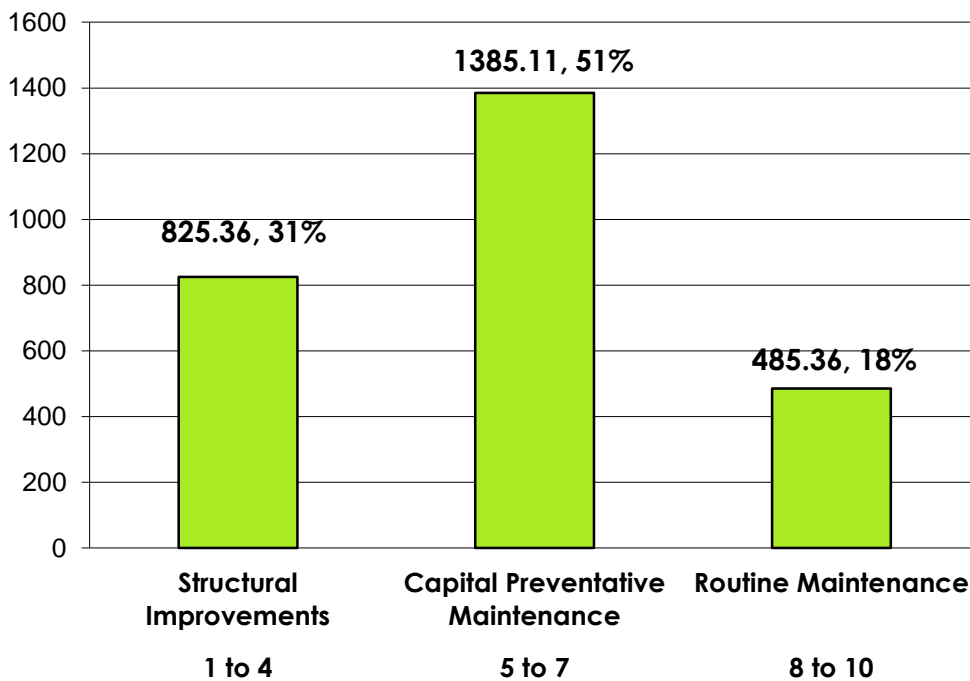
The federal-aid network data is divided into the following three categories: 485.36 lane miles (18%) of roadway received a rating of 8 or better; 1,385.11 lane miles (51%) of the roads received a rating of 5, 6 or 7; and 825.36 lane miles (31%) received a rating of less than or equal to 4.

In 2013, 31% of the local federal-aid road system is in the "poor" PASER Rating Category of 1 to 4. Roads with 1 to 4 ratings require structural improvements that include full depth repairs, major overlay, or reconstruction. This is a decrease of 7% as compared to the 2009 rating distribution in the same category.

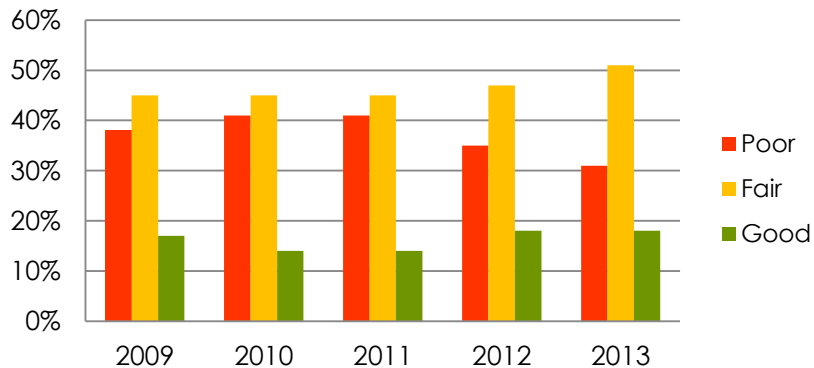
In 2013, 51% of the local federal aid road system is in the "fair" PASER Rating Category of 5 to 7. Roads with 5 to 7 ratings require some partial-depth joint repairs, or seal coat or crack filling. This is an increase of 5% as compared to the 2009 rating distribution in the same category.

In 2013, 18% of the local federal aid road system is in the "good" PASER Rating Category of 8 to 10. Roads with 8 to 10 ratings require little or no maintenance. This is a decrease of 1% as compared to the 2009 rating distribution in the same category.

Genesee County 2013 PASER Ratings in Lane Miles



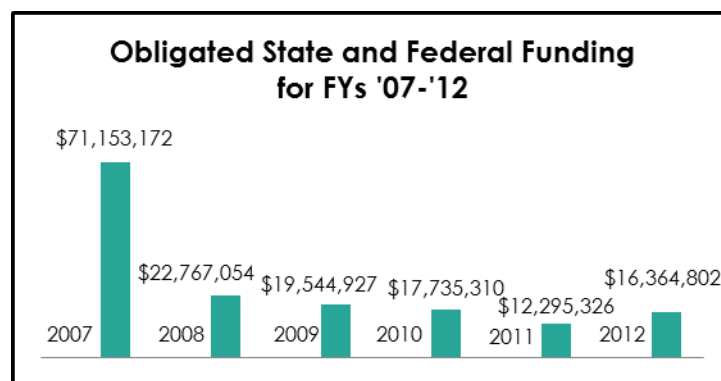
Genesee County PASER Road Condition 2009-2013

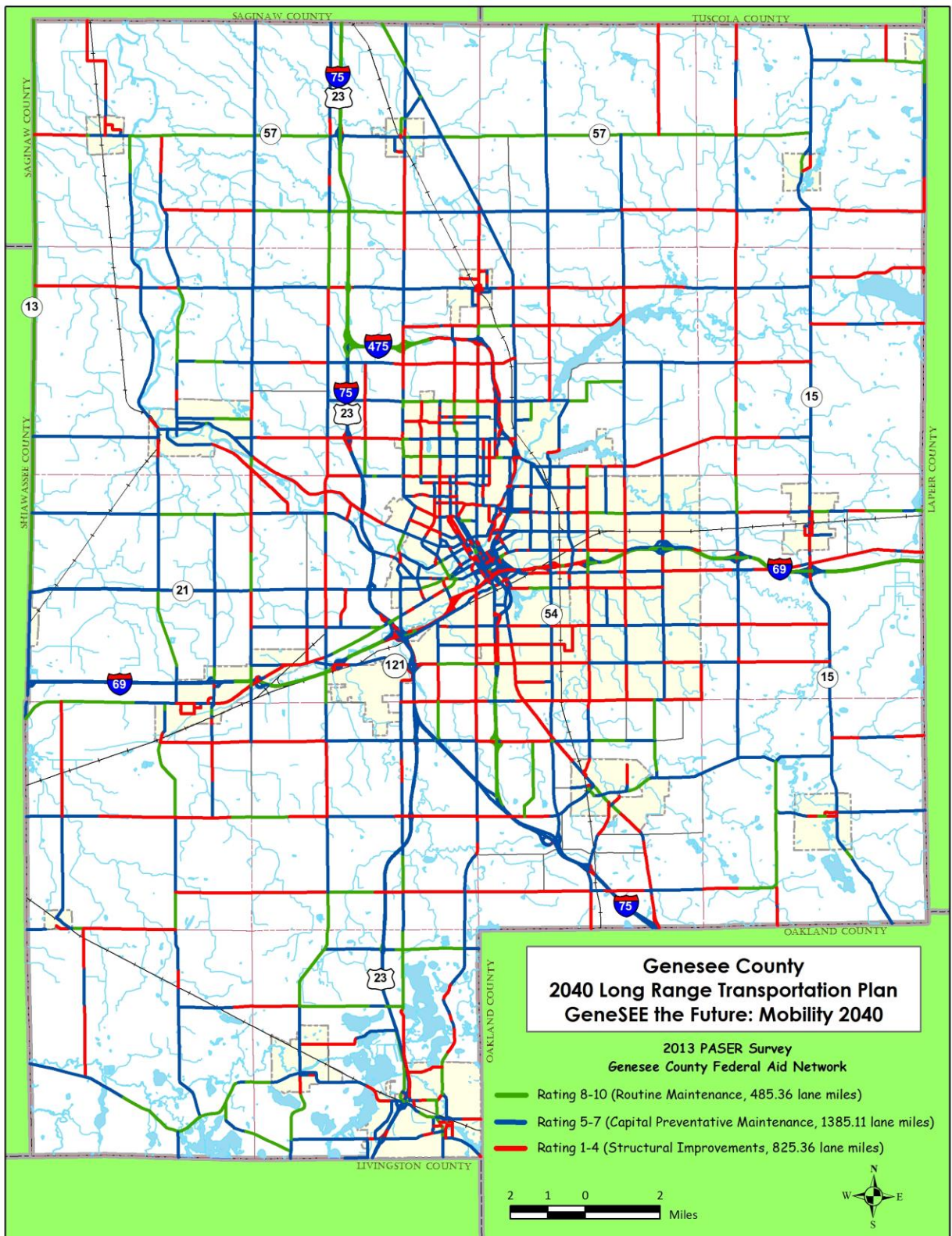


This comparison shows that from 2009 through 2011, the percentage of roads in poor condition increased, and the percentage of roads in good condition decreased. The percentage of roads in fair condition remained stable. However, we see that for 2012 and 2013, the percentage of roads in poor condition decreased, and the percentage of roads in good condition increased. The percentage of roads in fair condition also increased. At first glance, the improved condition of the Genesee County Federal-Aid Road Network does not seem logical given the past condition trends and increased project costs and reduced funding. After review of funding patterns, staff hypothesizes that the improvement shown in the 2011 and 2012 PASER ratings is partially the result of additional funding received through state and federal programs in the mid- to late-2000s. The delay from when the projects were obligated to when they were constructed and to when the PASER rating was taken, can reasonably account for why we are finally seeing an improvement in network conditions in 2011 and 2012.

In addition to funding, there are other contributing factors to the improvement in road conditions. The Genesee County Road Commission (GCRC) substantially increased its primary road chip seal program during this time period. In 2011, the GCRC only chip sealed approximately 22 centerline miles of federal aid roads. In 2012, this number increased to 61 centerline miles. In 2013, that number increased again, to 77 centerline miles of federal aid roads. Another contributing factor was a change in how the Michigan Transportation Asset Management Council rated chip seal improvements. The previous rating for a new chip seal used to be a PASER 7, but in 2012, that rating was upgraded to a PASER 8. The increase in chip seal operation and the improved chip seal ratings help account for the improved trend in pavement condition.

Even with new programs put in place by the various road agencies in Genesee County, staff still anticipates the condition of the network to continue to deteriorate as illustrated in the 2009-2011 years of the last chart, unless additional funding is provided.





2013 PASER Rating by Cities and Villages

Description	1 to 4 Structural Improvements	5 to 7 Capital Preventative Maintenance	8 to 10 Routine Maintenance	Total Lane Miles	Percentage of PASER Lane Miles in Jurisdiction
Burton	101.67	49.01	4.37	155.05	20.9%
Clio	1.65	3.76	0.95	6.36	0.9%
Davison	2.40	3.30	1.71	7.42	1.0%
Fenton	14.57	23.30	8.87	46.74	6.3%
Flint	125.71	265.63	30.71	422.04	56.8%
Flushing	2.05	19.17	2.32	23.55	3.2%
Gaines	0.00	1.55	0.00	1.55	0.2%
Goodrich	1.88	1.51	0.49	3.88	0.5%
Grand Blanc	4.40	11.58	6.06	22.03	3.0%
Linden	2.87	8.15	0.00	11.02	1.5%
Lennon	0.00	0.00	0.00	0.00	0.0%
Montrose	0.97	0.00	0.00	0.97	0.1%
Mt Morris	6.78	6.43	0.00	13.22	1.8%
Otisville	0.00	0.00	0.00	0.00	0.0%
Otter Lake	0.00	0.00	0.48	0.48	0.1%
Swartz Creek	16.63	8.96	3.48	29.07	3.9%
Total	281.60	402.34	59.44	743.38	100%
Percentage	38%	54%	8%	100%	

2013 PASER Rating by Townships

Description	1 to 4 Structural Improvements	5 to 7 Capital Preventative Maintenance	8 to 10 Routine Maintenance	Total Lane Miles	Percentage of PASER Lane Miles in Jurisdiction
Argentine Twp	6.900	19.820	9.868	36.588	3.2%
Atlas Twp	4.952	20.140	8.642	33.734	2.9%
Clayton Twp	0.391	22.578	13.966	36.935	3.2%
Davison Twp	33.252	25.524	5.431	64.207	5.6%
Fenton Twp	7.716	22.523	27.589	57.828	5.0%
Flint Twp	67.172	71.964	32.008	171.144	14.9%
Flushing Twp	9.624	25.788	5.534	40.946	3.6%
Forest Twp	17.274	10.594	3.754	31.622	2.8%
Gaines Twp	12.176	14.388	9.392	35.956	3.1%
Genesee Twp	73.214	40.923	9.707	123.844	10.8%
Grand Blanc Twp	70.737	44.366	13.108	128.211	11.2%
Montrose Twp	5.278	4.910	1.936	12.124	1.1%
Mt Morris Twp	74.536	57.622	16.556	148.714	12.9%
Mundy Twp	22.036	49.366	10.852	82.254	7.2%
Richfield Twp	32.996	11.858	2.006	46.860	4.1%
Theftord Twp	15.017	24.938	1.884	41.839	3.6%
Vienna Twp	11.490	29.257	15.420	56.167	4.9%
Total	464.761	496.559	187.653	1148.973	100%
Percentage	41%	43%	16%	100%	

** Township federal aid roads are under the jurisdiction of the Genesee County Road Commission.

2013 PASER Rating by Jurisdiction

Description	1 to 4 Structural Improvements	5 to 7 Capital Preventive Maintenance	8 to 10 Routine Maintenance	Total Lane Miles	Percentage of PASER Lane Miles in Jurisdiction
Cities	281.6	402.34	59.44	743.38	27%
GCRC	464.76	496.56	187.65	1148.97	43%
MDOT	79	486.21	238.27	803.49	30%
Genesee County Total	825.36	1385.11	485.36	2695.84	100%
Percentage	31%	51%	18%	100%	

Pavement Treatments

As discussed previously, based on the PASER rating system, there are three basic classes of pavement treatments that are applicable on any given roadway: routine maintenance, preventive maintenance, and structural improvements. Historically, Genesee County has not used federal-aid funding to perform any type of routine or preventive maintenance, but concentrates mainly on funding structural improvement projects. While routine maintenance operations, such as filling potholes, mowing, or plowing are not eligible for federal or state aid, preventive maintenance operations are eligible. The chart below lists the approved Preventive Maintenance Treatments as approved by the Michigan Department of Transportation.

Approved Preventive Maintenance Treatments				
Fix Type	Life Extension (in years)	Life Extension (in years)	Life Extension (in years)	PASER Rating
	Asphalt	Composite	Concrete	
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 Micro-Surface	3-5	**	N/A	5-6
Multiple Course Micro-Surface	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****

Note: 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.

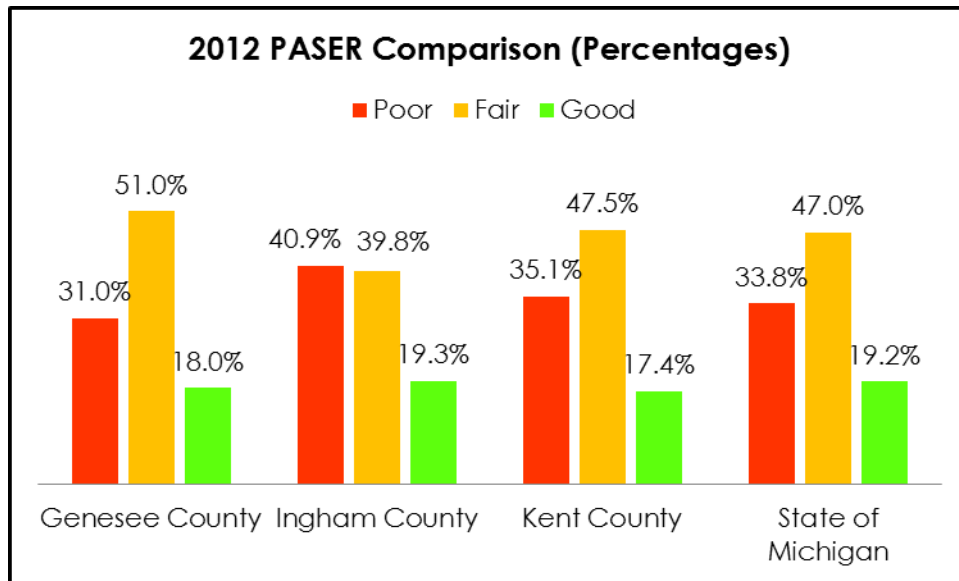
*** The concrete slabs must be in fair to good condition.

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

In Comparison

Genesee County is not unique in the state, nor is the challenge faced by the federal-aid system a new or misunderstood issue. It ultimately reaches the same inescapable conclusion: those federal-aid roads, whether in Genesee County or anywhere else in Michigan, are deteriorating faster than they can be repaired.

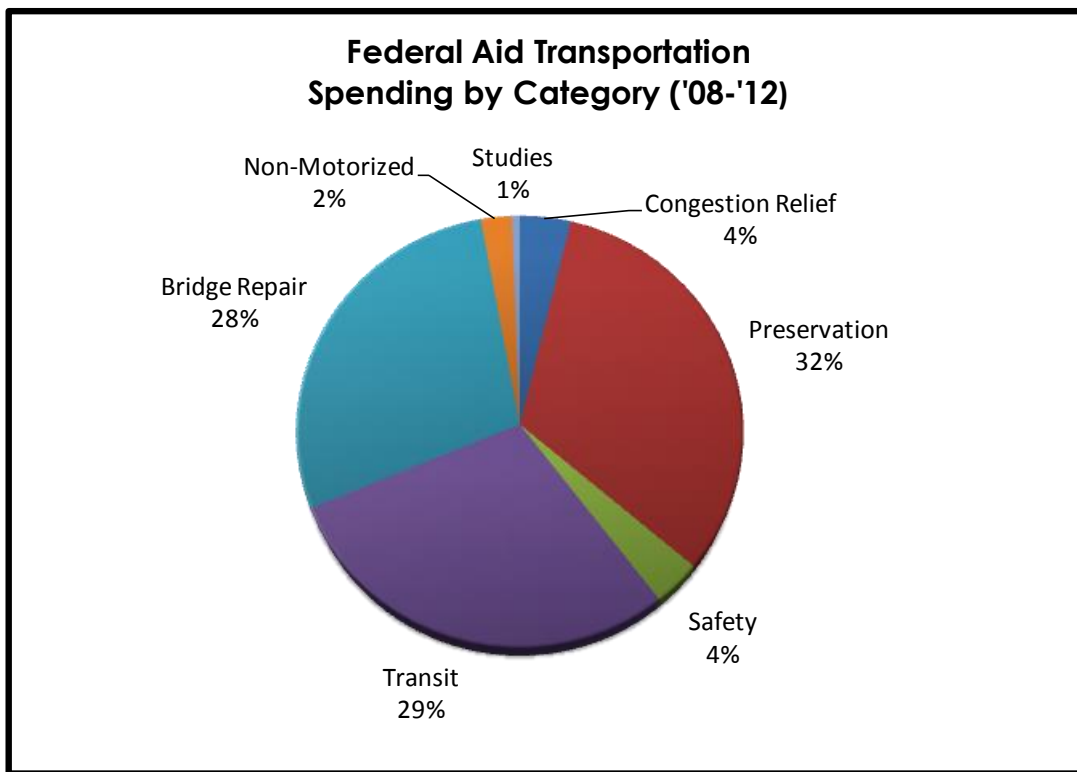
The following chart compares the PASER rating distribution for Genesee, Ingham, and Kent Counties, and the State of Michigan. The chart is current as of May, 2012. Data from 2012 was used as not all counties had reported 2013 data. Based on the data, Genesee County has a smaller percentage of “good” roads than Ingham County or the State of Michigan. Kent County has the smallest percentage of “good” roads, with 17.4%. Ingham County has the least amount of “fair” roads, with 39.8%. Ingham County also has the most “poor” roads, with 40.9%. Kent County is next, with 35.1% of “poor” roads, followed by the State of Michigan with 33.8% of “poor” roads. Genesee County has the least percentage of “poor” roads, with 31%. See Appendix B for PASER Comparison Charts from previous years which compare Genesee County to Ingham and Kent Counties, and to the State of Michigan.



2012 PASER Comparison (Lane Miles)				
Jurisdiction	1 to 4 Structural Improvements	5 to 7 Preventive Maintenance	8 to 10 Routine Maintenance	Total Lane Miles
Genesee County	933	1,279	487	2,699
Ingham County	751	730	353	1834
Kent County	1,085	1,465	536	3,086
State of Michigan	29,722	41,269	16,844	87,835

Pavement Funding

The future of roads in Genesee County is greatly influenced by the available federal and state funding. From 2008-2012, Genesee County has spent over \$273 million on improving the transportation system. With the increased cost of road projects and the decrease of available funds, the county is using its Pavement Management Program as a tool in the planning process when selecting road projects. The chart below shows the distribution of funding for various activities in Genesee County.



The pool of money to be used for pavement management in Genesee County comes from several different sources. In addition to the federal funds available through the Transportation Improvement Program, Genesee County's local units of government also receive State of Michigan Act 51 funds. Act 51 provides formulas for the distribution of the Michigan Transportation Fund to local units of government.

The primary uses of MTF funds are:

- **State Trunkline Fund** for the construction and maintenance of state trunkline roads and bridges and for administration of the Michigan Department of Transportation (MDOT).
- **Local Road Agencies** for 83 county road commissions and 535 cities and villages.
- **Comprehensive Transportation Fund (CTF)** for public transportation programs including capital and operating assistance to the state's 72 public transit agencies.

In FY 2012, Genesee County local road agencies received over \$34 million in Act 51 funds:

Local Road Agency	Total Act 51 Funding
Burton	\$2,386,630.91
Clio	\$154,578.59
Davison	\$292,239.73
Fenton	\$797,179.91
Flint	\$8,310,144.79
Flushing	\$517,041.05
Gaines	\$41,029.37
Genesee County	\$20,688,883.38
Goodrich	\$114,316.91
Grand Blanc	\$482,509.54
Linden	\$231,560.31
Montrose	\$108,113.16
Mt. Morris	\$194,097.91
Otisville	\$61,243.63
Swartz Creek	\$363,445.12
Total	\$34,743,014.31

Genesee County Pavement Funding Breakdown		
Pavement Management Network	% of Lane Miles	Yearly Average
Locally-Owned Roads	51.0%	\$13,758,233.66
Federal-Aid Roads	34.0%	\$9,542,319.90
MDOT Interstates, Highways, and Trunklines	15.0%	\$13,232,438.50
Total	100.0%	\$36,532,992.06

A breakdown of funds regarding the different networks can be seen above. When calculating the amount of the funds available, staff used a particular methodology as outlined for each network below.

MDOT Pavement Preservation

The majority of pavement preservation funds for this network are calculated and controlled by the Michigan Department of Transportation. MDOT reports to the MPO the amount of funds they plan to expend on each particular project for inclusion into the Transportation Improvement Program. In an effort to estimate the amount of funds used for pavement preservation on MDOT's Genesee County network, staff used the current TIP funding limits. An average-per-year funding amount was calculated as reported for the 2014-2017 Transportation Improvement Program.

Local Federal-Aid Network

The MPO receives a calculated amount of funding each year to apply to the local federal-aid network. This number is reported to the MPO by the Michigan Department of Transportation and is based on formulas for distribution of state and federal funds. The total amount listed for the local federal-aid network in the table on the previous page includes 20% of local match funding.

Locally-Owned Roadways

ACT 51 funds are the main funding source of pavement preservation monies for locally-owned roadways. In FY 2012, the Genesee County Road Commission received over 20 million dollars in state ACT 51 funds. In FY 2012, the cities and villages within Genesee County received over 14 million dollars in ACT 51 Funds. Due to State of Michigan legislation restrictions, these funds cannot be spent on just repaving roads. Staff reviewed Genesee County expenditure data from the Michigan Transportation Asset Management Council. Data from 2008 through 2011 was reviewed, and staff determined that on average, 40.4% of funding goes for road preservation (as opposed to maintenance, construction/capacity improvements, or administration). The yearly average identified in the chart for locally-owned roads is 40.4% of the \$34,743,014.31 of Act 51 funds received by Genesee County road agencies in FY 2012.

Pavement Listening Session

Genesee County Metropolitan Planning Commission
August 26, 2008

On August 26, 2008, the Genesee County Metropolitan Planning Commission held a Pavement Listening Session to generate understanding about current pavement conditions in the county and to explore potential improvements that can be made now and in the future. The meeting was attended by local officials, state and federal agency staff, and planning commission staff. To focus the group, a questionnaire was distributed and attendees were given time to briefly answer each question. Each question is listed below with ideas and comments generated by the group.

A number of questions, comments, concerns and suggestions were discussed at the Pavement Listening Session. However, one common theme came through: local jurisdictions need more money. Staff reviewed this 2008 information for the 2040 LRTP document, and found that it still reflected current conditions. The table below provides highlights from the 2008 Pavement Listening Session.

- 1) What funding is available for Road Improvements in Genesee County?
 - Michigan Transportation Fund
 - Local match from Townships
 - Special Assessment from subdivisions streets
 - Federal funds

- 2) What funds do local units of government use for routine maintenance?
 - Michigan Transportation Fund
 - Township's general fund

- 3) What factors have led us to our current situation? (42% pavement deficient)
 - ACT 51 Distribution Formula

- 4) Do you know of any innovative funding methods that are being used in other areas?
 - Toll Roads
 - Privatization

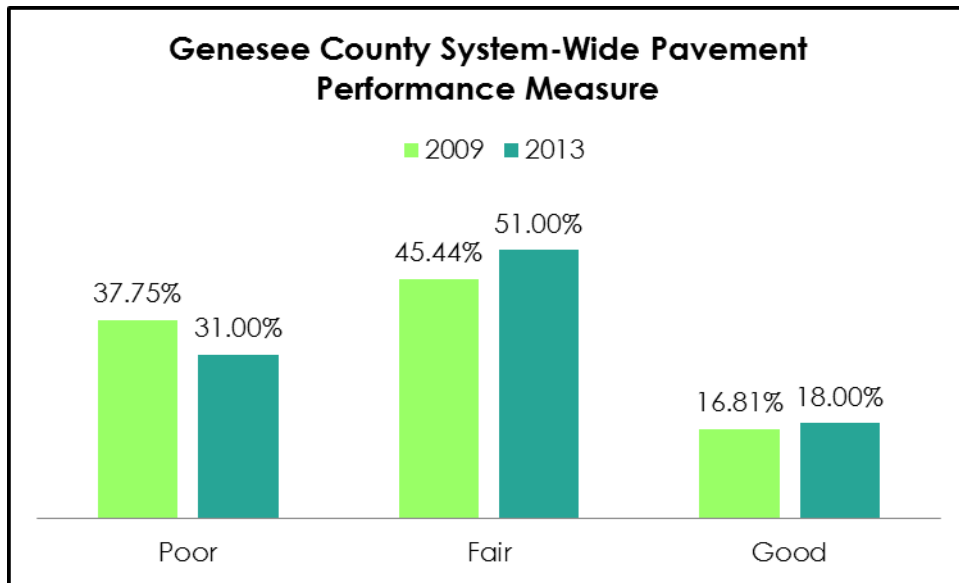
- 5) Do you know of any innovative maintenance programs that are being utilized in other areas?
 - None available

- 6) In your opinion, what should be done to improve the road condition in the county?
 - Change the Funding structure

- 7) What method do you use to determine which roads to fix
 - The volume of traffic and condition of the road is the primary factors in determining which roads are fixed

- 8) Do you have a system for determining a mix of fixes
 - None available

- 9) Are your roads getting better or worse and why?
 - The roads are getting worse due to the lack of local, State and federal funds



Summary of Appendix A--Pavement—Future Analysis

For the development of the 2035 LRTP, staff used the RoadSoft GIS program to run scenarios for a various mix of fixes, scenarios that focused on specific road networks, and also at various funding levels. The results of the analysis showed that only increased funding levels will improve the overall condition of the federal-aid network. Staff feels that this analysis is still valid as other reports from across the state show similar findings. Genesee County has seen recent improvements in the network condition, due to an influx of funds as previously illustrated in this report.

The Pavement Future Analysis Report is included in Appendix A for your review; however, the following is a summary of the findings and recommendations.

All the scenarios in the Pavement Future Analysis Report in Appendix A led to poor pavement conditions, except for scenarios that increased funding. We need more funding to maintain good road conditions. Other studies around the state have come to the same conclusion. However, we recommend that Genesee County should take the following steps:

1. Update the pavement management program regularly and annual data collection process
2. Adopt a preventive maintenance strategy and policy
3. Consider rehabilitation alternatives that will “stretch” the maintenance dollar
4. Direct staff to determine additional funding source.
5. Redistribution of current funds and the creation of new funding sources
6. Flexibility of use of funds

MAP-21 Performance Measures

A key feature of MAP-21 is the establishment of a performance-and-outcome-based program. The objective of this performance-and-outcome-based program is for states and Metropolitan Planning Organizations (MPO) to invest resources in projects that collectively will make progress toward the achievement of the national goals. MAP-21 requires state Department of Transportation (DOT) agencies to establish performance measures within 18 months of enactment of MAP-21. Within 180 days of performance targets being set by states or providers of public transportation, MPOs are required to set performance targets in relation to the performance measures (where applicable). These targets are required to be included in the MPO's Long Range Transportation Plan.

At the time the Genesee County 2040 Long Range Transportation Plan was developed and approved, no official federal guidance on the performance measure requirements of MAP-21 had been released. Also, the State of Michigan did not have performance targets in place. The Genesee County Metropolitan Alliance recognizes these MAP-21 requirements. Without official federal guidance in place, (and without targets set at the state level), the MPO though the Long Range Transportation Plan (LRTP) and the Transportation Improvement Program, has established funding goals that generally target the areas specified. These goals were established in the LRTP and implemented through the 2014-2017 TIP as closely as possible given the limitations on the availability and restrictions of local, state, and federal funding sources. Staff will also continue to gather data for the development of performance measures,

such as the overall system-wide pavement condition for Genesee County's federal-aid network, in preparation for more specific guidance at the federal and state level of government.

Appendix A

2035 Genesee County Long Range Transportation Plan--
Pavement—Future Analysis

2035 Genesee County Long Range Transportation Plan

Pavement – Future Analysis

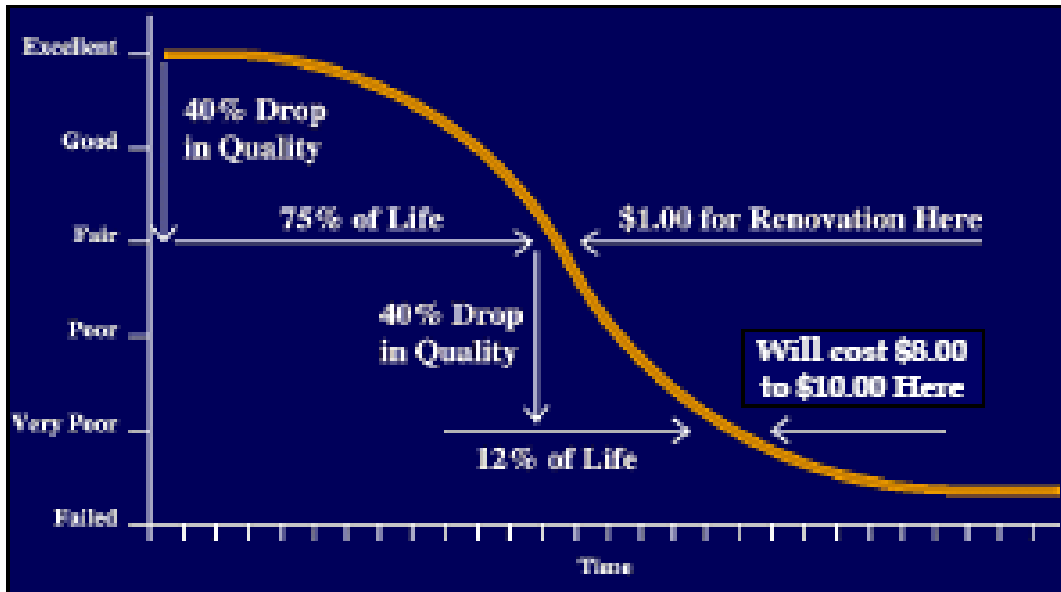
The Pavement Deterioration Curve

Pavement generally deteriorates according to a certain pattern. Figure 1 below is a model of this pattern, shown as a graph of pavement condition versus time. Please note that this figure is not to scale.

A road pavement begins its life in excellent condition and remains in excellent condition for a few years, without need of any maintenance. Over time, however, the condition of the street will worsen, and the rate at which its pavement condition deteriorates will increase dramatically as the street passes the midpoint of its life. It is at this point that pavement repair options must be weighed. Questions must be answered, such as: Will the investment related to a preventive maintenance repair be offset by the opportunity cost of not doing such a repair, or is the pavement at such a state that it would be better to simply wait until the pavement completely deteriorates before making the repair? The answers (and, indeed, the questions themselves) depend upon the individual pavement segment.

Figure 1 illustrates the benefit of addressing pavement concerns before the pavement condition reaches a poor or failed state. A preventive maintenance repair that may be applicable to a pavement in fair condition will not be appropriate for that same pavement in a few years when it is in poor or failed condition. By the time a pavement reaches a poor or failed condition, the required repair can be eight to ten times the cost of the preventive maintenance repair that could have been applied as soon as five years before. The answer, therefore, is to perform timely maintenance to slow or to repair pavement deterioration, thereby extending the life of the road – and doing so in a cost-effective manner.

Figure 1 –Typical Pavement Deterioration Curve



Costs for each Maintenance activity:

Constuction Cost Estimates			
Pavement Treatment	Surface Type	Cost Per Lane Mile	Cost Per Lane Foot
Reconstruction	Asphalt	\$ 792,000	\$ 150
Base Crush and Shape w/ 4" HMA Resurfacing	Asphalt	\$ 316,800	\$ 60
4" Mill and Resurface	Asphalt	\$ 237,600	\$ 45
2" Mill and Resurface	Asphalt	\$ 200,640	\$ 38
2" Overlay	Asphalt	\$ 190,080	\$ 36
Single Course Micro-Surfacing	Asphalt	\$ 26,400	\$ 5
Single Course Chip Seal	Asphalt	\$ 10,560	\$ 2
Crackseal	Asphalt	\$ 2,800	\$ 0.53
Concrete Reconstruction	Concrete	\$ 1,003,200	\$ 190
Concrete Rubblization & Asphalt Resurfacing	Concrete	\$ 343,200	\$ 65
Full Depth Concrete Joint Repair	Concrete	\$ 121,440	\$ 23

Scenarios Explored

The condition of the federal-aid road system in Genesee County continues to decline even with the millions of dollars spent on the system each year. This is a result of three factors: 1. Genesee County has an old federal-aid road network and almost half of the network is failing. These roads require reconstruction which is very expensive and puts a strain on a limited budget. 2. In the past the focus of the Transportation Improvement Program (TIP) has been to fund the worst roads with the most expensive fix, reconstruction. 3. The funding available to address the needs of the road network are not enough to effectively maintain the system at an acceptable level.

The goal of this pavement scenario section is to analyze present funding and maintenance practices to see what condition our system will be in if we continue to use these practices and to look at alternative practices and funding to see what it would take to improve our system. The following scenarios analyze mixtures of different maintenance techniques, different ways to use the funding that we currently receive, maintaining various road networks, and different funding levels.

Scenarios: Group 1

The first groups of scenarios analyze our urban and rural federal-aid systems separately as there are different federal funding sources for each. Both the urban and rural system has been analyzed using the following scenarios:

- **2007-2008 TIP**
- **Scenario 1**
- **Scenario 2**
- **Scenario 3**
- **Scenario 4**

2007-2008 TIP: This Scenario analyzes the urban and rural road networks using maintenance activities and funding levels for each activity reflective of the funding levels of the current Transportation Improvement Program (TIP). 75% of all federal funds used to maintain the road network were awarded to 4" Mill and Resurface projects while 25% of federal funds were awarded to 2" overlay projects.

Scenario 1: This scenario builds off of the 2007-2008 Scenario and allocates funds for reconstruction projects. The majority of the funds for Reconstruction were shifted from 4" Mill and Resurface. Reconstruction provides the best fix for failing roads however reconstruction is very costly.

Scenario 2: This scenario is similar to Scenario 1 but shifts all funds allocated for Reconstruction projects to Crush and Shape projects. This fix is less costly than reconstruction but still provides a reasonable fix for roads in poor condition.

Scenario 3: This scenario builds off of Scenario 1 but provides a large portion of the funds for Micro-surfacing. Funds were shifted from 4" Mill and Resurfacing to the Micro-surfacing maintenance activity. This is a relatively low cost fix that will help to preserve the road system, however does not address structural issues with the road.

Scenario 4: This scenario shifts all of the federal funds used to maintain the road network to the 2" Overlay maintenance activity. This is a relatively low cost fix that will help to preserve the road system, however does not address structural issues with the road.

Details of maintenance activities and funding levels for each activity for Group 4 scenarios and scenario results can be found on the Urban Road Network and Funds and Rural Road Network and Funds graphs and charts.

Scenarios: Group 2

The second group of scenarios analyzes the Urban Road Network using the maintenance activities and funding levels outlined in the 2007-2008 TIP scenarios from Group 1, but also adds various levels of Act 51 funds for preservation activities. The preservation activity selected for this scenario was Crack Sealing. The focus of this activity is to keep roads with a PASER rating of 6-8 in good condition. The urban road network was analyzed using the following scenarios:

- **2007-2008 TIP** – No preservation funds allocated
- **5% Preservation** – 2007-2008 TIP scenario with 5% of Act 51 funds allocated for preservation.

Details of maintenance activities and funding levels for each activity for Group 4 scenarios and scenario results can be found on the Urban Road Network and Funds with a Percentage of Act 51 Funds for Preservation graph and chart.

Scenarios: Group 3

The third group of scenarios analyzes the Urban Road Network using the maintenance activities and funding levels outlined in the 2007-2008 TIP scenarios from Group 1, but at various levels of funding. The goal of this scenario is to assess what level of funding, using current maintenance practices, would be needed to show a continual increase in Remaining Service Life (RSL) of the Urban Road network. The scenarios are as follows:

- **2007-2008 TIP** – Current funding levels
- **Double Funds** – 2007-2008 TIP with funding doubled
- **Triple Funds** – 2007-2008 TIP with funding tripled

Details of maintenance activities and funding levels for each activity for Group 4 scenarios and scenario results can be found on the Urban Road Network Various Levels of Funding graph and chart.

Scenarios: Group 4

The fourth group of scenarios analyze the Arterial Road Network using the maintenance activities and percent of funding levels outlined in the 2007-2008 TIP scenarios from Group 1 at various levels of funding. The focus of this group of scenarios is to assess how well a scaled down road network could be maintained given our current level of federal funds. The scenarios are as follows:

- **Current Funding Levels** – This Scenario uses current funding levels allocated to arterials which is 80% of the federal funds.
- **100% of Federal Funding** – This Scenario uses 100% of the federal funds to analyze the arterial road network.

Details of maintenance activities and funding levels for each activity for Group 4 scenarios and scenario results can be found on the Projects Limited to the Arterial Road Network graph and chart.

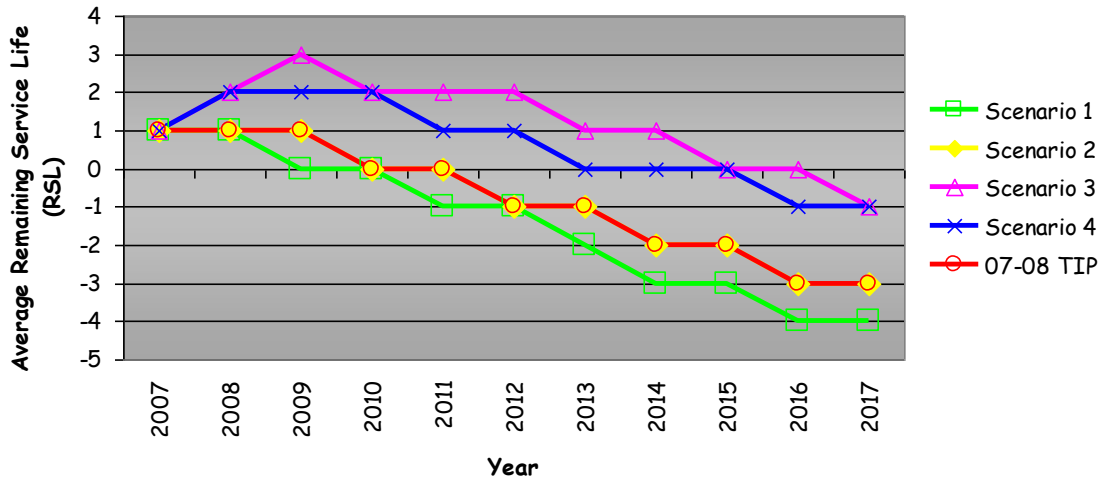
Analyzing the Scenarios Using RoadSoft GIS

These scenarios were analyzed using the RoadSoft GIS program. The program uses current pavement conditions and deterioration curves to assess each scenario. The data output of RoadSoft GIS for each scenario is Remaining Service Life (RSL). Remaining service life is defined by RoadSoft as “The predicted time in years that preventative maintenance treatments can cost effectively be applied to a pavement. If the pavement has reached the Critical Distress Point, it is most cost effective to forgo preventative maintenance and let the road deteriorate until heavy rehabilitation or reconstruction is necessary.” A positive RSL for a road network means that on average it is still cost effective to perform preventative maintenance activities on roads in the network. A negative RSL for a road network means that on average the road in the network are beyond preventative maintenance activities and heavy rehabilitation or reconstruction is required. The Remaining Service Life diagram has been provided to help explain the concept of RSL.

Analysis of Group 1

Staff developed 4 scenarios for the urban federal aid network and evaluated all of the scenario's using the 2007–2008 TIP as the status quo data. All of the scenarios used the same treatment types but different percent of funding allocations. Scenario #1 was an analysis of the effect of reconstruction as the predominant improvement on the Urban and Rural network. Scenario #2 is an analysis of the crush and shape as a predominate improvement, Scenario #3 is the analysis an overlay and micro-resurfacing as the type of fixes and scenario #4 was the analysis a 2” overlay as the predominate surface treatment on the network. Based on the data evaluated Scenario 1 through 4 all had a declining remaining service life after ten years. Scenario #3 provided the best results of initially improving the system by leveling out the remaining service life, but after 3 years the network starts to decline to a negative RSL. These scenarios do not include routine maintenance procedures which would most likely increase the condition of the road network.

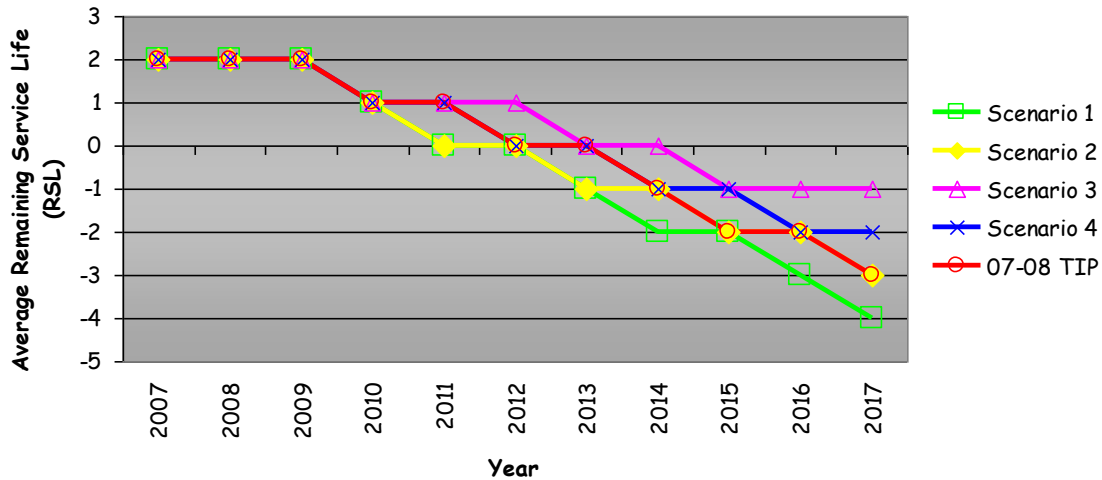
Urban Road Network and Funds



	Reconstruction	Crush & Shape	4" Mill & Resurface	2" Mill & Resurface	2" Overlay	Micro-Surface	Chip Seal	Concrete Reconstruction	Concrete Rubblization	Joint Repair	Total \$
07-08 TIP	0.0%	0.0%	60.0%	0.0%	20.0%	0.0%	8.2%	0.0%	8.9%	3.0%	\$ 7,442,304
Scenario 1	26.9%	0.0%	33.1%	0.0%	20.0%	0.0%	8.2%	11.8%	0.0%	0.0%	\$ 7,442,304
Scenario 2	0.0%	13.4%	33.1%	0.0%	20.0%	0.0%	8.2%	0.0%	25.2%	0.0%	\$ 7,442,304
Scenario 3	0.0%	0.0%	20.0%	0.0%	31.8%	40.0%	8.2%	0.0%	0.0%	0.0%	\$ 7,442,304
Scenario 4	0.0%	0.0%	0.0%	0.0%	91.8%	0.0%	8.2%	0.0%	0.0%	0.0%	\$ 7,442,304

The Rural network was evaluated using the same criteria but with only the federal funds allocated to the rural area. Staff used the 2007–2008 TIP as the status quo data and developed 4 scenarios using the same treatment types but different percent allocations. Unlike the urban network, none of the four scenarios projected a positive trend and ended the 10 year cycle with a negative remaining service life. This data shows that regardless of what mix of fixes you apply to the rural network, there's not enough funds available to maintain or improve the system. These scenarios do not include routine maintenance procedures which would most likely increase the condition of the road network.

Rural Road Network and Funds

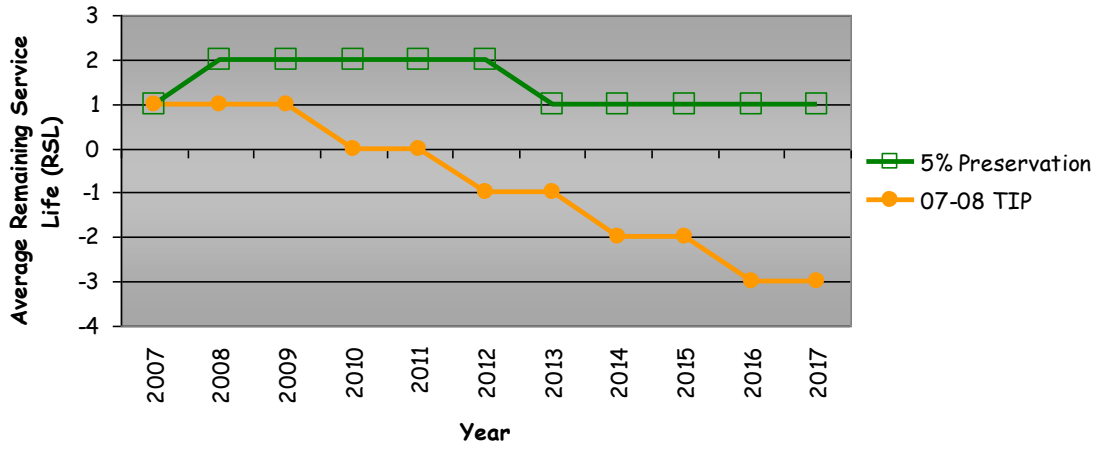


	Reconstruction	Crush & Shape	4" Mill & Resurface	2" Mill & Resurface	2" Overlay	Micro-Surface	Chip Seal	Concrete Reconstruction	Concrete Rubblization	Joint Repair	Total \$
07-08 TIP	0.0%	0.0%	43.0%	0.0%	14.3%	0.0%	42.0%	0.0%	0.5%	0.2%	\$ 928,696
Scenario 1	57.4%	0.0%	0.0%	0.0%	0.0%	0.0%	42.0%	0.7%	0.0%	0.0%	\$ 928,696
Scenario 2	0.0%	56.5%	0.0%	0.0%	0.0%	0.0%	42.0%	0.0%	1.5%	0.0%	\$ 928,696
Scenario 3	0.0%	0.0%	0.0%	0.0%	28.9%	29.1%	42.0%	0.0%	0.0%	0.0%	\$ 928,696
Scenario 4	0.0%	0.0%	0.0%	0.0%	58.0%	0.0%	42.0%	0.0%	0.0%	0.0%	\$ 928,696

Analysis of Group 2

Group 2 analyses is a comparison of the urban federal aid network with the 2007–2008 TIP as the status quo and this same network with 5% of the ACT 51 funds applied specifically to routine maintenance such as crack sealing. By adding the additional 5% for crack sealing, the urban system will slightly increase in RSL and then level off. This is due to the routine maintenance done to the good roads that expends the life and prevents it from declining into the lower category that requires more expensive repairs. Then network will return to its current condition and be maintained at that level.

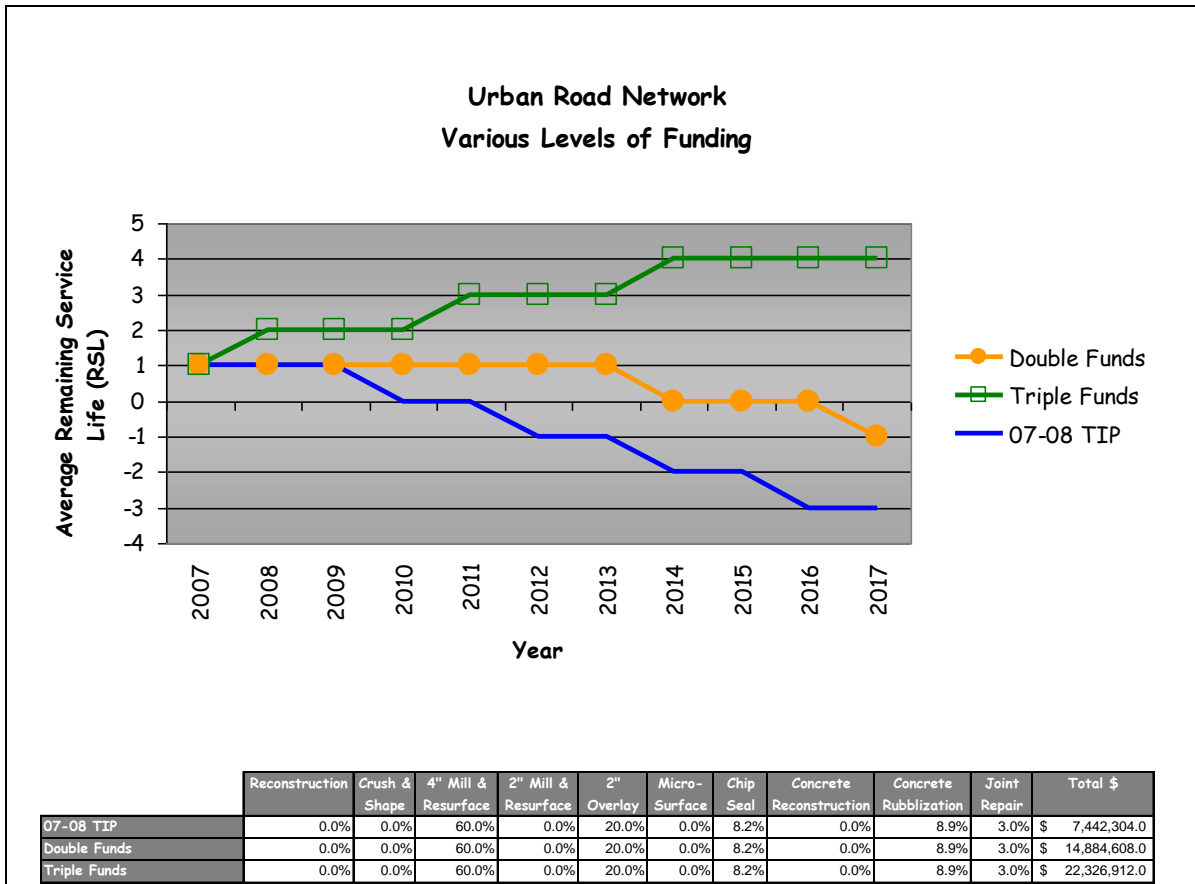
**Urban Road Network and Funds
with a Percentage of Act 51 Funds for Preservation**



	Reconstruction	Crush & Shape	4" Mill & Resurface	2" Mill & Resurface	2" Overlay	Micro-Surface	Chip Seal	Concrete Reconstruction	Concrete Rubblization	Joint Repair	Total \$	% of Act 51 for Preservation
07-08 TIP	0.0%	0.0%	60.0%	0.0%	20.0%	0.0%	8.2%	0.0%	8.9%	3.0%	\$ 7,442,304	0% \$ -
5% Preservation	0.0%	0.0%	60.0%	0.0%	20.0%	0.0%	8.2%	0.0%	8.9%	3.0%	\$ 7,442,304	5% \$ 992,852

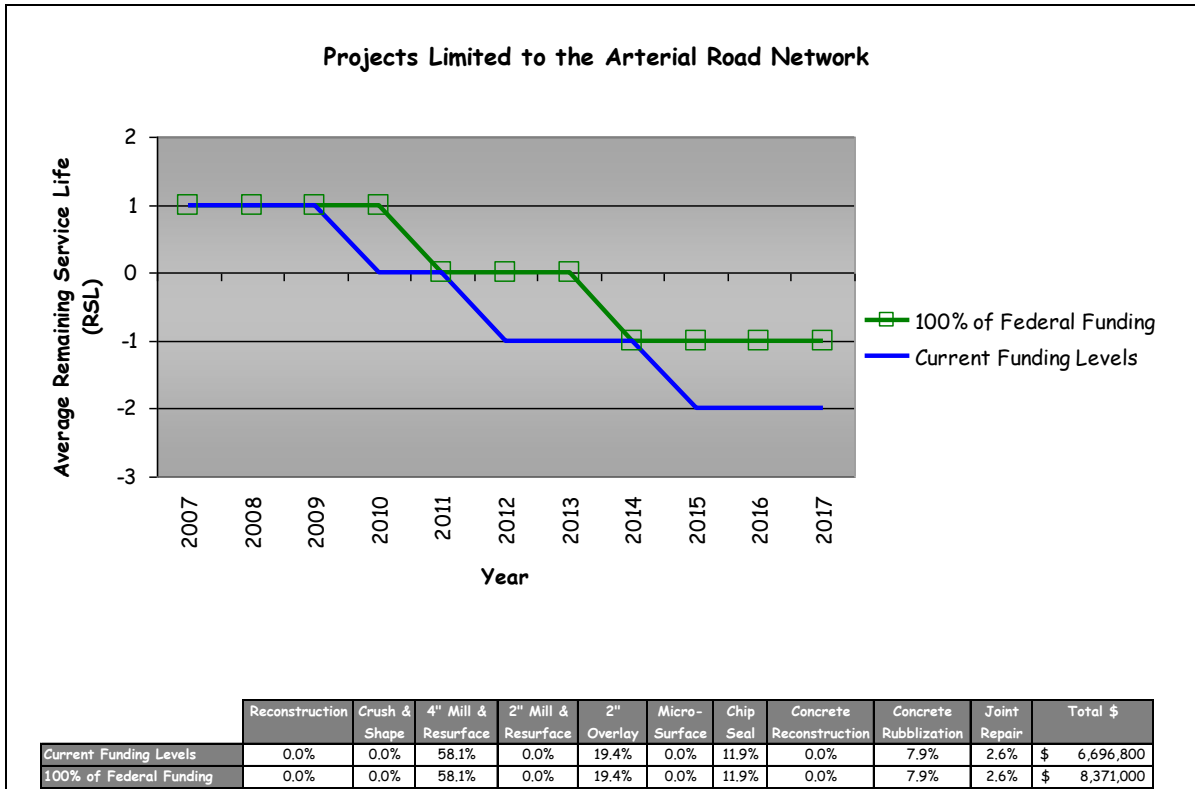
Analysis of Group 3

In this group analysis, staff developed 3 scenario's using the urban federal aid network. The 2007-2008 TIP data was used as the Statue quo, the second scenario doubled the federal funds and the third scenario tripled the federal funds. In this analysis, the doubled federal funds show that the network will stabilize at its present lever but will begin to decline after about 5 years. By tripling the federal aid funds, the urban system will significantly improve. These scenarios do not include routine maintenance procedures which would most likely increase the condition of the road network.



Analysis of Group 4

Group 4 analyses are a comparison of two systems using only the arterial roads in the federal aid network. The first scenario represents the current allocation of 80% of the federal all eligible funds to the network and the second scenario allocated 100% of the federal aid eligible funds to the network. Both of these systems predicted a declining remaining service life of the arterial road network at the current available federal funds. These scenarios do not include routine maintenance procedures which would most likely increase the condition of the road network.



Pavement Preservation Recommendations

Based upon the results of the scenarios discussed in this report, neither scenario provided a clear method of increasing the network condition at the current funding level. Overall, group 1 scenarios 1–4 all had a declining RSL at the end of the 10 years life, but scenario #3, which allocates a larger percentage of federal funds to micro-resurfacing projects, provides the most effective approach to maintaining the County's pavement network. Group 1 scenario #3 achieves two important goals: first, this scenario moves the network into a positive direction for the next 5 years; second, it improves more lane miles at a lower cost than any of the other scenarios. Both of these goals were achieved using the existing budget expensive.

The results of these scenarios also revealed the need for routine maintenance. In group 2 of the analysis, the allocation of approximately 1 million dollars to be used for crack sealing showed a positive impact on the system by predicting a positive RSL. This is mainly due to the stabilization of good roads by extending their life and at the same time making improvement to the poor roads.

As the 2007–2008 TIP scenario illustrated, the Genesee County road network RSL will continue to decline with the current funding levels. This decrease in RSL coupled with an increase in the road repair cost is an indication that not enough funding will be available for capital repairs, and total reconstructions. While aggressive routine and preventive maintenance can address many roads and maintain the average network RSL, only investment in capital improvements will prevent the total network condition from significantly declining.

Though the amount of funding is important, so too is the allocation of these funds. Based on the scenarios, the data shows that allocating more funds to micro-surfacing and overlays will increase the network system for a few years but do to the amount of poor roads and the declining rate of deterioration, will not hold the network in a positive trend. With this in mind, the County must developed a plan that reflects the definition of pavement management. At the present time, the County road network is declining at a significant rate. Therefore, adopting a policy that maintains the roads in good condition while also attempting to improve those roads in poor condition must be implemented.

Genesee County has a substantial investment in their road network as evidenced by the \$41.2 million spent in the 2006–2008 TIP. Overall, in 2007, 58% of the roads were in good condition, 42% of the streets are in "Poor" condition categories, which require a fairly significant amount of money to bring them into the "good" condition category. If sufficient funding is

unavailable for road maintenance and repair, the average RSL of the network is expected to decrease resulting in increased future costs as more capital intensive treatments (such as reconstruction) will be necessary as roads are deferred where less expensive treatments (such as surface seals or overlays) are currently feasible.

The analyses indicate that the County does not have enough federal funds to do capital preventative maintenance that is required on the system to project a positive overall trend. However, with the available funds micro-resurfacing and overlay and can be performed to essentially maintain the roads. By doing so, roads then can be maintained in good condition with on-going preventive maintenance such as crack sealing. This will eventually save money by avoiding reaching the level of major rehabilitation (such as reconstructions).

Pavement Budget

The County's current federal aid allocation for road improvements is approximately \$7.4 million per year. At this budget level, the network RSL is expected to continue to decrease in the next 10 years. This level of funding does not provide sufficient funding to improve the current system and will result in an unsustainable system.

We recommend that the County road agencies seek additional Federal, State and local funds and increasing pavement expenditures, especially those directed at routine maintenance. Additional funds may be achieved by the redistribution of ACT 51 funds, Local mileage, or additional sale tax. This will allow the Road Agencies to achieve the following objectives:

- * Allows the road agency to preserve and improve pavements in the "Good" category.
- * Reduces the percentage of pavements in the "Poor" categories.
- * Maintains the current RSL for a longer period of time.

Pavement Maintenance Strategies

The County's pavement maintenance strategies include Crush and shape, chip seals, overlays and reconstruction. Since a fairly large percentage of pavements are in "Good" condition, it is important to preserve good pavements. Crack sealing, one of the least expensive treatments, can keep moisture out of pavements and prevent the underlying aggregate base from premature failures. Life-extending surface seals, such as micro resurfacing is also cost-effective for pavements currently in fair condition. Therefore, we recommend that the County maintain the efforts in current

preventive maintenance program as outlined in Group 1, scenario #3 with a strong routine maintenance effort.

Re-inspection Strategies

In order to properly maintain the pavement management database, it is recommended that the federal aid network continue to be inspected annually using the PASER data collection process. It is also recommended that the local's incorporate the PASER process into their local road network process.

In Summary

All the scenarios led to poor pavement conditions. We need more funding to maintain good road conditions. Other studies around the state have come to the same conclusion. However, we recommend that Genesee County should take the following steps:

1. Update the pavement management program regularly and annual data collection process
2. Adopt a preventive maintenance strategy and policy
3. Consider rehabilitation alternatives that will "stretch" the maintenance dollar
4. Direct staff to determine additional funding source.
5. Redistribution of current funds and the creation of new funding sources
6. Flexibility of use of funds

Appendix B

PASER Comparison Charts

