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PASER Rating Summary & Street Asset Management Plan

Meridian Township

August 2017

Engineering • Architecture • Land Surveying

Table of Contents

List of Tables

List of Figures

Appendices

Executive Summary

This report provides analysis and evaluation of the roadway network in Meridian Township to help define needed asset allocation and improvements required to improve or maintain the network. The method of determining these conditions includes Pavement Surface Evaluation and Rating (PASER) analysis combined with Roadsoft asset management tools. All analysis using these tools can be found summarized within the report and the appendices following the report. Results of our analysis show that in order to achieve an overall increase in RSL over a 10 year period an annual funding level of $1.5 million would be required. Additional funding of $2.15 million per year would result in 75% of the roads being rated "good" at the end of 10 year period and $3.5 million per year would be needed to get all of them at a PASER rating of 8 (good) within a 10 year period.

This report acknowledges that there are some limitations to the analysis performed. Funding levels were set based on existing funding and an assumed level of tolerance for a millage within the township, actual levels may vary. Further, the preventative maintenance methods chosen were based on statewide common strategies, for a true management plan, the township's experience could be applied to select methods that are acceptable to its unique roadway situation.

Introduction

This document is to serve as Meridian Township's Asset Management Plan for its streets. The intent is that this document will assist in guiding all street work and improvements within the township. This plan has been developed using Michigan Department of Transportation (MDOT) suggested practices. This report reflects the best known practices currently in use by roadway agencies across the State, but is tailored to the unique street network within the township. As maintenance and construction work is completed on the roadway network, the intent is for this document to be updated to properly reflect current conditions. To provide a clear picture of the current network, this should be done whenever Pavement Surface Evaluation and Rating (PASER) analysis is completed. By updating this document regularly, the experience of applying preventative maintenance techniques by the township can be evaluated. This growing experience will lead to more informed maintenance decisions that best fit the township's unique situation. The current spending levels by the Township and County road department are not enough to address the township's long term needs.

Street Asset Management in Michigan

The State of Michigan is a leader in applying asset management principles to its 122,000 mile plus roadway network. The process that MDOT has applied to its mainline roadways has been passed

down to local road agencies through State legislation in recent years. The key piece of legislation, Public Act (PA) 499 of 2002, established the Transportation Asset Management Council (TAMC), which required efforts to assist local agencies in providing a uniform reporting system for asset management of roadways. This was considered the kicking off point for local agencies to participate in the asset management process.

Amendments to the original legislation have been introduced throughout the years to provide clear definition of local agency reporting requirements. The Acts related to TAMC and the local agency asset management processes are included following this report in Appendix A.

Among its other responsibilities, the TAMC is required to work with local agencies to ensure proper implementation of asset management plans on their roadway network. TAMC also provides an annual report tracking the status of Michigan's roadways and bridges. Local agencies are charged with implementing an asset management strategy to receive funding for specific improvements. Not only is this process required under the aforementioned legislation, its clout lies in the fact that funding sources are tied directly to the asset management process. To ensure that the maximum amount of funding is distributed to the township, it is paramount that an asset management plan for roadways is implemented and followed.

Summary of Meridian Township Streets

Meridian Township has a total of 211.4 miles of streets within its limits. Of these 211.4 total miles, 50.1 miles are primary streets and 151.8 miles are considered minor or local. The remaining 9.5 miles are State routes within the township, and the township has not historically spent any of their road improvement budget on state routes or the County primary system. The primary and local definition is set by the National Functional Classification System (NFC) created by the Federal Highway Administration. These classes are defined by ownership, roadway volumes, and intended use. The State and County obligations include routine maintenance (snow plowing, street sweeping, right-of-way work), preventative maintenance and roadway reconstruction. Ingham County Road Department focuses on the primary streets within Meridian Township and is limited to the amount of reconstruction work it can complete on the local road network. Therefore, during the asset management process, only local streets were evaluated for receiving funding from the Township's budget for roadway improvements, as the Township is required to fund the majority of street reconstruction and preventative maintenance work if it is to occur each year.

Meridian Township has a wide variety of street surfaces within its limits. Materials include asphalt, concrete, and gravel. Within these categories exist a plethora of varying cross sections and curb configurations. For the PASER process, roadways are classified on the uppermost roadway surface, thus it is hard to tell what is beneath the surface, which can impact the actual

rehabilitation and replacement costs. A summary of the mileage of each roadway type broken out by primary and local miles is provided on the following page in Table 1 for primary streets and Table 2 for minor streets.

Table 1: Meridian Township Primary Street Material Summary

Primary Roadway Material (Surface)	*Miles*	*Percent (%)*
Asphalt (HMA)	45.8	91.4
Concrete	4.3	8.6

Table 2: Meridian Township Minor Street Material Summary

Local Roadway Material (Surface)	*Miles*	*Percent (%)*
Asphalt (HMA)	147.5	97.2
Gravel	4.3	2.8

The township has an allocated yearly roadway budget for fiscal year 2018 of $1,081,000. This includes $416,000 from a dedicated road millage of 0.2484. There is a $550,000 contribution from the Township's General Fund, along with $115,000 from Ingham County. The contribution from the General Fund towards the roadway budget is variable and changes year to year. The total roadway budget for fiscal year 2017 was $750,000. Pursuing an asset management plan will ensure that funds are being appropriated to the streets that will receive the greatest benefit from repair and, in turn, will assist in maintaining the road network as best as possible on limited funding.

Asset Management Process

The TAMC published the "Asset Management Guide for Local Agencies in Michigan" as guidance to performing local street management programs. This publication lays out seven steps for completion of an asset management plan and is intended to be a guide that is supplemented with the local agency's experience. Meridian Township's plan has been based upon this recommended approach. Following this section is a summary of the seven step process used to arrive at the final asset management program that should be followed by the township.

1. Assess Current Condition of Streets

Rating Systems

The first step in the asset management process is to document the condition of the entire roadway network, within a fixed time frame, to provide a snapshot conditional assessment of the system. This documentation was completed for all roadways within the township limits between

June to August of 2017. Having a comprehensive listing of these ratings allows for proper understanding of where resources should be allocated and allows officials to be able to communicate the current network condition to interested parties such as residents, government, and funding agencies.

There are numerous systems that can be used to gather roadway condition data. Some common examples include the Distress Index, Pavement Condition Index, the Pavement Quality Index, and the PASER rating system. The TAMC recommends the PASER rating system to ensure uniform results from municipality to municipality for the State of Michigan. The system is easily understood and repeatable, and can be completed in a relatively quick and cost effective manner. One of the key benefits of the PASER system for use in Meridian Township is that it is applicable for a variety of roadway surfaces including asphalt, concrete, and gravel, all of which can be found within the township limits.

As a brief background, PASER stands for **Pa**vement **S**urface **E**valuation and **R**ating. It is a methodology adopted by the University of Wisconsin and is widely used throughout the country. The PASER system uses visual inspection for roadways to evaluate the pavement surface condition. The methodology involves identifying different types of pavement distress per surface type (potholes, cracking, rutting, slab failure, etc.) and tying them back to a road's remaining life expectancy. For asphalt and concrete roadways, this results in a rating scale of 10 to 1, with 10 being a newly constructed roadway and 1 being a failed road with total loss of surface integrity. Brick and Gravel roadways are rated on similar factors, but only receive ratings from 4 to 1 under the PASER system, with 4 being newly constructed and 1 being failed or non-traversable. Figures 1 through 3 on the following pages show asphalt pavements at various conditions based on the three functional rating categories (Very Good 10-8, Good/Fair 7-4, and Poor 3-1).

Figure 1: Asphalt Pavement PASER Rating 8 - Good (Grand River Ave west of Park Lake Rd)

Figure 2: Asphalt Pavement PASER Rating 5 - Fair (Okemos Rd north of Grand River Ave)

Figure 3: Asphalt Pavement PASER Rating 2 - Poor (Sylvan Glen Rd east of Dobie Rd)

Appendix B is provided following this report, and shows a summary of the pavement rating rationale for the four aforementioned roadway surface types under the PASER system. For a detailed rating guide, the full manuals can be found easily online by going to the Transportation

Information Center at the University of Wisconsin-Madison webpage and searching for "PASER Manuals".

Status of the Meridian Township Street Network

Meridian Township requested a PASER analysis to be completed in 2017 to determine what funding requirements would be needed to maintain or improve its current roadway network. Abonmarche was hired by the township to perform PASER ratings for all roadways within its limits to kickoff development of its asset management program.

The results of this analysis are provided in detail in *Appendix C* for the roadway network. These listings are broken into separate categories for the major roadway surface types mentioned previously to allow the reviewer to better understand the variety of roadway conditions within the township.

Mapping of the roadway network is provided in detail for roadways in *Appendix D*. These maps show the three functional rating categories. Also provided are maps for each individual PASER rating from 10 to 1 for further information. These maps show the network overview and are a useful tool in assessing which areas in the township may require the most attention.

Conclusions from Assessment

The following set of figures has been provided to summarize the PASER rating data collected in 2017 for the township. Figures 4 and 5 show the mileage breakdown by rating for primary and local roadways, respectively. Figures 6 and 7 show a percentage breakdown of the three functional categories (Very Good, Good/Fair, Poor) as stated previously. It is apparent from these graphics that the primary township roads are currently in much better condition than the minor township roads. This implies that roadway improvements need to be focused on the minor/local roads. The sooner the improvements can begin the better, as much of the network is close to, or has passed the window of opportunity for preventative maintenance.

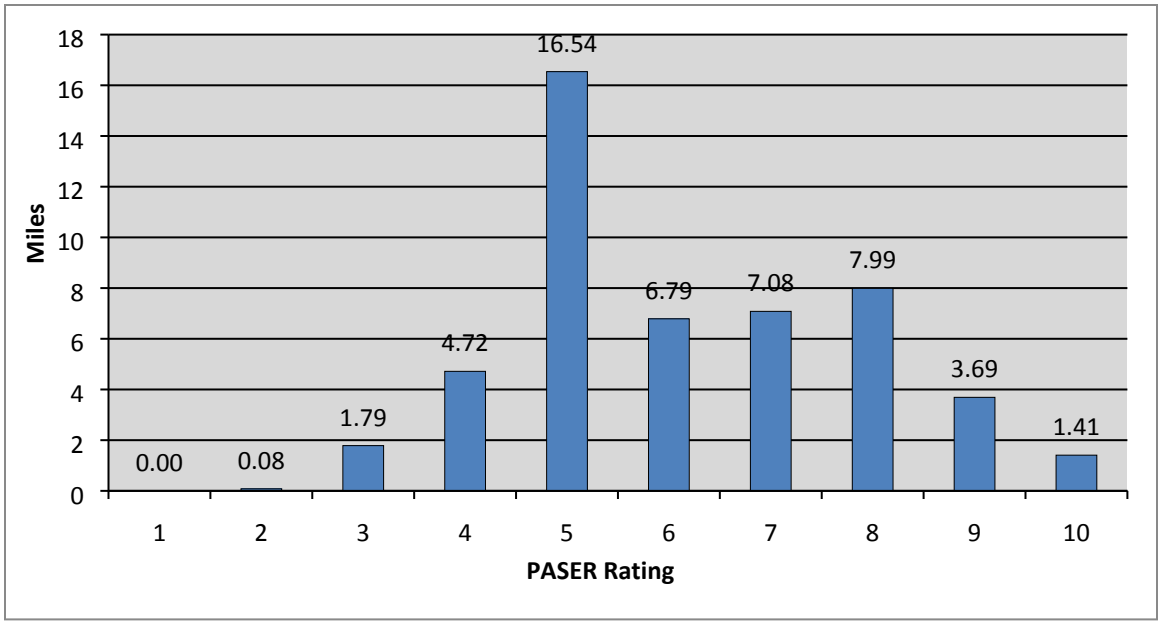


Figure 4: PASER Rating Mileage Summary for Primary Roads (Average Pavement Rating = 6.2)

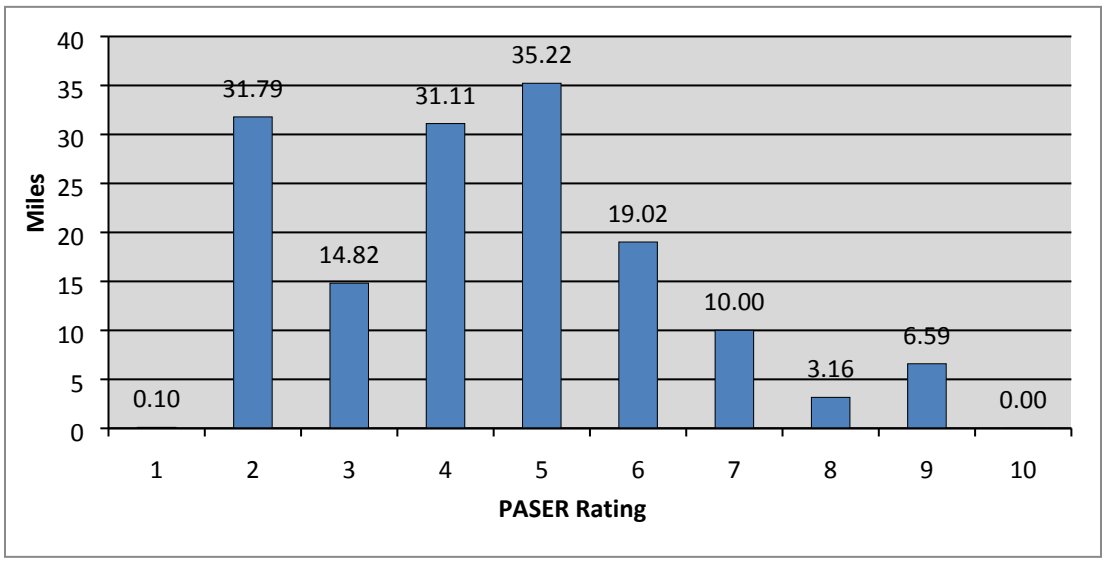


Figure 5: PASER Rating Mileage Summary for Minor Roads (Average Pavement Rating = 4.5)

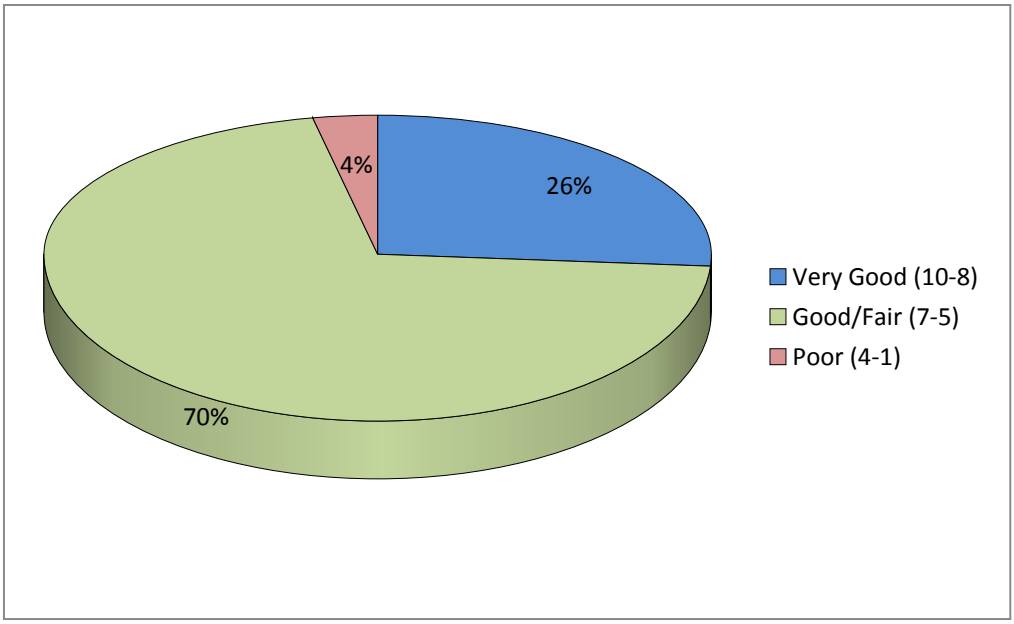


Figure 6: PASER Rating Distribution for Primary Roads

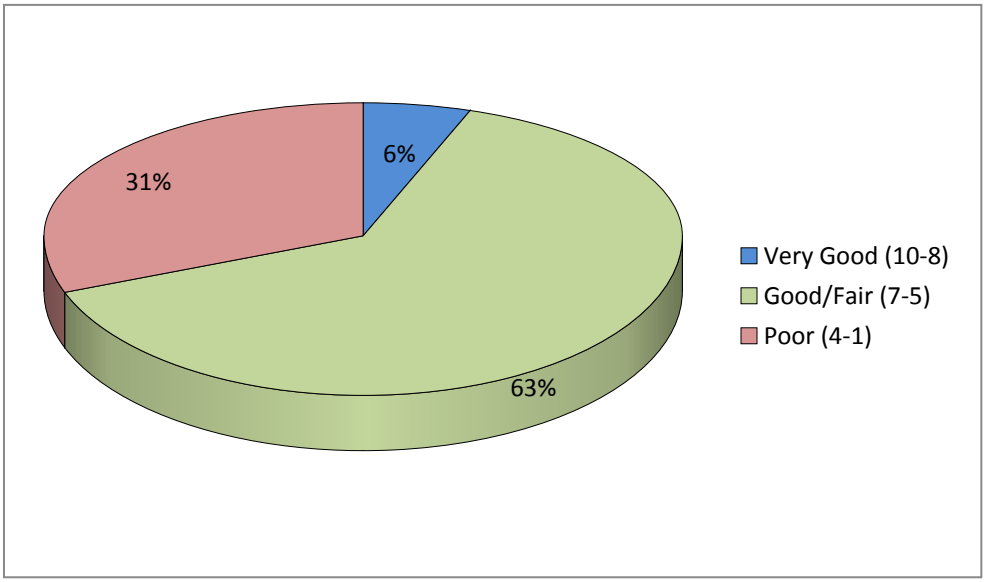


Figure 7: PASER Rating Distribution for Minor Roads

2. Select Appropriate Treatments

Once the network has been rated using an approved methodology, the second step of the asset management process is to select appropriate maintenance treatments. As roadway surfaces age, varying levels of degradation occur. Treatments extend the life of pavements by sealing out water and by adding structural integrity back to the pavement surface.

Many different treatment options can be pursued depending on the pavement condition and type. Each treatment has different characteristics, costs, and suitability for a given location. Not all treatments are appropriate for a given level of pavement distress. Further, not all treatments are suitable within an urban environment. The key to asset management is to ensure that there is a balance between cost and additional pavement life achieved.

Treatments have been broken into three broad categories by TAMC. The most basic of these is routine maintenance which involves day to day operations such as street sweeping, plowing, drainage structure maintenance and other related work. These actions maintain the accessibility of the road and alley network and ensure that water and debris don't degrade the pavement surface. The next category is capital preventative maintenance. This category is the heart of the asset management process. The treatments in this category are designed to address pavement deficiencies before the structural integrity is compromised. A large number of treatments fall under this category including crack sealing, joint repair, pavement surface treatments, and many others. The treatments deemed appropriate for an urban setting are highlighted in the following section. The final TAMC classification is structural improvements. Typical activities within this category include rehabilitation and reconstruction, which are the most expensive and inconvenient repairs.

Figure 8, on the following page, highlights the TAMC categories, showing that as a pavement ages, there comes a tipping point in which the necessary repairs on a system start to manifest at an increasingly rapid pace. It is the goal of a quality asset management program to ensure that the majority of work that is completed happens within the central "Window of Opportunity" range. By completing repairs in this time frame, costs and inconveniences to stakeholders are minimized. Each treatment in this category helps reset the pavement into a preventative maintenance repair regime.

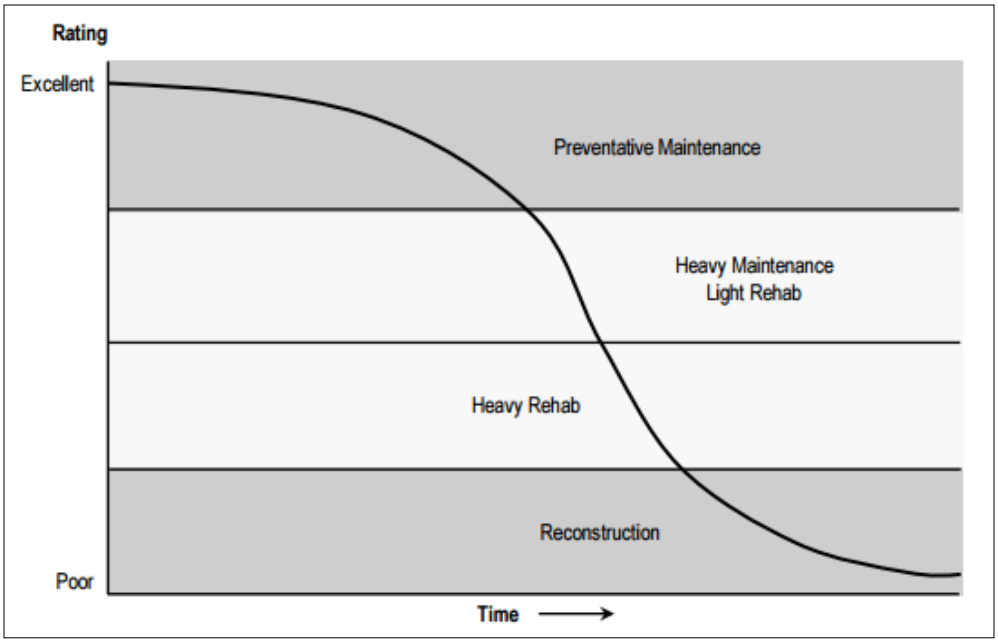


Figure 8: Window of Opportunity for Pavement

3. Estimate Treatment Costs and Budget Constraints

The next step in the asset management process is to estimate various treatment option costs and determine the financial constraints and budgets required to reach the township's goals.

For asphalt roadways, six methods were evaluated and are briefly described as follows:

1. Crack Seal: Overband method where joints are cleaned and then quickly sealed
2. Chip Seal with Fog Seal: Applying a fog seal over a chip seal base layer, which prevents loose aggregate on the pavement surface.
3. Cape Seal: Applying a Microsurface over a chip seal, providing a smoother surface than a chip seal
4. Hot In Place Recycling (HIPR): Grinding the top layer of asphalt and then heating it up and placing the recycled asphalt back in place
5. Crush & Shape: Grinding/crushing the existing asphalt and a thin layer of the base and then compacting and regrading it, 3.5" of new asphalt surface is then placed on top
6. Reconstruction: Includes removing the existing road and replacing it with a completely new base (9"), and asphalt surface (3")

Estimated costs are provided in Tables 3 and 4 below for both asphalt and concrete roadway surfaces. No cost information was provided for unimproved roadways at this time as there is need for financial investment in the first two surface types before the others can be evaluated.

The treatments presented below are those defined by TAMC and pricing was reviewed based on TAMC and previous experience by both Abonmarche and Ingham County Road Department. Pricing and methods should be reviewed and refined as the township gains experience implementing its asset management plan and costs change with time.

Table 3: Asphalt Pavement Treatment Options and Costs

Treatment Option	PASER Rating Trigger	Cost Per Lane Mile of Treatment	Additional Service Life (Years)	Cost Per Lane Mile per Year of Service Life
Crack Seal	7	$2,000	1	$2,000
Chip Seal with Fog Seal	5	$32,850	5	$6,570
Cape Seal	5	$37,500	5	$7,500
Hot In Place Recycling	4	$83,000	5-10*	$11,067
Crush and Shape	3	$150,000	12-15*	$11,111
Reconstruction – 9” Base, 3” Top	1	$250,000	15-18*	$15,152

*Note 1: Cost Per Lane Mile per Year of Service Life is calculated based on average of estimated additional service life

Table 4: Concrete Pavement Treatment Options and Costs

Treatment Option	PASER Rating Trigger	Cost Per Lane Mile of Treatment	Additional Service Life (Years)	Cost Per Lane Mile per Year of Service Life
Routine Joint and Crack Sealing	7	$3,550	3	$1,183.33
Routine Joint and Crack Sealing +	6	$7,070	4	$1,767.50
Joint Repair Grinding	5	$22,470	5	$4,494
Joint Repair & 2” Overlay	4	$69,080	8	$8,635
Joint Repair & 2” Overlay & Spot Slab Replacements	3	$125,840	10	$12,584
Reconstruction	2	$309,175	25	$12,367
Reconstruction & 12” Base	1	$375,450	30	$12,515

Sources of potential funding for primary roads are various state and federal grants. Minor road funding comes from General Fund transfers, Capital Improvement fund transfers, special assessments, or a dedicated millage on road work completed within the township. It is the goal of this asset management process to determine what level of funding would be required through a millage or other source of funding to ensure the maintenance or continuing repair of streets could be completed.

4. Predict Future Condition of Street Network

The fourth step in the asset management process is to model and predict the future condition of the street network. The simplest way to complete this task is through the use of a pavement management system (PMS) program. These sophisticated software tools allow the user to

compile all of the gathered data on the street network into a single database and analyze it through the program. There are several different PMS's available for use including PAVER, AgileAssets, Street Master, and Roadsoft GIS. For Meridian Township, Roadsoft was selected for the pavement management system process. The program is funded by MDOT and is provided by LTAP free of charge. It is used by road agencies across Michigan and is based on the PASER rating system which matches the format of data collected within the township.

The Roadsoft program allows the township to maintain an inventory of streets, track street conditions over time, summarize current and future anticipated conditions of the street network, optimize repair and maintenance strategies and promotes good communication to decision makers and residents. However, Roadsoft does not replace the need for engineering judgment or local road agency preference.

Roadsoft works by using PASER data and deterioration curves to model how pavement degrades over time. It uses sophisticated algorithms to project how a street segment will age over time. This process relies on the concepts of Remaining Service Life (RSL) and the Critical Distress Point (CDP) for roadways. RSL is a measure of how long a road will be serviceable until it reaches the CDP if no maintenance or repairs are made. CDP is the point at which preventative maintenance treatments are no longer viable for use because the window of opportunity for repair has closed and now substantial reconstruction is required. Figure 8 in Section 2 highlights this concept.

5. Establish Street Network Goals and Performance Measures

Once data has been collected and a methodology for pavement management has been selected, performance targets and measures must be selected. A primary objective of the asset management program is to ensure that scarce resources allocated to the street network are being utilized in the most cost-effective manner. However, without overall goals for the condition of the street network, it is difficult to measure progress and the success of the management plan chosen.

Goals for management can be set in a variety of ways. For example, a goal may be that all streets within the township are to be improved to and maintained at a PASER rating of 7 or above by a certain date. Another example may be to have a certain percentage of roads in the Very Good, Good/Fair and Poor category by a certain year. It is also possible that the goal may simply to ensure that the remaining service life average for the system is being increased to meet certain targets each year. It is clear that there is no one single answer to what the goals and performance measures for the system should be. The township has a long term goal of improving all roads to a level where they will only need to spend money on preventative maintenance.

The plan laid forth in this analysis is to evaluate the current system of funding which assumes $1,081,000 is being allocated towards road capital improvement projects on the township's

minor streets. This will establish the baseline from which additional scenarios can be compared to.

The township would need to increase the yearly funding to $2,150,000 to grow the percentage of minor roads rated as “very good” to 75% at the end of 10 years. $3,500,000 per year for 10 years would allow all minor streets to reach a rating of at least 8. The 2017 funding level was also evaluated as a comparison of what would occur if funding levels remained constant at historic levels of $750,000 per year.

6. Evaluate Impacts of Various Treatment Alternatives

Step six in the asset management process is to evaluate the effectiveness of various treatment regiments and programs towards reaching the township’s street network goals. Using Roadsoft, an optimized treatment plan can be developed based on varying funding levels, treatment types and timelines for construction. The program allows the user to insert selected funding parameters to measure the remaining service life (RSL) of the roadway network and evaluate the anticipated change in PASER ratings within the three maintenance windows noted earlier (Full Reconstruction/Rehab, Preventative Maintenance, No Maintenance Required).

Presented on the following pages are the results of the funding levels that were chosen to be evaluated. Figure 9, on the following page, shows the average remaining service life in years for both asphalt and concrete pavement roadways within the Township for the different funding strategies. In all of the scenarios, there were no holds placed on to what surface type funding was required to be allocated to. Due to this, asphalt pavements in the optimized strategy received the majority of the funding.

The takeaway from this figure is that under the current funding level the RSL remains constant and then has a slight decrease. Strategy 0 is the 2017 funding level available to the township of $750,000. Strategies 1 and 2 show the difference between using an optimized approach of multiple different treatments and only using Hot In Place Recycling (HIPR) as the treatment. Comparing strategies 0 and 2 show that although the funding level increased by $331,000 in strategy 2, it will arrive at a lower RSL level at the end of 10 years than strategy 0. This is caused by only using HIPR as the treatment option and not a mix of treatments approach. Emphasizing that increasing the budget available will not automatically make the road network better, the township must also spend the funds appropriately. Strategy 3 shows the funding level required ($1,500,000) to gain a RSL increase over 10 years. Strategies 4 and 5 show that by increasing funding levels directly correlates to developing a larger lasting average RSL increase.

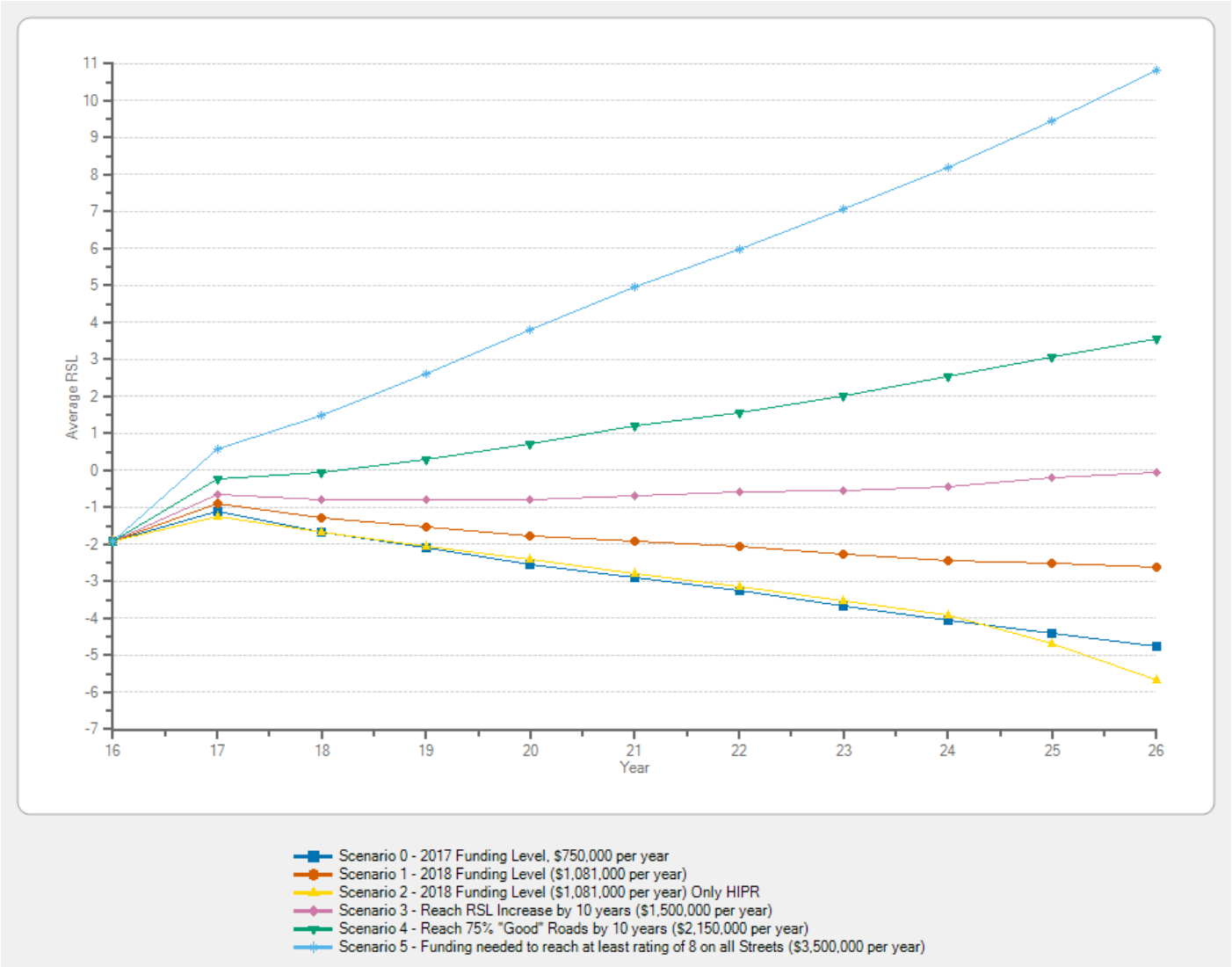


Figure 9: Average RSL Comparison

Figure 10 shows the average road rating over the next 10 years for each scenario ran. This graph correlates similarly with the RSL graph above.

Figure 11 shows average RSL comparison for the same funding level but changes the rehabilitation treatment available from cape seal to chip seal. Chip seal and Cape seal treat pavements of similar conditions, however have different final surface properties. Chip sealing is a cheaper option than cape sealing, therefore the township would be able to treat more roads with the same amount of funding. However, chip sealing isn't as an attractive finished product as cape sealing. This provides an example of how the township has to strategically choose between functionality and economics. Although cape sealing is more expensive it may be more appropriate for neighborhood streets that want a smoother surface for recreation activities such as bicycling.

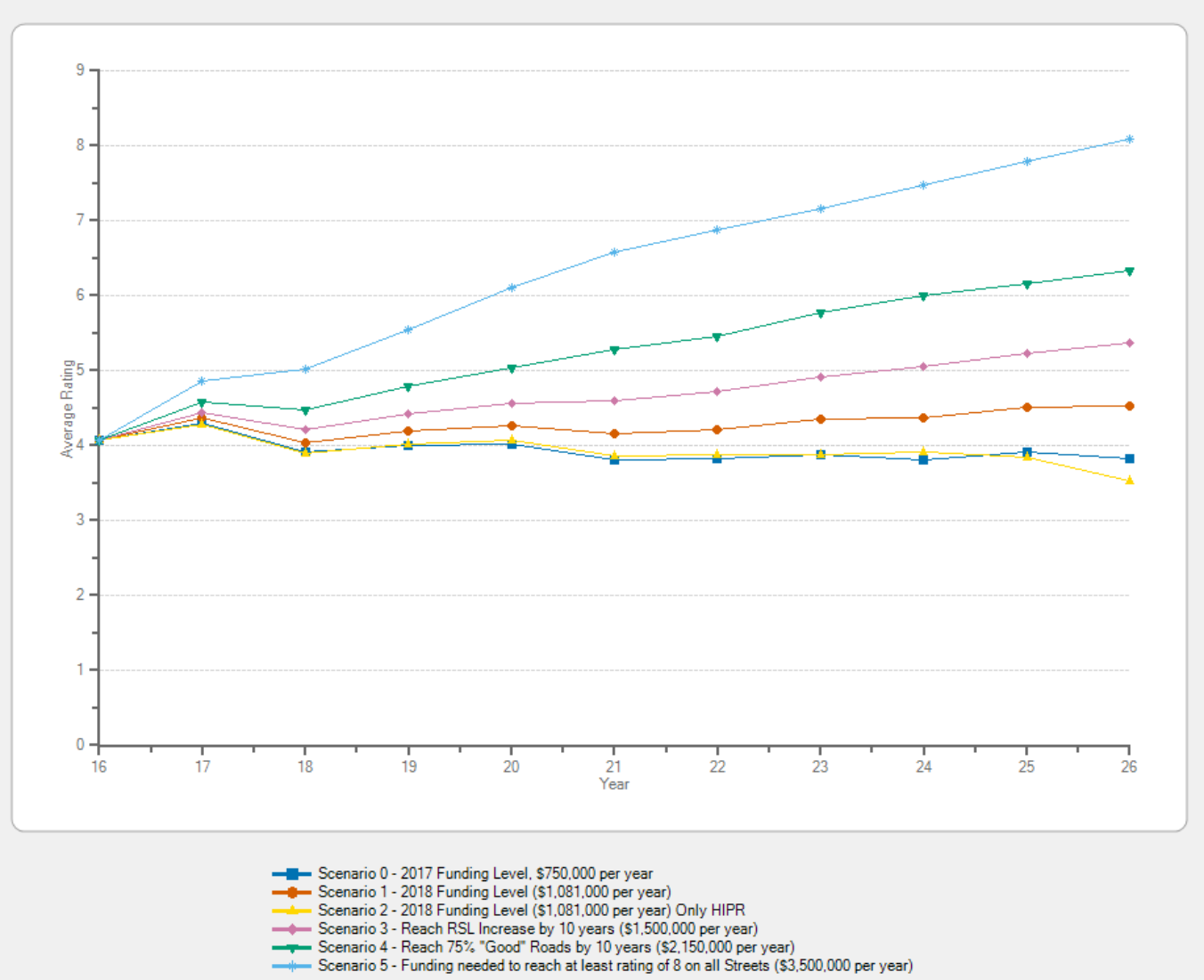


Figure 10: Average Road Rating Comparison

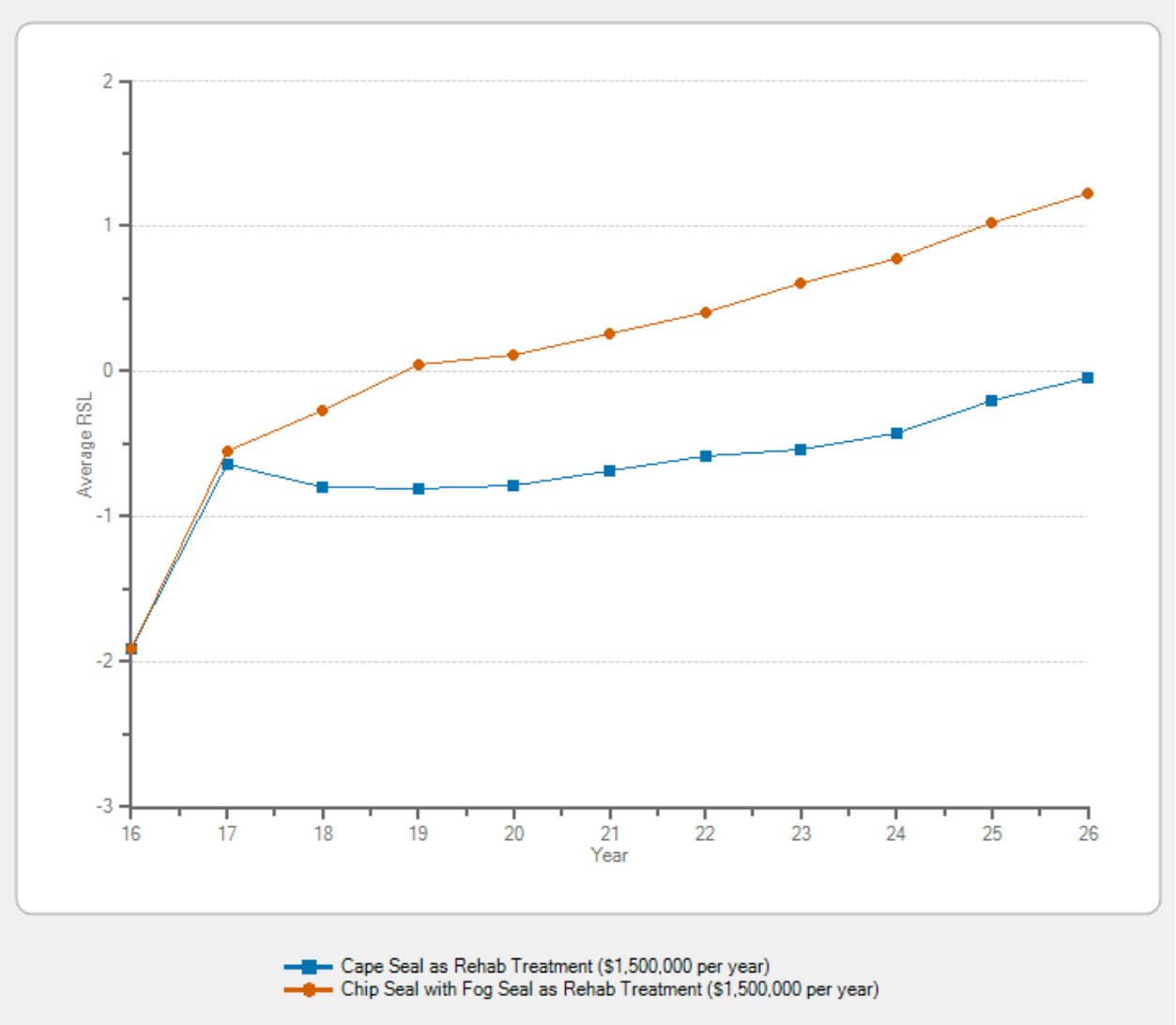
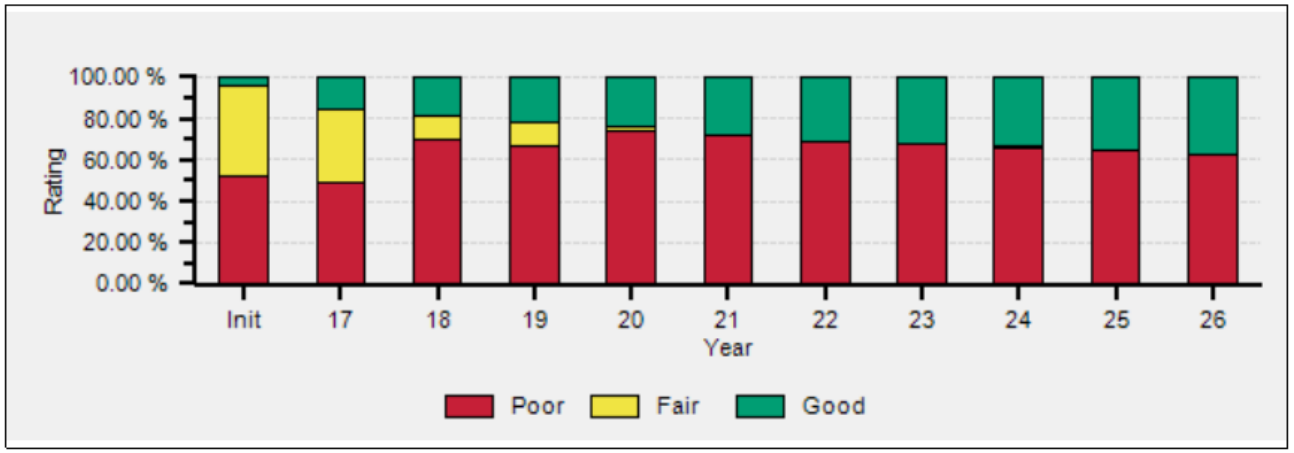


Figure 11: Average RSL Comparison for Cape Seal vs Chip Seal

Figures 12 through 17 show the percent of roadways that are rated Poor (Red), Fair (Yellow) and Good (Green) based on the funding level selected. These graphs are for both asphalt and concrete roadways. These charts show the concept that was discussed in the previous section, the roadways which are currently in the "window of opportunity" range, are repaired to a "Good" PASER condition first. This is shown by the reduction of the yellow areas first. The 2018 funding level will handle the current rehabilitation maintenance issues in the first 5 years, as shown by the Fair (Yellow) segment of the bar charts being reduced. It can be seen that as funding increases, the amount of lane miles turning from poor (red) to good (green) increases faster. Figure 14 shows how spending the funding available only on one treatment can negatively impact the roadway network as a whole due to funds not being used in the most efficient way possible.

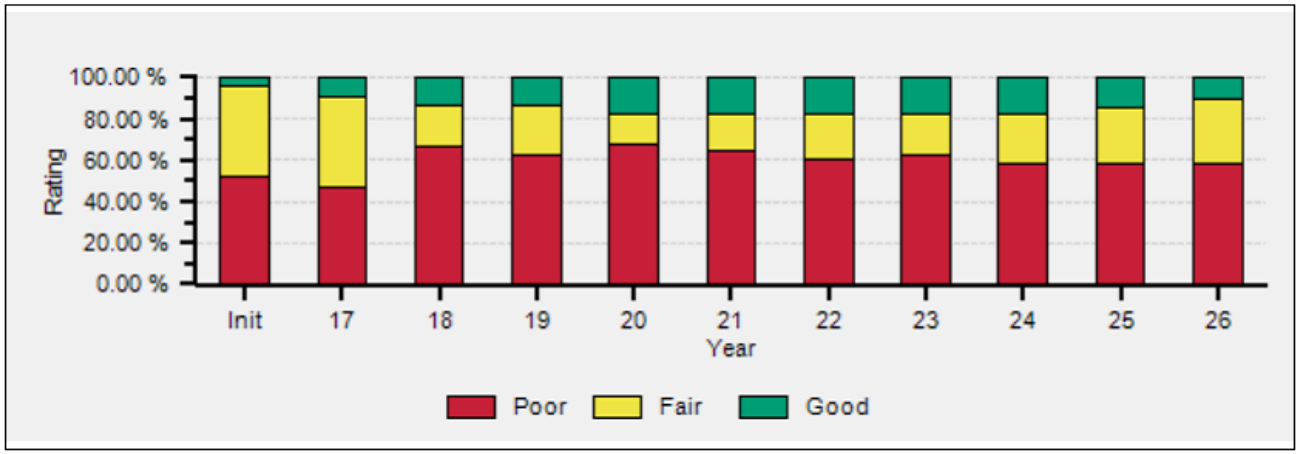


Scenario 0 - 2017 Funding Level, $750,000 per year

Figure 12: Rating Distribution for Scenario 0 – 2017 Funding Level

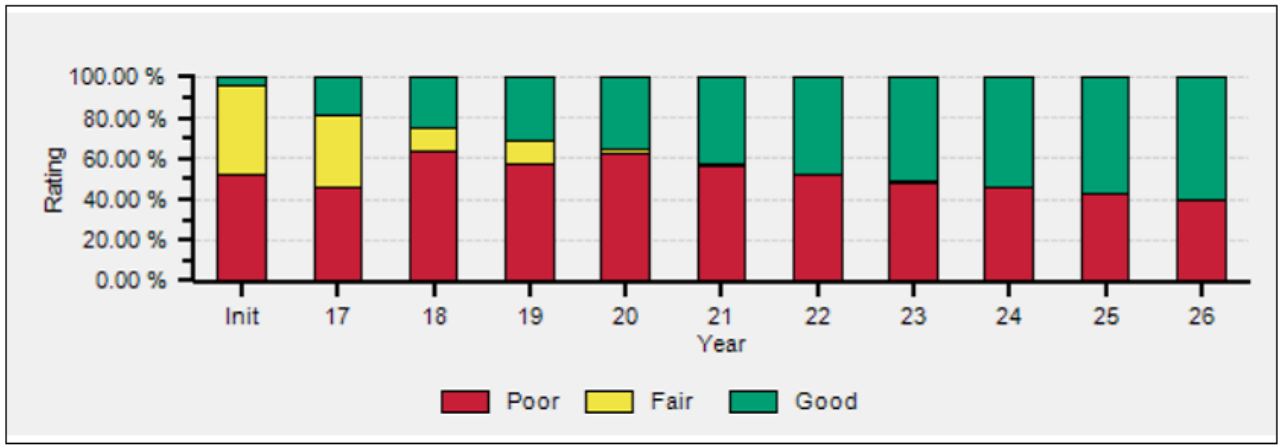
Scenario 1 - 2018 Funding Level ($1,081,000 per year)

Figure 13: Rating Distribution for Scenario 1 – 2018 Funding Level



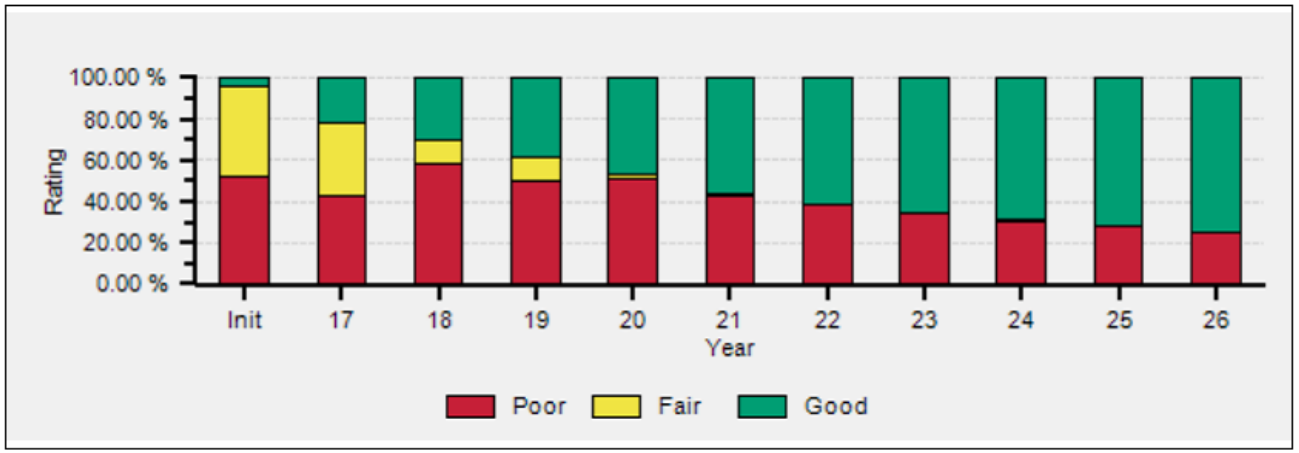
Scenario 2 - 2018 Funding Level ($1,081,000 per year) Only HIPR

Figure 14: Rating Distribution for Scenario 2 – 2018 Funding Level spent only on HIPR



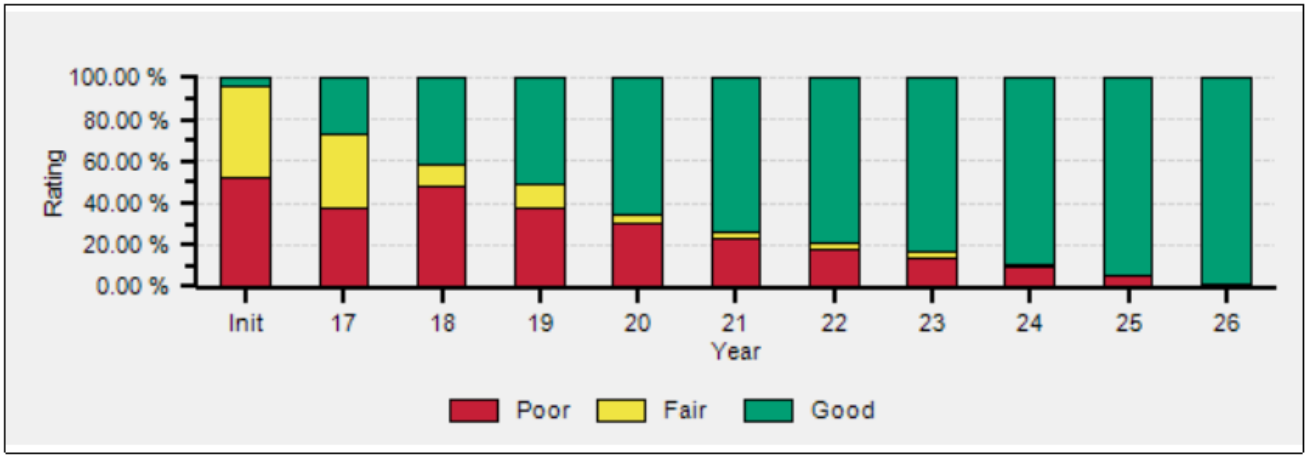
Scenario 3 - Reach RSL Increase by 10 years ($1,500,000 per year)

Figure 15: Rating Distribution for Scenario 3



Scenario 4 - Reach 75% "Good" Roads by 10 years ($2,150,000 per year)

Figure 16: Rating Distribution for Scenario 4



Scenario 5 - Funding needed to reach rating of 8 on all Streets ($3,500,000 per year)

Figure 17: Rating Distribution for Scenario 5

7. Identify, Prioritize, and Select Projects

The final step of the asset management process is to select the streets on which to apply the optimized strategy. The township will identify streets as potential candidates for treatment based first on the segments' PASER ratings, keeping in mind the concept of window of opportunity. Attached in appendix E is the Roadsoft Strategy Comprehensive Reports for each of the scenarios. This report includes the cost distribution chart which shows how much money should go to each maintenance category. However, prioritization beyond this will require a much more detailed analysis than is presented here. The discussion of what roads are priorities to the township will include PASER ratings and may include any number of the following:

- Detailed engineering review of potential segments
- Condition of roadway base (coring's and institutional knowledge)
- Traffic data
- Future utility improvements (water and sewer)
- Grant funding availability
- Future known projects
- Condition of curbs and gutters
- Economic impacts
- Dispersion of projects throughout neighborhoods
- Safety concerns

Once a logical basis for rating candidates is determined, the township can choose to come up with a ranking system that can be applied somewhat uniformly over the roadway network, thus allowing final selections to be made.

Conclusion

Applying asset management principals to the township's street network is not only mandated by the State for certain funding sources, it is one of the best business practices. Asset management leads to well informed, cost effective and transparent decisions when allocating scarce resources to the roadway network.

The plan presented here is merely a kicking off point in the asset management process for the township. The information presented can be used to help in future planning decisions and will allow a streamlined approach to future PASER ratings and roadway maintenance work. This plan should be reviewed and updated once there is further clarity on the selected funding level and whenever new PASER rating information is gathered. By updating this document regularly, there will be confidence from both the township and its citizens that roadway funding is being allocated in a logical and cost effective manner.