City of Asheville
Public Works Department

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Executive Summary

May 2016

Street Resurfacing Plan

Our City is nationally known for its historic buildings. These building have been renovated, restored and preserved. In comparison, our street infrastructure is old and in need of significant investment. At a time when our community is growing in epic proportions, it is essential to provide a transportation network to support a growing community.

In order to quantify the condition of the over 400 miles of City-maintained streets we utilize a numeric system that grades streets based on their condition. This is referred to as a Pavement Condition Index or PCI. On a scale of one to 100, the average PCI rating for City maintained streets is 60.8.

Public Works is making moves to modernize how we manage our streets. This includes new technology, advanced training and proven construction and maintenance methods that are new to Asheville. The new software allows staff to analyze how different funding levels and new treatments can impact the condition of our system.

Research has shown that investing in preventive maintenance is smart, but requires long term thinking, fiscal discipline and community education. The key is to proactively maintain the good streets before they are too far gone. Because efficient and effective maintenance requires work on streets that look perfectly fine to the average citizen, educating our citizens and management on the value of this activity will be essential. Unfortunately, many of our streets are in such disrepair that they are not candidates for these proactive treatments and will need to be completely reconstructed, but we have to start turning the tide.

The following report provides further details into this new plan. Although it has always been a challenge for transportation agencies across the country to publish lists of streets to be resurfaced too far out in to the future, this new system provides for systematic planning of street maintenance based on many criteria such as sustained funding programming, traffic volume and types of traffic, weather and more. Some of the challenges with regards to planning and publishing such lists prematurely include unpredictability of petroleum costs (a major component of most street repair products), the economy, development and the damage it does to streets, and funding levels. Our citizens deserve transparency in all of the work we do on their behalf. Once staff has a solid list of streets scheduled for repair, that information will be shared with the neighborhoods that would be impacted by the construction to get their feedback on how to minimize the disruption of the proposed work zone.

In summary, the following report provides further details in how staff propose to plan for the massive improvements required to bring Asheville's street network up to the level our citizens expect of such a core service. A healthier network allows for more transportation choices and will be more inviting to those considering to live, work, play or invest into our special city.

My best,

Greg Shuler
Public Works Director

	Asphalt Paving FY16	
Street	From	To
Braddock Way	All	
Lakeshore Drive	Merrimon Avenue	Mt. Vernon Place
N. Bear Creek Road	Patton Avenue	Old County Home Road
N. Oak Forest Drive	All	
Westridge Drive	N. Oak Forest Drive	Springside Road
Old Haw Creek Road	Middlebrook Road	Bethesda Road
Middlebrook Road	Old Haw Creek Road	New Haw Creek Road
Patton Avenue	N. French Broad	College Street
Washington Road	All	
Broad Street	Washington Road	N. Liberty Street
Victoria Road	Meadow Road	McDowell Street
W. Chapel Road	Hendersonville Road	Marietta Street
Woodland Road	Sunset Parkway	Ridgewood Place

Street Resurfacing Plan

Public Works Department, Streets Division

May 2016

Pavement Conditions

In the summer of 2015, the City hired a consultant to perform a new pavement condition survey of every City-maintained road segment. Previously, pavement surveys were completed in 1999 and 2004 for all road segments maintained by the City at that time. The survey is intended to create a base line for comparison of all roads in the system. Pavement surveys include evaluating the prevalence of distress conditions such as fatigue, block and transverse cracks, patch and potholes, rutting and roughness, and surface deterioration due to weathering.

The 2015 pavement condition survey was used to produce a pavement condition index (PCI). The PCI is a verbal description of pavement condition using a zero to one hundred score, zero being worst and one hundred being best. The data collected in this survey was input into Pavement Analyst for analysis and modeling. The City of Asheville's PCI is 60.8, which is classified as poor (Figures 1 and 2).

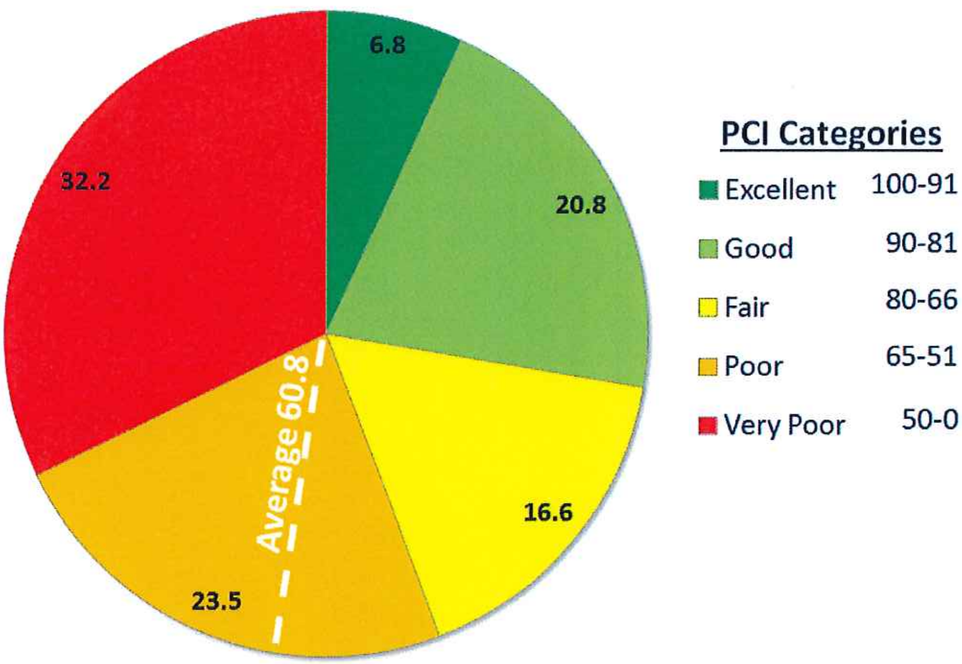

Figure 1. City of Asheville PCI Categories as a Percent of the System
The City of Asheville's average PCI is 60.8, which is in the poor category. Over half, 55.7%, of the City's road miles fall into the poor and very poor categories. Just over one quarter, 27.6%, are excellent or good.

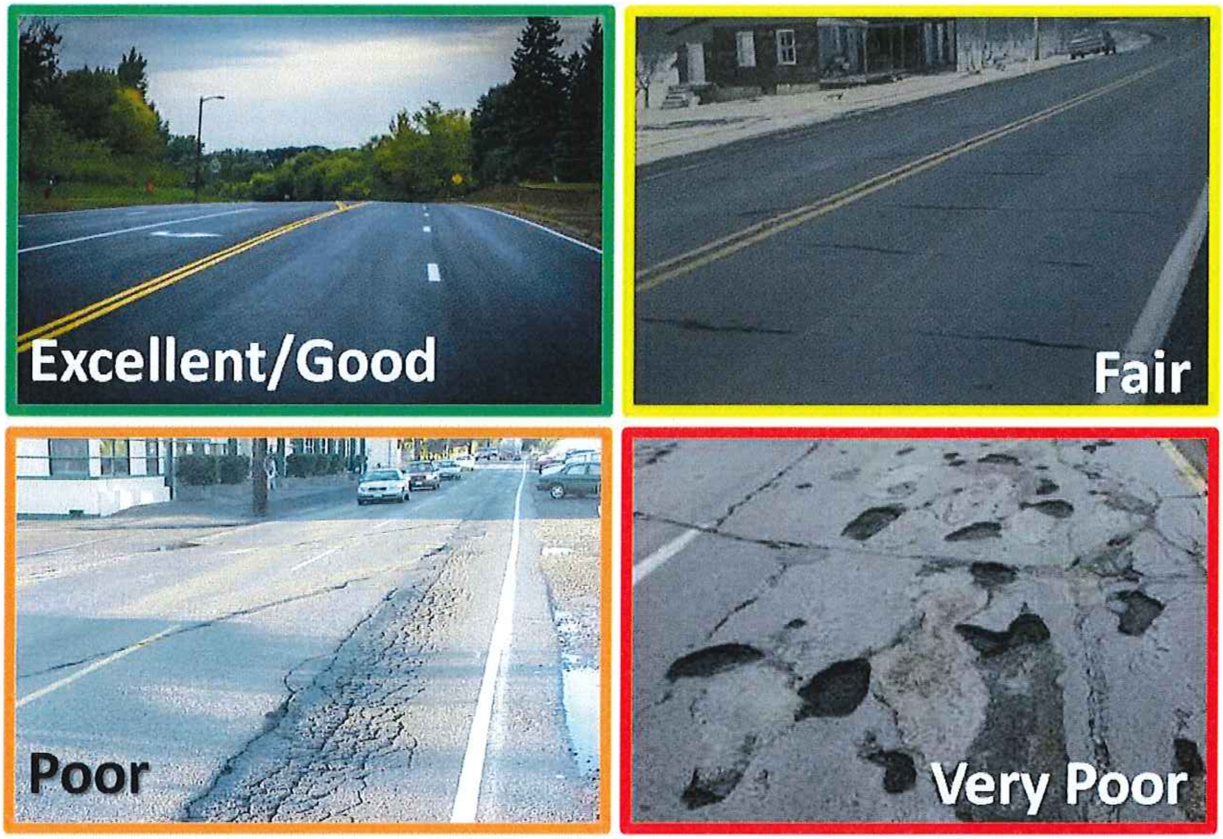

Figure 2. Pavement Conditions
Photographic examples of pavement condition classifications.

Municipality	Miles	PCI
Apex	280	83
Asheville	405	60.8
Burlington	530	87
Chapel Hill	340	80
Salisbury	345	84

Figure 3. Municipal PCIs
Municipalities with similar total road mileage to Asheville, have greater PCI scores. Data collected from 2015 benchmarking from the School of Government.

Pavement Condition Analysis

The City of Asheville has recently purchased the Agile Assets, Pavement Analyst software which is used by many municipalities and 20 state departments of transportation, including NCDOT, to help government agencies make decisions to use the right pavement treatment for the right road at the right time in that road's life cycle in order to maximize the impacts of the agency's pavement budget and achieve a greater return on investment (ROI). This software is one of the leading pavement management softwares; over 500,000 lane miles of roads across the United States are managed with Pavement Analyst. This software uses our most recent pavement condition survey as the baseline for all analysis of the City's roads and potential treatments. The data can be modeled with many different goals in mind, for example: maximize PCI score over 10 years using an annual budget of $8 million, but also include a short list of road segments required for inclusion due to a partnership with a utility replacement project. The software allows City staff to include a list or "work plan" of road segments that must receive a certain treatment in a certain year due to real-world situations such as partnerships with construction or utility projects. The computer model will incorporate this work plan into the optimized analysis in order to maximize the benefits of the remainder of the City's budget. The analysis can be completed for short term as well as long term plans.

The City is currently on an 80-year resurfacing schedule, which means the roads are being extended 55 years beyond the life of the asphalt. This delay of resurfacing has resulted in low PCI scores throughout the City. Roads in poor and very poor condition are very expensive to rehabilitate or rebuild. For example, using a $2 million budget, only 4 miles of very poor roads can be rebuilt at $480,000 per mile (Figure 4). Also, using the same $2 million budget, 66 miles of good roads can receive surface treatments at $30,000 per mile. When a road segment's PCI score drops to the next lowest category is the optimum time to perform the treatment associated with that pavement condition. For example, when a road segment transitions from Excellent to Good, around the score of 90, it is the best time to apply a surface treatment at about $30,000 per mile (Figure 4). Delaying that maintenance effort to lower score in the Good range will force the treatment costs to increase.

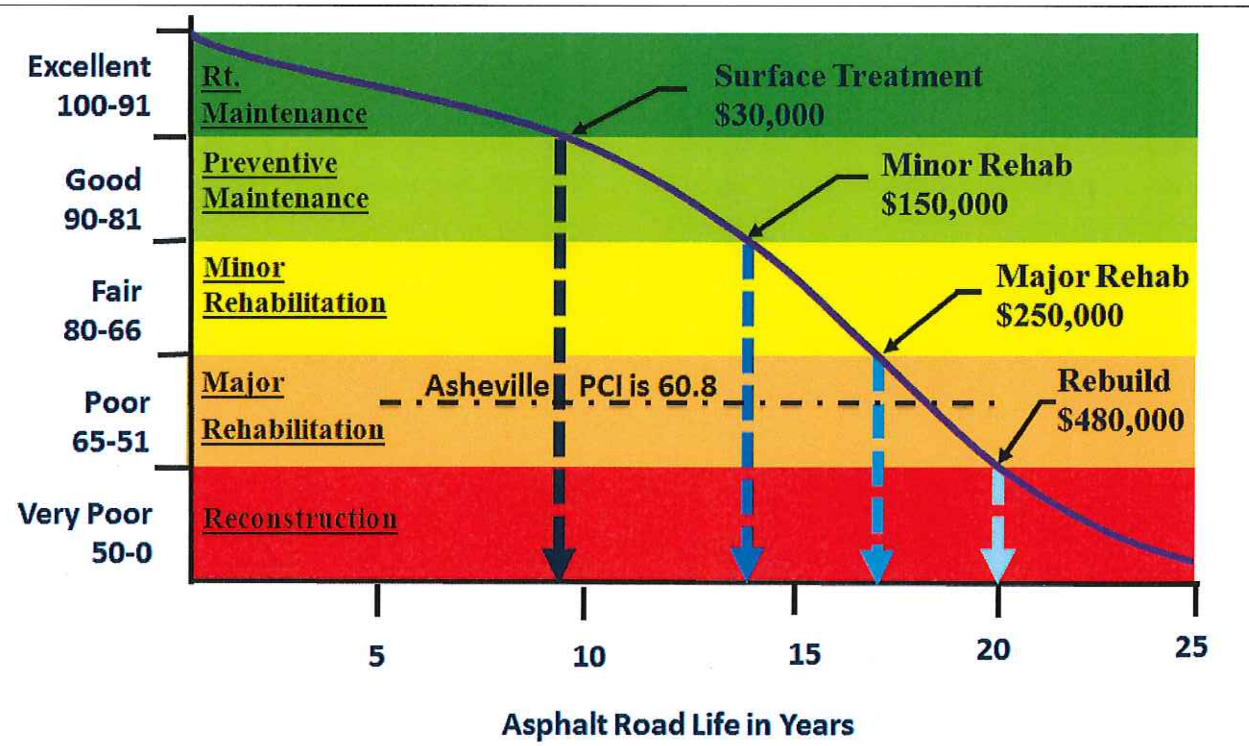

Figure 4. Cost of Delaying Maintenance Treatments
The chart displays PCI scores from excellent to very poor conditions and the associated treatment costs at specific times over the life of the asphalt road. As treatment is delayed, cost increases.

The Pavement Analyst software uses mathematical models representing pavement condition degradation and treatment improvements over time. Choosing the right treatment type for the road condition at the right time can return the greatest benefit to the condition of that road and lengthen the life of the asphalt, thus giving the highest possible return on investment (Figure 5). The return on investment is decreased by delaying the time at which the correct treatment is applied.

Roads deteriorate at different rates depending on many factors including: the amount and type of vehicular traffic, weather and environmental conditions, quality of the original road bed, quality of the pavement, and amount of road cuts due to underground utility work.

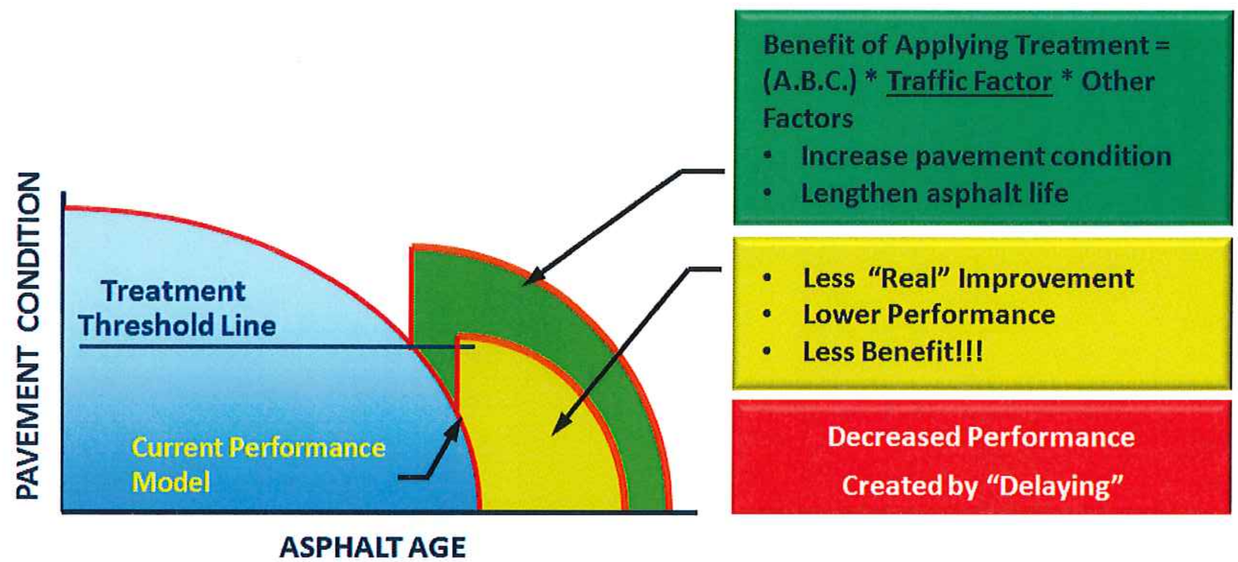

Figure 5. Return on Investment

The Pavement Analyst software uses mathematical models to help determine which treatments provide the greatest improvements to pavement condition and also lengthen the life of the asphalt. The blue area is the typical road's life with decreasing pavement condition over time. When a treatment is applied at the right threshold, the benefits (green area) include increased pavement condition and longer life of the road. When treatments are delayed beyond the treatment threshold, condition improvements are smaller and the life is not extended as far (yellow area).

Pavement Treatment Plans

States and municipalities across this country face the same challenge of "aging infrastructure". Infrastructure, like roads, have been in place for so long and budgets have not supported the necessary maintenance of this infrastructure therefore the older pieces need more costly repairs. Many types of road maintenance treatments are used across the country. Different treatments are used to repair different pavement conditions (Figure 6). Preventative maintenance may include crack sealing which seals the cracks that naturally form early in the life of asphalt. This type of treatment is performed in yrs 1-5 of a newly paved road. Preservation surface treatments may include slurry, microsurface, or fog seals. These treatments are applied to roads that are in the good to very good conditions. By doing this a new thin surface is placed on a road that helps extend the life of the road at a much lower cost. These treatments are ideal in yrs 5-8 of a pavements life. Minor rehabilitation treatments include "mill and fill" which means milling 1-2 inches off of the road surface and filling that space back in with new pavement. This type of activity replaces/repairs defects that are not terrible but are beyond the capability of the seals mentioned above. The typical surface defects that are present when these treatments are applied are minor potholes, minor rutting, of delamination of material due to weather effects. These treatments are typically applied yrs 8-20 of a roads life. Reconstruction typically includes removing the entire current road surface and the materials supporting that road bed, which means the entire road is rebuilt in place. Reconstruction is by far the most expensive and disruptive of any treatment option. As with all infrastructure some roads age different than others. Some factors that influence this are amount of traffic, type of traffic (trucks), drainage, and preventative measures during the pavement's life. All of these issues affect the timing and appropriateness of all of these treatments.

Figure 6. Pavement Treatments
Examples of pavement treatment options.

In the recent past, the City has primarily focused on reconstruction and minor rehabilitation treatment methods. In the future the City will continue to use these methods but also include preventative maintenance and preservation treatments. By diversifying treatment types, the City will be able to maintain and preserve the condition of excellent and good roads at a low cost while continuing to rehabilitate and reconstruct roads at the higher cost.

Most of the City's roads are in poor or very poor condition and will require expensive treatments, therefore using technology to optimize the timing of those treatments as well as maintain roads in excellent and good condition will help to maintain or increase the City's overall PCI score. Currently the City's budget is not large enough to apply the right treatment at the right time for each and every road, therefore many roads receive treatment many years later than what is optimum. This treatment delay is a major contributing factor to the current PCI score and if this trend continues, the score will continue to decrease (Figure 7). Greater annual funding is needed to prevent this delay in treatments. The Pavement Analyst software enables the City to create modeling scenarios using the most recent pavement condition survey results as well a work plan in order to estimate budgetary requirements in order to meet the goals of each scenario.

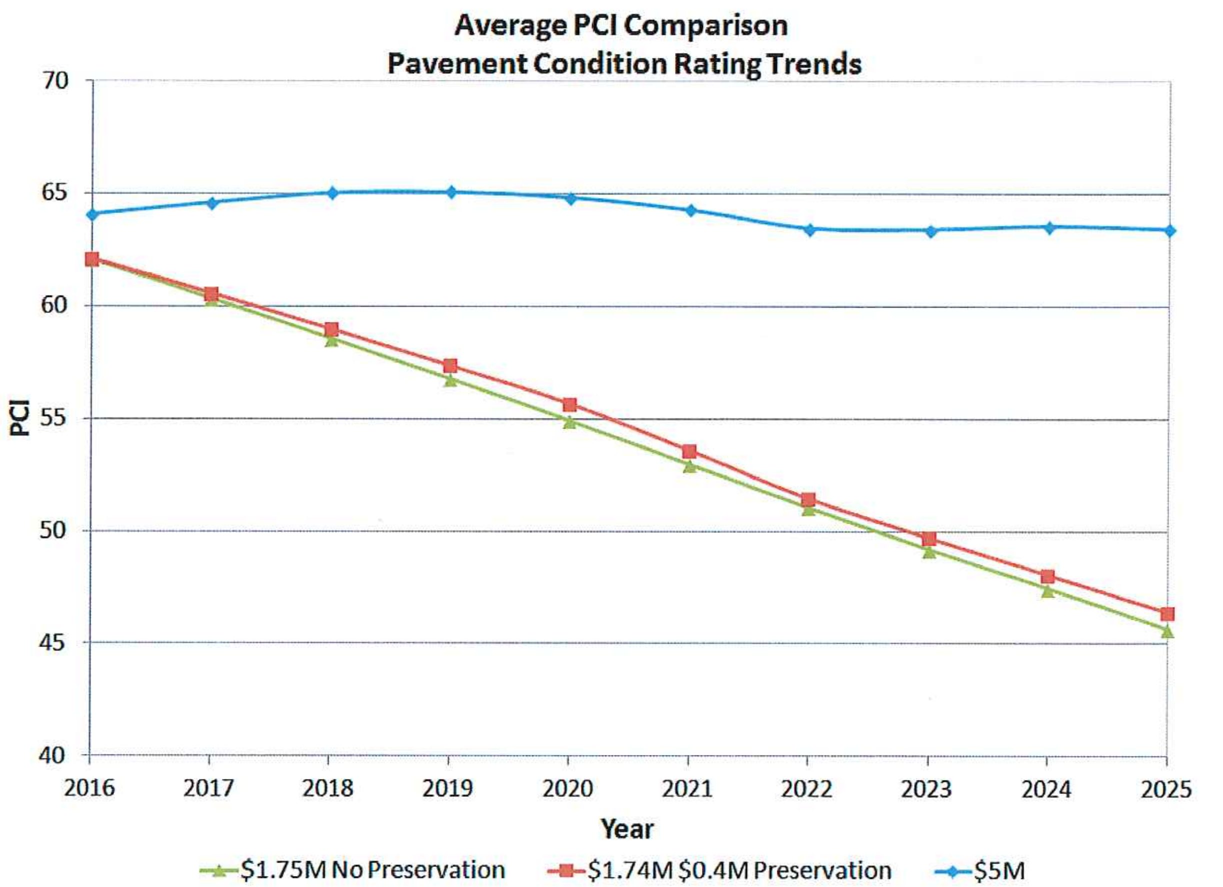

Figure 7.
In this scenario, Pavement Analyst projects that our PCI will drop from 60.8 to about 46 over the next 10 years if the City spends $1.75 million on pavement treatments annually. The City would have to spend $5 million each year to maintain a nearly flat PCI score over 10 years.

One example scenario includes a 20 year plan to reach a PCI of 80, without adding a work plan to constrain the optimization. Reaching a PCI of 80 would place the City of Asheville's roads in similar condition to those in other similar sized municipalities across the state. Moving the PCI from 60.8 to 80 is a large effort and will require large amounts of time and funding, therefore 20 years was chosen. The scenario results in annual budget requirements varying between $5 and 13 million (Figure 8) and treats lane miles varying from 45 to 190 miles (Figure 9). While this variation in annual costs is not realistic in the City's budget process, it does provide a staff with estimates to begin working on a plan that better fits the City's process and also uses the work plan to incorporate the real-world situations and partnerships that exist in our community.

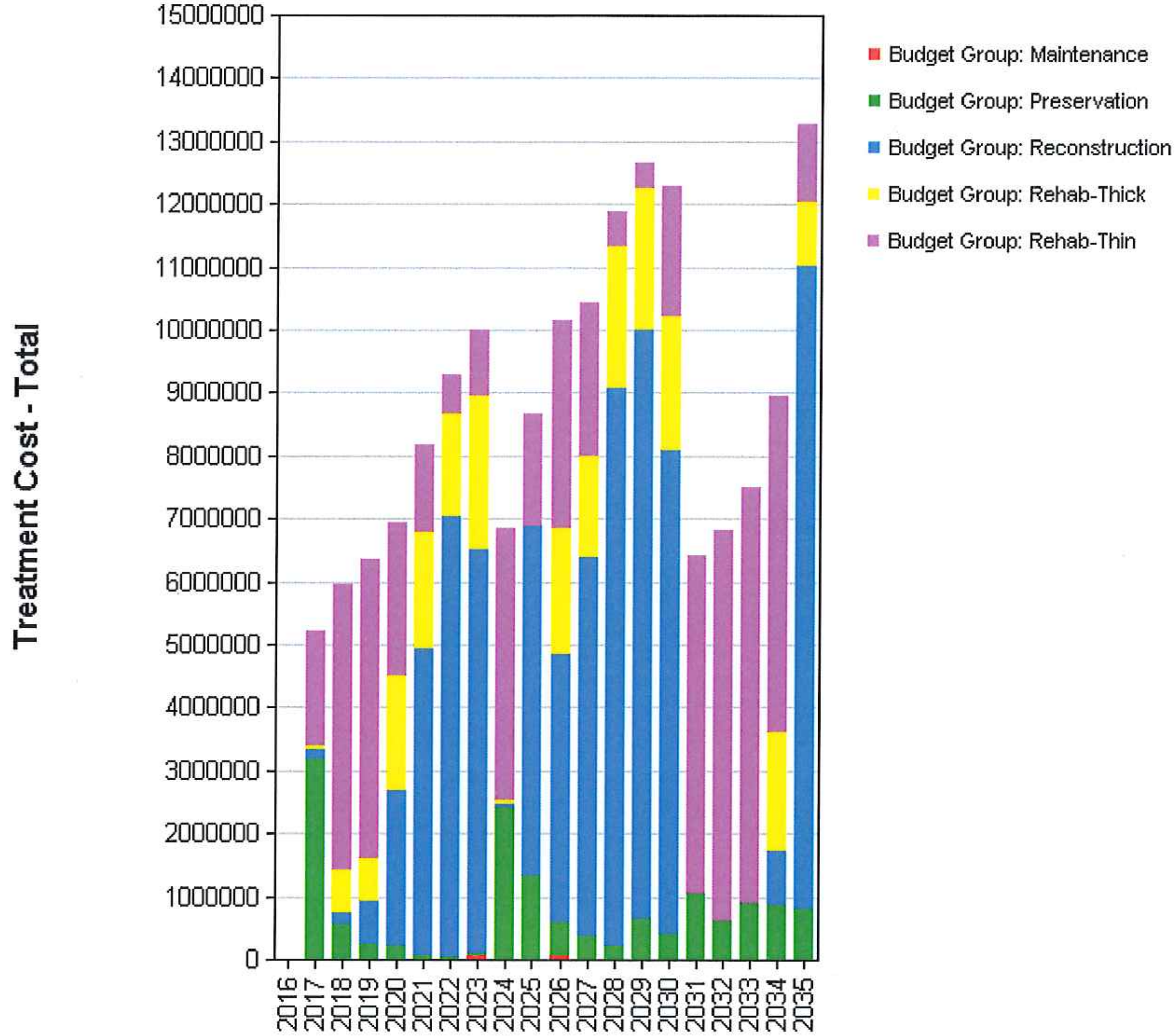

Figure 8. Optimization Analysis: PCI 80 over 20 years – Treatment Cost
The results of the optimization analysis use each of the five pavement treatment types over the 20 year plan. The annual treatment costs vary from approximately $5 million to $13 million.

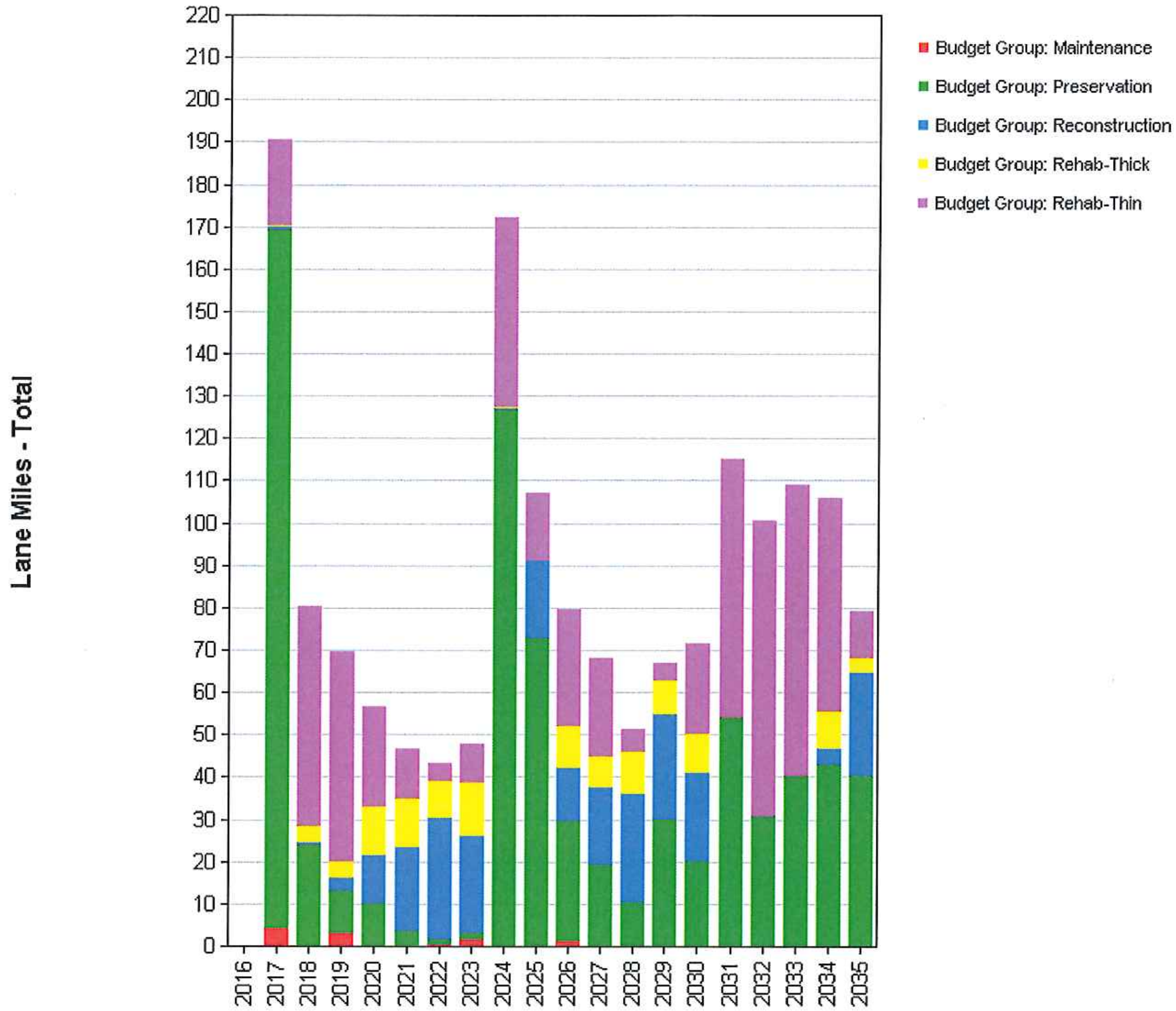

Figure 9. Optimization Analysis: PCI 80 over 20 years – Lane Miles
The results of the optimization analysis use each of the five pavement treatment types over the 20 year plan. The lane miles treated per year vary from approximately 45 to 190 miles.

A new scenario was created which spends $8.2 million annually for 20 years. This scenario achieves a PCI of 80.2 in year 20 (Figure 10). The budget remains constant at $8.2 million per year (Figure 11). The amount of lane miles treated varies widely from 30 to 275 (Figure 12). While a 20 year pavement plan is not realistic, because the community's needs are constantly changing, this long range thinking will enable the City to plan for the success of a long term and expensive project which will provide a high quality of life for residents and visitors, provide better conditions for those traveling the roads, which in turn promotes economic growth.

Figure 10. Optimization Analysis: $8.2M for 20 years – PCI Score

The PCI score increases from 60.8 initially to 80.2 after 20 years. The line varies over the 20 years due to budget limitations and road condition needs.

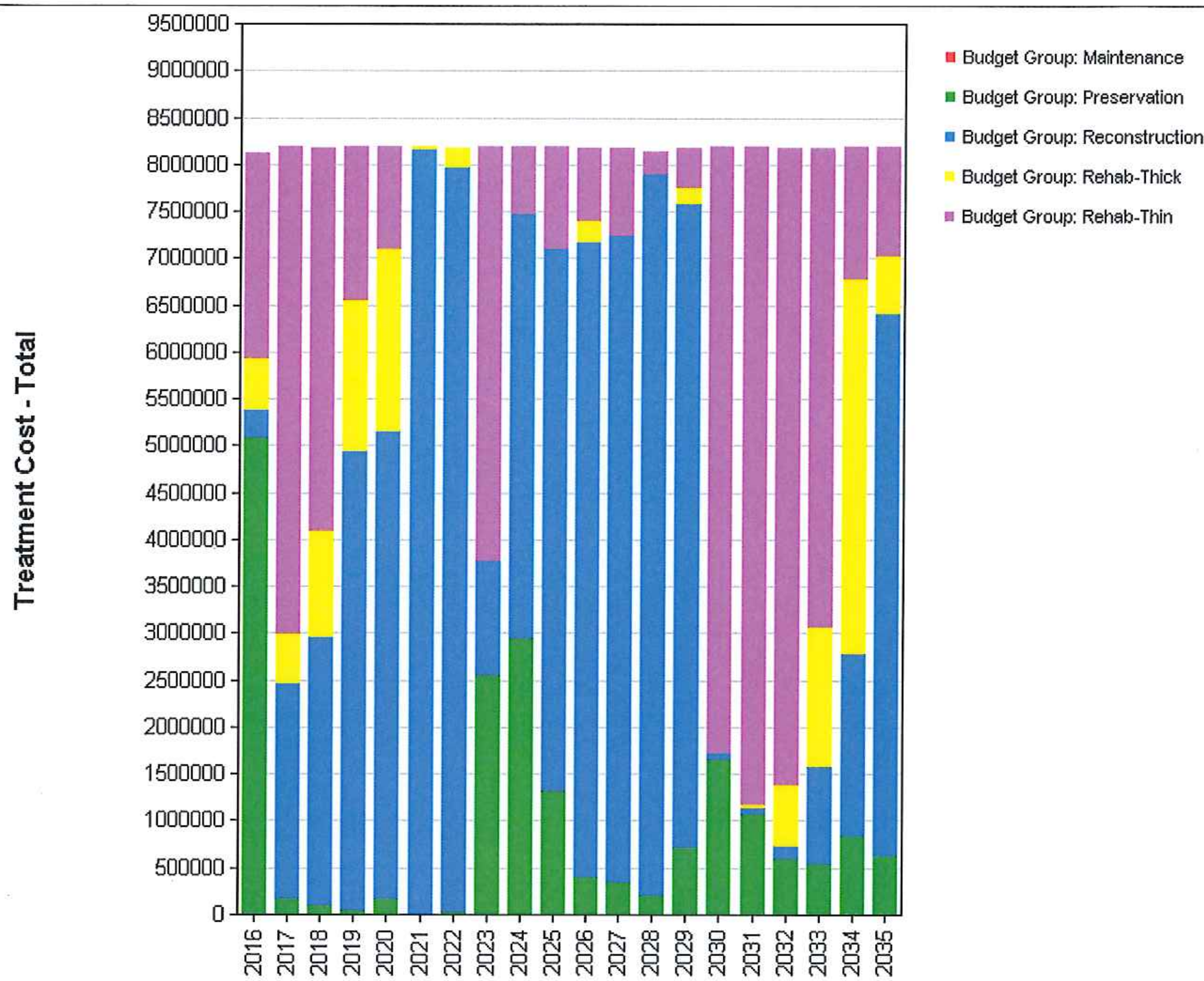

Figure 11. Optimization Analysis: PCI 80 over 20 years – Treatment Cost
The results of the optimization analysis use each of the five pavement treatment types over the 20 year plan. The annual treatment costs remains $8.2 million, but the total amount spent on each treatment type varies due to needs for that treatment type.

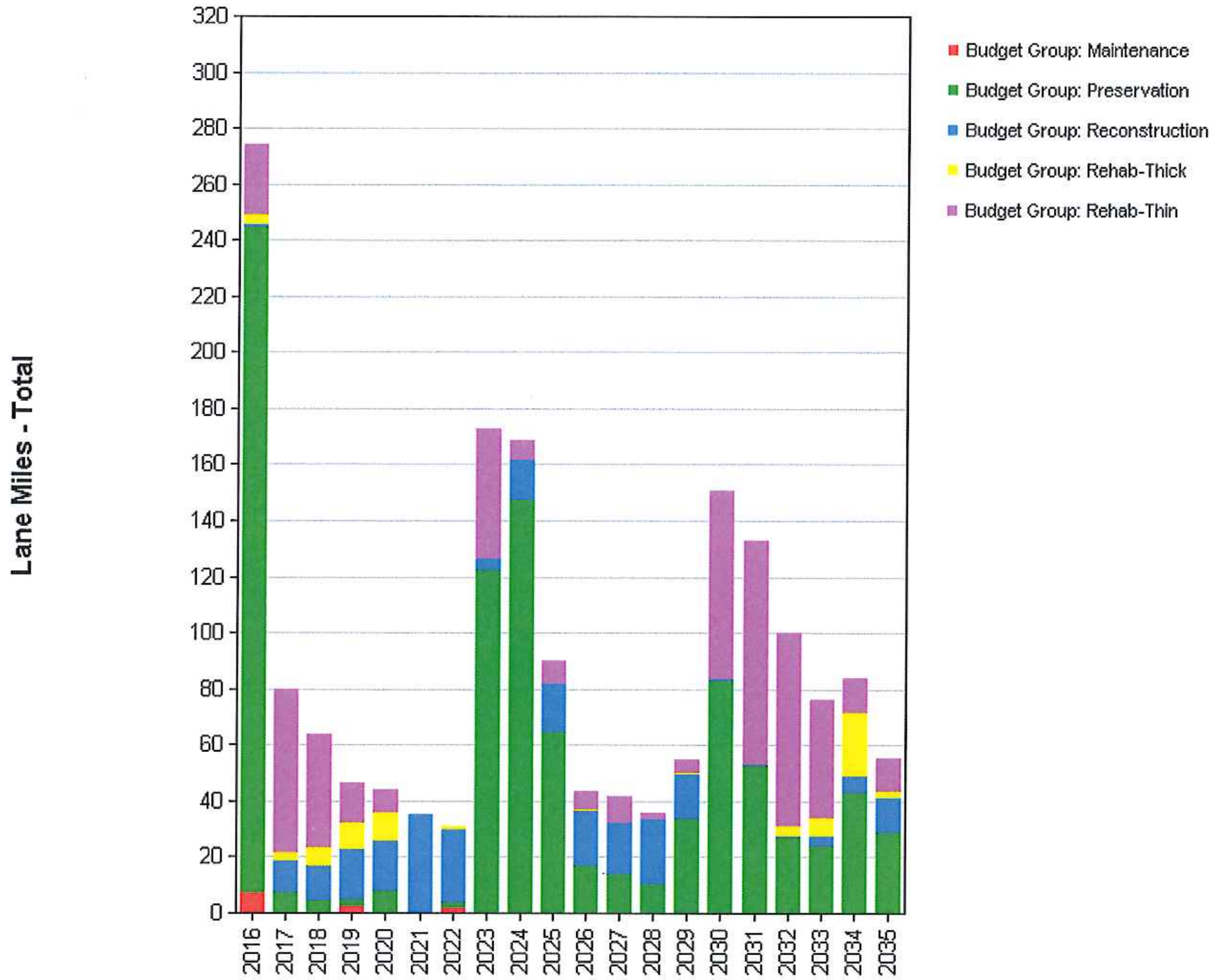

Figure 12. Optimization Analysis: $8.2M for 20 years – Lane Miles
The results of the optimization analysis use each of the five pavement treatment types over the 20 year plan. The lane miles treated per year vary from approximately 30 to 275 miles.