September 11, 2024

2024 PAVEMENT MANAGEMENT REPORT

Deephaven, MN

FOR: CITY OF DEEPHAVEN

20225 COTTAGEWOOD ROAD

DEEPHAVEN, MN 55331

WSB PROJECT NUMBER: 025341

Prepared by Matt Indihar, PE and Matt Henderson, PE

Table of Contents

I. Executive Summary

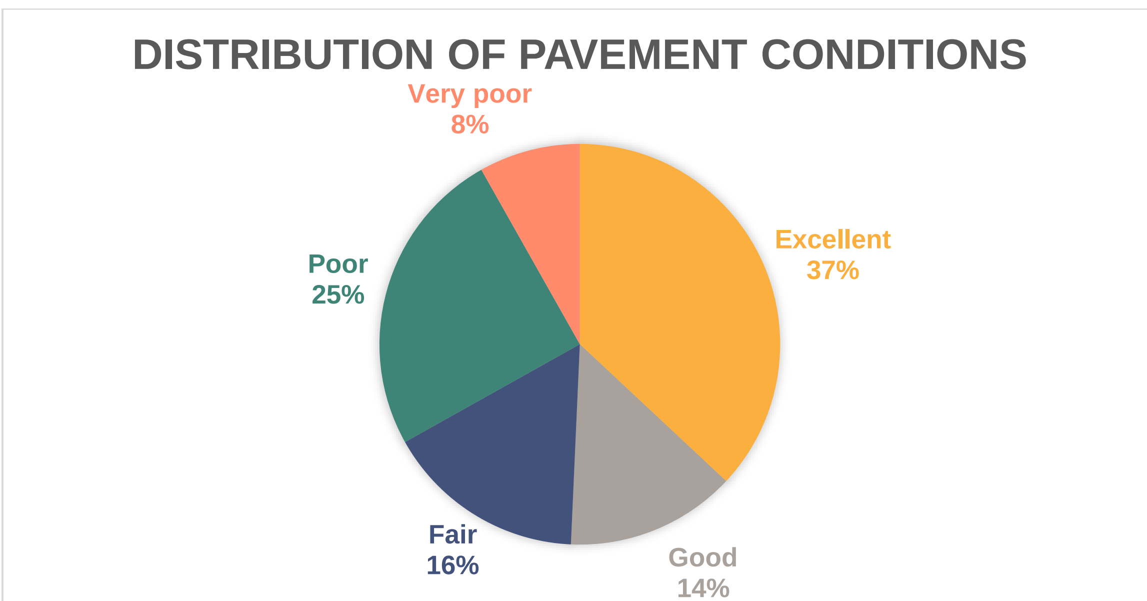
This report summarizes the findings of the pavement inspection of the road segments in Deephaven performed by WSB and completed in June 2024. The report gives an overview of the condition of roads in the City but is not intended to be a final document on public policy or City planning and is subject to change upon review by City Council. Maintenance best practices and repair guidance are also included in this document. Gravel roads and private roads were not included in the analysis in this document.

A summary of the pavement condition report is listed below:

- 30 miles of City road were evaluated in Deephaven, 27 miles of public and 3 miles of private streets.
- The current weighted average Pavement Condition Index (PCI) for bituminous roads in Deephaven is 69.3. Our review of the private roadways surveyed revealed a similar PCI score of 69.9. PCI is based on a 0 to 100 scale, with higher PCI values corresponding to better road conditions. This weighted average is calculated from the PCI values generated on each segment of roadway. A road's PCI is based on the quantity and severity of pavement distresses identified in the field. Any type of road maintenance (i.e. patching or crack sealing) done prior to inspections is accounted for in the PCI value.

Each segment of bituminous roadway was sorted into one of five broad categories based on their PCI value. Figure I.1. shows the percentage of bituminous roadways in each condition category in terms of surface area.

Figure I.1. Percent of System in Each Pavement Condition Category.



1THIS DATA EXCLUDES PRIVATE ROADS

Most roadways qualified for the Excellent or Good categories. However, 49% of the City's roads are in Fair, Poor, or Very poor condition. The spread between the categories indicates that the City has many options available to treat their pavements and increase the overall PCI score. However, the overall average PCI is less than 70, which is below average when compared to other cities of similar size. Cities with 30-40 miles of roadways tend to average in the high 70s for PCI score. Cities in this range of roadway mileage that WSB has analyzed recently include Mahtomedi, Princeton, and East Gull Lake.

II. Introduction

A pavement management program includes a systematic method of conducting a detailed distress survey to evaluate the condition of roads in a network, followed by performing a cost-effective analysis of various maintenance and rehabilitation strategies. This assists decision makers in making the best decision on the use of available resources. The pavement management ideology, if successfully implemented, can result in improvement of the life cycle costs, performance, and service life of roads. The inspection data provided in this report is a crucial component to a pavement management program. The main objectives of this type of analysis are to maintain a high-level network, evaluate the effectiveness of different alternatives, and optimize timing of maintenance and rehabilitation activities. These objectives can be met by routinely conducting inspections and determining the condition of a system of roads. The data is typically managed within a pavement management software which can manage, sort, and store the collected information. Through this software, various models can be generated that allow the user to customize maintenance protocols, run different budget scenarios, and evaluate the outcomes of each scenario.

By conducting a pavement management analysis, the City is showing their willingness to continue looking for ways to improve their network of roads and extend the life of their pavement. On top of that, the benefits of a pavement management program extend beyond helping a City improve the average condition of its pavement. Better pavement results in less wear and tear to vehicles that travel the roads, for both residents and the City. Extending the life of a road reduces the frequency of major reconstruction projects that require lengthy detours and delays to travelers. Safety is improved by giving drivers a surface that allows them to stop quickly and predictably. Achieving the maximum service life of a road is also more sustainable for the environment by reducing the amount of material and fuel that is needed when pavement needs to be completely replaced. For these reasons, WSB recommends completing routine pavement management program updates every three to four years.

Overall, a pavement management plan should improve the safety for a road network's users and the sustainability of its pavement maintenance while minimizing the costs to taxpayers. This document is designed to act as a guide to help the City manage its pavement. However, it is not the only source of information decision makers should use. It is important to also consult with maintenance staff and review other factors that cannot be accurately included in a model. Circumstances unique to a specific City are hard to capture in a scientific analysis and may take precedent over the recommendations provided.

WSB can help the City further analyze the information in this report and implement their pavement management system by providing City-specific funding and maintenance recommendations if needed.

This document focuses exclusively on street pavement and does not include analysis of other assets that are located along or underneath the roadway, such as storm sewer, sanitary sewer, or watermain. This type of data is often useful when considering major pavement rehabilitation projects. WSB's asset management team can help procure and manage data related to other assets if needed.

III. Pavement Condition Report Update

Pavement Lifecycle

Pavement is constructed to meet the demands of traffic and the environment for a certain design period. The Pavement Condition Index (PCI) of a roadway declines as traffic and time slowly take their toll on newly constructed pavement. Figure III.1. shows the typical life expectancy of pavement based on data obtained from the Army Corps of Engineers.

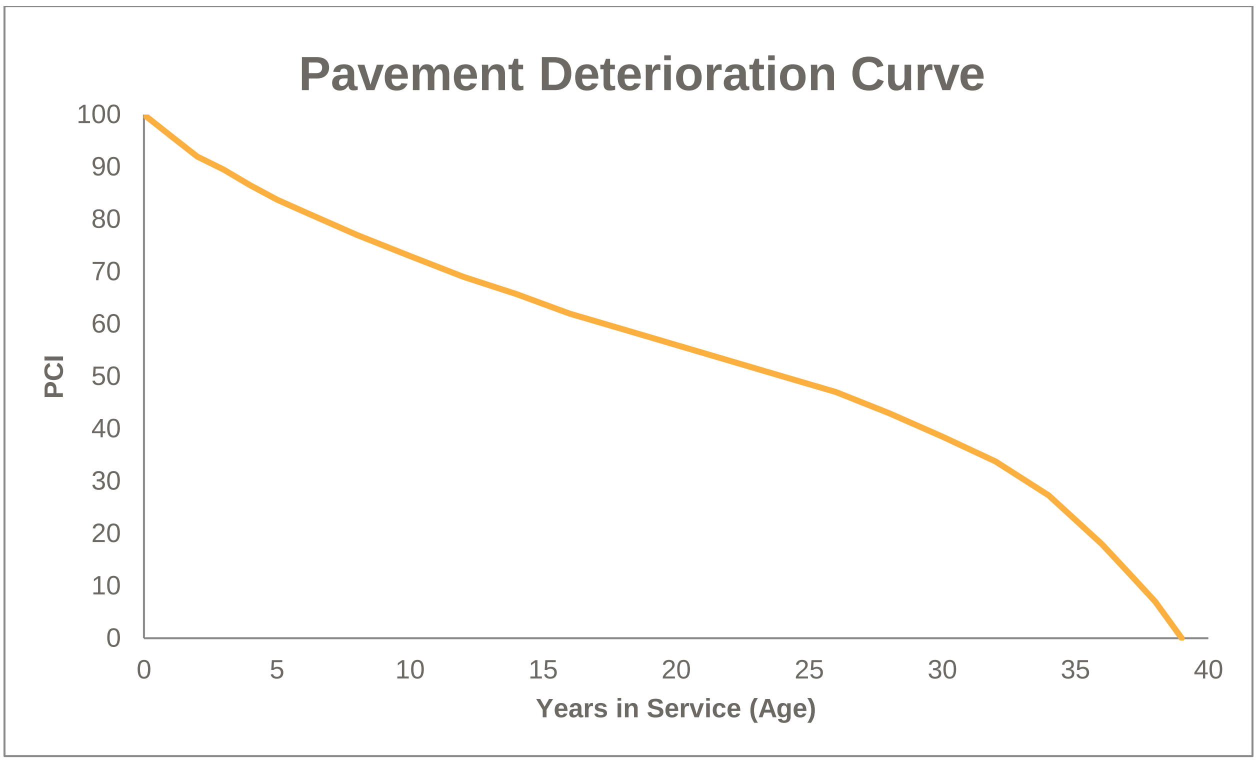


Figure III.1. Typical Pavement Deterioration Curve

This curve exhibits standard behavior when no maintenance is implemented. Each repair or preservation technique applied increases the PCI of a segment and increases its expected life by delaying degradation. The PCI values used in this report are based on a surface inspection of the City's streets. Surface inspections provide a good indication of the pavement and what riders experience when driving the road. However, they do not capture the sub-surface of a pavement structure. Pavement forensics such as pavement coring are required to analyze the entire depth of the road. Some repairs such as patching often improve the PCI of a road but fail to address underlying issues that will continue to cause deterioration. The recommendations in this report seek to keep PCI values high but also maintain the underlying layers of pavement for each segment.

Existing Pavement Conditions

WSB followed the American Society for Testing and Materials (ASTM D6433) standards for calculating the PCI for each section of pavement in Deephaven. This widely used method ensures that the pavement ratings were objectively generated with a repeatable approach. PCI values are used to evaluate pavement condition on a scale from 0 to 100 with 100 being a perfect roadway that exhibits no distress and 0 being a road that no longer functions as intended. Table III.1. displays the PCI categories that the engineering staff at WSB use to describe the condition of bituminous roadways along with the maintenance strategy typically implemented on roads in that condition.

Table III.1. Pavement Condition Categories Based on PCI Values

Category	Pavement Condition Index (PCI)	Recommended Strategy
Excellent	85.01 – 100.00	Corrective Maintenance as Needed
Good	75.01 – 85.00	Preventative Maintenance
Fair	58.01 – 75.00	Mill/Overlay
Poor	40.01 – 58.00	Reclamation
Very poor	0.00 – 40.00	Reconstruction

PAVER, an asset management software, was used to record the condition of each road segment. The software calculates PCI using deduct values that are based on the type, severity, and quantity of the visible pavement distresses on each road. Examples of asphalt pavement distresses include alligator cracking, longitudinal/transverse cracking, and potholes. Distress severity is classified as either low, moderate, or high. Depending on the type of distress, quantity is measured as the number of occurrences, length, or area.

The PCI values generated were based on a visual inspection and the corresponding recommended maintenance strategies should only be used as a guideline. In some cases, pavement forensics such as coring may be needed to supplement visual inspections and provide more information regarding roadway conditions and to confirm corrective strategies.

This report shows updated pavement conditions for all roads requested by the City. Most roadways at the time of inspection were in Excellent or Good condition. Table III.2. shows how much of the City's pavement is in each condition category. The average PCI in Deephaven is currently 69.3 which is below average for typical communities of this size and location.

Table III.2. City Roads by Condition Category

Pavement Condition Index	Mileage	Percent of System by Area
Excellent Category (85.01 – 100.00)	9.9	37.0 %
Good Category (75.01 – 85.00)	3.7	13.7 %
Fair Category (58.01 – 75.00)	4.4	16.2 %
Poor Category (40.01 – 58.00)	6.7	24.9 %
Very poor Category (0.00 – 40.00	2.2	8.2 %

Table III.3. Private Roads by Condition Category

Pavement Condition Index	Mileage	Percent of System by Area
Excellent Category (85.01 – 100.00)	.24	8.1 %
Good Category (75.01 – 85.00)	1.28	43.4 %
Fair Category (58.01 – 75.00)	.83	28.1 %
Poor Category (40.01 – 58.00)	.54	18.3 %
Very poor Category (0.00 – 40.00	.06	2 %

Appendix A includes a map of all the inspected road segments in the City with their PCI condition categories. Appendix B displays the PCI values of every inspected segment.

Pavement Rating Examples

PCI Rating = 93: Excellent

Sibley Ave (Segment ID: 154)

If a pavement section is categorized as Excellent, it will have been recently resurfaced or constructed. Distresses can be present but they are usually mild in severity. Drivers will experience few if any bumps while traveling the segment. In most cases, no maintenance is required on Excellent pavement. However, the City should be proactive by crack sealing seams and any early cracks to prevent water seepage into the base of the road

Detailed Distresses on Segment Shown:

- 2% Longitudinal and Transverse Cracking

PCI Rating = 82: Good

Vine Hill (Segment ID: 93)

Streets with a rating of Good have experienced enough freeze-thaw cycles to show signs of distress. These distresses are usually mild with some moderate distresses also present. Drivers on these segments encounter mostly smooth rides with few bumps. While the distresses may still be relatively minor, they are prime candidates for preventative maintenance techniques. It is recommended that the City use a combination of crack sealing, chip sealing, and fog sealing to restore segments in the Good category. These strategies are relatively inexpensive and cost-effective ways to extend the life of the pavement.

Detailed Distresses on Segment Shown:

weathering, ft^2			patching, ft^2			lt_cracking, ft		
h	m	l	h	m	l	h	m	l
0	0	15544.31	0	0	95.81	0	186.83	1066.96

depressions, ft^2		
h	m	l
0	183.07	46.05

PCI Rating = 68: Fair

Honeysuckle Lane (Segment ID: 238)

Segments rated as Fair may have a few moderate and severe distresses but usually only have mild widespread distresses. The road shows wear but it is still structurally sound. Drivers may experience some bumps while using these segments, but the driving surface is mostly smooth. Typically, streets in this category can be rehabilitated with a mill and overlay. This method involves milling off the top part of the pavement and replacing it with a new lift of fresh asphalt. Milling eliminates most of the distresses since they are usually mild and are still only on the surface. The overlay provides a new driving surface while utilizing the existing base, which is still in adequate condition. This strategy prevents the pavement from deteriorating past the point where a mill and overlay it is no longer cost-effective.

Detailed Distresses on Segment Shown:

alligator_cracking, ft^2			bumps_sags, ft^2			depressions, ft^2		
h	m	l	h	m	l	h	m	l
85.38	0	0	0	0	19.34	0	64.81	0

lt_cracking, Lin ft			patching, ft^2			pothole, Each		
h	m	l	h	m	l	h	m	l
0	112.59	492.55	0	164.03	24.16	0	1	0

raveling, ft^2			weathering, ft^2		
h	m	l	h	m	l
0	244.38	0	1433.57	652.83	8522.24

PCI Rating = 50: Poor

Azure Road (Segment ID: 232)

Roads in the Poor category are at the point where the number and severity of distresses dramatically worsen. Moderate and high severity distresses become common. Drivers experience many bumps while using these streets. Maintenance tactics such as crack sealing and seal coating are not effective, as the pavement has deteriorated beyond the point of repair. If the damage has not yet reached the base of the road, reclamation is recommended. Reclamation is an in-place grinding and recycling method for reconstruction of flexible pavements using the existing pavement section material as the base for a new roadway-wearing surface. While reclamation projects are less expensive than full reconstructions, it is still a costly procedure.

Detailed Distresses on Segment Shown:

alligator_cracking, ft^2			block_cracking, ft^2			bumps_sags, ft^2		
h	m	l	h	m	l	h	m	l
255.18	15.76	12.7	0.47	0	210.65	0	0	60.24
depressions, ft^2			**lt_cracking, Lin ft**			**patching, ft^2**		
h	m	l	h	m	l	h	m	l
13.09	16.24	0	0	0	1260.6	0	386.1	0
pothole, Each			**raveling, ft^2**			**weathering, ft^2**		
h	m	l	h	m	l	h	m	l
0	2	0	0	513.92	0	0	123.73	6043.59

PCI Rating = 21: Very poor

Westview Drive (Segment ID: 100)

When a road's PCI rating is 40 or below, the pavement shows high severity distresses at multiple locations or extensive moderate and low severity distresses. The street has deteriorated to the point where the structural integrity has diminished along with the driving surface. Drivers using segments of this condition experience bumpy and rough rides. Typically, streets of this category require full reconstruction. Reconstruction involves removing the pavement at full depth, through the surface layers of asphalt and into the gravel base and constructing the street to its original state. Reconstruction is very costly, so every effort should be made to keep streets from entering this category.

Detailed Distresses on Segment Shown:

alligator_cracking, ft^2			block_cracking, ft^2			edge_cracking, Lin ft		
h	m	l	h	m	l	h	m	l
1593.1	1022.66	366.32	102.86	0	0	0	0	480.74

raveling, ft^2			lt_cracking, Lin ft			patching, ft^2		
h	m	l	h	m	l	h	m	l
0	1603.39	0	0	54.61	1838.91	0	719.9	59.01

pothole, Each			weathering, ft^2		
h	m	l	h	m	l
0	7	0	1179.44	1588.97	4758.68

IV. Pavement Management Report

The information provided in this pavement management report is based on a systematic method of inspecting and rating the pavement condition of roads in the City's network, followed by an analysis of various cost-effective maintenance and rehabilitation strategies which can aid in making the best decisions on the use of available resources. It can also be used to provide updated data regarding the current pavement management plan.

Recommended Maintenance Action

Deephaven has many options at their disposal for pavement rehabilitation and preventative maintenance including reconstruction, reclamation, mill and overlays, and seal coats that extend the life of a roadway. Each of these treatments should last several years and be cost-effective if correctly implemented at the right time.

Corrective Maintenance

Corrective maintenance is used to fix a road segment that exhibits normal low severity distresses or corrected areas of acute high severity distresses like potholes. This may be the result of improper construction or unforeseen conditions. This type of maintenance typically involves crack sealing or patching. While roads in Excellent condition typically require no major repairs, corrective maintenance may be needed to address early distresses.

Preventative Maintenance

Preventative maintenance is defined as treatment to an existing road that will help preserve and protect the pavement, while also slowing future deterioration. This type of maintenance improves the condition of the system without increasing its structural capacity.

Implementing a preventative maintenance strategy is cost-effective and important since maintenance costs increase with pavement age. Preventative maintenance actions can be done at a much lower cost than preservation actions such as mill and overlays. By applying appropriate preventative maintenance before a road deteriorates, the pavement can be kept in good condition at a much lower cost. With proper preventative maintenance techniques, the life of an average paved road increases from 20 years to 60 years.

Preventative maintenance is best performed on newer pavements prior to the appearance of significant and/or severe distresses. There are many preventative maintenance applications that seek to protect pavement from deterioration. These treatments vary in effectiveness and price. Common preventative maintenance techniques include crack sealing, fog sealing, chip sealing, chip sealing followed by fog sealing, rejuvenators, micro-surfacing, slurry sealing, etc..

Patching can also be considered preventative maintenance, but it is usually implemented on small areas of severe distress. Additionally, patching a road to increase its PCI does not provide long term structural improvement. Patching may be necessary to keep roads in serviceable condition but it should not be considered routine maintenance for every road.

Additional details on the most common preventative maintenance techniques are included below.

Rejuvenators

One option to consider as a preventative maintenance technique is rejuvenating with a product called "Reclamite." Rejuvenators like Reclamite improve the durability of asphalt pavement by preventing or reversing the oxidation that causes the binder to dry out and crack. They also help seal out harmful moisture.

Pavement in good condition but exhibiting signs of aging like longitudinal and transverse cracking and weathering will benefit from a rejuvenator application. These products can be used to help keep pavements in good condition as long as possible.

Other benefits of rejuvenator products is their quick curing allowing them to be opened up to traffic within 2 hours in most cases when sand is applied after application. The sand is then swept off the following day to ensure a clean and uniform appearance. These products are generally clear in appearance once cured allowing all existing pavement markings to still be visible on completion of the project without any need to protect.

Crack Seal

Crack sealing is done to prevent the intrusion of water and incompressible materials into cracks. When water enters cracks in pavement, it can soften the sub-base and base layers. This leads to the development of more severe distresses and ultimately the formation of potholes. In Minnesota where extensive freeze/thaw cycles exist, the water that enters the pavement structure through cracks can also lead to frost heaving issues.

Crack sealing should be completed early in the life of a new pavement or overlay. For the most effective results, it should be performed 2 to 4 years after a new surface is constructed and periodically after that as deemed necessary. This technique will not improve the structural capacity of the pavement, but it will slow down future structural deterioration. In general, crack sealing should be done in coordination with other pavement preservation and rehabilitation treatments to enhance their performance. It may also be conducted as a stand-alone practice to increase pavement life through minimizing water and incompressible ingress and damage.

Best practice is to seal cracks prior to fog seals, chip seals, overlays, and any other surface treatment. All moderate to high severity longitudinal, transverse, and block cracks between ¼ inch and ½ inch wide should be sealed. Cracks less than ¼ inch wide may be difficult to seal and should be filled with a surface treatment. Cracks wider than 3/4 inch will require a mastic fill material. To mitigate roughness issues, overbanding or buildup of seal material on the surface of the pavement should be avoided. Finally, alligator cracks should be addressed through base repair or patching methods and should be largely removed prior to crack sealing.

Crack sealing is an important first step to mitigating future pavement damage but adding a seal coat layer on top of sealed cracks provides significantly more protection from distress. WSB recommends the City reference MnDOT Spec 3719, 3723, or 3725 for more information on crack sealing guidelines

Fog Seal

Fog sealing is another type of preventative maintenance in which asphalt emulsion is applied to the roadway to protect the surface from environmental aging, moisture damage, and oxidation. This preventative maintenance technique will not add any strength to the pavement. Fog sealing is typically completed one year after crack sealing. It is important to note that while the color of a fog seal may fade as early as a year after its application, a fog seal remains effective for as many as 3 to 5 years. WSB recommends the City reference MnDOT Spec 2355 for more information on fog sealing guidelines.

Chip Seal

Like a fog seal, the chip sealing process involves an application of a uniform layer of emulsified asphalt. However, chip sealing includes immediately applying a layer of cover aggregate across the pavement surface. Pre-sweeping and filling of cracks should be done prior to the chip seal application. Chip sealing creates a waterproof surface membrane to the existing membrane, which helps to slow down the deterioration of the pavement from oxidation as well as to prevent the intrusion of water.

Chip sealing is typically completed one year after crack sealing. Normally, a chip seal placed on a newer road will last 5 to 10 years. This assumes the chip seal is protected during placement to allow proper curing time. It is crucial that no moisture is trapped underneath a chip seal during construction because trapped moisture typically leads to premature failure of the bond between the pavement and the tack. Other factors that affect the performance of a chip seal include the type of binder that is used, the condition of the underlying road, and external factors such as plow damage. It is the responsibility of the owner to ensure that these external factors do not contribute to premature failure of a chip seal.

Field surveys should assist in determining which roads are candidates for a chip seal. WSB recommends the City reference MnDOT Spec 2356 and the MnDOT Seal Coat Handbook when considering chip sealing.

Chip Seal Followed by Fog Seal

A newer preventative maintenance strategy that has already proven cost-effective for cities includes combining the benefits of a chip seal and a fog seal. This technique is rapidly being adopted by cities and counties as the preferred sealcoat option. Applying a chip seal immediately followed by a fog seal extends the life of a traditional standalone chip seal project with some additional benefits. The fog seal over a chip seal provides for better chip retention resulting in a more durable surface and reducing the complaints from the public of chipped windows and rocks being tracked off the project. A study found the public has a more positive opinion of the fog sealed chip seal projects because they appear as if the road was just overlaid at a reduced price and far less impact to roadway users.

The construction of this type of fix is the same as for the chip seal section in this report with the addition of a fog seal once the chip seal rock has been compacted. WSB would recommend applying CSS-1H emulsion at a rate of 0.10 gallons per square yard as a starting point. The application rate can depend on the rate of emulsion applied under the chip seal and the rock used so adjust as needed to the project conditions.

If the City has had problems with standard chip seals in the past, adding a fog seal on top of a chip seal is a way to reduce many of common chip seal issues. Engineers at WSB recently completed a statewide study on chip seals followed by fog seals and found they performed much better, were well-received by the public, and provided the cost-effective solution that seal coats are designed to deliver. For these reasons, chip seal followed by fog seal is recommended as the main preventative maintenance solution for the City. Reference Minnesota Local Road Research Board report 2022RIC04 for additional information.

Overlay/Mill and Overlay

An overlay involves placing a new layer of bituminous material on top of an existing asphalt surface. A mill and overlay requires grinding all or a portion of the in-place asphalt surface and topping the ground surface with a bituminous wearing course. This rehabilitation strategy provides a structural improvement to the roadway. We recommend conducting more investigations such as pavement coring to evaluate the subsurface conditions before implementing an overlay project. Information such as depths of pavement layers, signs of debonding, and distresses that are not visible from the road surface can be obtained through pavement coring. Applying an overlay to a pavement structure with inadequate subsurface conditions will cause the new surface to fail prematurely.

Texas Underseal

One of the biggest complaints about overlaying existing asphalt pavement is how quickly the underlying cracks reflect up through the new layer of pavement. For cities interested in ways to reduce the reflective cracking that commonly occurs with overlay projects, a Texas Underseal project is worth considering. Texas Underseal is a relatively newer technique that suppresses reflective cracking in the layer of new asphalt pavement by applying a chip seal on the existing roadway immediately before placing the new layer of pavement. The seal coat layer acts as a barrier between the existing cracks and the new pavement. Studies have shown that a Texas Underseal can reduce reflective cracking in overlayed pavement by as much as 40%. MnDOT and several cities in Minnesota have experimented with Texas Underseals and have found them to be a cost-effective way to slow the inevitable advance of reflective cracks.

The additional cost associated with a Teas Underseal project is typically the cost of applying a chip seal on the segment. The chip seal for a Texas Underseal is constructed similarly to a traditional chip seal with the only difference being a slightly reduced application rate of emulsion: from the normal 0.35 gallons per square yard to 0.30 gallons per square yard. The chip seal should still be rolled and swept before placing the new asphalt pavement.

Reclamation

The most common types of reclamation are full-depth reclamations (FDR) and stabilized full-depth reclamations (SFDR). FDR involves pulverizing the full depth of a bituminous road and a portion of the underlying materials. That material then gets blended together and placed as a sound base for new pavement. Typically, FDR reclaim depth is 12 inches, although it can be as deep as 18 inches. Excess FDR mixture may be removed to allow 6-inch lifts compaction. Additional rock may need to be provided if the mixture is expected to be deficient in crushing or gradation. The reclaimed mixture can be topped with different types of surface course, depending on the structural requirements and anticipated traffic level. A layer of tack coat needs to be applied prior to surface treatment to provide good bonding between the FDR mixture and surface course. SFDR involves the same process but includes mechanical, chemical, or bituminous stabilization. The typical minimum depth of stabilization is 4 inches, but it can go as deep as 6 inches. Mechanical stabilization involves the addition of new aggregate or recycled materials. Chemical stabilization includes the addition of lime, cement, fly ash, calcium chloride, or other proprietary products. The asphalt additives can be foamed asphalt or asphalt emulsion. These stabilizing agents, if combined with additives, can help optimize the FDR performance.

Full & Partial Reconstruction

Reconstruction includes the complete replacement of the road's driving surface and pavement structure. The pavement along with its base layers are then replaced with new material. Asphalt mix type, ride specification, lift thicknesses, and compaction requirements must be in accordance with the specified standard. Selecting the specific appropriate reconstruction plan for a road requires more detailed investigation such as pavement coring. Each road segment requires a specific pavement design that considers existing subgrade materials and traffic loading to create the most effective pavement structure. Subsurface water management is a significant component of a reconstruction project. Thus, addressing roadway drainage is included in roadway reconstruction projects, including concrete curb and storm sewer. When performing a reconstruction, it is important to consider the entire pavement structure that includes the base and subbase. A larger initial investment in thicker base and subbase layers along with edge drains provides the pavement with a stronger foundation that reduces damage from moisture under the surface. This produces pavement that is less susceptible to damage and has a longer expected life. WSB can provide specific reconstruction design recommendations if requested. For a partial reconstruction, a reclamation is typically performed as opposed to a complete road-base replacement, includes some concrete curb and gutter, and relatively minor storm sewer replacement or additions; this method is similar to the last couple of street projects the City has completed.

Pavement Forensics

The final decision on implementing a reconstruction, reclamation, or mill/overlay project should come after a pavement forensic study. Pavement forensics involves studying the pavement structure and condition of the base underneath the visible layer of pavement. Important information results from this analysis. Examining pavement cores can determine the depths of pavement layers, signs of bonding or de-bonding, and distresses that might not be visible from the surface. Soil borings along the roadway can be used to identify aggregate depths and soil classifications to provide a better understanding of the roadway section. This information is crucial when determining what type of rehabilitation is needed and what it will cost. Several factors should be considered when deciding the number of cores to be taken such as the pavement condition and the variability in the pavement depth as cores are being taken. A pavement forensic study should be conducted less than two years before a major maintenance project to ensure the results of the study accurately reflect the road's condition. The findings of pavement forensic studies have been proven to lead to cost savings and more appropriate maintenance strategies. WSB can perform pavement forensics for Deephaven if requested.

Drainage Considerations

A major influence in selecting the correct maintenance or rehabilitation project for a particular road can be drainage. Proper drainage is crucial for pavement longevity. The consistent presence of water can erode the base layer of aggregate that supports the pavement, accelerate debonding of an asphalt mixture, and induce frost heave in freezing conditions. Common signs that road drainage is inadequate include standing water on the pavement after precipitation or the presence of pavement stripping at the bottom of a pavement core.

Ways to improve drainage include re-establishing a crown on the pavement to quickly shed water, improving the aggregate base layer below the pavement, adding edge drains under the pavement to wick moisture from under the road, installing curb and gutter to better convey surface flow, and installing catch basins/storm sewer. Many of these repairs cannot be implemented without a major repair or reconstruction. The need for drainage improvements can sometimes be a major factor in deciding which type of rehabilitation is best for a pavement segment. If poor drainage is not addressed, it will continue to shorten the life of the road, no matter what repair is made. The recommendations included in this report do not consider the effect of drainage improvements on pavement performance or costs.

V. Capital Planning

Cost Considerations

For the City to begin planning a budget for future roadway projects, high level construction costs should be considered for each of the 5 recommended project types. The unit costs can be used to either determine a target budget the City would like to achieve or be used with current budget numbers to determine how much can be spent to repair roads in each category. More in depth analysis and modeling can be done to help determine what the most efficient use of funds is or where to most effectively spend current dollars by running computerized scenarios, if requested.

The unit pricing of chip sealing followed by fog sealing was selected as the representative cost for the preventative maintenance activity since it has shown to be one of the most cost-effective forms of preventative maintenance. The cost of corrective maintenance on roads in Excellent condition was considered too minimal to include. Additionally, this minor maintenance is traditionally performed by City staff and comes from a separate maintenance budget.

- Preventative Maintenance - $ 2.16/square yard $ 30,000/Mile*
- Mill and Overlay - $ 25/square yard $ 350,000/Mile*
- Reclamation - $ 90/square yard $1,200,000/Mile*
- Partial Reconstruction - $120/square yard $1,600,000/Mile*
- Full Reconstruction - $150/square yard $2,000,000/Mile*

*Assumed 23 ft. road width

These cost estimates are based on average recent bids for similar work in your area. Estimates provided in this report only include the costs related to that specific fix for a 23' wide roadway. If additional construction items like curb replacement or other additional work types are added, then the unit pricing should be adjusted accordingly. The partial and full reconstruction prices shown includes adding or replacing concrete curbs in urban areas and regrading shoulders in rural areas; this cost also includes an allocation for storm sewer or culvert replacements to improve drainage.

To provide appropriate high level full project cost projections, incidental construction costs (10% contingency) and overhead costs (25%) associated with design, bidding, construction admin/inspection services, financing, and administrative costs were also included. It should be noted these unit costs are based on recent construction pricing and can vary significantly depending on the size of the project and other project specific information. The project size assumed was roughly one mile in length. A larger project can improve design/construction efficiency and increase the economy of scale, which can provide cost benefits. If projecting these unit prices out to future years, an inflation factor should be assumed as well.

Figure V.1. demonstrates how the cost of restoring pavement increases as pavement deteriorates. This shows the importance of implementing preventative maintenance because it is exponentially less expensive. It also shows the importance of repairing roads before they reach the level where a reconstruction is needed since the cost jumps significantly. Once roads reach this level, the cost no longer increases and urgency to repair the road is driven solely by the need to keep roads serviceable for the traveling public.

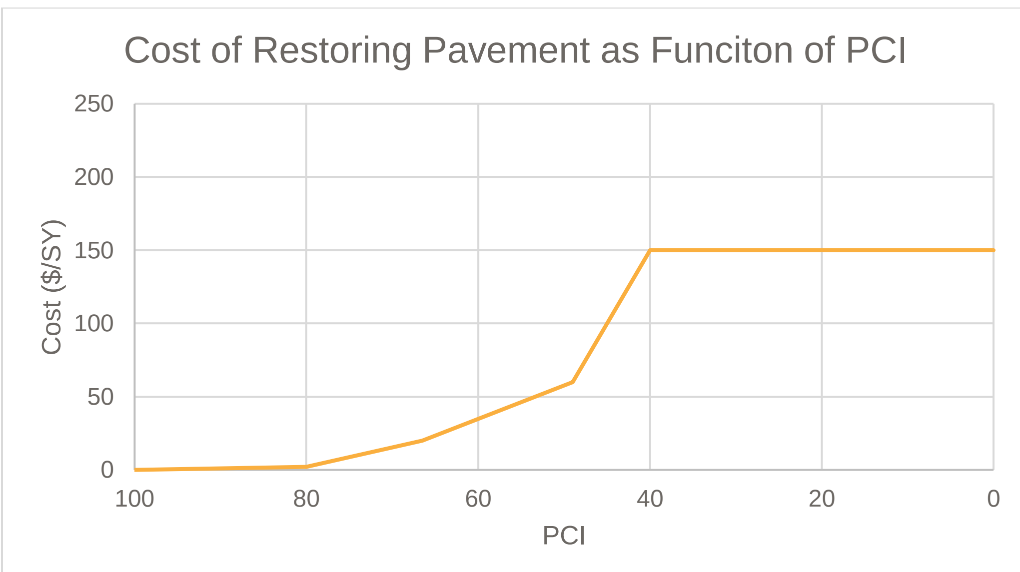


Figure V.1. Increasing Cost of Restoring Pavement

A main goal of this pavement management is to determine how much funding is necessary to maintain the City's streets in future years and how that budget should be spent. The best way to determine this would be to run a series of scenarios to determine the City's funding needs and how to most effectively work towards PCI goals.

Maintenance Recommendations

While the maintenance repair recommended for a segment typically aligns with its PCI score and the corresponding condition category noted above, there are a few other factors to consider when deciding which roads should receive a specific treatment. Anytime a major rehabilitation projects is needed (PCI less than 75), it is wise to do more investigation before moving ahead with a project. Spending resources investigating the pavement and base condition adds value by making sure the most cost-effective solution is applied. This is especially true when deciding between a reclamation or a reconstruction. The cost difference between these alternatives is substantial enough that pavement coring should always be implemented before moving forward with a project that has a PCI score lower than 58.

The actual performance of the roads in the City's system will depend on how cost-effective the maintenance is. There are several strategies that can be used to protect the roads in good condition and to stretch the impact of the City's resources. To maximize the effectiveness of the available funding, we recommend prioritizing preventative maintenance. While it seems counterintuitive to focus on roads in the best condition, their preventative maintenance is relatively cheap and retaining segments with high PCI values is necessary to avoid high maintenance costs in the future. While roads will inevitably need more expensive repairs at some point, delaying those expenses and keeping roads in good condition is a best practice. Figure V.2. illustrates this point.

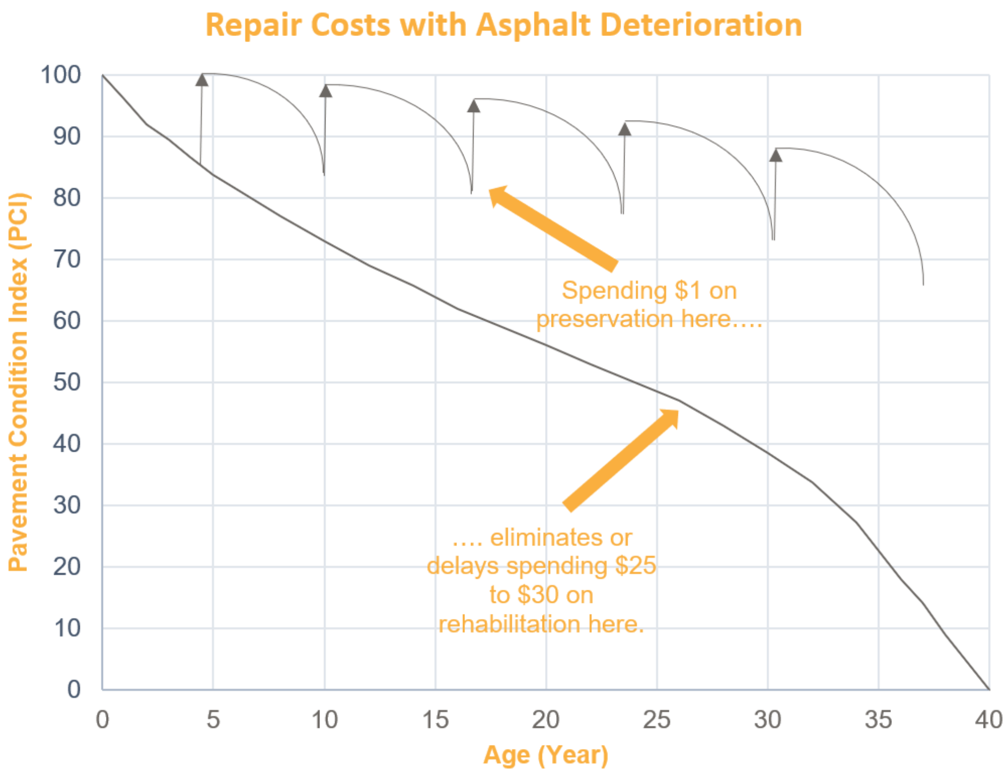


Figure V.2. Cost-Effectiveness of Preventative Maintenance Example

Similarly, taking advantage of the lower cost of mill and overlay projects compared to other more significant rehabilitation practices frees up more of the budget to improve additional road segments in the City. This same logic applies to not letting a road deteriorate to the point where it will need to be reconstructed. Reconstruction consumes many resources and should only be considered when other underground utilities are also in need of repair or there is a known issue with the subgrade. When reconstruction is cannot be avoided, we recommend investing in base and subbase layers with adequate thickness. Paying extra to make sure the new road is built on a sturdy and dry foundation will extend the life of the pavement and reduce the amount of resources needed for future maintenance. When constructed properly, aggregate bases and subbases should not need to be replaced, even when the roadway ages or pavement fails.

Another important methodology to adopt is to not implement a less expensive repair on a road that requires a more expensive fix. It is tempting to try and apply cheaper fixes when facing expensive repairs and related costs. However, this will result in wasting precious funds. For example, applying a chip seal or rejuvenator as preventative maintenance on a road that is in Fair, Poor, or Failing condition is not effective. Instead of providing years of protection as intended, it will deteriorate quickly and not result in long-term results. Similarly, implementing a mill/overlay on a road in Poor or Very poor Condition may temporarily increase PCI, but the repair will deteriorate quickly and hurt the long-term condition of the pavement network.

With all these factors in mind, a recommended maintenance schedule was created. This schedule is meant to serve as a guide for typical segments and will not apply to every road in the system. However, it does implement many best practices that cost-effectively keep the pavement in good condition. Table V.1. shows this recommendation.

We also recommend keeping a detailed log of all street maintenance implemented in the City. Recording information such as the type of maintenance activity, when it was implemented, how much it cost, the materials used, the age of the road during implementation, and any other testing results on that segment can prove helpful in the future. Maintenance logs can help determine what is working well for a City and what is not. Similarly, if a recommended maintenance strategy is not working well, reviewing details of the activity can help reveal why. This detailed information can also be used to improve the assumptions used by the PAVER model. This will ensure future recommendations will be based on accurate scenarios.

Table V.1. Recommended Typical Maintenance Schedule

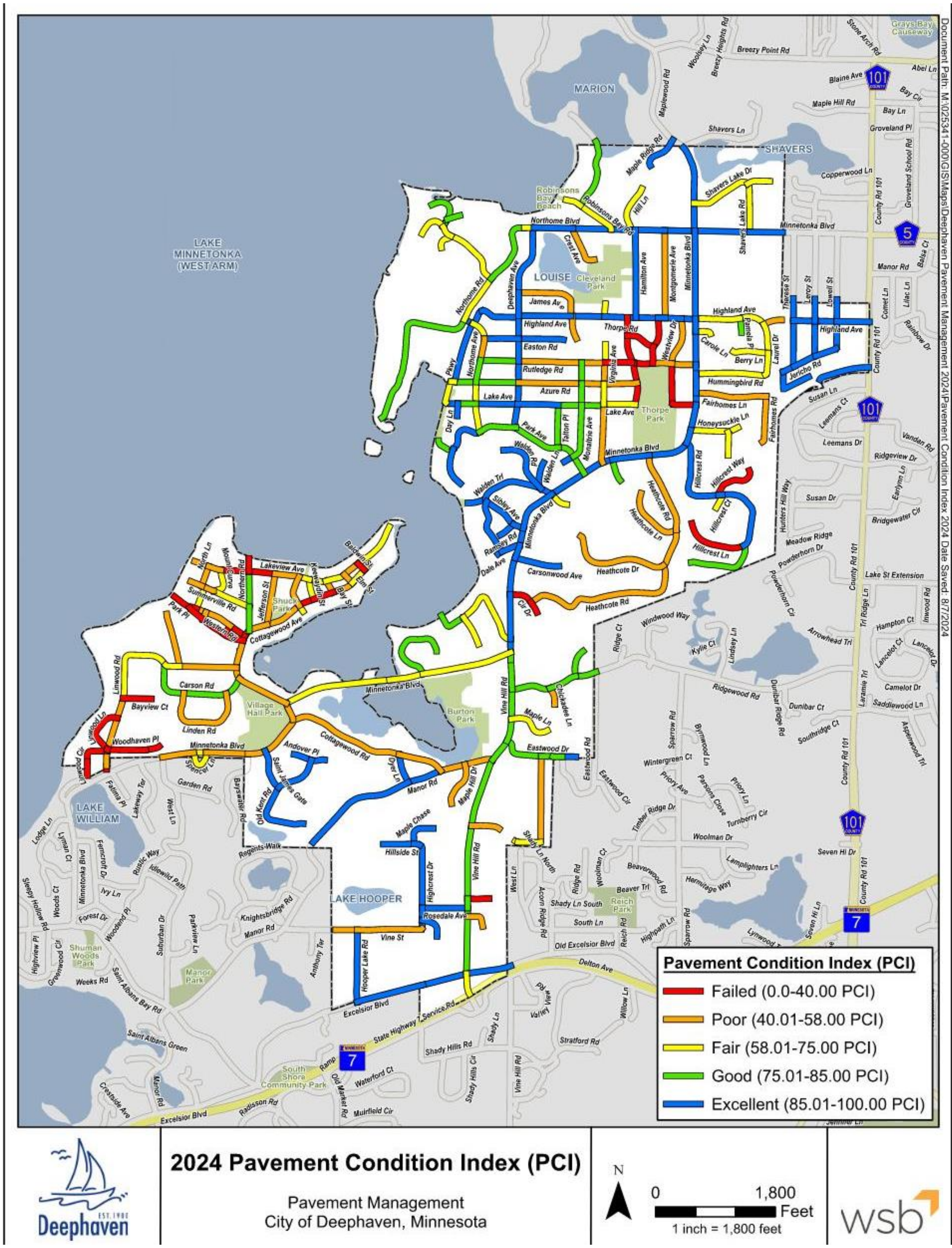
Typical Maintenance Schedule				
Cumulative Pavement Age (Years)	Time Between Maintenance	Maintenance	Predicted PCI	
			Initial	Improved
0	0	New Construction	100	
2	2 Years After New Construction	Initial Crack Seal*	92	99
4	2 Years After Crack Seal	Crack Seal	92	98
5	1 Year After Crack Seal	Chip & Fog Seal*	96	99
8-11	Every 3 to 6 Years	Crack Seal	85-90	98
12	1 Year After Final Crack Seal	Chip & Fog Seal*	85	98
18-22	6-10 Years After Chip & Fog Seal	Mill and Overlay	60	95
20-24	2 Years After Overlay	Initial Crack Seal	86	93
21-25	1 Year After Crack Seal	Chip & Fog Seal*	83	95
24-34	Every 3 to 6 Years	Crack Seal & Patch	80	92
27-35	1 Year After Final Crack Seal	Chip & Fog Seal*	78	95
33-45	6-10 Years After Chip & Fog Seal	Mill and Overlay	59	90
35-47	2 Years After Overlay	Initial Crack Seal	86	90
36-48	1 Year After Crack Seal	Chip & Fog Seal*	84	90
39-56	Every 3 to 6 Years	Crack Seal & Patch	85	90
42-57	1 Year After Final Crack Seal	Chip & Fog Seal*	76	88
52-75	10-20 Years After Chip & Fog Seal	Reclamation	50	100

*Rejuvenators can be considered in leu of chip seals

Finally, WSB recommends updating this pavement management plan periodically. As funding, construction costs, and pavement conditions change, the recommendations provided in this report gradually become less applicable. We recommend updating pavement condition ratings and revisiting maintenance strategies approximately every three to four years depending on the City's network and goals. Implementing routine inspections ensures pavement condition trends can be detected early and new maintenance or funding techniques can be promptly implemented as needed.

Appendices

Appendix A: PCI Condition Category Maps



Appendix B: PCI Values by Segment

STREET NAME	SECTIONID	LENGTH	WIDTH	Area SY	PCI	Recommended Fix
Highland Avenue	1	18.3	18	36.5	30	Reconstruction
Hooper Lake Road	2	1088.0	14	1692.4	93	Corrective Maintenance
Virginia Avenue	3	276.0	18	552.0	69	Mill/Overlay
Minnetonka Boulevard	4	621.8	24	1658.0	92	Corrective Maintenance
Fairhomes Road	5	695.8	16	1237.0	41	Reclamation
Sibley Avenue	6	38.5	16	68.5	100	Corrective Maintenance
Deephaven Avenue	7	323.9	20	719.7	89	Corrective Maintenance
Maplewood Road	8	413.8	20	919.6	85	Corrective Maintenance
Lakeview Avenue	10	225.1	20	500.1	52	Reclamation
Northern Road	11	536.8	20	1192.9	76	Preventative Maintenance
Northome Avenue	12	147.6	16	262.4	86	Corrective Maintenance
Heathcote Road	13	2504.9	20	5566.4	54	Reclamation
Linwood Road	14	492.8	20	1095.1	44	Reclamation
Eastwood Drive	15	643.9	16	1144.7	80	Preventative Maintenance
Parkway	16	240.8	16	428.1	89	Corrective Maintenance
Lake Avenue	17	632.9	18	1265.7	85	Corrective Maintenance
Minnetonka Boulevard	18	1611.2	24	4296.5	58	Mill/Overlay
Minnetonka Boulevard	19	580.0	24	1546.7	94	Corrective Maintenance
Rutledge Road	20	285.3	18	570.7	39	Reconstruction
Highland Avenue	21	488.8	18	977.5	86	Corrective Maintenance
Minnetonka Boulevard	22	88.2	24	235.2	47	Reclamation
Carole Lane	23	235.3	18	470.6	66	Mill/Overlay
Minnetonka Boulevard	24	202.1	24	538.9	88	Corrective Maintenance
Therese Street	25	693.1	16	1232.2	86	Corrective Maintenance
Highland Avenue	26	400.3	24	1067.4	69	Mill/Overlay
Rutledge Road	27	576.2	18	1152.4	76	Preventative Maintenance
Deephaven Avenue	28	22.0	20	48.9	85	Preventative Maintenance
Cottagewood Avenue	29	572.9	24	1527.7	42	Reclamation
Deephaven Avenue	30	359.5	20	798.9	86	Corrective Maintenance
Fairhomes Lane	31	1061.4	16	1887.0	47	Reclamation
Minnetonka Boulevard	32	191.3	24	510.0	63	Mill/Overlay
Lakeview Avenue	33	393.9	20	875.3	35	Reconstruction
Excelsior Boulevard	34	677.6	20	1505.8	87	Corrective Maintenance
Lake Avenue	35	184.0	18	367.9	95	Corrective Maintenance
Highcrest Drive	36	962.3	14	1497.0	92	Corrective Maintenance
Minnetonka Boulevard	37	646.6	24	1724.3	45	Reclamation
Cottagewood Avenue	38	328.2	18	656.4	50	Reclamation
Spencer Lane	39	444.7	20	988.3	64	Mill/Overlay

STREET NAME	SECTIONID	LENGTH	WIDTH	Area SY	PCI	Recommended Fix
Highland Avenue	41	577.7	16	1027.0	90	Corrective Maintenance
Ridgewood Road	43	583.4	20	1296.4	77	Preventative Maintenance
Vine Hill Road	44	131.3	24	350.0	79	Preventative Maintenance
Westview Drive	45	717.3	18	1434.5	57	Reclamation
Pamela Place	47	215.3	20	478.5	77	Preventative Maintenance
Woodhaven Place	48	212.7	20	472.7	36	Reconstruction
Leroy Street	49	529.2	16	940.9	89	Corrective Maintenance
Chickadee Lane	51	259.2	16	460.8	48	Reclamation
Heathcote Lane	53	923.7	20	2052.6	51	Reclamation
Park Avenue	54	287.0	16	510.2	77	Preventative Maintenance
Hillside Street	56	459.7	14	715.0	86	Corrective Maintenance
Hummingbird Road	58	1047.4	24	2793.0	63	Mill/Overlay
Azure Road	59	328.8	18	657.6	84	Preventative Maintenance
Sibley Avenue	60	535.6	16	952.2	85	Corrective Maintenance
Park Avenue	61	614.1	16	1091.7	86	Corrective Maintenance
Lake Avenue	62	335.5	18	671.0	77	Preventative Maintenance
Cottagewood Road	63	424.8	24	1132.8	56	Reclamation
Vine Street	64	329.4	14	512.5	42	Reclamation
Western Road	65	267.6	16	475.7	23	Reconstruction
James Avenue	66	1061.5	16	1887.1	56	Reclamation
Cottagewood Avenue	68	102.2	24	272.4	50	Reclamation
Vine Hill Road	69	452.0	24	1205.5	79	Preventative Maintenance
Shavers Lake Road	71	730.2	20	1622.6	69	Mill/Overlay
Cottagewood Avenue	73	237.9	18	475.8	32	Reconstruction
Virginia Avenue	74	197.0	16	350.3	70	Mill/Overlay
Rosedale Avenue	75	681.9	16	1212.3	90	Corrective Maintenance
Parkway	76	923.7	16	1642.1	86	Corrective Maintenance
Old Kent Road	77	1057.3	24	2819.5	85	Corrective Maintenance
Deephaven Avenue	78	323.9	20	719.9	89	Corrective Maintenance
Highcrest Drive	79	126.0	14	196.1	91	Corrective Maintenance
Hamilton Avenue	80	307.8	18	615.6	29	Reconstruction
Walden Trail	81	271.0	16	481.8	100	Corrective Maintenance
Minnetonka Boulevard	82	827.3	36	3309.3	93	Corrective Maintenance
Virginia Avenue	83	25.9	18	51.7	77	Preventative Maintenance
Manor Road	84	427.9	20	950.9	40	Reclamation
Minnetonka Boulevard	85	511.9	24	1364.9	61	Mill/Overlay
Lakeview Avenue	86	424.8	20	944.0	31	Reconstruction
Ramsey Road	87	259.2	16	460.8	92	Corrective Maintenance
Deephaven Avenue	88	1049.4	20	2332.1	86	Corrective Maintenance

STREET NAME	SECTIONID	LENGTH	WIDTH	Area SY	PCI	Recommended Fix
Western Road	89	150.3	16	267.2	41	Reclamation
Manor Road	90	522.5	20	1161.1	100	Corrective Maintenance
Dyer Lane	91	448.1	18	896.2	100	Corrective Maintenance
Crest Avenue	92	627.8	16	1116.2	56	Reclamation
Vine Hill Road	93	441.1	24	1176.2	82	Preventative Maintenance
Highland Avenue	94	327.9	20	728.6	92	Corrective Maintenance
Vine Hill Road	95	1101.1	24	2936.4	77	Preventative Maintenance
Vine Hill Road	96	859.8	24	2292.9	80	Preventative Maintenance
Highland Avenue	97	278.3	16	494.8	53	Reclamation
Lakeview Avenue	98	251.8	20	559.6	59	Mill/Overlay
Minnetonka Boulevard	99	177.8	24	474.0	90	Corrective Maintenance
Westview Drive	100	606.5	18	1213.0	21	Reconstruction
Montgomerie Avenue	101	1317.9	16	2342.9	53	Reclamation
Rutledge Road	102	32.2	18	64.4	32	Reconstruction
Linwood Circle	103	430.8	20	957.4	33	Reconstruction
Eastwood Drive	104	172.3	16	306.3	80	Preventative Maintenance
Hillcrest Court	105	217.5	16	386.7	62	Mill/Overlay
Vine Street	106	978.3	14	1521.7	54	Reclamation
Talton Place	107	641.5	16	1140.4	76	Preventative Maintenance
Vine Hill Road	108	1044.2	24	2784.5	76	Preventative Maintenance
Northome Boulevard	109	445.3	36	1781.1	93	Corrective Maintenance
Huss Street	110	155.3	16	276.0	28	Reconstruction
Virginia Avenue	112	322.4	18	644.8	51	Reclamation
Azure Road	113	638.4	18	1276.8	81	Preventative Maintenance
Honeysuckle Lane	114	163.6	16	290.8	64	Mill/Overlay
Harper Road	115	346.2	16	615.5	70	Mill/Overlay
Linwood Road	116	55.3	20	123.0	36	Reconstruction
Western Road	117	424.1	16	753.9	42	Reclamation
Jefferson Street	118	774.6	16	1377.1	41	Reclamation
Rutledge Road	119	358.8	18	717.6	46	Reclamation
Pederson Street	120	115.0	16	204.4	48	Reclamation
Cottagewood Avenue	121	286.3	24	763.4	48	Reclamation
Hillcrest Lane	122	959.8	16	1706.3	37	Reconstruction
Minnetonka Boulevard	123	322.9	24	861.1	88	Corrective Maintenance
Lake Avenue	124	354.4	16	630.1	28	Reconstruction
Minnetonka Boulevard	125	630.5	24	1681.3	57	Reclamation
Hamilton Avenue	126	330.1	18	660.2	38	Reconstruction
Therese Street	128	330.8	16	588.1	89	Corrective Maintenance
Northome Road	129	736.5	16	1309.4	62	Mill/Overlay

STREET NAME	SECTIONID	LENGTH	WIDTH	Area SY	PCI	Recommended Fix
Park Place	130	286.7	16	509.7	34	Reconstruction
Laurel Drive	131	443.0	24	1181.2	70	Mill/Overlay
Lake Avenue	132	349.9	18	699.8	85	Preventative Maintenance
Linwood Road	133	306.6	20	681.4	55	Reclamation
Vine Hill Road	134	358.2	24	955.2	78	Preventative Maintenance
Walden Trail	135	956.9	16	1701.2	89	Corrective Maintenance
Linwood Road	137	224.1	20	498.0	54	Reclamation
Highcrest Drive	138	185.1	14	287.9	92	Corrective Maintenance
Mount Curve	139	420.6	16	747.7	59	Mill/Overlay
Easton Road	140	674.0	18	1348.1	91	Corrective Maintenance
Rutledge Road	141	948.5	18	1897.0	48	Reclamation
Cottagewood Road	142	1740.7	20	3868.1	47	Reclamation
Manor Road	143	374.0	20	831.2	52	Reclamation
Keewaydin Street	144	306.9	16	545.7	59	Mill/Overlay
Lowell Street	145	330.0	16	586.7	90	Corrective Maintenance
Northome Avenue	146	299.9	16	533.1	62	Mill/Overlay
Northome Boulevard	147	52.2	20	115.9	84	Preventative Maintenance
James Avenue	149	347.2	18	694.4	50	Reclamation
Highland Avenue	150	341.7	18	683.4	87	Corrective Maintenance
Western Road	151	108.6	16	193.0	31	Reconstruction
Northome Avenue	153	326.2	18	652.3	64	Mill/Overlay
Sibley Avenue	154	158.1	16	281.0	100	Corrective Maintenance
Deephaven Avenue	155	339.2	20	753.8	89	Corrective Maintenance
Minnetonka Boulevard	156	559.2	24	1491.2	88	Corrective Maintenance
Cottagewood Road	157	696.7	20	1548.2	50	Reclamation
Rutledge Road	158	363.4	18	726.7	46	Reclamation
Valley Cove Court	159	767.7	26	2217.7	86	Corrective Maintenance
Saint Louis Avenue	160	162.0	14	252.0	85	Corrective Maintenance
Lowell Street	161	409.9	16	728.6	91	Corrective Maintenance
Minnetonka Boulevard	162	262.3	24	699.6	49	Reclamation
Berry Lane	164	530.9	20	1179.8	68	Mill/Overlay
Jericho Road	165	183.1	16	325.5	93	Corrective Maintenance
Minnetonka Boulevard	166	389.9	24	1039.6	90	Corrective Maintenance
Excelsior Boulevard	167	678.2	20	1507.1	93	Corrective Maintenance
Cottagewood Road	168	175.6	24	468.4	48	Reclamation
Lake Avenue	169	473.7	18	947.4	64	Mill/Overlay
Linwood Road	170	20.7	20	46.0	22	Reconstruction
Azure Road	171	950.2	18	1900.4	57	Reclamation
Circle Drive	172	360.0	20	800.1	39	Reconstruction

STREET NAME	SECTIONID	LENGTH	WIDTH	Area SY	PCI	Recommended Fix
Minnetonka Boulevard	173	156.8	24	418.2	92	Corrective Maintenance
Carson Road	175	657.5	16	1168.8	80	Preventative Maintenance
Hillcrest Road	176	1050.8	16	1868.1	83	Preventative Maintenance
Highland Avenue	177	336.6	18	673.1	89	Corrective Maintenance
Hillcrest Road	178	1233.3	16	2192.6	86	Corrective Maintenance
Summerville Road	179	48.7	16	86.6	62	Mill/Overlay
Minnetonka Boulevard	180	8.8	36	35.4	94	Corrective Maintenance
Minnetonka Boulevard	181	264.3	24	704.7	85	Corrective Maintenance
Park Place	182	390.6	16	694.4	25	Reconstruction
Summerville Road	183	588.5	16	1046.2	65	Mill/Overlay
Excelsior Boulevard	184	1022.7	20	2272.6	86	Corrective Maintenance
Northome Boulevard	185	575.2	20	1278.3	88	Corrective Maintenance
Minnetonka Boulevard	186	501.7	24	1337.9	90	Corrective Maintenance
Cottagewood Avenue	187	70.5	24	188.0	37	Reconstruction
Bay Street	188	202.1	16	359.3	49	Reclamation
Deephaven Avenue	189	320.9	20	713.1	86	Corrective Maintenance
Highland Avenue	190	668.1	24	1781.6	65	Mill/Overlay
Water Street	191	104.7	18	209.4	73	Mill/Overlay
Northome Avenue	192	429.5	16	763.6	67	Mill/Overlay
Linwood Lane	193	746.3	16	1326.7	38	Reconstruction
Lakeview Avenue	194	747.2	20	1660.4	60	Mill/Overlay
Vine Hill Road	196	310.7	50	1726.1	66	Mill/Overlay
Minnetonka Boulevard	197	111.7	24	297.8	76	Preventative Maintenance
Heathcote Road	198	582.9	20	1295.3	53	Reclamation
Minnetonka Boulevard	199	135.7	24	361.8	90	Corrective Maintenance
Highland Avenue	200	128.6	18	257.2	86	Corrective Maintenance
Andover Place	201	273.5	24	729.2	87	Corrective Maintenance
Lakeview Avenue	202	297.5	20	661.2	61	Mill/Overlay
Maplewood Road	203	877.1	20	1949.1	95	Corrective Maintenance
Eastwood Drive	204	205.6	16	365.5	86	Corrective Maintenance
Northome Road	205	1046.7	16	1860.7	76	Preventative Maintenance
Shavers Lake Drive	206	910.6	20	2023.6	65	Mill/Overlay
Maple Chase	207	484.7	14	754.0	87	Corrective Maintenance
Ridgewood Road	208	317.2	20	705.0	81	Preventative Maintenance
Maple Ridge Road	209	559.5	16	994.6	88	Corrective Maintenance
Hamilton Avenue	210	413.3	18	826.6	29	Reconstruction
Highland Avenue	211	788.0	18	1576.0	91	Corrective Maintenance
Minnetonka Boulevard	212	472.1	24	1258.9	45	Reclamation
North Lane	213	314.0	16	558.2	50	Reclamation

STREET NAME	SECTIONID	LENGTH	WIDTH	Area SY	PCI	Recommended Fix
Shavers Lake Drive	214	341.9	16	607.8	60	Mill/Overlay
Parkway	215	335.1	18	670.2	67	Mill/Overlay
Eastwood Drive	216	139.1	16	247.4	83	Preventative Maintenance
Park Place	217	302.9	16	538.5	26	Reconstruction
Heathcote Road	218	1220.6	20	2712.4	50	Reclamation
Vine Hill Road	219	338.6	24	903.0	83	Preventative Maintenance
Lakeview Avenue	220	161.1	20	358.0	69	Mill/Overlay
Virginia Avenue	221	857.8	18	1715.6	56	Reclamation
Lakeview Avenue	222	191.9	20	426.5	57	Reclamation
Monaltrie Avenue	223	312.9	18	625.8	76	Preventative Maintenance
Carson Road	224	309.8	20	688.4	78	Preventative Maintenance
Hill Lane	225	702.1	14	1092.1	69	Mill/Overlay
Highland Avenue	226	327.1	20	726.8	91	Corrective Maintenance
Hillcrest Road	227	1125.2	16	2000.4	87	Corrective Maintenance
Lakeview Avenue	228	362.4	20	805.3	51	Reclamation
Laurel Drive	229	336.5	24	897.4	71	Mill/Overlay
Northern Road	230	359.2	20	798.1	75	Preventative Maintenance
Northome Boulevard	231	312.4	20	694.2	93	Corrective Maintenance
Azure Road	232	336.9	18	673.9	50	Reclamation
Azure Road	233	496.4	18	992.9	42	Reclamation
Water Street	234	473.0	16	840.9	46	Reclamation
Park Avenue	235	302.5	20	672.3	80	Preventative Maintenance
Walden Lane	236	406.3	16	722.4	92	Corrective Maintenance
Highland Avenue	237	216.5	18	432.9	89	Corrective Maintenance
Honeysuckle Lane	238	566.3	16	1006.8	68	Mill/Overlay
Easton Road	239	514.8	18	1029.7	91	Corrective Maintenance
Robinsons Bay Road	240	598.2	14	930.6	64	Mill/Overlay
Deephaven Avenue	241	348.4	20	774.2	87	Corrective Maintenance
Honeysuckle Road	243	347.7	16	618.1	68	Mill/Overlay
Monaltrie Avenue	244	326.6	18	653.1	78	Preventative Maintenance
Jericho Road	246	362.1	16	643.7	88	Corrective Maintenance
Minnetonka Boulevard	247	1365.5	24	3641.4	67	Mill/Overlay
Linwood Circle	248	212.1	20	471.3	35	Reconstruction
Dale Avenue	249	67.2	16	119.4	100	Corrective Maintenance
Hillcrest Way	250	690.5	16	1227.6	38	Reconstruction
Hamilton Avenue	251	275.9	18	551.9	35	Reconstruction
Montgomerie Avenue	253	459.6	18	919.2	19	Reconstruction
Walden Trail	255	186.9	16	332.3	93	Corrective Maintenance
Summerville Road	257	144.4	16	256.7	56	Reclamation

STREET NAME	SECTIONID	LENGTH	WIDTH	Area SY	PCI	Recommended Fix
Walden Road	258	930.8	16	1654.8	93	Corrective Maintenance
Linwood Road	259	1288.4	20	2863.1	61	Mill/Overlay
Thorpe Road	260	441.1	18	882.2	31	Reconstruction
Park Place	261	268.3	16	477.0	33	Reconstruction
Vine Hill Road	262	139.4	24	371.8	78	Preventative Maintenance
Woodhaven Place	263	575.9	20	1279.8	37	Reconstruction
Highland Avenue	264	239.0	18	477.9	88	Corrective Maintenance
Highland Avenue	265	105.5	18	211.0	90	Corrective Maintenance
Vine Street	266	388.3	14	604.0	86	Corrective Maintenance
Cottagewood Avenue	267	311.8	18	623.6	38	Reconstruction
Bayview Court	268	423.9	20	942.1	25	Reconstruction
Virginia Avenue	269	303.5	18	607.0	59	Mill/Overlay
Maple Lane	270	647.0	18	1294.0	61	Mill/Overlay
Walden Trail	271	841.6	16	1496.2	93	Corrective Maintenance
Lake Avenue	272	266.3	18	532.7	83	Preventative Maintenance
Summerville Road	273	177.8	16	316.0	49	Reclamation
Minnetonka Boulevard	274	182.5	24	486.6	56	Reclamation
Linwood Road	275	856.8	20	1904.1	47	Reclamation
Northern Road	276	191.3	16	340.1	39	Reconstruction
Rutledge Road	277	287.4	18	574.8	53	Reclamation
Carsonwood Avenue	278	673.3	20	1496.1	86	Corrective Maintenance
Park Avenue	279	282.8	20	628.5	81	Preventative Maintenance
Carson Road	280	642.6	20	1428.0	82	Preventative Maintenance
Cottagewood Road	281	796.7	24	2124.4	44	Reclamation
Rutledge Road	282	396.1	18	792.3	37	Reconstruction
Minnetonka Boulevard	284	553.9	24	1477.1	90	Corrective Maintenance
Dale Avenue	285	287.0	16	510.3	92	Corrective Maintenance
Park Avenue	286	729.1	20	1620.1	82	Preventative Maintenance
Northome Boulevard	287	144.8	20	321.7	70	Mill/Overlay
Hillcrest Road	288	53.5	16	95.2	100	Corrective Maintenance
Lake Avenue	289	612.6	18	1225.2	90	Corrective Maintenance
Lakeview Avenue	290	262.4	20	583.2	54	Reclamation
Leroy Street	292	331.3	16	589.0	88	Corrective Maintenance
Minnetonka Boulevard	293	706.9	24	1885.0	91	Corrective Maintenance
Montgomerie Avenue	294	248.1	18	496.3	24	Reconstruction
Hillside Street	295	91.4	14	142.1	96	Corrective Maintenance
Northome Avenue	296	330.4	18	660.8	57	Reclamation
Elm Street	298	171.7	16	305.3	52	Reclamation
Saint James Gate	299	609.3	24	1624.9	88	Corrective Maintenance

STREET NAME	SECTIONID	LENGTH	WIDTH	Area SY	PCI	Recommended Fix
Monaltrie Avenue	300	813.1	18	1626.1	77	Preventative Maintenance
Northome Avenue	301	334.1	18	668.3	77	Preventative Maintenance
Cottagewood Avenue	302	265.7	18	531.4	64	Mill/Overlay
Cottagewood Avenue	303	107.8	18	215.5	71	Mill/Overlay
Linwood Road	304	7.0	20	15.6	18	Reconstruction
Minnetonka Boulevard	305	200.2	24	533.9	90	Corrective Maintenance
Minnetonka Boulevard	306	668.6	24	1783.1	88	Corrective Maintenance
Ridgewood Road	307	427.3	20	949.6	78	Preventative Maintenance
Minnetonka Boulevard	308	290.8	24	775.4	88	Corrective Maintenance
Andover Place	309	202.3	24	539.5	89	Corrective Maintenance
Jericho Road	310	325.9	16	579.3	89	Corrective Maintenance
Heathcote Drive	311	1547.1	20	3438.1	55	Reclamation
Northome Boulevard	312	441.5	20	981.2	93	Corrective Maintenance
Northome Boulevard	313	587.0	20	1304.4	90	Corrective Maintenance
Highland Avenue	314	487.8	20	1084.0	88	Corrective Maintenance
Minnetonka Boulevard	315	1325.8	24	3535.4	86	Corrective Maintenance
Azure Road	316	48.2	18	96.5	74	Mill/Overlay
Old Kent Road	318	685.6	24	1828.3	87	Corrective Maintenance
Minnetonka Boulevard	319	492.1	20	1093.5	86	Corrective Maintenance
Linwood Road	320	214.4	20	476.4	67	Mill/Overlay
Day Lane	321	184.3	18	368.6	89	Corrective Maintenance
Circle Drive	322	172.3	20	382.8	38	Reconstruction
Linden Road	323	1438.0	20	3195.5	43	Reclamation
Park Avenue	324	570.2	16	1013.7	78	Preventative Maintenance
Maple Hill Drive	325	664.8	20	1477.3	47	Reclamation
Cottonwood Lane	163	811	16	1443	50	Reclamation
Minnetonka Boulevard	326	200.2	24	533.9	87	Corrective Maintenance
Baldwin Street	327	133.8	16	237.8	38	Reconstruction
Minnetonka Boulevard	328	188.6	24	503.0	87	Corrective Maintenance
Hamilton Avenue	329	1321.2	16	2348.8	86	Corrective Maintenance
Manor Road	245	1759.3	20	3909.6	93	Corrective Maintenance

Private Road Data

STREET NAME	SECTIONID	LENGTH	WIDTH	Area SY	PCI	Recommended Fix
Cedarhurst	9	934	14	1453	71	Mill/Overlay
Chimo West	40	1239	16	2202	84	Preventative Maintenance
Robinsons Bay Road	42	1053	14	1638	78	Preventative Maintenance
Rosedale Court	46	323	14	503	39	Reconstruction
Spring Creek Drive	50	1294	16	2300	48	Reclamation
Spring Creek Drive	52	45	24	119	66	Mill/Overlay
Chimo East	55	463	16	822	80	Preventative Maintenance
Northome Road	57	2426	16	4312	80	Preventative Maintenance
Walden Shores Road	67	581	16	1033	88	Corrective Maintenance
Cedarhurst	70	258	14	401	65	Mill/Overlay
Stonecroft Lane	72	674	18	1348	86	Corrective Maintenance
Tramore Lane	111	337	18	674	79	Preventative Maintenance
Cedarhurst	136	128	14	199	75	Preventative Maintenance
East Valley Road	148	279	16	496	66	Mill/Overlay
Spring Creek Drive	152	340	16	604	59	Mill/Overlay
Chimo East	174	1231	16	2188	62	Mill/Overlay
Chimo East	195	461	16	820	71	Mill/Overlay
Robinsons Bay Road	242	231	14	359	62	Mill/Overlay
Cedarhurst	252	441	14	686	69	Mill/Overlay
Cedarhurst	254	494	14	769	79	Preventative Maintenance
Willow Haven	256	424	14	659	44	Reclamation
Wyndhill Circle	283	417	14	649	79	Preventative Maintenance
Cedarhurst	291	199	14	310	81	Preventative Maintenance
Cedarhurst	297	184	14	287	61	Mill/Overlay
Vine Ridge Court	317	337	14	525	43	Reclamation