Analysis and Recommendations for Street Network

Silver Creek

October 2016

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Introduction

One of Silver Creek's most valuable infrastructure assets is the 25 ± miles of streets within its network. Maintaining the street network at a high level of service will promote the prosperity of Silver Creek's entire community. Many state and local transportation agencies currently use a pavement management system and/or a maintenance management system to cost effectively preserve and improve their street network. The Utah Local Technical Assistance Program (LTAP) assists local agencies in the state of Utah and surrounding states to implement and use such a tool to maintain, preserve, and enhance their road and street facilities and more effectively manage the allocation of funding as it pertains to the existing street network.

Silver Creek asked the Utah Local Technical Assistance Program (LTAP) to develop a pavement management system that could be used in their transportation plan. This report describes the system's major elements, the processes, and the work accomplished to facilitate its implementation in Silver Creek. The pavement management system provides:

- A complete GIS-based physical inventory and condition survey of the street network
- A needs assessment process
- Analyses of root causes of pavement deterioration
- Analysis of current street maintenance programs
- Recommended maintenance and preservation treatments
- Treatment costs and budget proposals
- A method to evaluate alternate funding scenarios to maximize the average remaining service life (RSL) of the street network

Figure 1 outlines the major elements and processes incorporated in Silver Creek's Pavement Management System. The following sections of this report describe each step of the process in detail, the results of field surveys and analyses, and the conclusions and recommendations offered to assist in the full implementation of the system in Silver Creek.

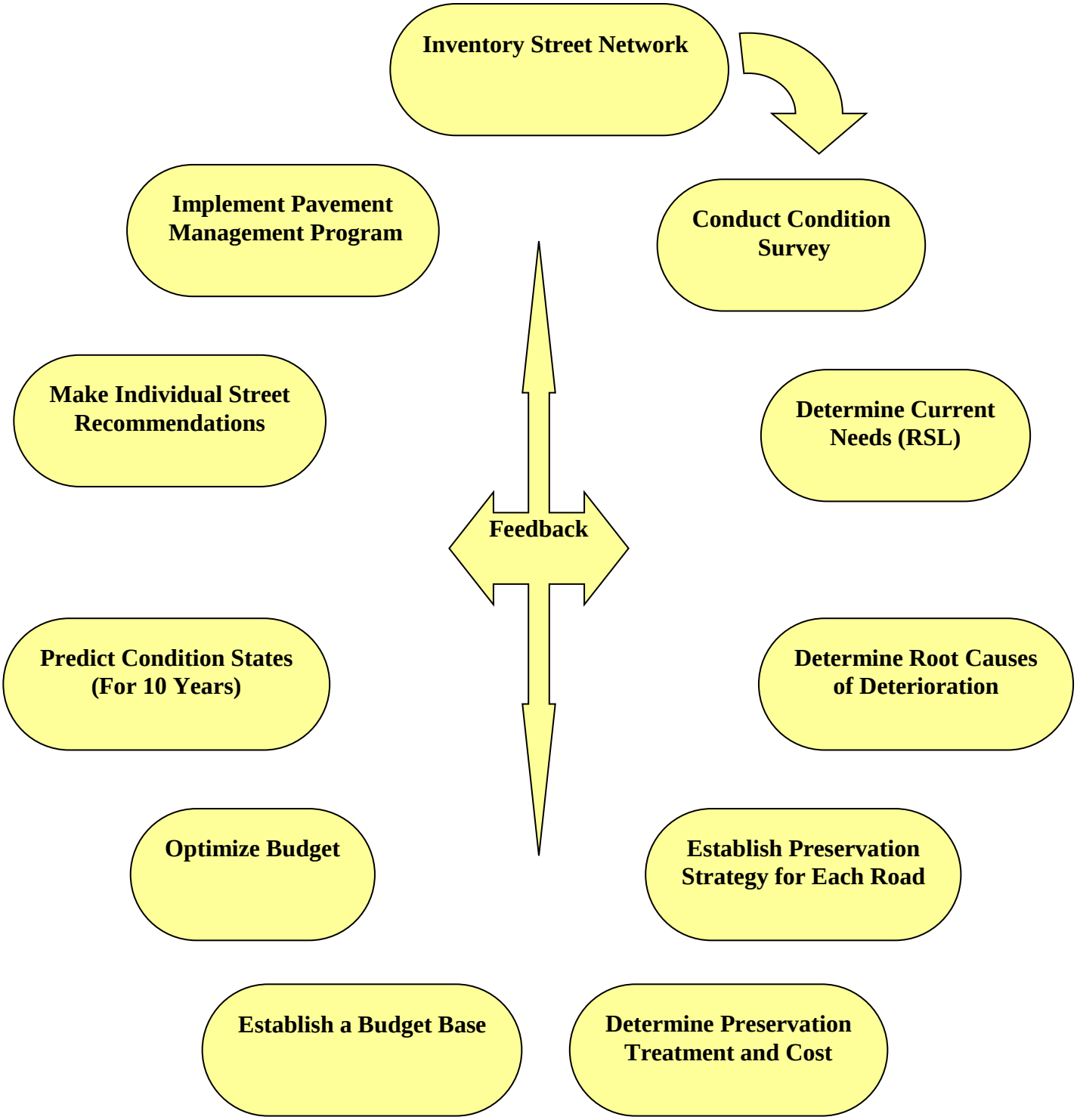


Figure 1. Pavement Management Process Diagram

Inventory of Road Network

The first step in the process of inventorying Silver Creek's street network involved assigning a functional classification to each street. City officials assisted in making these classifications. Excluding the state routes, the inventory identified two functional classifications: residential and minor collector.

The second step in the inventory process involved using Global Positioning System technologies (GPS – Trimble Geo XT) to map the centerline of each street and establish a base reference map. Silver Creek had previously developed a GIS map with shapefiles of the road network so this step was unnecessary. In addition to using the existing shapefiles of the centerlines of each street, hand roto-wheel was used to measure the widths. The data from the GPS mapping process was used to calculate the lengths of all street segments. These measured widths and lengths were used to calculate the surface areas.

A complete condition survey of Silver Creek's road network was conducted during June of 2016. Employees from the Utah LTAP (Local Technical Assistance Program) Center used the Strategic Highway Research Program (SHRP) Distress Manual as a guide to conduct the pavement distress survey.

Appendix A has the complete results of the inventory processes. Inventory details include street name, starting and ending addresses of the segment, functional classification, segment width and length, estimated remaining service life (RSL), surface area of the pavement in square yards, and the percent of network area represented by each segment.

Table 1, an excerpt from Appendix A, shows the details covered in the inventory process.

Table 1. Excerpt Showing Details in the Inventory Process of the Street Network

ID	Street Name	From	To	Class	Width (ft)	Length (ft)	RSL	%Area	Area (sq yd)
80	Tollgate Road	Silver Creek Road	Dead End	Residential	21	4048	10	3.18	9445
81	Aspen Lane	Silver Creek Road	Sagebrush Place	Residential	21	2161	10	1.70	5042
82	Maple Circle	Maple Drive	Long Rifle Road	Residential	50	55	0	0.10	306
83	Aspen Drive	Sagebrush Place	Continues on…	Residential	15	1447	10	0.81	2412
86	Silver Creek Road	Division Street	Earl Street	Minor Collector	25	242	6	0.23	672

Table 2 provides a summary of the street inventory information with respect to each functional class in terms of surface area and the percent of the street network represented by each functional class.

Table 2. Functional Classification by Surface Area and Percent of Street Network

	Major Arterial	Minor Arterial	Major Collector	Minor Collector	Forest/Rec	Other	Residential
Area (yd2)	0	0	0	22255	0	0	274664
Percent of Road Network	0.0%	0.0%	0.0%	7.5%	0.0%	0.0%	92.5%

As shown in Table 2, the street network in Silver Creek is classified as 7.5% minor collectors, 92.5% residential. Figure 2 illustrates this information in histogram form.

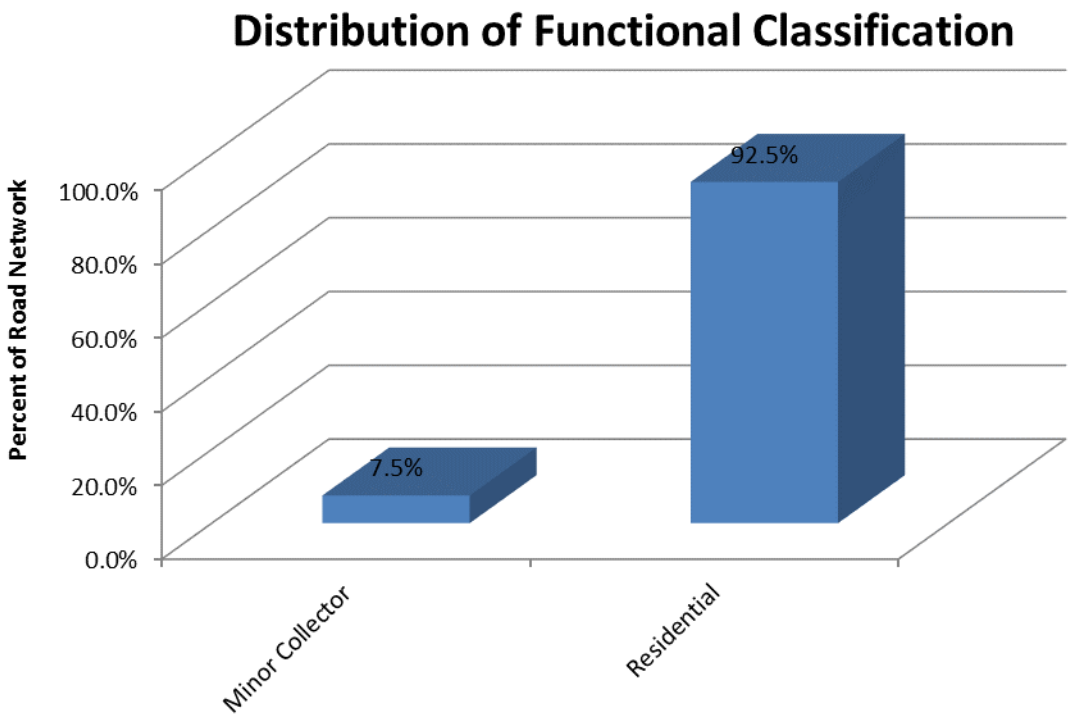


Figure 2. Distribution of Street Network by Functional Classification

This inventory excludes pavement structure details regarding date of initial construction, layer thickness, and pavement design criteria of each street. This information can be obtained from historical records, maintenance personnel, or sampling and testing of the pavement structure.

Pavement Type Distribution of the Road Network

Currently a small percentage of Silver Creek's street network (22.8 % by surface area) is made up of unpaved roads. The current percentages of asphalt and unpaved roads by surface area are shown in Figure 3.

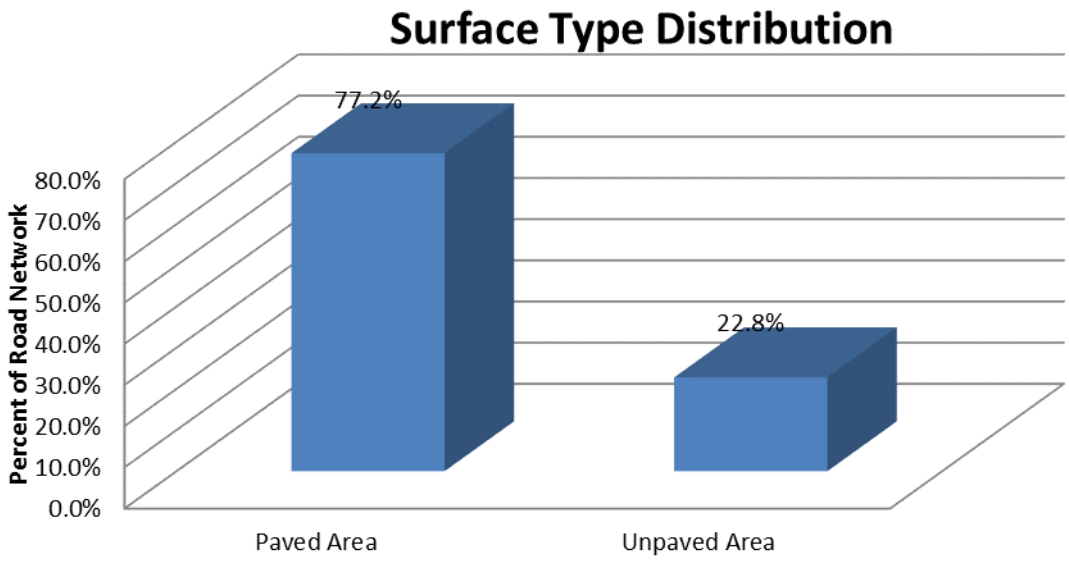


Figure 3. Percentages of Asphalt and Unpaved Streets by Surface Area

If this same comparison is made using the number of street segments instead of surface area, there are 77 street segments in Silver Creek that are asphalt and 23 segments that are unpaved.

Pavement Condition Survey

Asphalt Road Network

A complete condition survey covering surface smoothness, drainage, and pavement distress of Silver Creek's road network was conducted during June of 2016. Employees from the Utah LTAP (Local Technical Assistance Program) Center used the Strategic Highway Research Program (SHRP) manual, Distress Identification Manual for the Long-Term Pavement Performance Project as a guide to conduct the pavement distress survey.

The principal focus of the condition survey was to identify and determine the severity level and extent of each distress type. Each asphalt street segment was closely surveyed with respect to potholes/utility cuts, rutting, transverse cracking, longitudinal cracking, block cracking, edge cracking, and fatigue (alligator) cracking. The severity level and extent of each distress type were evaluated in accord with the condition survey evaluation sheet shown in Appendix B. Appendix C shows the detailed distress information for each road segment.

Pavement surface smoothness and surface drainage for each segment were evaluated subjectively using the ratings of excellent, good, fair, or poor. Pavement surface smoothness of each street was determined by driving over each segment. If the pavement appeared to be new and there was no discernible roughness felt in the ride of the vehicle, the pavement smoothness was rated excellent. The pavement smoothness was rated good if the ride of the vehicle remained smooth, yet the pavement appeared to show some signs of distress. A rating of fair for pavement smoothness was given if there was notable roughness felt in the ride of the vehicle but little discomfort sensed by the driver. If there was substantial roughness felt in the ride of the vehicle, leading to a reduction of speed of the vehicle below the posted limit, the pavement smoothness was rated as poor. Table 3 illustrates this information. Figure 4 shows the results of the pavement smoothness survey.

Table 3. Pavement Surface Smoothness Rating Criteria

RATINGS	SMOOTHNESS RATING CRITERIA
Excellent	Newly Constructed
Good	Smooth ride, minor distress
Fair	Moderate Distress
Poor	Severe Distress (decrease speed)

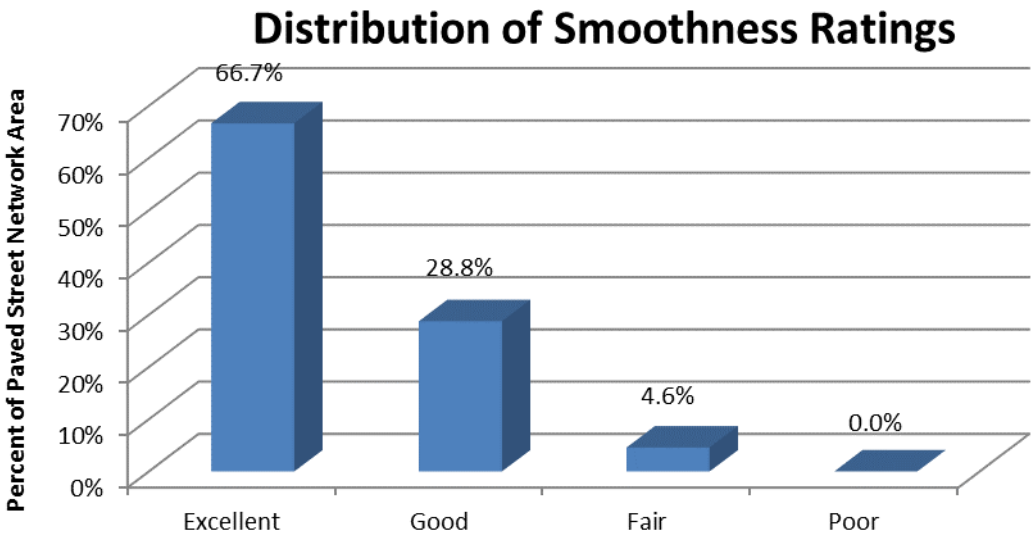


Figure 4. Distribution of Smoothness Ratings

As shown in Figure 4, the majority of Silver Creek's asphalt streets under the "Excellent" category. Rough streets provide a lower level of service that may increase car repair costs and fuel consumption.

During the condition survey, pavement surface drainage conditions were also evaluated. Table 4 shows the rating criteria used to evaluate pavement surface drainage.

Table 4. Pavement Surface Drainage Rating Criteria

RATINGS	DRAINAGE RATING CRITERIA
Excellent	Newly constructed, cross-slope > 2%, drainage provisions provided
Good	Cross-slope > 2%, drainage provisions provided
Fair	Cross-slope < 2%, no drainage provisions provided
Poor	Flat or concave cross-slope, ponding surface water evident, no drainage provisions provided

Visual condition surveys were calculated to evaluate pavement surface drainage conditions. If a newly-constructed road had a cross-slope of at least two percent (2%) or more, and provision was made for surface water to drain (e.g., well-graded ditches, curb and gutter, drainage structures, or paved ditches); surface drainage was rated as excellent. In the case that the road was not newly constructed but otherwise met the preceding criteria then it received a surface drainage rating of good. When the pavement cross-slope varied below two percent (2%), evidence of surface water ponding was observed, or the surface drainage features were not well maintained; surface drainage conditions were rated as fair. A poor surface drainage rating was given if the pavement cross-slope was flat or directed toward the centerline of the street, if surface water ponding was observed, or drainage provisions were not maintained or provided. The following three photographs illustrate excellent, good, and fair ratings, respectively.

Photo 1. Excellent Surface Drainage (Rae Circle from Greenfield Drive to Dead End)

Photo 2. Good Surface Drainage (Meadowview Road from Redden Road to Silver Creek Road)

Photo 3. Fair Surface Drainage (Silver Creek Road from Valley Drive to Wasatch Way)

Figure 5 shows the pavement drainage rating distribution for Silver Creek's street network in graph form.

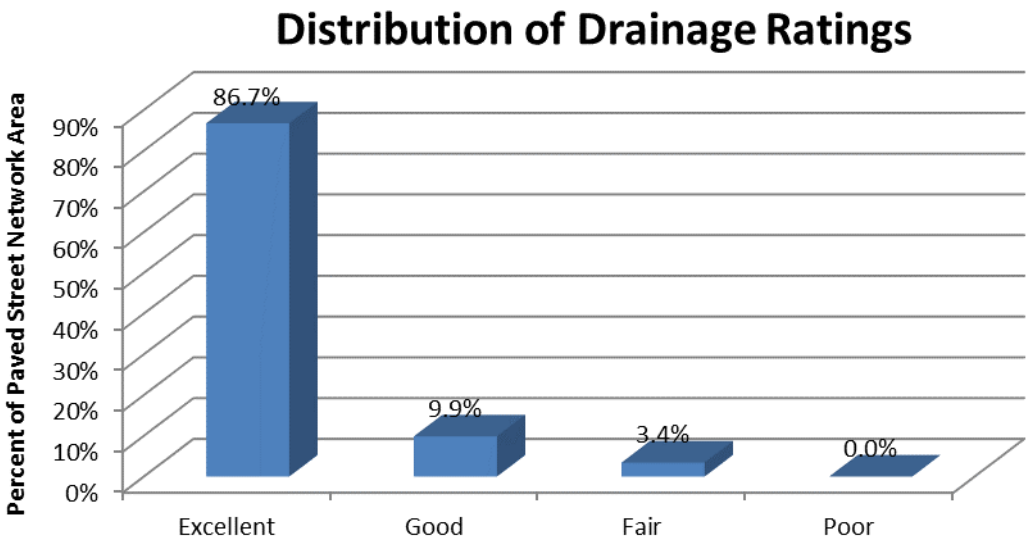


Figure 5. Pavement Drainage Rating Distribution

Unpaved Road Network

The Civil Engineering Technicians from the Utah LTAP (Local Technical Assistance Program) Center used the Transportation Asset Management System (TAMS) Distress Guide to conduct the gravel road distress survey.

The principal focus of the gravel condition survey was to identify and determine the severity level and extent of each distress type. Each road segment was closely surveyed with respect to potholes, cross-section, dust, corrugations (wash boarding), rutting, roadside drainage, and loose aggregate. The severity level and extent of each distress type was evaluated in accord with the condition survey evaluation shown in Appendix B. Appendix C shows the detailed distress information for each segment. As shown in Figure 6, the majority of Silver Creek's gravel roads fall into the "Good" Drainage category.

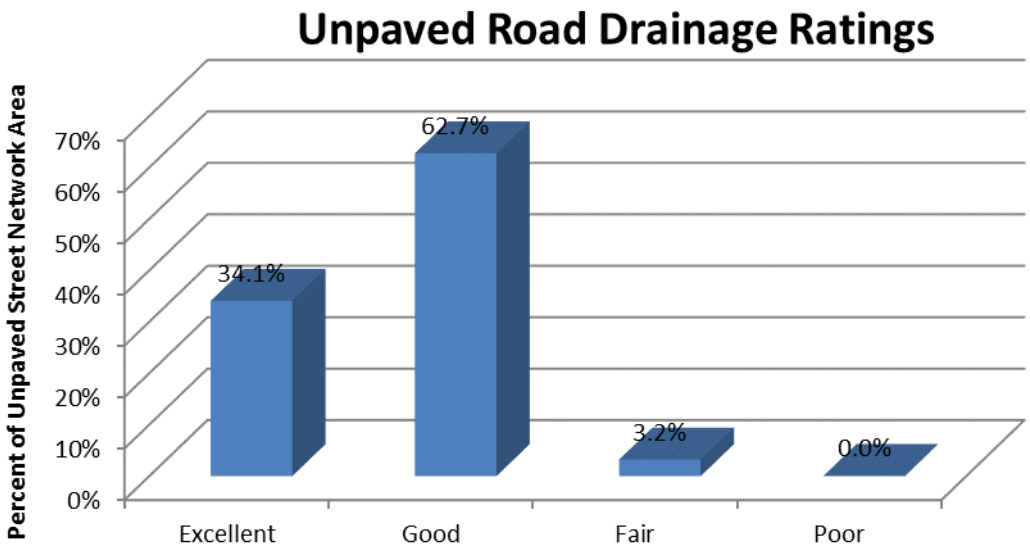


Figure 6. Unpaved Road Drainage Rating Distribution

As shown in Figure 6, thirty-four percent (34.1%) of the gravel road network has excellent roadside drainage, sixty-three (62.7%) has good roadside drainage, and three percent (3.2%) has fair roadside drainage. No segments had a poor roadside drainage rating.

Roadside drainage must be sufficient to deal with the surface water runoff from the road's surface. If there is not sufficient drainage, surface water will pond on the roadway and soften the road base. If the roadside drainage along a road segment was clear of debris and had no low spots where local ponding could occur, a good rating was given. If the roadside had small amounts of gravel or silt deposits, a rating of fair was given. A roadside that did not slope properly, or had excess amounts of gravel, silt, and debris received a poor rating.

A gravel road must be constructed and maintained so that water drains quickly off the roadway. A four percent (4%) cross slope is recommended for gravel roads. For the cross section rating, a segment was rated good if the cross-slope was at least four percent with no rutting evident. If there was less than a four percent cross slope, a fair rating was given. If the segment had no crown or slope, and had low spots in the middle that impede proper drainage, a poor rating was given. Figure 7 shows that the cross sections of most gravel roads fall into the excellent category.

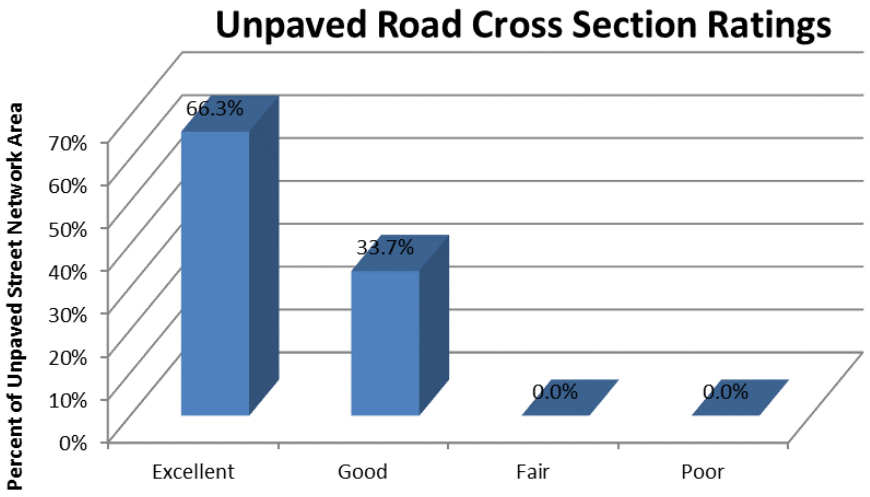


Figure 7. Unpaved Road Cross-Section Rating Distribution

As shown in Figure 7, sixty-six percent (66.3%) of the gravel roads have an excellent condition and thirty-four percent (33.7%) have good cross section. No segments had a fair or poor cross section rating. These condition ratings are indicative of Silver Creek's gravel road maintenance practices. The staff and field maintenance crews are to be commended for their work and the attention given to applying the basics of gravel road maintenance.

Asphalt Pavement Design & Performance

Typically, asphalt pavements, designed in accord with the AASHTO Guide for Design of Pavement Structures, ought to provide for twenty years of traffic loading (18 kip ESAL's) before reaching a terminal serviceability level at which point reconstruction is required (RSL = 0). For management purposes, the same estimate is used to calculate the service life of concrete pavements as well. Conventional practice usually provides for a preventative maintenance treatment and rehabilitative treatment to be applied to the asphalt or concrete pavement during its 20-year service life. Timing is critical in the placement of the preventative maintenance and the rehabilitative treatment to achieve the best level of service at the least amount of cost.

Figure 8 shows the typical pavement performance curve for asphalt pavements. This figure emphasizes the time relationship between street pavement condition and the cost of repair.

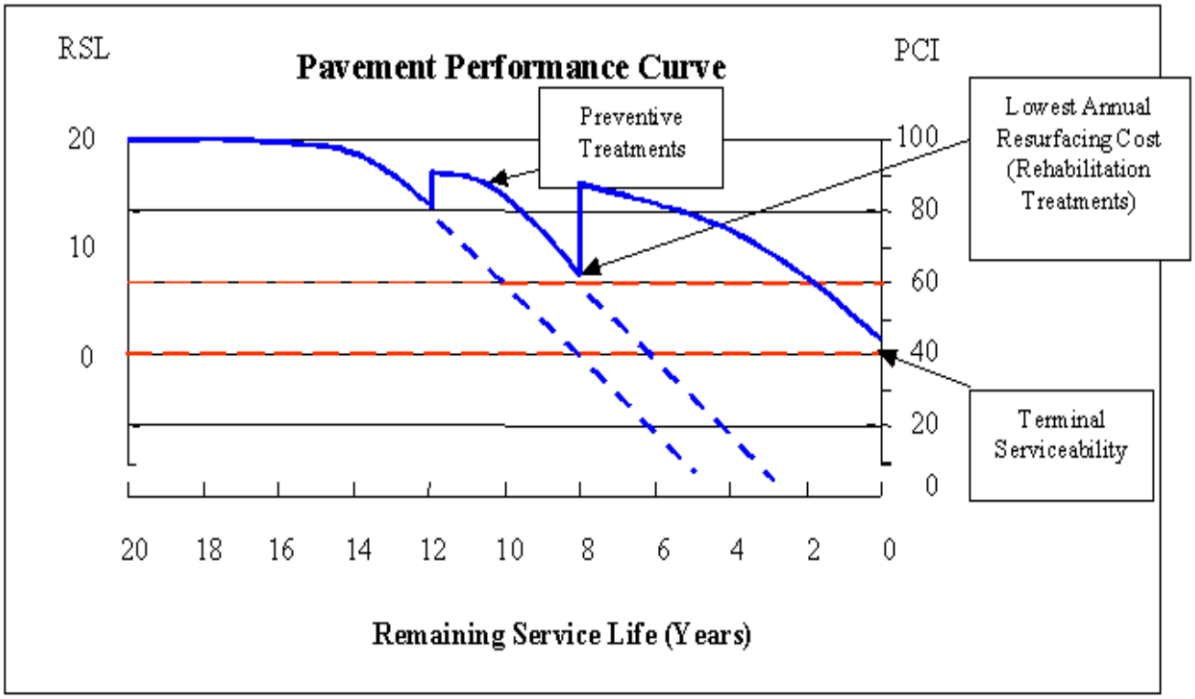


Figure 8. Pavement Performance Curve

After eight years of service (RSL = 12), most asphalt and concrete pavements will deteriorate to a "good" condition category. This relates to a thirty-three percent (33%) drop in the service life of the pavement and is the optimal point in time at which a preventative maintenance treatment should be placed. After twelve years of service (RSL = 8), most asphalt and concrete pavements will deteriorate to a “fair” condition rating. This represents a sixty percent (60%) drop in the service life of the pavement and is the best point in time at which to consider a rehabilitation treatment. If no renovation action occurs at this point, the street will likely deteriorate to the "poor" category within three years (RSL = 5). Cost comparisons show that reconstruction costs three to five times more than rehabilitation strategies. The cost to maintain a pavement with preventative maintenance strategies relates to about one-third the cost of rehabilitation strategies, or one-sixth the cost of reconstruction.

Major Causes of Asphalt Pavement Distress

The predominant asphalt pavement distresses affecting Silver Creek's streets were determined from the pavement distress survey information. Analysis of this information showed that there were five major distress types prevalent in the street network. Pavement roughness results from these distresses. Fatigue cracking was the major distress type found occurring most frequently in the street network.

The root causes of each of the five main distress types are described as follows, along with respective suggestions on how to mitigate the development of each:

Transverse cracking in asphalt pavements is normally attributed to thermal changes in the pavement structure. As seasonal temperatures change, the pavement expands and contracts beyond the limits that asphalt can tolerate, thus causing transverse cracking. If these transverse cracks are not sealed early in their development, they will continue to grow in terms of both severity and extent, and they will allow surface moisture to enter the pavement causing further distress to develop. Recent developments in asphalt technology known as the Superpave System have shown the potential to preclude the development of transverse cracking if used in new asphalt pavements. Use of performance graded (PG) asphalt cements and the Superpave mix design system, along with good quality control and good hot mix asphalt construction practice can potentially eliminate this type of distress from occurring. Using the Superpave System on newly constructed or reconstructed streets that serve a relatively high volume of traffic is recommended.

Longitudinal cracking is related to two different causes. The first is poor construction. When a street is constructed, it is normally built in two or more sections. Problems, such as poor compaction or segregation in the asphalt mix, will cause longitudinal cracks along the construction seam. The second cause of longitudinal cracks is load related. These longitudinal cracks are found in the wheel paths of the travel lanes. These cracks are due to early fatigue failure and should be treated as fatigue cracks. On some street segments that are extremely wide, longitudinal cracking may be caused by thermal changes as with transverse cracks.

Block cracking is a combination of transverse and longitudinal cracking that occurs when the transverse and longitudinal cracks intersect. The combination of these two distresses allows greater opportunity for surface water to enter the pavement structure, thus decreasing the load carrying capacity of the pavement. Once a block forms, water enters and softens the base. As the base softens, normal traffic loading progressively breaks the pavement into smaller and smaller blocks. This leads to the development of fatigue cracking.

Utility cuts are man-made cuts and have been shown to reduce the service life of a street by as much as five to seven years. Although utility cuts are sometimes inevitable, good planning and coordination of utility work can reduce the number of utility cuts made in newer streets.

Only limited rutting of the pavement surface was observed in Silver Creek's street network. This form of distress typically occurs in the wheel paths and is a result of deformation in the pavement structure or subgrade. This deformation comes from heavy axle loads acting in combination with moisture to deform and rut the pavement. Inadequate compaction during construction can also result in deformation. Rutting may also occur in hot weather when the asphalt is less viscous and has less shear strength. In this case, rutting usually results from the use of poor materials, poor asphalt mix design, poor quality control, or poor construction.

Edge cracking was generally found in street segments where pavement edges had little or no support. Those segments that had no paved shoulders or supporting curb and gutter sections were more prone to this type of distress.

Fatigue cracking is the main governing distress in the majority of the streets and affects seventy-seven percent (77.2%) of the network surface area. Fatigue cracking in asphalt pavements is largely caused by loss of base and subgrade support due to moisture infiltrating the pavement. Once moisture softens the base and subgrade layers, the asphalt pavement can no longer effectively carry the traffic loading. This results in pavement cracking and breakup. The fatigue cracking prevalent in the streets of Silver Creek is most likely caused by water saturating the base and subgrade layers. With the subgrade saturated, the road structure flexes and gives under the weight of a vehicle that drives over the street.

Heavy vehicle traffic on the streets also causes fatigue cracking. Such vehicles cause higher stresses in the pavement than is provided in the design. In those areas of the city where new homes are being constructed, concrete trucks or other heavy vehicles, can cause major damage to the streets. Heavy commercial trucks fall within the heavy vehicle traffic designation.

Pavement Distress Survey & Analysis

The first step in the analysis of the pavement distress survey information involved determining what the governing distress type is for each street segment. This requires analysis of each condition rating sheet to determine which distress type is rated the highest with regard to severity and extent. For example, Figure 9 shows the condition rating sheet for a particular street segment. The pavement distress of fatigue cracking is shown as having the highest rating with regard to severity and extent. Based on this rating, fatigue cracking is determined to be the governing distress and is most likely to cause the pavement to deteriorate the earliest.

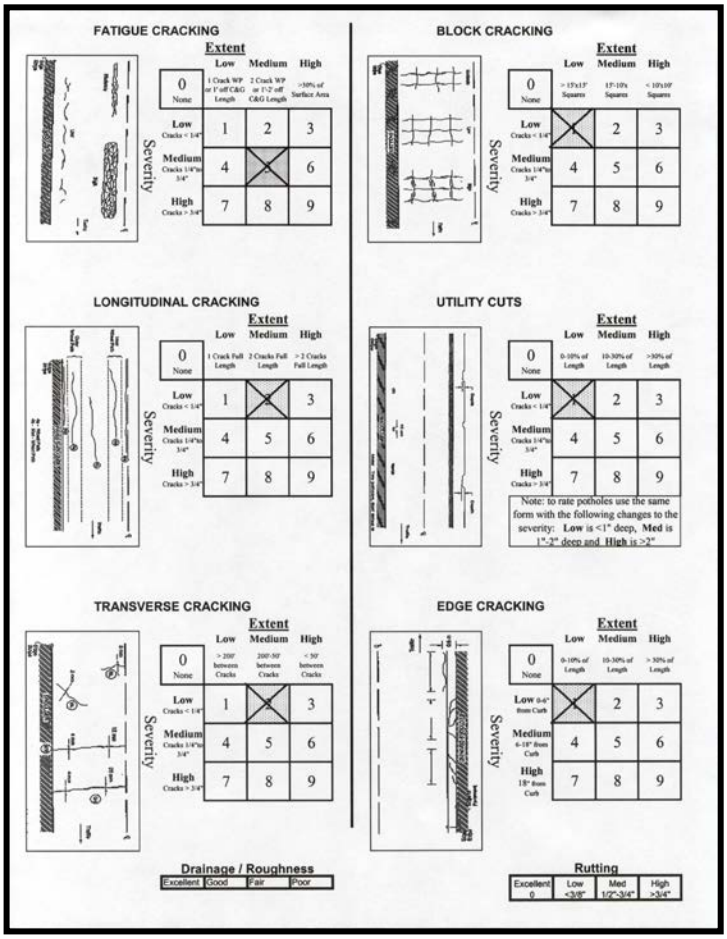


Figure 9. Condition Rating Sheet

Once the governing distress is determined, reference is made to the respective distress table that shows the condition rating value and its corresponding estimated remaining service life. Included in the table are the recommended preservation strategy and the recommended treatment that is most cost effective in correcting the governing distress. This is shown in Table 5- Fatigue Cracking Distress Table.

The highlighted row in Table 5 shows a severity and extent rating of 5, which corresponds to a remaining service life (RSL) of 6 years. Because the 6-year RSL was the lowest RSL among the distress types, fatigue cracking is considered the governing distress for the street segment. The governing distress is the distress most likely to cause the pavement to deteriorate the soonest and reduce the service life of the street. Appendix D contains the deterioration tables for the other distress types. These tables can be adjusted by experienced personnel to more accurately reflect the effects of local environmental and traffic loading conditions.

Table 5. Fatigue Cracking Distress Table

RATING	SEVERITY & EXTENT	RSL	STRATEGY	TREATMENT
0	No Alligator Cracking	20	No Maintenance	No Maintenance
1	Low, Low	10	Routine	Patch
2	Low, Medium	8	Rehabilitation	Patch & Thin Overlay
3	Low, High	6	Rehabilitation	Overlay
4	Medium, Low	8	Rehabilitation	Patch & Thin Overlay
5	Medium, Medium	6	Reconstruct	Thick Overlay
6	Medium, High	4	Reconstruct	Rotomill & Thick Overlay
7	High, Low	6	Reconstruct	Patch & Thick Overlay
8	High, Medium	2	Reconstruct	Rebuild
9	High, High	0	Reconstruct	Rebuild/Replace

The above procedure was used to determine the governing distress and the RSL for each asphalt segment. Figure 10 shows the governing distress types in the asphalt street network along with the percent of the total street network area affected by each type.

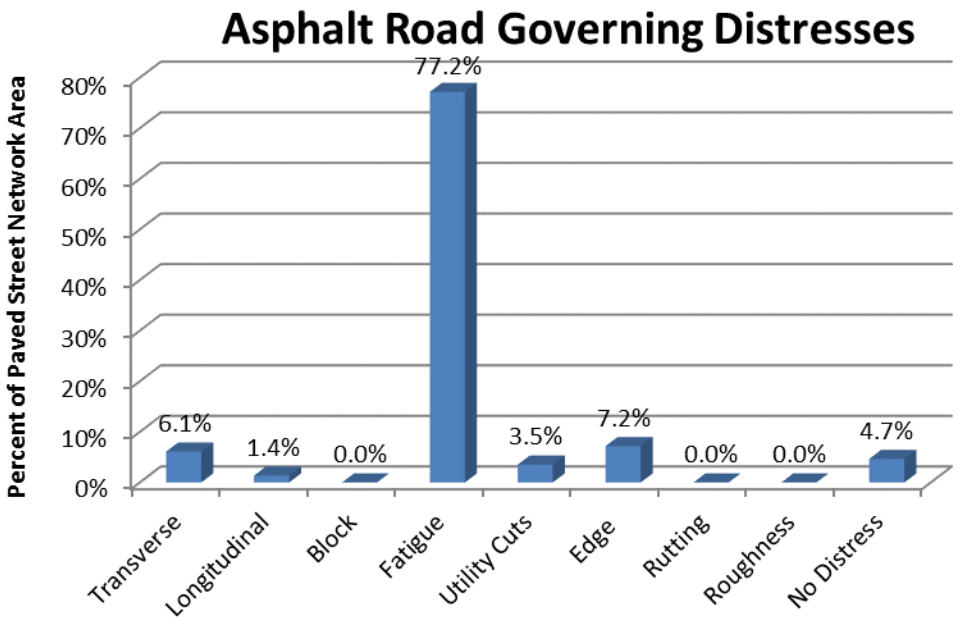
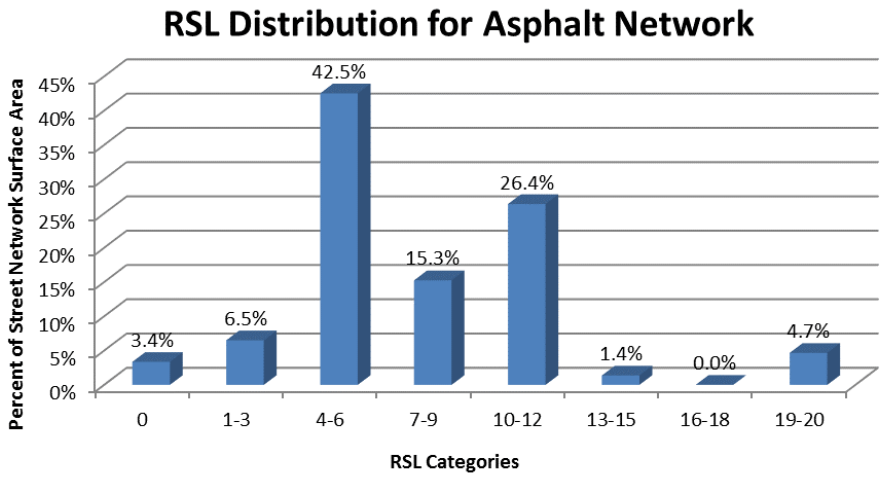


Figure 10. Governing Distress Rating Distribution for Asphalt Roads

As a reference, one percent (1%) of Silver Creek's street network represents approximately .25 miles in length. Figure 10 also illustrates that some governing distress types are more common to the street network than others. Fatigue is the most common governing distress types in Silver Creek's asphalt street network.

The governing distress type of each segment provided the means of calculating the average RSL for the street network. For management purposes, the estimated RSL values are grouped incrementally in three-year categories. Figure 11 shows the current RSL distribution for Silver Creek's street network in terms of percent of surface area of the network.

Figure 11. Current RSL Distribution for Asphalt Street Network



The estimated average RSL of Silver Creek's asphalt street network is 7.5 years. This average RSL value is slightly lower than many cities surveyed to date by the Utah LTAP Center.

Table 6 shows this same information along with the corresponding subjective condition ratings of poor, fair, good, very good, and excellent.

Table 6. Subjective Condition Rating of Asphalt Street Network

SUBJECTIVE CONDITION RATING OF STREET NETWORK							
	FAILED	POOR		FAIR	GOOD	VERY GOOD	EXCELLENT
RSL (Years)	0	1-3	4-6	7-9	10-12	13-15	16-18	19-21
% of Network	3.4%	6.5%	42.5%	15.3%	26.4%	1.4%	0.0%	4.7%

Three percent (3.4%) of the paved street network in Silver Creek is considered to be in a failed condition. Forty-nine percent (49%) is considered to be in poor condition. Fifteen percent (15.3%) is rated to be in fair condition, twenty-six percent (26.4%) is in good condition, one percent (1.4%) is in very good condition, and five percent (4.7%) of the street network is rated to be in excellent condition.

For further illustrative purposes, the following photographs show examples of the condition ratings of poor, fair, good, and excellent and their respective RSL estimates.

Photo 4. Poor Condition – Crescent North from Silver Creek Rd to the End of Pavement (RSL = 6 years)

Photo 5. Fair Condition – Whileaway Rd from Parkway Dr to Wasatch Ln (RSL = 8 years)

Photo 6. Good Condition – Greenfield Drive from Wasatach Way to the Dead End Sign (RSL = 10 years)

Photo 7. Excellent Condition – Westwood Rd from Redden Rd to Cottonwood Trail Rd (RSL = 20 years)

Currently, Silver Creek's paved street network is in "fair" condition. Three percent (3.4%) of the network is at a terminal serviceability level as shown in Figure 11. If no preservation or rehabilitation work is undertaken, another 16.2% can be expected to deteriorate to a terminal serviceability level in 3 years.

On average, each street segment will most likely lose one year of service life per year without some preservation work being done. Within three years, if no pavement preservation is performed, about 50% of the asphalt paved network will probably deteriorate to a poor condition. This could place a major financial burden on the city to reconstruct these segments to provide adequate roads, as well as reduce the amount of public content with the street network. If a systematic pavement management program is implemented now, a balanced set of preservation strategies (e.g., routine maintenance, preventative maintenance, rehabilitation, and reconstruction) can be used to preclude the development of a backlog of needs and the overall decline in the service life of the network.

Unpaved Road Network

Typically, a well constructed and well maintained unpaved pavement should provide for ten years of traffic loadings (18 kip ESAL's) before reaching a terminal serviceability level (RSL = 0) that requires reconstruction. Conventional practice usually provides for periodic preventative maintenance and periodic re-graveling to achieve this level of service life. Timing of treatments is critical with respect to the conduct of preventative maintenance and rehabilitation to achieve the best level of service at the least amount of cost.

Figure 12 shows the typical pavement performance curve for unpaved roads. This figure emphasizes the relationship between road pavement condition and the timing of preventative maintenance and rehabilitation treatments.

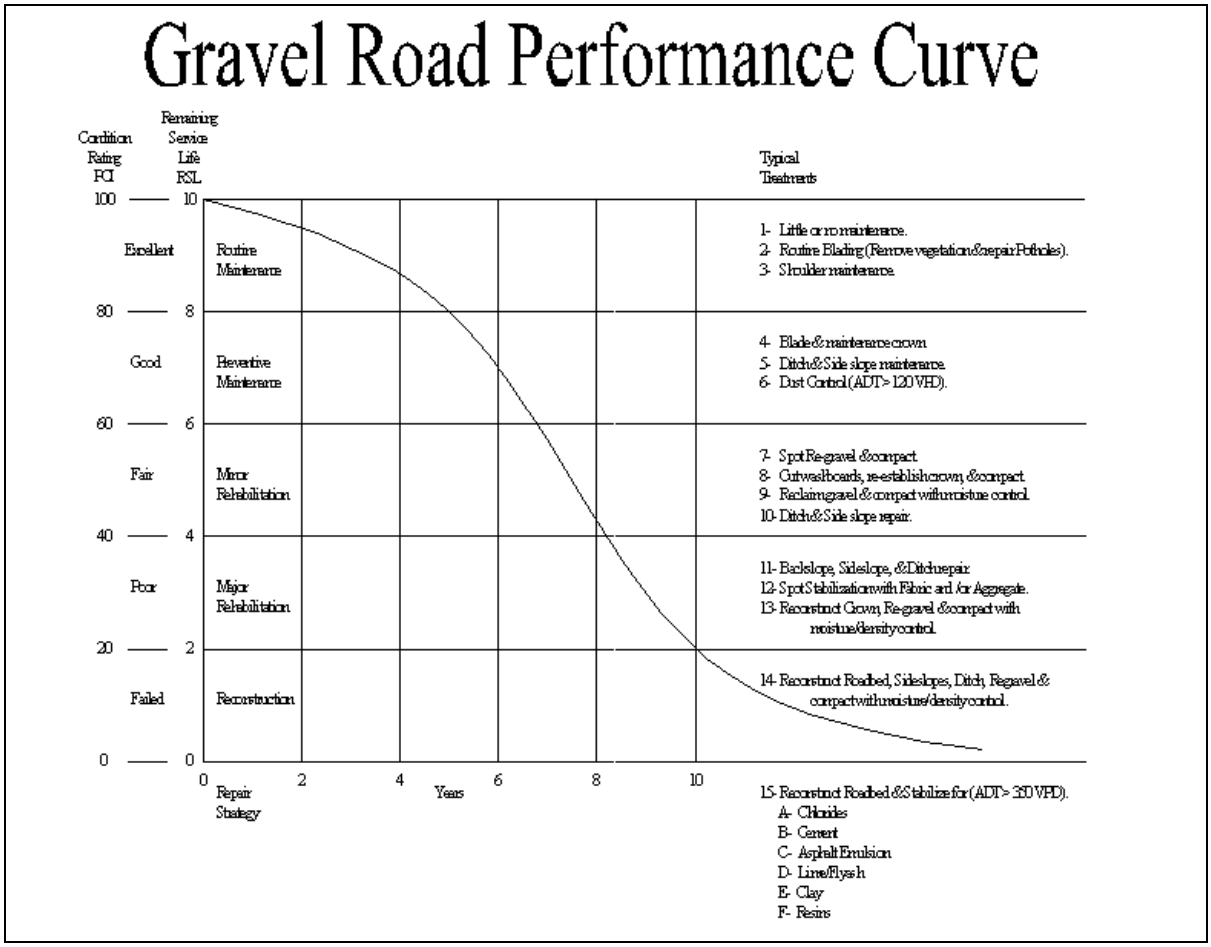


Figure 12. Unpaved Road Performance Curve

During the first four years of service life, routine grading and preventative maintenance treatments (Treatments 1-6) given in Figure 12, are typically required. During the next four years of service life, rehabilitation treatments (Treatments 7-13) are typically required to provide a good level of service. Once the unpaved road has been in service for eight years, reconstruction treatments (Treatments 14 –15) are normally required. However, with proper timing of preventative maintenance and rehabilitation treatments the service life of unpaved roads can be extended. The service life of unpaved roads is heavily affected by type and frequency of traffic loadings. The timing of the various treatments is very critical with regard to increased traffic loading. Understandably, as more frequent and heavier traffic loadings are applied to an unpaved road, the faster the service life is reduced. Conventional practice calls for some form of stabilization to be undertaken at about a 250 average annual daily traffic (AADT) level. For unpaved roads that have an AADT exceeding 350 vehicles, studies have shown it is typically more cost effective to provide a surface treatment or a paved surface rather than maintain it as an unpaved road.

After completing the condition survey, the estimated remaining service life (RSL) for each road segment was calculated. Each segment's pavement condition was evaluated to determine which distress types received the highest rating with regard to severity and extent. For example, Figure 13 shows the condition-rating sheet for a particular road segment. Corrugations were the dominant distress type for this particular road segment.

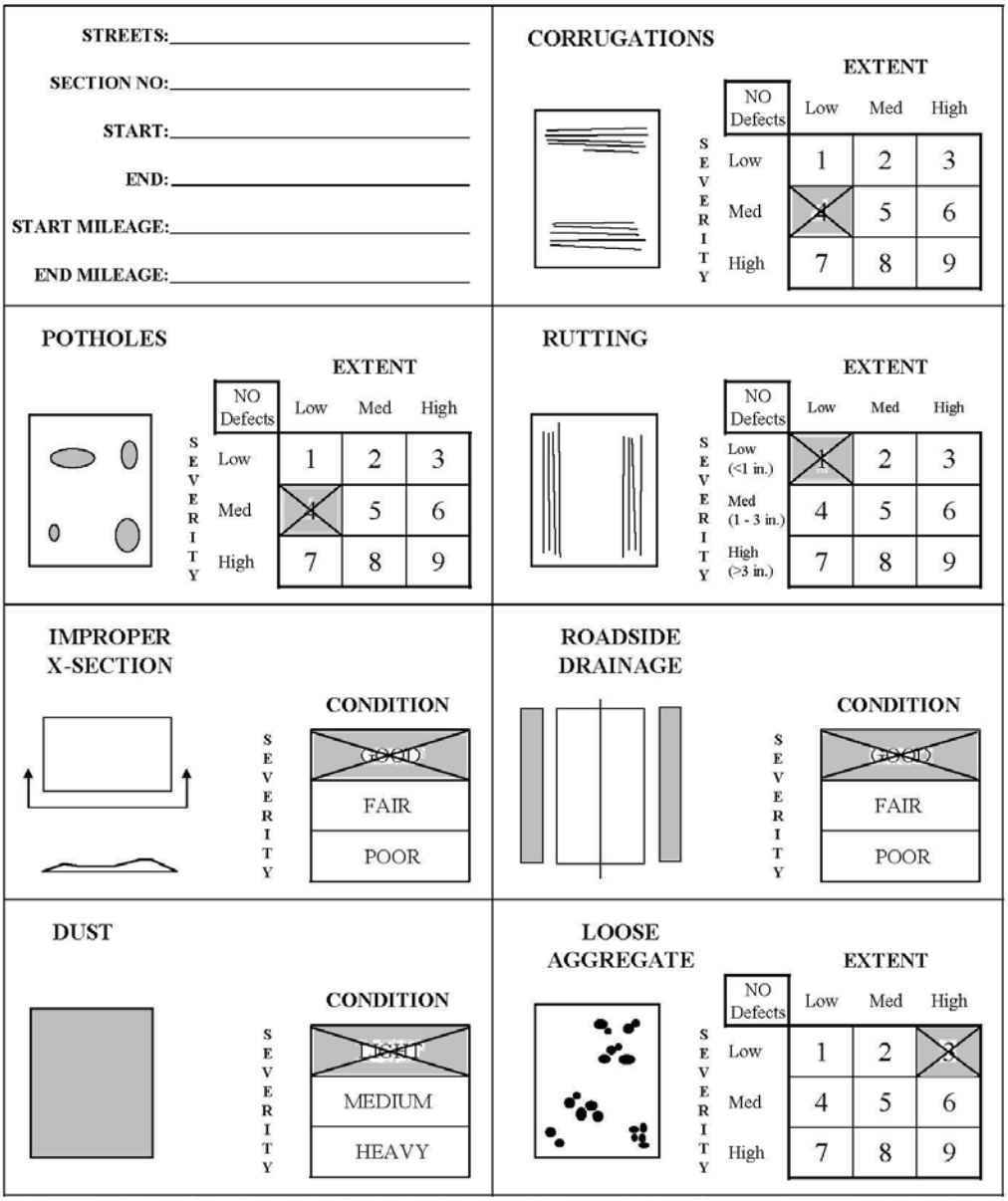


Figure 13. Unpaved Road Condition Rating Sheet

Table 7. Corrugation Distress Table

RATING	SEVERITY & EXTENT	RSL	STRATEGY	TREATMENT
0	No Corrugations	10	No Maintenance	No Maintenance
1	Low, Low	9	Routine	Routine Regrading
2	Low, Medium	7	Preventative	Blade & Maintain Crown
3	Low, High	7	Preventative	Blade & Maintain Crown
4	Medium, Low	6	Preventative	Blade & Maintain Crown
5	Medium, Medium	5	Rehabilitation	Cut Washboards/ Re-est. Crown & Compact
6	Medium, High	5	Rehabilitation	Cut Washboards/ Re-est. Crown & Compact
7	High, Low	4	Rehabilitation	Cut Washboards/ Re-est. Crown & Compact
8	High, Medium	3	Rehabilitation	Re-const. Crown, Regravel, Compact (M/D)
9	High, High	0	Reconstruct	Reconst Roadbed, Sideslopes, Ditches, Re-gravel & Compact (M/D)

The highlighted row in Table 7 shows a severity and extent rating of 4, which corresponds to an estimated remaining service life (RSL) of 6 years. Because the 6-year RSL was the lowest RSL among the distress types, corrugations are considered the governing distress for the road segment. The governing distress is the distress most likely to cause the pavement to deteriorate the earliest reducing the service life of the road. Appendix D contains the deterioration tables for the other distress types. These tables can be adjusted by experienced personnel to more accurately reflect the effects of local environmental and traffic loading conditions.

The above procedure was used to determine the governing distress and the RSL for each segment. Figure 14 shows the governing distress types in the unpaved road network along with the percent of the total road network area affected by each type.

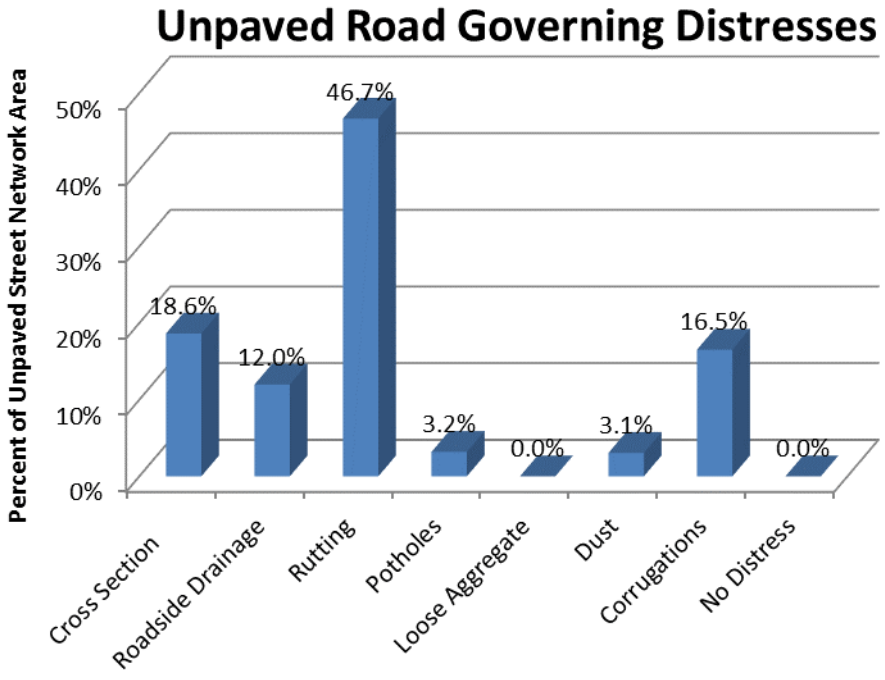


Figure 14. Governing Distress Rating Distribution for Unpaved Roads

Figure 14 illustrates that some governing distress types are more common to the unpaved road network than others. Rutting and Cross Section are the most common governing distress types in Silver Creek's road network.

The governing distress type of each segment provided the means of calculating the average RSL for the road network. For management purposes, the estimated RSL values are grouped incrementally in two-year categories. Figure 15 shows the current RSL distribution for Silver Creek's road network in terms of percent of surface area of the network.

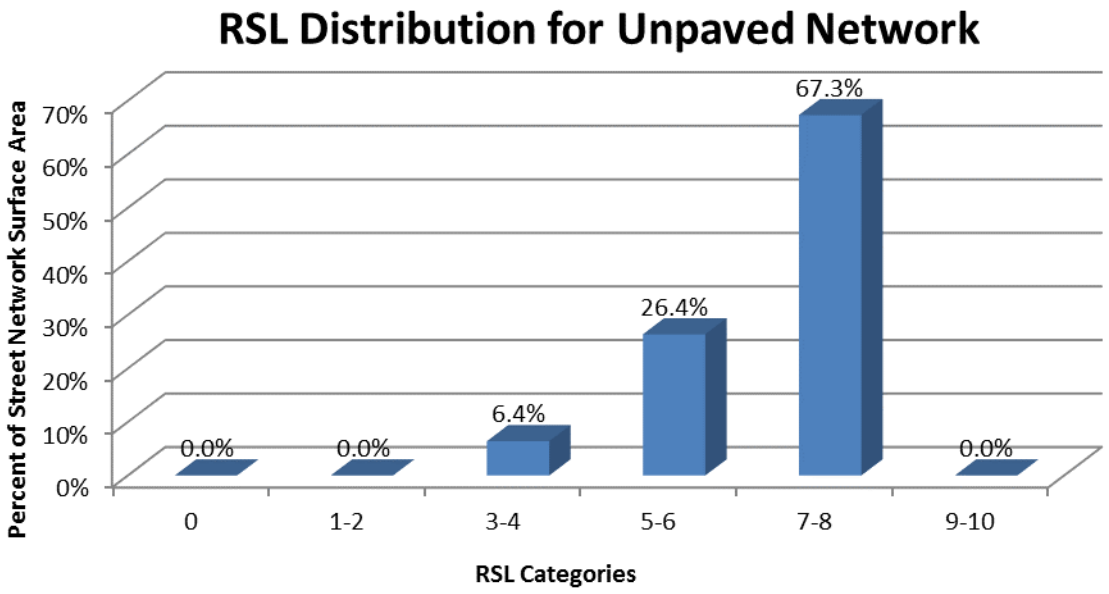


Figure 15. Current RSL Distribution for Unpaved Road Network

The estimated average RSL of Silver Creek's unpaved road network is 6.7 years. This average RSL value is slightly higher than most counties/cities surveyed to date by the Utah LTAP Center.

Table 8 shows this same information along with the corresponding subjective condition ratings of poor, fair, good, and excellent.

Table 8. Subjective Condition Rating of Unpaved Road Network

SUBJECTIVE CONDITION RATING OF UNPAVED ROAD NETWORK						
	FAILED	POOR	FAIR	GOOD		EXCELLENT
RSL (Years)	0	1-2	3-4	5-6	7-8	9-10
% of Network	0.0%	0.0%	6.4%	26.4%	67.3%	0.0%

Zero percent (0%) of the unpaved road network in Silver Creek is considered to be in a failed condition. Zero percent (0%) is considered to be in poor condition. Six percent (6.4%) is rated to be in fair condition, Ninety-four percent (93.7%) is in good condition, and Zero percent (0%) of the unpaved road network is rated to be in excellent condition.

Currently, Silver Creek's unpaved road network is in "good" condition. Zero (0%) of the network is at a terminal serviceability level. If no preservation or rehabilitation work is undertaken, 6.5% can be expected to deteriorate to a terminal serviceability level in 3 years.

On average, each unpaved road segment will most likely lose one year of service life per year without some preservation work being done. Within three years, if no preservation is performed, about 57% of the unpaved network will probably deteriorate to a "poor" condition (See Figure 22). This could place a financial burden on the community. If a systematic management program is implemented now, a balanced set of preservation strategies (e.g., routine maintenance, preventative maintenance, rehabilitation, and reconstruction) can be used to preclude the development of a backlog of needs and the overall decline in the service life of the unpaved road network.

Development of Preservation Strategies and Recommended Treatments

After determining the governing distress types for each street segment, pavement preservation strategies and treatments that can effectively correct or remove the root causes were identified. Frequently, more than one strategy or treatment can be used to cost effectively remedy the governing distress and other accompanying distresses that may exist. As an example, the distress deterioration table for fatigue cracking is shown in Table 9. This table shows the various combinations of severity and extent (rating) levels that may occur, along with their preservation strategies and recommended treatments. The corresponding estimated RSL of each rating level is also shown.

Table 9. Fatigue Cracking Preservation Strategies and Treatments

RATING	SEVERITY & EXTENT	RSL	STRATEGY	TREATMENT
0	No Alligator Cracking	20	No Maintenance	No Maintenance
1	Low, Low	10	Routine	Patch
2	Low, Medium	8	Rehabilitation	Thin Hot Mix Overlay (<2 in)
3	Low, High	6	Rehabilitation	Thin Hot Mix Overlay (<2 in)
4	Medium, Low	8	Rehabilitation	Thin Hot Mix Overlay (<2 in)
5	Medium, Medium	6	Reconstruct	Thick Overlay (3 in)
6	Medium, High	4	Reconstruct	Rotomill & Thick Overlay
7	High, Low	6	Reconstruct	Thick Overlay (3 in)
8	High, Medium	2	Reconstruct	Cold Recycle & Overlay (3 in)
9	High, High	0	Reconstruct	Base/Pavement Replacement

Distress deterioration tables with their preservation strategies and recommended treatments similar to this were developed for each distress type and are given in Appendix D.

The preservation strategies and recommended treatments given in Appendix F are grouped in the general preservation strategies of routine maintenance, preventative maintenance, rehabilitation, and reconstruction. Each major preservation strategy represents a particular level of work effort and a specific goal with regard to preserving or restoring the pavement.

Routine maintenance is primarily proactive and includes the work items of crack sealing, dig-outs, and patching.

Preventative maintenance is designed to slow pavement deterioration, as well as preserve and improve the functional condition of the pavement. Preventative maintenance strategies do not substantially increase structural capacity. Treatments in the category of preventative maintenance include: sand seals, fog seals, chip seals, scrub seals, cape seals, slurry seals, and microsurfacing.

Rehabilitation serves to correct or remove root causes of distress and to add structural capacity and service life to the pavement. Rehabilitation treatments include thin hot mix asphalt overlays, hot surface recycling, plant mix seals, and combinations of leveling courses or rotomilling with overlays.

Reconstruction covers all types of work involved in totally reconstructing or replacing the pavement structure, thus providing a completely new pavement.

A detailed listing of all preservation strategies and their associated treatments with unit costs are given in Appendix F. The unit costs are those provided by the Utah Department of Transportation (UDOT) and are based on the average costs per square yard. A special inventory form built within the Transportation Asset Management System (TAMS) computer program facilitates the analysis process and allows engineering judgment to be exercised at any point. An example of this form is shown in Figure 16. The program uses the previously entered distress information to determine appropriate treatments. For the segment shown in Figure 12, the recommended treatment is a Thick Overlay (3 in.).

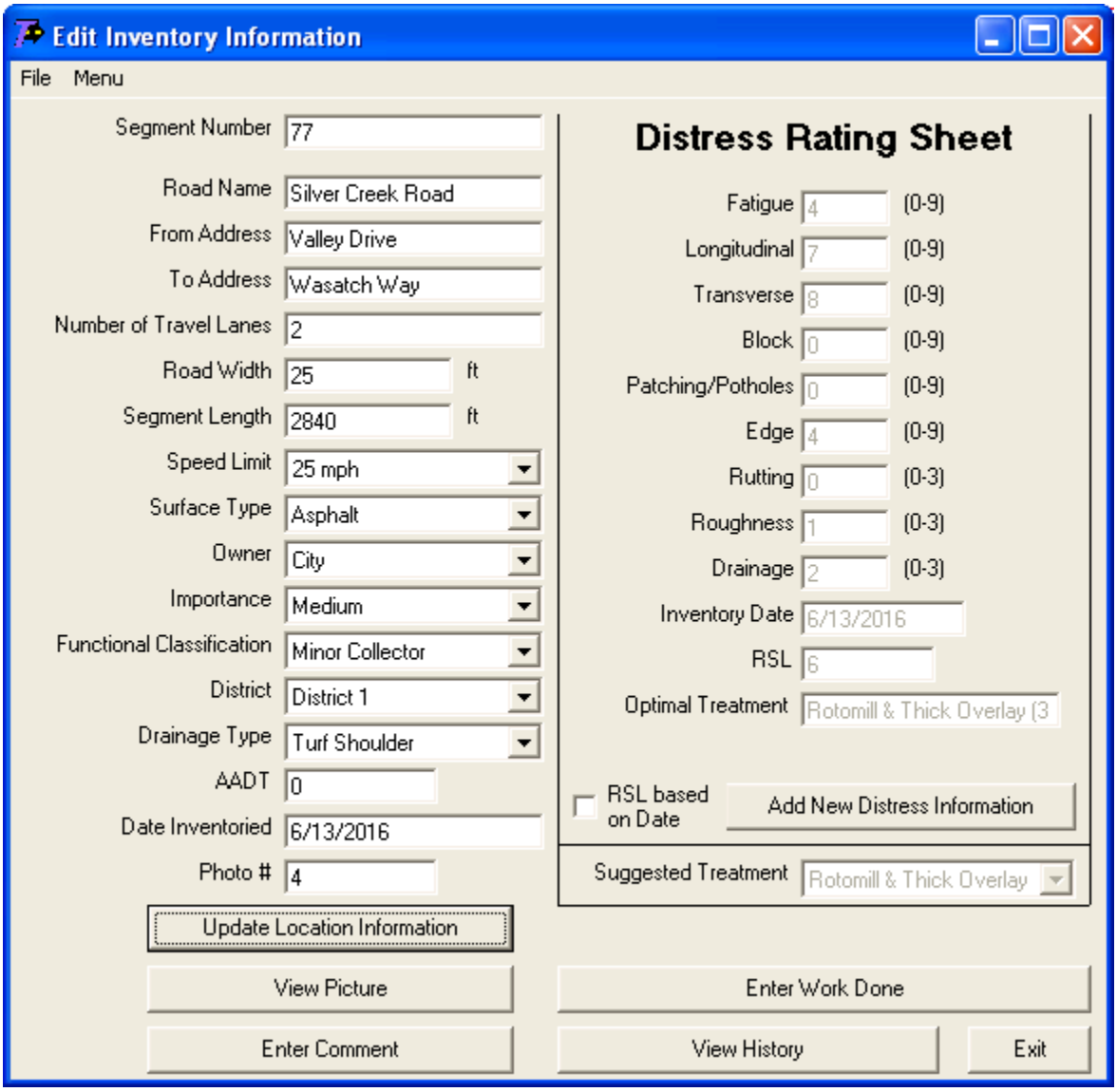


Figure 16. TAMS Inventory Form

On the left side of the form, inventory information pertaining to the street segment is shown. This information includes the address and location of the segment, surface type, number of lanes, length, width, area, posted speed limit, and date inventoried. On the right side, the various distress ratings are listed, along with a recommended preservation treatment. The "View Picture" button allows the user to look at a digitized photograph of the street segment.

The program provides valuable insight into the distresses affecting street segments and the corresponding pavement condition. The program should not be used indiscriminately in selecting pavement treatments. In order to be the most effective, the program must be combined

with good engineering judgment, and project level field inspections to make project level analyses. The program should be considered a tool, which the pavement manager can use to improve their decision-making skills, not replace them.

Appendix E shows the initial recommended pavement preservation strategies to be used on each street segment. Table 10 gives an example of the information contained in Appendix E. This information is sorted by treatment type and street name.

Table 10. Recommended Preservation Treatments for Each Segment (Appendix E)

ID	STREET NAME	FROM	TO	CLASS	TREATMENT	AREA (YD^2)
11	Echo Lane	Parkway Drive	Wasatch Lane	Residential	Base/Pavement Replacement	2088
27	Silver Creek Road	Aspen Lane	Over Hill Road	Minor Collector	Thin Hot Mix Overlay (<2 in)	3204
64	Wasatch Way	Silver Creek Road	Long Rifle Road	Residential	Thick Overlay (3 in.)	2472
70	Parkway Drive	Echo Lane	Pace Place	Residential	Cold Recycling & Overlay (3 in.)	2613
13	Greenfield Drive	Wasatch Way	Dead End Sign	Residential	Cold Patch	1111
68	Long Rifle Road	Wasatch Way	Shepherd Way	Residential	Rotomill & Thick Overlay (3 in.)	2902
123	Wasatch Way	Greenfield Drive	Rae Circle	Residential	Crack Seal	3120

Assessment of Current Street Maintenance Program Funding

Asphalt Road Network

Maintaining and preserving Silver Creek's street network at a high service level is vital to the well being of the community. A systematic and balanced pavement preservation program, providing for routine maintenance, preventative maintenance, rehabilitation, and reconstruction, will enable Silver Creek to cost effectively maintain the street network. A pavement preservation program recommended for cities and towns is one that maintains an estimated average RSL of 10 years with no more than three percent (3%) of the street network at the terminal serviceability level (i.e. RSL = 0). Silver Creek's 2016 RSL distribution is shown in Figure 17.

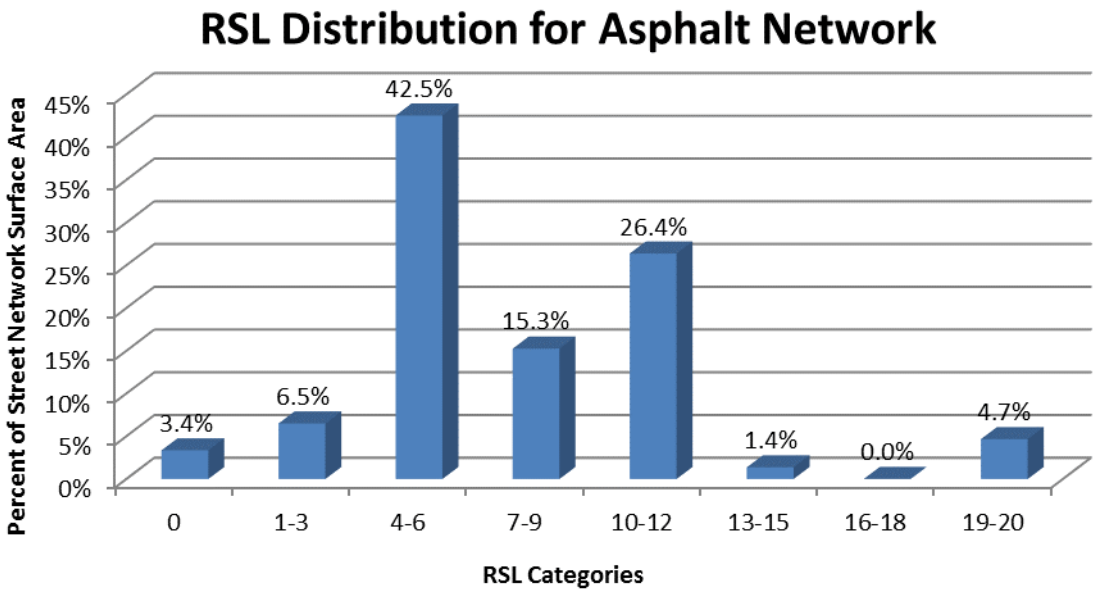


Figure 17. Current RSL Distribution for Asphalt Street Network

The average RSL for Silver Creek's paved street for 2016 is estimated at 7.5 years with 3.4% of the street network at a terminal service level.

Figure 18 and Figure 19 illustrate the estimated RSL distribution for 2021 and 2026 if no maintenance is performed on the street network. The number of streets at a terminal service level (RSL = 0) would increase from 3.4% to about 70.5% by 2026.

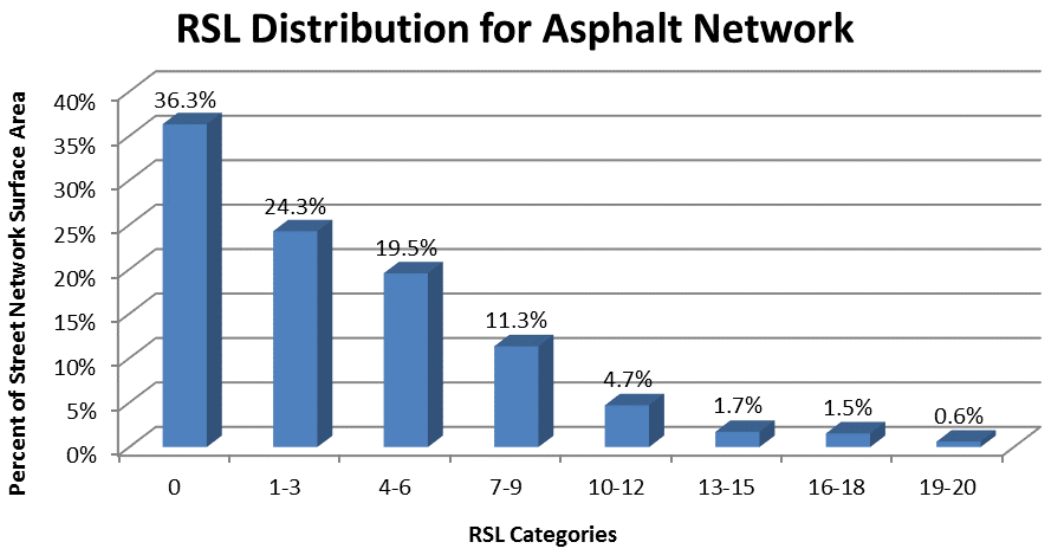


Figure 18. Estimated RSL Distribution for 2021 (if no treatment is done)

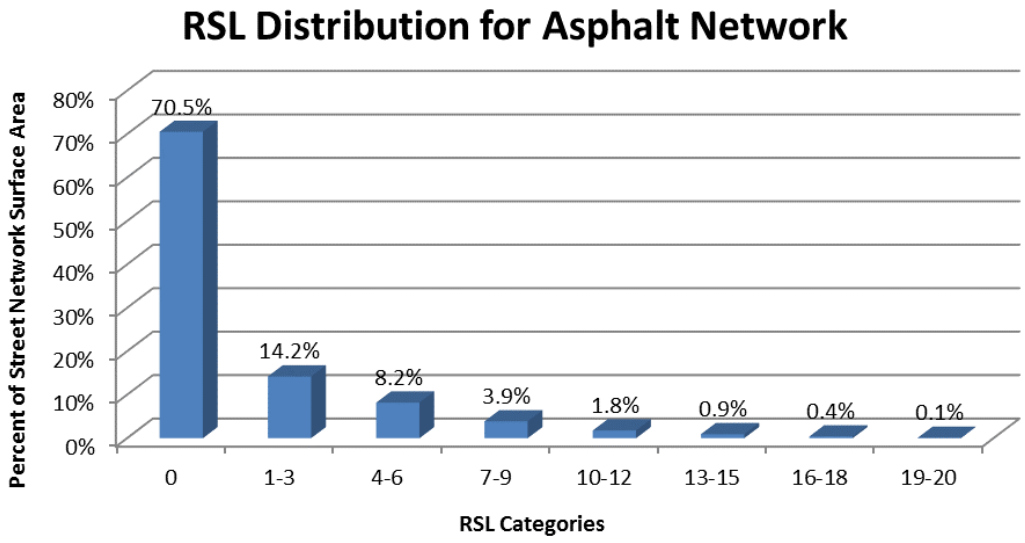


Figure 19. Estimated RSL Distribution for Year 2026 (if no treatment is done)

The resulting estimated average RSL for the year 2021 is 3.5 years, and for the year 2026 is 1.4 years.

Unpaved Road Network

An unpaved road preservation program recommended for counties and cities is one that maintains an estimated average RSL of 6 years with no more than three percent (3%) of the unpaved road network at the terminal serviceability level (i.e. RSL = 0). Silver Creek's 2016 unpaved road RSL distribution is shown in Figure 20.

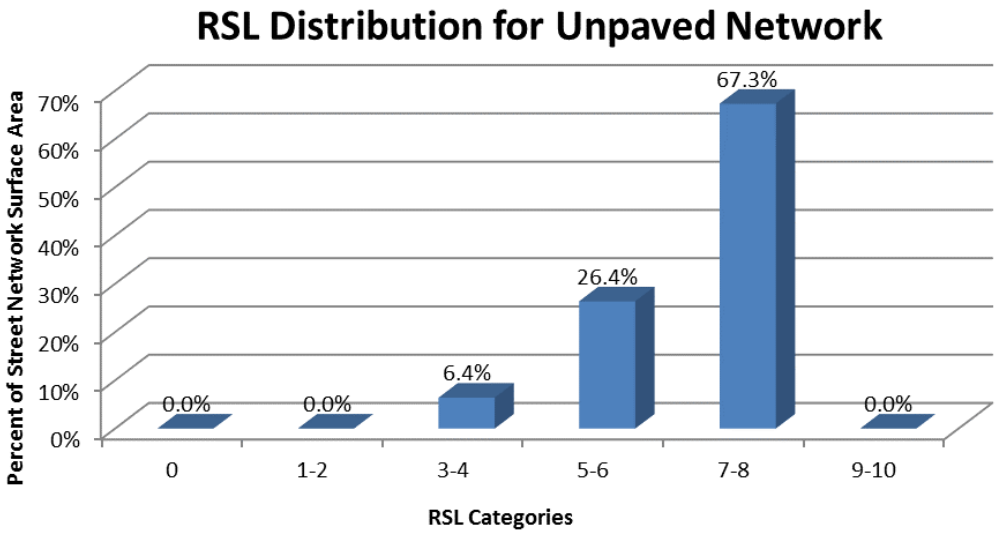


Figure 20. Current RSL Distribution for Unpaved Road Network

The average RSL for Silver Creek's unpaved roads for 2016 is estimated at 6.7 years with 0.0% of the unpaved network at a terminal service level (RSL=0).

Figure 21 and Figure 22 illustrate the estimated RSL distribution for 2019 and 2025 if no maintenance is performed on the unpaved network. The number of roads at a terminal service level (RSL = 0) would increase from 0.0% to about 87% by 2025.

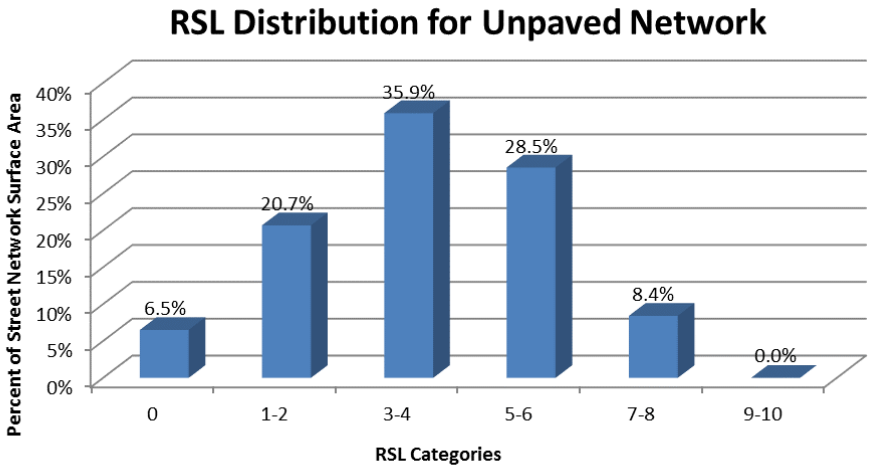


Figure 21. Estimated Unpaved Road RSL Distribution for 2019 (if no treatment is done)

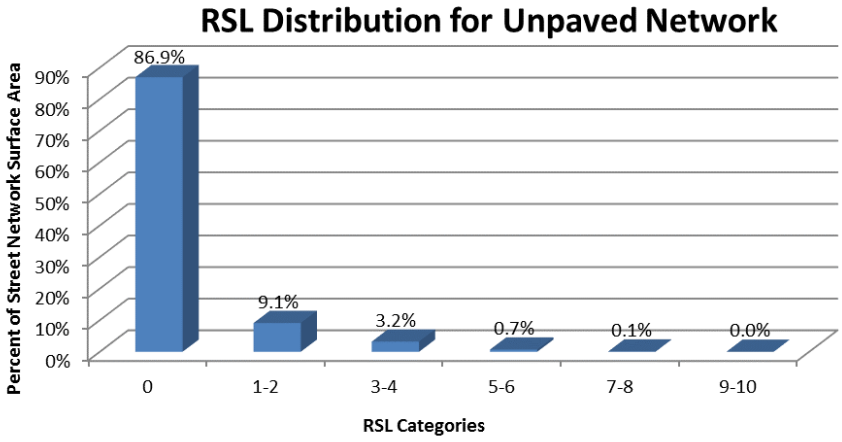


Figure 22. Estimated Unpaved Road RSL Distribution for Year 2025 (if no treatment is done)

The resulting estimated average RSL for the year 2019 is 3.8 years, and for the year 2025 is 0.5 years.

Development of Recommended Pavement Preservation Program

Asphalt Road Network

A three-step pavement preservation program is recommended to increase the level of service of Silver Creek's road network. Such an approach can increase the estimated average RSL of the road network from 7.5 years to 10.8 years over a 9-year period. The percentage of paved roads at a terminal service level will be 2.97% at the end of this 9-year period. This approach achieves the recommended average RSL of at least 10 years service life with less than 3 % of the road network at a terminal service level and maintains the high serviceability level that Silver Creek desires.

The first step in the recommended pavement preservation program deals with the years from 2016 to 2020. A high percentage of preventative maintenance and reconstruction with some routine maintenance and rehabilitation treatments are recommended to decrease the percentage of roads in the "poor" category. Some of the preventative maintenance and rehabilitation strategies are to be applied at less than optimal points in time in order to buy time and move the needs of the road network from reconstruction to preventative maintenance.

The baseline funding for step one (2016-2020) is estimated to be $222,018 per year. It is important to note that if a higher amount of money is allocated initially to the asphalt network, it will require less to maintain later. The recommended funding distribution for the four pavement preservation strategies is given in Table 11.

Table 11. Paved Road Funding Distribution for 2016-2020 (Step One)

PAVEMENT PRESERVATION STRATEGIES	PERCENT OF ROAD NETWORK	FUNDING DISTRIBUTION
Routine Maintenance	3.00%	$3,095
Preventative Maintenance	13.00%	$58,124
Rehabilitation	1.00%	$23,227
Reconstruction	4.00%	$137,572
TOTAL	21.00%	$222,018

The resulting RSL distribution for step one in 2020 is shown in Figure 23.

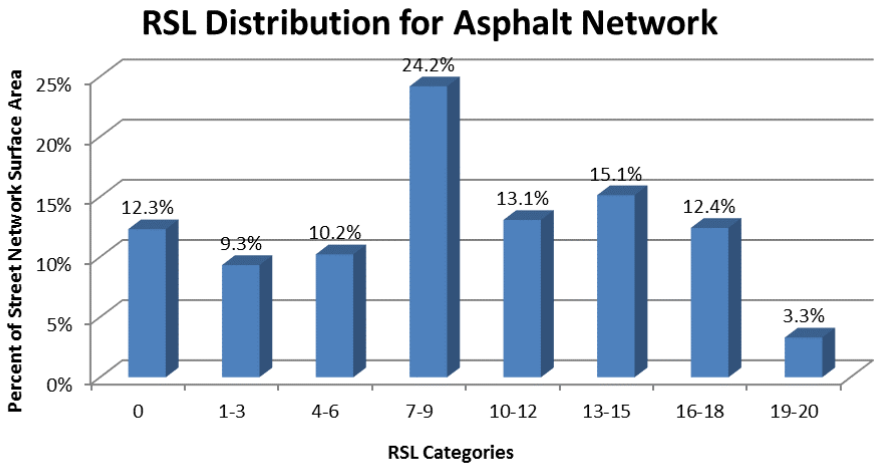


Figure 23. RSL Distribution for 2020 Using Recommended Preservation Program

Figure 23 shows a significantly decreased percentage of roads in the "4-6" categories, an improved RSL distribution, and an increase in the estimated average RSL to 8.96 years.

Step two of the pavement preservation program deals with the years 2020-2024. The baseline funding for step two is estimated to be $228,655 per year. The recommended funding distribution for the four pavement preservation strategies of step two is given in Table 12.

Table 12. Paved Road Funding Distribution for 2020-2024 (Step Two)

PAVEMENT PRESERVATION STRATEGIES	PERCENT OF ROAD NETWORK	FUNDING DISTRIBUTION
Routine Maintenance	6.0%	$6,191
Preventative Maintenance	6.0%	$26,826
Rehabilitation	2.5%	$58,067
Reconstruction	4.0%	$137,571
TOTAL	18.5%	$228,655

The resulting RSL distribution for step two in 2024 is shown in Figure 24.

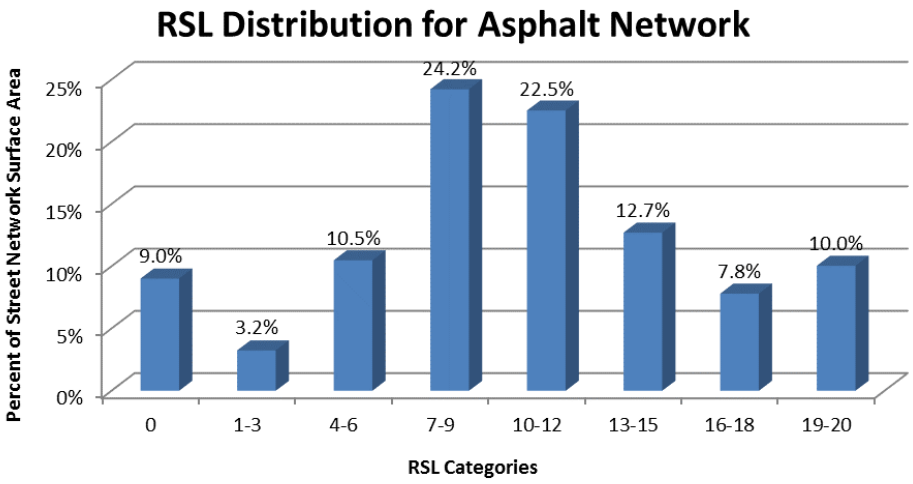


Figure 24. RSL Distribution for 2026 Using Recommended Preservation Program

Figure 24 shows a decrease in the percentage of roads in the “0” & “1-3” RSL categories, an improved RSL distribution, and an increase in the estimated average RSL to 10.1 years. The improved RSL distribution allows the road network to be maintained by strategies that are more cost effective.

Step three of the pavement preservation program deals with the years 2024-2026. The baseline funding for step three is estimated to be $231,120 per year. The recommended funding distribution for the four pavement preservation strategies of step three is given in Table 13.

Table 13. Paved Road Funding Distribution for 2024-2026 (Step Three)

PAVEMENT PRESERVATION STRATEGIES	PERCENT OF ROAD NETWORK	FUNDING DISTRIBUTION
Routine Maintenance	6.0%	$6,191
Preventative Maintenance	8.0%	$35,768
Rehabilitation	0.0%	$0
Reconstruction	5.5%	$189,161
TOTAL	19.5%	$231,120

The resulting RSL distribution for step three in 2026 is shown in Figure 25.

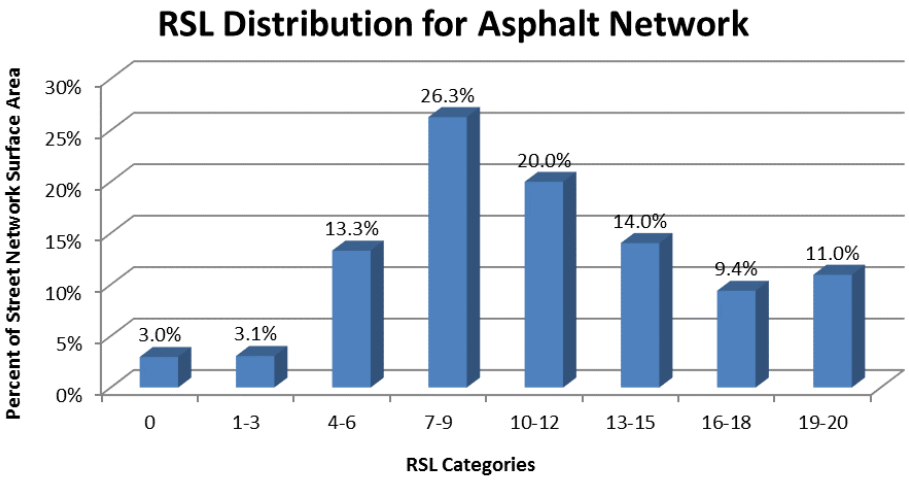


Figure 25. RSL Distribution for 2026 Using Recommended Preservation Program

Figure 25 shows a decrease in the percentage of roads in the "0" RSL category, an improved RSL distribution, and an increase in the estimated average RSL to 10.8 years. The improved RSL distribution allows the road network to be maintained by strategies that are more cost effective.

The recommended three-step pavement preservation program uses strategies and treatments that are applied at points in time that are the most cost effective. The following tables show the recommended strategies and treatments that are to be applied in each step. In the first step of the pavement preservation program, the percent of road network area receiving treatment as distributed in the RSL categories is shown in Table 14.

Table 14. Paved Road Treatment Distribution for Step One (2016-2020)

PAVEMENT PRESERVATION STRATEGIES	0	1-3	4-6	7-9	10-12	13-15	16-18	19-21	TOTAL
Routine Maintenance						1.0%		2.0%	3.0%
Preventative Maintenance			6.5%	2.6%	3.9%				13.0%
Rehabilitation			1.0%						1.0%
Reconstruction	1.6%	0.8%	1.6%						4.0%

Routine maintenance strategies are recommended to treat three percent (3%) of the asphalt road network in step one with crack seal. Other routine maintenance such as dig out and hot patch can be supplemented in as needed. Preventative maintenance strategies are recommended to treat thirteen percent (13%) of the road network with single chip seals. Rehabilitation maintenance strategies are recommended to treat one percent (1%) of the road network with a thin hot mix overlay (<2 in.). For roads requiring reconstruction a thick overlay (3 in.) is recommended to treat four percent (4%) of the road network.

This step applies preventative maintenance strategies to roads with “4-6”, “7-9”, and “10-12” years of remaining service life to prolong the time before these roads need to be reconstructed. A thick overlay (3 in.) is used to strengthen some of the roads. Currently, many of the roads seem to have a thin layer of asphalt. As Silver Creek grows, the increased traffic will wear out the roads quickly if there isn’t more asphalt on them so overlays are recommended to strengthen the road network for the present time.

The percent of the road network area receiving treatment in the second step of the pavement preservation program as distributed in the RSL categories is shown in Table 15.

Table 15. Paved Road Treatment Distribution for Step Two (2020-2024)

PAVEMENT PRESERVATION STRATEGIES	0	1-3	4-6	7-9	10-12	13-15	16-18	19-21	TOTAL
Routine Maintenance						1.8%	3.6%	0.6%	6.0%
Preventative Maintenance			3.0%	1.2%	1.8%				6.0%
Rehabilitation			2.5%						2.5%
Reconstruction	2.4%	1.6%							4.0%

Routine maintenance strategies are recommended to treat six percent (6%) of the asphalt road network in step two with crack seal. Other routine maintenance such as dig out and hot patch can be supplemented in as needed. Preventative maintenance strategies are recommended to treat six percent (6%) of the road network with single chip seals. For rehabilitation strategies, a thin hot mix overlay (<2 in.) is recommended to treat two point five percent (2.5%) of the road network. For roads requiring reconstruction, a thick overlay (3 in.) is recommended to treat four percent (4%) of the road network.

As in step one, overlays are used to strengthen the road network. Single chip seals and crack seal are used to prolong the life of the road network before these roads are in need of rehabilitation or reconstruction.

The percent of the road network area receiving treatment in the third step of the pavement preservation program as distributed in the RSL categories is shown in Table 16.

Table 16. Paved Road Treatment Distribution for Step Three (2024-2026)

PAVEMENT PRESERVATION STRATEGIES	0	1-3	4-6	7-9	10-12	13-15	16-18	19-21	TOTAL
Routine Maintenance						1.8%	3.6%	0.6%	6.0%
Preventative Maintenance			4.0%	1.6%	2.4%				8.0%
Rehabilitation									0.0%
Reconstruction	3.3%	2.2%							5.5%

Routine maintenance strategies are recommended to treat six percent (6%) of the asphalt road network in step three with crack seal. Other routine maintenance such as dig out and hot patch can be supplemented in as needed. Preventative maintenance strategies are recommended to treat eight percent (8%) of the road network with single chip seals. No rehabilitation treatments are recommended for this step. For roads requiring reconstruction, a thick overlay (3 in.) is recommended to treat five point five percent (5.5%) of the road network.

After these three steps are completed, the cost to maintain the road network will decrease because the RSL distribution will have improved. The cost of routine and preventative maintenance is much less than reconstruction meaning that the improved road network is cheaper to maintain since less reconstruction will be necessary. Continued routine and preventative maintenance strategies such as single chip seals and crack seal will prolong the road network life and extend the time before reconstruction is needed. The thin hot mix overlays (<2 in.) and the thick overlays (3 in.) will strengthen the roads helping to make them more durable for an increase in traffic loads on them as Silver Creek expands making the road network last longer.

The suggested baseline budgets for Step One ($222,018), Step Two ($228,655), and Step Three ($231,120) were calculated using treatment costs for 2016. Table 17 shows the projected budgets for the years 2017-2026 considering a three percent inflation rate per year based on the baseline budgets.

Table 17. Budget Recommendation Considering Inflation

STEP ONE	
Year	Proposed Budget
2017	$222,018
2018	$228,679
2019	$235,539
2020	$242,605

STEP TWO	
Year	Proposed Budget
2021	$257,353
2022	$265,074
2023	$273,026
2024	$281,217

STEP THREE	
Year	Proposed Budget
2025	$292,776
2026	$301,559

Asphalt Road Routine Maintenance

Table 18 shows the roads recommended for routine maintenance in 2017. Segments were selected based on of their level of functional importance to the road network. The treatment recommended for routine maintenance is Crack Seal. The total area represented by these segments is approximately 3.0 % of the paved road network.

Table 18. Routine Maintenance Recommendations

Segment ID	Road	From	To	Width (ft)	Length (ft)	Area (yd^2)	Treatment
123	Wasatch Way	Greenfield Road	Rea Circle	24	1170	3120	Crack Seal
67	Wasatch Lane	Whileaway Road	Silver Creek Road	24	967	2579	Crack Seal
122	Rae Circle	Wasatch Way	Dead End	24	392	1045	Crack Seal
Total Area of Segments is 6,744 sq. yards or 2.94% of Asphalt Network							

Asphalt Road Preventative Maintenance

Table 19 shows the roads recommended for preventative maintenance in 2017. Segments were selected based on of their level of functional importance to the road network. The treatment recommended for preventative maintenance is a Single Chip Seal. The total area represented by these segments is approximately 13.0 % of the paved road network.

Table 19. Preventative Maintenance Recommendations

Segment ID	Road	From	To	Width (ft)	Length (ft)	Area (yd^2)	Treatment
29	Silver Creek Road	Earl Street	Parkway Drive	25	250	694	Single Chip Seal
34	Silver Creek Road	Parkway Drive	Valley Drive	25	183	508	Single Chip Seal
77	Silver Creek Road	Valley Drive	Wasatch Way	25	2840	7889	Single Chip Seal
78	Silver Creek Road	Wasatch Lane	Wasatch Way	26	275	794	Single Chip Seal
27	Silver Creek Road	Aspen Lane	Over Hill Road	21	1373	3204	Single Chip Seal
25	Silver Creek Road	Redden Road	Oakridge North	21	1156	2697	Single Chip Seal
26	Silver Creek Road	Oakridge North	Aspen Lane	21	128	299	Single Chip Seal
28	Silver Creek Road	Over Hill Road	Tollgate Road	21	629	1468	Single Chip Seal
59	Parleys Road	Redden Road	Long Rifle Road	20	2374	5276	Single Chip Seal
30	Redden Road	Continues on..	Brookwood Drive	21	788	1839	Single Chip Seal
31	Redden Road	Meadowview Road	Continues on...	21	503	1174	Single Chip Seal
39	Redden Road	Bump	Meadowview Road	24	336	896	Single Chip Seal
40	Redden Road	Silver Creek Road	Bump	24	962	2565	Single Chip Seal
Total Area of Segments is 29,303 sq. yards or 12.8 % of Asphalt Network							

Asphalt Road Rehabilitation

Table 20 shows the roads recommended for rehabilitation maintenance in 2017. The treatment recommended for rehabilitation maintenance is a Thin Hot Mix Overlay (<2 in.). The total area represented by these segments is approximately 1.0% of the paved road network. Roads were selected based on their importance to the road network.

Table 20. Rehabilitative Maintenance Recommendations

Segment ID	Road	From	To	Width (ft)	Length (ft)	Area (yd^2)	Treatment
61	Silver Creek Road	Westwood Road	Crescent North	24	830	2213	Thin Hot Mix Overlay (<2 in.)
Total Area of the Segment is 2213 sq. yards or 0.97 % of Asphalt Network							

Asphalt Road Reconstruction

Table 21 shows the roads recommended for reconstruction maintenance in 2017. The treatments recommended for reconstruction maintenance is a Thick Overlay (3 in.). The total area represented by these segments is approximately 4.0 % of the paved road network. Roads were selected based on their importance to the road network.

Table 21. Reconstruction Maintenance Recommendations

Segment ID	Road	From	To	Width (ft)	Length (ft)	Area (yd^2)	Treatment
75	Beehive Drive	Pace Place	Echo Lane	24	2553	6808	Thick Overlay (3 in.)
11	Echo Lane	Wasatch Lane	Parkway Drive	18	1044	2088	Thick Overlay (3 in.)
Total Area of Segments is 8,896 sq. yards or 3.88 % of Asphalt Network							

Unpaved Road Network

The Public Works staff and field maintenance crews are to be commended for their work and the attention given to applying the basics of gravel road maintenance. Currently Silver Creek's over all gravel road network is in the "Good" category.

For dust control, magnesium chloride is the best solution for our area. There are plants near the Great Salt Lake for it which means this will be the cheapest option. This will help reduce the amount of dust but that doesn't mean there will be no dust. The only way to fully remove dust is to pave the unpaved roads. Asphalt would be the best option but also the most expensive. A much cheaper alternative to asphalt would be to put a double chip seal down on the unpaved roads. This would strengthen these roads and remove the issue of dust. If the base beneath the double chip seal is done well, the double chip seal could last 5 years before needing to be redone thus making it a cost effective alternative to gravel roads since there would be less maintenance expenses than with the gravel roads. The double chip seal would only be effective if the amount of traffic on these roads remains low. If traffic increases on these unpaved roads, paving them with asphalt will be more cost effective in the long run.

In the spring, the gravel roads should be reshaped to have a 4% crown and compacted. The 4% crown is important for drainage purposes so that water does not start to collect on the road. After this, magnesium chloride can be sprayed on the gravel roads to control dust. This should last for the majority of the summer. The purpose of the magnesium chloride spray is to keep the surface moist thus reducing the amount of dust that gets kicked up from passing cars.
Sodium chloride, calcium chloride, and enzyme emulsions are other options that could be used as well for dust control.

Regular preventative blading and maintaining of crown is suggested every six to eight weeks with some ditch/slide slope repair as needed. These treatments will allow Silver Creek to maintain the high level of serviceability that already exists in the unpaved road network.

Currently pot holes are not an issue in the unpaved road network but if this becomes a problem in the future, spot re-gravel and compacting will be necessary.

Implementation of Pavement Management System

A fully implemented pavement management system can be a useful tool to a city, town, or county in cost effectively maintaining their street or road networks at a high service level. Silver Creek leaders should be applauded for recognizing the value of their street network as well as for their desire to maintain its value and service life.

A majority of the work necessary to implement a pavement management system has been done by the Utah LTAP Center. As described in this report, a full inventory and condition survey of Silver Creek's street network has been made. This provided the basis for the analyses of the street network's current conditions. In addition, a pavement preservation program and recommendations have been made that will enable Silver Creek to maintain and enhance the service life of its street network. The Utah LTAP Center has also provided a pavement management computer program that will enable personnel at Silver Creek to keep accurate and up-to-date records of their street network's conditions and the preservation work that is done.

The following steps are suggested to facilitate the implementation of the pavement management system and assure its beneficial use:

1. Conduct briefings with appropriate personnel to explain the details and procedures of the pavement management system.
2. Install the computer program on the computers of the personnel who are responsible for maintenance of the street network.
3. Train the appropriate personnel how to implement the recommended pavement preservation program.
4. Develop a pavement structure history database including dates of initial construction and subsequent maintenance and rehabilitation actions.
5. Develop a traffic database and incorporate traffic counts, classifications, and axle load data.
6. In cooperation with the personnel responsible for the maintenance of the street network, conduct site reviews of street segments recommended for treatment.
7. Fine-tune the pavement management computer program and establish periodic condition survey and feedback mechanisms to keep the street network conditions current.

The Utah LTAP Center is available and can assist in this implementation effort. Further fieldwork and support is available on an as needed actual cost basis. This can be arranged and scheduled by contacting Nick Jones at the Utah LTAP Center.

Importance of Feedback

The pavement management system set forth in this report is systematic in nature. Therefore, special steps and efforts should be taken to assure that everyone involved has an opportunity and a means to provide both input and feedback in the pavement management process. As shown in Figure 1 of the introduction to this report, feedback among all elements of the pavement management process is essential for the system to be dynamic and useful to the city. Effective feedback has been accomplished by several agencies by establishing a pavement management team or group. This team is comprised of representatives from each operating element involved in the process within the organization. Typically, this team is led by someone from the Public Works Department who assigns specific duties to each team member commensurate with their role in the pavement management process.

The pavement preservation program requires accurate and timely feedback on all decisions and actions taken with respect to preservation (routine maintenance, preventative maintenance, rehabilitation maintenance, and reconstruction) of each street segment. This feedback should include such information as type of work performed, unit costs of work items, amount and quality of work performed, date of completed work, additional pavement structure added, and any other design related information. In addition, periodic condition surveys should be made to keep track of the condition of each street and the network as a whole. These periodic condition surveys should be conducted every two to three years. This feedback information will enable the pavement management team to fine-tune the pavement management computer program providing better information to the decision-makers at all levels.

Any pavement management system must have a means of keeping accurate, up-to-date information about the condition and inventory of the street network. Good decisions are difficult to make without such information. The Transportation Asset Management System (TAMS) computer program provided by the Utah LTAP Center makes this process easy for users. This computer program allows for the inventory of current distress information, tracking of treatments applied, history of work done, and cross section information via pictures of the street segment. These tools provide valuable information that can assist in better decision-making

regarding the allocation of resources to maintain and preserve the street network. Figure 26 shows the forms used for the inventorying and updating of the street network.

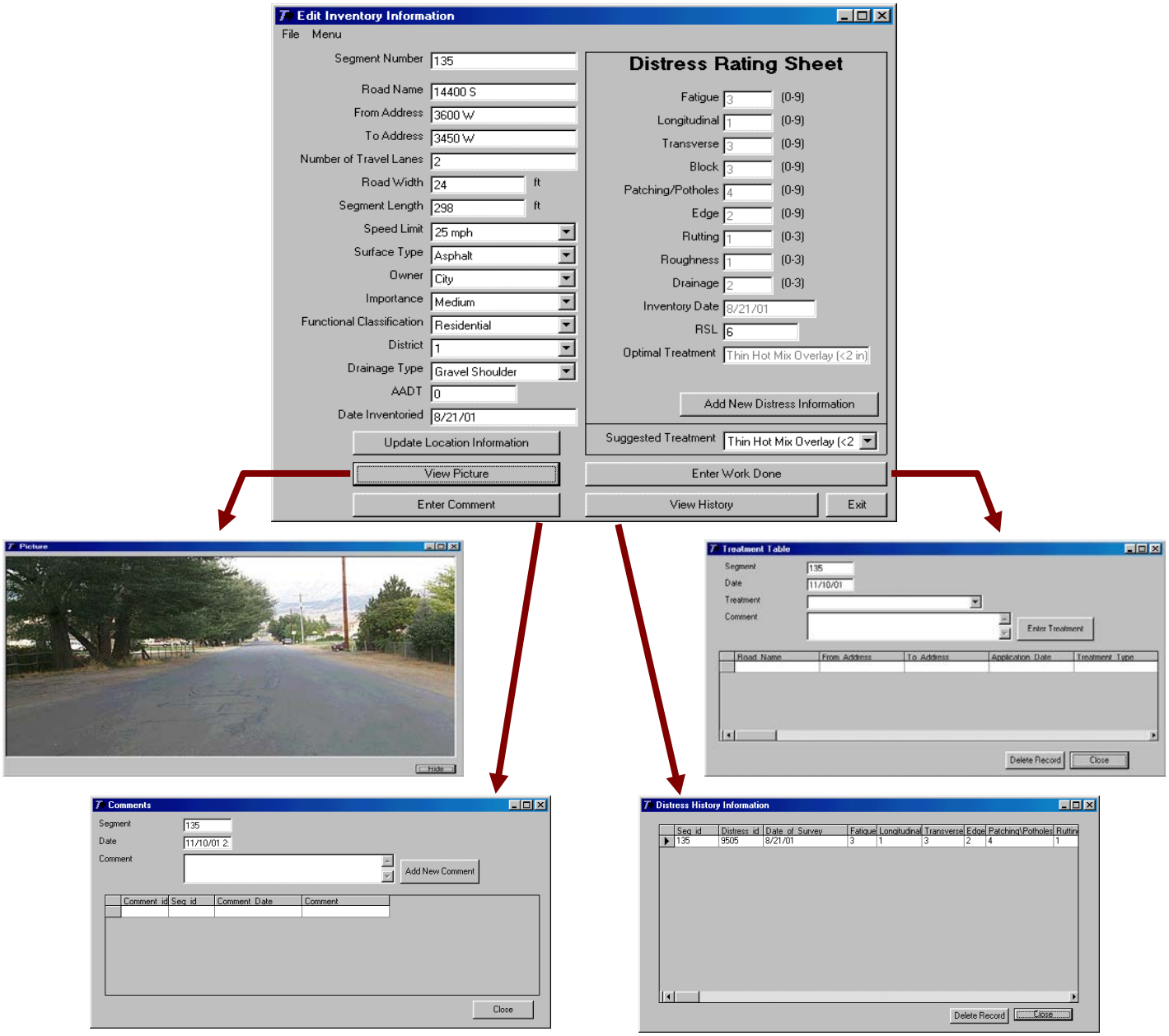


Figure 26. TAMS Inventory and Updating Forms

For documentation on the TAMS program, refer to the TAMS User's Manual.

Summary of Findings and Recommendations

Findings

Currently the streets network classifications in Silver Creek are: 7.5% of the street network is classified as minor collector and 92.5% as residential.

Analyses of the distress information of the paved street network showed that there were five major distress types prevalent in the asphalt paved streets network. Of these distress types, fatigue cracking occurred most frequently in the total streets network. The percent area of the street network affected by these distress types was previously shown in Figure 10.

Currently, the average remaining service life (RSL) for Silver Creek's entire asphalt paved street network is estimated to be 7.5 years. The percent of street network surface area with no service life left (terminal serviceability or RSL = 0) is 3.3%.

Recommendations

The pavement preservation program recommended for cities and towns is one that maintains the street network at an estimated average remaining service life (RSL) of at least 10 years with no more than three percent (3%) of the street network at the terminal serviceability level. Using the pavement preservation program presented in this report, the estimated average RSL of Silver Creek's streets network can be increased to approximately 10.8 years by the year 2026. The percent of street network surface area at the terminal serviceability level will be approximately 2.97%. In addition, the RSL distribution of the street network in terms of RSL distribution categories is improved. With the improved RSL distribution, the most cost-effective strategies and treatments can be used to maintain the street network. The Silver Creek streets network is currently in a "fair" condition. The leaders of Silver Creek should be commended for recognizing the importance of improving and preserving this valuable asset.

A three-step funding level is recommended for preserving the asphalt street networks at a high level of service. The recommended funding for step one is $222,018 per year, for step two is $228,655 per year, and for step three is $231,120. Costs of expanding the network are not included in this recommended budget. Future funding needs will likely increase due to inflation, increased pavement surface areas, increased traffic volumes, and increased material costs. All Road Funds should be allocated to pavement preservation. Additional funds required for personnel, capital improvements, and capacity improvements should come from other funding sources such as impact fees and mill levies. The details of this recommended pavement preservation program are given in Appendix H.

Community personnel need to be trained in the use of the TAMS computer program so that it may be used and maintained properly. This includes training in data collection and analysis. Community personnel will be trained and in turn they can train others. Periodic condition surveys, and updates as work is accomplished, are critical in maintaining the pavement management program. Once community personnel are fully trained, the pavement management program can be fine-tuned to fully incorporate the knowledge and experience of Silver Creek's Public Works staff.

It has been a pleasure working with Silver Creek to provide the information included in this report. The community of Silver Creek and Glenn Colvin have been extremely supportive of the work that has been done in preparing the pavement preservation program. The pavement management program can be used to maintain and improve the streets network for several years to come.

Appendix A

Inventory of Street Network

Inventory Report - Asphalt

ID	Road Name	From	To	Class	Width	Length	RSL	Area(yd)
1	Aspen Drive	House #294	House #305	Residential	15	185	0	308.3333
2	Aspen Drive	House #305	Dead End	Residential	15	171	0	285
6	Silver Creek Road	Tollgate Road	Dead End	Residential	50	83	0	461.1111
11	Echo Lane	Wasatch Lane	Parkway Drive	Residential	18	1044	0	2088
13	Green Field Drive	Wasatch Way	Dead End Sign	Residential	20	500	10	1111.111
14	Valley Drive	Silver Creek Rd	Greenfield Road	Residential	24	1291	10	3442.667
15	Whileaway Road	Parkway Drive	Wasatch Lane	Residential	18	2363	8	4726
16	Pace Place	Parkway Drive	Division Drive	Residential	24	495	0	1320
18	Shepard Way	Long Rilfle Road	Dead End	Residential	24	232	6	618.6667
19	Shepard Way	Long Rifle Road	Dead End	Residential	24	519	8	1384
20	Whileaway Road	Beehive Road	Corner	Residential	18	2102	4	4204
21	Whileaway Road	Corner	Vista Circle	Residential	18	1642	6	3284
23	Silver Creek Road	Meadowview Road	Highfield Road	Residential	21	1483	6	3460.333
24	Silver Creek Road	Highfield Road	Redden Road	Residential	21	1694	6	3952.667
25	Silver Creek Road	Redden Road	Oakridge North	Residential	21	1156	10	2697.333
26	Silver Creek Road	Oakridge North	Aspen Lane	Residential	21	128	10	298.6667
27	Silver Creek Road	Aspen Lane	Over Hill Road	Residential	21	1373	8	3203.667
28	Silver Creek Road	Over Hill Road	Tollgate Road	Residential	21	629	10	1467.667
29	Silver Creek Road	Earl Street	Parkway Drive	Minor Collector	25	250	6	694.4445
30	Redden Road	House #600	Brookwood Drive	Residential	21	788	8	1838.667
31	Redden Road	Meadowview Road	House #600	Residential	21	503	8	1173.667
32	Westwood Road	Redden Road	Brookwood Drive	Residential	21	1207	10	2816.333
33	Pace Place	Division Street	Beehive Drive	Residential	24	427	6	1138.667
34	Silver Creek Road	Parkway Drive	Valley Drive	Minor Collector	25	183	6	508.3333
35	Long Rifle Road	Parley Road	Wasatch Way	Residential	20	1034	10	2297.778
36	Whileaway Road	Wasatch Lane	Corner	Residential	18	1123	6	2246
37	Whileaway Road	Vista Circle	Corner	Residential	18	331	6	662
38	Westwood Road	Cottonwood Trail Road	Dead End	Residential	27	1153	20	3459
39	Redden Road	Bump	Meadowview Road	Residential	24	336	8	896
40	Redden Road	Silver Creek Road	Bump	Residential	24	962	8	2565.333
41	Parkway Drive	Silver Creek Road	Whileaway Road	Residential	24	1004	6	2677.333
42	Parkway Drive	Whileaway Drive	Pace Place	Residential	24	132	10	352
45	Wasatch Way	Greenfield Road	Redden Road	Residential	20	326	12	724.4445
47	Silver Creek Road	Wasatch Lane	Crescent South	Minor Collector	24	2386	6	6362.667
50	Sagebrush Place	Aspen Way	Dead End	Residential	15	539	6	898.3333
51	Over Hill Road	Silver Creek Road	Red Hawk Lane	Residential	16	280	8	497.7778
52	Redden Road	Brookwood Drive	Westwood Road	Residential	21	1913	6	4463.667
53	Westwood Road	Redden Road	Cottonwood Trail Road	Residential	27	1199	20	3597
54	Redden Road	Westwood Road	Maple Drive	Residential	21	1235	10	2881.667
57	Meadowview Road	Redden Road	Silver Creek Road	Residential	21	3710	6	8656.667
58	Brookwood Drive	Westwood Drive	Redden Road	Residential	21	2091	6	4879
59	Parleys Road	Redden Road	Long Rifle Road	Residential	20	2374	10	5275.556
60	Wasatch Way	Long Rifle Road	Greenfield Drive	Residential	20	1506	8	3346.667
61	Silver Creek Road	Westwood Road	Crescent North	Minor Collector	24	830	4	2213.333
62	Silver Creek Road	Crescent North	Meadowview Road	Minor Collector	21	1199	6	2797.667
63	Parkway Drive	Echo Lane	Echo Lane	Residential	18	1461	0	2922
64	Wasatch Way	Silver Creek Road	Long Rifle Road	Residential	24	927	6	2472
65	Wasatch Lane	Whileaway Road	Echo Lane	Residential	18	1012	10	2024
66	Long Rifle Road	Parley Road	Maple Drive	Residential	20	919	8	2042.222
67	Wasatch Lane	Whileaway Road	Silver Creek Road	Residential	24	967	20	2578.667
68	Long Rifle Road	Wasatch Way	Shepherd Way	Residential	18	1451	6	2902
70	Parkway Drive	Echo Lane	Pace Place	Residential	21	1120	6	2613.333
71	Red Hawk Lane	Over Hill Road	Dead End	Residential	16	1170	10	2080
73	Maple Drive	Long Rifle Road	Redden Road	Residential	20	2883	12	6406.667

74	Westwood Road	Silver Creek Road	Brookwood Drive	Residential	27	3277	6	9831
75	Beehive Drive	Pace Place	Echo Lane	Residential	24	2553	2	6808
76	Beehive Drive	Pace Place	Whileaway Road	Residential	24	397	8	1058.667
77	Silver Creek Road	Valley Drive	Wasatch Way	Minor Collector	25	2840	6	7888.889
78	Silver Creek Road	Wasatch Lane	Wasatch Way	Minor Collector	26	275	8	794.4445
79	Silver Creek Road	Crescent South	Westwood Rd	Minor Collector	24	419	6	1117.333
80	Tollgate Road	Silver Creek Road	Dead End	Residential	21	4048	10	9445.333
81	Aspen Lane	Silver Creek Road	Sagebrush Place	Residential	21	2161	10	5042.333
82	Maple Circle	Maple Drive	Long Rifle Road	Residential	50	55	0	305.5555
83	Aspen Drive	Sagebrush Place	House #294	Residential	15	1447	10	2411.667
86	Silver Creek Road	Division Street	Earl Street	Minor Collector	25	242	6	672.2222
87	Division Street	Silver Creek Road	Pace Place	Residential	29	1306	6	4208.222
109	Oakridge North	Silver Creek Road	Meier Drive	Residential	21	3258	6	7602
111	Oakridge South	Meier Drive	Silver Creek Road	Residential	24	3031	2	8082.667
112	Highfield Road	Silver Creek Road	End of pavement	Residential	21	925	8	2158.333
115	Crescent North	Silver Creek Road	End of Pavement	Residential	20	2009	6	4464.444
117	South Crescent	Silver Creek Road	End of Pavement	Residential	20	2622	8	5826.667
118	Greenfield Road	Valley Drive	Greenfield Road	Residential	24	1209	10	3224
119	Greenfield Road	Greenfield Road	Dead End	Residential	24	1293	8	3448
120	Earl Street	Commerse Street	Dead End	Residential	24	1660	10	4426.667
121	Earl Street	Commerse Street	Silver Creek Road	Residential	20	913	10	2028.889
122	Rae Circle	Greenfield Drive	Dead End	Residential	24	392	20	1045.333
123	Wasatch Way	Greenfield Drive	Rae Circle	Residential	24	1170	14	3120

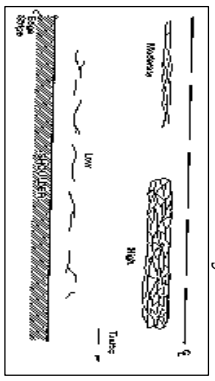
Inventory Report - Unpaved

ID	Road Name	From	To	Class	Width	Length	RSL	Area (yd)
10	Wasatch Way	Redden Road	Corner	Residential	21	823	5	1920.333
12	Echo Lane	Parkway Drive	Beehive Drive	Residential	22	945	7	2310
17	Highfield Road	Crescent North/South	Pace Road	Residential	19	3584	7	7566.222
22	Linger Lane	Oakridge South	Dead End	Residential	19	879	7	1855.667
43	Redden Road	Westwood Drive	Parleys Road	Residential	21	929	4	2167.667
44	Redden Road	Parley's Road	Wasatch Way	Residential	21	1237	7	2886.333
46	East Summit Drive	Over Hill Drive	Dead End	Residential	19	2141	7	4519.889
48	Echo Lane	Parkway Drive	Wasatch Lane	Residential	22	1083	7	2647.333
49	Oakridge South	Linger Lane	Middle of Curve	Residential	19	557	7	1175.889
55	Cottonwood Trail Road	Westwood Road	Dead End	Residential	20	1746	7	3880
56	Pace Road	Highfield Road	Silver Creek Road	Residential	19	2798	5	5906.889
69	Vista Circle	Whileaway Road	Dead End	Residential	15	558	6	930
84	Highfield Road	House #8822	Pace Road	Residential	19	979	8	2066.778
85	Wasatch Way	Corner	Dead End	Residential	16	1093	7	1943.111
90	Meier Drive	Oakridge North	Oakridge South	Residential	16	1211	4	2152.889
91	Cottonwood Trail Road	Westwood Road	Dead End	Residential	20	4078	6	9062.223
108	Oakridge North	Middle of Curve	Meier Drive	Residential	19	1980	7	4180
110	Oakridge South	Meier Drive	Linger Lane	Residential	19	1061	8	2239.889
113	Highfield Road	End of Pavement	House #8822	Residential	19	1747	8	3688.111
114	Crescent North	Highfield Road	End of Pavement	Residential	16	1271	7	2259.556
116	Crescent South	End of Pavement	Highfield Rd	Residential	16	1280	7	2275.556

Appendix B

Condition Survey Evaluation Sheet

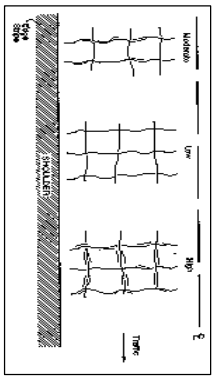
FATIGUE CRACKING



Extent

Severity	Low	Medium	High
0 None	1 Crack WP or 1' off C&G Length	2 Crack WP or 1'-2' off C&G Length	>30% of Surface Area or Length
Low Cracks < 1/4"	1	2	3
Mediu m Cracks 1/4"to 3/4"	4	5	6
High Cracks > 3/4"	7	8	9

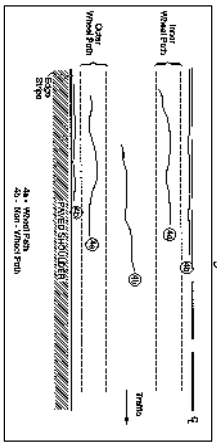
BLOCK CRACKING



Extent

Severity	Low	Medium	High
0 None	> 15'x15' Squares	15'-10'x Squares	< 10'x10' Squares
Low Cracks < 1/4"	1	2	3
Mediu m Cracks 1/4"to 3/4"	4	5	6
High Cracks > 3/4"	7	8	9

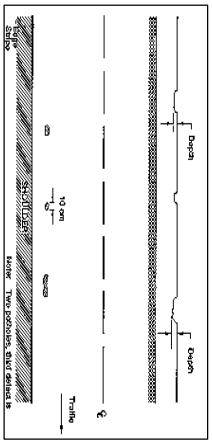
LONGITUDINAL CRACKING



Extent

Severity	Low	Medium	High
0 None	1 Crack Full Length	2 Cracks Full Length	> 2 Cracks Full Length
Low Cracks < 1/4"	1	2	3
Mediu m Cracks 1/4"to 3/4"	4	5	6
High Cracks > 3/4"	7	8	9

UTILITY CUTS

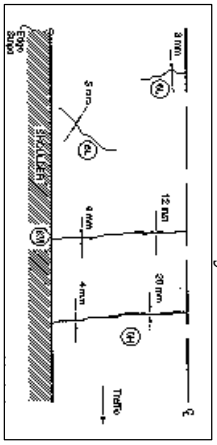


Extent

Severity	Low	Medium	High
0 None	0-10% of Length	10-30% of Length	>30% of Length
Low Cracks < 1/4"	1	2	3
Mediu m Cracks 1/4"to 3/4"	4	5	6
High Cracks > 3/4"	7	8	9

Note: to rate potholes use the same form with the following changes to the severity: **Low** is <1" deep, **Med** is 1"-2" deep and **High** is >2"

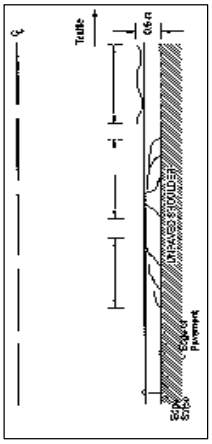
TRANSVERSE CRACKING



Extent

Severity	Low	Medium	High
0 None	> 100' between Cracks	100'-20' between Cracks	< 20' between Cracks
Low Cracks < 1/4"	1	2	3
Mediu m Cracks 1/4"to 3/4"	4	5	6
High Cracks > 3/4"	7	8	9

EDGE CRACKING



Extent

Severity	Low	Medium	High
0 None	0-10% of Length	10-30% of Length	> 30% of Length
Low 0-6" from Curb	1	2	3
Mediu m 6-18" from Curb	4	5	6
High 18" from Curb	7	8	9

Drainage / Roughness

Excellent	Good	Fair	Poor

Rutting

Excellent	Low	Med	High
0	<3/8"	1/2"-3/4"	>3/4"

STREETS: _____

SECTION NO: _____

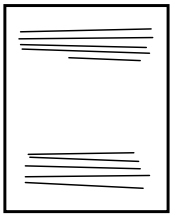
START: _____

END: _____

START MILEAGE: _____

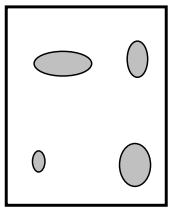
END MILEAGE: _____

CORRUGATIONS



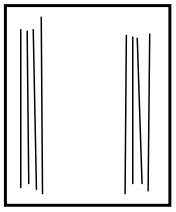
SEVERITY	NO Defects	EXTENT: Low	EXTENT: Med	EXTENT: High
Low		1	2	3
Med		4	5	6
High		7	8	9

POTHOLES



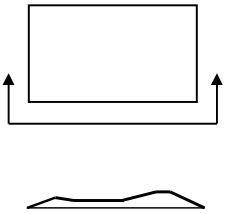
SEVERITY	NO Defects	EXTENT: Low	EXTENT: Med	EXTENT: High
Low		1	2	3
Med		4	5	6
High		7	8	9

RUTTING



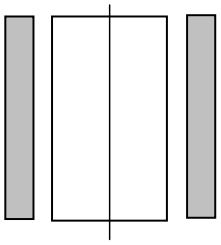
SEVERITY	NO Defects	EXTENT: Low	EXTENT: Med	EXTENT: High
Low (<1 in.)		1	2	3
Med (1 - 3 in.)		4	5	6
High (>3 in.)		7	8	9

IMPROPER X-SECTION



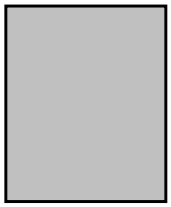
SEVERITY	CONDITION
	GOOD
	FAIR
	POOR

ROADSIDE DRAINAGE



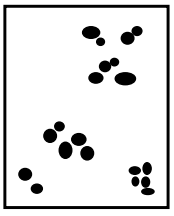
SEVERITY	CONDITION
	GOOD
	FAIR
	POOR

DUST



SEVERITY	CONDITION
	LIGHT
	MEDIUM
	HEAVY

LOOSE AGGREGATE



SEVERITY	NO Defects	EXTENT: Low	EXTENT: Med	EXTENT: High
Low		1	2	3
Med		4	5	6
High		7	8	9

Appendix C

Condition Survey of Street Network

Condition Report - Asphalt

ID	Road Name	From	To	RSL	Transverse	Longitudinal	Block	Fatigue	Patch	Edge	Rutting	Roughness	Drainage	Survey Date
1	Aspen Drive	House #294	House #305	0	0	0	0	9	0	0	0	0	0	13-Jun-16
2	Aspen Drive	House #305	Dead End	0	0	0	0	9	0	0	0	0	0	13-Jun-16
6	Silver Creek Road	Tollgate Road	Dead End	0	0	0	0	9	0	0	0	0	0	13-Jun-16
11	Echo Lane	Wasatch Lane	Parkway Drive	0	0	0	0	9	0	0	0	0	0	06-Jun-16
13	Green Field Drive	Wasatch Way	Dead End Sign	10	0	0	0	1	0	1	0	1	0	06-Jun-16
14	Valley Drive	Silver Creek Rd	Greenfield Road	10	1	4	0	1	0	0	0	0	0	06-Jun-16
15	Whileaway Road	Parkway Drive	Wasatch Lane	8	2	1	0	4	7	7	0	0	0	06-Jun-16
16	Pace Place	Parkway Drive	Division Drive	0	0	0	0	9	0	4	0	0	0	06-Jun-16
18	Shepard Way	Long Rilfle Road	Dead End	6	8	0	0	0	0	4	0	0	0	06-Jun-16
19	Shepard Way	Long Rifle Road	Dead End	8	7	0	0	4	0	4	1	0	0	06-Jun-16
20	Whileaway Road	Beehive Road	Corner	4	1	0	0	6	7	7	0	0	0	06-Jun-16
21	Whileaway Road	Corner	Vista Circle	6	1	0	0	7	0	7	0	0	0	06-Jun-16
23	Silver Creek Road	Meadowview Road	Highfield Road	6	2	0	0	5	0	7	0	1	0	13-Jun-16
24	Silver Creek Road	Highfield Road	Redden Road	6	8	7	0	7	0	7	1	0	0	13-Jun-16
25	Silver Creek Road	Redden Road	Oakridge North	10	5	0	0	1	0	0	1	1	0	13-Jun-16
26	Silver Creek Road	Oakridge North	Aspen Lane	10	4	0	0	1	0	0	0	0	0	13-Jun-16
27	Silver Creek Road	Aspen Lane	Over Hill Road	8	5	0	0	4	1	0	0	0	0	13-Jun-16
28	Silver Creek Road	Over Hill Road	Tollgate Road	10	7	0	0	0	0	0	0	0	0	13-Jun-16
29	Silver Creek Road	Earl Street	Parkway Drive	6	8	7	0	5	0	0	0	0	0	13-Jun-16
30	Redden Road	House #600	Brookwood Drive	8	0	0	0	4	0	5	0	0	0	13-Jun-16
31	Redden Road	Meadowview Road	House #600	8	0	0	0	4	0	5	0	0	0	13-Jun-16
32	Westwood Road	Redden Road	Brookwood Drive	10	0	0	0	1	0	1	0	0	0	13-Jun-16
33	Pace Place	Division Street	Beehive Drive	6	1	0	0	7	1	4	0	0	0	06-Jun-16
34	Silver Creek Road	Parkway Drive	Valley Drive	6	0	7	0	5	0	7	0	0	0	13-Jun-16
35	Long Rifle Road	Parley Road	Wasatch Way	10	1	0	0	1	0	1	0	0	0	06-Jun-16
36	Whileaway Road	Wasatch Lane	Corner	6	2	1	0	7	4	7	0	0	0	06-Jun-16
37	Whileaway Road	Vista Circle	Corner	6	0	0	0	7	4	0	0	0	0	06-Jun-16
38	Westwood Road	Cottonwood Trail Road	Dead End	20	0	0	0	0	0	0	0	0	0	13-Jun-16
39	Redden Road	Bump	Meadowview Road	8	0	0	0	4	0	4	0	0	0	13-Jun-16
40	Redden Road	Silver Creek Road	Bump	8	0	0	0	4	2	4	0	0	0	13-Jun-16
41	Parkway Drive	Silver Creek Road	Whileaway Road	6	5	7	0	7	0	3	0	0	0	13-Jun-16
42	Parkway Drive	Whileaway Drive	Pace Place	10	1	0	0	1	0	0	0	0	0	06-Jun-16
45	Wasatch Way	Greenfield Road	Redden Road	12	0	0	0	0	4	1	0	0	0	06-Jun-16
47	Silver Creek Road	Wasatch Lane	Crescent South	6	0	0	0	7	2	7	1	1	1	13-Jun-16
50	Sagebrush Place	Aspen Way	Dead End	6	0	0	0	3	7	1	0	0	0	13-Jun-16
51	Over Hill Road	Silver Creek Road	Red Hawk Lane	8	7	0	0	4	0	0	0	0	0	13-Jun-16
52	Redden Road	Brookwood Drive	Westwood Road	6	0	0	0	5	1	0	0	0	0	13-Jun-16
53	Westwood Road	Redden Road	Cottonwood Trail Road	20	0	0	0	0	0	0	0	0	0	13-Jun-16
54	Redden Road	Westwood Road	Maple Drive	10	0	0	0	1	0	1	0	0	0	13-Jun-16
57	Meadowview Road	Redden Road	Silver Creek Road	6	0	0	0	5	7	1	1	1	1	13-Jun-16
58	Brookwood Drive	Westwood Drive	Redden Road	6	0	0	0	5	0	6	0	0	0	13-Jun-16
59	Parleys Road	Redden Road	Long Rifle Road	10	0	0	0	0	1	4	0	0	0	06-Jun-16
60	Wasatch Way	Long Rifle Road	Greenfield Drive	8	0	0	0	4	4	5	0	1	0	06-Jun-16
61	Silver Creek Road	Westwood Road	Crescent North	4	8	1	0	6	0	9	0	0	0	13-Jun-16

62	Silver Creek Road	Crescent North	Meadowview Road	6	2	0	0	5	0	0	0	0	0	13-Jun-16
63	Parkway Drive	Echo Lane	Echo Lane	0	0	0	0	9	0	0	0	2	0	06-Jun-16
64	Wasatch Way	Silver Creek Road	Long Rifle Road	6	1	0	0	7	1	4	0	1	0	06-Jun-16
65	Wasatch Lane	Whileaway Road	Echo Lane	10	0	0	0	1	0	1	0	0	0	06-Jun-16
66	Long Rifle Road	Parley Road	Maple Drive	8	1	0	0	1	0	5	0	0	0	06-Jun-16
67	Wasatch Lane	Whileaway Road	Silver Creek Road	20	0	0	0	0	0	0	0	0	0	06-Jun-16
68	Long Rifle Road	Wasatch Way	Shepherd Way	6	8	1	0	4	4	7	0	1	0	06-Jun-16
70	Parkway Drive	Echo Lane	Pace Place	6	1	0	0	7	4	4	0	0	0	06-Jun-16
71	Red Hawk Lane	Over Hill Road	Dead End	10	5	0	0	1	1	1	0	0	0	13-Jun-16
73	Maple Drive	Long Rifle Road	Redden Road	12	2	0	0	0	0	1	0	0	0	06-Jun-16
74	Westwood Road	Silver Creek Road	Brookwood Drive	6	1	0	0	5	4	5	1	1	0	13-Jun-16
75	Beehive Drive	Pace Place	Echo Lane	2	4	0	0	8	7	7	0	1	0	06-Jun-16
76	Beehive Drive	Pace Place	Whileaway Road	8	2	0	0	4	0	1	0	0	0	06-Jun-16
77	Silver Creek Road	Valley Drive	Wasatch Way	6	8	7	0	4	0	4	0	1	2	13-Jun-16
78	Silver Creek Road	Wasatch Lane	Wasatch Way	8	0	0	0	4	4	2	2	0	0	06-Jun-16
79	Silver Creek Road	Crescent South	Westwood Rd	6	8	0	0	4	0	0	1	0	0	13-Jun-16
80	Tollgate Road	Silver Creek Road	Dead End	10	1	0	0	1	0	1	0	0	0	13-Jun-16
81	Aspen Lane	Silver Creek Road	Sagebrush Place	10	0	0	0	1	4	1	0	0	0	13-Jun-16
82	Maple Circle	Maple Drive	Long Rifle Road	0	0	0	0	9	0	0	0	0	0	06-Jun-16
83	Aspen Drive	Sagebrush Place	House #294	10	0	0	0	1	7	1	0	1	0	13-Jun-16
86	Silver Creek Road	Division Street	Earl Street	6	8	7	0	7	0	0	1	0	0	13-Jun-16
87	Division Street	Silver Creek Road	Pace Place	6	0	0	1	7	7	1	0	0	0	06-Jun-16
109	Oakridge North	Silver Creek Road	Meier Drive	6	0	0	0	7	7	4	2	2	1	13-Jun-16
111	Oakridge South	Meier Drive	Silver Creek Road	2	0	0	0	4	9	7	2	0	0	13-Jun-16
112	Highfield Road	Silver Creek Road	End of pavement	8	0	0	0	4	0	4	1	1	0	13-Jun-16
115	Crescent North	Silver Creek Road	End of Pavement	6	0	0	0	5	7	5	0	0	0	13-Jun-16
117	South Crescent	Silver Creek Road	End of Pavement	8	0	0	0	4	7	4	1	1	0	13-Jun-16
118	Greenfield Road	Valley Drive	Greenfield Road	10	0	0	0	1	1	1	0	0	0	06-Jun-16
119	Greenfield Road	Greenfield Road	Dead End	8	1	1	0	4	0	1	0	0	0	06-Jun-16
120	Earl Street	Commerse Street	Dead End	10	1	0	0	1	0	0	0	0	0	06-Jun-16
121	Earl Street	Commerse Street	Silver Creek Road	10	0	0	0	0	0	4	0	0	0	06-Jun-16
122	Rae Circle	Greenfield Drive	Dead End	20	0	0	0	0	0	0	0	0	0	06-Jun-16
123	Wasatch Way	Greenfield Drive	Rae Circle	14	0	1	0	0	0	0	0	0	0	06-Jun-16

Condition Report - Unpaved

ID	Road Name	From	To	RSL	Cross Section	Drainage	Rutting	Pot Holes	Loose Aggregate	Dust	Corrugations
10	Wasatch Way	Redden Road	Corner	5	0	1	2	0	5	1	5
12	Echo Lane	Parkway Drive	Beehive Drive	7	0	0	1	1	5	1	1
17	Highfield Road	Crescent North/South	Pace Road	7	0	1	1	2	3	1	2
22	Linger Lane	Oakridge South	Dead End	7	0	0	1	0	1	1	2
43	Redden Road	Westwood Drive	Parleys Road	4	1	2	0	1	0	1	1
44	Redden Road	Parley's Road	Wasatch Way	7	0	1	1	2	2	1	2
46	East Summit Drive	Over Hill Drive	Dead End	7	0	1	1	2	1	1	2
48	Echo Lane	Parkway Drive	Wasatch Lane	7	0	0	1	1	2	0	1
49	Oakridge South	Linger Lane	Middle of Curve	7	0	0	0	0	2	0	2
55	Cottonwood Trail Road	Westwood Road	Dead End	7	1	0	1	4	0	1	0
56	Pace Road	Highfield Road	Silver Creek Road	5	1	0	2	1	1	1	1
69	Vista Circle	Whileaway Road	Dead End	6	0	0	0	1	4	1	4
84	Highfield Road	House #8822	Pace Road	8	0	0	0	1	0	1	0
85	Wasatch Way	Corner	Dead End	7	0	1	1	0	0	0	0
90	Meier Drive	Oakridge North	Oakridge South	4	1	1	1	5	6	1	2
91	Cottonwood Trail Road	Westwood Road	Dead End	6	0	1	1	1	1	1	4
108	Oakridge North	Middle of Curve	Meier Drive	7	1	1	0	0	1	1	2
110	Oakridge South	Meier Drive	Linger Lane	8	0	1	0	0	2	1	1
113	Highfield Road	End of Pavement	House #8822	8	0	1	0	0	2	0	1
114	Crescent North	Highfield Road	End of Pavement	7	1	0	1	1	2	1	2
116	Crescent South	End of Pavement	Highfield Rd	7	1	1	0	0	2	1	1

Appendix D

Distress Deterioration Table and Recommended Preservation Strategies

Asphalt

Fatigue_id	Severity & Extent	RSL_Fatigue	Strategy
0	No Fatigue Cracking	20	Routine
1	Low,Low	16	Routine
2	Low, Medium	10	Preventative
3	Low, High	6	Rehabilitation
4	Medium, Low	12	Preventative
5	Medium, Medium	8	Preventative
6	Medium, High	4	Rehabilitation
7	High, Low	10	Preventative
8	High, Medium	6	Rehabilitation
9	High, High	0	Reconstruct

Transverse_id	Severity & Extent	RSL_Transverse	Strategy
0	No Cracking	20	Routine
1	Low,Low	16	Routine
2	Low, Medium	14	Routine
3	Low, High	8	Preventative
4	Medium, Low	12	Preventative
5	Medium, Medium	10	Preventative
6	Medium, High	8	Preventative
7	High, Low	10	Preventative
8	High, Medium	6	Rehabilitation
9	High, High	2	Reconstruct

Longitudinal_id	Severity & Extent	RSL_Longitudinal	Strategy
0	No Cracking	20	Routine
1	Low,Low	16	Routine
2	Low, Medium	12	Preventative
3	Low, High	10	Preventative
4	Medium, Low	12	Preventative
5	Medium, Medium	10	Preventative
6	Medium, High	8	Preventative
7	High, Low	10	Preventative
8	High, Medium	8	Preventative
9	High, High	6	Rehabilitation

Patch_id	Severity & Extent	RSL_Patch	Strategy
0	No Cracking	20	Routine
1	Low,Low	16	Routine
2	Low, Medium	12	Preventative
3	Low, High	10	Preventative
4	Medium, Low	12	Preventative
5	Medium, Medium	10	Preventative
6	Medium, High	8	Preventative
7	High, Low	10	Preventative
8	High, Medium	8	Preventative
9	High, High	6	Rehabilitation

Asphalt

Edge_id	Severity & Extent	RSL_Edge	Strategy
0	No Cracking	20	Routine
1	Low,Low	12	No Maintenance
2	Low, Medium	10	Preventative
3	Low, High	8	Preventative
4	Medium, Low	10	Preventative
5	Medium, Medium	8	Preventative
6	Medium, High	6	Rehabilitation
7	High, Low	8	Preventative
8	High, Medium	6	Rehabilitation
9	High, High	4	Rehabilitation

Block_id	Severity & Extent	RSL_Block	Strategy
0	No Cracking	20	Routine
1	Low,Low	12	Routine
2	Low, Medium	10	Preventative
3	Low, High	8	Preventative
4	Medium, Low	10	Preventative
5	Medium, Medium	8	Preventative
6	Medium, High	6	Rehabilitation
7	High, Low	12	Preventative
8	High, Medium	6	Rehabilitation
9	High, High	2	Reconstruct

Rutting_id	Rating	RSL_Rutting	Strategy
0	No Rutting	20	Routine
1	Low	16	Routine
2	Medium	10	Preventative
3	High	4	Rehabilitation

Roughness_id	Rating	RSL_Roughness	Strategy
0	Smooth	20	Routine
1	Low	16	Routine
2	Medium	10	Preventative
3	High	4	Rehabilitation

Drainage_id	Rating
0	Excellent
1	Good
2	Fair
3	Poor

Unpaved Corrugate_id	Severity & Extent	RSL	Strategy	All_Maint_Dec
0	No Corrugation	10	No Maintenance	No Maintenance
1	Low, Low	9	No Maintenance	No Maintenance
2	Low, Medium	7	No Maintenance	No Maintenance
3	Low, High	7	No Maintenance	No Maintenance
4	Medium, Low	7	No Maintenance	No Maintenance
5	Medium, Medium	6	Routine	Routine Regrading
6	Medium, High	6	Routine	Routine Regrading
7	High, Low	6	Rehabilitation	MGCHL Stabilization
8	High, Medium	5	Routine	Major Regrading
9	High, High	5	Routine	Major Regrading

Unpaved Dust_id	Severity & Extent	RSL	Strategy	Blo_Maint_Dec
0	Excellent	10	No Maintenance	No Maintenance
1	Good	10	No Maintenance	No Maintenance
2	Fair	8	Preventative	Dust Control
3	Poor	6	Preventative	Dust Control

Unpaved Loose Aggregate_id	Severity & Extent	RSL	Strategy	Edg_Maint_Dec
0	No Loose Aggregate	10	No Maintenance	No Maintenance
1	Low, Low	9	No Maintenance	No Maintenance
2	Low, Medium	9	No Maintenance	No Maintenance
3	Low, High	9	No Maintenance	No Maintenance
4	Medium, Low	8	No Maintenance	No Maintenance
5	Medium, Medium	7	Routine	Routine Regrading
6	Medium, High	7	Routine	Routine Regrading
7	High, Low	7	Routine	Routine Regrading
8	High, Medium	6	Routine	Routine Regrading
9	High, High	6	Routine	Routine Regrading

Unpaved Potholes_id	Severity & Extent	RSL	Strategy	Lon_Maint_Dec
0	No Potholes	10	No Maintenance	No Maintenance
1	Low, Low	9	No Maintenance	No Maintenance
2	Low, Medium	7	No Maintenance	No Maintenance
3	Low, High	5	No Maintenance	No Maintenance
4	Medium, Low	7	Rehabilitation	Lime/Flyash Stabilization
5	Medium, Medium	4	Routine	Routine Regrading
6	Medium, High	4	Routine	Routine Regrading

7	High, Low	4	Rehabilitation	Lime/Flyash Stabilization
8	High, Medium	2	Routine	Major Regrading
9	High, High	0	Routine	Major Regrading

Unpaved X-Section_id	Severity & Extent	RSL	Strategy	Pat_Maint_Dec
0	No X-Section	10	No Maintenance	No Maintenance
1	Low, Low	7	No Maintenance	No Maintenance
2	Low, Medium	4	Routine	Routine Regrading
3	Low, High	0	Routine	Major Regrading

Unpaved Rutting_id	Rating	RSL	Strategy	Rut_Maint_Dec
0	No Rutting	10	No Maintenance	No Maintenance
1	Low	7	No Maintenance	No Maintenance
2	Medium	4	Routine	Routine Regrading
3	High	0	Routine	Major Regrading

Unpaved Drainage_id	Rating	Strategy	Dra_Maint_Dec
0	Excellent	No Maintenance	No Maintenance
1	Good	No Maintenance	No Maintenance
2	Fair	Preventative	Regravel Road
3	Poor	Preventative	Regravel Road

Appendix E

Recommended Preservation Strategies for Each Street Segment

Treatment Recommendations - Asphalt

ID	Road Name	From	To	Class	Treatment	Area (yd^2)	Unit Cost
1	Aspen Drive	House #294	House #305	Residential	Thick Overlay (3 in.)	308.33	$4,625.00
2	Aspen Drive	House #305	Dead End	Residential	Thick Overlay (3 in.)	285.00	$4,275.00
6	Silver Creek Road	Tollgate Road	Dead End	Residential	Thick Overlay (3 in.)	461.11	$6,916.67
11	Echo Lane	Wasatch Lane	Parkway Drive	Residential	Thick Overlay (3 in.)	2088.00	$31,320.00
13	Green Field Drive	Wasatch Way	Dead End Sign	Residential	Cold Patch	1111.11	$500.00
14	Valley Drive	Silver Creek Rd	Greenfield Road	Residential	Single Chip Seal	3442.67	$6,713.20
15	Whileaway Road	Parkway Drive	Wasatch Lane	Residential	Thin Hot Mix Overlay (2 in.)	4726.00	$47,874.38
16	Pace Place	Parkway Drive	Division Drive	Residential	Thick Overlay (3 in.)	1320.00	$19,800.00
18	Shepard Way	Long Rilfle Road	Dead End	Residential	Thick Overlay (3 in.)	618.67	$9,280.00
19	Shepard Way	Long Rifle Road	Dead End	Residential	Thin Hot Mix Overlay (2 in.)	1384.00	$14,019.92
20	Whileaway Road	Beehive Road	Corner	Residential	Thick Overlay (3 in.)	4204.00	$63,060.00
21	Whileaway Road	Corner	Vista Circle	Residential	Thick Overlay (3 in.)	3284.00	$49,260.00
23	Silver Creek Road	Meadowview Road	Highfield Road	Residential	Thick Overlay (3 in.)	3460.33	$51,905.00
24	Silver Creek Road	Highfield Road	Redden Road	Residential	Thick Overlay (3 in.)	3952.67	$59,290.01
25	Silver Creek Road	Redden Road	Oakridge North	Residential	Single Chip Seal	2697.33	$5,259.80
26	Silver Creek Road	Oakridge North	Aspen Lane	Residential	Single Chip Seal	298.67	$582.40
27	Silver Creek Road	Aspen Lane	Over Hill Road	Residential	Thin Hot Mix Overlay (2 in.)	3203.67	$32,453.15
28	Silver Creek Road	Over Hill Road	Tollgate Road	Residential	Crack Seal	1467.67	$660.45
29	Silver Creek Road	Earl Street	Parkway Drive	Minor Collector	Thick Overlay (3 in.)	694.44	$10,416.67
30	Redden Road	House #600	Brookwood Drive	Residential	Thin Hot Mix Overlay (2 in.)	1838.67	$18,625.70
31	Redden Road	Meadowview Road	House #600	Residential	Thin Hot Mix Overlay (2 in.)	1173.67	$11,889.25
32	Westwood Road	Redden Road	Brookwood Drive	Residential	Single Chip Seal	2816.33	$5,491.85
33	Pace Place	Division Street	Beehive Drive	Residential	Thick Overlay (3 in.)	1138.67	$17,080.01
34	Silver Creek Road	Parkway Drive	Valley Drive	Minor Collector	Thick Overlay (3 in.)	508.33	$7,625.00
35	Long Rifle Road	Parley Road	Wasatch Way	Residential	Single Chip Seal	2297.78	$4,480.67
36	Whileaway Road	Wasatch Lane	Corner	Residential	Thick Overlay (3 in.)	2246.00	$33,690.00
37	Whileaway Road	Vista Circle	Corner	Residential	Thick Overlay (3 in.)	662.00	$9,930.00
38	Westwood Road	Cottonwood Trail Road	Dead End	Residential	No Maintenance	3459.00	$0.00
39	Redden Road	Bump	Meadowview Road	Residential	Thin Hot Mix Overlay (2 in.)	896.00	$9,076.48
40	Redden Road	Silver Creek Road	Bump	Residential	Thin Hot Mix Overlay (2 in.)	2565.33	$25,986.82
41	Parkway Drive	Silver Creek Road	Whileaway Road	Residential	Thick Overlay (3 in.)	2677.33	$40,160.00
42	Parkway Drive	Whileaway Drive	Pace Place	Residential	Single Chip Seal	352.00	$686.40
45	Wasatch Way	Greenfield Road	Redden Road	Residential	Cold Patch	724.44	$326.00
47	Silver Creek Road	Wasatch Lane	Crescent South	Minor Collector	Thick Overlay (3 in.)	6362.67	$95,440.01
50	Sagebrush Place	Aspen Way	Dead End	Residential	Thin Hot Mix Overlay (2 in.)	898.33	$9,100.12

51	Over Hill Road	Silver Creek Road	Red Hawk Lane	Residential	Thin Hot Mix Overlay (2 in.)	497.78	$5,042.49
52	Redden Road	Brookwood Drive	Westwood Road	Residential	Thick Overlay (3 in.)	4463.67	$66,955.01
53	Westwood Road	Redden Road	Cottonwood Trail Road	Residential	No Maintenance	3597.00	$0.00
54	Redden Road	Westwood Road	Maple Drive	Residential	Single Chip Seal	2881.67	$5,619.25
57	Meadowview Road	Redden Road	Silver Creek Road	Residential	Thick Overlay (3 in.)	8656.67	$129,850.01
58	Brookwood Drive	Westwood Drive	Redden Road	Residential	Thick Overlay (3 in.)	4879.00	$73,185.00
59	Parleys Road	Redden Road	Long Rifle Road	Residential	Single Chip Seal	5275.56	$10,287.33
60	Wasatch Way	Long Rifle Road	Greenfield Drive	Residential	Thin Hot Mix Overlay (2 in.)	3346.67	$33,901.74
61	Silver Creek Road	Westwood Road	Crescent North	Minor Collector	Thick Overlay (3 in.)	2213.33	$33,200.00
62	Silver Creek Road	Crescent North	Meadowview Road	Minor Collector	Thick Overlay (3 in.)	2797.67	$41,965.01
63	Parkway Drive	Echo Lane	Echo Lane	Residential	Thick Overlay (3 in.)	2922.00	$43,830.00
64	Wasatch Way	Silver Creek Road	Long Rifle Road	Residential	Thick Overlay (3 in.)	2472.00	$37,080.00
65	Wasatch Lane	Whileaway Road	Echo Lane	Residential	Single Chip Seal	2024.00	$30,360.00
66	Long Rifle Road	Parley Road	Maple Drive	Residential	Thin Hot Mix Overlay (2 in.)	2042.22	$20,687.71
67	Wasatch Lane	Whileaway Road	Silver Creek Road	Residential	No Maintenance	2578.67	$0.00
68	Long Rifle Road	Wasatch Way	Shepherd Way	Residential	Thick Overlay (3 in.)	2902.00	$43,530.00
70	Parkway Drive	Echo Lane	Pace Place	Residential	Thick Overlay (3 in.)	2613.33	$39,200.00
71	Red Hawk Lane	Over Hill Road	Dead End	Residential	Single Chip Seal	2080.00	$4,056.00
73	Maple Drive	Long Rifle Road	Redden Road	Residential	Crack Seal	6406.67	$2,883.00
74	Westwood Road	Silver Creek Road	Brookwood Drive	Residential	Thick Overlay (3 in.)	9831.00	$147,465.00
75	Beehive Drive	Pace Place	Echo Lane	Residential	Thick Overlay (3 in.)	6808.00	$102,120.00
76	Beehive Drive	Pace Place	Whileaway Road	Residential	Thin Hot Mix Overlay (2 in.)	1058.67	$10,724.30
77	Silver Creek Road	Valley Drive	Wasatch Way	Minor Collector	Thick Overlay (3 in.)	7888.89	$118,333.34
78	Silver Creek Road	Wasatch Lane	Wasatch Way	Minor Collector	Thin Hot Mix Overlay (2 in.)	794.44	$8,047.72
79	Silver Creek Road	Crescent South	Westwood Rd	Minor Collector	Thick Overlay (3 in.)	1117.33	$16,760.00
80	Tollgate Road	Silver Creek Road	Dead End	Residential	Single Chip Seal	9445.33	$18,418.40
81	Aspen Lane	Silver Creek Road	Sagebrush Place	Residential	Single Chip Seal	5042.33	$9,832.55
82	Maple Circle	Maple Drive	Long Rifle Road	Residential	Thick Overlay (3 in.)	305.56	$4,583.33
83	Aspen Drive	Sagebrush Place	House #294	Residential	Cold Patch	2411.67	$1,085.25
86	Silver Creek Road	Division Street	Earl Street	Minor Collector	Thick Overlay (3 in.)	672.22	$10,083.33
87	Division Street	Silver Creek Road	Pace Place	Residential	Thick Overlay (3 in.)	4208.22	$63,123.33
109	Oakridge North	Silver Creek Road	Meier Drive	Residential	Thick Overlay (3 in.)	7602.00	$114,030.00
111	Oakridge South	Meier Drive	Silver Creek Road	Residential	Thick Overlay (3 in.)	8082.67	$121,240.01
112	Highfield Road	Silver Creek Road	End of pavement	Residential	Thin Hot Mix Overlay (2 in.)	2158.33	$21,863.91
115	Crescent North	Silver Creek Road	End of Pavement	Residential	Thick Overlay (3 in.)	4464.44	$66,966.66
117	South Crescent	Silver Creek Road	End of Pavement	Residential	Thin Hot Mix Overlay (2 in.)	5826.67	$59,024.14
118	Greenfield Road	Valley Drive	Greenfield Road	Residential	Single Chip Seal	3224.00	$6,286.80

119	Greenfield Road	Greenfield Road	Dead End	Residential	Thin Hot Mix Overlay (2 in.)	3448.00	$34,928.24
120	Earl Street	Commerse Street	Dead End	Residential	Single Chip Seal	4426.67	$8,632.00
121	Earl Street	Commerse Street	Silver Creek Road	Residential	Cold Patch	2028.89	$913.00
122	Rae Circle	Greenfield Drive	Dead End	Residential	No Maintenance	1045.33	$0.00
123	Wasatch Way	Greenfield Drive	Rae Circle	Residential	Crack Seal	3120.00	$1,404.00

Treatment Recommendations - Unpaved

ID	Road Name	From	To	Class	Treatment	Area (yd^2)
10	Wasatch Way	Redden Road	Corner	Residential	Reclaim Gravel & Compact (M/D)	1920.333
12	Echo Lane	Parkway Drive	Beehive Drive	Residential	Blade & Maintain Crown	2310
17	Highfield Road	Crescent North/South	Pace Road	Residential	Blade & Maintain Crown	7566.222
22	Linger Lane	Oakridge South	Dead End	Residential	Blade & Maintain Crown	1855.667
43	Redden Road	Westwood Drive	Parleys Road	Residential	Ditch/Side Slope Repair	2167.667
44	Redden Road	Parley's Road	Wasatch Way	Residential	Blade & Maintain Crown	2886.333
46	East Summit Drive	Over Hill Drive	Dead End	Residential	Blade & Maintain Crown	4519.889
48	Echo Lane	Parkway Drive	Wasatch Lane	Residential	Blade & Maintain Crown	2647.333
49	Oakridge South	Linger Lane	Middle of Curve	Residential	Blade & Maintain Crown	1175.889
55	Cottonwood Trail Road	Westwood Road	Dead End	Residential	Blade & Maintain Crown	3880
56	Pace Road	Highfield Road	Silver Creek Road	Residential	Reclaim Gravel & Compact (M/D)	5906.889
69	Vista Circle	Whileaway Road	Dead End	Residential	Blade & Maintain Crown	930
84	Highfield Road	House #8822	Pace Road	Residential	Dust Control	2066.778
85	Wasatch Way	Corner	Dead End	Residential	Blade & Maintain Crown	1943.111
90	Meier Drive	Oakridge North	Oakridge South	Residential	Cut Washboards/ Re-est. Crown & Compact	2152.889
91	Cottonwood Trail Road	Westwood Road	Dead End	Residential	Blade & Maintain Crown	9062.223
108	Oakridge North	Middle of Curve	Meier Drive	Residential	Blade & Maintain Crown	4180
110	Oakridge South	Meier Drive	Linger Lane	Residential	Shoulder Maintenance	2239.889
113	Highfield Road	End of Pavement	House #8822	Residential	Shoulder Maintenance	3688.111
114	Crescent North	Highfield Road	End of Pavement	Residential	Blade & Maintain Crown	2259.556
116	Crescent South	End of Pavement	Highfield Rd	Residential	Blade & Maintain Crown	2275.556

Appendix F

Preservation Strategies, Treatments, and Associated Costs

Treatment Type	Maint. Category	Cost	0	1-3	4-6	9-Jul	10-12	13-15	16-18	19-21
Crack Seal	Routine	**$0.45**	0	0	0	0	1	2	3	2
Cold Patch	Routine	$0.45	0	0	0	0	0	0	0	0
Digout and Hot Patch	Routine	**$0.68**	0	0	0	0	0	0	0	0
High Perf. Cold Patch	Routine	$0.90	0	0	0	0	0	0	0	0
Fog Coat	Routine	**$0.68**	0	0	0	1	1	2	2	2
High Mineral Asphalt Emulsion	Preventative	**$1.80**	0	0	0	1	2	3	5	5
Sand Seal	Preventative	**$0.98**	0	0	0	1	2	2	2	2
Scrub Seal	Preventative	**$1.50**	0	1	3	5	5	5	5	5
Single Chip Seal	Preventative	**$1.95**	0	1	3	5	5	5	5	5
Slurry Seal	Preventative	**$2.63**	0	1	3	5	5	5	5	5
Microsurfacing	Preventative	**$3.60**	0	2	3	5	7	7	7	7
Plant Mix Seal	Rehabilitation	**$8.40**	0	3	4	5	7	7	7	7
Cold In-place Recycling (2 in with chip seal)	Rehabilitation	**$7.50**	0	3	4	5	6	7	7	7
Thin Hot Mix Overlay (<2 in)	Rehabilitation	**$10.13**	0	4	6	7	7	7	7	7
HMA (leveling) & Overlay (<2 in.)	Rehabilitation	**$11.25**	0	4	6	8	8	8	8	8
Hot Surface Recycling	Rehabilitation	**$7.50**	0	3	5	7	8	8	8	8
Rotomill & Overlay (<2 in)	Rehabilitation	**$12.60**	0	4	7	8	8	8	8	8
Cold In-place Recycling (2/2 in.)	Reconstruction	**$15.45**	15	15	15	15	15	15	15	15
Thick Overlay (3 in.)	Reconstruction	**$15.00**	12	12	12	12	12	12	12	12
Rotomill & Thick Overlay (3 in.)	Reconstruction	**$16.50**	12	12	12	12	12	12	12	12
Base Repair\Pavement Replacement	Reconstruction	**$18.00**	16	16	16	16	16	16	16	16
Cold Recycling & Overlay (3/3 in.)	Reconstruction	**$16.73**	14	14	14	14	14	14	14	14
Full Depth Reclamation& Overlay (3/3 in.)	Reconstruction	**$19.88**	20	20	20	20	20	20	20	20
Base/Pavement Replacement (3/3/6 in.)	Reconstruction	**$28.50**	20	20	20	20	20	20	20	20

***Fit the current RSL into a category along the top row and then move downward to the applied treatment to find the additional RSL that will be achieved from the selected treatment.**

(2/2 in.) Means 2" overlay with 2" recycle (3/3/6) Means 3" HMA over 3" Road Base over 6" Base Costs are per square yard

Appendix G

Analysis of Current Pavement Preservation Program

Allocation 2016-2020

Maintenance	% System	Cost	0	1 to 3	4 to 6	7 to 9	10 to 12	13 to 15	16 to 18	19 to 21
Maintenance Type: Routine										
<> Crack Seal	3%	$3,095	0	0	0	0	0	34%	0	66%
Maintenance Type: Preventative										
<> Single Chip Seal	13%	$58,124	0	0	50%	20%	30%	0	0	0
Maintenance Type: Rehabilitation										
<>Thin Hot Mix Overlay (<2 in.)	1%	$23,227	0	0	100%	0	0	0	0	0
Maintenance Type: Reconstruction										
<>Thick Overlay (3 in.)	4%	$137,572	40%	20%	40%	0	0	0	0	0

Annual Cost	$222,018	
Area Treated	48,150	Yd^2

Allocation 2020-2024

Maintenance	% System	Cost	0	1 to 3	4 to 6	7 to 9	10 to 12	13 to 15	16 to 18	19 to 21
Maintenance Type: Routine										
<> Crack Seal	6%	$6,191	0	0	0	0	0	30%	60%	10%
Maintenance Type: Preventative										
<>Single Chip Seal	6%	$26,826	0	0	50%	20%	30%	0	0	0
Maintenance Type: Rehabilitation										
<>Thin Hot Mix Overlay (<2 in.)	2.5%	$58,067	0	0	100%	0	0	0	0	0
Maintenance Type: Reconstruction										
<>Thick Overlay (3 in.)	4%	$137,572	60%	40%	0	0	0	0	0	0
Annual Cost	$228,656									
Area Treated	42,418	Yd^2								

Allocation 2024-2026

Maintenance	% System	Cost	0	1 to 3	4 to 6	7 to 9	10 to 12	13 to 15	16 to 18	19 to 21
Maintenance Type: Routine										
<> Crack Seal	6%	$6,191	0	0	0	0	0	30%	60%	10%
Maintenance Type: Preventative										
<> Single Chip Seal	8%	$35,768	0	0	50%	20%	30%	0	0	0
Maintenance Type: Rehabilitation										
<>Thin Hot Mix Overlay (<2 in.)	0%	$0	0	0	0	0	0	0	0	0
Maintenance Type: Reconstruction										
<>Thick Overlay (3 in.)	5.5%	$189,161	60%	40%	0	0	0	0	0	0

Annual Cost	$231,120	
Area Treated	44,711	Yd^2

Appendix H

Recommended Pavement Preservation Program and Proposed Funding Allocation

Silver Creek 2016-2020

Percent of System in each RSL Category

Year	0	1 to 3	4 to 6	7 to 9	10 to 12	13 to 15	16 to 18	19 to 21	Average RSL
2016	3.35	6.49	42.52	15.25	26.37	1.36	0	4.66	7.5
2017	3.65	14.93	26.5	22.42	18.56	4.4	5.77	3.77	7.81
2018	6.76	15.22	18.21	24.6	14.37	8.35	9.32	3.17	8.15
2019	9.96	12.65	13.4	24.66	12.89	12.17	11.49	2.77	8.53

Silver Creek 2020-2024

Percent of System in each RSL Category

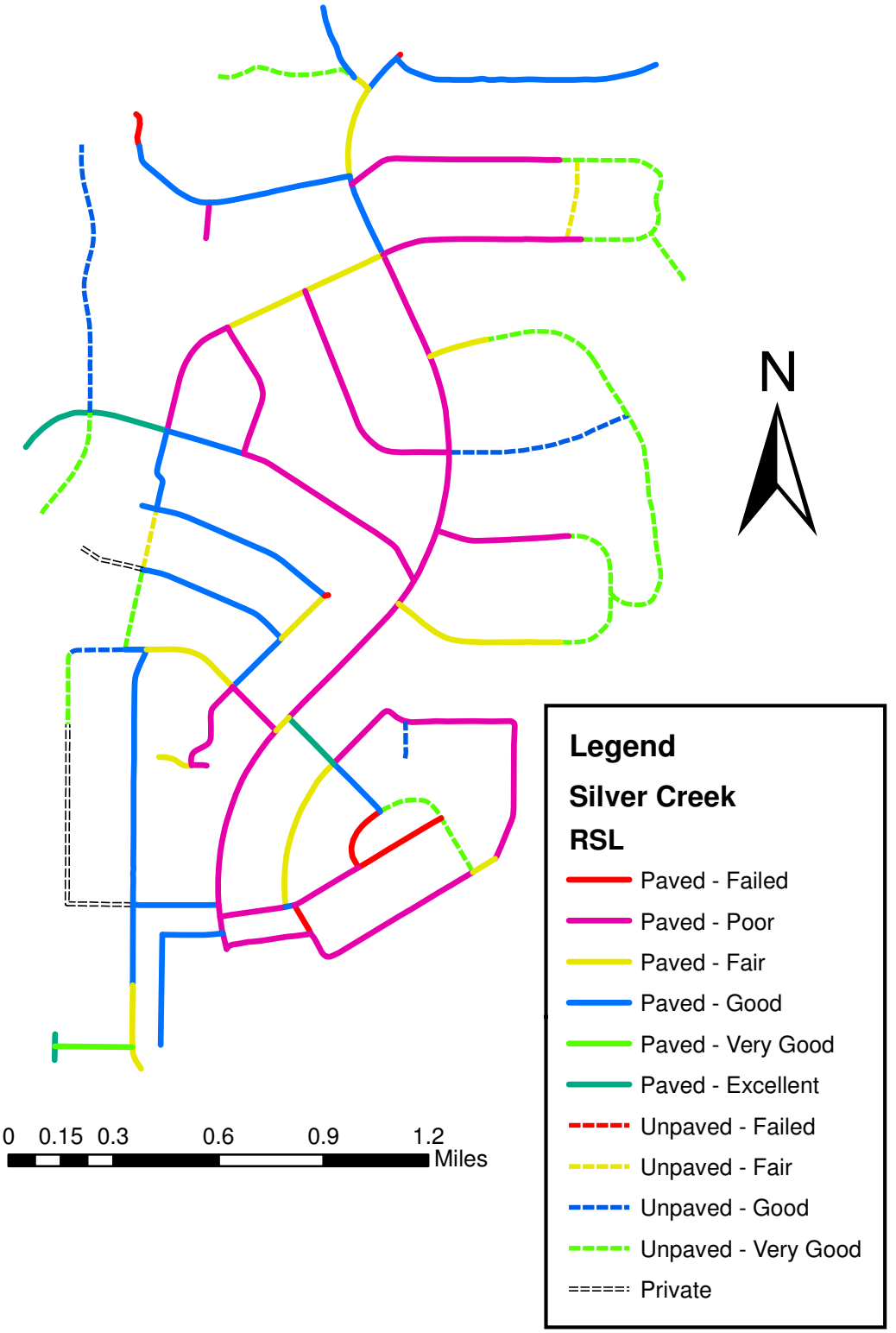
Year	0	1 to 3	4 to 6	7 to 9	10 to 12	13 to 15	16 to 18	19 to 21	Average RSL
2020	12.31	9.33	10.22	24.2	13.18	15.44	12.81	2.51	8.92
2021	12.49	6.73	10.81	22.13	17.43	15.76	9.18	5.47	9.22
2022	11.8	5.19	10.52	22.16	20.38	14.77	7.74	7.45	9.52
2023	10.59	4.07	10.33	23.17	22.01	13.63	7.44	8.77	9.8

Silver Creek 2024-2026

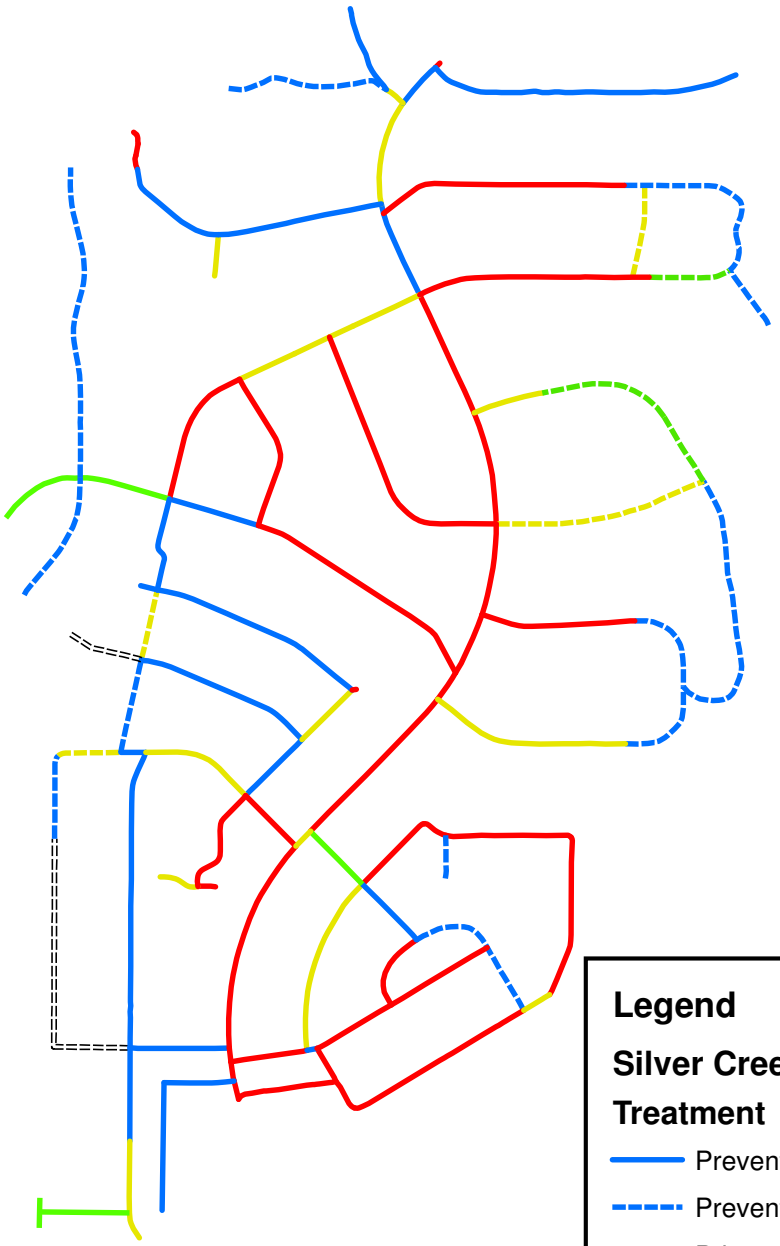
Percent of System in each RSL Category

Year	0	1 to 3	4 to 6	7 to 9	10 to 12	13 to 15	16 to 18	19 to 21	Average RSL
2024	9.01	3.25	10.54	24.38	22.71	12.77	7.68	9.64	10.06
2025	6.06	2.88	11.95	25.96	21.03	13.34	8.53	10.23	10.41
2026	2.99	3.1	13.42	26.45	20.1	14	9.3	10.62	10.72

Silver Creek 2016



Silver Creek 2016



N

0 0.15 0.3 0.6 0.9 1.2
Miles

Legend

Silver Creek

Treatment

- Preventative
- Preventative - Unpaved
- Private
- Reconstruction
- Reconstruction - Unpaved
- Rehabilitation
- Rehabilitation - Unpaved
- Routine
- Routine - Unpaved