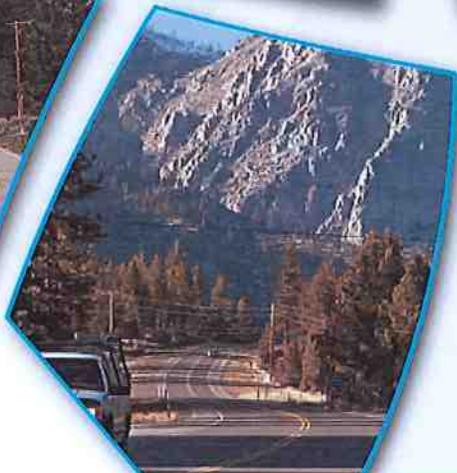


## Alpine County

## Pavement Management System Plan Update

September 4, 2018



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# Environmental Management System

Version 1.0



## APPENDIX

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2.0 Objectives  
3.0 Implementation  
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## Executive Summary

NCE was selected by Alpine County (County) in 2018 to perform an update of its StreetSaver Pavement Management System (PMS). The previous update was performed in 2012. Since the 2012 update, maintenance on the County's road network has been limited to pothole filling, emergency drainage fixes, and crack filling.

The goals of this project were to update the County's PMS, develop maintenance and rehabilitation strategies, and to conduct budgetary analysis and funding needs. This report contains a detailed record of the road network comprised of road names, functional classification, road length, paved area and condition.

The weighted-average Pavement Condition Index (PCI) of 58 for the County's entire road network, which is considered to be "Fair" condition. PCI is defined with 0 being a fully deteriorated road and 100 being a newly constructed road with no cracking or other distresses.

A decision tree was developed, which is used by the StreetSaver software to recommend the appropriate treatment to be applied for each road condition category. As the County has not performed pavement maintenance projects recently, the cost for each treatment was determined by using recent bid tabulations for adjacent Caltrans and NDOT districts, as well as RTC of Washoe County. These were deemed most relevant as the closest materials suppliers for the majority of the County are in the eastern Sierra region.

Budget analysis was performed using several different scenarios. These show that the SB1 RMRA funds alone will not be sufficient to maintain the current network condition. Under this scenario, the maintenance backlog is projected to grow from the current \$4.19 million to \$12.98 million over the next 10 years, while the network average PCI will decline to 44. A sum of \$210,000 per year in addition to the projected SB1 RMRA funds would be required to keep the PCI from declining and the inflation-adjusted maintenance backlog from growing. Improving the average network PCI to 70 (the commonly used threshold for "good") would require \$1 million of spending per year in addition to the projected SB1 RMRA funds, for a total of \$12.9 million over the next 10 years.



## Introduction

Alpine County, California is responsible for the repair and maintenance of 134 centerline miles of county roads, including 69 centerline miles of paved roads. These roads are all rural and are predominantly very low volume. This network includes approximately 8.8 million square feet of pavement, and the total replacement value of the pavement structures is estimated at \$39.1 million.

In 2012, the County contracted with Quincy Engineering to perform the initial implementation of a pavement management system (PMS). In consultation with the County, Quincy selected the StreetSaver PMS software. Quincy was also responsible for sectioning the network into appropriate management segments, performing the initial condition surveys, as well as performing maintenance needs and budget analysis.

In 2018, the County contracted with NCE to update its existing PMS. This effort included updating the StreetSaver software to the latest version, performing new surveys of the same samples rated in 2012, entering the new survey data, reviewing and updating the decision trees, and performing analysis and budget scenarios. This report documents those activities. This work was done in accordance with the Quality Control Plan developed by NCE for this project, which is included in Appendix A.



## Condition Survey

The initial implementation of the County's PMS in 2012 divided the paved roadway network into 73 segments, with an average centerline length of 0.95 miles. 211 sample units with a nominal area of 2000 to 2500 square feet were randomly selected to be surveyed – in all 6% of the total pavement area was surveyed. Quincy recorded GPS coordinates for the start of each sample unit, and the start and end of each sample unit were also marked with paint.

NCE re-surveyed the same sample units in May and June of 2018. Sample units were located based on the GPS coordinates, although in a large majority of cases the original paint markings were also found. The paint markings were renewed or replaced as appropriate. The condition inspections did not address non-pavement issues such as traffic, safety and road hazards, geometric issues, road shoulders, sidewalks, curb and gutters, drainage issues, or immediate maintenance needs.

NCE performed the 2018 surveys in accordance with the *Pavement Condition Index Distress Identification Manual*<sup>1</sup> published by MTC. This manual was updated since the previous survey – the only significant change is that in the 2012 survey weathering and raveling were rated together, whereas in the 2018 survey they were considered two separate distresses. This has some implications for the comparability of the data, as discussed below.

The pavement condition index, or PCI, is a measurement of pavement condition and ranges from 0 to 100. A newly constructed road will have a PCI of 100, while a failed road will have a PCI of 25 or less. The PCI is calculated based on the quantity and severity of distresses, which in the current version of StreetSaver include:

- |                                     |                                      |
|-------------------------------------|--------------------------------------|
| 1. Alligator Cracking               | 5. Patching and Utility Cut Patching |
| 2. Block Cracking                   | 6. Rutting and Depressions           |
| 3. Distortions                      | 7. Raveling                          |
| 4. Longitudinal/Transverse Cracking | 8. Weathering                        |

A more detailed description of each distress type is available in MTC's Pavement Condition Index Distress Identification Manual.

Figure 1 illustrates the definitions of the pavement condition categories. The "Fair" category includes roads with both non-load related (e.g. weathering) and load related (e.g. alligator cracking) distresses. The two categories are designated II (non-load related) and III (load related). Although the PCI range is the same, these categories are treated differently as they have different implications for the future rate of deterioration and the type of repair required. Generally, roads with

<sup>1</sup> MTC. Pavement Condition Index Distress Identification Manual for Flexible Pavements. March 2016 – Fourth Edition



load-related distress will deteriorate faster and require more costly repairs than roads with non-load related distress. StreetSaver assigns repairs and estimated costs to roads based on the category.

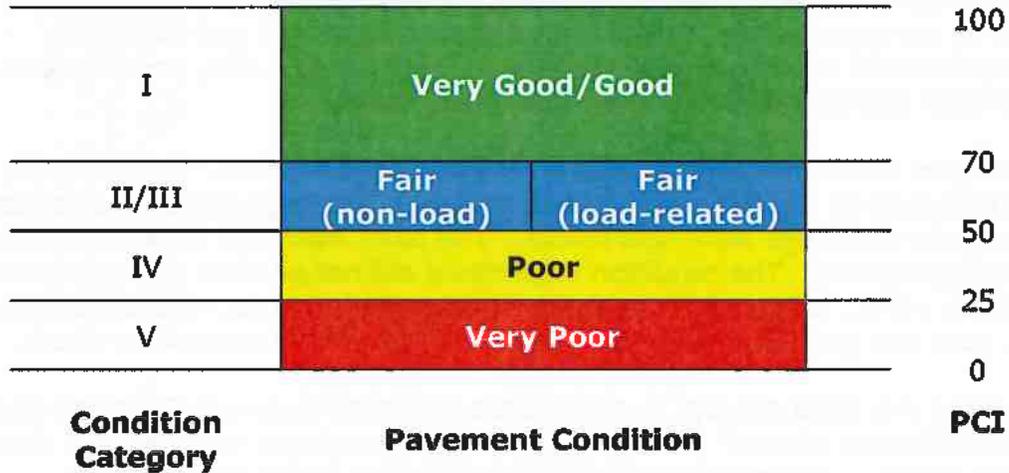


Figure 1: Pavement Condition Categories



The photos in Figure 2 illustrate roads with a range of PCIs.



**Figure 2: Examples of Roads with Different PCIs**



The County's average weighted (by area)<sup>2</sup> PCI is 58 and this is considered to be in "Fair" condition. However, the average PCI does not completely describe the road network. Table 1 is a summary of the County's road network and the PCI by functional class.

**Table 1: Pavement Network and Condition Summary**

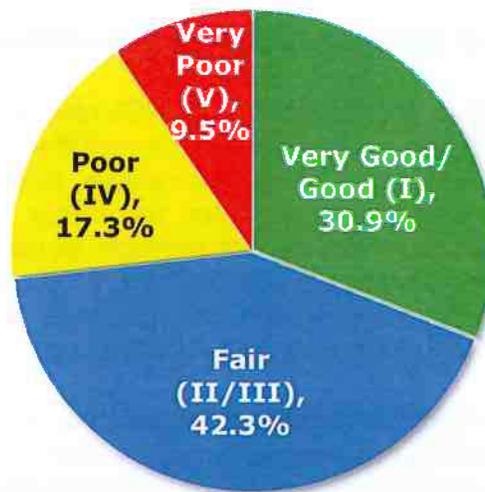
Functional Class	Centerline Mileage	# of Sections	Pavement Area (sf)	Weighted Average PCI
<b>Collector</b>	20	10	4,361,969	66
<b>Local</b>	49	63	4,477,304	51
<b>Total</b>	69	73	8,839,273	58

Table 2 and Figure 3 show the distribution of pavements by functional class and condition category for 2018. Approximately one third (30.9%) of the County's roads are "Very Good/Good" and 9.5% is considered to be in "Very Poor" condition. To compare, Figure 4 shows the distribution of pavements by condition category for 2012. Appendix B contains the PCI listing for all roads in the County.

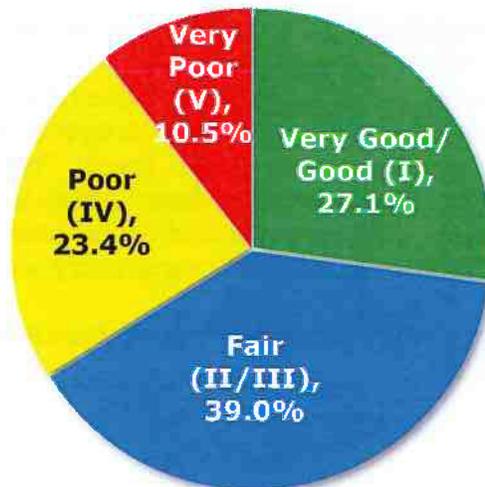
**Table 2: Area Breakdown by Functional Class and Condition Category**

Condition Category	PCI Range	Collector (%)	Residential (%)	Entire Network (%)
<b>Very Good/Good (I)</b>	<b>70-100</b>	44.2%	18.0%	30.9%
<b>Fair (II/III)</b>	<b>50-69</b>	37.4%	47.0%	42.3%
<b>Poor (IV)</b>	<b>25-49</b>	18.4%	16.2%	17.3%
<b>Very Poor (V)</b>	<b>0-24</b>	0.0%	18.8%	9.5%
<b>Total (%)</b>		<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

<sup>2</sup> The weighted average PCI is a result of multiplying the area of each road section by the PCI of that section, totaling all sections together and then dividing by the total of the network areas or functional classification.



**Figure 3: 2018 Pavement Network Breakdown by Condition Category**



**Figure 4: 2012 Pavement Network Breakdown by Condition Category**

Based on the previous survey data, the network PCI was 56 in 2012. The County has not performed any maintenance or rehabilitation activities in the past 6 years. The apparent slight increase in PCI is due to a change in the MTC distress rating methodology between the two surveys. Previously, weathering and raveling were considered to be a single distress. This single distress was associated with a deduct value that is higher than the current value for weathering and lower than the current value for raveling. In most cases where raveling/weathering was rated previously, in this survey that distress was determined to be weathering in accordance the new procedure, resulting in a lower deduct value and a higher PCI. In the absence of this change in procedure, the average network PCI would have slightly decreased over this time period.



## Budget Analysis and Recommended Maintenance Practices

Upon completion of the data collection activities, NCE reviewed maintenance and rehabilitation strategies with the County staff. This included the selection of appropriate treatments such as slurry seals or overlays, and the determination of unit costs. As the County has not performed any pavement maintenance for several years and therefore does not have any recent projects to use for cost estimates, recent bid tabs from Caltrans Districts 9 and 10, NDOT District 2, and the Regional Transportation Commission of Washoe County were used. The unit costs developed include all related construction costs as well as engineering and design costs.

Once appropriate maintenance alternatives were defined, a treatment unit cost was determined for each alternative and these alternatives and costs were entered into the PMS database for budgetary analyses. NCE then performed several budgetary analyses based on different constraints, including a 30-year analysis using projected SB1 RMRA funds only.

StreetSaver recommends repairs for each road based on the condition category and the decision tree settings. When the pavement condition is within the "Very Good/Good" category, a crack seal or slurry seal is the recommended treatment. These types of treatments are usually considered "preventive maintenance". When the pavement condition deteriorates to lower PCI levels, "rehabilitation" is performed. For example, when the pavement deteriorates to the "Poor" condition category, a 2-inch overlay and 20% removal and replacement is performed. In addition, base repairs are commonly used as preparatory work prior to overlays.

After discussions with County staff, a detailed maintenance decision tree was prepared and included in Table 3.



**Table 3: Decision Tree**

Functional Class	Condition Category	Treatment Type	Treatment	Cost/Sq Yd, except Seal Cracks in LF:
Collector	I - Very Good	Crack Treatment	SEAL CRACKS	\$1.15
		Surface Treatment	CHIP SEAL	\$2.88
		Restoration Treatment	2" OVERLAY	\$12.08
	II - Good, Non-Load Related		CHIP SEAL	\$2.88
	III - Good, Load Related		CAPE SEAL	\$5.75
	IV - Poor		2" OVERLAY, 20% R+R	\$17.94
V - Very Poor		PULVERIZE, + 3" OVERLAY	\$24.15	
Local	I - Very Good	Crack Treatment	SEAL CRACKS	\$1.15
		Surface Treatment	SLURRY SEAL	\$2.88
		Restoration Treatment	2" OVERLAY	\$12.08
	II - Good, Non-Load Related		SLURRY SEAL/ CHIP SEAL	\$2.88
	III - Good, Load Related		CAPE SEAL	\$5.75
	IV - Poor		2" OVERLAY, 20% R+R	\$17.94
V - Very Poor		PULVERIZE, + 3" OVERLAY	\$24.15	

The only difference between the decision tree for collectors and local roads is that for Category II, chip seals are recommended for collectors whereas slurry seals are recommended for local roads. Chip seals are generally not recommended for residential areas due to resident complaints from loose chips as well as difficulty in evenly spraying asphalt emulsion on tight curves and irregular areas.

Treatments in Category I and II have further specifications for the number of years before treatments, and the number of surface treatments that can be applied before a restoration treatment is required. These are shown in Table 4.



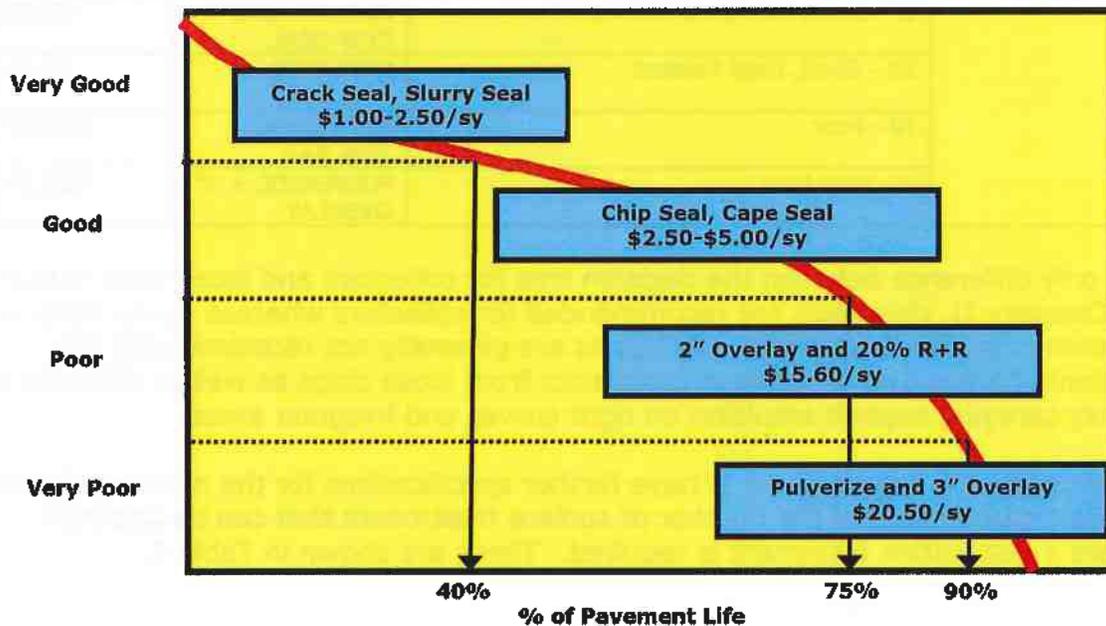
**Table 4: Years Between Treatments**

Treatment Type	Years Between Treatments	# of Treatments before Restoration Treatment
Crack Treatment	4	N/A
Surface Treatment	6	3

Figure 5 illustrates that pavement maintenance follows the old colloquial saying of "pay now or pay more later". It is much less expensive to maintain roads in good condition than to repair roads that have failed. By letting pavements deteriorate, roads that once cost \$2.88/square yard to slurry seal may soon cost as much as \$24.15/square yard to pulverize and construct a 3-inch overlay. The costs shown in the chart below are based on recent bid tabs from Caltrans, NDOT, and RTC of Washoe County.

The pavement deterioration curve shown by the red line describes how pavements deteriorate over time. The appropriate treatment and its associated cost is shown.

**Pavement Condition**



**Figure 5: Costs of Maintaining Pavements over Time**



## Budget Analysis

### Unconstrained Budget Scenario

Once the pavement condition has been determined, and the appropriate maintenance treatments have been assigned in the decision tree, then it is possible to determine the funding needs for the County’s maintained roads. For the unconstrained scenario, the StreetSaver program seeks to answer the following questions:

**If funding is not a constraint, how much money is needed to bring the pavement condition to a state of good repair? And once there, how much is required to maintain it at that level over the next five years?**

Therefore, based on the principle that it costs less to maintain roads in good condition than those in poor condition, StreetSaver will develop a maintenance strategy that will improve the overall condition of the roads and then maintain it at that level. The condition of each road determines the appropriate treatment and cost from the decision tree. For example, if Montgomery Street has a PCI of 56, and the appropriate treatment is a cape seal, then the area of the pavement section is multiplied by the unit cost to determine the total treatment cost. Additional maintenance treatments over the next five years will also be applied (e.g. slurry seal) to preserve it.

Using this process, the entire road network for the County was evaluated and the costs were summed, and the results are presented in Table 5. This results in maintenance needs of approximately \$8.97 million over the next five years. An annual inflation rate of 3% was assumed. The “treated PCI” represents the resulting network PCI level if recommended treatments are performed. The “untreated PCI” represents the resulting network PCI level if no maintenance and rehabilitation is done. If Alpine County follows the funding strategy recommended by the program, the average PCI will increase to 78.

**Table 5: Results of 5 Year Budget Needs**

Fiscal Year	17/18	18/19	19/20	20/21	21/22	Total
<b>Total Budget Needs (\$M)</b>	8.62	0.20	0.01	0.35	0.19	9.37
<b>Rehabilitation (\$M)</b>	7.76	0.20	0.01	0.35	0.17	8.49
<b>Preventive Maintenance (\$M)</b>	0.86	0.00	0.00	0.00	0.02	0.88
<b>Treated PCI</b>	73	70	75	79	78	N/A
<b>Untreated PCI</b>	58	56	53	50	47	N/A



The funding level or determined maintenance needs illustrates the level of expenditures required to raise the pavement condition to a network PCI in the mid 70's and eliminates the maintenance backlog. Of the \$9.37 million in maintenance needs, approximately \$0.88 million (approximately 9%) is programmed for preventive maintenance, while the rest is allocated for more costly rehabilitation and reconstruction treatments. Again, preventive maintenance includes treatments such as slurry seals, while rehabilitation includes overlays.

Note that in this analysis, the total funding needed is "front-loaded" since it is less expensive to repair the roads in the first year than in subsequent years because of deferring maintenance and inflation. The budget needs for the first year is equal to the County's current deferred maintenance backlog of \$8.62 million.

Using the same process, a needs calculation was done for a 30-year span. The results of this process are shown in Table 6. Of the \$30.5 million in maintenance needs, approximately \$18.5 million (approximately 60%) is allocated for preventative maintenance. Rehabilitation and reconstruction treatments make up the other \$12.0 million. If the County follows this maintenance plan, then the average network PCI is projected to increase to 79 by the year 2047. Generally, following this maintenance plan would maintain the average network PCI in the upper 70's over the next 30 years. More detailed results of the budget needs and scenarios can be found in Appendix D.

**Table 6: Results of 30 Year Budget Needs**

<b>Fiscal Year</b>	<b>Total Budget Needs (\$M)</b>	<b>Rehabilitation (\$M)</b>	<b>Preventative Maintenance (\$M)</b>	<b>Treated PCI</b>	<b>Untreated PCI</b>
17/18	8.62	7.76	0.86	73	58
18/19	0.20	0.20	0.00	70	56
19/20	0.01	0.01	0.00	75	53
20/21	0.35	0.35	0.00	79	50
21/22	0.17	0.17	0.02	78	47
22/23	0.00	0.00	0.00	85	44
23/24	4.11	2.55	1.56	87	41
24/25	0.49	0.36	0.13	86	38
25/26	0.53	0.01	0.52	85	35
26/27	0.02	0.00	0.02	84	32
27/28	0.02	0.00	0.02	84	29
28/29	0.85	0.00	0.85	84	26
29/30	2.27	0.40	1.87	86	24
30/31	0.11	0.00	0.11	85	22
31/32	1.55	0.02	1.53	84	20
32/33	0.17	0.00	0.17	83	18



Fiscal	Total Budget	Rehabilitation	Preventative	Treated	Untreated
33/34	0.32	0.00	0.32	82	17
34/35	0.28	0.00	0.28	82	15
35/36	1.51	0.00	1.51	83	13
36/37	2.26	0.13	2.13	84	11
37/38	0.14	0.00	0.14	82	9
38/39	2.38	0.00	2.38	85	7
39/40	0.43	0.00	0.43	83	6
40/41	0.72	0.00	0.72	84	5
41/42	0.63	0.00	0.63	83	4
42/43	0.18	0.00	0.18	83	3
43/44	0.35	0.00	0.35	82	2
44/45	0.17	0.00	0.17	80	2
45/46	0.27	0.00	0.27	79	1
46/47	1.32	0.00	1.32	79	1
<b>Total</b>	<b>30.5</b>	<b>12.0</b>	<b>18.5</b>	<b>N/A</b>	<b>N/A</b>

## Budget Scenarios

### Constrained Budget Scenarios

As the County does not have unlimited funds to spend on road maintenance, several constrained scenarios were performed. StreetSaver allows either budget or network condition to be used as constraints. If budget is a constraint, then StreetSaver determines the optimal maintenance treatments to maximize network condition under a fixed budget. If condition is a constraint, then StreetSaver determines the optimal maintenance treatments to minimize cost to maintain the network at a certain condition.

The following scenarios were analyzed:

**Scenario 1: Allow Network PCI to decrease to 50 (\$300,000 per year over 5 years)** – An annual budget of approximately \$300,000 is required if the network PCI to allowed decrease to and then stabilized at 50 during the next five years. Also, the maintenance backlog will increase from \$8.62 million to \$11.2 million by fiscal year (FY) 2021/22.

**Scenario 2: Maintain Existing PCI (\$980,000 per year over 5 years)** – To maintain the current PCI Level of 58, an annual budget of \$980,000 per year over 5 years is required, and the maintenance backlog will decrease to \$7.44 million by FY 2021/22.



**Scenario 3: Increase Network PCI to 60 (\$1,130,000 per year over 5 years)** – This budget scenario shows that an annual budget of approximately \$1,130,000 for 5 years would be required to slightly improve and maintain the network PCI at 60. By FY 2021/22, the deferred maintenance will also decrease to \$6.61 million.

**Scenario 4: Increase Network PCI to 70 (\$1,520,000 per year over 5 years)** – This scenario would increase the network PCI level to 70 and maintain it there. It requires an annual budget of \$1,520,000 for 5 years. The deferred maintenance will decrease to \$4.59 million by FY 2021/22.

**Scenario 5: Do Nothing (no investment in preventative maintenance and rehabilitation)** – This budget scenario was performed to establish a baseline if there is no investment made in preventative maintenance and rehabilitation. After 5 years, the network PCI level is projected to decrease to 47. The deferred maintenance greatly increases to \$12.7 million by FY 2021/22.

**Scenario 6: Projected SB 1 RMRA Funding (Bi-Annual Budget starting with a base budget of \$360,000 for FY 2019/20)** – This scenario is constrained to the projected SB1 RMRA funding. The budget will be spent bi-annually to economize on planning, engineering and contractor mobilization costs and is projected to increase by approximately \$20,000 every two years until FY 2026/27. After FY 2026/27, no growth is projected. Using the current budget, the network PCI level is projected to slowly decline to 50 after 5 years. By FY 2021/22, deferred maintenance increases to \$11.7 million.

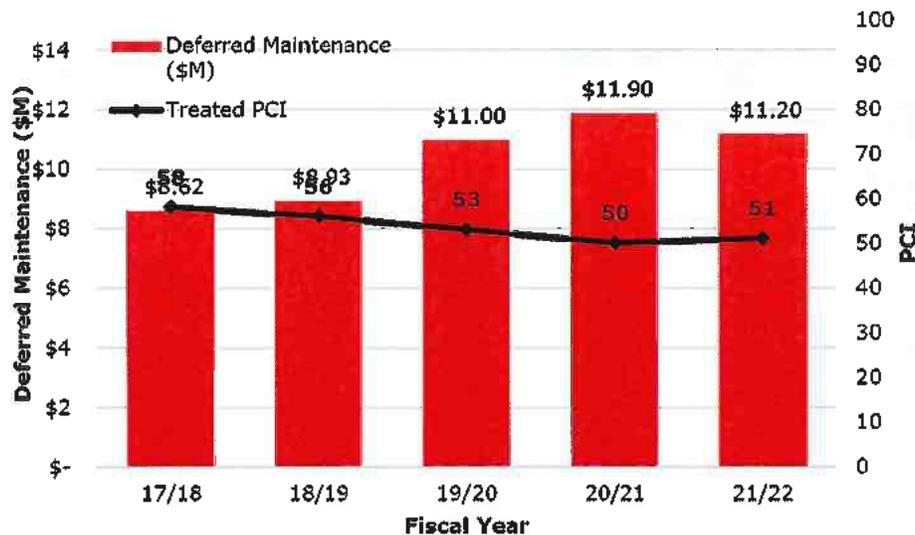


### Scenario 1: Allow Network PCI to decrease to 50 (\$300,000/year for 5 years)

This budget scenario uses an annual budget of approximately \$300,000 per year for 5 years. The deferred maintenance will increase to \$11.2 million by FY 2021/22. At the end of the analysis period, 42% of the pavement area will be in the "Very Good/Good" condition categories, 31.6% in the "Fair", and 44% in the "Poor" and "Very Poor" categories. Table 7 and Figure 6 summarize results from Scenario 1.

**Table 7: Summary of Results for Scenario 1**

Fiscal Year	17/18	18/19	19/20	20/21	21/22	Total
<b>Total Budget (\$M)</b>	0.00	0.00	0.00	0.13	1.37	1.50
<b>Rehabilitation (\$M)</b>	0.00	0.00	0.00	0.13	0.70	0.83
<b>Preventive Maintenance (\$M)</b>	0.00	0.00	0.00	0.00	0.67	0.67
<b>Deferred Maintenance (\$M)</b>	8.62	8.93	11.0	12.0	11.2	N/A
<b>Treated PCI</b>	58	58	56	53	50	N/A



**Figure 6: PCI vs. Deferred Maintenance for Scenario 1**

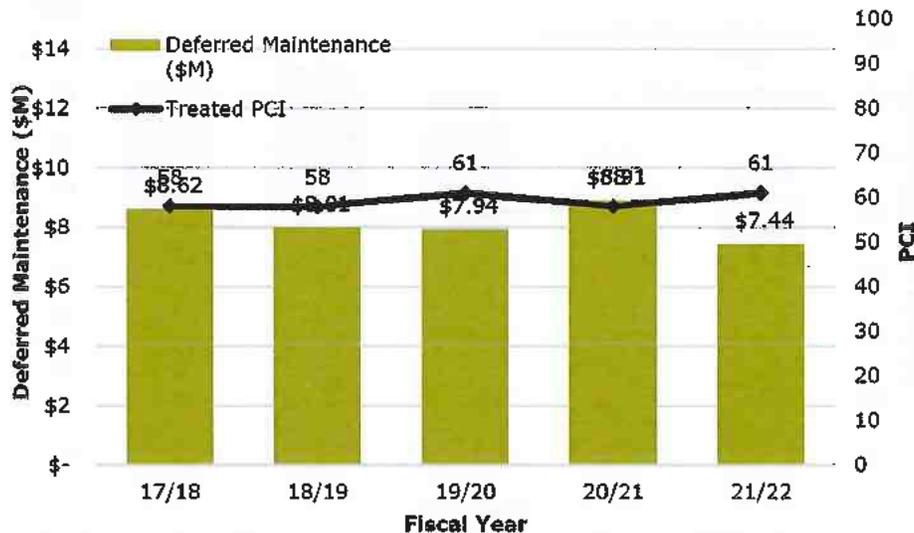


## Scenario 2: Maintain Existing PCI (\$980,000/year)

With an annual budget of \$980,000 per year for 5 years, the network PCI will be maintained at the current level of 58 and the deferred maintenance will decrease to \$7.44 million by FY 21/22. At the end of the analysis period, 45.7% of the pavement area will be in the "Very Good/Good" condition categories, 24.5% in the "Fair", and 29.7% in the "Poor" and "Very Poor" categories. Road sections selected for treatment under this funding level are included in Appendix E. Table 8 and Figure 7 summarize results from Scenario 2.

**Table 8: Summary of Results for Scenario 2**

Fiscal Year	17/18	18/19	19/20	20/21	21/22	Total
<b>Total Budget (\$M)</b>	0.00	0.92	2.13	0.04	1.83	4.92
<b>Rehabilitation (\$M)</b>	0.00	0.18	1.98	0.04	1.83	4.02
<b>Preventive Maintenance (\$M)</b>	0.00	0.74	0.15	0.00	0.00	0.89
<b>Deferred Maintenance (\$M)</b>	8.62	8.01	7.94	8.91	7.44	N/A
<b>Treated PCI</b>	58	58	58	61	58	N/A



**Figure 7: PCI vs. Deferred Maintenance for Scenario 2**

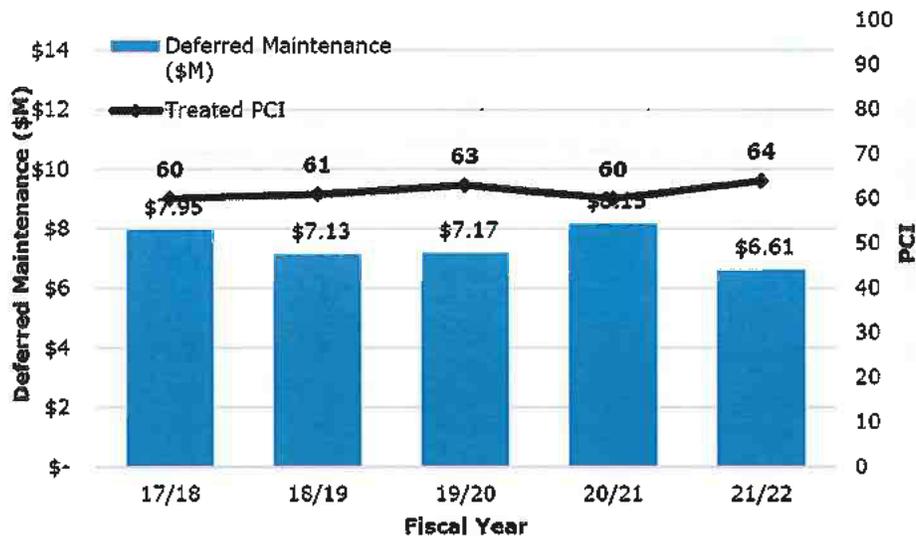


### Scenario 3: Increase Network PCI to 60 (\$1,130,000/year for 5 years)

This scenario illustrates that an annual budget of \$1,130,000 is required to increase the network PCI to 60 over the next five years. The deferred maintenance also decreases from \$8.62 million to \$6.61 million by FY 2021/22. Furthermore, 29.9% of the pavement area will be in the "Very Good/Good" condition categories, 40.3% in the "Fair", and 29.7% in the "Poor" and "Very Poor" categories by the end of the analysis period. Table 9 and Figure 8 summarize results from Scenario 3.

**Table 9: Summary of Results for Scenario 3**

Fiscal Year	17/18	18/19	19/20	20/21	21/22	Total
<b>Total Budget (\$M)</b>	0.67	1.11	1.98	0.00	1.88	5.65
<b>Rehabilitation (\$M)</b>	0.18	0.74	1.98	0.00	1.87	4.77
<b>Preventive Maintenance (\$M)</b>	0.49	0.37	0.02	0.00	0.01	0.88
<b>Deferred Maintenance (\$M)</b>	7.95	7.13	7.17	8.15	6.61	N/A
<b>Treated PCI</b>	58	60	61	63	60	N/A



**Figure 8: PCI vs. Deferred Maintenance for Scenario 3**

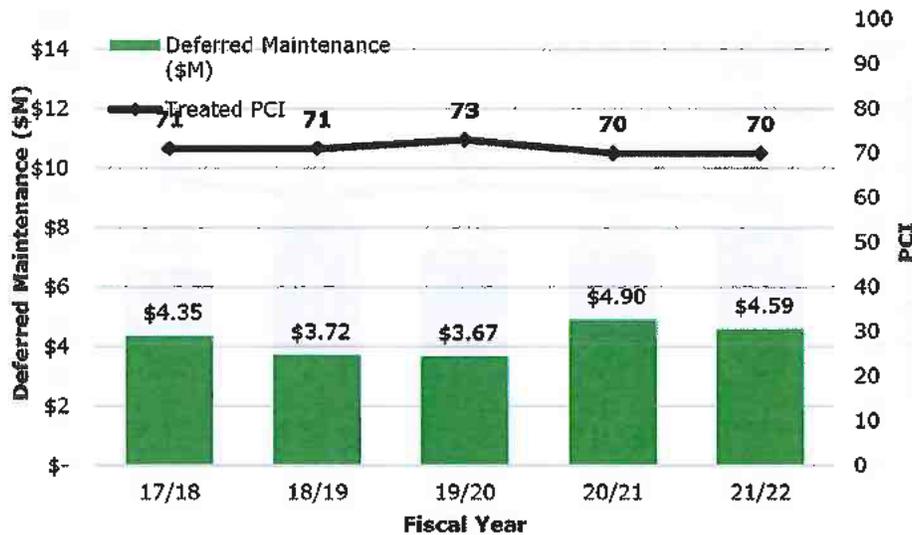


### Scenario 4: Increase Network PCI to 70 (\$1,520,000/year for 5 years)

This scenario illustrates that an annual budget of \$1,520,000 is required to increase the network PCI to 70 over the next five years. The deferred maintenance also decreases from \$8.62 million to \$4.59 million by FY 2021/22. Furthermore, 88.8% of the pavement area will be in the "Very Good/Good" condition categories, 7.2% in the "Fair", and 3.9% in the "Poor" and "Very Poor" categories by the end of the analysis period. Table 10 and Figure 9 summarize results from Scenario 3.

**Table 10: Summary of Results for Scenario 4**

Fiscal Year	17/18	18/19	19/20	20/21	21/22	Total
<b>Total Budget (\$M)</b>	4.27	0.81	1.98	0.00	0.55	7.61
<b>Rehabilitation (\$M)</b>	3.41	0.81	1.98	0.00	0.54	6.74
<b>Preventive Maintenance (\$M)</b>	0.86	0.00	0.00	0.00	0.01	0.87
<b>Deferred Maintenance (\$M)</b>	4.34	3.72	3.67	4.90	4.59	N/A
<b>Treated PCI</b>	71	71	73	70	70	N/A



**Figure 9: PCI vs. Deferred Maintenance for Scenario 4**



### Scenario 5: Do Nothing (no investment in preventative maintenance and rehabilitation)

In this budget scenario, no preventative and rehabilitation is performed. This scenario was conducted so that a baseline could be established, to show what the impact on the pavement network would be if no investment is made in preventative maintenance and rehabilitation. In this scenario, the deferred maintenance sharply increases from \$8.62 million to \$12.7 million by FY 2021/22. The network PCI level also decreases to 47 after 5 years. At the end of the analysis period, 8% of the pavement area will be in the "Very Good/Good" condition categories, 42.6% in the "Fair", and 49.5% in the "Poor" and "Very Poor" categories.

**Table 11: Summary of Results for Scenario 5**

Fiscal Year	17/18	18/19	19/20	20/21	21/22	Total
<b>Total Budget (\$M)</b>	0.00	0.00	0.00	0.00	0.00	0.00
<b>Rehabilitation (\$M)</b>	0.00	0.00	0.00	0.00	0.00	0.00
<b>Preventive Maintenance (\$M)</b>	0.00	0.00	0.00	0.00	0.00	0.00
<b>Deferred Maintenance (\$M)</b>	8.62	8.93	11.0	12.1	12.7	N/A
<b>Untreated PCI</b>	58	56	53	50	47	N/A



**Figure 10: PCI vs. Deferred Maintenance for Scenario 5**



**Scenario 6: Projected SB 1 RMRA Funding (Bi-Annual Budget starting with a base budget of \$640,000 for FY 2019/20)**

This budget scenario was conducted using the projected SB 1 RMRA funding for Alpine County, which will be used for maintenance and rehabilitation. The base funding level is \$360,000, to be spent in FY 2019/20. This includes \$40,000 leftover from FY 17/18 combined with \$320,000 for FY 18/19. Projected funds for future years are shown in Table 12.

**Table 12: Projected CB1 RMRA Funding**

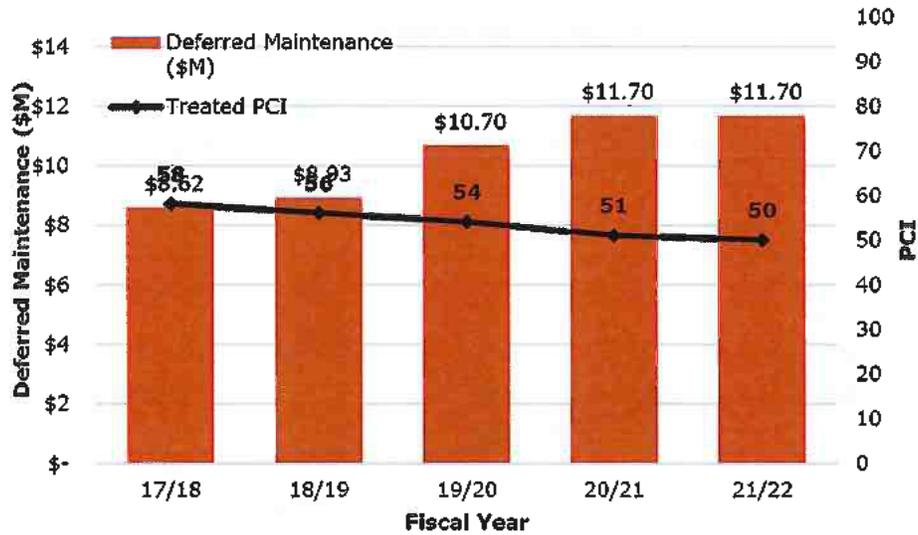
Fiscal Year	Road Maintenance Funds
19/20	\$360,000
21/22	\$680,000
23/24	\$750,000
25/26	\$800,000
27/28	\$850,000
29/30	\$860,000
31/32	\$860,000
33/34	\$860,000
35/36	\$860,000
37/38	\$860,000
39/40	\$860,000
41/42	\$860,000
43/44	\$860,000
45/49	\$860,000

Under this scenario the deferred maintenance increases from \$8.62 million to \$11.7 million by FY 2021/22. The network PCI level also decreases to 50 after 5 years. Furthermore, 38% of the pavement area will be in the "Very Good/Good" condition categories, 20.9% in the "Fair", and 41% in the "Poor" and "Very Poor" categories by the end of the analysis period.



**Table 13: Summary of Results for Scenario 6**

Fiscal Year	17/18	18/19	19/20	20/21	21/22	Total
<b>Total Budget (\$M)</b>	0.00	0.00	0.36	0.00	0.68	1.04
<b>Rehabilitation (\$M)</b>	0.00	0.00	0.32	0.00	0.61	0.93
<b>Preventive Maintenance (\$M)</b>	0.00	0.00	0.04	0.00	0.07	0.11
<b>Deferred Maintenance (\$M)</b>	8.62	8.93	10.7	11.7	11.7	N/A
<b>Treated PCI</b>	58	56	54	51	50	N/A

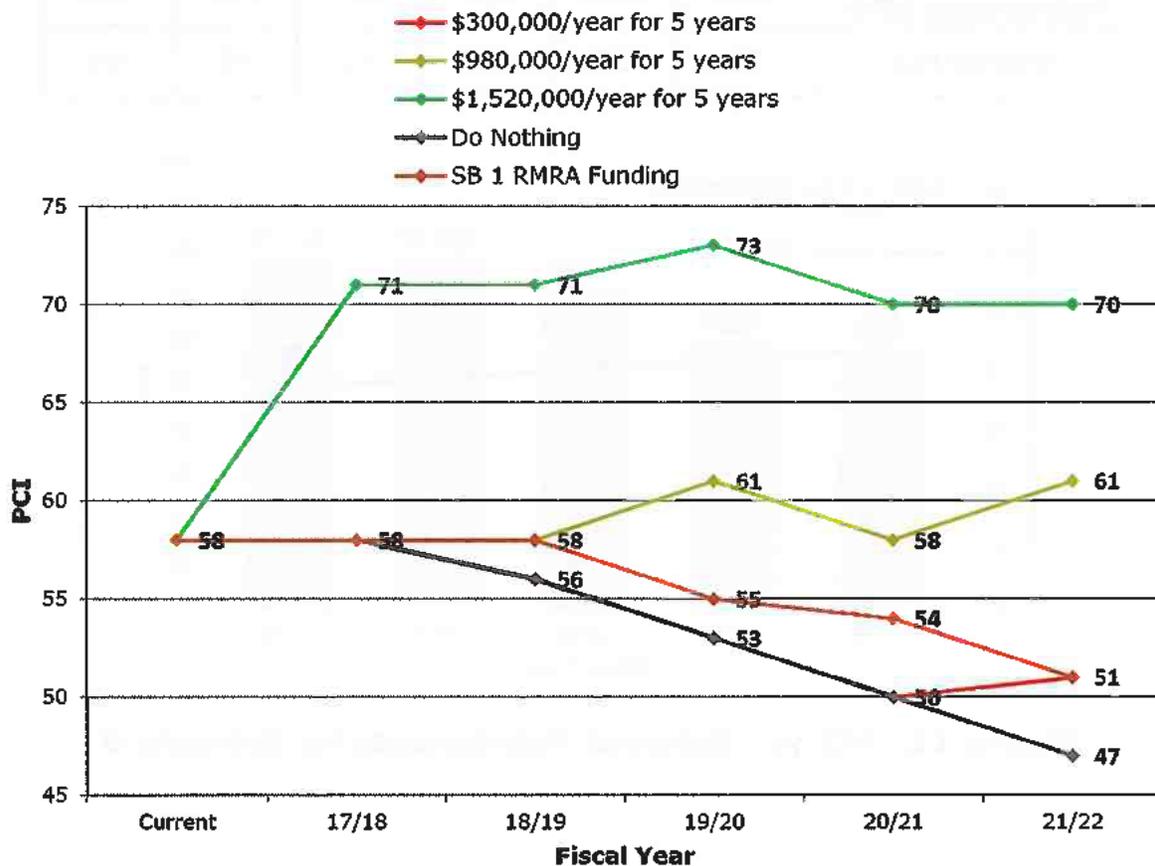


**Figure 11: PCI vs. Deferred Maintenance for Scenario 6**



## Budget Summary

Figure 12 compares the resulting PCIs for each of the scenarios. The County's current bi-annual budget with a baseline of \$360,000 (Scenario 6) will result in an eight-point decrease from 58 to 50 by FY 2021/22. Scenario 5, where there is no investment made in maintenance and rehabilitation, results in an eleven-point decrease from 58 to 47 over 5 years. Scenario 2 shows that an annual budget of approximately \$980,000 is required to maintain the existing network PCI level of 58. Scenario 1 shows that having an annual budget of \$1,520,000 would increase the network PCI level to 70.

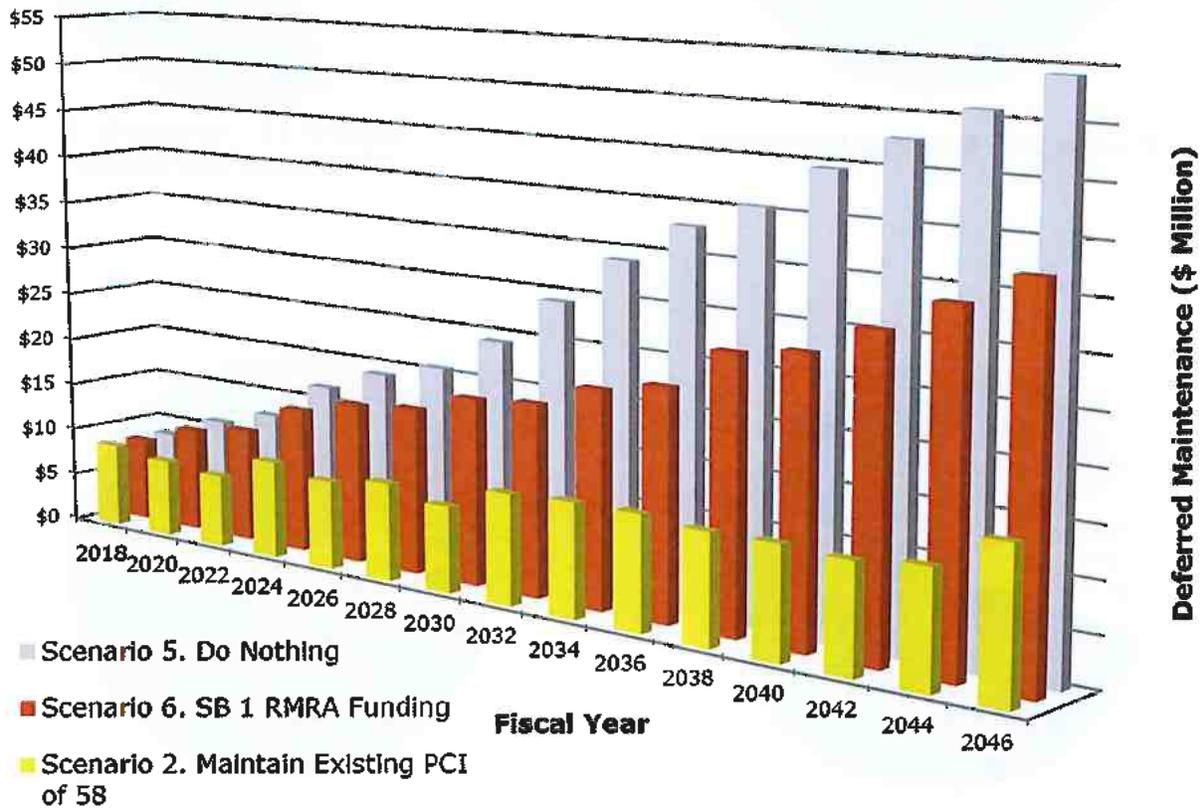


**Figure 12: PCI Comparisons between Scenarios**

Figure 13 shows the increase in deferred maintenance costs that result from the "Do Nothing," "SB 1 RMRA Funding," and "Maintain Existing PCI of 58" budget scenarios. After 30 years, if no investment is made in maintenance and rehabilitation, the deferred maintenance cost is projected to sharply increase to \$55.9 million. On the other hand, in the budget scenario using SB 1 RMRA funding, the deferred maintenance cost by 2047 is \$37.5 million. By using the SB 1 RMRA



funding as opposed to doing nothing, the deferred maintenance cost is cut nearly in half by the year 2046. Additionally, if the current network PCI of 58 was maintained, the deferred maintenance cost would greatly reduce to \$12.6 million. The projected SB1 budget using RMRA funding totals approximately \$15.4 million over 30 years. To maintain the existing PCI of 58, a total of \$22.3 million over 30 years is needed. To prevent further degradation of the network PCI, the County would need to spend \$310,000 per year in addition to the SB1 RMRA funds.



**Figure 13: Deferred Maintenance Comparisons between Do Nothing and SB 1 RMRA Funding Scenarios**

Figure 14 shows the current breakdown of the County’s road mileage by condition, whereas Figures 15 – 20 show the projected conditions at the end of 5 years for each budget scenario considered.

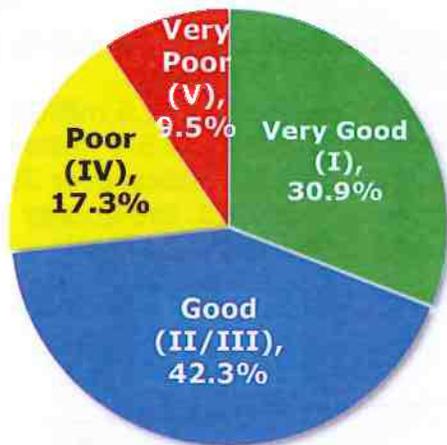


Figure 14. Current Condition

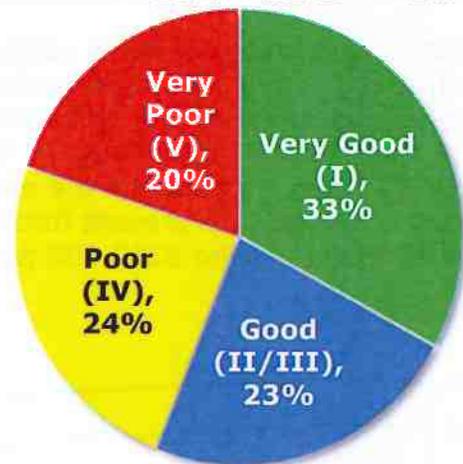


Figure 15. Scenario 1 Projected Condition

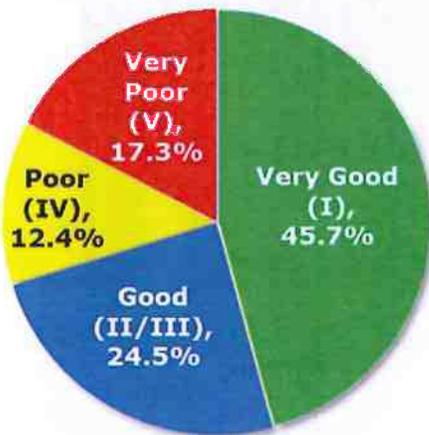


Figure 16. Scenario 2 Projected Condition

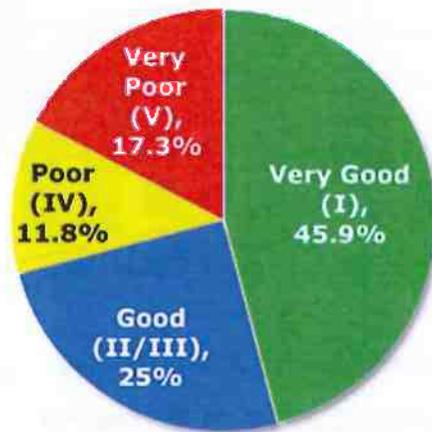
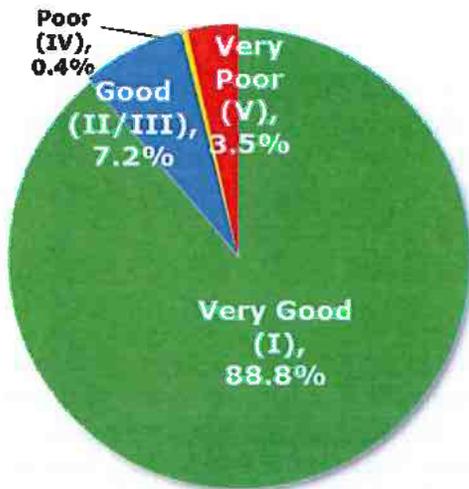
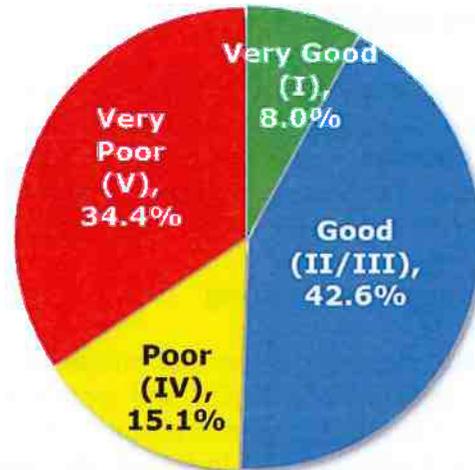


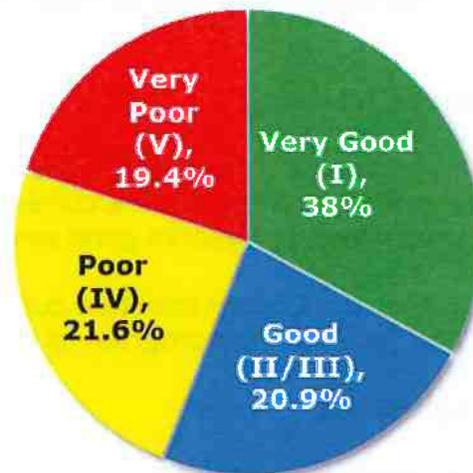
Figure 17. Scenario 3 Projected Condition



**Figure 18. Scenario 4  
Projected Condition**



**Figure 19. Scenario 5  
Projected Condition**



**Figure 20. Scenario 6  
Projected Condition**



## Conclusions

Alpine County has a substantial investment in its road network, estimated at \$39.1 million. Overall, the roads are in "Fair" condition with an average PCI of 58. Approximately one third of the roads are in the "Very Good/Good" condition. The County's projected bi-annual budget starting with a base budget of \$640,000 for FY 2019/20 will result in the average PCI decreasing to 50 by FY 21/22.

### a. Pavement Funding

County's current bi-annual budget for pavements is estimated to be approximately \$360,000 in FY 2019/20 and increases by approximately \$20,000 every two years until FY 2026/27, where no growth is projected. At this budget level, the County's average network PCI level will decrease to 50 over the next 5 years. The overall condition of the pavement will remain in the "Fair" category; however, it will be near the PCI breakpoint that will soon put the pavement condition into the "Poor" category. In addition, the percentage of roads in the "Poor" or "Very Poor" category will increase to 41%. However, the percentage of pavement in the "Very Good/Good" category will increase to 38%. The resulting deferred maintenance at the end of the analysis period will increase to \$11.7 million.

It should be noted that there is a significant unknown in the future cost of rehabilitation; with the volatility in oil prices, we would recommend that the County carefully monitor future construction costs and be ready to adapt to large increases if necessary.

### b. Pavement Maintenance Strategies

The County's pavement maintenance strategies include surface seals and overlays. Since a nearly three fourths of the pavements are currently in "Very Good/Good" and "Fair" condition, it is important to preserve good pavements.

Therefore, we recommend that the County maintain current efforts in the preventive maintenance and rehabilitation program as outlined in the decision tree.

### c. Re-inspection Strategies

In order to monitor future pavement performance and on-going maintenance needs, it is recommended that all roads in the network be re-inspected every two years.

### d. Maintenance and Rehabilitation Decision Tree

The maintenance and rehabilitation decision tree and the associated unit costs should be reviewed and updated annually to reflect new construction techniques and changing costs so the funding analysis can be reliable and accurate.



**e. Next Steps**

To summarize, we recommend that the County consider the following steps:

- Implement alternative maintenance treatments as technology changes.
- Update the pavement management program regularly.
- Review and update maintenance and rehabilitation decision tree and associated unit costs annually.



## Appendix A

# Quality Control Plan



# Quality Control Plan

Alpine County 2018 Pavement Management Update

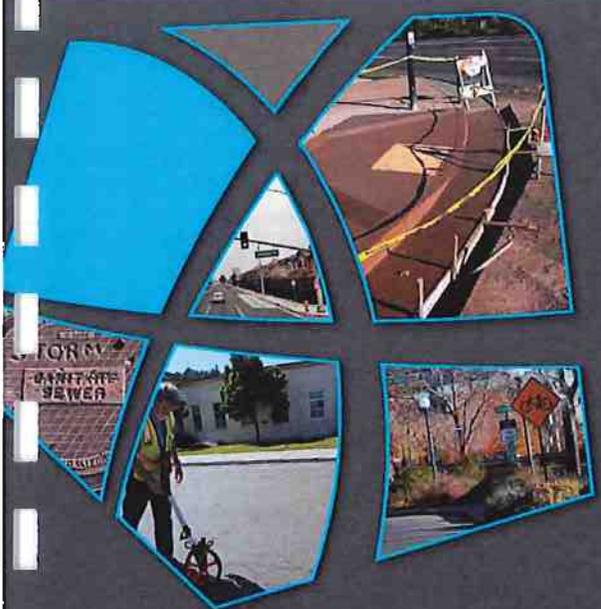
March 29, 2018



Reno, NV

1885 S. Arlington Ave., Suite 111

Reno, NV 89509



## Alpine County

99 Water Street

Markleeville, California 96120



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### Appendix

A. Resumes of Inspectors



## 1.0 INTRODUCTION

When performing data collection in any field, the need for quality control is paramount. This need for quality data is essential for accurate planning, analysis, and design. NCE's "Quality Assurance Management Plan" (QAMP) affirms that:

*"NCE is dedicated to achieving technical and management excellence and to delivering professional engineering and environmental services that meet or exceed our clients' needs. NCE's Quality Assurance (QA) Program is designed to achieve these goals. This QA Management Plan (QAMP) describes NCE's QA Program, which is based on four principles: client satisfaction, employee participation, problem prevention, and continuous quality improvements."*

NCE's QAMP establishes minimum quality standards for performance and procedures for assuring that our clients receive quality service. It requires the participation of employees at every level. It encourages Project Managers and technical staff to take pride in their work and responsibility for ensuring that the work is done the first time correctly. The program is designed to reduce the incidence of problems related to quality and results in implementation, where necessary, of corrective actions and modification of work procedures to minimize the incidence of future problems.

NCE has also prepared detailed and specific Quality Control Plans for projects, one of the most notable example being the Long Term Pavement Performance (LTPP) – Western Regional Support Contract for the Federal Highway Administration. This quality control plan documents data collection on highways, including deflection, profile, pavement distresses, traffic, maintenance and rehabilitation history, materials testing and sampling as well as a document control.

### 1.1 Objectives

The objective of this document is to describe a formal Quality Control Plan (QCP) for the Alpine County (County) 2018 Pavement Management Program Update project.

### 1.2 Structure

The following components are addressed in this QCP:

- Condition survey procedures used
- Accuracy required for data collection
- Inspector qualifications and experience
- Safety



## 2.0 QUALITY CONTROL PLAN

### 2.1 Condition Survey Procedure

The governing documents in performing condition surveys are:

- "Pavement Condition Index Distress Identification Manual for Flexible Pavements," Metropolitan Transportation Commission, 4th Edition, March 2016.
- "Pavement Condition Index Distress Identification Manual for Rigid Pavements," Metropolitan Transportation Commission, 3rd Edition, March 2016.

Any exceptions to the above procedures will be discussed with the County before surveys are performed. These are usually related to distresses or situations that are not covered in the manuals but are important to the agency. Examples might include slippage cracks, roller check marks or edge cracking on streets with no curbs and gutters. Others include the rating of raveling on chip seals or open-graded asphalt concrete mixes. Any modifications will be documented and submitted to the County for approval prior to conducting the first survey.

All surveys will be performed as *walking* surveys with a single person crew.

A record of GPS locations for approximately 210 sample units has been obtained from the previous 2012 PMS plan update and these same sample units will be inspected in this 2018 survey. It is assumed that the condition of the sample units are representative of the section as a whole. If a sample unit is determined to be unrepresentative, it will be inspected and an additional sample unit will be identified and inspected that is considered to be more representative of the overall condition of the section. The inspector will place an appropriate comment on each sample unit, and the decision of whether to substitute the new sample unit for the old sample unit will be made in consultation with the County.

It is also assumed that the pavement sections are homogeneous based on the following criteria:

- Pavement condition
- Construction age, if known
- Maintenance history, if known
- Traffic volumes (or functional classification as a surrogate)
- Surface types, e.g., asphalt concrete or Portland cement concrete
- Geometric elements, e.g., widths

It is not uncommon for section homogeneity to change over time, and thus may vary from one survey to the next. If in the course of the survey the section is observed to lack homogeneity, then the section will be split according to the criteria agreed upon by NCE and the County prior to conducting the first survey. This may require selecting alternative and/or additional sample units. Any modifications to the section inventory data will be documented and provided to the County.



When selecting new sample units, typical sample unit dimensions will be 100 ft long by the width of the street. Since the maximum size of a sample unit allowed under StreetSaver is 4000 ft<sup>2</sup>, sample units on streets that are wider than 40 ft will have shorter lengths (generally 50 ft). If the street is divided by a raised median, separate sample units will be selected in each direction.

## 2.2 Accuracy Required For Data Collection

The accuracy of the data collection effort will be assessed through the following two approaches, both of which are further described in the following paragraphs.

- Random re-inspections
- Systematic re-inspection.
- PCI comparisons with past surveys.

### 2.2.1 Random and Systematic Re-inspection

As a minimum, 5% of the total sample units that have been inspected will be re-inspected by a different inspector who was not directly involved in the initial inspection. The sample units to be re-inspected will be randomly selected but chosen to be broadly representative of the network based on the following categories:

- Functional classes, i.e., arterials, collectors, locals;
- Surface types, e.g., asphalt concrete or chip seal;
- Pavement conditions, e.g., good, fair, poor;
- Inspectors;
- Geographical areas, if applicable.

Based on the results of the random re-inspection, systematic re-inspections may be needed due to potential bias noted within data collected for a specific treatment type (e.g., open-graded mixes), by a specific inspector, or within a specific geographical area. In such cases, the sample units to be re-inspected will be determined based on the nature of the bias discovered in the random inspection.



### Acceptability Criteria for Re-Inspected Sample Units

At the time of re-inspection, the actual distress will be re-inspected and verified, and any corrections made, if necessary. The following acceptance criteria shall be applied to the re-inspection as required by the Metropolitan Transportation Commission (MTC):

- 1) At least 50 percent of the PCI values for the re-inspected sample units must be within +/- 5 PCI points of the original inspection PCI values.
- 2) No more than 12 percent of the PCI values for the re-inspected sample units can be greater than +/- 15 PCI points of the original inspection PCI values

If the above acceptance criteria are not met, then an additional 5% of the sample units will be re-inspected. This will continue until the re-inspected sections meet the acceptability criteria.

### 2.2.2 PCI Comparison with Past Surveys

As another level of quality control, the new PCI are compared with the previous PCI for each section. If they differ by more than  $\pm 20$  PCI points, these sections will be automatically flagged for further investigation to assess the accuracy of the most recent survey.

#### If PCI is +20 points:

For sections that showed a dramatic improvement in condition as assessed by the PCI, the section will be investigated to see if a maintenance and rehabilitation event has occurred since the last survey that was not recorded. This can only be resolved with feedback from the County. Typically, it may include activities such as:

- Crack sealing activities – changes medium or high severity cracking to low severity
- Patching activities - alligator cracking that has been removed and patched, so that the resultant PCI is increased.
- Surface seals
- Overlays
- Reconstruction

#### If PCI is -20 points:

For sections that showed a dramatic decrease in condition as assessed by the PCI, the section will be checked to see if the average deterioration rate exceeds the 4 points per year which, is not considered to be normal. If the deterioration rate exceeds 4 points per year, a re-inspection will be performed to verify that the recorded condition is accurate based on the criteria presented in Section 2.2.1. The verified PCI value will be recorded and if the PCI drop exceeded 4 points per year, the section will be flagged for additional evaluation to determine what may have caused the rapid rate of deterioration.



## 2.3 Inspectors Qualification and Experience

All NCE's inspectors are required to attend formal training on condition distress surveys. Additionally, for projects using the MTC StreetSaver system, NCE only uses inspectors that have attend the distress training conducted by MTC and been certified by MTC. After formal training, NCE inspectors work with an experienced inspector for a minimum of three months before they are allowed to work on their own. Within the first month of working on their own, up to 20% of their work is checked weekly. Any necessary corrections are made immediately. In addition, NCE conducts an annual one-day training and calibration workshop for all NCE staff involved with data collection.

Resumes of the technicians who may be utilized on this project are included in Appendix A. Alternate technicians will only be used with permission of the County.

## 3.0 SAFETY PROCEDURE

NCE administers a health and safety program in compliance with the Nevada Occupational Safety and Health act (Section 618.383) and Cal OSHA Title VIII, Section 3203. The program is documented in NCE's *Workplace Safety Program Manual*.

The safety procedures include:

- Inspectors to wear a safety vest at all times;
- Flashing beacon on all vehicles utilized for surveys; and
- Stopped vehicles to be parked at locations away from moving traffic, e.g., nearby parking, shoulders, etc.

On streets where there is a high volume of traffic or high speeds, additional measures may be necessary, such as:

- Surveys to occur during off-peak periods or on weekends;
- Additional inspector to watch out for traffic; and
- Traffic flaggers in extreme cases.

In extreme cases where it is not possible to walk on the pavement surface, surveys will be performed from sidewalks or raised medians. However, this is rare for city or county roads/streets; this is most often encountered on state highways, and lane closures are the most likely option at this point. The cost for traffic flaggers or lane-closure are additional, and not within NCE's scope or budget for this project.

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**APPENDIX A**

**RESUMES OF FIELD INSPECTORS**

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## Dick Minto

### Senior Construction Manager

Prior to joining NCE in 2012, Dick managed road maintenance and construction activities for the Washoe County Public Works Department. He was responsible for implementing cost effective approaches for construction and maintenance activities. Those duties also included road reconstruction, surface treatments, erosion control project, repairing and maintaining drainage systems etc. He has performed construction oversight, management and resident inspection services for over 30 years. As such, Dick is extremely familiar with cost effective approaches for construction and the long term maintenance implications of various design options. He has extensive experience with the Manual on Uniform Traffic Control Devices (MUTCD) and the Standard Specifications for Public Works Construction.

## Representative Projects

### Roadway Improvements

#### Virginia Street Bus RAPID Transit Extension

*Regional Transportation Commission of Washoe County, Nevada*

Constructability and Maintainability Reviews. NCE prepared the environmental document and preliminary engineering of Virginia Street, a project that increases mobility and safety along the corridor. The project includes roadway reconstruction, intersection and signal modification, landscaping and aesthetics, pedestrian and bicycle improvements, and a gateway to the University of Nevada, Reno campus.

#### East Newlands Road and Nevada Pacific Parkway Crack Repair Project

*City of Fernley, Nevada*

Resident Inspector. The East Newlands Road and Nevada Pacific Parkway Crack Repair Project consisted of repairing transverse and longitudinal cracks in an Industrial area that supports high volumes of truck traffic. The cracks ranged in width from 3" to 12" and continue to grow as a result of the asphalt roadway shrinking. NCE has worked with several jurisdictions over the past several years to provide agencies with maintenance techniques that are cost effective to maintain shrinking asphalt roadways and parking lots. Dick served as the resident inspector for the 10,300 linear feet repair project. His duties included tracking work quantities and assurance that work was completed per plans and specifications. Maintain a field set of record drawings. He also monitored the project and recorded asphalt shrinkage resulting in crack growth on a monthly basis for one year after completion of the project.

#### Prater Way and El Rancho Drive Pavement Project

*Regional Transportation Commission of Washoe County, Nevada*

Field Data Collection. Dick provided existing condition surveys of pavement, sidewalk, curb & Gutter. Marked locations of base repairs and provided input on repair alternatives to ensure the project was constructable and cost effective to maintain.

#### West Huffaker Lane Rehabilitation

*Regional Transportation Commission of Washoe County, Nevada*

Construction Manager and Inspector. The project included inspection services for design and construction for rehabilitation to pavement section, full depth



#### Education

Shasta College

#### Joined NCE

2012

#### Total Years of Experience

30 years

pulverization, regrading shoulders, paved shoulders, repairing drainage structures, surface treatment, minor curb and gutter replacement, guardrail installation, signage and striping modifications to accommodate bike lanes. The scope of work also included investigation of existing conditions, condition survey, preliminary design, final design, contract administration, and construction inspection services.

#### **East Newlands Crack Repair Project**

*City of Fernley, Nevada*

Construction Manager/Inspector. Responsibilities included working with the design team to complete plans for the project that would be cost effective to construct and maintain. Dick also provided daily construction inspection services for the project during construction. His duties included marking repairs in the field, insuring the contractors work met standards called out in the plans and specs. Tracking time and materials used. Providing as-builts plans. Working with the client to make sure they were comfortable with the project.

#### **Lakeshore Drive Pavement Rehabilitation and Drainage Improvements**

*Washoe County Public Works Department, Nevada*

Resident Inspector/Project Maintenance Manager. Responsibilities included advising the design team on existing conditions and design alternatives to achieve a completed project that would be efficient and cost effective to maintain. The project included underground drainage, storm treatment vaults and improvements to bicycle and pedestrian traffic. Dick reviewed proposed construction plans and schedules and worked with project managers, construction supervisors, field personnel and engineers in their performance of field inspections to ensure a high quality cost effective project.

#### **2013 Corrective Maintenance Project**

*Regional Transportation Commission of Washoe County, Nevada*

Construction Manager and Inspector. The 2013 Corrective Maintenance Project consisted of several different treatments ranging from full depth patching and surface treatments to full depth reconstruction of several streets in the Reno Area. Dick provided daily construction inspection services for the project.

#### **Gonowabie Road Slope Repair**

*Washoe County Community Services Department, Nevada*

Construction Manager and Inspector. The project included inspection services for the construction of a soil nail wall on Gonowabie Road in Crystal Bay. Tasks included documenting daily construction progress, and meeting with project managers, engineers, county inspector, and job superintendents for planning and construction questions. Conducted traffic control inspections, ensured daily construction procedures were consistent with plans, and ensured Best Management Practices (BMPs) were in place.

#### **Lakeshore Boulevard and Northwood Boulevard Pedestrian Path Overlay**

*Washoe County Public Works Department, Nevada*

Construction Manager and Inspector. The project task included full time inspection services for construction of 15,742 linear feet of asphalt paving, 200,000 square feet of asphalt surface sealing, pre and post construction video of the project site, meeting with construction superintendents, project supervisors, provide environmental oversight, reviewing and approving construction methods and schedules, write construction and material reports, schedule material testing and documenting results. Updating project managers/owners on a daily basis, creating preliminary and final punch lists, traffic control inspections, and completing the project closeout report were also included.

#### **Miscellaneous Field Inspection Services**

*Washoe County, Nevada*

Field Data Collection and Constructability Reviews. Provide miscellaneous on-call field inspection services for construction projects, street rehabilitation projects, surface treatment projects, curb and gutter replacement projects, plan and spec oversight and review. Provide inspections for the street excavation permitting program.

#### **Pervious Concrete Study**

*Nevada Department of Transportation, Nevada*

Field Inspector. Provide condition assessments and infiltration testing for two pervious concrete test sections constructed at Lake Tahoe.

#### **Comstock Drive Drainage and Roadway Improvements**

*City of Fernley, Nevada*

Construction Manager. Dick provided constructability and maintainability input to the design team and part-time construction inspection. Worked with design team to make sure the project was constructable and maintainable in an efficient and cost effective manner.

#### **Road Operations Effectiveness Testing**

*City of South Lake Tahoe, California*

Maintenance Management Consulting Services. Provided oversight for Road RAM, winter road operations (sanding & sweeping) cost effectiveness study of jurisdictions in the Tahoe Basin. Duties included advising regulatory agencies and road maintenance managers on alternatives to reduce sediment loading in Lake Tahoe.

#### **Kings Beach Commercial Core Improvement Project**

*Placer County Public Works Department, California*

Onsite Inspector. Provided inspection services for curb and gutter installation. Work with contractor and owner to make sure the project was completed as the designer's intent to match plans and specs. Duties also included tracking labor, equipment and materials used.

#### **Twelve Bridges and Joiner Parkway Resurfacing Project**

*City of Lincoln, California*

Field Data Collection Constructability Review. Dick conducted existing condition surveys and evaluated repair methods and locations of repair limits. Evaluate existing conditions and provide input to the design team for choosing repair methods that were cost effective.

#### **South Main Street and Soda Bay Road Repair**

*City of Lakeport, California*

Field Data Collection and Constructability Reviews Dick conducted existing condition surveys and evaluated repair methods and locations of repair limits. Evaluate existing conditions and provide input to the design team for choosing repair methods that were cost effective.

#### **Reconstruction and Resurfacing Project**

*City of Berkeley, California*

Field Inspector. Dick conducted inspection services for subgrade base repairs duties included reviewing plans and specs, providing repair alternatives that were cost effective and provided field markings of repair limits for the onsite inspectors

#### **Street Rehabilitation Plan**

*City of Capitola, California*

Construction Inspector. Constructability review and mark base repairs. Worked with the design team on construction alternatives that were cost effective to construct and maintain. Provided Inspection oversight for the City's 2016 street reconstruction project.

#### **Pavement Repair Project**

*Town of Moraga, California*

Field Inspector. Conduct maintainability and constructability review for design and construction

#### **Pavement Rehabilitation and Curb Ramp Repairs**

*City of Sunnyvale, California*

Field Inspector. Conduct constructability and maintainability review, locate different repair areas, and conduct ADA Ramp surveys.

### Road Rehabilitation Project

*City of Concord, California*

Construction Inspector. Conduct Constructability and Maintainability reviews.

### Surface Treatment and Bicycle/Pedestrian Path

*City of Davis, California*

Construction Inspector. Conduct Constructability and Maintainability reviews.

### Pavement Data Collection

#### Pavement Condition Surveys for Misc. Jurisdictions

*Various Locations, ID, CA and NV*

Field Data Collection. Projects included evaluating conditions of existing streets to assist jurisdictions with future needs for funding, and maintaining roadways in a cost effective manner. Some of the clients Dick has recently worked with include:

- Sparks, NV
- Washoe County RTC, NV
- Washoe County
- Yuba City, CA
- Ada County, ID
- Pebble Beach Community, CA
- Trinity County, CA
- Rancho Cordova, CA

### San Francisco Bay Trail Project

*East Bay Regional Park District, California*

Constructability and Maintainability Reviews. Worked with design team to provide cost effective construction alternatives to the project.

### Pavement Condition Data Collection

*Washoe County, Nevada*

Senior Engineering Technician. Scope included verifying road inventory – lengths, widths, locations, and segmentation for a local road network of approximately 184 centerline miles, conducting manual PCI data collection using PAVER software, surveying the roads using ASTM D6433-11 protocols, updating PAVER databases, updating the maintenance and work history, ensuring a rigorous and extensive QC program, creating and updating a pavement network in GIS with field verification, and reviewing PAVER database with user. Annually performed similar work for the client since 2011.

### Program Management System Updates

*Orange County, California*

Engineering Technician. Scope includes verifying the road inventory for a road network (674 centerline miles), surveying the roads using ASTM D6433-11 protocols, updating the maintenance history, developing maintenance strategies, performing multiple budget scenarios, linking to a GIS shapefile, developing a seven-year work plan, and preparing reports. Concurrent with the pavement condition survey, mobile data collection units gathered high-resolution 360 degree georeferenced right-of-way street level digital imagery along with 3D point cloud data. Assets collected included markings, signs, curb ramps, signals, and drainage features.

### **FY16 Site 200 Pavement Rehabilitation Project**

*Lawrence Livermore National Laboratory (LLNL), California*

**Constructability Review.** Dick conducted a constructability review of each project site with the NCE project manager, lead designer, and Lawrence Livermore National Security (LLNS) staff. The review considered items, such as storm drain pipe replacement, paving operations, and striping improvements. LLNS developed a pavement rehabilitation project for preventive maintenance and rehabilitation of several roads and parking lots within the Site 200 Campus located just off of Vasco Road in Livermore. LLNS obtained the services of NCE to perform pavement design and civil design services for its FY16 pavement maintenance project. NCE worked with LLNS to identify site improvements, above and beyond typical pavement resurfacing. In lieu of a conventional rehabilitation or reconstruction, NCE tailored pavement treatments in parking lots to address localized areas of failure with asphalt surface reconstruction in addition to a slurry seal to create a uniform finished surface. Additional cost savings were assumed by use of Full Depth Reclamation (FDR) design for a road in need of reconstruction. Other design improvements included storm drain pipe replacement, addition of drainage channel slope protection, and striping improvements to streets and parking lots. Up to five project locations are out to bid in spring 2017 and NCE will perform bidding and construction support.

### **Street and Parking Lot Reconstruction Project**

*City of Half Moon Bay, California*

**Constructability Review.** Dick conducted a constructability review of each project site with the NCE project manager. The review considered items, such as storm drain pipe replacement, surface drainage improvements, and paving operations. The City of Half Moon Bay asked NCE to provide pavement design recommendations and PS&E for nine residential streets in need of reconstruction and three parking lots in need of repair. The residential streets typically do not have curb and gutter and are in need of surface and sub-surface drainage and shoulder improvements. The parking lot improvements include drainage, grading, and accommodation for parking lot users, such as buses and horse trailers. Streets slated for reconstruction were surveyed by a topographic surveyor to best design for grading and a private utility locator was hired to locate the alignment and depth of underground facilities by way of ground penetrating radar. NCE is assisting the City with coordination of utility companies where underground facility relocation is necessary. The surface seal plans used vicinity maps, quantity schedules, and details and included striping plans. Pavement reconstruction treatments included the use of full depth reclamation (FDR) and rubberized hot mix asphalt (RHMA) overlays.

## **Water Supply**

### **Venice Drive Water Line Replacement**

*Tahoe Keys Property Owners Association, California*

**Resident Inspector.** Responsibilities include on-site construction inspection for a water main replacement project for the Tahoe Keys Property Owners Association. Dick provided bid assistance including the project pre-bid meeting, preparing responses to Contractor RFIs and addendum during the bid phase as well as evaluating construction bids.

## **Water Quality Improvements**

### **Crystal Bay Water Quality Improvement Project Phase I and II**

*Washoe County Community Services Department, Nevada*

**Project Maintenance / Construction Manager.** Project included design and construction of a comprehensive erosion control and water quality improvement project. The project included water quality improvements utilizing best management (BMPs) within the County Right-of-Way to enhance water quality within the watershed. Project design conforms to the Tahoe Regional Planning Agency (TRPA) Environmental Improvement Program for water quality retrofit. Specific project responsibilities included advising the design team on existing conditions and design alternatives to achieve a completed project that would be efficient and cost effective to construct and maintain.

### **Fairview/Fairway Phase III, Water Quality Improvement Project**

*Washoe County Community Services Department, Nevada*

**Project Maintenance/Construction Manager.** The Fairview/Fairway Phase III, Water Quality Improvement Project included planning of a comprehensive erosion control and water quality improvement project within the Incline Village subdivision to reduce sources of erosion, reduce the amount of storm water generated within and discharged from the County right-of-way, and improve the quality of storm water discharged from the County right-of-way. Specific project responsibilities

included advising the design team on existing conditions and design alternatives to achieve a completed project that would be efficient and cost effective to maintain.

**Central Incline Village Water Quality Improvement Project**  
*Washoe County Community Services Department, Nevada*

Constructability and Maintainability Reviews. The Central Incline Village Water Quality Improvement Project included installation of drainage improvements and sediment control measures to help improve the clarity of Lake Tahoe. Dick assisted the design team in evaluating and proposing design alternatives from a cost effective approach related to construction and maintainability.

**Bijou Area Erosion Control Project**  
*City of South Lake Tahoe, California*

Construction Manager and Inspector. The project was a complex water quality improvement project that was the first of its kind in the Lake Tahoe Area. The project separated clean stream water from the untreated runoff generated in the commercial core area of South Lake Tahoe. The stream was put underground in over 1,000 ft. of 2.5' by 7' box culvert. The previously untreated stormwater was collected by installing several thousand feet of storm drain and connected to large treatment vaults as large as 30,000 gallons. After treatment the storm water was pumped through nearly 7,000 feet of force main to several large sediment basins that were also part of the project. The project was the most complex water quality treatment project built in the Lake Tahoe Basin. It was a multiple year project with highly restrictive environmental conditions and within a commercial area with several businesses that needed 24 hour access.

Dick provided construction inspection for the two year project. His duties included participation in the preconstruction, planning and public meetings. Reviewing construction schedules, material submittals, facilitate weekly construction meetings, review, and address owner/client concerns. Review RFI's and RFC's work with the design and engineering teams to resolve questions related to the plans and specs. Schedule Inspectors and material testing. Track labor and materials used, prepare and review pay estimates and quantity sheets, review pay requests and advise engineer of differences. Attend meetings with various jurisdictions affected by the project. Provide daily inspections and associated required documentation. Conduct field sampling, inspect daily traffic control. Complete daily BMP inspections. Coordinate, schedule and work with revegetation specialist. Organize and maintain project files to meet Caltrans requirements. Create and maintain construction punch list. Maintain As Built plan set. And project closeout documentation.

**Tilden Nature Area Sediment Basin Dredging and Pond Restoration Project**  
*East Bay Regional Park District, California*

Constructability and Maintainability Reviews. Work with design team to provide cost effective construction alternatives to the project.

# CERTIFICATE OF ACHIEVEMENT

This is to certify that

**Dick Minto**

has completed the requirements of the

**MTC StreetSaver Rater Certification Program**

with the skills and knowledge on pavement condition assessment based on the MTC's modified ASTM D6433

**Certificate valid until Aug 08 2018**

Serial no: 1038



*Sui Tan*

Sui Tan, StreetSaver Program Manager  
Metropolitan Transportation Commission

**Kevin Foxcroft**  
**Field Technician**

With more than five years of experience, Mr. Foxcroft has experience in data collection and entry, construction inspection, and data analysis. Prior to joining NCE, he worked with the Nevada Department of Transportation in the survey and construction departments in which he performed a variety of tasks ranging from field reconnaissance and topographic surveys to completion of daily construction inspection reports to verify contractor work and progression.

**Representative Projects**

**Transportation/Roadway**

**Pavement Condition Data Collection | Field Technician**

*RTC of Washoe County, NV*

This project involves collecting pavement condition survey data on the regional road network. NCE has collected data annually on over 160 centerline miles of roadway identified in RTC's Regional Transportation Plan (approximately 1,870 sample units will be inspected each year). NCE's services include updating pavement management databases for Washoe County, City of Reno, and City of Sparks as well as performing QC/QA activities on the data.

**Pavement Condition Data Collection | Field Technician**

*Washoe County, NV*

This project involves collecting pavement condition survey data on the County's roadway and parking lot networks, including inspecting approximately 3,000 sample units every year. NCE's services include coordinating with the County, collecting data, QC/QA, updating the management system, developing GIS shapefiles and linking those to the management system. This work also includes establishing new sample units, and identifying unrecorded maintenance activities.

**Pavement Condition Data Collection | Field Technician**

*City of Sparks, NV*

This project involves collecting pavement condition survey data on the City's roadway network as well as their regional bike and pedestrian trails, including inspecting approximately 1,000 sample units every year. NCE's services include coordinating with the City, collecting data, QC/QA, updating the management system. This work also includes establishing new sample units, and identifying unrecorded maintenance activities.



**Education**

A.A.S., Construction Technologies  
(Emphasis in Renewable Energy), 2013  
Truckee Meadows Community College

**Registrations and Certifications**

OHSA 10-Hour Construction

**Joined NCE**

2016

**Total Years of Experience**

5 years

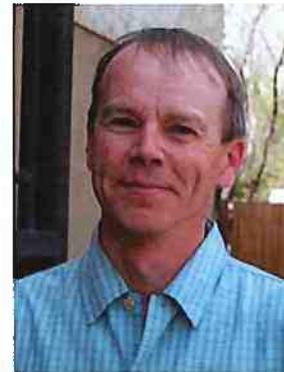
**Long Term Pavement Performance | Field Technician**  
*Federal Highway Administration, Western Regional States*

The project involves scheduling of all field activities, roadway evaluations, field materials sampling, and coordination of with agencies to receive maintenance information that has occurred on over 500 roadway segments across 14 Highway Agencies in the Western US. The field monitoring activities include materials sampling, falling weight deflectometer, pavement condition surveys, profile, environmental, global positioning measurements, and dynamic cone penetrometer.

**Maintenance Achievement Program Data Collection | Field Technician**  
*Nevada Department of Transportation, Nevada*

NCE is conducting field surveys, collecting data, and calculating level of service achieved through highway maintenance activities. The project includes the development of professional and accurate documentation to present the level of service to the Nevada Department of Transportation.

**Richard LaValley**  
**Engineering Technician**



As an Engineering Technician, Rich has been performing Falling Weight Deflectometer (FWD) operations in all of the Western States, and is capable of verifying and analyzing FWD and Deflection data. He has been accredited by the FHWA as a Distress Rater for 12 years and as a Seasonal Monitoring Technician for five years. Other duties include Transverse Profile and Distress testing and he performs downloads of Seasonal data. Rich has vital expertise with the care and maintenance of the FWD equipment and is responsible for the vehicle and all testing equipment in the field. In the course of Distress monitoring, he notes damage to roads and structures including markings and signs, and reports to appropriate agencies when attention is required. He also performed pavement materials sampling (i.e., coring) at locations across the Western U.S. Rich's extensive experience in the field with different kinds of asphalt and concrete surfaces allows him to work independently and efficiently.

In 14 years of field data collection, Rich has tested over 28,000 test points using the standard FHWA 12 and 16 drop test setups (the equivalent of 300,000 test drops). He has participated in 15 FHWA certified reference calibrations at Dynatest's facility in Starke, Florida, A & M's facility in College Station, Texas, Denver, Colorado, and U.C. Davis. He has been involved in the comprehensive overhaul of two Dynatest 8000 Falling Weight Deflectometers, having collaborated with Dynatest in performing FHWA sponsored yearly maintenance on both FHWA and NCE privately owned FWD.

**Education**  
 University of Nevada – Reno  
 (1984-1988)

**Joined NCE**  
 1998

**Total Years of Experience**  
 16

**Representative Projects**

**LTPP**

Mr. LaValley has over sixteen years of experience with data collection on the Long Term Pavement Performance (LTPP) project. This federal project has test sites in every state and province. NCE, as the Western Region Support Contractor, has several accredited raters, including Mr. LaValley, who has measured distress at hundreds of sections over the Western United States and operated profile measurement equipment and participated in forensic activities. In the field and at home, he is responsible for all equipment calibrations and maintenance, daily logs and reports, and verification of reliable data.

**Pavement Condition Data Collection (2010, 2012, and 2013-2015), RTC of Washoe County, NV – Technician.** This project involves collecting pavement condition survey data on the regional road network. NCE is scheduled to collect data on over 160 centerline miles of roadway identified in RTC's Regional Transportation Plan (approximately 1,870 sample units will be inspected). NCE's services include updating pavement management databases for Washoe County, City of Reno, and City of Sparks as well as performing QC/QA activities on the data.

**2013 Corrective Maintenance, RTC of Washoe County, NV -- Technician.** The RTC selected NCE to provide engineering services related to the corrective maintenance for approximately three miles of roads in Washoe County, City of Sparks, and City of Reno. The project design alternatives may include full depth base repairs, mill existing asphalt and replace, and mill existing asphalt and patch. NCE will evaluate the various surface treatments which may include crack sealant, chip seal, micro surface and slurry seal. NCE's services include project management, development of PS&E, pavement design and soils investigation reports, utility coordination, construction administration, construction management and inspection, and bidding services.

**Los Altos Parkway Pavement Rehabilitation, RTC of Washoe County, NV – Technician.** The project area spans Los Altos Parkway from the intersections of Canyon Run Drive to Goodwin Road in Sparks. The project included completion of a pavement condition survey, development of rehabilitation/reconstruction alternatives, a life-cycle cost analysis, PS&E, and bidding services. NCE also provided full construction management and inspection services.

**2011-2016 Pavement Condition Data Collection, City of Sparks, NV** - Technician. This project involves collecting pavement condition survey data on the City's roadway network as well as their regional bike and pedestrian trails, including inspecting approximately 1,000 sample units every year. NCE's services include coordinating with the City, collecting data, QC/QA, updating the management system. This work also includes establishing new sample units, and identifying unrecorded maintenance activities.

**San Francisco International Airport (SFIA) Pavement Engineering On-Call Services, San Francisco, CA** - Engineering Technician. Scope included collecting pavement distress data for both airside and landside pavements as per ASTM D5340 and D6433, respectively. A semi-automated vehicle was used to collect data on the runways and taxiways with walking surveys used on the aprons. Updated SFIA's PAVER™ PMS and submitted reports to the Federal Aviation Administration. Determining the ACN/PCN for runways and taxiways, and performed deflection testing and pavement designs (FAARFIELD) for Runways 1L/19R, Taxiways E, F, and L.

**Inyo County Pavement Management Program, Inyo County, CA** - Engineering Technician. Scope included developing the inventory and condition information for the paved roads - approximately 550 centerline miles Inyo County and City of Bishop, conducting annual manual condition data collection using PAVER software and ASTM D6433 standards, ensuring a rigorous and extensive QC program, determining traffic volume (average daily traffic) data at 20 locations in Bishop, predicting the future pavement condition of the paved network, determining impacts of multiple budget/funding scenarios on future roadway conditions, performing 20-year and 5-year work planning analysis, and integrating the PMS database with the County and City's GIS.

#### Distress Surveys

Mr. LaValley worked on the following projects collecting detailed distress surveys:

Start Date	Project Name	Client
Aug 2014	PCI Data Collection Update	Town of Gardnerville
May 2014	Bishop PCI Data Collection	Inyo County
May 2014	PCI Data Collection	Reno & Sparks, Washoe County
Apr 2013	Corrective Maintenance	Washoe County RTC
Apr 2013	Bishop PCI Data Collection	Inyo County
July 2013	PCI Data Collection	Reno & Sparks, Washoe County
Aug 2012	PCI Data Collection	Washoe County RTC
Mar 2012	Huffaker Lane Rehab	Washoe County RTC
Mar 2010	PCI Data Collection	Washoe County RTC
Feb 2010	DOT 2010 Overlay	City of Sacramento CA
Feb 2010	Sunnyvale 2010 Pavement Rehabilitation & Resurfacing	City of Sunnyvale CA
Feb 2010	2010 Pavement Rehabilitation Project	City of Richmond CA
Feb 2010	Contra Costa Improvement Project	City of Pleasant Hill CA
Jan 2010	El Cerrito Pavement Testing & Design	City of El Cerrito CA
Dec 2009	MCOG PMP Update 2010	Mendocino Council of Gov'ts
Oct 2009	2009 Pavement Management Update	City of Larkspur CA
Sep 2009	Phase II ESA Florin Rd Project	City of Sacramento CA
Aug 2009	Corona On-Call Services	City of Corona CA
May 2009	Moya Blvd Rehabilitation Project	Washoe County RTC
Apr 2009	Mono County Road Rehabilitation	Mono County
Mar 2009	Vasco Rd Safety Improvements	Contra Costa County
Mar 2009	Magnolia Ave Pavement Rehabilitation	City of Larkspur CA
Mar 2009	Camino Pablo Pavement Rehabilitation	City of Orinda CA
Feb 2009	2008 PMS Update	City of Fremont CA
Jan 2009	Los Altos Parkway Rehabilitation Project	Washoe County RTC

#### Coring

Mr. LaValley worked on the following projects collecting pavement cores:

Start Date	Project Name	Client
Apr 2014	WesTrack	Nevada DOT
Feb 2014	S Whitney 5 Star & Destiny	City of Rocklin

Mar 2013	Huffaker Ln Rehab	Washoe County RTC
May 2011	DOT 2011 Overlay	City of Sacramento CA
Feb 2010	DOT 2010 Overlay	City of Sacramento CA
Feb 2010	2010 Pavement Rehabilitation & Resurfacing	City of Sunnyvale CA
Feb 2010	2010 Pavement Rehabilitation Project	City of Richmond CA
Jan 2010	El Cerrito Pavement Testing & Design	City of El Cerrito CA
Oct 2009	2009 Pavement Management Update	City of Larkspur CA
Sep 2009	Phase II ESA Florin Rd Project	City of Sacramento CA
May 2009	Moya Blvd Rehabilitation Project	Washoe County RTC
Apr 2009	Mono County Road Rehabilitation	Mono County
Mar 2009	Vasco Rd Safety Improvements	Contra Costa County
Mar 2009	Magnolia Ave Pavement Rehabilitation	City of Larkspur CA
Mar 2009	Camino Pablo Pavement Rehabilitation	City of Orinda CA
Feb 2009	2008 PMS Update	City of Fremont CA
Feb 2009	Norton Road Deflection Testing	City of San Leandro CA

#### FWD Work

A sampling of condition survey projects where Mr. LaValley was responsible for the operation of the falling weight deflectometer (FWD):

<b>Start Date</b>	<b>Project Name</b>	<b>Client</b>
Feb 2010	Contra Costa Improvement Project	City of Pleasant Hill CA
Aug 2009	Corona On-Call Services	City of Corona CA
Apr 2009	Mono County Road Rehabilitation	Mono County



## Appendix B

### Section Description Inventory

- **Sorted by Name**
- **Sorted by Descending PCI**





Road Name	From	To	FC	Surface Type	Length (ft)	Width (ft)	Area (sf)	PCI	Inspection Date
Airport Road - CR0007	Hwy 89	Diamond Valley Road	RL	A	29281	24	702744	58	5/2/2018
Aspen Way - CR0167	Pine Avenue	End	RL	A	404	20	8080	80	5/2/2018
Avalanche Road - CR0204	Snowshoe Road	End	RL	A	1683	18	30294	10	6/1/2018
Barber Road - CR0105	Begin	End	RL	A	1855	25	46375	79	5/2/2018
Barrett Court - CR0222	Montgomery Street	End	RL	A	833	33	27489	27	5/3/2018
Bear Valley Road - CR0186	Hwy 4	Creekside Dr	C	A	12974	28	363272	44	6/1/2018
Bloods Ridge Road - CR0188	Bear Valley Road	Quaking Aspen Road	RL	A	4257	40	170280	28	6/1/2018
Blue Lakes Road - CR0005	Begin	Beginning of Section 10	C	A	23415	24	561960	89	5/31/2018
Blue Lakes Road - CR0005	End of Section 05	End	C	A	37412	24	897888	83	5/2/2018
California Road - CR0205	Emigrant Trail	End	RL	A	2412	22	53064	65	5/1/2018
Canon View - CR0171	Pleasant Valley Road	End	RL	A	343	22	7546	10	5/3/2018
Carson River Road - CR0198	Hwy 88	Diamond Valley Road	RL	A	18308	20	366160	69	5/2/2018
Carson View - CR0207	California Road	End	RL	A	1671	22	36762	73	5/1/2018
Cedar Lane - CR0165	Pine Avenue	End	RL	A	229	21	4809	84	5/2/2018
Chambers Lane - CR0130	Diamond Valley Road	Old Chambers Road	R	A	6842	20	136840	18	4/30/2018
Chisholm Trail - CR0211	Larson Canyon	End	RL	A	723	22	15906	62	5/1/2018
Cole Court - CR0219	Montgomery Street	End	RL	A	126	24	3024	35	5/2/2018
Creekside Drive - CR0202	Bear Valley Road	No Name Road	C	A	6442	35	225470	58	6/1/2018
Crystal Springs Road - CR0175	Hwy 88 - West End	Hwy 88 - East End	RL	A	3605	20	72100	23	5/2/2018
Cub Lane - CR0220	Bear Valley Road	End	R	A	421	20	8420	86	6/1/2018
Diamond Valley Road - CR0003	Hwy 89	Foothill Road	C	A	38797	24	931128	54	5/1/2018
Diamond View - CR0208	Emigrant Trail	End	RL	A	971	21	20391	75	5/1/2018
Douglas Way - CR0135	Hwy 89	End	RL	A	1535	24	36840	45	5/2/2018
Eberhardt Road - CR9003	Bear Valley Road	End	RL	A	252	34	8568	40	6/1/2018
Emigrant Trail - CR0009	Hwy 88	Foothill Road	C	A	17990	24	431760	79	5/1/2018
Flynn Road - CR0226	Bear Valley Road	End	RL	A	642	26	16692	73	6/1/2018
Foothill Road - CR0001	Hwy 88	State Line	C	A	19073	24	457752	67	4/30/2018
Fredericksburg Lane - CR0002	Foothill Road	Hwy 88	RL	A	2285	24	54840	18	4/30/2018
Fremont Road - CR0193	Quaking Aspen Road	End	RL	A	1426	24	34224	84	6/1/2018
Goldrush Trail - CR9001	Sunrise Trail	End	RL	A	1249	24	29976	67	5/1/2018



Road Name	From	To	FC	Surface Type	Length (ft)	Width (ft)	Area (sf)	PCI	Inspection Date
Hawkins Peak Road - CR2002	Emigrant Trail	End	RL	A	5231	24	125544	73	5/1/2018
Hawkside Drive - CR0214	Diamond Valley Road	End	RL	A	1501	54	81054	35	5/1/2018
Highland Lakes Road - CR0113	Hwy 4	End	RL	A	5591	14	78274	80	5/31/2018
Hot Springs Road - CR0004	Montgomery Street	End	C	A	19061	23	438403	36	5/3/2018
John Ebbetts Road - CR0191	Bear Valley Road	End	RL	A	1890	23	43470	76	6/1/2018
Lake Road - CR0194	Bear Valley Road	End	RL	A	884	30	26520	60	6/1/2018
Laramie Street - CR0006	Montgomery Street	Hwy 89	C	A	1525	24	36600	73	5/3/2018
Larson Canyon - CR0210	Carson View	End	RL	A	962	22	21164	67	5/1/2018
Lava Cap - CR0172	Pleasant Valley Road	End	RL	A	340	21	7140	10	5/3/2018
Merk Creek Court - CR0221	Crystal Springs Road	End	RL	A	302	20	6040	13	5/2/2018
Montgomery Street - CR0123	Hwy 89	End	C	A	739	24	17736	56	5/3/2018
Monty Wolf Road - CR0190	Quaking Aspen Road	Bear Valley Road	RL	A	2392	24	57408	62	6/1/2018
Mule Ear Road - CR0216	Bear Valley Road	End	RL	A	670	17	11390	7	6/1/2018
Nevada Road - CR0209	Emigrant Trail	Carson View	RL	A	1756	21	36876	73	5/1/2018
No Name Road - CR0218	Bear Valley Road	Creekside Drive	RL	A	658	35	23030	47	6/1/2018
Old Pony Express Road - CR0176	Highway 88	End	RL	A	2173	23	49979	48	5/2/2018
Orvis Road - CR0192	Bear Valley	End of Road	R	A	1600	24	38400	63	6/1/2018
Ox Bow - CR0169	Pleasant Valley Road	End	RL	A	396	20	7920	17	5/3/2018
Pine Avenue - CR0166	Barber Road	Sage Avenue	RL	A	631	23	14513	59	5/2/2018
Pinon Road - CR0170	Pleasant Valley Road	End	RL	A	1300	21	27300	19	5/3/2018
Pioneer Trail - CR0217	Emigrant Trail	End	RL	A	646	21	13566	10	5/1/2018
Pleasant Valley Road - CR0132	Sawmill Road	End	RL	A	3656	25	91400	13	5/3/2018
Quaking Aspen Road - CR0187	Bear Valley Road	End	RL	A	5483	25	137075	32	6/1/2018
Red Vista Road - CR9004	Hwy 88	End	RL	A	741	19	14079	69	5/31/2018
River Ranch Road - CR0225	Hwy 88	End	RL	A	5085	19	96615	45	4/30/2018
Sage Avenue - CR0168	Pine Avenue	Cedar Lane	RL	A	329	22	7238	87	5/2/2018
Sawmill Road - CR9002	Timber Lane	End	R	A	12893	17	219181	20	5/3/2018
Schimke Road - CR0189	Bear Valley Road	End	RL	A	2552	26	66352	59	6/1/2018
Schneider Cow Camp Road - CR0164	Hwy 88	End	RL	A	600	32	19200	40	5/2/2018



Alpine County  
2018 PMS Update  
PCI Listing

Sorted by Name

Road Name	From	To	FC	Surface Type	Length (ft)	Width (ft)	Area (sf)	PCI	Inspection Date
School Street - CR0125	Montgomery Street	End	RL	A	540	14	7560	33	5/3/2018
Shakehill Road - CR0224	Emigrant Trail	End	RL	A	1902	23	43746	75	5/1/2018
Shay Creek Road - CR0138	Hot Springs Road	End	RL	A	7659	18	137862	15	5/3/2018
Snowshoe Road - CR0203	Bloods Ridge Road	End	RL	A	3220	12	38640	59	6/1/2018
Spring Canyon Drive - CR0223	Emigrant Trail	End	R	A	1040	20	20800	33	5/1/2018
Spring Cliff Road - CR0201	Bear Valley Road	End	RL	A	766	22	16852	17	6/1/2018
Station House Road - CR0185	Alpine Way	End	RL	A	2177	17	37009	85	6/1/2018
Sunrise Trail - CR2003	Emigrant Trail	End	RL	A	5598	24	134352	81	5/1/2018
Timber Lane - CR0173	Pleasant Valley Road	End	RL	A	2249	20	44980	25	5/3/2018
Topaz Place - CR0206	California Road	End	RL	A	549	21	11529	67	5/1/2018
Turtle Rock Country Park Road - CR0212	Hwy 89	End	RL	A	3825	14	53550	68	5/2/2018
Water Street - CR0129	Hwy 89	End	RL	A	330	17	5610	67	5/3/2018
Wolf Creek Road - CR0112	Hwy 4	Jeep	RL	A	26799	22	589578	52	5/8/2012
Woods Lake Road - CR0122	Hwy 88	End	RL	A	6838	18	123084	73	5/31/2018



Road Name	From	To	FC	Surface Type	Length (ft)	Width (ft)	Area (sf)	PCI	Inspection Date
Blue Lakes Road - CR0005	Begin	Beginning of Section 10	C	A	23415	24	561960	89	5/31/2018
Sage Avenue - CR0168	Pine Avenue	Cedar Lane	RL	A	329	22	7238	87	5/2/2018
Cub Lane - CR0220	Bear Valley Road	End	R	A	421	20	8420	86	6/1/2018
Station House Road - CR0185	Alpine Way	End	RL	A	2177	17	37009	85	6/1/2018
Cedar Lane - CR0165	Pine Avenue	End	RL	A	229	21	4809	84	5/2/2018
Fremont Road - CR0193	Quaking Aspen Road	End	RL	A	1426	24	34224	84	6/1/2018
Blue Lakes Road - CR0005	End of Section 05	End	C	A	37412	24	897888	83	5/2/2018
Sunrise Trail - CR2003	Emigrant Trail	End	RL	A	5598	24	134352	81	5/1/2018
Aspen Way - CR0167	Pine Avenue	End	RL	A	404	20	8080	80	5/2/2018
Highland Lakes Road - CR0113	Hwy 4	End	RL	A	5591	14	78274	80	5/31/2018
Barber Road - CR0105	Begin	End	RL	A	1855	25	46375	79	5/2/2018
Emigrant Trail - CR0009	Hwy 88	Foothill Road	C	A	17990	24	431760	79	5/1/2018
John Ebbetts Road - CR0191	Bear Valley Road	End	RL	A	1890	23	43470	76	6/1/2018
Diamond View - CR0208	Emigrant Trail	End	RL	A	971	21	20391	75	5/1/2018
Shakehill Road - CR0224	Emigrant Trail	End	RL	A	1902	23	43746	75	5/1/2018
Carson View - CR0207	California Road	End	RL	A	1671	22	36762	73	5/1/2018
Flynn Road - CR0226	Bear Valley Road	End	RL	A	642	26	16692	73	6/1/2018
Hawkins Peak Road - CR2002	Emigrant Trail	End	RL	A	5231	24	125544	73	5/1/2018
Laramie Street - CR0006	Montgomery Street	Hwy 89	C	A	1525	24	36600	73	5/3/2018
Nevada Road - CR0209	Emigrant Trail	Carson View	RL	A	1756	21	36876	73	5/1/2018
Woods Lake Road - CR0122	Hwy 88	End	RL	A	6838	18	123084	73	5/31/2018
Carson River Road - CR0198	Hwy 88	Diamond Valley Road	RL	A	18308	20	366160	69	5/2/2018
Red Vista Road - CR9004	Hwy 88	End	RL	A	741	19	14079	69	5/31/2018
Turtle Rock Country Park Road - CR0212	Hwy 89	End	RL	A	3825	14	53550	68	5/2/2018
Foothill Road - CR0001	Hwy 88	State Line	C	A	19073	24	457752	67	4/30/2018
Goldrush Trail - CR9001	Sunrise Trail	End	RL	A	1249	24	29976	67	5/1/2018
Larson Canyon - CR0210	Carson View	End	RL	A	962	22	21164	67	5/1/2018
Topaz Place - CR0206	California Road	End	RL	A	549	21	11529	67	5/1/2018
Water Street - CR0129	Hwy 89	End	RL	A	330	17	5610	67	5/3/2018



Road Name	From	To	FC	Surface Type	Length (ft)	Width (ft)	Area (sf)	PCI	Inspection Date
California Road - CR0205	Emigrant Trail	End	RL	A	2412	22	53064	65	5/1/2018
Orvis Road - CR0192	Bear Valley	End of Road	R	A	1600	24	38400	63	6/1/2018
Chisholm Trail - CR0211	Larson Canyon	End	RL	A	723	22	15906	62	5/1/2018
Monty Wolf Road - CR0190	Quaking Aspen Road	Bear Valley Road	RL	A	2392	24	57408	62	6/1/2018
Lake Road - CR0194	Bear Valley Road	End	RL	A	884	30	26520	60	6/1/2018
Pine Avenue - CR0166	Barber Road	Sage Avenue	RL	A	631	23	14513	59	5/2/2018
Schimke Road - CR0189	Bear Valley Road	End	RL	A	2552	26	66352	59	6/1/2018
Snowshoe Road - CR0203	Bloods Ridge Road	End	RL	A	3220	12	38640	59	6/1/2018
Airport Road - CR0007	Hwy 89	Diamond Valley Road	RL	A	29281	24	702744	58	5/2/2018
Creekside Drive - CR0202	Bear Valley Road	No Name Road	C	A	6442	35	225470	58	6/1/2018
Montgomery Street - CR0123	Hwy 89	End	C	A	739	24	17736	56	5/3/2018
Diamond Valley Road - CR0003	Hwy 89	Foothill Road	C	A	38797	24	931128	54	5/1/2018
Wolf Creek Road - CR0112	Hwy 4	Jeep	RL	A	26799	22	589578	52	5/8/2012
Old Pony Express Road - CR0176	Highway 88	End	RL	A	2173	23	49979	48	5/2/2018
No Name Road - CR0218	Bear Valley Road	Creekside Drive	RL	A	658	35	23030	47	6/1/2018
Douglas Way - CR0135	Hwy 89	End	RL	A	1535	24	36840	45	5/2/2018
River Ranch Road - CR0225	Hwy 88	End	RL	A	5085	19	96615	45	4/30/2018
Bear Valley Road - CR0186	Hwy 4	Creekside Dr	C	A	12974	28	363272	44	6/1/2018
Eberhardt Road - CR9003	Bear Valley Road	End	RL	A	252	34	8568	40	6/1/2018
Schneider Cow Camp Road - CR0164	Hwy 88	End	RL	A	600	32	19200	40	5/2/2018
Hot Springs Road - CR0004	Montgomery Street	End	C	A	19061	23	438403	36	5/3/2018
Cole Court - CR0219	Montgomery Street	End	RL	A	126	24	3024	35	5/2/2018
Hawkside Drive - CR0214	Diamond Valley Road	End	RL	A	1501	54	81054	35	5/1/2018
School Street - CR0125	Montgomery Street	End	RL	A	540	14	7560	33	5/3/2018
Spring Canyon Drive - CR0223	Emigrant Trail	End	R	A	1040	20	20800	33	5/1/2018
Quaking Aspen Road - CR0187	Bear Valley Road	End	RL	A	5483	25	137075	32	6/1/2018
Bloods Ridge Road - CR0188	Bear Valley Road	Quaking Aspen Road	RL	A	4257	40	170280	28	6/1/2018
Barrett Court - CR0222	Montgomery Street	End	RL	A	833	33	27489	27	5/3/2018



Road Name	From	To	FC	Surface Type	Length (ft)	Width (ft)	Area (sf)	PCI	Inspection Date
Timber Lane - CR0173	Pleasant Valley Road	End	RL	A	2249	20	44980	25	5/3/2018
Crystal Springs Road - CR0175	Hwy 88 - West End	Hwy 88 - East End	RL	A	3605	20	72100	23	5/2/2018
Sawmill Road - CR9002	Timber Lane	End	R	A	12893	17	219181	20	5/3/2018
Pinon Road - CR0170	Pleasant Valley Road	End	RL	A	1300	21	27300	19	5/3/2018
Chambers Lane - CR0130	Diamond Valley Road	Old Chambers Road	R	A	6842	20	136840	18	4/30/2018
Fredericksburg Lane - CR0002	Foothill Road	Hwy 88	RL	A	2285	24	54840	18	4/30/2018
Ox Bow - CR0169	Pleasant Valley Road	End	RL	A	396	20	7920	17	5/3/2018
Spring Cliff Road - CR0201	Bear Valley Road	End	RL	A	766	22	16852	17	6/1/2018
Shay Creek Road - CR0138	Hot Springs Road	End	RL	A	7659	18	137862	15	5/3/2018
Merk Creek Court - CR0221	Crystal Springs Road	End	RL	A	302	20	6040	13	5/2/2018
Pleasant Valley Road - CR0132	Sawmill Road	End	RL	A	3656	25	91400	13	5/3/2018
Avalanche Road - CR0204	Snowshoe Road	End	RL	A	1683	18	30294	10	6/1/2018
Canon View - CR0171	Pleasant Valley Road	End	RL	A	343	22	7546	10	5/3/2018
Lava Cap - CR0172	Pleasant Valley Road	End	RL	A	340	21	7140	10	5/3/2018
Pioneer Trail - CR0217	Emigrant Trail	End	RL	A	646	21	13566	10	5/1/2018
Mule Ear Road - CR0216	Bear Valley Road	End	RL	A	670	17	11390	7	6/1/2018



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## Appendix C

# Maintenance and Rehabilitation Decision Tree





Alpine County  
2018 PMS Update  
Decision Tree

Functional Class	Surface	Condition Category	Treatment Type	Treatment	Cost/Sq Yd, except Seal Cracks in LF:	Yrs Between Crack Seals	Yrs Between Surface Seals	# of Surface Seals before Overlay
Collector	AC	I - Very Good	Crack Treatment	SEAL CRACKS	\$1.15	4		
			Surface Treatment	CHIP SEAL	\$2.88		6	
			Restoration Treatment	2" THIN OVERLAY	\$12.10			3
		II - Good, Non-Load Related		CHIP SEAL	\$2.88		6	
		III - Good, Load Related		CAPE SEAL	\$5.75			
		IV - Poor		2" OVERLAY, 20% R+R	\$17.90			
		V - Very Poor		PULVERIZE, + 3" OVERLAY	\$24.20			
<hr/>								
Residential and Rural/Local	AC	I - Very Good	Crack Treatment	SEAL CRACKS	\$1.15	4		
			Surface Treatment	SLURRY SEAL	\$2.88		6	
			Restoration Treatment	2" THIN OVERLAY	\$12.10			3
		II - Good, Non-Load Related		SLURRY SEAL	\$2.88		6	
		III - Good, Load Related		CAPE SEAL	\$5.75			
		IV - Poor		2" OVERLAY, 20% R+R	\$17.90			
		V - Very Poor		PULVERIZE, + 3" OVERLAY	\$24.20			



## **Appendix D**

### **Budget Needs**

- **Projected PCI/Cost Summary Report**
- **Rehabilitation Treatment Cost Summary Report**
- **Preventive Maintenance Treatment Cost Summary Report**

### **Budget Scenario 1-6**

- **Cost Summary Report**
- **Network Condition Summary Report**



## Needs - Projected PCI/Cost Summary

Inflation Rate = 3.00 % Printed: 09/04/2018

Year	PCI Treated	PCI Untreated	PM Cost	Rehab Cost	Cost	
2018	87	58	\$863,035	\$7,759,795	\$8,622,830	
2019	83	56	\$0	\$195,023	\$195,023	
2020	81	53	\$0	\$12,426	\$12,426	
2021	79	50	\$0	\$346,360	\$346,360	
2022	79	47	\$16,506	\$174,864	\$191,390	
			<b>% PM</b>	<b>PM Total Cost</b>	<b>Rehab Total Cost</b>	<b>Total Cost</b>
			9.39%	\$879,541	\$8,488,508	\$9,368,049

## Needs - Rehabilitation Treatment/Cost Summary

Inflation Rate = 3.00 % Printed: 09/04/2018

Treatment	Year	Area Treated	Cost
RECONSTRUCT PAVEMENT	2018	93,363.44 sq.yd.	\$2,259,402
	<b>Total</b>	<b>93,363.44 sq.yd.</b>	<b>\$2,259,402</b>
THIN OVERLAY	2018	235,305.22 sq.yd.	\$4,211,970
	<b>Total</b>	<b>235,305.22 sq.yd.</b>	<b>\$4,211,970</b>
SINGLE CHIP SEAL	2018	103,458.67 sq.yd.	\$297,961
	2020	4,066.67 sq.yd.	\$12,426
	<b>Total</b>	<b>107,525.33 sq.yd.</b>	<b>\$310,387</b>
CHIP SEAL AND SLURRY SEAL	2018	97,960.78 sq.yd.	\$563,280
	2019	32,928.78 sq.yd.	\$195,023
	2021	55,128 sq.yd.	\$346,380
	2022	27,022.89 sq.yd.	\$174,884
	<b>Total</b>	<b>213,040.44 sq.yd.</b>	<b>\$1,279,567</b>
SLURRY SEAL	2018	148,325.11 sq.yd.	\$427,182
	<b>Total</b>	<b>148,325.11 sq.yd.</b>	<b>\$427,182</b>
<b>Total Cost</b>			<b>\$8,488,508</b>

## Needs - Preventive Maintenance Treatment/Cost Summary

Inflation Rate = 3.00 %    Printed: 09/04/2018

Treatment	Year	Area Treated	Cost
SEAL CRACKS	2022	13,786.42    ft.	\$16,506
	Total	13,786.42	\$16,506
SINGLE CHIP SEAL	2018	210,178.67    sq.yd.	\$605,317
	Total	210,178.67	\$605,317
SLURRY SEAL	2018	89,482.89    sq.yd.	\$257,718
	Total	89,482.89	\$257,718
<b>Total Quantity</b>		<b>313,447.98</b>	<b>\$879,541</b>

## Target-Driven Scenarios - Cost Summary

Interest: 5%

Inflation: 3%

Printed: 09/04/2018

Scenario: PCI = 50 (5 Year)

Objective: Minimum Network Average PCI

Target: Overall 50

Year	Rehabilitation	Preventive Maintenance	Total Cost	Deferred	
2018	II	\$0	Non-Project	\$0	\$8,622,796
	III	\$0	Project	\$0	
	IV	\$0			
	V	\$0			
	<b>Total</b>	<b>\$0</b>			
	<b>Project</b>	<b>\$0</b>			
2019	II	\$0	Non-Project	\$0	\$8,933,730
	III	\$0	Project	\$0	
	IV	\$0			
	V	\$0			
	<b>Total</b>	<b>\$0</b>			
	<b>Project</b>	<b>\$0</b>			
2020	II	\$0	Non-Project	\$0	\$11,014,614
	III	\$0	Project	\$0	
	IV	\$0			
	V	\$0			
	<b>Total</b>	<b>\$0</b>			
	<b>Project</b>	<b>\$0</b>			
2021	II	\$132,961	Non-Project	\$0	\$11,984,903
	III	\$0	Project	\$0	
	IV	\$0			
	V	\$0			
	<b>Total</b>	<b>\$132,961</b>		<b>\$132,961</b>	
	<b>Project</b>	<b>\$0</b>			
2022	II	\$154,386	Non-Project	\$670,666	\$11,234,224
	III	\$0	Project	\$0	
	IV	\$544,421			
	V	\$0			
	<b>Total</b>	<b>\$698,807</b>		<b>\$1,369,473</b>	
	<b>Project</b>	<b>\$0</b>			

Functional Class	Rehabilitation	Prev. Maint.	<b>Summary</b>
Collector	\$557,603	\$525,784	
Residential/Local	\$274,165	\$144,882	
<b>Total:</b>	<b>\$831,768</b>	<b>\$670,666</b>	<b>Grand Total: \$1,502,434</b>

Scenario: PCI = 50 (5 Year)

Objective: Minimum Network Average PCI

Target: Overall 50

**Projected Network Average PCI by year**

Year	Never Treated	With Selected Treatment
2018	58	58
2019	56	56
2020	53	53
2021	50	50
2022	47	51

**Percent Network Area by Functional Classification and Condition Class**

Condition in base year 2018, prior to applying treatments.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	21.8%	9.1%	0.0%	30.9%
II / III	0.0%	18.5%	17.1%	0.0%	35.6%
IV	0.0%	9.1%	14.9%	0.0%	24.0%
V	0.0%	0.0%	9.5%	0.0%	9.5%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

Condition in year 2018 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	21.8%	9.1%	0.0%	30.9%
II / III	0.0%	18.5%	17.1%	0.0%	35.6%
IV	0.0%	9.1%	14.9%	0.0%	24.0%
V	0.0%	0.0%	9.5%	0.0%	9.5%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

Condition in year 2022 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	19.7%	13.3%	0.0%	33.0%
II / III	0.0%	10.1%	13.0%	0.0%	23.0%
IV	0.0%	14.6%	9.3%	0.0%	24.0%
V	0.0%	5.0%	15.1%	0.0%	20.0%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

# Target-Driven Scenarios - Cost Summary

Interest: 5%

Inflation: 3%

Printed: 09/04/2018

Scenario: PCI=58 (5 Year)

Objective: Minimum Network Average PCI

Target: Overall 58

Year	Rehabilitation	Preventive Maintenance	Total Cost	Deferred	
2018	II	\$0	Non-Project	\$0	\$8,622,796
	III	\$0	Project	\$0	
	IV	\$0			
	V	\$0			
	Total Project	\$0			
2019	II	\$177,759	Non-Project	\$741,920	\$8,014,058
	III	\$0	Project	\$0	
	IV	\$0			
	V	\$0			
	Total Project	\$177,759		\$919,679	
2020	II	\$12,426	Non-Project	\$148,959	\$7,941,280
	III	\$0	Project	\$0	
	IV	\$1,964,692			
	V	\$0			
	Total Project	\$1,977,118		\$2,126,077	
2021	II	\$0	Non-Project	\$2,531	\$8,911,240
	III	\$0	Project	\$0	
	IV	\$38,546			
	V	\$0			
	Total Project	\$38,546		\$41,077	
2022	II	\$0	Non-Project	\$0	\$7,435,873
	III	\$0	Project	\$0	
	IV	\$504,718			
	V	\$1,326,769			
	Total Project	\$1,831,487		\$1,831,487	

Functional Class	Rehabilitation	Prev. Maint.	Summary
Collector	\$3,847,151	\$623,476	
Residential/Local	\$177,759	\$269,934	
<b>Total:</b>	<b>\$4,024,910</b>	<b>\$893,410</b>	<b>Grand Total: \$4,918,320</b>

Scenario: PCI=58 (5 Year)

Objective: Minimum Network Average PCI

Target: Overall 58

**Projected Network Average PCI by year**

Year	Never Treated	With Selected Treatment
2018	58	58
2019	56	58
2020	53	61
2021	50	58
2022	47	61

**Percent Network Area by Functional Classification and Condition Class**

Condition in base year 2018, prior to applying treatments.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	21.8%	9.1%	0.0%	30.9%
II / III	0.0%	18.5%	17.1%	0.0%	35.6%
IV	0.0%	9.1%	14.9%	0.0%	24.0%
V	0.0%	0.0%	9.5%	0.0%	9.5%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

Condition in year 2018 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	21.8%	9.1%	0.0%	30.9%
II / III	0.0%	18.5%	17.1%	0.0%	35.6%
IV	0.0%	9.1%	14.9%	0.0%	24.0%
V	0.0%	0.0%	9.5%	0.0%	9.5%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

Condition in year 2022 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	40.1%	14.4%	0.0%	54.4%
II / III	0.0%	5.2%	11.9%	0.0%	17.1%
IV	0.0%	4.1%	9.3%	0.0%	13.4%
V	0.0%	0.0%	15.1%	0.0%	15.1%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

## Target-Driven Scenarios - Cost Summary

Interest: 5%

Inflation: 3%

Printed: 09/04/2018

Scenario: PCI = 60 (5 Year)

Objective: Minimum Network Average PCI

Target: Overall 60

Year		Rehabilitation	Preventive Maintenance	Total Cost	Deferred
2018	II	\$181,070	Non-Project	\$489,229	\$7,952,505
	III	\$0	Project	\$0	
	IV	\$0			
	V	\$0			
	<b>Total</b>	<b>\$181,070</b>			
	Project	\$0			
2019	II	\$0	Non-Project	\$367,662	\$7,131,492
	III	\$0	Project	\$0	
	IV	\$744,183			
	V	\$0			
	<b>Total</b>	<b>\$744,183</b>			
	Project	\$0			
2020	II	\$12,426	Non-Project	\$15,424	\$7,165,768
	III	\$0	Project	\$0	
	IV	\$1,984,692			
	V	\$0			
	<b>Total</b>	<b>\$1,977,118</b>			
	Project	\$0			
2021	II	\$0	Non-Project	\$0	\$8,153,540
	III	\$0	Project	\$0	
	IV	\$0			
	V	\$0			
	<b>Total</b>	<b>\$0</b>			
	Project	\$0			
2022	II	\$0	Non-Project	\$11,137	\$8,612,933
	III	\$0	Project	\$0	
	IV	\$544,421			
	V	\$1,326,769			
	<b>Total</b>	<b>\$1,871,190</b>			
	Project	\$0			

Functional Class	Rehabilitation	Prev. Maint.	Summary
Collector	\$4,592,491	\$615,625	
Residential/Local	\$181,070	\$267,827	
<b>Total:</b>	<b>\$4,773,561</b>	<b>\$883,452</b>	<b>Grand Total: \$5,657,013</b>

Scenario: PCI = 60 (5 Year)

Objective: Minimum Network Average PCI

Target: Overall 60

**Projected Network Average PCI by year**

Year	Never Treated	With Selected Treatment
2018	58	60
2019	56	61
2020	53	63
2021	50	60
2022	47	64

**Percent Network Area by Functional Classification and Condition Class**

Condition in base year 2018, prior to applying treatments.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	21.8%	9.1%	0.0%	30.9%
II / III	0.0%	18.5%	17.1%	0.0%	35.6%
IV	0.0%	9.1%	14.9%	0.0%	24.0%
V	0.0%	0.0%	9.5%	0.0%	9.5%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

Condition in year 2018 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	21.8%	15.5%	0.0%	37.3%
II / III	0.0%	18.5%	10.7%	0.0%	29.2%
IV	0.0%	9.1%	14.9%	0.0%	24.0%
V	0.0%	0.0%	9.5%	0.0%	9.5%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

Condition in year 2022 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	44.2%	14.4%	0.0%	58.6%
II / III	0.0%	5.2%	11.9%	0.0%	17.1%
IV	0.0%	0.0%	9.3%	0.0%	9.3%
V	0.0%	0.0%	15.1%	0.0%	15.1%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

## Target-Driven Scenarios - Cost Summary

Interest: 5%

Inflation: 3%

Printed: 09/04/2018

Scenario: PCI = 70 (5 Year)

Objective: Minimum Network Average PCI

Target: Overall 70

Year	Rehabilitation	Preventive Maintenance	Total Cost	Deferred
2018	II \$181,070	Non-Project \$863,035	\$4,276,462	\$4,346,360
	III \$373,937	Project \$0		
	IV \$1,188,372			
	V \$1,670,048			
	Total \$3,413,427			
	Project \$0			
2019	II \$0	Non-Project \$0	\$807,742	\$3,721,260
	III \$0	Project \$0		
	IV \$0			
	V \$807,742			
	Total \$807,742			
	Project \$0			
2020	II \$12,426	Non-Project \$0	\$1,977,118	\$3,668,648
	III \$0	Project \$0		
	IV \$1,964,692			
	V \$0			
	Total \$1,977,118			
	Project \$0			
2021	II \$0	Non-Project \$0	\$0	\$4,897,888
	III \$0	Project \$0		
	IV \$0			
	V \$0			
	Total \$0			
	Project \$0			
2022	II \$0	Non-Project \$14,958	\$559,379	\$4,588,988
	III \$0	Project \$0		
	IV \$544,421			
	V \$0			
	Total \$544,421			
	Project \$0			

Functional Class	Rehabilitation	Prev. Maint.	Summary
Collector	\$3,536,500	\$611,975	
Residential/Local	\$3,206,208	\$266,018	
Total:	\$6,742,708	\$877,993	Grand Total: \$7,620,701

Scenario: PCI = 70 (5 Year)

Objective: Minimum Network Average PCI

Target: Overall 70

## Projected Network Average PCI by year

Year	Never Treated	With Selected Treatment
2018	58	71
2019	56	71
2020	53	73
2021	50	70
2022	47	70

## Percent Network Area by Functional Classification and Condition Class

Condition in base year 2018, prior to applying treatments.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	21.8%	9.1%	0.0%	30.9%
II / III	0.0%	18.5%	17.1%	0.0%	35.6%
IV	0.0%	9.1%	14.9%	0.0%	24.0%
V	0.0%	0.0%	9.5%	0.0%	9.5%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

Condition in year 2018 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	31.1%	26.6%	0.0%	57.7%
II / III	0.0%	13.3%	9.3%	0.0%	22.6%
IV	0.0%	5.0%	12.2%	0.0%	17.2%
V	0.0%	0.0%	2.5%	0.0%	2.5%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

Condition in year 2022 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	39.2%	28.4%	0.0%	67.6%
II / III	0.0%	5.2%	10.9%	0.0%	16.0%
IV	0.0%	0.0%	6.7%	0.0%	6.7%
V	0.0%	5.0%	4.7%	0.0%	9.7%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

Interest: 5.00%

Inflation: 3.00%

Printed: 09/04/2018

Scenario: Do Nothing 5 Years

Year	PM	Budget	Rehabilitation	Preventative Maintenance	Surplus PM	Deferred	Stop Gap		
2018	0%	\$0	II	\$0	Non-Project	\$0	\$0	Funded	\$0
			III	\$0				Unmet	\$0
			IV	\$0				Project	\$0
			V	\$0					
			Total	\$0					
			Project	\$0					
2019	0%	\$0	II	\$0	Non-Project	\$0	\$0	Funded	\$0
			III	\$0				Unmet	\$0
			IV	\$0				Project	\$0
			V	\$0					
			Total	\$0					
			Project	\$0					
2020	0%	\$0	II	\$0	Non-Project	\$0	\$0	Funded	\$0
			III	\$0				Unmet	\$0
			IV	\$0				Project	\$0
			V	\$0					
			Total	\$0					
			Project	\$0					
2021	0%	\$0	II	\$0	Non-Project	\$0	\$0	Funded	\$0
			III	\$0				Unmet	\$0
			IV	\$0				Project	\$0
			V	\$0					
			Total	\$0					
			Project	\$0					
2022	0%	\$0	II	\$0	Non-Project	\$0	\$0	Funded	\$0
			III	\$0				Unmet	\$0
			IV	\$0				Project	\$0
			V	\$0					
			Total	\$0					
			Project	\$0					

Summary				
Functional Class	Rehabilitation	Prev. Maint.	Funded Stop Gap	Unmet Stop Gap
Collector	\$0	\$0	\$0	\$0
Residential/Local	\$0	\$0	\$0	\$0
<b>Grand Total:</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>

## Scenarios - Network Condition Summary

Interest: 5%

Inflation: 3%

Printed: 09/04/2018

Scenario: Do Nothing 5 Years

Year	Budget	PM	Year	Budget	PM	Year	Budget	PM
2018	\$0	0%	2020	\$0	0%	2022	\$0	0%
2019	\$0	0%	2021	\$0	0%			

## Projected Network Average PCI by year

Year	Never Treated	With Selected Treatment	Treated Centerline Miles	Treated Lane Miles
2018	58	58	0	0
2019	56	56	0	0
2020	53	53	0	0
2021	50	50	0	0
2022	47	47	0	0

## Percent Network Area by Functional Class and Condition Category

Condition in base year 2018, prior to applying treatments.

Condition	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	21.8%	9.1%	0.0%	30.9%
II / III	0.0%	18.5%	17.1%	0.0%	35.6%
IV	0.0%	9.1%	14.9%	0.0%	24.0%
V	0.0%	0.0%	9.5%	0.0%	9.5%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

Condition in year 2018 after schedulable treatments applied.

Condition	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	21.8%	9.1%	0.0%	30.9%
II / III	0.0%	18.5%	17.1%	0.0%	35.6%
IV	0.0%	9.1%	14.9%	0.0%	24.0%
V	0.0%	0.0%	9.5%	0.0%	9.5%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

Condition in year 2022 after schedulable treatments applied.

Condition	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	16.5%	4.6%	0.0%	21.1%
II / III	0.0%	10.5%	21.7%	0.0%	32.2%
IV	0.0%	17.4%	9.3%	0.0%	26.7%
V	0.0%	5.0%	15.1%	0.0%	20.0%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

Interest: 5.00%

Inflation: 3.00%

Printed: 09/04/2018

Scenario: SB1 RMRA Budget 5 Years

Year	PM	Budget	Rehabilitation	Preventative Maintenance	Surplus PM	Deferred	Stop Gap		
2018	5%	\$0	II	\$0	Non-Project	\$0	\$8,622,796	Funded	\$0
			III	\$0	Project	\$0		Unmet	\$0
			IV	\$0					
			V	\$0					
			Total	\$0					
			Project	\$0					
2019	5%	\$0	II	\$0	Non-Project	\$0	\$8,933,730	Funded	\$0
			III	\$0	Project	\$0		Unmet	\$0
			IV	\$0					
			V	\$0					
			Total	\$0					
			Project	\$0					
2020	10%	\$360,000	II	\$170,627	Non-Project	\$37,590	\$10,654,943	Funded	\$0
			III	\$36,297	Project	\$0		Unmet	\$0
			IV	\$115,157					
			V	\$0					
			Total	\$322,081					
			Project	\$0					
2021	5%	\$0	II	\$0	Non-Project	\$0	\$11,747,388	Funded	\$0
			III	\$0	Project	\$0		Unmet	\$0
			IV	\$0					
			V	\$0					
			Total	\$0					
			Project	\$0					
2022	10%	\$680,000	II	\$99,548	Non-Project	\$70,836	\$11,680,778	Funded	\$0
			III	\$4,035	Project	\$0		Unmet	\$0
			IV	\$504,718					
			V	\$9,152					
			Total	\$607,453					
			Project	\$0					

Summary				
Functional Class	Rehabilitation	Prev. Maint.	Funded Stop Gap	Unmet Stop Gap
Collector	\$554,568	\$0	\$0	\$0
Residential/Local	\$374,986	\$108,426	\$0	\$0
<b>Grand Total:</b>	<b>\$929,534</b>	<b>\$108,426</b>	<b>\$0</b>	<b>\$0</b>

## Scenarios - Network Condition Summary

Interest: 5%

Inflation: 3%

Printed: 09/04/2018

Scenario: SB1 RMRA Budget 5 Years

Year	Budget	PM	Year	Budget	PM	Year	Budget	PM
2018	\$0	5%	2020	\$360,000	10%	2022	\$680,000	10%
2019	\$0	5%	2021	\$0	5%			

## Projected Network Average PCI by year

Year	Never Treated	With Selected Treatment	Treated Centerline Miles	Treated Lane Miles
2018	58	58	0	0
2019	56	56	0	0
2020	53	54	6.75	13.50
2021	50	51	0	0
2022	47	50	5.62	11.24

## Percent Network Area by Functional Class and Condition Category

Condition in base year 2018, prior to applying treatments.

Condition	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	21.8%	9.1%	0.0%	30.9%
II / III	0.0%	18.5%	17.1%	0.0%	35.6%
IV	0.0%	9.1%	14.9%	0.0%	24.0%
V	0.0%	0.0%	9.5%	0.0%	9.5%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

Condition in year 2018 after schedulable treatments applied.

Condition	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	21.8%	9.1%	0.0%	30.9%
II / III	0.0%	18.5%	17.1%	0.0%	35.6%
IV	0.0%	9.1%	14.9%	0.0%	24.0%
V	0.0%	0.0%	9.5%	0.0%	9.5%
Total	0.0%	49.3%	50.7%	0.0%	100.0%

Condition in year 2022 after schedulable treatments applied.

Condition	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	19.7%	15.0%	0.0%	34.7%
II / III	0.0%	10.1%	11.7%	0.0%	21.8%
IV	0.0%	14.6%	8.9%	0.0%	23.5%
V	0.0%	5.0%	15.0%	0.0%	20.0%
Total	0.0%	49.3%	50.7%	0.0%	100.0%



## Appendix E

### Sections Selected for Treatments Based on County's Current Budget



# Scenarios – Sections Selected for Treatment

Interest: 5.00%    Inflation: 3.00%  
Scenario: SB1 RMRA Budget 5 Years

StreetID	Year	PCI	PCI Treated	PCI Prior Treat	Area Treated	Cost	PCI	Road Name	Begin Location	End Location	Section Length	Section Width	Surf Type	Treatment
CR02006	2020	78	69	4067	\$ 12,426.00	72	Laramie Street	Montgomery Street	Hwy 89	1525	24	AC	SINGLE CHIP SEAL	
CR02005	2020	82	73	5353	\$ 16,703.00	78	Barber Road	Begin	End	1855	25	AC	SLURRY SEAL	
CR020123	2020	100	50	1971	\$ 37,424.00	55	Montgomery Street	Hwy 89	End	739	24	AC	THIN OVERLAY	
CR020129	2020	71	60	623	\$ 4,083.00	66	Water Street	Hwy 89	End	330	17	AC	CHIP SEAL AND SLURRY SEAL	
CR020165	2020	86	78	534	\$ 1,793.00	83	Cedar Lane	Pine Avenue	End	229	21	AC	SLURRY SEAL	
CR020167	2020	83	74	898	\$ 2,911.00	79	Aspen Way	Pine Avenue	End	404	20	AC	SLURRY SEAL	
CR020168	2020	89	81	804	\$ 2,607.00	86	Sage Avenue	Pine Avenue	Cedar Lane	329	22	AC	SLURRY SEAL	
CR020198	2020	76	67	40684	\$ 124,307.00	69	Carson River Road	Hwy 88	Diamond Valley Road	18308	20	AC	SLURRY SEAL	
CR020205	2020	73	62	5896	\$ 18,015.00	64	California Road	Emigrant Trail	End	2412	22	AC	SLURRY SEAL	
CR020206	2020	74	65	1281	\$ 3,914.00	67	Topaz Place	California Road	End	549	21	AC	SLURRY SEAL	
CR020207	2020	79	70	4085	\$ 12,481.00	72	Carson View	California Road	End	1671	22	AC	SLURRY SEAL	
CR020208	2020	81	72	2266	\$ 6,923.00	74	Diamond View	Emigrant Trail	End	971	21	AC	SLURRY SEAL	
CR020209	2020	79	70	4097	\$ 12,519.00	72	Nevada Road	Emigrant Trail	Carson View	1756	21	AC	SLURRY SEAL	
CR020210	2020	74	65	2352	\$ 7,185.00	67	Larson Canyon	Carson View	End	962	22	AC	SLURRY SEAL	
CR020211	2020	75	66	5950	\$ 36,297.00	68	Turtle Rock Country Park Road	Hwy 89	End	3825	14	AC	CHIP SEAL AND SLURRY SEAL	
CR020219	2020	100	24	336	\$ 9,152.00	34	Cole Court	Montgomery Street	End	126	24	AC	RECONSTRUCT PAVEMENT	
CR020202	2020	76	67	13949	\$ 45,217.00	72	Hawkins Peak Road	Emigrant Trail	End	5231	24	AC	SLURRY SEAL	
CR020004	2020	76	67	1564	\$ 4,780.00	69	Red Vista Road	Hwy 88	End	741	19	AC	SLURRY SEAL	
CR020113	2022	83	74	8697	\$ 28,192.00	80	Highland Lakes Road	Hwy 4	End	5591	14	AC	SLURRY SEAL	
CR020122	2022	76	67	13676	\$ 44,331.00	73	Woods Lake Road	Hwy 88	End	6838	18	AC	SLURRY SEAL	
CR020135	2022	100	41	4093	\$ 77,733.00	44	Douglas Way	Hwy 89	End	1535	24	AC	THIN OVERLAY	
CR020191	2022	79	70	4830	\$ 15,657.00	76	John Ebbetts Road	Bear Valley Road	End	1890	23	AC	SLURRY SEAL	
CR020202	2022	100	44	25052	\$ 504,718.00	57	Creekside Drive	Bear Valley Road	No Name Road	6442	35	AC	THIN OVERLAY	
CR020220	2022	88	80	956	\$ 3,033.00	86	Cub Lane	Bear Valley Road	End	421	20	AC	SLURRY SEAL	
CR020226	2022	79	70	1855	\$ 5,667.00	73	Flynn Road	Bear Valley Road	End	642	26	AC	SLURRY SEAL	

**2020 Total = \$358,629**

**2022 Total = \$679,331**





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