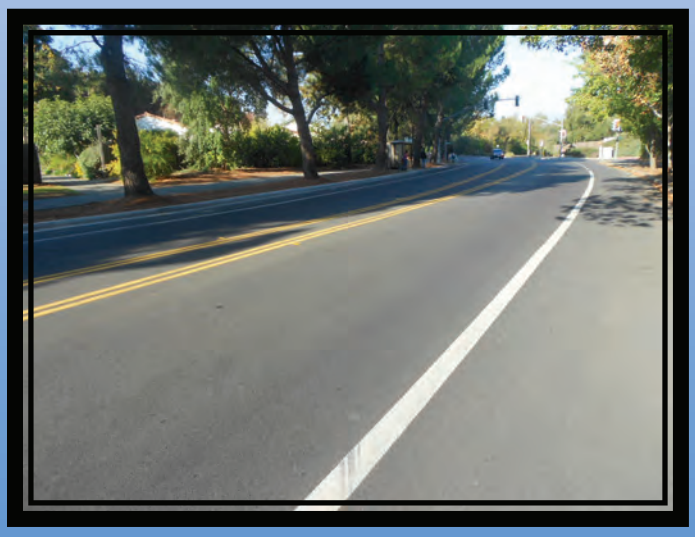
City of Davis

Pavement Management Final Report



Submitted to:
City of Davis
23 Russell Blvd Suite 4
Davis, CA 95616

NICHOLS CONSULTING ENGINEERS, Chtd.
Engineering and Environmental Services
501 Canal Boulevard Suite I Richmond CA 94804
(510) 215-3620 Phone / (510) 215-2898 Fax
NCE Project No. 55.111.20

January 2013

Collaboration. Commitment. Confidence.SM

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Background

The City currently utilizes the StreetSaver (version 9) pavement management program (PMP) for the street network, which is comprised of approximately 163 centerline miles. This is separated into 34.6 miles of arterials, 22.8 miles of collectors, and 103.9 miles of residential/local streets. In addition, there are 50.4 miles of bicycle paths which are maintained in a separate database. The City is actively using the StreetSaver program as a tool to manage and develop multi-year workplans as well as to plan for future funding needs.

Nichols Consulting Engineers, Chtd. (NCE) was selected to update the City of Davis's pavement network in 2012. Our scope of work included performing semi-automated pavement condition surveys which were completed in November 2012. The condition surveys did not address issues including but not limited to traffic, safety and road hazards, geometric issues, road shoulders, drainage issues or emergency repairs.

The maintenance and rehabilitation decision tree treatments and unit costs were updated based on both City policies and on recent 2010-2011 bid tabulations from the City and neighboring agencies. Then a budget needs analysis was performed. Finally, three budgetary scenarios were performed for the streets, and two for the bicycles. This report presents a summary of our analyses.

Purpose

The purpose of this report is to assist decision makers in utilizing the results of the Metropolitan Transportation Commission (MTC) StreetSaver Pavement Management Program (PMP). Specifically, this report links the recommended repair program costs to the City of Davis's current and projected budget alternatives to improve overall maintenance and rehabilitation strategies. This report assesses the adequacy of ideal and projected revenues to meet the maintenance needs recommended by the StreetSaver program. It also maximizes the return from expenditures by:

(1) implementing a multi-year road rehabilitation and maintenance program;
(2) developing a preventive maintenance program; and
(3) selecting the most cost effective repairs.

This report assists the City with identifying maintenance priorities specific to its needs. This study examines the overall condition of the road network and highlights options for improving the current network-level pavement condition index (PCI). These options are developed by conducting "what-if" analyses using the City's StreetSaver pavement management system. By varying the budget amounts available for pavement maintenance and repair, one can show how different funding strategies can impact the City's streets over the next five years.

Pavement Network and Current Condition

The City of Davis is responsible for the repair and maintenance of approximately 163 centerline miles of pavements or 1048 pavement sections. **The replacement value of the City's streets is approximately $167 million**. The replacement unit costs for arterials, collectors, and residentials, are $76, $35.5, and $55.4 respectively. This replacement value does not include replacement of concrete curb and gutter, sidewalk, or ADA ramps.

The bicycle network has approximately 50.4 centerline miles of pavement with 0.42 miles of gravel. Similarly, the replacement cost for this network is approximately $24.2 million.

The pavement condition index, or PCI, is a measurement of pavement grade or condition and ranges from 0 to 100. A newly constructed street has a PCI of 100, while a failed street has a PCI of 25 or less. Figure 1 illustrates the definitions of the pavement condition categories. The average PCI for the City street network is 62, which indicates the network overall is in "Fair" condition. The average PCI for the bicycle paths is 59, which is very close to the street network.

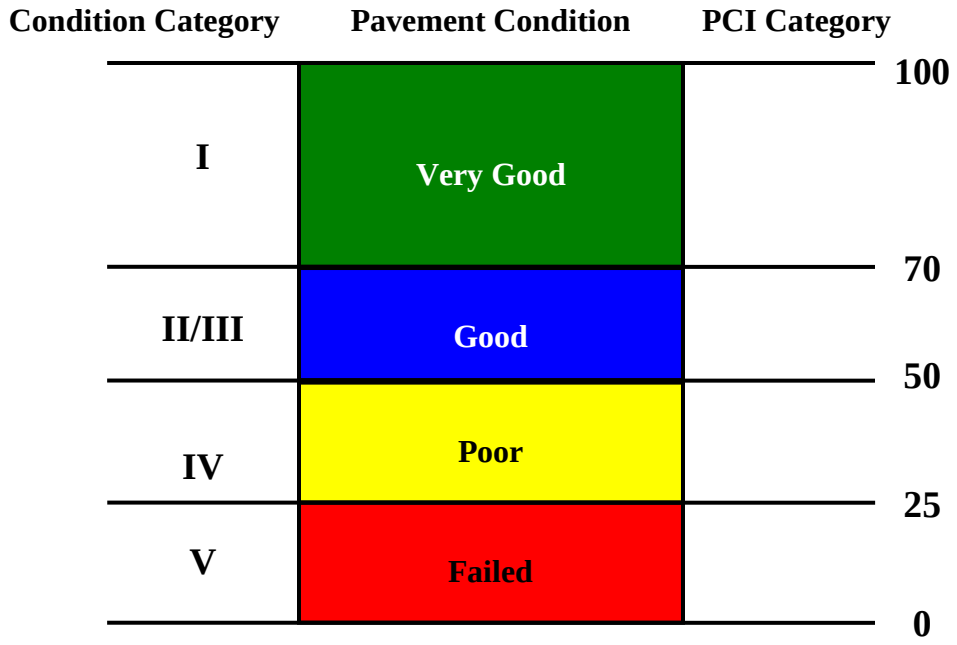


Figure 1 Pavement Condition Categories by PCI

Tables 1A and 1B summarize the pavement network and its condition by functional classes for both the street and bicycle paths. As shown in Table 1A, the arterial and collector streets in the City are in better condition than the residential streets. This is typical of most cities since arterials and major collectors generally have highest priority for rehabilitation and are eligible for more state and federal funds.

Table 1A Pavement Network and Condition Summary (Streets)

Functional Class	Centerline Miles	Lane Miles	No. of Management Sections	% of the Network (by Pavement Area)	Average PCI
Arterial	34.6	91.9	152	21.2	63
Collector	22.8	49.4	92	13.9	60
Residential/ Local	103.9	209.1	784	63.7	62
Other (Alleys)	1.74	2.44	20	1.1	42
Total	**163**	**352.9**	**1048**	**100**	**62**

Table 1B Pavement Network and Condition Summary (Bicycle Paths)

Functional Class	Centerline Miles	Lane Miles	No. of Management Sections	% of the Network (by Pavement Area)	Average PCI
Other	50.0	96.8	289	99.2	59
Combined (Gravel)	0.42	0.83	1	0.8	N/A
Total	**50.4**	**97.6**	**290**	**100**	**59 (network average)**

Tables 2A and 2B provide pavement condition breakdowns by PCI ranges or condition category. Approximately 71 percent of the City's streets are in the "Good" to "Fair" condition categories. However, equally significant is that 29.1 percent are considered to be in "Poor" or "Very Poor" condition. In general, the streets are in slightly better condition than the bicycle paths.

Table 2A Pavement Condition Breakdown (Streets)

Condition Category	PCI Range	Arterial (%)	Collector (%)	Residential/ Other(%)	Other	Entire Network (%)
Good (I)	70-100	9.6	5.0	22.2	0.1	36.9
Fair (II/III)	50-69	9.5	6.0	18.5	0.0	34.0
Poor (IV)	25-49	6.5	4.8	15.5	0.0	26.8
Very Poor (V)	<25	0.2	0.4	1.5	0.2	2.3
Total (%)		**25.9**	**16.1**	**57.7**	**0.3**	**100.0**

Table 2B Pavement Condition Breakdown (Bicycle Paths)

Condition Category	PCI Range	Other	Entire Network (%)
Good (I)	70-100	26.9	26.9
Fair (II/III)	50-69	32.3	32.3
Poor (IV)	25-49	36.1	36.1
Very Poor (V)	<25	4.7	4.7
Total (%)		**100.0**	**100.0**

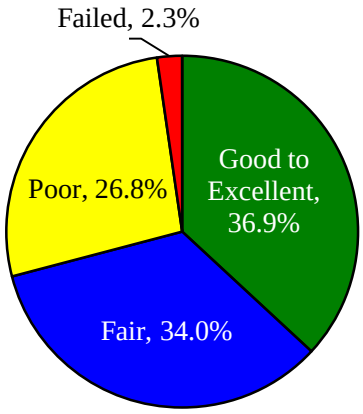


Figure 2A Current Pavement Condition by Condition Category (Streets)

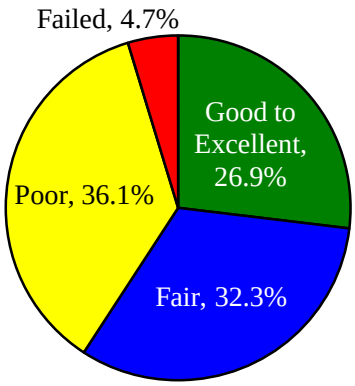


Figure 2B Current Pavement Condition by Condition Category (Bicycle Paths)

Current Budget and Maintenance Practices

The City has utilized crack seals and surface treatments as a means of preventive maintenance when the pavements are in "fair" condition or above. When the pavement condition deteriorates further, overlays and reconstruction have been performed. Base repairs are commonly used as preparation prior to overlays.

Figure 3 below demonstrates that pavement maintenance follows the old colloquial saying of "pay me now, or pay me more later." History has shown that it costs much less to maintain streets in good condition than to repair streets that have failed. By allowing pavements to deteriorate, streets that once cost $4/sy to slurry seal may soon cost $14-$27/sy to overlay and $61-$81/sy to reconstruct. In other words, delays in repairs can result in costs increasing as much as 20-fold. Appendix A shows the detailed decision tree and the unit cost associated with each type of treatment. Appendix C also includes a description of various typical maintenance and rehabilitation treatments.

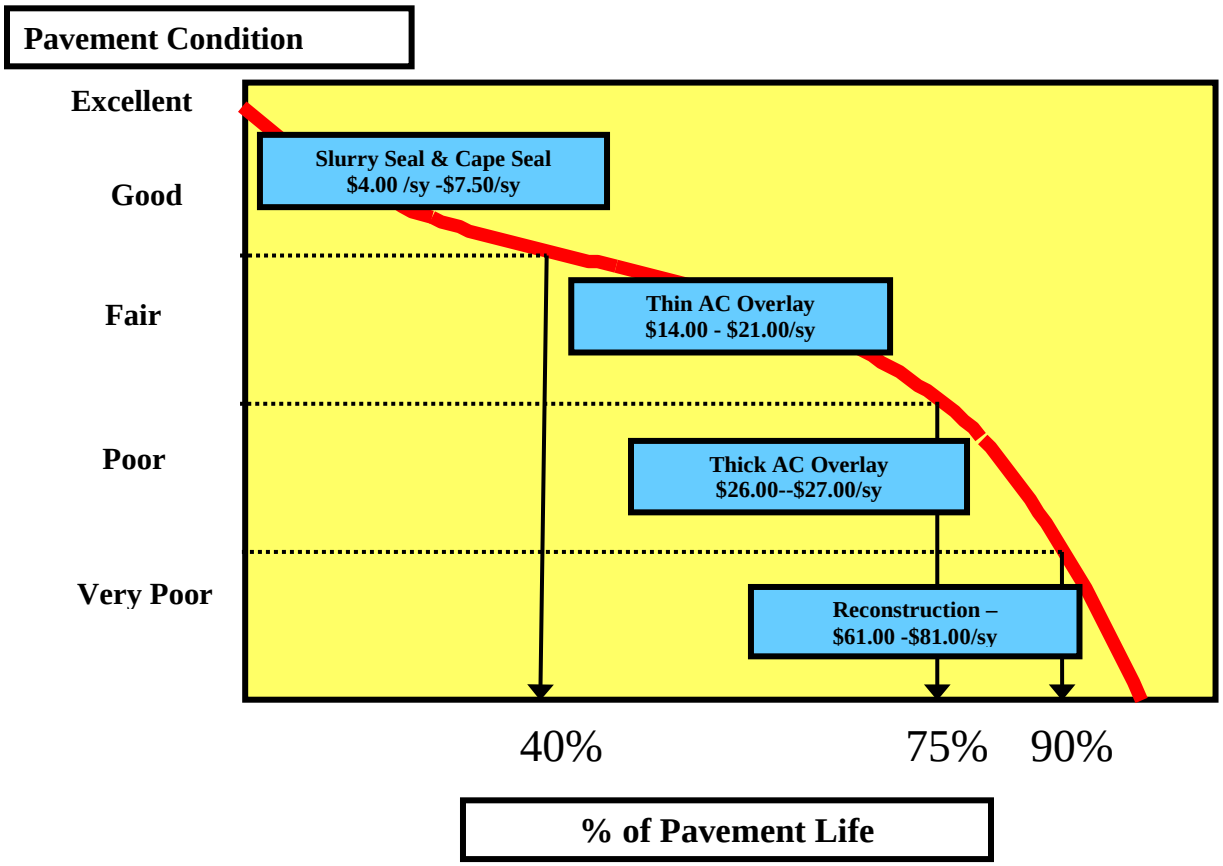


Figure 3 Costs of Maintaining Pavements over Time

Budget Needs

Based on the principle that it costs less to maintain roads in good condition than those in bad condition, StreetSaver strives to develop a maintenance strategy that will improve the overall condition of the network and then sustain it at that level. Since the **average 2012 PCI of the street network is 62**, which is in the "fair" condition category, a significant portion of the network suffers from load-related distresses. If these are not addressed, the quality of the road network will inevitably decline. In order to correct these deficiencies, a cost-effective funding and maintenance and rehabilitation strategy must be implemented.

The first step in developing a cost-effective maintenance and rehabilitation strategy is to estimate the pavement "needs" of the roadway network. Using the StreetSaver budget needs module, pavement needs over the next twenty years were estimated **at approximately $142 million for the City**. If the City of Davis follows the strategy recommended by the program, the average network PCI will increase to 72 by 2032 following the trend shown in Figure 4. The results of the budget needs analysis are summarized in Table 3 below. These results were calculated based on the revised unit costs and treatments to the maintenance and rehabilitation decision tree in Appendix A.

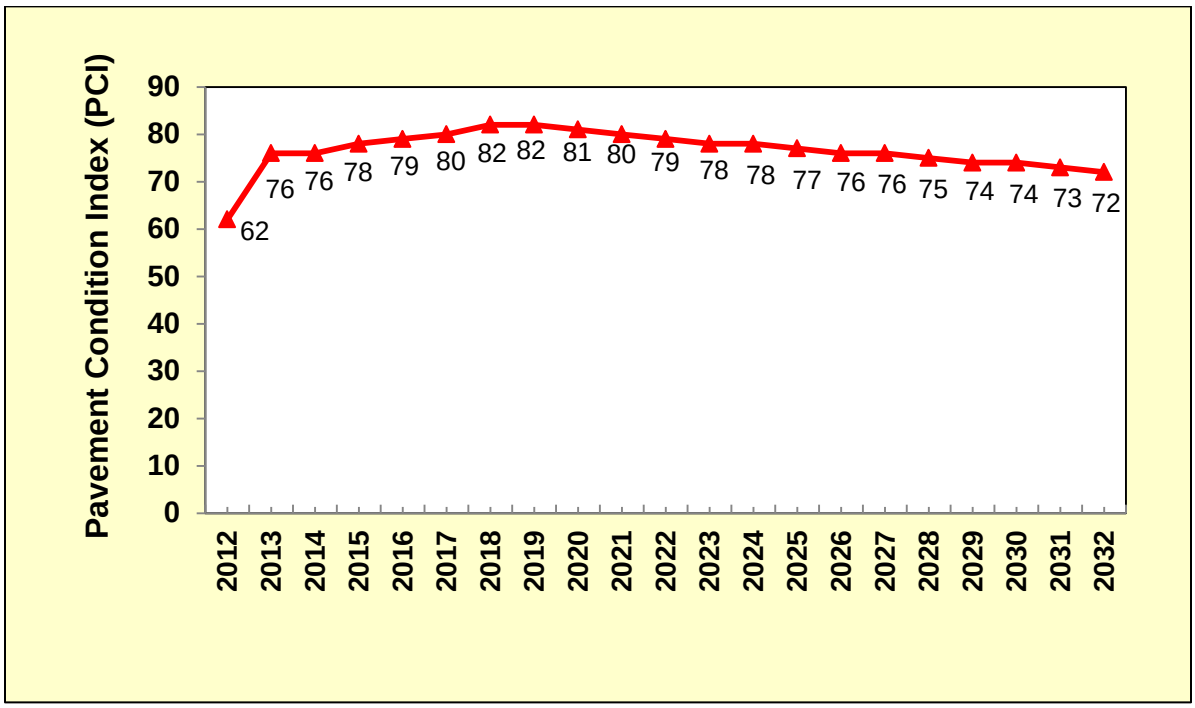


Figure 4 **PCI from Needs Calculations** (Streets)

Table 3 Summary of Results from Needs Analysis (Streets)

Year	2013	2032	Total
PCI Treated	76	72	--
PCI Untreated	61	18	--
Rehabilitation ($M)	19.5	6.5	117.2
Preventive Maintenance ($M)	1.90	0.03	24.94
Total Needs ($M)	21.4	6.5	142.1

Table 3 identifies the approximate level of expenditures required to raise the pavement condition index and eliminate the current maintenance backlog. The results of the budget needs analysis represent the unconstrained funding strategy recommended by the StreetSaver program. Of the $142 million in maintenance needs shown, approximately $24.9 million (about 17.5%) is earmarked for preventive maintenance or life-extending treatments, while the rest is allocated for more costly rehabilitation and reconstruction treatments.

An inflation rate of 8% was used for the budgetary analyses. The inflation rate was calculated based on the asphalt price index together with the inflation rate used by the Sacramento Area Council of Governments (SACOG) in the Metropolitan Transportation Plan 2010. The asphalt price index has increased by about 15% annually between 1999-2012 (source: Caltrans). The inflation rate for other costs used by SACOG was 3.1% (source: Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS) - SACOG 2012). A weighted average of these two inflation rates was used to determine an overall inflation rate of 8%.

A similar analysis was performed for the bicycle paths. However, it has to be noted that the lengths and the widths of various bicycle paths in the StreetSaver database are not accurate, and therefore any results should be viewed with some caution.

The current PCI of the bicycle path network was found to be 59 and most distresses in this case were found to be environmentally related rather than load-related, such as block cracking or raveling. The overall budget needed to fix all the bicycle paths is $12.3 million based on the budget “needs” module.

If the City of Davis follows the strategy recommended by the program, the average network PCI will improve to the high 70s before stabilizing around 71 by 2032 (see Figure 5). A snapshot of the results of the budget needs analysis is shown in Table 4 below. These results were calculated based on the revised unit costs and treatments to the maintenance and rehabilitation decision tree (See Appendix A).

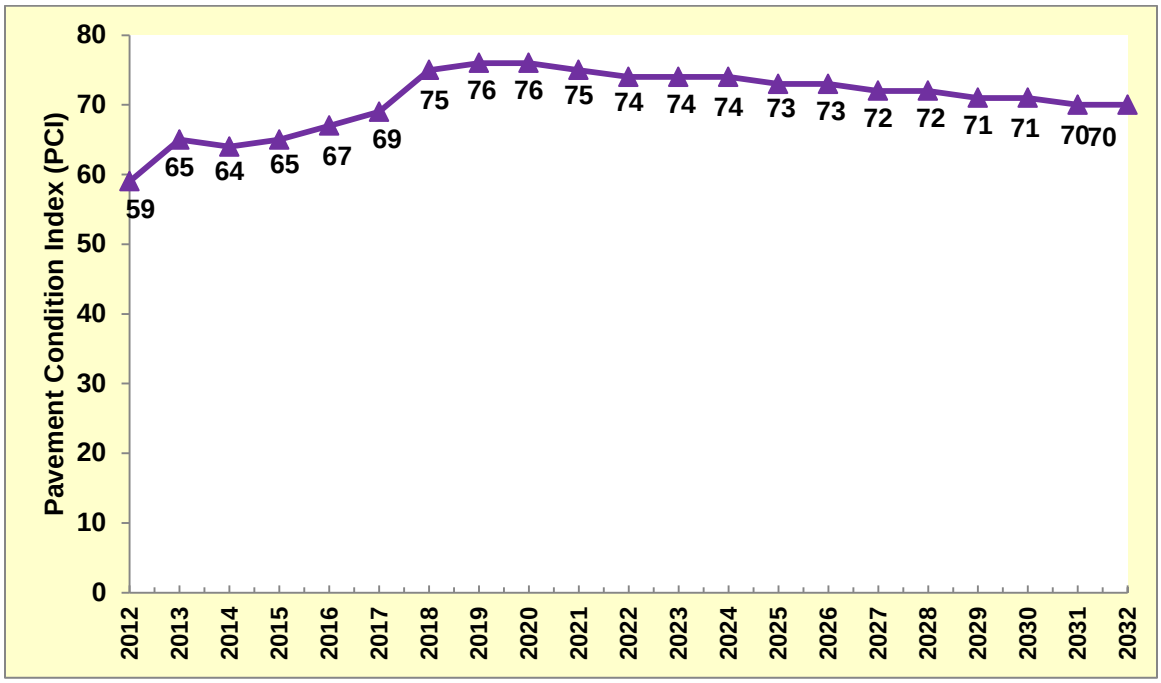


Figure 5 PCI from Needs Calculations (Bicycle Paths)

Table 4 Summary of Results from Needs Analysis (Bicycle Paths)

Year	2013	2032	Total
PCI Treated	65	70	--
PCI Untreated	58	24	--
Rehabilitation ($M)	1.34	0.41	12.29
Preventive Maintenance ($M)	0	0	0
Total Needs ($M)	1.34	0.41	12.29

Budget Scenarios

Having determined the maintenance needs of the road network, the next step in developing a cost-effective maintenance and rehabilitation strategy is to conduct several “what-if” analyses. Using the StreetSaver budget scenario module, the impacts of various budget "scenarios" can be evaluated. The program projects the effects of the different scenarios on pavement condition index (PCI) and deferred maintenance (backlog). By examining the effects on these indicators, the advantages and disadvantages of different funding levels and maintenance strategies become clear. The following scenarios were performed for the purposes of this report.

Scenario 1: Current City Funding Level

a. Streets: Based on an existing funding level of $20 million over 20 years, with approximately 3% allocated for preventive maintenance, the condition of the network will deteriorate to a PCI of 27 in twenty years and the deferred maintenance or unfunded backlog will dramatically increase more than ten-fold from $21.4 million in 2012 to $439.4 million in 2032.
b. Bicycle Paths: The current funding level of $200K/year will result in the PCI dropping from 59 to 46 in the next twenty years. The deferred maintenance or unfunded backlog will increase from $1.3 million to $27.7 million by 2032.

Scenario 2: Improve PCI to 70

a. Streets: In order to increase the current network PCI of 62 to 70 by one point a year and then maintain it at 70 till 2032, a total of $160.6 million is required over the next twenty years. However, the unfunded backlog will still increase from $21.4 million to $119.8 million by 2032.
b. Bicycle Paths: Due to the nature of the decision tree and network conditions of the bicycle paths, maintaining the PCI of the overall network at 70 was not a viable option.

Scenario 3: Maintain Current Unfunded Backlog

a. Streets: In this scenario, the City will require a total budget of $139.5 million for the next twenty years with around 5.4% allocated for preventive maintenance in order to maintain the current backlog of $21 million. The PCI will increase from 62 to 70 in twenty years.
b. Bicycle Paths: The City will need a total budget of $13.1 million to maintain the same unfunded backlog as in 2012. This scenario would help improve the PCI of the network to 69 by 2032.

Note: “Deferred maintenance” or “Unfunded backlog” consists of pavement maintenance that is needed, but cannot be performed due to lack of funding. These terms are often used interchangeably. Shrinking budgets have forced many cities and counties to defer much-needed road maintenance. By deferring maintenance, not only does the frequency of citizens'

complaints about the condition of the network increase, but the cost to repair these streets rises as well.

More detailed results of the budget needs and scenarios can be found in Appendix B of this report.

Scenarios for Streets

Scenario 1: Current City Funding Level ($20 million)

The current projected City budget is approximately $1 million per year for the next twenty years. A total of $18.3 million should be allocated for rehabilitation and approximately 3% allocated for preventive maintenance. The results indicate that the network PCI will decrease to 27 by 2032. In addition, 69% of the network will fall into the "Poor" or "Very Poor" condition category (currently 29.1%). Finally, the unfunded backlog or deferred maintenance will increase from $21 million to $439.4 million in 2032. Table 5 and Figure 6 summarize these results.

Table 5 Summary of Results for Scenario 1 (Streets)

Year	2013	2022	2032	Total
Budget ($-Millions)	1.0	1.0	1.0	20.0
Rehabilitation ($-Millions)	0.90	0.90	0.94	18.31
Preventive Maintenance ($-Millions)	0	0.08	0	0.61
Unfunded Backlog ($-Millions)	33.8	146.5	439.4	-
PCI	62	45	27	-

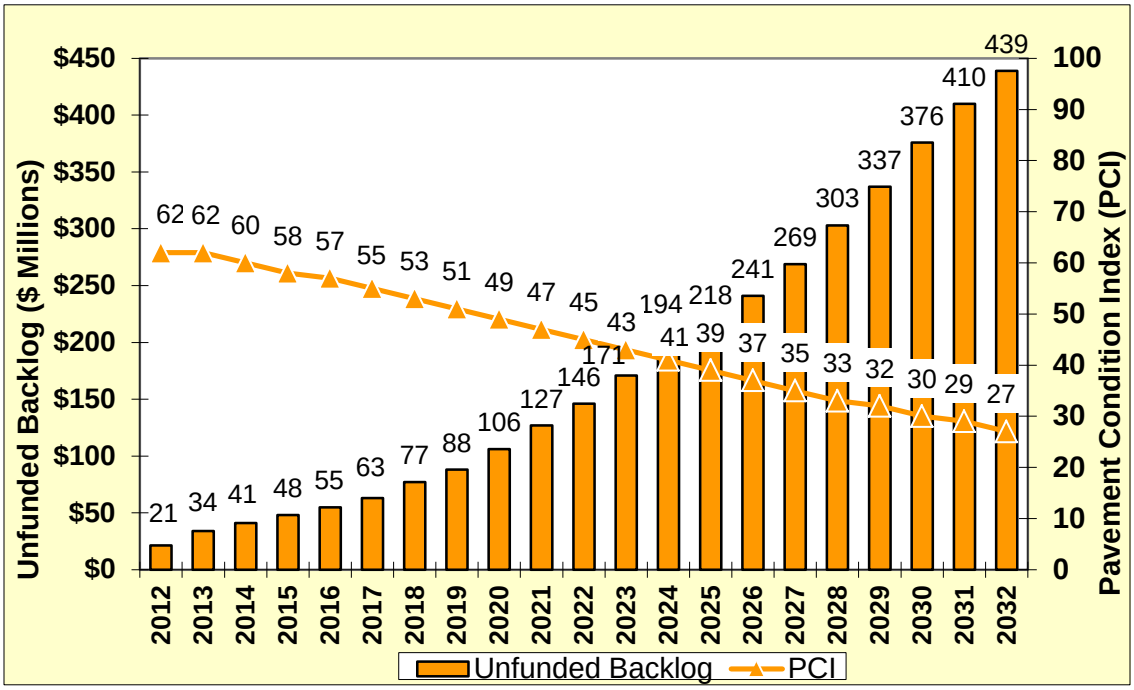


Figure 6 PCI vs. Unfunded Backlog for Scenario 1 (Streets)

Scenario 2: Improve the PCI to 70 ($160.6 million)

In order to improve the current PCI of 62 to 70 by one point a year and then maintain it at 70, a total budget of $160.6 million over the next twenty years is required. Further, approximately 18% of the budget should be allocated to preventive maintenance. By 2032, 88.7% of the network will be in the "Good" condition category. However, the deferred maintenance or unfunded backlog will still grow to $119.8 million by 2032. Table 6 and Figure 7 summarize these results.

Table 6 Summary of Results for Scenario 2 (Streets)

Year	2013	2022	2032	Total
Budget ($-Millions)	3.1	6.1	13.4	160.6
Rehabilitation ($-Millions)	1.9	4.6	10.7	131.7
Preventive Maintenance ($-Millions)	1.2	1.5	2.6	28.9
Unfunded Backlog ($-Millions)	31.7	61.6	119.8	-
PCI	63	70	70	--

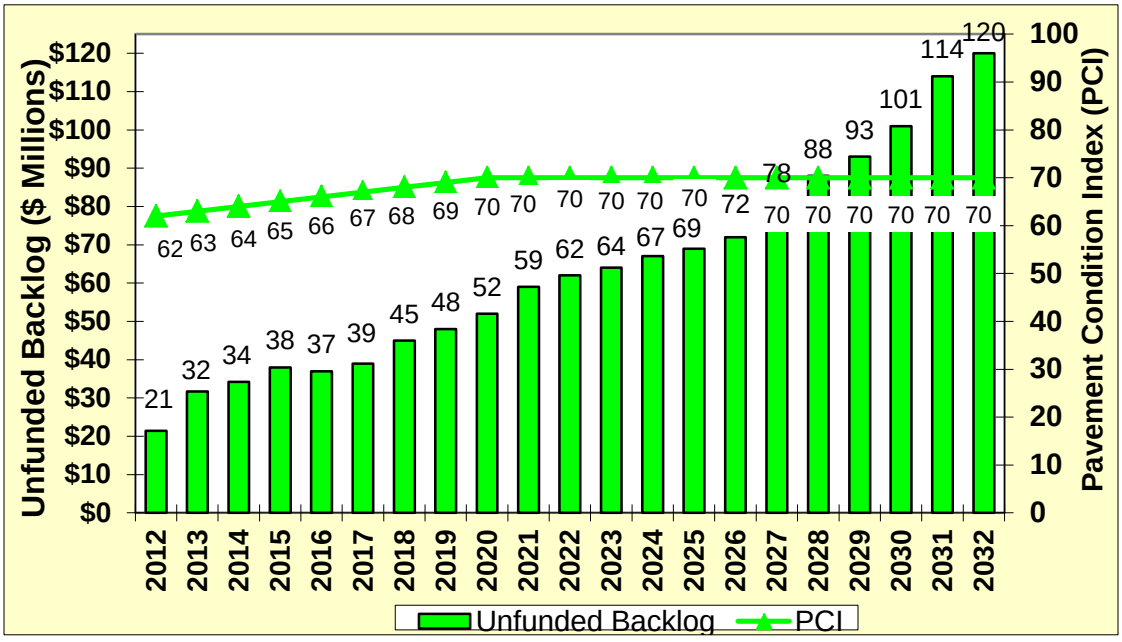


Figure 7 PCI vs. Unfunded Backlog for Scenario 2 (Streets)

Scenario 3: Maintain the Current Unfunded Backlog ($139.4 million)

In order to maintain the same backlog from 2013 to 2032, the required total budget is $139.4 million for the next twenty years with 5.5% of the budget allocated to preventive maintenance. By 2032, 99.3% of the network will be in the "Good" condition category. In addition, the PCI will go up from 62 to 70 in 2032. Table 7 and Figure 8 summarize these results.

Table 7 Summary of Results for Scenario 3 (Streets)

Year	2013	2022	2032	Total
Budget ($-Millions)	15	3.0	10.0	139.4
Rehabilitation ($-Millions)	13.2	2.8	9.5	131
Preventive Maintenance ($-Millions)	1.5	0.2	0.4	7.6
Unfunded Backlog ($-Millions)	20.0	21.5	23.9	--
PCI	71	76	70	-

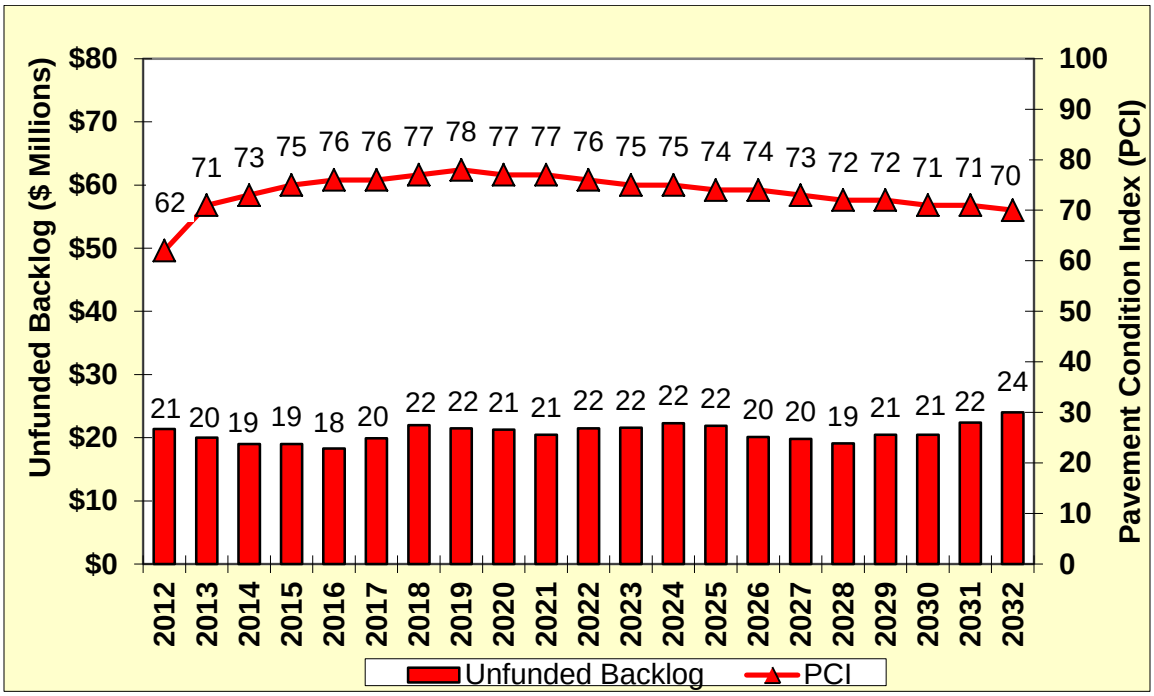


Figure 8 PCI vs. Unfunded Backlog for Scenario 3 (Streets)

Scenarios for Bicycle Paths

Scenario 1: Current Funding Level ($4 million)

The current projected City budget is approximately $4 million ($200k per year) out of which a total of $3.7 million is required for rehabilitation. The results indicate that the network PCI will decrease to 46 by 2032, and 42.7% of the bicycle network will fall into the "Poor" or "Very Poor" condition category. In addition, the deferred maintenance or unfunded backlog of work will increase to $27.7 million. Table 8 and Figure 9 summarize these results.

Table 8 Summary of Results for Scenario 1 (Bicycle Paths)

Year	2013	2022	2032	Total
Budget ($-Millions)	0.2	0.2	0.2	4.0
Rehabilitation ($-Millions)	0.19	0.17	0.19	3.7
Preventive Maintenance ($-Millions)	0	0	0	0
Unfunded Backlog ($-Millions)	1.2	11.4	27.7	--
PCI	61	54	46	

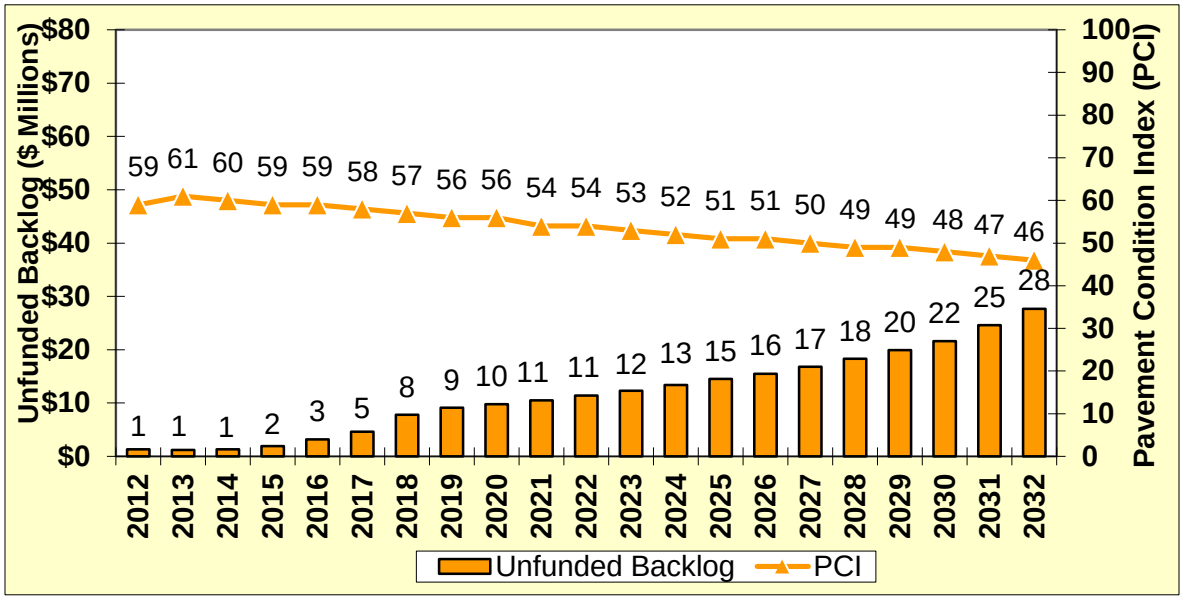


Figure 9 PCI vs. Unfunded Backlog for Scenario 1 (Bicycle Paths)

Scenario 2: Maintain the Current Unfunded Backlog ($13.1 million)

The City will need a total budget of $13.1 million to maintain the backlog around $1.3 million. The percentage of bicycle paths in "good" condition will increase from 59.2% to 97.9% by 2032 and PCI of the overall bicycle network will improve from 59 to 69 in twenty years.

Table 9 Summary of Results for Scenario 2 (Bicycle Paths)

Year	2013	2022	2032	Total
Budget ($-Millions)	0.14	0.17	0.22	13.1
Rehabilitation ($-Millions)	0.14	0.17	0.21	13.1
Preventive Maintenance ($-Millions)	0	0	0	0
Unfunded Backlog ($-Millions)	1.2	1.3	1.6	--
PCI	61	73	69	-

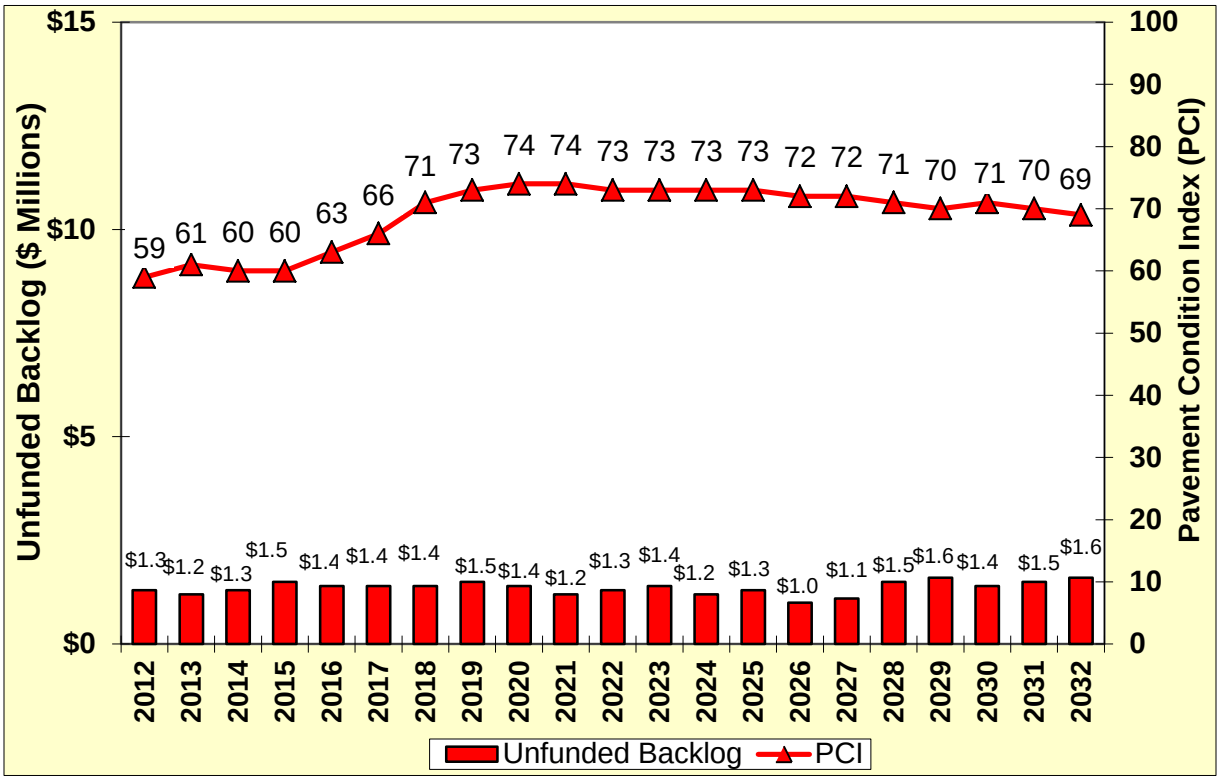


Figure 10 PCI vs. Unfunded Backlog for Scenario 2 (Bicycle Paths)

Discussion

Figure 11A (below) illustrates the change in PCI over time for the different budget scenarios for the street network. In scenario 1 (Current City Funding Level), the network continues to deteriorate annually and ultimately reaches a PCI of 27 after twenty years. Scenario 2 will increase the PCI one point a year until it reaches 70 and then maintains the same PCI at 70 through year 2032 and in the case of scenario 3 (Maintain the Current Unfunded Backlog), the PCI increases from the initial 62 to 78 in 2020 and then slowly drops to 70 by 2032.

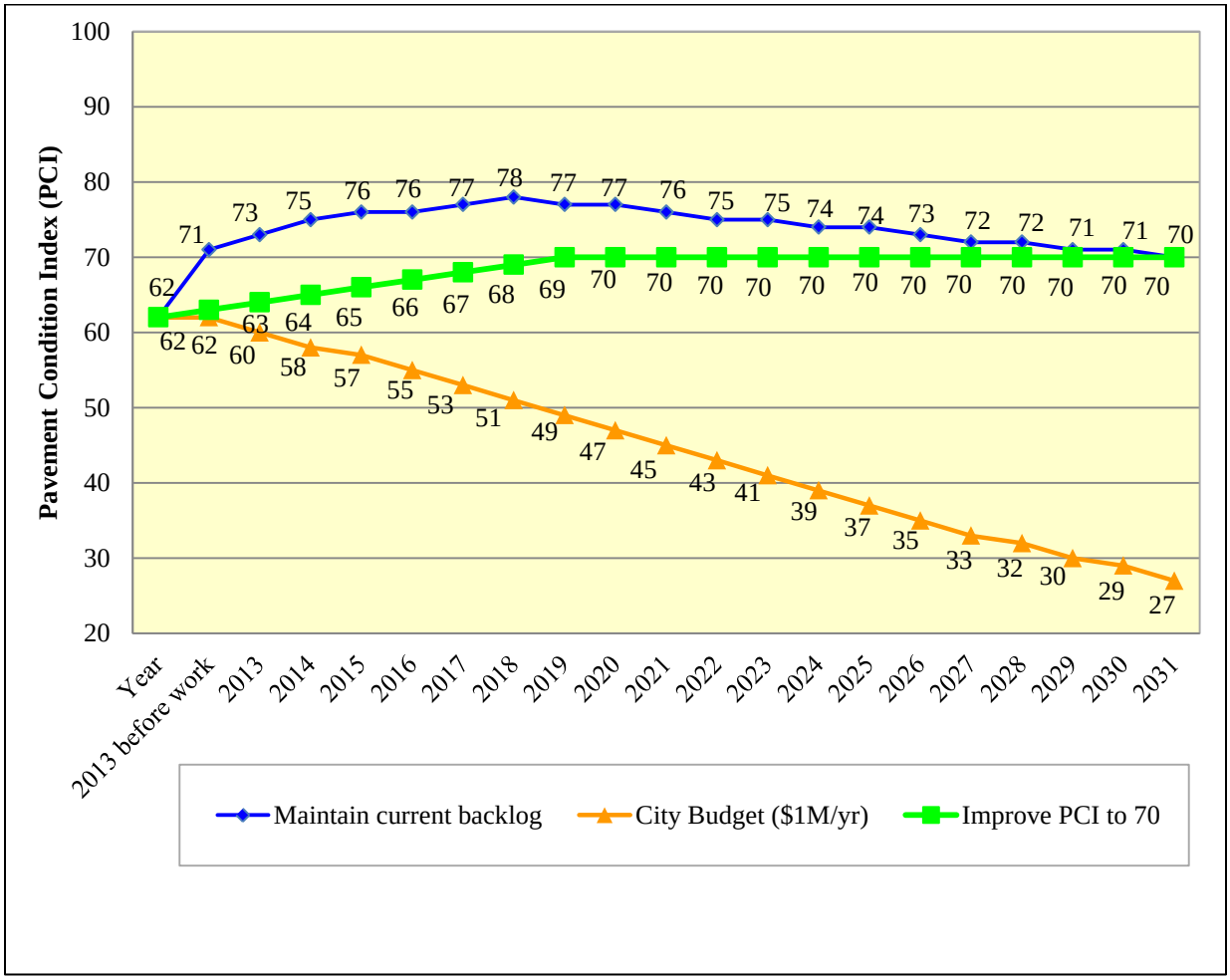


Figure 11A Pavement Condition Index by Scenario by Year (Streets)

Figure 11B shows the change in PCI for each scenario in the case of bicycle paths. The PCI consistently drops to 46 by 2032 in Scenario 1. In the case of Scenario 2, the PCI increases to 74 by 2020 and then slowly decreases to 69 by the end of the twenty year period.

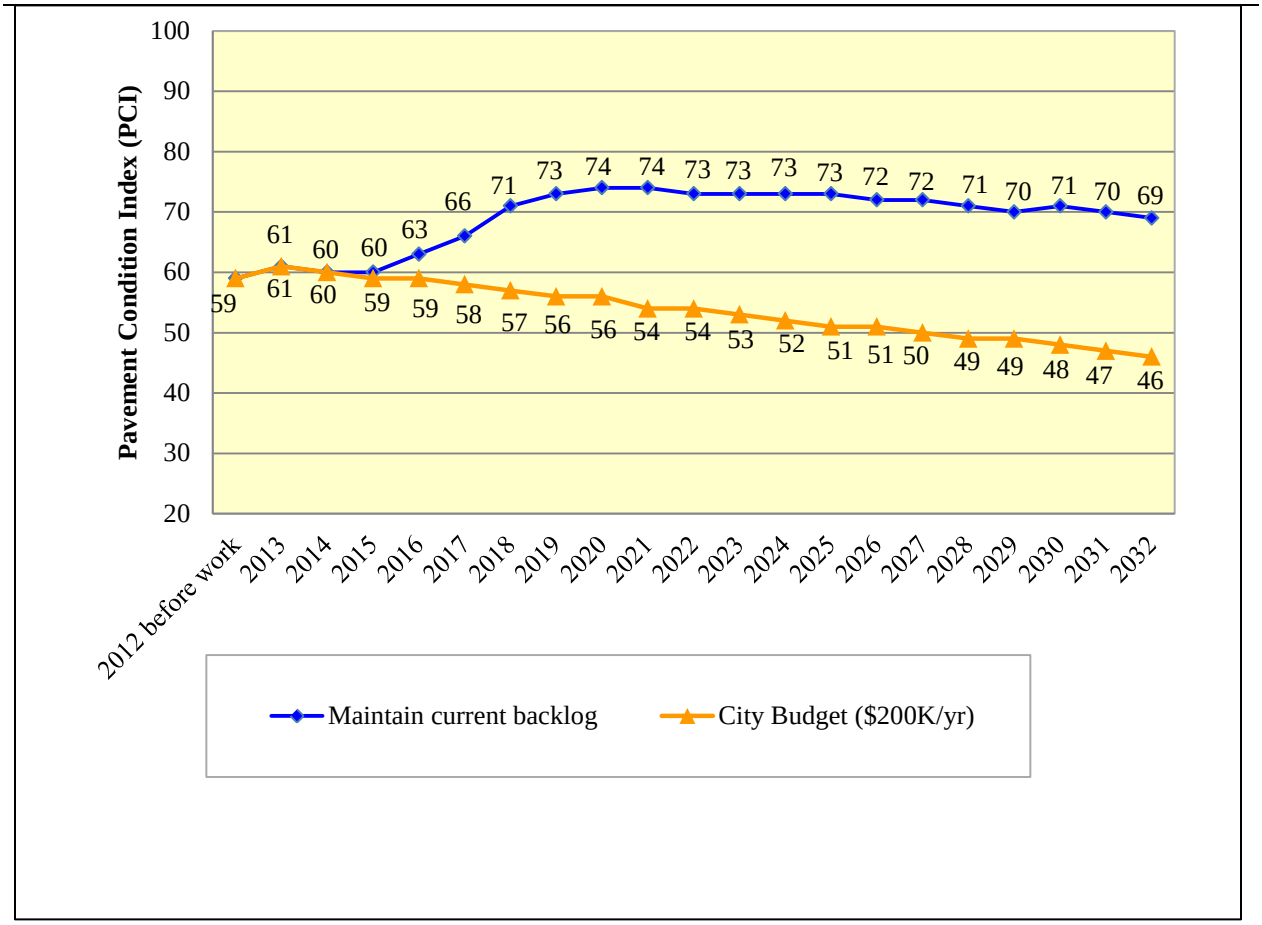


Figure 11B Pavement Condition Index by Scenario by Year (Bicycle paths)

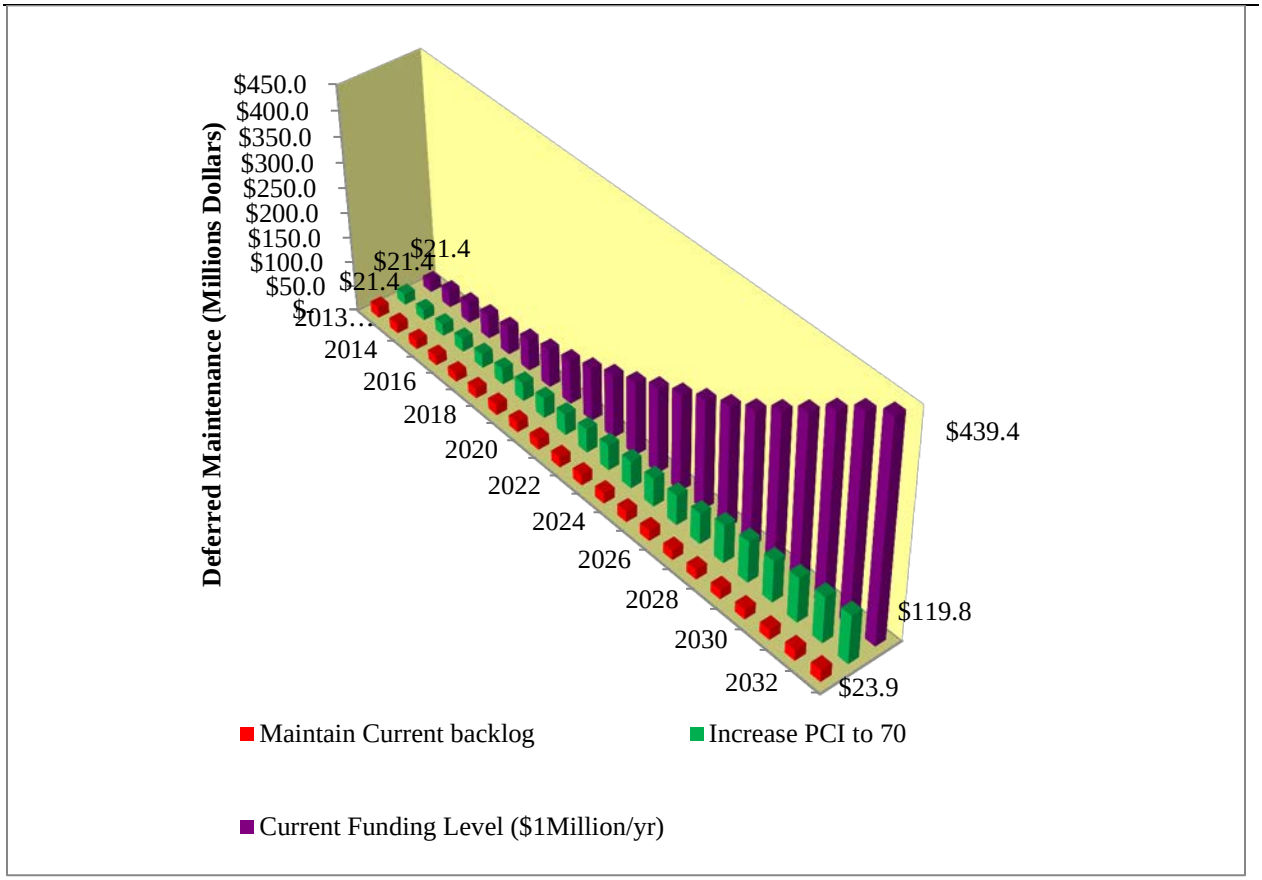


Figure 12A Deferred Maintenance by Scenario by Year- (Streets)

Figure 12A illustrates the change in deferred maintenance over time for the different budget scenarios. Note that Scenario 1 (Current City Funding Level) will increase the amount of deferred maintenance to a staggering $439.4 million, Scenario 2 (Improve PCI to 70) results in a deferred maintenance of $119.8 million by 2032 and Scenario 3 (Maintain Current Backlog) will maintain the deferred maintenance close to the current level of $21 million.

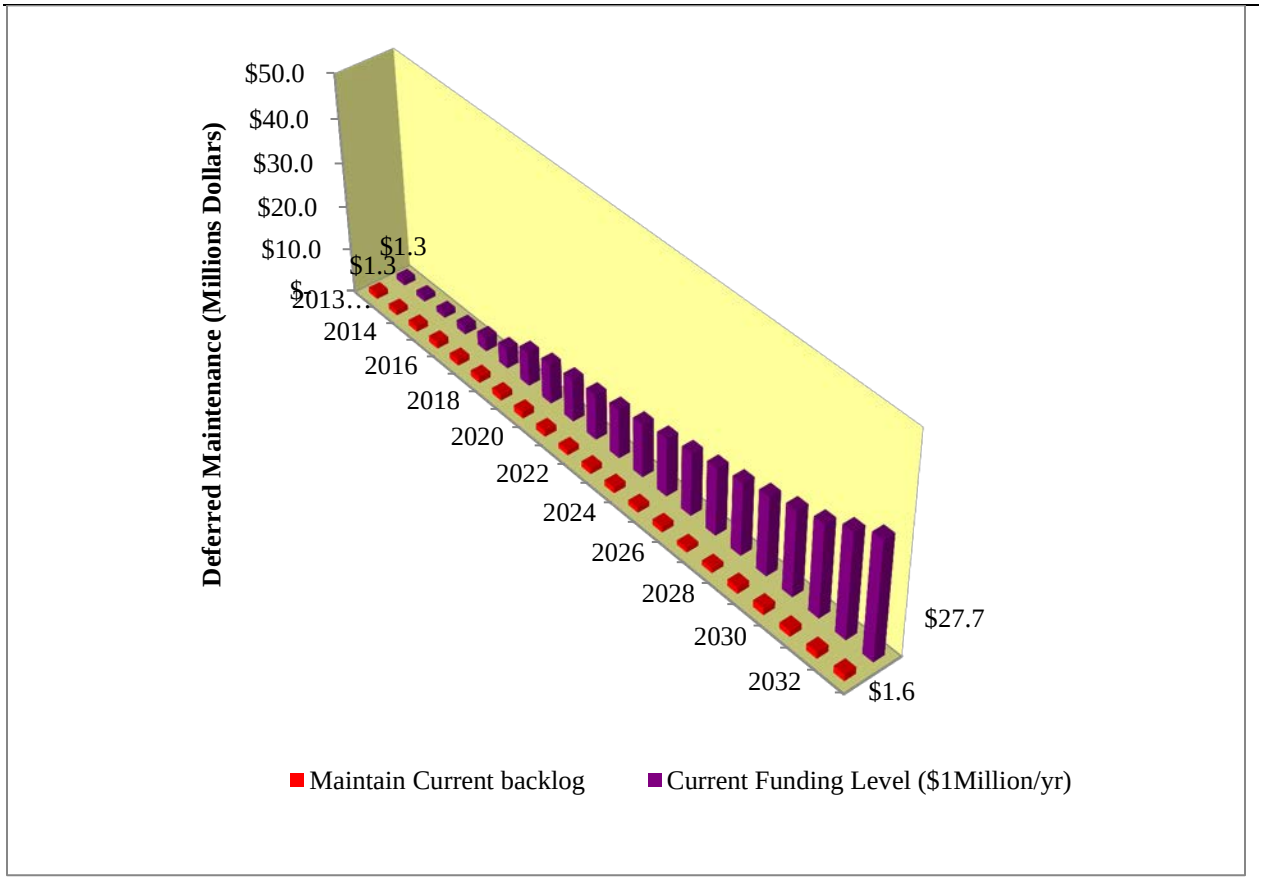
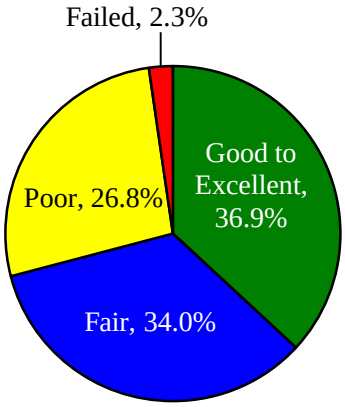


Figure 12B Deferred Maintenance by Scenario by Year- bicycle paths

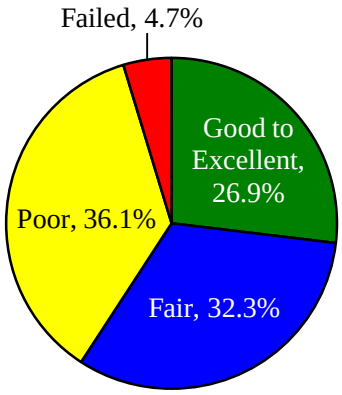
Figure 12B shows the change in deferred maintenance over time for the different budget scenarios for the bicycle paths. The deferred maintenance in Scenario 1 (Current Funding Level) will increase to $27.7 million and Scenario 2 maintains the backlog around $1.3 million for the total period of the twenty years.

Figure 13 (below) illustrates the pavement condition changes under the various scenarios. Currently, 70.9% of the network is in the "Good" condition category and 29.1% in "Poor" and "Very Poor" condition categories. For Scenario 1(Current City Funding Level), only 31.1% of the network will be in the "Good" or "Fair" condition categories by 2032. Under Scenario 2 (Improve the PCI to 70), it is projected that the amount of the network in the "Good" condition category will increase to 88.7% by 2032. In the case of Scenario 3 (Maintain the current backlog), it goes up to approximately 99.3 % by 2032.

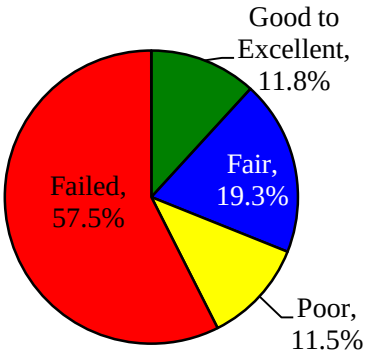
Also, included are the figures showing the pavement conditions for Bicycle Paths. The current condition in 2012 indicates that about 59.2% of the network is in a good condition. In the case of Scenario 1 (Current Funding Level), this percentage drops down to 57.2% and the in the case of Scenario 2 (Maintain the current backlog), it goes up to approximately 97.9% by 2032.



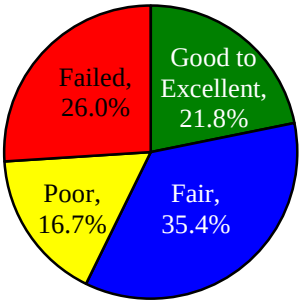
2012 PCI for Streets



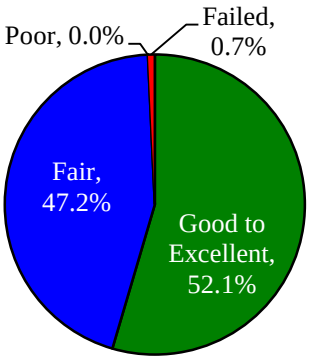
2012 PCI for Bicycle Paths



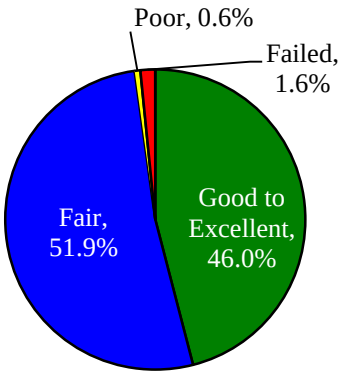
2032 PCI (Streets – Current Funding Level)-



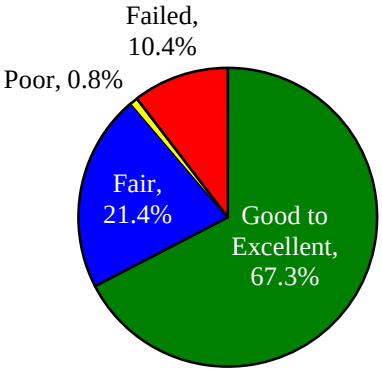
2032 PCI (Bike - Current Funding Level)



2032 PCI (Streets - Maintain Backlog)



2032 PCI (Bike - Maintain Backlog)



2032 PCI (Streets - Improve PCI to 70)

Figure 13 Effects of Different Funding Scenarios on PCI Categories

Summary

The City of Davis has a substantial investment in their street network with a replacement cost of approximately $167 million and $24 million in their bicycle path network. Overall, the network is in "fair" condition with a street network PCI of 62 and bicycle network PCI of 59. Approximately 70.9% of the City's street network is in the "Good" condition category, while 29.1% of the streets are in "Poor" or "Very Poor" condition categories. The latter requires a significant amount of money to bring them into the "Good" condition category. If sufficient funding is unavailable for street maintenance, the average PCI of the network is expected to decrease and the deferred maintenance will increase. The higher backlog will result in increased future costs as more capital intensive treatments (such as reconstruction) will be necessary as streets are deferred where less expensive treatments (such as surface seals or overlays) are currently feasible.

The analyses indicate that the City needs to spend $142 million in pavement maintenance and rehabilitation over the next 20 years in order to essentially repair all streets. By doing so, streets can be maintained in "Good" condition with on-going preventive maintenance. This will eventually save money by avoiding reaching the level of major rehabilitation (such as reconstruction).

a. Pavement Budget

The City's current funding level for pavement maintenance and rehabilitation is $1 million annually through 2032. At this budget level, the network PCI will decrease to 27 in twenty years. The percentage of streets in the "very poor/failed" condition will increase from 2.3% in 2012 to 57.5% by the end of the analysis period. This will result in increased funding needs in the future since rehabilitating streets that "slip" into the "very poor/failed" condition category represent the least cost-effective projects. In addition, the amount of deferred maintenance will increase from $21 million to a staggering $439.4 million after twenty years.

It is recommended that the City of Davis, as a minimum, consider increasing pavement expenditures to at least maintain the current deferred maintenance, especially those directed at preventive maintenance, to achieve the following objectives:

- **Allows the City to preserve and improve pavements in the "Good" category.**
- **Maintains the current average PCI.**

It should be noted that a significant unknown is the future cost of rehabilitation; with the recent volatility in oil prices, we would recommend that the City carefully monitor future construction costs and be ready to adapt to large increases if necessary. Figure 14 illustrates the changes in the Asphalt Price Index (source: Caltrans) since 1999. As can be seen, asphalt prices have been extremely volatile since 2007.

Finally, NCE also recommends that the City continue with a strong and well-funded preventive maintenance program. This is necessary to maintain the good condition (currently 70.9% in 2012) of the street inventory and avoid escalating the deferred maintenance backlog even more.

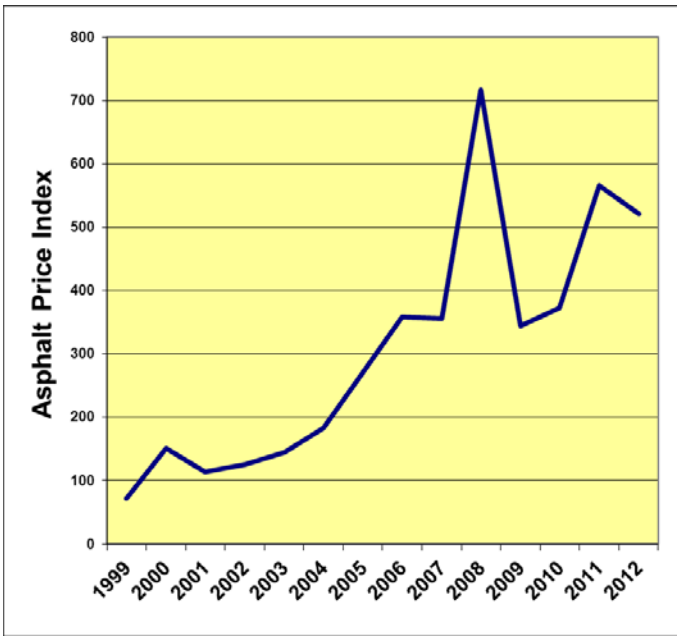


Figure 14 Asphalt Price Index (1999-2012, Caltrans)

In light of the substantial financial commitment that is required to maintain and /or improve city wide road condition and the increase in construction and raw material costs, it is relevant to discuss the various possible financing alternatives to help fund pavement rehabilitation and preventive maintenance for the City. The following alternatives are some of the possible ways that the City should consider to generate additional revenue to fund needed rehabilitation and maintenance of both the City streets and bicycle paths.

1) Truck Route Permit Fee – Leverages a surcharge fee on trucks for use of City streets to help recoup the costs of heavy wheel loads imposed by truck traffic.
2) Residential Waste Collection Fee – Surcharge is leveraged on waste companies to account for damage to pavement incurred by heavy waste collection trucks.
3) Development Repairs – Fees assessed to new developments to account for increased traffic associated with new residential and commercial tenants.
4) Establish Utility Cut Impact Fee – Fee is leveraged against utility to provide compensation for reduced pavement life due to utility cuts and patches.
5) Pursue Local Transportation Sales Tax Measures
6) Pursue parcel tax increases
7) Devote More Local Sales Tax/General Fund revenues to Road Maintenance
8) Establish Downtown and Business Improvement Districts
9) Establish Citywide Assessment Districts

b. Pavement Maintenance Strategies

The City's pavement maintenance strategies include a variety of seals, overlays and reconstruction. Since a large percentage of pavements are in "Good" condition, it is important to preserve good pavements. Crack sealing, one of the least expensive treatments, can keep moisture out of pavements and prevent the underlying aggregate base from premature failures. Life-extending surface seals, such as slurry seal and cape seals, are also cost-effective for pavements currently in good condition. A detailed description of the various M&R strategies is provided in Appendix C.

c. 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/repairs and changing costs so the budget analysis results can be reliable and accurate.

d. Next Steps

To summarize, we recommend that the City undertake the following steps:

- Update the pavement management system regularly
- Continue to fund its current preventive maintenance strategy as aggressively as possible
- Identify additional funding sources
- Review alternative maintenance treatments

APPENDIX A

Maintenance and Rehabilitation Decision Tree

Maintenance and Rehabilitation (M&R) Decision Tree

This report presents the current maintenance and rehabilitation decision tree that exists in the database. The decision tree forms the basis for all of the budgetary computations that are included in this volume. ***Changes to the decision tree will make the results in the budget reports invalid.*** All pavement treatment unit costs relevant to the street types in the database were updated.

The decision tree lists the treatments and costs selected for preventive maintenance and rehabilitation activities. Each line represents a specific combination of functional classification and surface type.

The preventive maintenance portion of the report is identified as Condition Category I – Very Good. All preventive maintenance treatment listings are assigned only to sections in Condition Category I where the PCI $\geq$ 70. Sections with PCI values less than 70 are assigned to treatments listed in Categories II through V.

In the preventive maintenance category (PCI $\geq$ 70), a time sequence is used to identify the appropriate treatment and cost. Each preventive maintenance treatment description consists of three parts: 1) a CRACK treatment, 2) a SURFACE treatment, and 3) a RESTORATION treatment. These three parts allow the user to specify one of three different preventive maintenance treatments depending on the prior maintenance history of the section.

1. The CRACK treatment part can be used to specify the most frequent type of preventive maintenance activity planned (typically crack seals).
2. The SURFACE treatment part can be used to specify more extensive and less frequent preventive maintenance activities, such as chip seals or slurry seals. For example, a crack seal can be specified on a 3-year cycle with a slurry seal specified after 5 years.
3. The RESTORATION part can be used to specify a surface restoration treatment (such as an overlay) to be performed after a specified number of surface treatments. For example, after a certain number of successive slurry seals, an overlay can be specified instead of another slurry seal.

Rehabilitation treatments are assigned to sections in Condition Categories II through V (PCI less than 70). Each line is defined by a specific combination of functional classification, surface type, and condition category.

COLUMN	**DESCRIPTION**
Functional Class	Functional Classification identifying the branch number.
Surface	Surface Type identifying the branch number.
Condition Category	Condition Category (I through V).
Treatment Type	First Row (Crack Treatment) indicates localized treatment (e.g. crack sealing). Second Row (Surface Treatment) indicates surface treatment (e.g. slurry sealing). Third Row (Restoration Treatment) indicates surface restoration (e.g. overlay).
Treatment	Name of treatments from the "Treatment Descriptions" report.

COLUMN	DESCRIPTION
Yrs. Between Crack Seals	First Row - number of years between successive treatment applications specified in the first row (i.e. CRACK treatment).
Yrs. Between Surface Seals	Second Row - number of years between successive treatment applications specified in the second row (i.e. SURFACE treatment).
Number of Sequential Seals	Number of times that the treatment application in the second row (i.e. SURFACE treatment) will be performed prior to performing the treatment application in the third row.

Note that the treatments assigned to each section should not be blindly followed in preparing a street maintenance program. Engineering judgment and project level analysis should be applied to ensure that the treatment is appropriate and cost effective for the section.

Decision Tree- Streets

Decision Tree for the City of Davis- Streets

Functional Class	Surface Type	PCI Condition Category	Treatment Type	Treatment	Cost Per Sq Yd except seal cracks in LF ($)	Years between Crack Seals	Years between Surface Seals	# of Surface Seals before overlay
Arterial	AC	Condition Category I - Very Good	Crack Treatment	DO NOTHING	0	5		
Arterial	AC	Condition Category I - Very Good	Surface Treatment	DO NOTHING	0		9	
Arterial	AC	Condition Category I - Very Good	Restoration Treatment	DO NOTHING	0			2
Arterial	AC	Condition Category II - Good, Non-Load Related		DO NOTHING	0			
Arterial	AC	Condition Category III - Good, Load Related		THIN OVERLAY (2" INCHES)	20			
Arterial	AC	Condition Category IV - Poor		THICK AC OVERLAY(2.5 INCHES)	27			
Arterial	AC	Condition Category V - Very Poor		FDR (6" AC)	81			
Arterial	AC/AC	Condition Category I - Very Good	Crack Treatment	DO NOTHING	0	5		
Arterial	AC/AC	Condition Category I - Very Good	Surface Treatment	DO NOTHING	0		9	
Arterial	AC/AC	Condition Category I - Very Good	Restoration Treatment	DO NOTHING	0			2
Arterial	AC/AC	Condition Category II - Good, Non-Load Related		DO NOTHING	0			
Arterial	AC/AC	Condition Category III - Good, Load Related		MILL AND FILL 2" AC	22.5			
Arterial	AC/AC	Condition Category IV - Poor		MILL AND FILL 2.5" AC	30			
Arterial	AC/AC	Condition Category V - Very Poor		FDR (6" AC)	81			
Arterial	AC/PCC	Condition Category I - Very Good	Crack Treatment	DO NOTHING	0	15		
Arterial	AC/PCC	Condition Category I - Very Good	Surface Treatment	DO NOTHING	0		9	
Arterial	AC/PCC	Condition Category I - Very Good	Restoration Treatment	DO NOTHING	0			2
Arterial	AC/PCC	Condition Category II - Good, Non-Load Related		DO NOTHING	0			
Arterial	AC/PCC	Condition Category III - Good, Load Related		MILL AND FILL 2" AC	20.5			
Arterial	AC/PCC	Condition Category IV - Poor		MILL AND FILL 2.5" AC	25			
Arterial	AC/PCC	Condition Category V - Very Poor		MILL AND FILL 4" AC	40			
Collector	AC	Condition Category I - Very Good	Crack Treatment	DO NOTHING	0	7		
Collector	AC	Condition Category I - Very Good	Surface Treatment	DO NOTHING	0		9	
Collector	AC	Condition Category I - Very Good	Restoration Treatment	DO NOTHING	0			2
Collector	AC	Condition Category II - Good, Non-Load Related		SURFACE SEAL	4.5		5	
Collector	AC	Condition Category III - Good, Load Related		THIN AC OVERLAY(1.5 INCHES)	14			

AC- Asphalt Overlay, AC/AC-Asphalt Concrete Overlaid with Asphalt Concrete, AC/PCC- PCC Pavement Overlaid with Asphalt Concrete, PCC-Portland Cement Concrete

Decision Tree for the City of Davis- Streets

Functional Class	Surface Type	PCI Condition Category	Treatment Type	Treatment	Cost Per Sq Yd except seal cracks in LF ($)	Years between Crack Seals	Years between Surface Seals	# of Surface Seals before overlay
Collector	AC	Condition Category IV - Poor		THIN OVERLAY (2" INCHES)	20.5			
Collector	AC	Condition Category V - Very Poor		FDR (4" AC)	61			
Collector	AC/AC	Condition Category I - Very Good	Crack Treatment	DO NOTHING	0	7		
Collector	AC/AC	Condition Category I - Very Good	Surface Treatment	DO NOTHING	0		9	
Collector	AC/AC	Condition Category I - Very Good	Restoration Treatment	DO NOTHING	0			2
Collector	AC/AC	Condition Category II - Good, Non-Load Related		SURFACE SEAL	4.5		5	
Collector	AC/AC	Condition Category III - Good, Load Related		MILL AND FILL 1.5" AC	16.5			
Collector	AC/AC	Condition Category IV - Poor		MILL AND FILL 2" AC	23			
Collector	AC/AC	Condition Category V - Very Poor		FDR (4" AC)	61			
Collector	AC/PCC	Condition Category I - Very Good	Crack Treatment	DO NOTHING	0	10		
Collector	AC/PCC	Condition Category I - Very Good	Surface Treatment	DO NOTHING	0		9	
Collector	AC/PCC	Condition Category I - Very Good	Restoration Treatment	DO NOTHING	0			2
Collector	AC/PCC	Condition Category II - Good, Non-Load Related		SURFACE SEAL	4.5		5	
Collector	AC/PCC	Condition Category III - Good, Load Related		MILL AND FILL 1.5" AC	15			
Collector	AC/PCC	Condition Category IV - Poor		MILL AND FILL 2" AC	20			
Collector	AC/PCC	Condition Category V - Very Poor		MILL AND FILL 3" AC	30			
Residential/ Local	AC	Condition Category I - Very Good	Crack Treatment	DO NOTHING	0	10		
Residential/ Local	AC	Condition Category I - Very Good	Surface Treatment	SLURRY SEAL	4		5	
Residential/ Local	AC	Condition Category I - Very Good	Restoration Treatment	DO NOTHING	0			2
Residential/ Local	AC	Condition Category II - Good, Non-Load Related		SLURRY SEAL	4		5	
Residential/ Local	AC	Condition Category III - Good, Load Related		AR CAPE SEAL	7.5			
Residential/ Local	AC	Condition Category IV - Poor		THIN AC OVERLAY(1.5 INCHES)	15			
Residential/ Local	AC	Condition Category V - Very Poor		LOCAL REPAIRS WITH AC OVERLAY	25			
Residential/ Local	AC/AC	Condition Category I - Very Good	Crack Treatment	DO NOTHING	0	10		
Residential/ Local	AC/AC	Condition Category I - Very Good	Surface Treatment	SLURRY SEAL	4		5	
Residential/ Local	AC/AC	Condition Category I - Very Good	Restoration Treatment	DO NOTHING	0			2

AC- Asphalt Overlay, AC/AC-Asphalt Concrete Overlaid with Asphalt Concrete, AC/PCC- PCC Pavement Overlaid with Asphalt Concrete, PCC-Portland Cement Concrete

Decision Tree for the City of Davis- Streets

Functional Class	Surface Type	PCI Condition Category	Treatment Type	Treatment	Cost Per Sq Yd except seal cracks in LF ($)	Years between Crack Seals	Years between Surface Seals	# of Surface Seals before overlay
Residential/ Local	AC/AC	Condition Category II - Good, Non-Load Related		SLURRY SEAL	4		5	
Residential/ Local	AC/AC	Condition Category III - Good, Load Related		AR CAPE SEAL	7.5			
Residential/ Local	AC/AC	Condition Category IV - Poor		MILL AND FILL 1.5" AC	17			
Residential/ Local	AC/AC	Condition Category V - Very Poor		LOCAL REPAIRS WITH AC OVERLAY	27.5			
Other	AC	Condition Category I - Very Good	Crack Treatment	DO NOTHING	0	10		
Other	AC	Condition Category I - Very Good	Surface Treatment	DO NOTHING	0		5	
Other	AC	Condition Category I - Very Good	Restoration Treatment	DO NOTHING	0			5
Other	AC	Condition Category II - Good, Non-Load Related		DO NOTHING	0			
Other	AC	Condition Category III - Good, Load Related		DO NOTHING	0			
Other	AC	Condition Category IV - Poor		LOCAL REPAIRS	3.5			
Other	AC	Condition Category V - Very Poor		LOCAL REPAIRS	3.5			
Other	PCC	Condition Category I - Very Good	Crack Treatment	SEAL CRACKS	1.6	4		
Other	PCC	Condition Category I - Very Good	Surface Treatment	DO NOTHING	0		99	
Other	PCC	Condition Category I - Very Good	Restoration Treatment	DO NOTHING	0			100
Other	PCC	Condition Category II - Good, Non-Load Related		DO NOTHING	0			
Other	PCC	Condition Category III - Good, Load Related		DO NOTHING	0			
Other	PCC	Condition Category IV - Poor		DO NOTHING	0			
Other	PCC	Condition Category V - Very Poor		LOCAL REPAIRS	3.5			

AC- Asphalt Overlay, AC/AC-Asphalt Concrete Overlaid with Asphalt Concrete, AC/PCC- PCC Pavement Overlaid with Asphalt Concrete, PCC-Portland Cement Concrete

Decision Tree- Bicycle Paths

Decision Tree for the City of Davis- Bicycle Paths

Functional Class	SurfaceType	PCI Condition Category	Treatment Type	Treatment	Cost Per Sq Yd except seal cracks in LF ($)	Years between Crack Seals	Years between Surface Seals	# of Surface Seals before overlay
Other	AC	Condition Category I - Very Good	Crack Treatment	DO NOTHING	0	4	99	100
Other	AC	Condition Category I - Very Good	Surface Treatment	DO NOTHING	0	9	8	100
Other	AC	Condition Category I - Very Good	Restoration Treatment	DO NOTHING	0	9	99	3
Other	AC	Condition Category II - Good, Non-Load Related		DO NOTHING	0			
Other	AC	Condition Category III - Good, Load Related		CRACK SEAL	1			
Other	AC	Condition Category IV - Poor		PATCH	3.5			
Other	AC	Condition Category V - Very Poor		RECONSTRUCT STRUCTURE (PCC)	80			
Other	AC/AC	Condition Category I - Very Good	Crack Treatment	DO NOTHING	0	4	99	100
Other	AC/AC	Condition Category I - Very Good	Surface Treatment	DO NOTHING	0	9	8	100
Other	AC/AC	Condition Category I - Very Good	Restoration Treatment	DO NOTHING	0	9	99	3
Other	AC/AC	Condition Category II - Good, Non-Load Related		DO NOTHING	0			
Other	AC/AC	Condition Category III - Good, Load Related		CRACK SEAL	1			
Other	AC/AC	Condition Category IV - Poor		PATCH	3.5			
Other	AC/AC	Condition Category V - Very Poor		RECONSTRUCT STRUCTURE (PCC)	80			
Other	PCC	Condition Category I - Very Good	Crack Treatment	DO NOTHING	0	9	99	100
Other	PCC	Condition Category I - Very Good	Surface Treatment	DO NOTHING	0	9	99	100
Other	PCC	Condition Category I - Very Good	Restoration Treatment	DO NOTHING	0	9	99	100
Other	PCC	Condition Category II - Good, Non-Load Related		DO NOTHING	1.11			
Other	PCC	Condition Category III - Good, Load Related		CRACK SEAL	1			
Other	PCC	Condition Category IV - Poor		PATCH	3.5			
Other	PCC	Condition Category V - Very Poor		RECONSTRUCT SURFACE (PCC)	80			

AC- Asphalt Concrete, AC/AC- Asphalt Concrete Overlaid with Asphalt Concrete, AC/PCC- PCC Pavement Overlaid with Asphalt Concrete, PCC-Portland Cement Concrete

APPENDIX B

Budget Needs

Projected PCI / Cost Summary

Preventative Treatment / Cost Summary

Rehabilitation Treatment / Cost Summary

Budget Needs Reports

The purpose of this module is to answer the question: ***If the City had all the money in the world, what sections should be fixed and how much will it cost?*** Based on the Maintenance & Rehabilitation (M&R) decision tree and the PCIs of the sections, the program will then select a maintenance or rehabilitation action and compute the total costs over a period of five years. The Budget Needs represents the "ideal world" funding levels, while the Budget Scenarios reports in the next section represent the most "cost effective" prioritization possible for the actual funding levels.

A budget needs analysis has been performed. The summary results from the analysis are shown below. An interest rate of 5% and an inflation factor of 3% were used to project the costs for the next five years. This report shows the total five-year budget that would be required to meet the City's standards as exemplified in the M&R decision tree.

As indicated in the report, with a budget of 115.8 million dollars over the next five years the PCI of the street network will improve from the current level of 65 to 85 by 2017. If no treatments are programmed, the weighted average PCI is projected to deteriorate from 65 to 54 by 2017.

Budget Needs reports included in this volume are listed below:

- Projected PCI/Cost Summary
- Preventative Maintenance Treatment/Cost Summary
- Rehabilitation Treatment/Cost Summary

Needs - Projected PCI/Cost Summary

This report summarizes and projects the City's network PCI values over a five-year period, both with and without treatments applied. These costs are based on those in the M&R decision tree. It also projects the costs over a five-year period.

COLUMN	DESCRIPTION
Year	Year in the analysis period.
PCI Treated	Projected network average PCI with all needed treatments applied.
PCI Untreated	Projected network average PCI without any treatments applied.
PM Cost	Total preventive maintenance treatment cost.
Rehab Cost	Total rehabilitation treatment cost.
Cost	The budget required for each year in the analysis period to meet the City's standard as shown on the M&R decision tree.
Total Cost	Total budget required over a five-year period.

City of Davis- Streets

Needs - Projected PCI/Cost Summary

Inflation Rate = 8.00 %

Printed: 01/14/2013

Year	PCI Treated	PCI Untreated	PM Cost	Rehab Cost	Cost
2013	76	61	$1,901,243	$19,473,742	$21,374,985
2014	76	59	$63,445	$8,337,878	$8,401,323
2015	78	57	$141,702	$9,332,255	$9,473,957
2016	79	55	$95,899	$7,208,810	$7,304,709
2017	80	52	$87,182	$9,492,792	$9,579,974
2018	82	50	$2,978,275	$5,867,803	$8,846,078
2019	82	47	$3,180,054	$2,511,119	$5,691,173
2020	81	45	$1,198,682	$2,316,897	$3,515,579
2021	80	42	$1,148,765	$2,322,007	$3,470,772
2022	79	40	$798,479	$961,321	$1,759,800
2023	78	37	$797,674	$1,333,166	$2,130,840
2024	78	35	$5,035,511	$4,347,367	$9,382,878
2025	77	32	$1,425,676	$4,075,859	$5,501,535
2026	76	30	$1,394,189	$3,067,006	$4,461,195
2027	76	28	$952,394	$4,605,151	$5,557,545
2028	75	26	$1,213,401	$6,659,657	$7,873,058
2029	74	24	$1,426,424	$5,149,925	$6,576,349
2030	74	22	$875,974	$6,492,511	$7,368,485
2031	73	20	$185,897	$7,104,515	$7,290,412
2032	72	18	$34,814	$6,503,977	$6,538,791

% PM	PM Total Cost	Rehab Total Cost	Total Cost
17.55%	$24,935,680	$117,163,758	$142,099,438

Needs - Preventive Maintenance
Treatment/Cost Summary

Inflation Rate = 8.00 % Printed: 01/10/2013

Treatment	Year	Area Treated	Cost
SLURRY SEAL			
	2013	475,289.33 sq.yd.	$1,901,243
	2014	14,685.89 sq.yd.	$63,445
	2015	30,370.22 sq.yd.	$141,702
	2016	19,031 sq.yd.	$95,899
	2017	16,019.67 sq.yd.	$87,182
	2018	506,724.44 sq.yd.	$2,978,275
	2019	500,979.78 sq.yd.	$3,180,054
	2020	174,850.44 sq.yd.	$1,198,682
	2021	155,157.22 sq.yd.	$1,148,765
	2022	99,857.11 sq.yd.	$798,479
	2023	92,367.67 sq.yd.	$797,674
	2024	539,902.44 sq.yd.	$5,035,511
	2025	141,536.33 sq.yd.	$1,425,676
	2026	128,158.44 sq.yd.	$1,394,189
	2027	81,061.89 sq.yd.	$952,394
	2028	95,627.11 sq.yd.	$1,213,401
	2029	104,088.78 sq.yd.	$1,426,424
	2030	59,186.33 sq.yd.	$875,974
	2031	11,630 sq.yd.	$185,897
	2032	2,016.67 sq.yd.	$34,814
	Total	3,248,540.78	$24,935,680
	Total Quantity	3,248,540.78	$24,935,680

Needs - Rehabilitation
Treatment/Cost Summary

Inflation Rate = 8.00 % Printed: 01/10/2013

Treatment	Year		Area Treated		Cost
AR CAPE SEAL	2013		90,357.11	sq.yd.	$677,691
	2014		26,564.22	sq.yd.	$215,172
	2015		39,689.11	sq.yd.	$347,206
	2016		5,241.67	sq.yd.	$49,523
	2017		16,844.78	sq.yd.	$171,882
	2018		2,598.89	sq.yd.	$28,641
		Total	181,295.78	sq.yd.	$1,490,115
FDR (4" AC)	2014		11,240	sq.yd.	$740,492
	2015		7,365.56	sq.yd.	$524,063
	2016		18,531.11	sq.yd.	$1,423,977
	2017		12,411.11	sq.yd.	$1,029,997
	2018		9,127.78	sq.yd.	$818,114
		Total	58,675.56	sq.yd.	$4,536,643
FDR (6" AC)	2013		8,083.89	sq.yd.	$654,795
	2014		21,051.67	sq.yd.	$1,841,602
	2015		35,015	sq.yd.	$3,308,163
	2016		10,214.33	sq.yd.	$1,042,239
	2017		39,114.89	sq.yd.	$4,310,452
		Total	113,479.78	sq.yd.	$11,157,251
LOCAL REPAIRS	2013		6,602.89	sq.yd.	$23,114
	2014		7,067.33	sq.yd.	$26,717
	2015		480	sq.yd.	$1,960
	2016		6,602.89	sq.yd.	$29,115
	2017		1,128.89	sq.yd.	$5,376
	2018		1,131.11	sq.yd.	$5,818
	2020		7,749.56	sq.yd.	$46,488
	2021		462.22	sq.yd.	$2,995
	2022		464.44	sq.yd.	$3,250
	2024		7,269.56	sq.yd.	$59,328
	2025		480	sq.yd.	$4,231
	2026		462.22	sq.yd.	$4,400
	2027		464.44	sq.yd.	$4,775
	2028		5,560.67	sq.yd.	$61,741
	2029		2,188.89	sq.yd.	$26,248
	2031		926.67	sq.yd.	$12,961
	2032		573.33	sq.yd.	$8,661
		Total	49,615.11	sq.yd.	$327,178
LOCAL REPAIRS WITH AC OVERLAY	2013		55,727.22	sq.yd.	$1,430,697
	2014		6,755	sq.yd.	$196,215
	2015		24,112.78	sq.yd.	$749,520

Needs - Rehabilitation
Treatment/Cost Summary

Inflation Rate = 8.00 % Printed: 01/10/2013

Treatment	Year		Area Treated		Cost
	2016		27,758.44	sq.yd.	$897,373
	2017		51,908.33	sq.yd.	$1,865,579
	2018		36,918.78	sq.yd.	$1,396,783
	2019		39,009.44	sq.yd.	$1,650,123
		Total	242,190	sq.yd.	$8,186,290
MILL AND FILL 1.5" AC	2013		299,986.67	sq.yd.	$5,096,504
	2014		50,574.89	sq.yd.	$928,559
	2015		69,356.33	sq.yd.	$1,375,262
	2016		41,612.22	sq.yd.	$891,139
	2017		24,075.56	sq.yd.	$556,830
	2018		54,589.44	sq.yd.	$1,363,572
	2019		8,894.78	sq.yd.	$239,955
	2020		6,327.78	sq.yd.	$178,938
	2022		1,806.67	sq.yd.	$61,397
	2029		21,895	sq.yd.	$1,275,192
	2030		7,789.44	sq.yd.	$489,960
	2031		19,088.89	sq.yd.	$1,296,757
	2032		24,354.56	sq.yd.	$1,786,821
		Total	630,352.22	sq.yd.	$15,540,886
MILL AND FILL 2" AC	2013		140,988.67	sq.yd.	$3,214,566
	2014		51,745.56	sq.yd.	$1,279,765
	2015		41,604.44	sq.yd.	$1,116,134
	2016		15,267.78	sq.yd.	$442,360
	2017		26,208.89	sq.yd.	$820,111
	2026		14,909.44	sq.yd.	$932,607
	2027		2,022.22	sq.yd.	$136,613
	2028		5,062.11	sq.yd.	$369,332
	2029		14,464.11	sq.yd.	$1,139,725
	2030		35,948.33	sq.yd.	$3,059,220
	2031		14,077.22	sq.yd.	$1,293,816
	2032		17,064.44	sq.yd.	$1,693,837
		Total	379,363.22	sq.yd.	$15,498,086
MILL AND FILL 2.5" AC	2013		85,741	sq.yd.	$2,488,827
	2014		19,067.89	sq.yd.	$617,800
	2015		15,433.33	sq.yd.	$540,044
	2016		23,647.44	sq.yd.	$893,670
	2017		7,383.33	sq.yd.	$301,349
	2018		8,133.33	sq.yd.	$358,517
	2019		5,726	sq.yd.	$272,594
	2020		16,816.11	sq.yd.	$864,598
	2021		9,436.11	sq.yd.	$523,969

Needs - Rehabilitation
Treatment/Cost Summary

Inflation Rate = 8.00 % Printed: 01/10/2013

Treatment	Year		Area Treated		Cost
	2022		5,997.78	sq.yd.	$359,689
	2023		6,297.89	sq.yd.	$407,901
	2024		25,328.33	sq.yd.	$1,771,697
	2025		17,811.56	sq.yd.	$1,345,577
	2027		10,326.22	sq.yd.	$909,904
	2028		15,094.44	sq.yd.	$1,436,465
	2029		16,883.44	sq.yd.	$1,735,252
	2030		23,055.56	sq.yd.	$2,559,180
	2031		11,677.78	sq.yd.	$1,399,940
	2032		14,042.11	sq.yd.	$1,818,048
		Total	337,899.67	sq.yd.	$20,605,021
MILL AND FILL 3" AC	2013		13,947.22	sq.yd.	$418,417
		Total	13,947.22	sq.yd.	$418,417
SURFACE SEAL	2013		55,492.67	sq.yd.	$249,718
	2014		23,210.56	sq.yd.	$112,805
	2015		6,984.89	sq.yd.	$36,663
	2018		46,737.11	sq.yd.	$309,028
	2019		19,760.56	sq.yd.	$141,110
	2020		818.22	sq.yd.	$6,311
	2021		3,450	sq.yd.	$28,736
		Total	156,454	sq.yd.	$884,371
THIN OVERLAY (2" INCHES)	2013		79,950.56	sq.yd.	$1,611,226
	2014		30,045	sq.yd.	$648,972
	2015		1,320	sq.yd.	$31,563
	2016		20,793.89	sq.yd.	$536,985
	2021		8,755.56	sq.yd.	$332,222
	2023		5,842.22	sq.yd.	$258,566
	2024		24,229.44	sq.yd.	$1,148,712
	2025		48,317.56	sq.yd.	$2,467,770
	2026		39,058.67	sq.yd.	$2,129,999
	2027		19,186.56	sq.yd.	$1,140,271
	2028		44,337.11	sq.yd.	$2,821,185
	2029		2,250	sq.yd.	$158,022
		Total	324,086.56	sq.yd.	$13,285,493
THICK AC OVERLAY(2.5 INCHES)	2013		48,300	sq.yd.	$1,304,100
	2014		35,846.56	sq.yd.	$1,045,287
	2015		11,816.67	sq.yd.	$372,141
	2016		24,097.67	sq.yd.	$819,618
	2017		5,495.56	sq.yd.	$201,871
	2018		7,083.33	sq.yd.	$281,009

Needs - Rehabilitation
Treatment/Cost Summary

Inflation Rate = 8.00 % Printed: 01/10/2013

Treatment	Year		Area Treated		Cost
	2019		2,517.89	sq.yd.	$107,881
	2020		23,540.56	sq.yd.	$1,089,299
	2021		27,575.56	sq.yd.	$1,378,094
	2022		6,283.33	sq.yd.	$339,132
	2023		10,618.89	sq.yd.	$618,986
	2024		16,810	sq.yd.	$1,058,263
	2027		21,883.56	sq.yd.	$1,735,460
	2028		21,437.78	sq.yd.	$1,836,116
	2029		4,333.33	sq.yd.	$400,836
		Total	267,640.67	sq.yd.	$12,588,093
THIN AC OVERLAY(1.5 INCHES)	2013		96,758.67	sq.yd.	$1,442,193
	2014		32,912.22	sq.yd.	$533,178
	2015		34,689.33	sq.yd.	$606,931
	2016		9,674.56	sq.yd.	$182,811
	2017		11,238.22	sq.yd.	$229,345
	2018		11,107.22	sq.yd.	$244,805
	2019		2,436.67	sq.yd.	$58,001
	2021		2,016.67	sq.yd.	$55,991
	2022		6,598.33	sq.yd.	$197,853
	2023		1,473.33	sq.yd.	$47,713
	2024		8,845.44	sq.yd.	$309,367
	2025		6,837.78	sq.yd.	$258,281
	2027		15,391.67	sq.yd.	$678,128
	2028		2,833.33	sq.yd.	$134,818
	2029		8,068.78	sq.yd.	$414,650
	2030		6,921.56	sq.yd.	$384,151
	2031		51,735.33	sq.yd.	$3,101,041
	2032		18,484.56	sq.yd.	$1,196,610
		Total	328,023.67	sq.yd.	$10,075,867
SLURRY SEAL	2013		215,465	sq.yd.	$861,894
	2014		35,025.67	sq.yd.	$151,314
	2015		69,142.56	sq.yd.	$322,605
	2018		180,607.33	sq.yd.	$1,061,516
	2019		6,530.67	sq.yd.	$41,455
	2020		19,147.11	sq.yd.	$131,263
		Total	525,918.33	sq.yd.	$2,570,047

Total Cost $117,163,758

Scenarios 1-3
For the Streets

Scenario 1: Current Funding Level ($1 Million per Year)

Cost Summary Report

Network Condition Summary Report

[PCI Condition Categories: I: Very Good; II: Good, Non-load Related; III: Good, Load Related; IV: Poor; V: Very Poor]

Scenarios - Cost Summary

Interest: 8.00% Inflation: 8.00% Printed: 01/10/2013

Scenario: Existing Funding

Year	PM Amt	Budget	Rehabilitation			Preventative Maintenance	Surplus PM	Deferred		Stop Gap
2013	10%	$1,000,000	II	$410,680	Non-Project	$0	$15	$33,863,636	Funded	$100,001
			III	$489,336					Unmet	$284,070
			IV	$0	Project	$0				
			V	$0						
			Total	$900,016						
			Project	$0						
2014	9%	$1,000,000	II	$255,040	Non-Project	$28,177	$0	$40,910,999	Funded	$13,386
			III	$160,440					Unmet	$0
			IV	$0	Project	$0				
			V	$0						
			Total	$415,480						
			Project	$541,980						
2015	9%	$1,000,000	II	$352,805	Non-Project	$83,861	$100	$48,223,701	Funded	$6,039
			III	$511,143					Unmet	$0
			IV	$45,773	Project	$0				
			V	$0						
			Total	$909,721						
			Project	$0						
2016	10%	$1,000,000	II	$280,250	Non-Project	$97,230	$0	$54,924,409	Funded	$3,270
			III	$578,433					Unmet	$0
			IV	$39,996	Project	$0				
			V	$0						
			Total	$898,679						
			Project	$0						
2017	8%	$1,000,000	II	$418,386	Non-Project	$79,087	$0	$63,554,574	Funded	$1,395
			III	$459,543					Unmet	$0
			IV	$40,815	Project	$0				
			V	$0						
			Total	$918,744						
			Project	$0						
2018	10%	$1,000,000	II	$711,899	Non-Project	$0	$0	$76,565,628	Funded	$100,411
			III	$0					Unmet	$836,839
			IV	$187,711	Project	$0				
			V	$0						
			Total	$899,610						
			Project	$0						

Year	PM Amt	Budget	Rehabilitation		Preventative Maintenance	Surplus PM	Deferred		Stop Gap
2019	8%	$1,000,000	II $621,654	Non-Project	$67,047	$0	$88,403,529	Funded	$14,117
			III $0					Unmet	$0
			IV $297,120	Project	$0				
			V $0						
			Total $918,774						
			Project $0						
2020	10%	$1,000,000	II $512,783	Non-Project	$80,042	$0	$105,738,326	Funded	$21,595
			III $0					Unmet	$0
			IV $385,253	Project	$0				
			V $0						
			Total $898,036						
			Project $0						
2021	5%	$1,000,000	II $710,736	Non-Project	$34,770	$0	$126,535,660	Funded	$17,618
			III $0					Unmet	$0
			IV $236,841	Project	$0				
			V $0						
			Total $947,577						
			Project $0						
2022	9%	$1,000,000	II $669,159	Non-Project	$81,891	$0	$146,493,231	Funded	$9,315
			III $0					Unmet	$0
			IV $236,234	Project	$0				
			V $3,250						
			Total $908,643						
			Project $0						
2023	10%	$1,000,000	II $856,025	Non-Project	$0	$0	$171,114,531	Funded	$100,382
			III $0					Unmet	$2,272,170
			IV $43,611	Project	$0				
			V $0						
			Total $899,636						
			Project $0						
2024	5%	$1,000,000	II $808,659	Non-Project	$0	$0	$193,631,718	Funded	$50,718
			III $0					Unmet	$13,453
			IV $135,959	Project	$0				
			V $4,679						
			Total $949,297						
			Project $0						
2025	10%	$1,000,000	II $843,892	Non-Project	$29,762	$0	$217,902,883	Funded	$70,594
			III $0					Unmet	$0
			IV $51,413	Project	$0				
			V $4,231						
			Total $899,536						
			Project $0						

Year	PM Amt	Budget	Rehabilitation		Preventative Maintenance	Surplus PM	Deferred		Stop Gap
2026	5%	$1,000,000	II $842,391	Non-Project	$0	$0	$241,443,179	Funded	$50,462
			III $0					Unmet	$0
			IV $106,021	Project	$0				
			V $0						
			Total $948,412						
			Project $0						
2027	7%	$1,000,000	II $525,773	Non-Project	$33,184	$0	$268,466,319	Funded	$37,619
			III $0					Unmet	$0
			IV $401,101	Project	$0				
			V $0						
			Total $926,874						
			Project $0						
2028	10%	$1,000,000	II $840,938	Non-Project	$0	$0	$302,653,557	Funded	$103,203
			III $0					Unmet	$4,199,235
			IV $55,868	Project	$0				
			V $0						
			Total $896,806						
			Project $0						
2029	10%	$1,000,000	II $366,331	Non-Project	$0	$0	$337,416,778	Funded	$101,639
			III $0					Unmet	$101,221
			IV $532,039	Project	$0				
			V $0						
			Total $898,370						
			Project $0						
2030	10%	$1,000,000	II $752,746	Non-Project	$0	$0	$375,551,842	Funded	$104,161
			III $0					Unmet	$191,070
			IV $128,429	Project	$0				
			V $14,678						
			Total $895,853						
			Project $0						
2031	10%	$1,000,000	II $472,735	Non-Project	$0	$0	$410,397,440	Funded	$104,745
			III $0					Unmet	$141,826
			IV $422,528	Project	$0				
			V $0						
			Total $895,263						
			Project $0						
2032	6%	$1,000,000	II $617,098	Non-Project	$0	$0	$439,444,411	Funded	$60,619
			III $0					Unmet	$22,483
			IV $313,630	Project	$0				
			V $8,661						
			Total $939,389						
			Project $0						

Year	PM Amt	Budget	Rehabilitation	Preventative Maintenance	Surplus PM	Deferred	Stop Gap

Summary

Functional Class	Rehabilitation	Prev. Maint.	Funded Stop Gap	Unmet Stop Gap
Arterial	$2,311,174	$0	$427,932	$2,283,000
Collector	$991,163	$0	$189,262	$1,737,505
Other	$41,995	$0	$5,336	$42,197
Residential/Local	$14,962,364	$615,051	$448,760	$3,999,664
Grand Total:	$18,306,696	$615,051	$1,071,289	$8,062,366

Scenarios - Network Condition Summary

Interest: 8% Inflation: 8% Printed: 01/10/2013

Scenario: Existing Funding

Year	Budget	PM Amt	Year	Budget	PM Amt	Year	Budget	PM Amt
2013	$1,000,000	10%	2014	$1,000,000	9%	2015	$1,000,000	9%
2016	$1,000,000	10%	2017	$1,000,000	8%	2018	$1,000,000	10%
2019	$1,000,000	8%	2020	$1,000,000	10%	2021	$1,000,000	5%
2022	$1,000,000	9%	2023	$1,000,000	10%	2024	$1,000,000	5%
2025	$1,000,000	10%	2026	$1,000,000	5%	2027	$1,000,000	7%
2028	$1,000,000	10%	2029	$1,000,000	10%	2030	$1,000,000	10%
2031	$1,000,000	10%	2032	$1,000,000	6%			

Projected Network Average PCI by year

Year	Never Treated	With Selected Treatment
2013	61	62
2014	59	60
2015	57	58
2016	55	57
2017	52	55
2018	50	53
2019	47	51
2020	45	49
2021	42	47
2022	40	45
2023	37	43
2024	35	41
2025	32	39
2026	30	37
2027	28	35
2028	26	33
2029	24	32
2030	22	30
2031	20	29
2032	18	27

Percent Network Area by Functional Classification and Condition Class
Condition in base year 2013, prior to applying treatments.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	9.6%	5.0%	22.2%	0.1%	36.9%
II / III	9.5%	6.0%	18.5%	0.0%	34.0%
IV	6.5%	4.8%	15.5%	0.0%	26.8%
V	0.2%	0.4%	1.5%	0.2%	2.3%

Total	25.9%	16.1%	57.7%	0.3%	100.0%

Percent Network Area by Functional Classification and Condition Class
Condition in year 2013 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	10.1%	6.3%	23.8%	0.1%	40.3%
II / III	9.0%	4.7%	16.8%	0.0%	30.6%
IV	6.5%	4.8%	15.5%	0.0%	26.8%
V	0.2%	0.4%	1.5%	0.2%	2.3%
Total	25.9%	16.1%	57.7%	0.3%	100.0%

Percent Network Area by Functional Classification and Condition Class
Condition in year 2032 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	0.2%	11.6%	0.0%	11.8%
II / III	4.9%	1.8%	12.5%	0.1%	19.3%
IV	4.1%	2.9%	4.5%	0.0%	11.5%
V	16.8%	11.3%	29.2%	0.2%	57.5%
Total	25.9%	16.1%	57.7%	0.3%	100.0%

Scenario 2: Improve PCI to 70

Cost Summary Report

Network Condition Summary Report

[PCI Condition Categories: I: Very Good; II: Good, Non-load Related; III: Good, Load Related; IV: Poor; V: Very Poor]

Target-Driven Scenarios - Cost Summary

Interest: 8% Inflation: 8% Printed: 01/14/2013

Scenario: Bring PCI to 70 **Objective: Minimum Network Average PCI**

Year	Value	Year	Value	Year	Value	Year	Value
Year 1	63	Year 2	64	Year 3	65	Year 4	66
Year 5	67	Year 6	68	Year 7	69	Year 8	70
Year 9	70	Year 10	70	Year 11	70	Year 12	70
Year 13	70	Year 14	70	Year 15	70	Year 16	70
Year 17	70	Year 18	70	Year 19	70	Year 20	70

Year		Rehabilitation	Preventive Maintenance		Total Cost	Deferred
2013	II	$848,322	Non-Project	$1,178,692	$3,087,454	$31,676,266
	III	$637,892	Project	$0		
	IV	$422,548				
	V	$0				
	Total	$1,908,762				
		$0				
2014	II	$345,621	Non-Project	$136,411	$5,350,039	$34,184,241
	III	$1,772,229	Project	$0		
	IV	$2,553,798				
	V	$0				
	Total	$4,671,648				
		$541,980				
2015	II	$478,905	Non-Project	$440,302	$5,854,785	$36,097,653
	III	$741,297	Project	$0		
	IV	$4,194,281				
	V	$0				
	Total	$5,414,483				
		$0				
2016	II	$54,264	Non-Project	$293,112	$5,848,578	$37,034,320
	III	$0	Project	$0		
	IV	$5,501,202				
	V	$0				
	Total	$5,555,466				
		$0				
2017	II	$134,158	Non-Project	$226,257	$6,374,139	$38,859,442
	III	$0	Project	$0		
	IV	$6,013,724				
	V	$0				
	Total	$6,147,882				
		$0				

Year		Rehabilitation	Preventive Maintenance		Total Cost	Deferred
2018	II	$1,172,712	Non-Project	$1,946,638	$8,365,933	$44,880,728
	III	$0	Project	$0		
	IV	$5,246,583				
	V	$0				
	Total	$6,419,295				
		$0				
2019	II	$369,248	Non-Project	$600,331	$6,175,722	$47,953,946
	III	$0	Project	$0		
	IV	$1,853,412				
	V	$3,352,731				
	Total	$5,575,391				
		$0				
2020	II	$448,211	Non-Project	$1,473,959	$7,968,641	$52,353,569
	III	$341,333	Project	$0		
	IV	$2,967,815				
	V	$2,737,323				
	Total	$6,494,682				
		$0				
2021	II	$42,389	Non-Project	$1,444,201	$5,970,890	$58,910,224
	III	$294,002	Project	$0		
	IV	$2,563,935				
	V	$1,626,363				
	Total	$4,526,689				
		$0				
2022	II	$318,170	Non-Project	$1,490,157	$6,097,412	$61,602,702
	III	$0	Project	$0		
	IV	$1,404,475				
	V	$2,884,610				
	Total	$4,607,255				
		$0				
2023	II	$300,495	Non-Project	$1,723,725	$6,083,908	$63,587,901
	III	$0	Project	$0		
	IV	$1,158,763				
	V	$2,900,925				
	Total	$4,360,183				
		$0				
2024	II	$105,158	Non-Project	$825,113	$6,279,270	$66,525,958
	III	$0	Project	$0		
	IV	$3,256,864				
	V	$2,092,135				
	Total	$5,454,157				
		$0				

Year		Rehabilitation	Preventive Maintenance		Total Cost	Deferred
2025	II	$242,185	Non-Project	$1,921,120	$6,833,016	$69,180,172
	III	$98,487	Project	$0		
	IV	$2,152,369				
	V	$2,418,855				
	Total	$4,911,896				
		$0				
2026	II	$149,502	Non-Project	$2,477,663	$6,170,046	$71,831,770
	III	$412,840	Project	$0		
	IV	$424,107				
	V	$2,705,934				
	Total	$3,692,383				
		$0				
2027	II	$103,676	Non-Project	$1,690,338	$8,821,541	$78,110,444
	III	$3,163,795	Project	$0		
	IV	$3,863,732				
	V	$0				
	Total	$7,131,203				
		$0				
2028	II	$138,219	Non-Project	$0	$13,332,879	$87,969,929
	III	$9,853,446	Project	$0		
	IV	$3,341,214				
	V	$0				
	Total	$13,332,879				
		$0				
2029	II	$0	Non-Project	$4,152,109	$13,151,330	$93,209,767
	III	$6,235,763	Project	$0		
	IV	$2,763,458				
	V	$0				
	Total	$8,999,221				
		$0				
2030	II	$180,140	Non-Project	$1,863,033	$13,138,177	$100,903,463
	III	$5,672,214	Project	$0		
	IV	$5,422,790				
	V	$0				
	Total	$11,275,144				
		$0				
2031	II	$155,286	Non-Project	$2,434,100	$12,343,636	$113,819,673
	III	$4,344,693	Project	$0		
	IV	$5,409,557				
	V	$0				
	Total	$9,909,536				
		$0				

Year		Rehabilitation	Preventive Maintenance		Total Cost	Deferred
2032	II	$145,008	Non-Project	$2,654,742	$13,390,494	$119,800,494
	III	$5,284,247				
	IV	$5,306,497	Project	$0		
	V	$0				
	Total	$10,735,752				
		$0				

Summary

Functional Class	Rehabilitation	Prev. Maint.		
Arterial	$64,002,349	$0		
Collector	$20,749,843	$0		
Other	$32,269	$0		
Residential/Local	$46,881,426	$28,972,003		
Total:	$131,665,887	$28,972,003	Grand Total:	$160,637,890

Target-Driven Scenarios
Network Condition Summary

Interest: 8% Inflation: 8% Printed: 01/14/2013

Scenario: Bring PCI to 70 Objective: Minimum Network Average PCI

Year	Value	Year	Value	Year	Value	Year	Value
Year 1	63	Year 2	64	Year 3	65	Year 4	66
Year 5	67	Year 6	68	Year 7	69	Year 8	70
Year 9	70	Year 10	70	Year 11	70	Year 12	70
Year 13	70	Year 14	70	Year 15	70	Year 16	70
Year 17	70	Year 18	70	Year 19	70	Year 20	70

Projected Network Average PCI by year

Year	Never Treated	With Selected Treatment
2013	61	63
2014	59	64
2015	56	65
2016	54	66
2017	52	67
2018	49	68
2019	47	69
2020	44	70
2021	42	70
2022	39	70
2023	37	70
2024	34	70
2025	32	70
2026	30	70
2027	27	70
2028	25	70
2029	23	70
2030	21	70
2031	19	70
2032	18	70

Percent Network Area by Functional Classification and Condition Class

Condition in base year 2013, prior to applying treatments.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	9.6%	5.0%	22.2%	0.1%	36.9%
II / III	9.5%	6.0%	18.5%	0.0%	34.0%
IV	6.5%	4.8%	15.5%	0.0%	26.8%
V	0.2%	0.4%	1.5%	0.2%	2.3%
Total	25.9%	16.1%	57.7%	0.3%	100.0%

Condition in year 2013 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	10.7%	6.8%	26.4%	0.1%	43.9%
II / III	8.8%	4.2%	14.4%	0.0%	27.5%
IV	6.1%	4.8%	15.4%	0.0%	26.3%

V	0.2%	0.4%	1.5%	0.2%	2.3%
Total	25.9%	16.1%	57.7%	0.3%	100.0%

Condition in year 2032 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	18.8%	6.8%	41.7%	0.0%	67.3%
II / III	2.2%	3.1%	16.0%	0.1%	21.4%
IV	0.0%	0.8%	0.0%	0.0%	0.8%
V	4.8%	5.4%	0.0%	0.2%	10.4%
Total	25.9%	16.1%	57.7%	0.3%	100.0%

Scenario 3: Maintain current backlog

Cost Summary Report

Network Condition Summary Report

[PCI Condition Categories: I: Very Good; II: Good, Non-load Related; III: Good, Load Related; IV: Poor; V: Very Poor]

Scenarios - Cost Summary

Interest: 8.00% Inflation: 8.00% Printed: 01/10/2013

Scenario: maintain backlog 2

Year	PM Amt	Budget	Rehabilitation		Preventative Maintenance	Surplus PM	Deferred		Stop Gap
2013	12%	$15,000,000	II $1,111,612	Non-Project	$1,548,803	$0	$20,015,462	Funded	$251,278
			III $2,379,242					Unmet	$0
			IV $9,706,669	Project	$0				
			V $2,007						
			Total $13,199,530						
			Project $0						
2014	4%	$8,000,000	II $264,119	Non-Project	$297,196	$0	$18,944,334	Funded	$1,280
			III $998,001					Unmet	$0
			IV $5,892,454	Project	$0				
			V $4,704						
			Total $7,159,278						
			Project $541,980						
2015	0%	$6,500,000	II $359,268	Non-Project	$0	$0	$19,000,226	Funded	$1,155
			III $78,930					Unmet	$0
			IV $4,914,265	Project	$0				
			V $1,145,700						
			Total $6,498,163						
			Project $0						
2016	0%	$6,000,000	II $0	Non-Project	$0	$0	$18,372,578	Funded	$0
			III $54,848					Unmet	$0
			IV $3,769,111	Project	$0				
			V $2,175,068						
			Total $5,999,027						
			Project $0						
2017	2%	$5,000,000	II $0	Non-Project	$107,598	$0	$19,966,325	Funded	$0
			III $160,795					Unmet	$0
			IV $2,117,633	Project	$0				
			V $2,613,007						
			Total $4,891,435						
			Project $0						
2018	5%	$7,000,000	II $1,393,348	Non-Project	$141,562	$0	$22,014,017	Funded	$211,869
			III $28,641					Unmet	$0
			IV $2,278,331	Project	$0				
			V $2,945,472						
			Total $6,645,792						
			Project $0						

Year	PM Amt	Budget	Rehabilitation		Preventative Maintenance	Surplus PM	Deferred		Stop Gap
2019	5%	$7,000,000	II $252,512	Non-Project	$475,883	$0	$21,455,557	Funded	$0
			III $0					Unmet	$0
			IV $1,443,523	Project	$0				
			V $4,826,862						
			Total $6,522,897						
			Project $0						
2020	5%	$6,000,000	II $392,949	Non-Project	$390,153	$0	$21,298,193	Funded	$0
			III $349,624					Unmet	$0
			IV $2,658,478	Project	$0				
			V $2,208,598						
			Total $5,609,649						
			Project $0						
2021	5%	$6,000,000	II $304,125	Non-Project	$403,047	$0	$20,483,249	Funded	$0
			III $164,207					Unmet	$0
			IV $2,571,882	Project	$0				
			V $2,555,813						
			Total $5,596,027						
			Project $0						
2022	5%	$3,000,000	II $366,308	Non-Project	$174,219	$0	$21,456,432	Funded	$0
			III $35,816					Unmet	$0
			IV $1,355,566	Project	$0				
			V $1,068,039						
			Total $2,825,729						
			Project $0						
2023	5%	$4,000,000	II $530,183	Non-Project	$95,464	$0	$21,557,802	Funded	$119,941
			III $0					Unmet	$0
			IV $1,333,166	Project	$0				
			V $1,918,745						
			Total $3,782,094						
			Project $0						
2024	5%	$6,000,000	II $494,062	Non-Project	$348,070	$0	$22,288,149	Funded	$0
			III $20,533					Unmet	$0
			IV $3,960,236	Project	$0				
			V $1,173,909						
			Total $5,648,740						
			Project $0						
2025	5%	$6,000,000	II $423,176	Non-Project	$648,878	$0	$21,937,149	Funded	$0
			III $48,937					Unmet	$0
			IV $3,026,593	Project	$0				
			V $1,851,271						
			Total $5,349,977						
			Project $0						

Year	PM Amt	Budget	Rehabilitation		Preventative Maintenance	Surplus PM	Deferred		Stop Gap
2026	3%	$5,000,000	II $35,073	Non-Project	$477,570	$0	$20,108,858	Funded	$0
			III $0					Unmet	$0
			IV $1,162,452	Project	$0				
			V $3,323,045						
			Total $4,520,570						
			Project $0						
2027	5%	$6,000,000	II $0	Non-Project	$749,709	$0	$19,853,687	Funded	$0
			III $0					Unmet	$0
			IV $4,005,120	Project	$0				
			V $1,244,152						
			Total $5,249,272						
			Project $0						
2028	5%	$7,000,000	II $237,760	Non-Project	$375,203	$0	$19,188,551	Funded	$67,679
			III $59,920					Unmet	$0
			IV $4,135,255	Project	$0				
			V $2,124,086						
			Total $6,557,021						
			Project $0						
2029	3%	$8,000,000	II $140,511	Non-Project	$191,431	$0	$20,470,199	Funded	$51,269
			III $3,013,750					Unmet	$0
			IV $4,602,580	Project	$0				
			V $0						
			Total $7,756,841						
			Project $0						
2030	4%	$10,000,000	II $281,324	Non-Project	$350,504	$0	$20,545,387	Funded	$54,662
			III $2,916,934					Unmet	$0
			IV $6,393,264	Project	$0				
			V $0						
			Total $9,591,522						
			Project $0						
2031	5%	$8,000,000	II $282,378	Non-Project	$359,409	$0	$22,369,434	Funded	$53,048
			III $1,356,394					Unmet	$0
			IV $5,948,565	Project	$0				
			V $0						
			Total $7,587,337						
			Project $0						
2032	5%	$10,000,000	II $276,546	Non-Project	$442,939	$449	$23,994,488	Funded	$56,612
			III $3,542,157					Unmet	$0
			IV $5,677,840	Project	$0				
			V $0						
			Total $9,496,543						
			Project $0						

Summary

Functional Class	Rehabilitation	Prev. Maint.	Funded Stop Gap	Unmet Stop Gap
Arterial	$53,530,641	$0	$353,734	$0
Collector	$27,512,446	$0	$120,472	$0
Other	$331,650	$0	$4,836	$0
Residential/Local	$49,654,687	$7,577,638	$389,750	$0
Grand Total:	$131,029,424	$7,577,638	$868,793	$0

Scenarios - Network Condition Summary

Interest: 8% Inflation: 8% Printed: 01/10/2013

Scenario: maintain backlog 2

Year	Budget	PM Amt	Year	Budget	PM Amt	Year	Budget	PM Amt
2013	$15,000,000	12%	2014	$8,000,000	4%	2015	$6,500,000	0%
2016	$6,000,000	0%	2017	$5,000,000	2%	2018	$7,000,000	5%
2019	$7,000,000	5%	2020	$6,000,000	5%	2021	$6,000,000	5%
2022	$3,000,000	5%	2023	$4,000,000	5%	2024	$6,000,000	5%
2025	$6,000,000	5%	2026	$5,000,000	3%	2027	$6,000,000	5%
2028	$7,000,000	5%	2029	$8,000,000	3%	2030	$10,000,000	4%
2031	$8,000,000	5%	2032	$10,000,000	5%			

Projected Network Average PCI by year

Year	Never Treated	With Selected Treatment
2013	61	71
2014	59	73
2015	57	75
2016	55	76
2017	52	76
2018	50	77
2019	47	78
2020	45	77
2021	42	77
2022	40	76
2023	37	75
2024	35	75
2025	32	74
2026	30	74
2027	28	73
2028	26	72
2029	24	72
2030	22	71
2031	20	71
2032	18	70

Percent Network Area by Functional Classification and Condition Class
Condition in base year 2013, prior to applying treatments.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	9.6%	5.0%	22.2%	0.1%	36.9%
II / III	9.5%	6.0%	18.5%	0.0%	34.0%
IV	6.5%	4.8%	15.5%	0.0%	26.8%
V	0.2%	0.4%	1.5%	0.2%	2.3%

Total	25.9%	16.1%	57.7%	0.3%	100.0%

Percent Network Area by Functional Classification and Condition Class
Condition in year 2013 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	15.9%	7.6%	37.3%	0.1%	60.9%
II / III	6.7%	4.0%	12.6%	0.0%	23.4%
IV	3.0%	4.1%	6.3%	0.0%	13.4%
V	0.2%	0.4%	1.5%	0.2%	2.3%
Total	25.9%	16.1%	57.7%	0.3%	100.0%

Percent Network Area by Functional Classification and Condition Class
Condition in year 2032 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	10.8%	5.9%	35.4%	0.0%	52.1%
II / III	14.4%	10.2%	22.3%	0.3%	47.2%
V	0.7%	0.0%	0.0%	0.0%	0.7%
Total	25.9%	16.1%	57.7%	0.3%	100.0%

City of Davis- Bicycle Paths

Needs - Projected PCI/Cost Summary

Inflation Rate = 8.00 % Printed: 01/10/2013

Year	PCI Treated	PCI Untreated	PM Cost	Rehab Cost	Cost
2013	65	58	$0	$1,340,288	$1,340,288
2014	64	56	$0	$252,515	$252,515
2015	65	54	$0	$676,518	$676,518
2016	67	52	$0	$1,328,515	$1,328,515
2017	69	50	$0	$1,304,978	$1,304,978
2018	75	48	$0	$3,063,697	$3,063,697
2019	76	46	$0	$805,970	$805,970
2020	76	44	$0	$208,581	$208,581
2021	75	42	$0	$103,187	$103,187
2022	74	39	$0	$167,789	$167,789
2023	74	37	$0	$265,578	$265,578
2024	74	35	$0	$256,946	$256,946
2025	73	33	$0	$215,071	$215,071
2026	73	32	$0	$181,542	$181,542
2027	72	30	$0	$252,261	$252,261
2028	72	29	$0	$365,616	$365,616
2029	71	27	$0	$428,428	$428,428
2030	71	26	$0	$340,432	$340,432
2031	70	25	$0	$325,679	$325,679
2032	70	24	$0	$412,982	$412,982

% PM	PM Total Cost	Rehab Total Cost	Total Cost
0.00%	$0	$12,296,573	$12,296,573

Needs - Rehabilitation
Treatment/Cost Summary

Inflation Rate = 8.00 % Printed: 01/10/2013

Treatment	Year	Area Treated		Cost
CAPE SEAL	2022	411.11	sq.yd.	$6,164
	2031	411.11	sq.yd.	$12,322
	Total	822.22	sq.yd.	$18,486
CRACK SEAL	2013	38,332.44	sq.yd.	$38,344
	2014	19,269.67	sq.yd.	$20,815
	2015	3,832.22	sq.yd.	$4,474
	2016	4,557.22	sq.yd.	$5,745
	2017	14,484.44	sq.yd.	$19,711
	2018	10,022.22	sq.yd.	$14,732
	2019	5,973.11	sq.yd.	$9,481
	2020	12,858.67	sq.yd.	$22,041
	2021	4,659.22	sq.yd.	$8,627
	2022	16,144.44	sq.yd.	$32,277
	2023	5,962.56	sq.yd.	$12,875
	2024	5,792	sq.yd.	$13,508
	2025	4,250.89	sq.yd.	$10,707
	2026	5,370.33	sq.yd.	$14,608
	2027	4,197	sq.yd.	$12,330
	2028	4,753.67	sq.yd.	$15,085
	2029	4,818.78	sq.yd.	$16,514
	2030	2,306.78	sq.yd.	$8,540
	2031	2,373.44	sq.yd.	$9,491
	2032	2,501.22	sq.yd.	$10,800
	Total	172,460.33	sq.yd.	$300,705
PATCH	2013	47,665.56	sq.yd.	$166,853
	2014	6,768.44	sq.yd.	$25,588
	2015	21,365.44	sq.yd.	$87,235
	2016	29,075.22	sq.yd.	$128,202
	2017	18,081.89	sq.yd.	$86,110
	2018	18,845.67	sq.yd.	$96,928
	2019	25,705.56	sq.yd.	$142,781
	2020	31,095.56	sq.yd.	$186,540
	2021	14,594.89	sq.yd.	$94,560
	2022	18,486.11	sq.yd.	$129,348
	2023	33,441	sq.yd.	$252,703
	2024	29,828.67	sq.yd.	$243,438
	2025	23,186	sq.yd.	$204,364
	2026	17,536.56	sq.yd.	$166,934
	2027	23,337.56	sq.yd.	$239,931
	2028	31,570.44	sq.yd.	$350,531
	2029	34,351.44	sq.yd.	$411,914

Needs - Rehabilitation
Treatment/Cost Summary

Inflation Rate = 8.00 % Printed: 01/10/2013

Treatment	Year		Area Treated		Cost
	2030		25,627.78	sq.yd.	$331,892
	2031		21,725.33	sq.yd.	$303,866
	2032		26,625	sq.yd.	$402,182
		Total	498,914.11	sq.yd.	$4,051,900
RECONSTRUCT STRUCTURE (PCC)	2013		14,188.56	sq.yd.	$1,135,091
	2014		2,385.56	sq.yd.	$206,112
	2015		6,267.22	sq.yd.	$584,809
	2016		11,853.56	sq.yd.	$1,194,568
	2017		11,017.67	sq.yd.	$1,199,157
	2018		25,113.78	sq.yd.	$2,952,037
	2019		5,060	sq.yd.	$642,367
		Total	75,886.33	sq.yd.	$7,914,141
RECONSTRUCT SURFACE (PCC)	2019		89.33	sq.yd.	$11,341
		Total	89.33	sq.yd.	$11,341

Total Cost $12,296,573

Scenarios 1-2
For the Bicycle Paths

Scenario 1: Current Funding Level ($200K per Year)

Cost Summary Report

Network Condition Summary Report

[PCI Condition Categories: I: Very Good; II: Good, Non-load Related; III: Good, Load Related; IV: Poor; V: Very Poor]

Scenarios - Cost Summary

Interest: 8.00% Inflation: 8.00% Printed: 01/10/2013

Scenario: Current funding level

Year	PM Amt	Budget	Rehabilitation		Preventative Maintenance	Surplus PM	Deferred		Stop Gap
2013	5%	$200,000	II $0	Non-Project	$0	$0	$1,150,478	Funded	$10,232
			III $37,349					Unmet	$1,788
			IV $152,451	Project	$0				
			V $0						
			Total $189,800						
			Project $0						
2014	0%	$200,000	II $0	Non-Project	$0	$0	$1,295,395	Funded	$1,445
			III $20,815					Unmet	$181
			IV $41,140	Project	$0				
			V $136,608						
			Total $198,563						
			Project $0						
2015	2%	$200,000	II $0	Non-Project	$0	$0	$1,877,583	Funded	$5,702
			III $4,474					Unmet	$0
			IV $75,442	Project	$0				
			V $106,252						
			Total $186,168						
			Project $0						
2016	5%	$200,000	II $0	Non-Project	$0	$0	$3,198,336	Funded	$11,647
			III $5,745					Unmet	$0
			IV $139,551	Project	$0				
			V $24,019						
			Total $169,315						
			Project $0						
2017	5%	$200,000	II $0	Non-Project	$0	$0	$4,581,788	Funded	$11,304
			III $19,711					Unmet	$0
			IV $87,608	Project	$0				
			V $71,569						
			Total $178,888						
			Project $0						
2018	5%	$200,000	II $0	Non-Project	$0	$0	$7,846,421	Funded	$34,417
			III $14,732					Unmet	$7,424
			IV $96,928	Project	$0				
			V $53,941						
			Total $165,601						
			Project $0						

Year	PM Amt	Budget	Rehabilitation		Preventative Maintenance	Surplus PM	Deferred		Stop Gap
2019	5%	$200,000	II $0	Non-Project	$0	$1,348	$9,077,006	Funded	$8,652
			III $9,481					Unmet	$0
			IV $128,494	Project	$0				
			V $50,837						
			Total $188,812						
			Project $0						
2020	5%	$200,000	II $0	Non-Project	$0	$0	$9,835,428	Funded	$10,119
			III $17,735					Unmet	$0
			IV $172,043	Project	$0				
			V $0						
			Total $189,778						
			Project $0						
2021	5%	$200,000	II $0	Non-Project	$0	$0	$10,537,074	Funded	$14,165
			III $8,627					Unmet	$2,948
			IV $126,880	Project	$0				
			V $50,346						
			Total $185,853						
			Project $0						
2022	5%	$200,000	II $0	Non-Project	$0	$0	$11,380,040	Funded	$15,894
			III $32,277					Unmet	$0
			IV $135,512	Project	$0				
			V $0						
			Total $167,789						
			Project $0						
2023	5%	$200,000	II $0	Non-Project	$0	$0	$12,340,393	Funded	$14,216
			III $7,451					Unmet	$49,233
			IV $178,346	Project	$0				
			V $0						
			Total $185,797						
			Project $0						
2024	5%	$200,000	II $0	Non-Project	$0	$0	$13,421,123	Funded	$10,214
			III $3,361					Unmet	$6,572
			IV $186,439	Project	$0				
			V $0						
			Total $189,800						
			Project $0						
2025	5%	$200,000	II $0	Non-Project	$0	$0	$14,509,024	Funded	$10,110
			III $631					Unmet	$9,003
			IV $189,268	Project	$0				
			V $0						
			Total $189,899						
			Project $0						

Year	PM Amt	Budget	Rehabilitation		Preventative Maintenance	Surplus PM	Deferred		Stop Gap
2026	5%	$200,000	II $0	Non-Project	$0	$0	$15,551,228	Funded	$11,389
			III $3,726					Unmet	$13,756
			IV $184,897	Project	$0				
			V $0						
			Total $188,623						
			Project $0						
2027	5%	$200,000	II $0	Non-Project	$0	$0	$16,787,888	Funded	$10,643
			III $577					Unmet	$14,319
			IV $188,794	Project	$0				
			V $0						
			Total $189,371						
			Project $0						
2028	5%	$200,000	II $0	Non-Project	$0	$0	$18,261,392	Funded	$10,069
			III $1,032					Unmet	$86,983
			IV $188,912	Project	$0				
			V $0						
			Total $189,944						
			Project $0						
2029	5%	$200,000	II $0	Non-Project	$0	$0	$19,946,884	Funded	$10,080
			III $1,509					Unmet	$21,953
			IV $188,421	Project	$0				
			V $0						
			Total $189,930						
			Project $0						
2030	5%	$200,000	II $0	Non-Project	$0	$0	$21,577,294	Funded	$10,051
			III $641					Unmet	$25,438
			IV $189,316	Project	$0				
			V $0						
			Total $189,957						
			Project $0						
2031	5%	$200,000	II $0	Non-Project	$0	$0	$24,561,813	Funded	$10,102
			III $619					Unmet	$46,688
			IV $189,291	Project	$0				
			V $0						
			Total $189,910						
			Project $0						
2032	5%	$200,000	II $0	Non-Project	$0	$0	$27,734,175	Funded	$10,099
			III $281					Unmet	$46,564
			IV $189,628	Project	$0				
			V $0						
			Total $189,909						
			Project $0						

Year	PM Amt	Budget	Rehabilitation	Preventative Maintenance	Surplus PM	Deferred	Stop Gap

Summary

Functional Class	Rehabilitation	Prev. Maint.	Funded Stop Gap	Unmet Stop Gap
Other	$3,713,707	$0	$230,550	$332,850
Grand Total:	$3,713,707	$0	$230,550	$332,850

Scenarios - Network Condition Summary

Interest: 8% Inflation: 8% Printed: 01/10/2013

Scenario: Current funding level

Year	Budget	PM Amt	Year	Budget	PM Amt	Year	Budget	PM Amt
2013	$200,000	5%	2014	$200,000	0%	2015	$200,000	2%
2016	$200,000	5%	2017	$200,000	5%	2018	$200,000	5%
2019	$200,000	5%	2020	$200,000	5%	2021	$200,000	5%
2022	$200,000	5%	2023	$200,000	5%	2024	$200,000	5%
2025	$200,000	5%	2026	$200,000	5%	2027	$200,000	5%
2028	$200,000	5%	2029	$200,000	5%	2030	$200,000	5%
2031	$200,000	5%	2032	$200,000	5%			

Projected Network Average PCI by year

Year	Never Treated	With Selected Treatment
2013	58	61
2014	56	60
2015	54	59
2016	52	59
2017	50	58
2018	48	57
2019	46	56
2020	44	56
2021	42	54
2022	39	54
2023	37	53
2024	35	52
2025	33	51
2026	32	51
2027	30	50
2028	29	49
2029	27	49
2030	26	48
2031	25	47
2032	24	46

Percent Network Area by Functional Classification and Condition Class
Condition in base year 2013, prior to applying treatments.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	0.0%	0.0%	26.9%	26.9%
II / III	0.0%	0.0%	0.0%	32.3%	32.3%
IV	0.0%	0.0%	0.0%	36.1%	36.1%
V	0.0%	0.0%	0.0%	4.7%	4.7%

Total	0.0%	0.0%	0.0%	100.0%	100.0%

Percent Network Area by Functional Classification and Condition Class
Condition in year 2013 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	0.0%	0.0%	39.2%	39.2%
II / III	0.0%	0.0%	0.0%	34.4%	34.4%
IV	0.0%	0.0%	0.0%	21.8%	21.8%
V	0.0%	0.0%	0.0%	4.7%	4.7%
Total	0.0%	0.0%	0.0%	100.0%	100.0%

Percent Network Area by Functional Classification and Condition Class
Condition in year 2032 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	0.0%	0.0%	21.8%	21.8%
II / III	0.0%	0.0%	0.0%	35.4%	35.4%
IV	0.0%	0.0%	0.0%	16.7%	16.7%
V	0.0%	0.0%	0.0%	26.0%	26.0%
Total	0.0%	0.0%	0.0%	100.0%	100.0%

Scenario 2: Maintain current backlog

Cost Summary Report

Network Condition Summary Report

[PCI Condition Categories: I: Very Good; II: Good, Non-load Related; III: Good, Load Related; IV: Poor; V: Very Poor]

Scenarios - Cost Summary

Interest: 8.00% Inflation: 8.00% Printed: 01/14/2013

Scenario: MAINTAIN BACKLOG

Year	PM Amt	Budget	Rehabilitation		Preventative Maintenance	Surplus PM	Deferred		Stop Gap
2013	0%	$140,000	II $0	Non-Project	$0	$0	$1,200,395	Funded	$148
			III $37,126					Unmet	$14,739
			IV $102,749	Project	$0				
			V $0						
			Total $139,875						
			Project $0						
2014	0%	$230,000	II $0	Non-Project	$0	$0	$1,295,395	Funded	$1,626
			III $20,815					Unmet	$0
			IV $68,663	Project	$0				
			V $136,608						
			Total $226,086						
			Project $0						
2015	0%	$553,000	II $0	Non-Project	$0	$0	$1,481,525	Funded	$1,840
			III $4,474					Unmet	$0
			IV $44,040	Project	$0				
			V $502,310						
			Total $550,824						
			Project $0						
2016	0%	$1,526,000	II $0	Non-Project	$0	$0	$1,420,250	Funded	$6,063
			III $5,745					Unmet	$0
			IV $139,335	Project	$0				
			V $1,374,367						
			Total $1,519,447						
			Project $0						
2017	0%	$1,450,000	II $0	Non-Project	$0	$0	$1,399,623	Funded	$5,381
			III $19,711					Unmet	$608
			IV $91,524	Project	$0				
			V $1,333,405						
			Total $1,444,640						
			Project $0						
2018	0%	$3,210,000	II $0	Non-Project	$0	$0	$1,371,517	Funded	$5,622
			III $14,732					Unmet	$0
			IV $96,928	Project	$0				
			V $3,092,113						
			Total $3,203,773						
			Project $0						

Year	PM Amt	Budget	Rehabilitation		Preventative Maintenance	Surplus PM	Deferred		Stop Gap
2019	0%	$1,590,000	II $0	Non-Project	$0	$0	$1,520,544	Funded	$2,142
			III $5,494					Unmet	$1,249
			IV $85,775	Project	$0				
			V $1,496,602						
			Total $1,587,871						
			Project $0						
2020	0%	$455,000	II $0	Non-Project	$0	$0	$1,404,803	Funded	$0
			III $22,041					Unmet	$0
			IV $199,710	Project	$0				
			V $233,081						
			Total $454,832						
			Project $0						
2021	0%	$460,000	II $0	Non-Project	$0	$0	$1,169,870	Funded	$2,060
			III $8,627					Unmet	$621
			IV $102,011	Project	$0				
			V $347,318						
			Total $457,956						
			Project $0						
2022	0%	$170,000	II $0	Non-Project	$0	$0	$1,263,460	Funded	$2,225
			III $32,277					Unmet	$1,482
			IV $135,512	Project	$0				
			V $0						
			Total $167,789						
			Project $0						
2023	0%	$208,000	II $0	Non-Project	$0	$0	$1,364,537	Funded	$2,264
			III $12,875					Unmet	$0
			IV $192,208	Project	$0				
			V $0						
			Total $205,083						
			Project $0						
2024	0%	$510,000	II $0	Non-Project	$0	$0	$1,222,919	Funded	$123
			III $13,508					Unmet	$4,098
			IV $245,606	Project	$0				
			V $250,781						
			Total $509,895						
			Project $0						
2025	0%	$222,400	II $0	Non-Project	$0	$0	$1,320,752	Funded	$0
			III $10,707					Unmet	$0
			IV $211,611	Project	$0				
			V $0						
			Total $222,318						
			Project $0						

Year	PM Amt	Budget	Rehabilitation		Preventative Maintenance	Surplus PM	Deferred		Stop Gap
2026	0%	$549,000	II $0	Non-Project	$0	$0	$1,033,218	Funded	$1,415
			III $3,726					Unmet	$0
			IV $139,439	Project	$0				
			V $404,076						
			Total $547,241						
			Project $0						
2027	0%	$234,400	II $0	Non-Project	$0	$0	$1,104,124	Funded	$5,448
			III $12,330					Unmet	$0
			IV $216,600	Project	$0				
			V $0						
			Total $228,930						
			Project $0						
2028	0%	$31,200	II $0	Non-Project	$0	$0	$1,473,603	Funded	$463
			III $1,392					Unmet	$14,950
			IV $29,351	Project	$0				
			V $0						
			Total $30,743						
			Project $0						
2029	0%	$471,600	II $0	Non-Project	$0	$3	$1,559,451	Funded	$8
			III $818					Unmet	$17,125
			IV $470,793	Project	$0				
			V $0						
			Total $471,611						
			Project $0						
2030	0%	$583,600	II $0	Non-Project	$0	$0	$1,390,878	Funded	$0
			III $8,540					Unmet	$0
			IV $574,970	Project	$0				
			V $0						
			Total $583,510						
			Project $0						
2031	0%	$297,000	II $0	Non-Project	$0	$0	$1,502,148	Funded	$0
			III $9,491					Unmet	$0
			IV $287,096	Project	$0				
			V $0						
			Total $296,587						
			Project $0						
2032	0%	$217,400	II $0	Non-Project	$0	$0	$1,622,320	Funded	$8,004
			III $10,800					Unmet	$0
			IV $198,429	Project	$0				
			V $0						
			Total $209,229						
			Project $0						

Year	PM Amt	Budget	Rehabilitation	Preventative Maintenance	Surplus PM	Deferred	Stop Gap

Summary

Functional Class	Rehabilitation	Prev. Maint.	Funded Stop Gap	Unmet Stop Gap
Other	$13,058,240	$0	$44,832	$54,873
Grand Total:	$13,058,240	$0	$44,832	$54,873

Scenarios - Network Condition Summary

Interest: 8% Inflation: 8% Printed: 01/14/2013

Scenario: MAINTAIN BACKLOG

Year	Budget	PM Amt	Year	Budget	PM Amt	Year	Budget	PM Amt
2013	$140,000	0%	2014	$230,000	0%	2015	$553,000	0%
2016	$1,526,000	0%	2017	$1,450,000	0%	2018	$3,210,000	0%
2019	$1,590,000	0%	2020	$455,000	0%	2021	$460,000	0%
2022	$170,000	0%	2023	$208,000	0%	2024	$510,000	0%
2025	$222,400	0%	2026	$549,000	0%	2027	$234,400	0%
2028	$31,200	0%	2029	$471,600	0%	2030	$583,600	0%
2031	$297,000	0%	2032	$217,400	0%			

Projected Network Average PCI by year

Year	Never Treated	With Selected Treatment
2013	58	61
2014	56	60
2015	54	60
2016	52	63
2017	50	66
2018	48	71
2019	46	73
2020	44	74
2021	42	74
2022	39	73
2023	37	73
2024	35	73
2025	33	73
2026	32	72
2027	30	72
2028	29	71
2029	27	70
2030	26	71
2031	25	70
2032	24	69

Percent Network Area by Functional Classification and Condition Class
Condition in base year 2013, prior to applying treatments.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	0.0%	0.0%	26.9%	26.9%
II / III	0.0%	0.0%	0.0%	32.3%	32.3%
IV	0.0%	0.0%	0.0%	36.1%	36.1%
V	0.0%	0.0%	0.0%	4.7%	4.7%

Total	0.0%	0.0%	0.0%	100.0%	100.0%

Percent Network Area by Functional Classification and Condition Class
Condition in year 2013 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	0.0%	0.0%	39.2%	39.2%
II / III	0.0%	0.0%	0.0%	29.7%	29.7%
IV	0.0%	0.0%	0.0%	26.5%	26.5%
V	0.0%	0.0%	0.0%	4.7%	4.7%
Total	0.0%	0.0%	0.0%	100.0%	100.0%

Percent Network Area by Functional Classification and Condition Class
Condition in year 2032 after schedulable treatments applied.

Condition Class	Arterial	Collector	Res/Loc	Other	Total
I	0.0%	0.0%	0.0%	46.0%	46.0%
II / III	0.0%	0.0%	0.0%	51.9%	51.9%
IV	0.0%	0.0%	0.0%	0.6%	0.6%
V	0.0%	0.0%	0.0%	1.6%	1.6%
Total	0.0%	0.0%	0.0%	100.0%	100.0%

APPENDIX C

CURRENT M&R PAVEMENT TREATMENTS

To provide the City with information of the various pavement treatment technologies that are available (some of which the City is already utilizing), NCE prepared a brief summary of key pavement treatment alternatives (see table below). In particular, some of the emerging pavement technologies that may allow the City to extend pavement life and reduce treatment costs were included. Table 1 provides an overall summary of the types of M&R treatment technologies and their purpose. The following paragraphs provide description of each treatment type as well as planning level treatment costs. Costs only include material and construction labor for placing the resurfacing material and do not include other bid item costs (i.e. milling, wedge grinds, base repairs, striping, etc.) not non-construction costs such as engineering, administrative, or construction inspection costs. These costs are strictly for planning level purposes only and may vary significantly based on project specific elements, particularly bid quantities. Costs are based recent projects bid tabs and conversations with contractors, and may vary significantly depending on material costs (particularly oil costs which drive asphalt price) and the bidding environment, and other economic factors. Specialty pavement treatments such as field blended rubberized cape seals, cold in-place recycling, and full depth reclamation, have fewer qualified contractors that can perform this work (particularly in Northern California) and can be more vulnerable to price increases.

TABLE 1 – Pavement Treatment Technologies and Functions

Pavement Condition	Type of Activities	Function of Activity		
		Increase Strength	Reduce Aging	Restore Serviceability
Very Good	Routine/ Preventive Maintenance		✓	✓
Good, Non-Load Related	Minor Rehabilitation		✓	✓
Good, Load Related	Structural Overlay	✓	✓	✓
Poor	Major Rehabilitation	✓	✓	✓

Very Poor	Reconstruction	✓	✓	✓

*From FHWA Pavement Preservation Definition Memorandum, September 2005

Type of Activities	Treatment Technologies
Routine/ Preventive Maintenance	Crack sealing/ filling, fog seal, slurry seal, scrub seal, chip seal, cape seal, micro-surfacing
Minor Rehabilitation	Thin asphalt overlay, ultra-thin bonded wearing surface
Structural Overlay	Thick asphalt overlay
Major Rehabilitation	Cold-in-place recycling, mill & thick overlay
Reconstruction	Reconstruction, full depth reclamation, perpetual pavements

PREVENTIVE MAINTENANCE TECHNIQUES

Crack Sealing/Filling

Crack sealing is a maintenance procedure that involves placement of the polymerized/ rubberized asphalt materials into working cracks (the crack may open and close with thermal stresses or traffic loading). Crack sealing is the introduction of materials that adhere to the crack walls, are flexible and elastomeric in nature. This allows significant strain to be absorbed by the material without fracture. Much of this strain will be recoverable. Thus the crack may open and close with thermal stresses or traffic loading and remain sealed. On the other hand, crack filling places polymerized/rubberized asphalt materials into non-working cracks. It is more cost effective to use this technique as preventive maintenance when the overall pavement condition is in good condition. Sealing cracks on a deteriorated pavement surface is not cost effective.

Pros:

- Prevents surface water infiltration into the substructure of pavement
- Prevents accumulation of debris in the cracks
- Very inexpensive

Cons:

- Does not add any structural strength/ capacity to the pavement
- Can be viewed as not aesthetically pleasing and calls attention to cracking

Cost: $.80 - $1.20/linear foot

Surface Seals

The next grouping of preventive maintenance technologies involve the application of surface seals that can prevent and/or delay more costly corrective rehabilitation measures by protecting and sealing the pavement from harmful environmental conditions such as sunlight, rain, and water. Surface seals can also be used to improve tire traction and wearing properties as well. These surface seals are essentially thin layers of an asphalt emulsion that can mixed with sand, aggregate, and fillers depending on the technology. However, to provide a complete discussion of surface seals, the City should be aware that emulsions can be modified in many ways to enhance the various properties of the asphalt cement binder. Traditional emulsions suspend asphalt particles in water, and when the asphalt emulsion is applied to the road or street, the water separates from the asphalt cement, a process commonly known as breaking. The water then evaporates leaving the asphalt cement behind.

However, most surface seal emulsions can be modified and probably the most common modifier to asphalt emulsions is polymer additives. Polymer additives (depending on the type), can enhance properties such as flexibility, strength, and durability, break temperatures (chemical break), and performance in hot and cold temperatures. Lastly, there are rejuvenators that can be added to asphalt emulsions that penetrate into the asphalt pavement, soften the aged asphalt, and can help the new asphalt emulsion bond better with the existing asphalt pavement. Polymer and rejuvenating additives are more costly, can be newer (proprietary) and less tested with time and performance, but can increase performance and longevity.

1. Fog Seals

This is a light application of slow setting asphalt emulsion diluted with water and applied to the surface of a bituminous pavement. Fog seals are especially good for treating pavements that carry light traffic such as parking lots.

Pros:

- Less expensive than other surface seal treatments
- Rejuvenate aged asphalt surfaces
- Seals small cracks and surface voids
- Improves chip retention in newly applied chip seals
- Can help slow down raveling in poorly compacted hot mix asphalt

Cons:

- Does not add any structural strength/ capacity to the pavement.
- The binder may be picked up on vehicle wheels if emulsion is not completely cured prior to opening to traffic
- Poor durability on higher traffic volume streets/areas
- Shorter design life

Cost: $.75 - $1.25/square yard (sy)

2. Slurry Seals

A slurry seal is most commonly composed of a quick setting emulsion in California (CQS- 1h or LMCQS-1h) which passes the ASTM (T59) slow setting specification with the exception of the cement-mixing test, well graded fine aggregate, mineral filler, and water. In California, polymer in latex form is usually added to the slurry. Slurry seal can usually be categorized into three types which depend on the maximum aggregate size in the mix. Type I slurry seals usually contain maximum aggregate size of 1/8 inch; Type II slurry seals usually contain maximum aggregate size of ¼ inch; and Type III slurry seals usually contain maximum aggregate size of 3/8 inch.

Pros:

- Fills fine non- active cracks
- Seals areas of old or raveling pavements
- Adds aesthetic appeal with uniform treatment
- Restores a uniform surface texture
- Seals the surface to prevent moisture and air intrusion into the pavement
- Improves skid resistance.
- Surface friendly and smoother than chip type seals

Cons:

- Does not add any structural strength/ capacity to the pavement.
- May not provide enough skid resistance in high speed traffic road
- Poorer durability on higher traffic volume streets/areas

Cost: $1.25 - $1.75/sy (Conventional Type II)

3. Scrub Seals

A scrub seal is an application of a polymer modified asphalt emulsion to the pavement surface followed by the broom scrubbing of the emulsion into cracks and voids, then the application of an even coat of sand or small aggregate, and a second brooming of the aggregate and asphalt mixture. This seal is then rolled with a pneumatic tire roller.

Pros:

- Similar to slurry seal, but better filling of cracks due to broom action
- Enriches hardened/oxidized asphalt
- Can eliminate the need for crack sealing prior to application

Cons:

- Does not add any structural strength/ capacity to the pavement.
- In California, many contractors are still unfamiliar with the scrub seal method, so tests may be needed to determine what emulsion or polymer-modified emulsion would work with the brooms.

Cost: $3.50 - $4.50/sy

4. Chip Seals

A chip seal is a surface treatment in which the pavement is sprayed with asphalt (generally emulsified) and then immediately covered with aggregate (chip) and rolled. Chip seals are used primarily to seal the surface of a pavement with non load-associated cracks and to improve surface friction, although they also are commonly used as a wearing course on low volume roads. Use of special binders such as asphalt rubber or polymer modified binders can make an effective crack alleviation treatment and allow significantly deflecting pavements to flex without premature cracking. Rubberized chip seal usually consists of two binder types 1) asphalt rubber, derived from field blending high levels of coarser crumbed tire rubber (more viscous and allows for thicker application) or 2) PGTR, a terminal homogeneous blend of finer ground tire rubber.

Pros:

- Seals non-load-related cracks
- Improves surface friction
- Can be used as wearing surface of low volume roads
- Roadway can be opened to low-speed traffic just after the application of the aggregate

- Rubberized chip seals provide can provide better retard reflection cracking and therefore offer a longer services life

Cons:

- Does not add any structural strength/capacity to the pavement.
- Windshields can be damaged by loose aggregate before the excess is removed
- Dust can be created during the brooming of the loose aggregate
- Requires constant attention for application rates and aggregate to minimize chip loss, fly rock, bleeding, and other problems

Cost: $2.00 - $3.00/sy (Conventional Chip Seal)
$4.00 - $6.00/sy (Rubberized Chip Seal, could be less for PGTR)

5. Cape Seals

A cape seal is composed of a slurry seal placed over a chip seal. These may be placed on newly constructed surfaces. Cape Seals are used where a chip seal is too rough and when a smooth finish is required e.g. on residential streets. In instances where cracking is a problem, a polymer or asphalt rubber modified chip seal can alleviate cracking and the slurry provides the smooth surface. It can increase the life of a chip seal by enhancing the binding of the chips and by protecting the surface. This treatment, particularly with the use of a rubberized chip seal, in combination with base repairs on fair condition residential and collector streets can be a viable alternative to more costly overlays and base repairs.

Pros:

- Similar to a chip seal except has the further benefit of being sealed with a slurry seal
- To provide a dense, waterproof surface
- To improve skid resistance and ride quality.

Cons:

- Does not add any structural strength/ capacity to the pavement
- The construction process is longer and requires equipment for both the chip seal and slurry seal

Cost: $3.25 - $4.75/sy (Conventional Cape Seal)
$5.25 – 7.75/sy (Rubberized Cape Seal, could be less for PGTR)

6. Microsurfacing

Microsurfacing is a mixture of polymer modified asphalt emulsion, mineral aggregate, mineral filler, water, and other additives, properly proportioned, mixed, and spread on a paved surface. Microsurfacing differs from slurry seal in that it is usually applied at more than a single stone thickness and is therefore a thicker and more robust seal. Also, it has special emulsifiers for more rapid setting and, higher stiffness; it may be used for rut filling in stable pavements.

Pros:

- Thicker layer that can be used to fill ruts and correct minor leveling problems
- Better suited for heavier traffic road or streets
- Quicker cure time and can open to traffic sooner than other seal methods
- Can cure in colder temperatures sometimes allowing for night operations

Cons:

- Does not add any structural strength/ capacity to the pavement.
- Cost is higher than a slurry or chip seal treatment.

Cost: $1.50 – 3.00/sy

REHABILITATION TECHNIQUES

Ultrathin Bonded Wearing Surface

A bonded wearing course (BWC) is a gap or open graded, ultra thin hot-mix asphalt (HMA) mixture applied over a thick polymer modified asphalt emulsion membrane. The emulsion membrane seals the existing surface and produces high binder content at the interface of the existing roadway surface and the gap or open graded mix all in one pass. The gap-graded and open-graded mixes provide an open surface texture to allow water to flow through the surface. This can be used on streets in fair condition, where only a moderate structural deficit is present and/or where grade constraints are an issue,

Pros:

- Resistance to rutting
- Good skid resistance
- Improves driving visibility by reducing back spray and tire splash
- Reduces tire noise
- Can open to traffic in short time

- Can be used in high traffic areas as a surface treatment
- Can be used on in-situ condition of distressed pavement without milling
- Thin pavement thickness can offer solution where road is heavily crowned or geometrically constrained

Cons:

- High cost
- Needs special construction equipment

Cost: $7.00 - $10.00/sy

Cold In-Place Recycling (CIR)

CIR is in-place recycling technology that is a very cost effective alternative to traditional "mill and fill" pavement treatments. The technology involves milling of existing asphalt concrete (AC), typically to a depth of 3 to 4 inches (but can involve complete removal of existing AC to top of aggregate base), pulverizing and processing AC materials to specified material size, adding emulsion, mixing, and then placing and compacted down back onto to roadway. The recycled pavement surface typically then receives a thin AC overlay (1.5 inches) as a smooth wearing course.

The technology is becoming more common due to its cost effectiveness, recycling benefits, lower energy requirements, time efficiency, and it provides a smoother interim driving surface as opposed to a rougher milled surface. Cost efficiency is gained by the use of existing AC materials, less hauling and off-hauling, and time efficiency in placement. Longer pavement sections (generally at least 500,000 square feet [sf] of pavement area) that require deeper mill and fills (typically at least 3 inches) are generally good candidates for CIR with potentially significant cost savings. However, the presence of significant fabric can make the CIR process very difficult, particularly during milling and processing, and can be done but is not typically recommended. This would be a very cost effective treatment alternative for the City to consider in lieu of more costly traditional deeper mill and fills.

Pros:

- Cost effective
- Time efficiency
- Reduced traffic disruption and loose aggregate usually present after traditional milling
- Able to retain original profile

- Environmental benefit (less energy intensive and recycling existing material in-place)
- Reduced haul route and distance issues that can affect pavement temperature
- Can correct raveling, poor ride quality, weathering, bleeding, corrugation, corrugation, shoving, slippage, rutting, patches, shallow potholes, and cracking

Cons:

- Requires new wearing surface
- Requires an experienced contractor to perform correctly
- Cannot be used in the following conditions
    - High traffic volume road (CIR surfaces tend to ravel)
    - Rubberized Hot Mix Asphalt (RHMA)
    - Full depth cracking : must recycle at least 70% of the existing pavement thickness
    - Presence of existing fabric layers
    - Moisture related problems such as poor drainage and pumping
    - Saturated subgrade materials
    - Numerous utility access points
    - Excessive or high structural deficits
    - Thin existing pavements

Cost: Potential cost savings up to 30% compared to non-recycling alternatives

Asphalt Overlays

This technique involves adding a conventional Hot Mix Asphalt (HMA) or Rubberized Hot Mix Asphalt (RHMA) layer to an existing HMA or Portland cement concrete (PCC) pavements. The use of an HMA overlay is usually more economic when the existing pavement is still in fair condition. However if reflective cracking from underlying PCC and/or severe longitudinal/transverse and block cracking is an issue, RHMA is a good solution and can offer greater resistance to damaging reflective cracking in addition to the recycling benefits of old tires. An overlay may be combined with other methods such as cold milling, cold recycling, hot recycling, and heater scarification. The thickness of the new surface will be dependent on the type, severity and extent of the pavement surface distresses, the ride quality and the required structural improvement necessary to accommodate the design traffic and future growth. To tailor the correct overlay thickness to address existing pavement conditions and distresses, expected traffic levels, and future growth, we recommend that deflection testing, coring, and pavement conditions surveys be completed as will be discussed in greater detail in a subsequent section of this report.

Pros:

- Widely used, tried and true strategy
- Most cities and counties are very familiar with the technology and have well developed specifications
- Easy to maintain in the future
- Thin overlay is used to correct/ improve the functional deficiency (skid resistance, ride quality, aesthetics) or smaller structural deficiency (pavement section is not structurally adequate for the design traffic index and predicted traffic growth)
- Thick overlay can be used to correct/ improve a more significant structural deficiency

Cons:

- If the structural deficiency is high, a thicker overlay may not be feasible given existing grade and cross-slope constraints (i.e. pronounced road crown, median, surface drainage, ADA curb ramps, etc.)
- More expensive than recycling strategies

Cost: Varies depending on thickness and type of asphalt concrete