

P-TAP 18

Pavement Management Program Update

Final Report

NCE Project No. 55.151.55

January 2018



Richmond, CA

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Richmond, CA 94804



City of Martinez

525 Henrietta Street
Martinez, CA 94553

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Pavement Management Program Update**

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Submitted to:

**City of Martinez
525 Henrietta Street
Martinez, CA 94553**

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Background

NCE was selected by the Metropolitan Transportation Commission (MTC) to update the City of Martinez's (City) pavement management database as part of P-TAP 18 (Pavement Management Technical Assistance Program, Round 18). As part of the scope, NCE performed condition surveys on the City's entire pavement network, which included 18.2 centerline miles (62 sections) of arterials, 21.3 centerline miles (101 sections) of collectors, and 82 centerline miles (777 sections) of residential streets. Once field surveys were completed in October 2017, all survey data was entered into the StreetSaver database.

Maintenance and rehabilitation strategies and recent unit costs were also updated in StreetSaver, together with the maintenance and rehabilitation histories. Finally, the pavement funding needs were determined, and two budgetary scenarios were analyzed for the pavement network.

Purpose

The purpose of this report is to assist decision makers at the City of Martinez in utilizing the results of the StreetSaver Pavement Management Program (PMP). Specifically, this report assesses the adequacy of projected revenues to meet the maintenance needs recommended for the City. It also maximizes the return from expenditures by:

- 1) Implementing a multi-year street rehabilitation and maintenance program
- 2) Developing a preventive maintenance program
- 3) Selecting streets with the most cost effective repairs

This report examines the overall condition of the street network and highlights options for improving the current network level pavement condition index (PCI). These options are developed by conducting "what if" analyses. By varying the budget amounts available for pavement maintenance and repair, one can show how different funding strategies affect the City's streets over the next five years.



Network Description

The City of Martinez is responsible for the repair and maintenance of approximately 121.5 centerline miles of pavement, or 940 pavement sections. Table 1 below summarizes the entire network by functional class.

Table 1: Network Summary Statistics for City-Maintained Sections

Functional Class	Sections	Centerline Miles	Lane Miles	% of the Entire Network (by Pavement Area)
Arterials	62	18.2	44.0	19.5%
Collectors	101	21.3	44.5	17.0%
Residentials	777	82.0	144.1	63.5%
Total	940	121.5	232.6	100%

The network replacement cost of the maintained sections is approximately \$180.8 million. This can be viewed as the value of the pavement network. It is the amount needed to fund the full reconstruction of the City's pavement network and does not include related infrastructure assets, such as sidewalks, signals, markings, signs, etc.

A list of all sections in the network and their corresponding PCI at the time of inspection and other attribute data is included in Appendix A. For convenience, there are two listings – one sorted by street name and the other sorted by descending PCI.



Pavement Current Condition

The pavement condition index, or PCI, is a measurement of the pavement condition and ranges from 0 to 100. A newly constructed street will have a PCI of 100, while a failed street will have a PCI of 25 or less. **The average 2017 PCI of the City’s street network is 61.** Note that these values are projected and area-weighted calculations from StreetSaver. The average remaining service life (RSL) is estimated to be approximately 15 years for the streets (this is the time required for pavement to reach a “Very Poor/Failed” condition if no maintenance occurs).

Figure 1 below illustrates the definitions of the five pavement condition categories. Note that the StreetSaver “Maintenance and Rehabilitation Decision Tree” in Appendix B assigns different condition category titles from those in Figure 1.

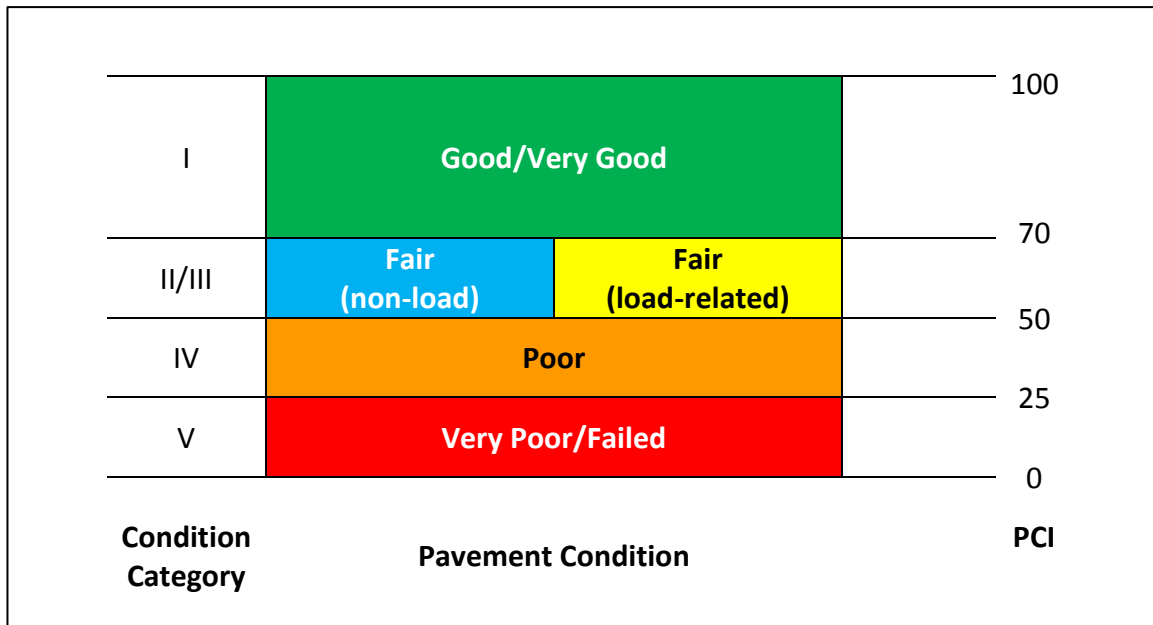


Figure 1: Pavement Condition Categories



Figure 2 below shows the historical network PCI between 2007 and 2017. The PCI values from 2007, 2010, 2011, 2014 and 2017 are from pavement condition surveys, while the remaining values are projected values from StreetSaver. Based on 2011 pavement condition surveys and the projected PCI in 2012 and 2013, the PCI in 2014 could be higher than 50. If we exclude the 2014 surveys from the historical PCI, the City’s average network PCI has been maintained between high 50s and low 60s in the past ten years.

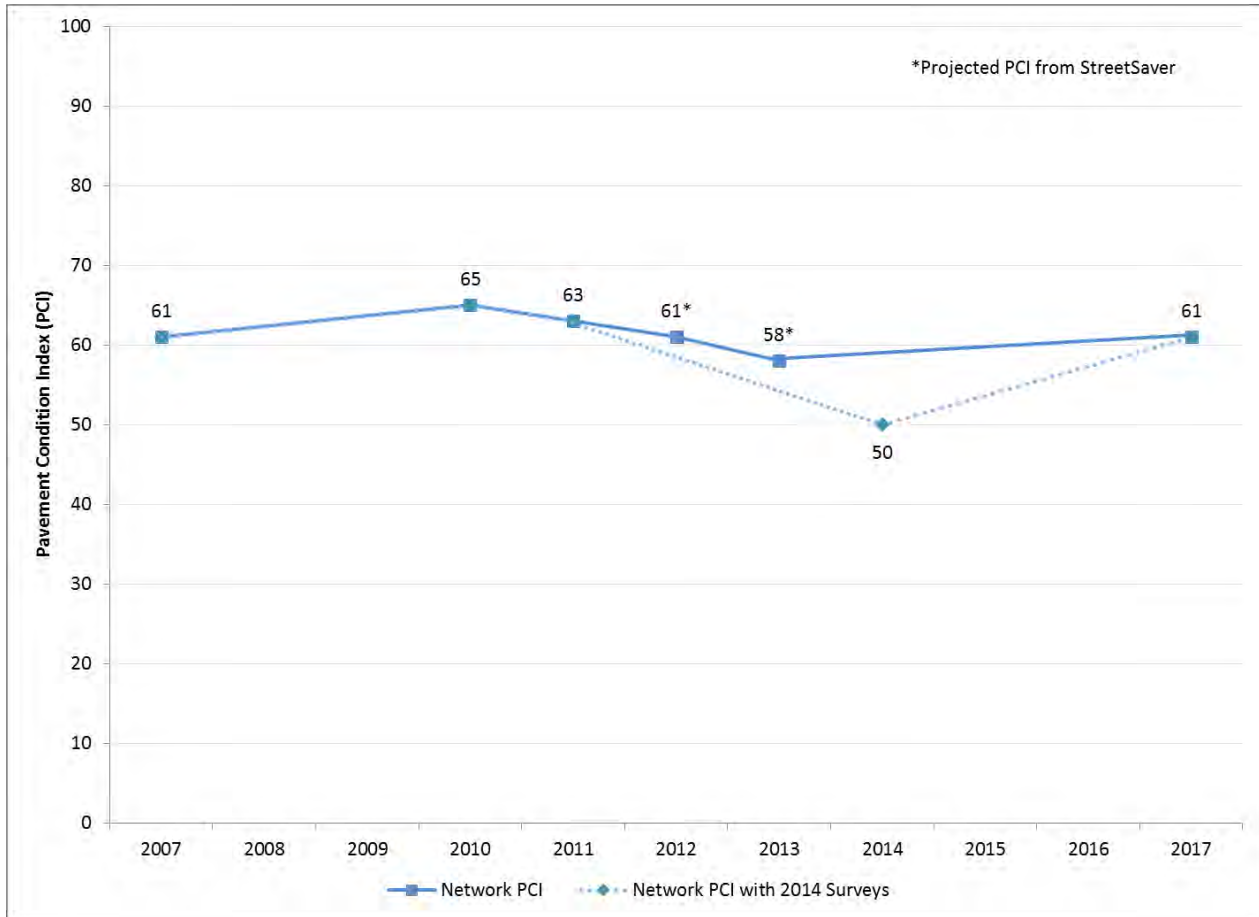


Figure 2: Historical Network PCI between 2007 and 2017

Table 2 and Figure 3 and 4 detail the network by PCI ranges or condition category. Currently, 44 percent of the City’s streets are in the “Good/Very Good” condition, with 32.7 percent in the “Poor” or “Very Poor/Failed” categories, which is a significant percentage that will require funding for repair. Overall, arterials are in a better condition than collectors and residential. This is a typical profile for most cities, and reflects the lack of funding for residential roads in general and a greater focus on maintaining higher traffic volume streets that serve as the backbone of the street network.

Table 2: 2017 Pavement Condition Breakdowns by Area (Entire Network)

Condition Category	PCI Range	Arterials (%)	Collectors (%)	Residentials (%)	Entire Network (%)
Good/Very Good (I)	70-100	10.1	6.1	27.8	44.0
Fair (II/III)	50-69	7.8	4.8	10.7	23.3
Poor (IV)	25-49	1.5	5.2	14.6	21.3
Very Poor/Failed (V)	<25	0.1	0.9	10.4	11.4
Total		19.5	17.0	63.5	100.0

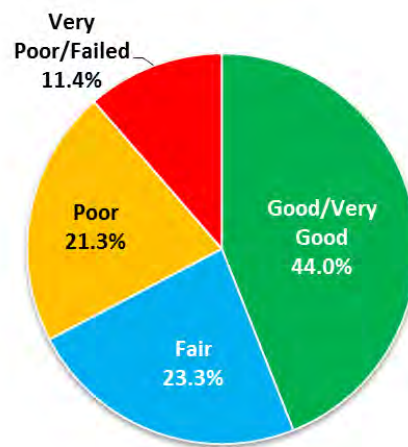


Figure 3: Pavement Condition Summary by Condition Categories (Entire Network by Area, 2017)

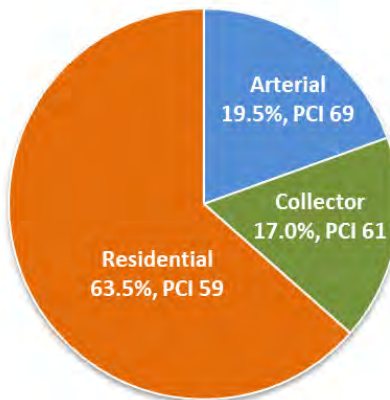


Figure 4: Pavement Condition Summary by Functional Classification (Entire Network by Area, 2017)



Maintenance and Rehabilitation Strategies

Historically, the City has utilized slurry seals and cape seals as maintenance and rehabilitation strategies. Slurry seals have been utilized as a preventive maintenance technique when the pavements are in “Good/Very Good” condition or above. As the pavement condition deteriorates, cape seals are applied. Digouts are typically used as preparation prior to cape seals as necessary. These pavement treatments are formalized in the maintenance and rehabilitation decision tree shown in Appendix B.

Figure 5 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/Very Good” condition than to repair streets that have failed. By allowing pavements to deteriorate, streets that once cost \$3.00 per square yard (SY) to slurry seal may soon cost \$27.00/SY for RHMA overlay and \$50.00/SY for full depth reclamation (FDR). In other words, delays in repairs can result in construction costs increasing as much as 16 times. Appendix B shows the detailed decision tree and the unit costs associated with each type of treatment.

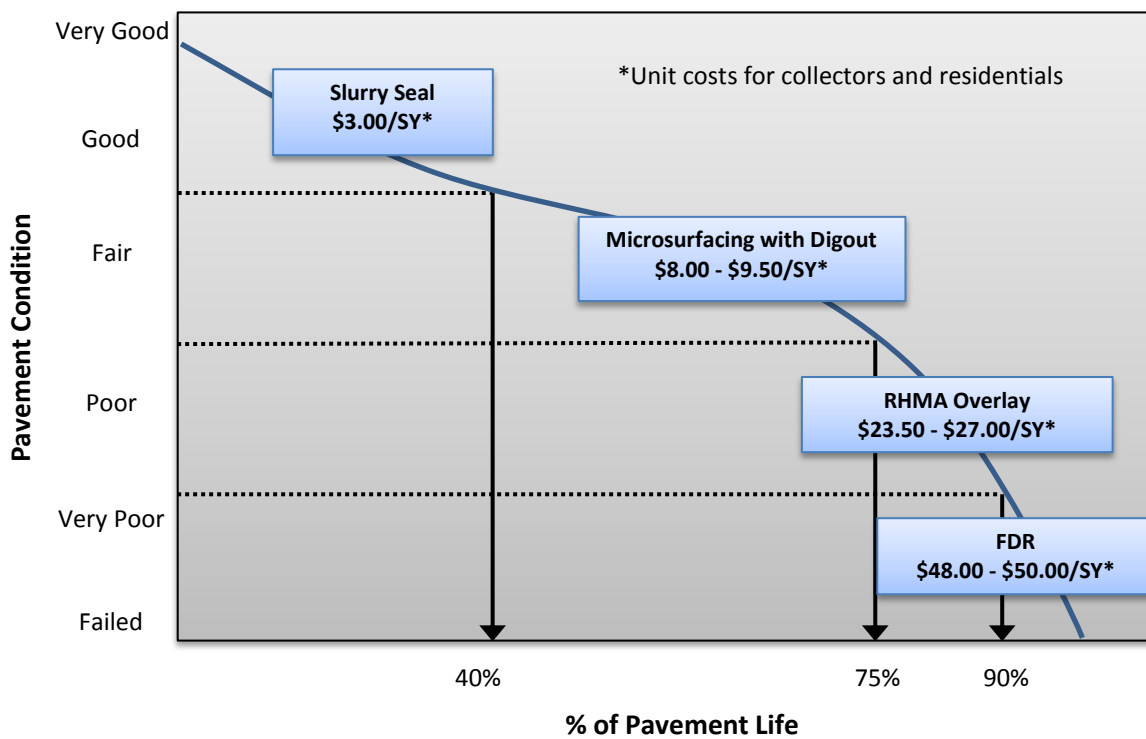


Figure 5: Costs of Maintaining Pavements over Time



Budget Needs

Based on the principle that it costs less to maintain streets in good condition than those in bad condition, the PMP strives to develop a maintenance strategy that will improve the overall condition of the network to an optimal PCI and then sustain it at that level. By not addressing the maintenance needs, the quality of the street network will inevitably decline. In order to correct these deficiencies, a cost effective funding and maintenance strategy must be implemented.

The first step in developing a cost effective maintenance and rehabilitation strategy is to determine the maintenance "needs" of the pavement network. Using the StreetSaver budget needs module with an inflation rate of four percent, the maintenance needs over the next five years were estimated at approximately \$38 million for the entire network. If the City follows the strategy recommended by the program, the average network PCI will increase to 88 in 2018 and stays above 80 in the subsequent five years. If, however, no maintenance is applied, already distressed streets will continue to deteriorate, and the network PCI will drop to 51 by 2022. The results of the budget needs analysis are summarized in Table 3 below.

Table 3: Summary Results from Needs Analysis

Year	2018	2019	2020	2021	2022	Total
PCI Treated	88	84	82	81	80	--
PCI Untreated	61	58	56	53	51	--
Needs (\$ Millions)	34.0	1.2	0.9	0.2	1.7	38.0

The results of the budget needs analysis represent the ideal funding strategy recommended by the StreetSaver PMP. Of the total \$38 million in maintenance needs shown, approximately \$1.8 million (4.7 percent) is earmarked for preventive maintenance, while the majority (\$36.2 million or 95.3 percent) is allocated for the more costly rehabilitation and reconstruction treatments.

It should be noted that the prediction models in StreetSaver may result in a more conservative performance because the impacts of newer and more cost-effective technologies may not be included before. For example, if improved materials are utilized, e.g. asphalt-binder with rubber or polymers, the actual performance of these treatments may be under-stated by the models. However, if the City continues to assess the pavement conditions regularly, the prediction of future conditions will continue to improve.



Budget Scenarios

Having determined the maintenance needs of the street network, the next step in developing a cost effective maintenance and rehabilitation strategy is to conduct several “what-if” analyses using StreetSaver’s budget scenario module. The program projects the effects of the different scenarios on pavement condition index (PCI), deferred maintenance (unfunded backlog), and average remaining service life of the network. By examining the effects on these indicators, the advantages and disadvantages of different funding levels and maintenance strategies become clear. Each of the following budget scenarios includes the OBAG¹, SB1², and Measure D³ funded projects, as well as the other maintenance and rehabilitation in 2018.

Scenario 1: City’s Existing Funding – Based on the City’s existing funding of \$3.3 million per year (\$1.3 million for arterials and \$2 million for collectors and residential), the results show that the deferred maintenance will increase to \$37.7 million by 2022. This budget scenario demonstrates that the City’s existing budgets is sufficient to maintain the current PCI and the overall network PCI will not drop below 61 over the next five years. Therefore, the “Maintain Current PCI” scenario is redundant and not included in the report.

Scenario 2: Improve PCI to 66 – This scenario seeks to improve the network pavement network PCI to 66 over the next five years. A total of \$25.5 million is required (average of \$5.1 million per year); in addition, the deferred maintenance will decrease to \$28.8 million by 2022.

Note: The term “deferred maintenance” consists of pavement maintenance that is needed, but cannot be performed due to lack of funding. Shrinking budgets have forced many cities and counties to defer much needed pavement 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 are included in Appendix C.

Appendix E contains maps which illustrate the results of each scenario. The maps show the pavement network, highlighting the color-coded condition category of each pavement section in 2022 for Scenarios 1 and 2. A map illustrating the current condition is also provided for comparison.

¹ MTC’s One Bay Area Grant program — or OBAG — is a funding approach that aligns the Commission's investments with support for focused growth. Established in 2012, OBAG taps federal funds to maintain MTC's commitments to regional transportation priorities while also advancing the Bay Area's land-use and housing goals.

² Road Maintenance and Rehabilitation Account (RMRA - Roads and Highways Code Sec 2030 et sec. – also known as Senate Bill 1 (SB1)) includes funds from the taxes enacted by the Road Repair and Accountability Act of 2017.

³ Measure D is a one-half percent (0.50%) transactions and use (sales) tax on the November 8, 2016 ballot which would provide funding exclusively for Martinez road improvement and maintenance needs.



Scenario 1: City's Existing Funding (\$16.5 Million)

This scenario determines the impacts of the City's existing funding of \$3.3 million per year. With a total of \$16.5 million, the network PCI will be maintained in the low 60s over the next five years (see Table 4 and Figure 6). More than half of the network will be in the "Good/Very Good" condition category, but 27 percent of the network will be in the "Poor" or "Very Poor/Failed" condition. The deferred maintenance will increase from \$34 million to \$37.7 million by 2022. The projected remaining service life (RSL) of the pavement network will increase to 18 years. Appendix D provides lists of candidate sections selected for treatment for this scenario, including the OBAG and SB-1 projects, as well as other maintenance and rehabilitation in 2018.

Table 4: Summary Results for Scenario 1

Year	2018	2019	2020	2021	2022	Total
Budget (\$ Millions)	3.3	3.3	3.3	3.3	3.3	16.5
Deferred Maintenance (\$ Millions)	31.5	33.3	36.1	36.6	37.7	--
Network PCI	63	62	62	62	61	--

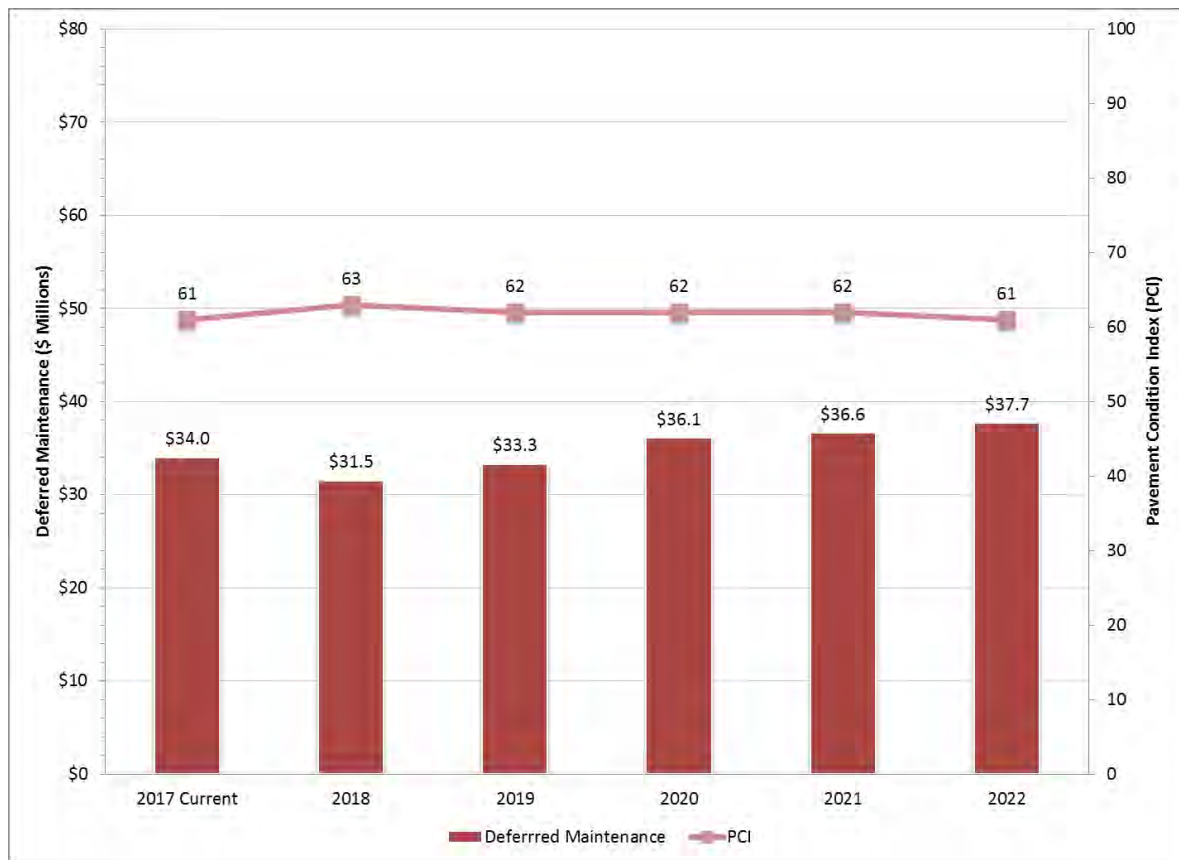


Figure 6: PCI vs Deferred Maintenance for Scenario 1



Scenario 2: Improve PCI to 66 (\$25.5 Million)

This scenario seeks to improve the network PCI to 66 over the next five years. A total of \$25.5 million is required, of which more than 95 percent will be allocated to rehabilitation treatments. By 2022, approximately 64 percent of the network will be in “Good/Very Good” condition and 17 percent pavement will be in the “Very Poor/Failed” condition category. The deferred maintenance will decrease to \$28.8 million by 2022, and the remaining service life of the pavement network will increase to 19 years. Table 5 and Figure 7 below summarize the results of this scenario.

Table 5: Summary Results for Scenario 2

Year	2018	2019	2020	2021	2022	Total
Budget (\$ Millions)	2.0	4.0	6.5	6.5	6.5	25.5
Deferred Maintenance (\$ Millions)	32.8	33.9	33.5	30.9	28.8	--
Network PCI	62	63	64	65	66	--

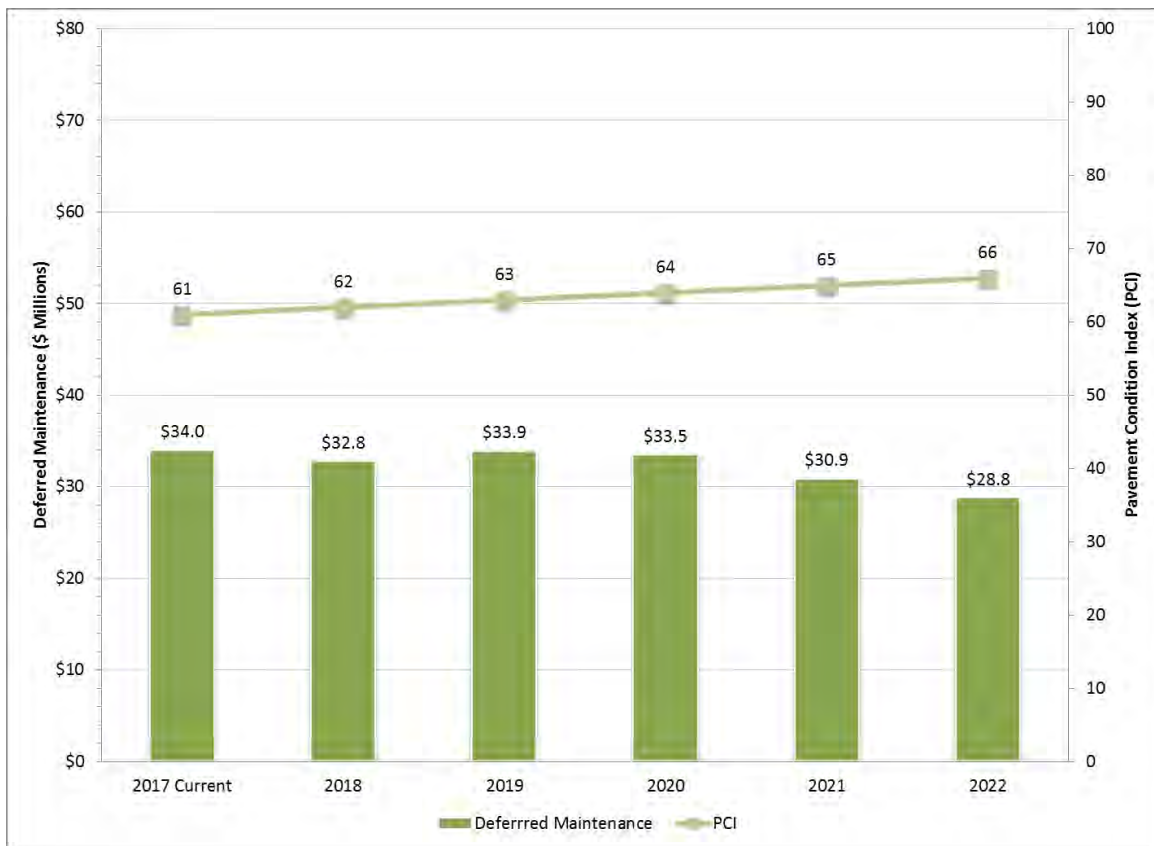


Figure 7: PCI vs Deferred Maintenance for Scenario 2



Scenario Comparisons

The following two figures graphically illustrate the annual changes in PCI and deferred maintenance for each scenario. Figure 8 below illustrates the changes in PCI over time for Scenario 1 and 2. With the existing funding (Scenario 1), the PCI will be maintained at low 60s over the next five years. Scenario 2 will increase the PCI to 66 by 2022.

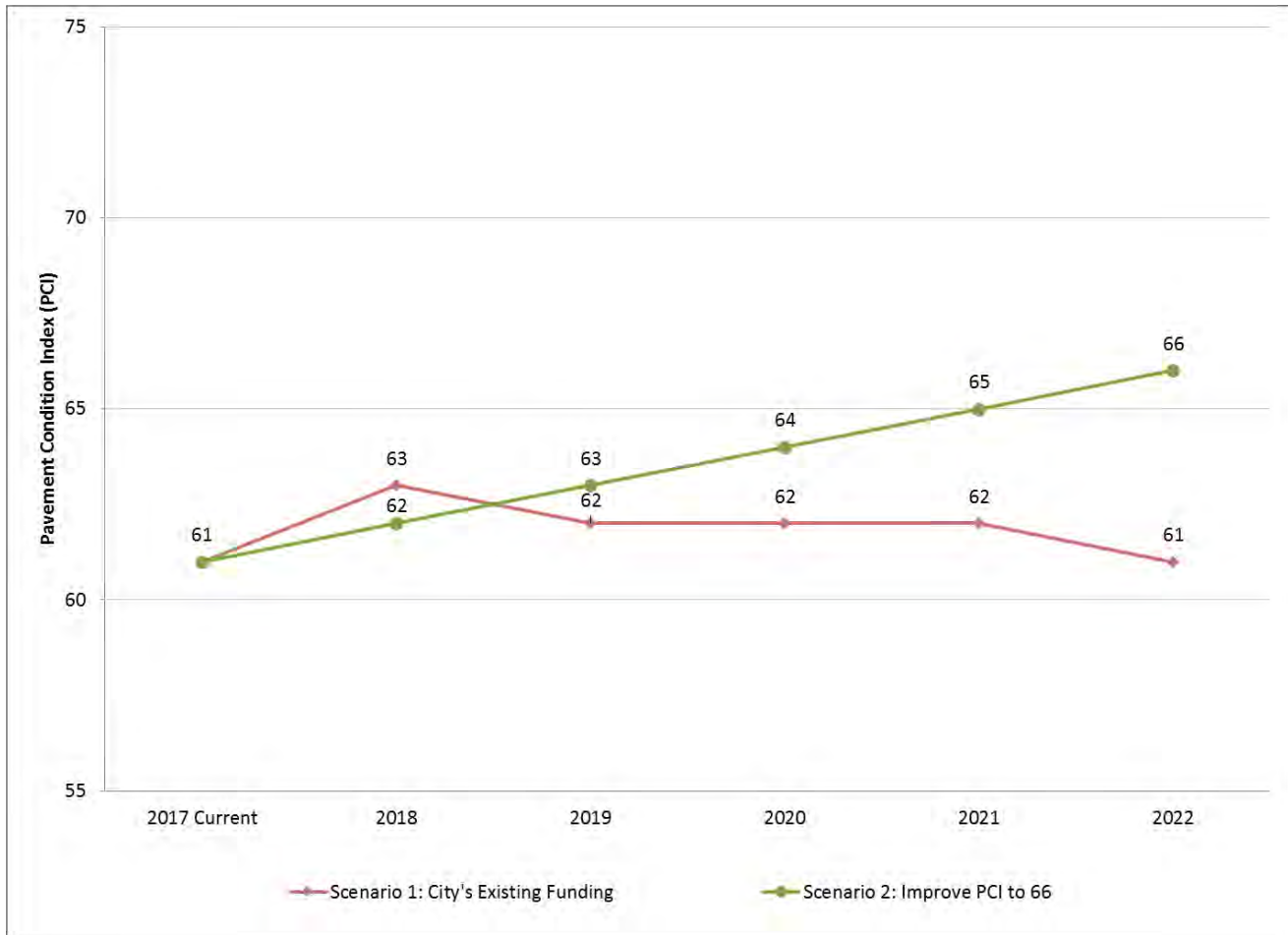


Figure 8: Annual Pavement Condition Index by Scenarios 1 and 2

Figure 9 on the next page illustrates the change in deferred maintenance over time for the each budget scenario. By 2022, Scenario 1 will increase the deferred maintenance to \$37.7 million. The deferred maintenance in Scenario 2 will decrease to \$28.8 million over the next five years.

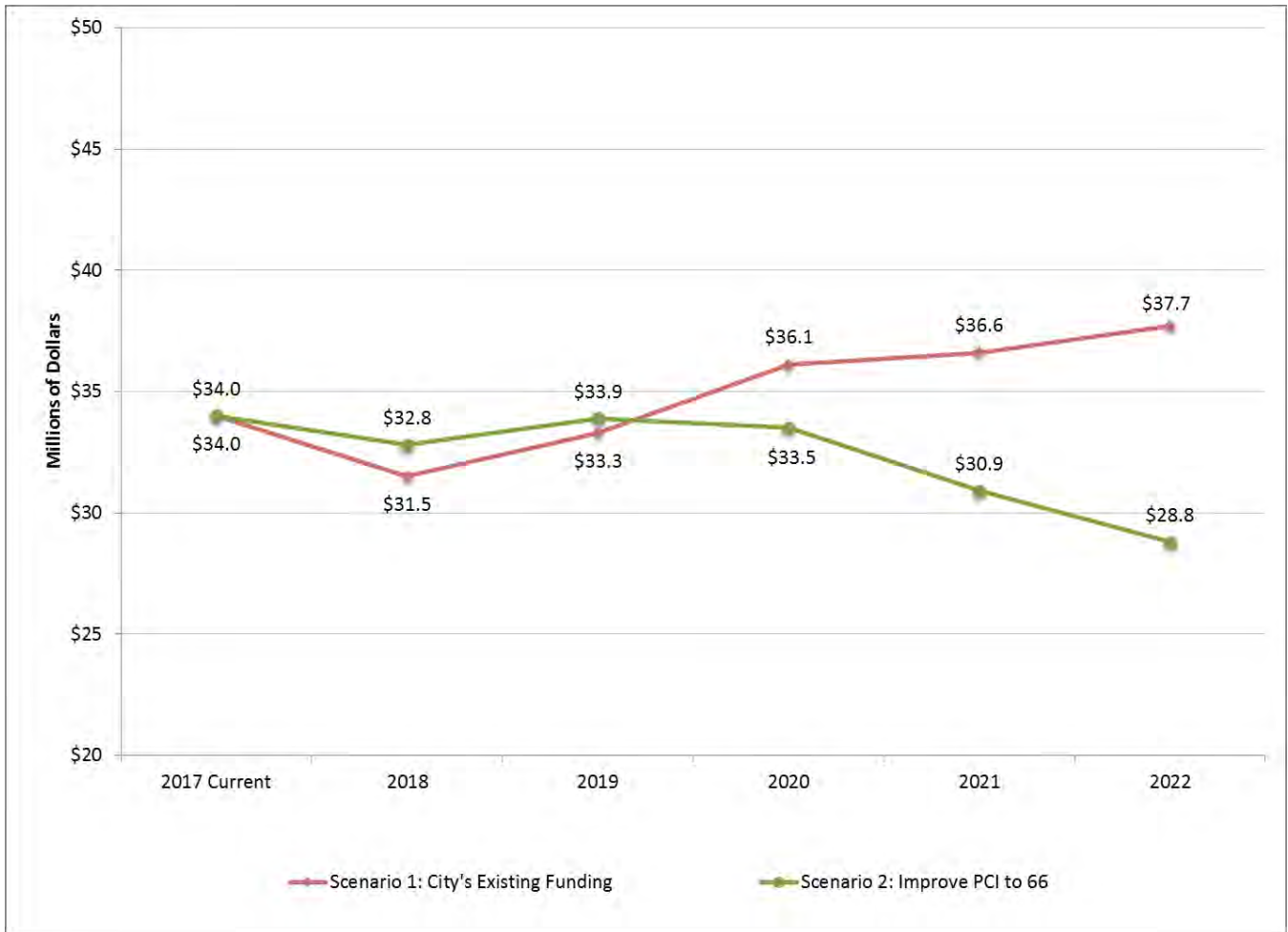


Figure 9: Annual Deferred Maintenance by Scenarios 1 and 2

Figure 10 on the next page illustrate the pavement condition changes under various scenarios. As previously noted, 44 percent of the network is in “Good/Very Good” condition with 32.7 percent in “Poor” to “Very Poor/Failed” condition. In both Scenarios 1 and 2, the pavement percentage of “Good/Very Good” category will increase to 55.6 percent and 63.7 percent, respectively. However, in Scenario 1, the pavement in “Very Poor/Failed” condition will almost double to 22.4 percent.

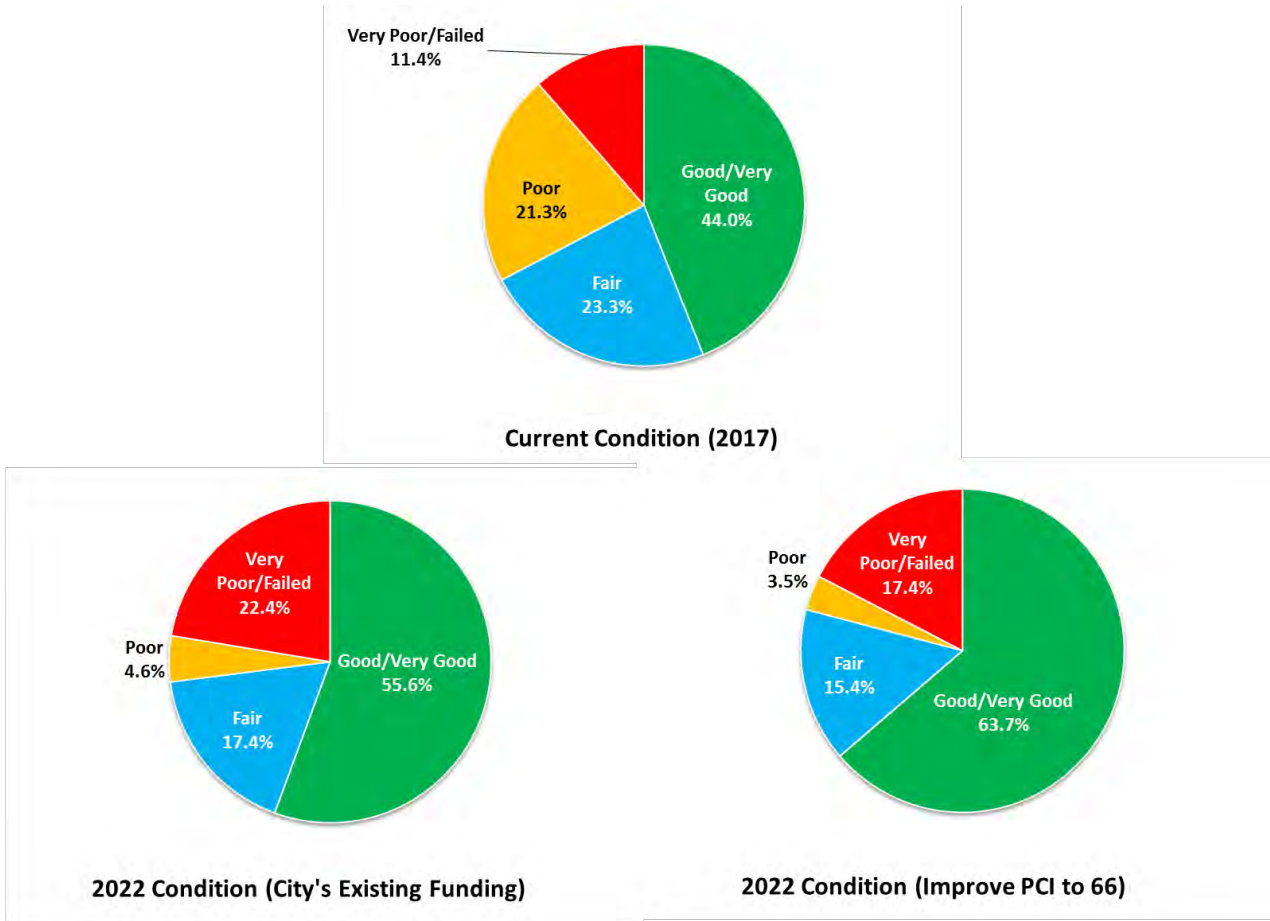


Figure 10: Pavement Condition Changes under Scenarios 1 and 2

Discussion

To summarize, the City of Martinez has a substantial investment of \$180.8 million in the street network. Overall, the City’s network is in the “Fair” condition with a network PCI of 61. Of the 121.5 centerline miles of City-maintained streets, approximately 44 percent are currently in the “Good/Very Good” condition with 32.7 percent in “Poor” or “Very Poor/Failed” condition category.

The analyses indicate that the City needs to spend approximately \$38 million in pavement maintenance and rehabilitation over the next five years to essentially repair all streets. By doing so, streets then can be maintained in good condition with on-going preventive maintenance. This will save money by avoiding reaching the level of major rehabilitation (such as FDR or surface reconstruction).



Recommendations

A. Pavement Budget

The recommended scenario for the City of Martinez is Scenario 2 (Improve PCI to 66), with a budget of \$25.5 million over the next five years. This will not only allow the City to increase percentage of streets in good condition but also decrease the deferred maintenance.

B. Pavement Maintenance Strategies

The City's pavement maintenance strategies primarily include slurry seals and cape seals. Since a large percentage of pavements are in "Good/Very Good" to "Fair" condition, it is important to preserve good pavements. Crack sealing is relatively inexpensive and can keep moisture out of pavements and prevent the underlying aggregate base from premature failures. Life-extending surface seals such as slurry seals are also cost-effective for pavements currently in fair to good condition.

NCE recommends that the City continue with a well-funded preventive maintenance program, and with rehabilitation projects to improve pavement currently in poor condition. This is necessary to at least maintain the portion of pavement network that is in the "Good" condition and avoid increasing the deferred maintenance even more.

C. Re-inspection Strategies

In order to continue monitoring the street network, and make appropriate decisions, it is recommended that arterial and collector streets continue to be inspected every two years and residential streets every four to five years. This also ensures that the City is compliant with MTC's requirements for certification and funding.

D. Maintenance and Rehabilitation Decision Tree

The maintenance and rehabilitation treatment strategies and associated unit costs should be reviewed and updated annually to reflect new construction techniques/costs so that the budget analysis results will continue to be reliable and accurate.

E. Next Steps

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

- Update the pavement management program every two years to ensure that MTC's certification does not expire.
- Continue to maintain a preventive maintenance strategy.
- Pursue additional pavement funding sources to ensure that Scenario 2 is feasible. Examples of some funding sources are listed as the next page:



Federal Funding Sources

- Community Development Block Grants (CDBG)
- Congestion Mitigation & Air Quality Improvement (CMAQ)
- Surface Transportation Block Grant Program
- Highway Safety Improvement Program (HSIP)
- High Risk Rural Roads Program (HR3)

State Funding Sources

- Active Transportation Program (ATP) which now includes the Bicycle Transportation Account (BTA) and Safe Routes to Schools (SR2S)
- State Transportation Improvement Program (STIP)
- AB 2766 (vehicle surcharge)
- Vehicle License Fees (VLF)
- CalRecycle grants
- State Water Resource Control Board
- Transportation Development Act (TDA)
- Traffic Safety Fund
- Transportation Uniform Mitigation Fee (TUMF)

Local/Regional Funding Sources

- Local sales taxes
- Development impact fees
- General funds
- Various assessment districts – lighting, maintenance, flood control, special assessments, community facility districts
- Traffic impact fees
- Utilities e.g., stormwater, water, wastewater enterprise funds
- Flood Control Districts
- Parcel/property taxes
- Vehicle registration fees
- Vehicle code fines
- Underground impact fees
- Solid waste funds
- Transient Occupancy Taxes (TOT)