FINAL REPORT

UPDATE OF PAVEMENT MANAGEMENT PROGRAM

(Citywide)

2019-2024

Submitted to:

City of Monterey Park, CA

January 28, 2019

BUCKNAM | INFRASTRUCTURE GROUP, INC.

January 29, 2019

Mr. Mark McAvoy, P.E.
Director of Public Works
Public Works Department/Engineering Division
320 West Newmark Avenue
Monterey Park, CA 91754

Subject: Final Report - Update of the Pavement Management Program

Dear Mark:

As part of the 2019 Update of the Pavement Management System for the City of Monterey Park, *Bucknam Infrastructure Group, Inc.* is pleased to submit the Final Report for the City's pavement network.

The information contained in this report was used to develop the recommended improvement program for the pavement network. The report covers the following categories:

- **Executive Summary (Section I)**

- **Pavement Management Program Development and Reporting (Section II)**

- **Pavement Conditions For Each Segment in the Network (PCI Report – Section III)**
  The Pavement Condition Index report shows the present condition of each street in the pavement network. In addition, the report shows the basic geometry of each street segment.

- **Forecast Maintenance Reports (Section IV)**

  - **Recommended Maintenance and Repair Strategies**
    The recommended maintenance and repair strategies were used to generate the Forecasted Maintenance Report and were based on our 2018 inspections. Additionally, we have assessed and incorporated unit cost and maintenance application practices/types with our strategies.

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- **Projected Projects based on M&R Strategies**

  The Forecasted Maintenance Report projects the street maintenance activities required for the next five years, broken down to show maintenance levels for Arterials, Collectors and Local streets. The report included in this section is broken down by fiscal year.

Our thorough analysis of previous and current Monterey Park PMP strategies enabled our staff to make proactive recommendations to the City's pavement CIP. All comments received from the City have been incorporated in the reports that follow. All of the City's issues and needs that were brought to our attention are included in the report. It has been a pleasure working with you and the City on updating your Pavement Management Program. We look forward to the continued success of this project and future teamwork with City staff.

Sincerely,

Bucknam Infrastructure Group, Inc.

Peter J. Bucknam
Project Manager
Infrastructure Management – GIS Services

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Acronym Listing

Asphalt Concrete (AC)
Army Corps of Engineers (ACOE)
Capital Improvement Program (CIP)
Geographic Information System (GIS)
Government Accounting Standards Board Statement 34 (GASB 34)
Los Angeles County MTA (METRO)
Maintenance and Repair (M&R)
Pavement Condition Index (PCI)
Pavement Management Program (PMP)
Portland Cement Concrete (PCC)

SECTION I
EXECUTIVE SUMMARY

2018 PAVEMENT MANAGEMENT PROGRAM

This report reflects the continued dedication and proactive management of the City's Pavement Management Program (PMP); the last major update to the City's PMP was performed in 2015. As the City of Monterey Park continues to show limited growth with its population, demographics, infrastructure and maintenance needs, the street network has been running parallel as the system matures and capital street projects widen streets. The City of Monterey Park developed its PMP in 2006 with the use of an automated database program. Today, the City is currently using the Metropolitan Transportation Commission software, StreetSaver, to manage the street network. This system is essential to the City in that it assists Public Works staff in capturing funding for its arterial street system as well as cost-effectively manages the local network through proactive maintenance and scheduling. Under this project, the City has incorporated the development of a unique Pavement Management – GIS layer that will assist the City in spatially analyzing pavement conditions and other attribute information that resides in the StreetSaver database.

The Monterey Park PMP has been developed to assist City personnel by providing current data on the City's street network and to develop cost-effective maintenance strategies to maintain a desirable level of pavement performance on a network scale, while optimizing the expenditure of limited fiscal resources. The PMP efforts in 2018 consisted of analyzing the City's previous PMP dataset for quality and usability. City staff also provided key information pertaining to the ongoing maintenance that has occurred throughout the City since 2015. In doing this, we were tasked to generate an updated Capital Improvement Program report that identified recommendations and deficiencies in the current operating and maintenance efforts put forth by the City.

For the 2018 project, our staff surveyed all arterial and collector routes to assist the City in complying with Los Angeles County MTA (METRO) PMP requirements as well as surveyed all local streets and analyzed historical maintenance operations.

Specifically, the program provides administrators and maintenance personnel with:

- *The present condition status of the pavement network (arterial, collector, and local streets), as a whole and of any grouping or individual component within the City;*
- *A ranked list of all streets, or segments of streets, by condition within the network;*
- *Rehabilitation/maintenance needs of each street segment by year;*
- *An optimized priority maintenance and rehabilitation program based on cost/benefit analysis and various levels of funding;*
- *Optimum annual budget levels for pavement maintenance for the current and the following five (5) years;*
- *Prediction of the future performance of the City's pavement network and*

each individual street section;

- *Updated PMP data to assist the City with GASB 34 compliance; and*
- *Pavement condition data and analysis presented in ArcGIS* that is compatible with City's existing GIS (GIS map provided within Section III and shapefiles delivered to the City)

Pavement is a dynamic structure where deterioration is constantly occurring; thus the pavement management system needs to be updated on a regular basis to reflect these changes in pavement conditions, pavement maintenance histories, and maintenance strategies based upon budgetary constraints. In our approach to develop the City's forecasted maintenance recommendations we worked with Monterey Park staff in identifying unit costs for all maintenance practices used on an annual basis. Currently, based upon the City's maintenance practices and their associated unit costs, the total replacement value of the Monterey Park pavement network is $247.174.000. This value clearly indicates that the City's pavement network is the most valuable and essential asset to Monterey Park. The City's use of slurry seal, ARHM Overlay and R&R practices are typically applied at a five year, ten year and 25 year frequency respectively. These frequencies are typical but the City may see increases in deterioration rates due to environmental, load and high average daily traffic (ADT) volumes. For example, high ADT volumes along one of Monterey Park's arterial streets will increase deterioration rates for a previously applied AC Overlay compared to a small local street. These deterioration rates are monitored through frequent inspections and functional class deterioration analysis within the City's PMP database.

This report reflects our findings and recommendations for the PMP and the current state of the City's pavement network. Furthermore, we have recommended detailed funding and maintenance strategies for the arterial/collector and residential networks for next five (5) years.

CITY'S PAVEMENT NETWORK

Within the Monterey Park pavement management network there are approximately 46.4 section miles of Arterial/Collector streets. The Arterial and Collector network consists of approximately 10,147,172 SF of pavement which consists of 342 pavement sections. The Local network consists of approx. 14,038,617 SF of pavement which consists of 672 pavement sections totaling in 80.0 section miles. Combined, the entire network consists of 123.4 section miles of streets, 24,169,368 SF and 989 total pavement sections.

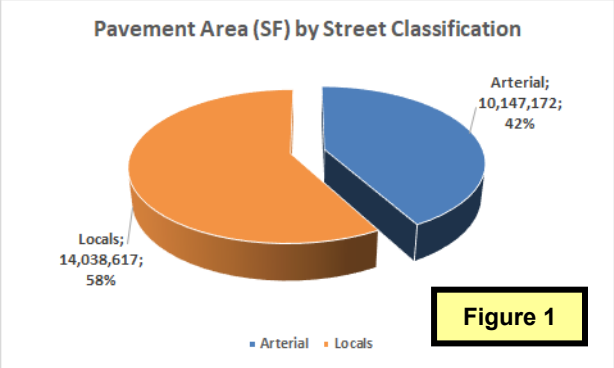

Figure 1

The City's pavement network is broken down into manageable groups that have similar characteristics, such as pavement street classification, surface type and logical segmentation. Pavement segments are identified by their branch and section numbers. Pavement "branches" that have a common usage, such as Garvey Ave, defines a "branch" within StreetSaver. Pavement "sections" are pavement segments within the defined branch that have consistent pavement street classifications, construction/maintenance histories and use. Representative inspection samples are then selected and visually surveyed to locate distress data. This data is used to calculate the pavement sections Pavement

Condition Index (PCI) which includes distress type, extent of the distress and its severity.

The PCI is a condition rating that ranges from 100 (a new pavement section or recently overlaid or reconstructed) to 0 for a section that has structurally failed and deteriorated dramatically. Weighted average PCI of a given area/zone = pavement section PCI * its own area divided by the total square footage of the given area/zone. Table 2 summarizes the section conditions found within the City of Monterey Park pavement network by street classification.

- **The weighted average PCI for the City of Monterey Park Arterial / Collector network is 72.8**
  - The Arterial/Collector weighted PCI has increase by 0.6% since 2015
- **The weighted average PCI for the City of Monterey Park Local network is 62.0**
  - The Local weighted PCI has increased by 5% since 2015

The weighted PCI value associated with the Arterial and Local routes shown through our survey analysis is timely in that it is showing that a large amount of preventive, slurry seal, and overlay work will continue to be needed over the next several years to proactively increase the PCI level to ultimately achieve a "preventive maintenance" state (typically a weighted PCI of 65 or higher).

Rank	Mileage	SF	2018 PCI	2015 PCI	2010 PCI	2006 PCI
Arterial	46.4	10,147,172	72.8	72.4	68.0	44.3
Locals	79.7	14,038,617	62.0	59.1	57.0	59.7
Citywide	126.1	24,185,789	66.5	64.6	61.0	52.3

Table 1 –Past and Present PCI Results and Comparisons

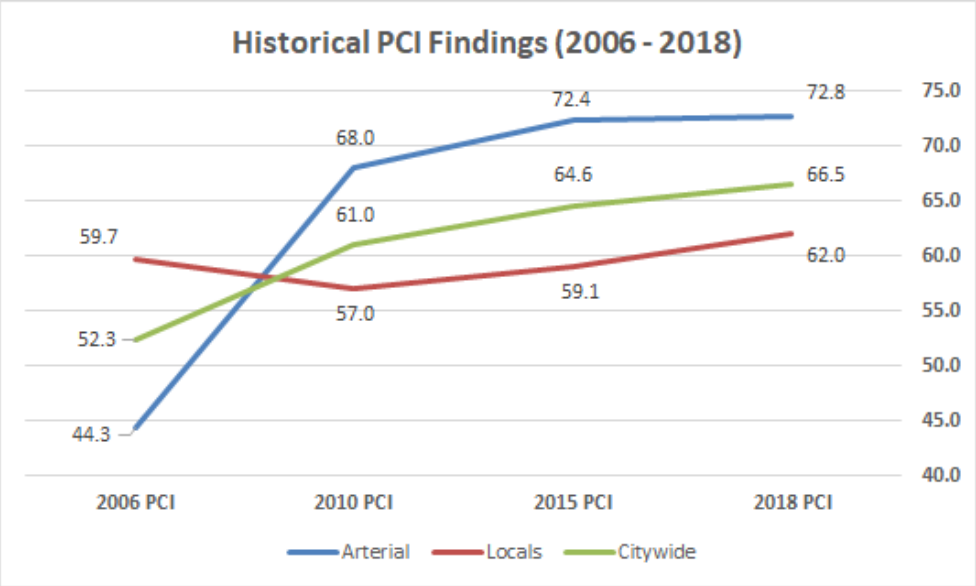

Figure 2 – Historical PCI Findings (2006-2019)

CURRENT CITYWIDE CONDITIONS (ARTERIALS AND LOCALS)

The overall condition of the City's pavement network is "Good" with a weighted average PCI of 66.5 based on the surface area of each segment. Comparing this result to the 2015 PMP findings, the overall weighted PCI has increased by 3%. The distribution of the City's overall pavement network is shown in Section III of this report (Condition Distribution).

For comparison, Bucknam performed pavement management studies for several other Los Angeles County agencies and have included their weighted PCI values; El Segundo (64.5), Culver City (62.9), and Compton (58.1).

		Citywide			
Condition	PCI Range	Arterial	Local	Total	% of Network
Excellent	86-100	17.2	12.9	30.1	23.9%
Very Good	71-85	9.0	12.9	21.9	17.4%
Good	56-70	10.2	22.3	32.5	25.8%
Fair	41-55	5.5	19.1	24.6	19.5%
Poor	26-40	3.9	11.3	15.2	12.1%
Very Poor	11-25	0.6	1.2	1.8	1.4%
Failed	0-10	0.0	0.0	0.0	0.0%
		46.4	79.7	126.1	

Table 2 – Condition Distribution by Mileage for All Streets

As shown above, a large majority of segments are evenly distributed through Excellent to Poor condition categories. For a network in "preventive" condition status you would typically see Excellent and Very Good section percentage totals at the 55 to 60% range. These findings indicate that the proper rehabilitation maintenance needs to be performed on the pavement network in the near/immediate future. The condition ranges shown above are defined by the Army Corps of Engineers.

With approximately 58% of the City's pavement sections within a condition level of "Good to Poor" (approximately 71.3 miles), a proactive overlay maintenance program needs to be implemented and funded; this will improve the citywide weighted PCI to a higher network condition level while reducing deferred maintenance costs in fiscal years 2018 and beyond.

Local conditions show that 79% of the pavement network require slurry seal or overlay maintenance; this accounts for approximately 63.7 miles of streets. With the high amount of local sections needing maintenance the City should proactively appropriate more funding to the Local street network in order to increase the overall condition of the locals. The Local network has remained at low condition levels for over eight years and will continue to be a major contributor to the high amount of deferred overlay maintenance unless additional pavement funding is appropriated.

On a similar note, the Arterial network is showing higher condition levels compared to the Local network. This is clear by looking at the number of arterial sections that fall within the Good to Poor condition categories (approximately 17.3 miles of the 43.4 mi., which accounts for approx. only

39% of the arterial network compared to 58% of the local network.

Through our assessment of the City's annual pavement maintenance budget allocation the lack of necessary CIP funds will allow the City's current citywide weighted PCI will decrease over the next five years if additional funding is not appropriated.

Furthermore, as large overlay and rehabilitation projects are considered for funding, the City should also consider using sub-grade R - Values, structural design, distress severities and extents as parameters for determining whether a pavement section that lies within the Fair to Very Poor condition range should be overlaid or reconstructed. PCI conditions reflect "surface" conditions; additional sub-surface data such as coring data, R-Values and asphalt depths will provide City to with a better approach to the maintenance that should be applied.

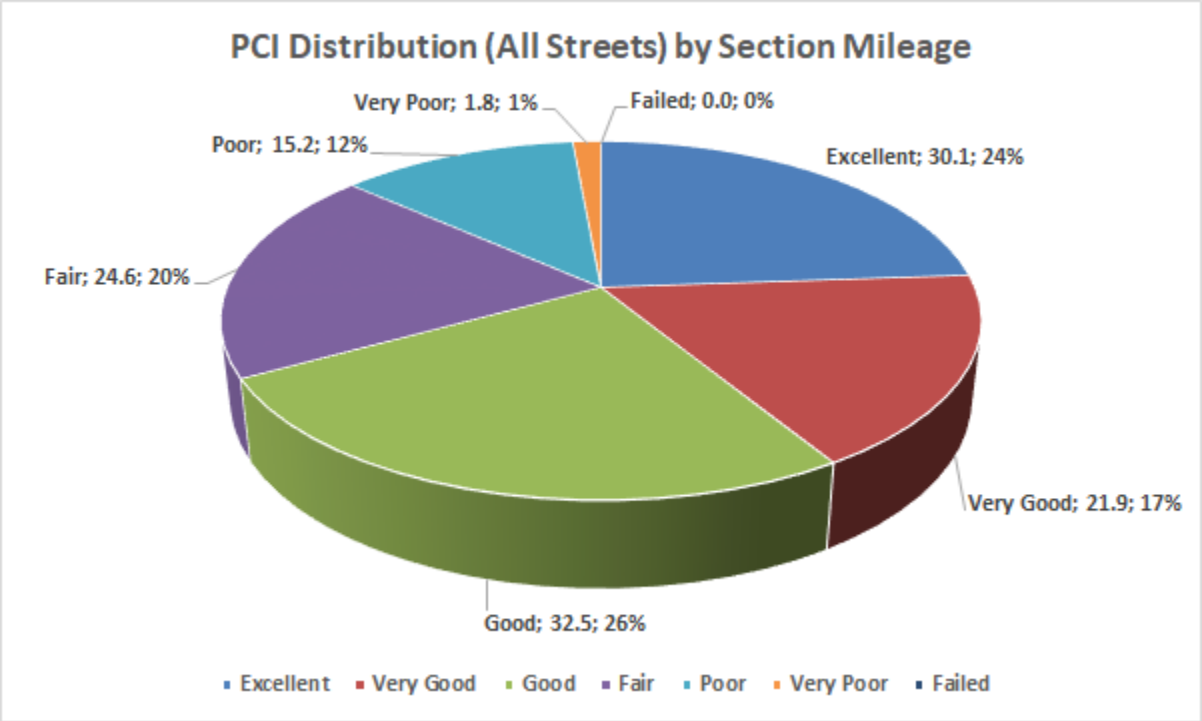

Figure 3 – PCI Distribution by Section Mileage for All Streets

MAINTENANCE STRATEGY DEVELOPMENT

Based on the results of the condition survey and input from the City, pavement maintenance/rehabilitation strategies were developed. At the outset, the City and Bucknam staff identified a distribution of City maintenance funds that would be applied to the network over the next five years. This was based upon the desire to prevent the decrease in street conditions and not allow an increase in the maintenance backlog funds over the five-year program.

Through our assessment and discussions with the City we were provided with the City's annual street / maintenance revenues which totaled over $2.5 Million/yr. With this approach, Bucknam has recommended a "minimal level of service" which creates a major dividing line in determining between preventive maintenance and major pavement rehabilitation. Generally within pavement management programs, a PCI range between 55 to 70 determines the threshold of when preventive or major overlay maintenance is activated. Based on the City's weighted average PCI, condition distribution, maintenance practices, our team has identified a PCI of "65" as the minimum level of service. This means that any pavement section with a PCI greater than 65 will be recommended for preventive maintenance (i.e. slurry seal). This recommendation is indicated in Table 6, Section II.

Bucknam developed three multi-year Capital Improvement Programs for the City based on the pavement records, yearly capital expenditures, available funding and the most recent 2018 inspections. These recommendations and results are shown in Section II of this report where, for example, we have demonstrated what level of funding is necessary to improve the current weighted condition level of 66.5 to a level of 75 by FY 2024.

As shown in Figure 3, 41% of the City's streets are in Excellent to Very Good condition. These sections will be targeted for "preventive" maintenance within our Capital Improvement Program (CIP) recommendations. The reasoning in doing this is to extend the life cycles of those "good" pavement sections which accrues capital saving to aggressively rehabilitate those pavement sections that are below the "minimal level of service".

In order to achieve the most effective and optimum program for the City, certain strategies have been selected and/or analyzed. Below is a listing of the maintenance activities utilized in strategy development. Each activity is representative of the types of work that have been programmed as part of the long-term maintenance requirements of the City's street network.

General Repairs-Stop Gap (Localized Maintenance*)

For this maintenance type, small localized surface treatments are utilized as "holding action" solutions (stop gaps) to delay the need for pavement structural strengthening. They typically include activities such as crack sealing, AC deep patching, AC skin patching, PCC slab replacement, grinding and leveling.

The City of Monterey Park may consider an Asphalt Zipper to apply proactive localized surface patch repairs. In doing this, they prevent portions of pavement sections (high severity distress locations) from deteriorating at a continuously fast rate.

High Density Mineral Bond (HDMB) - (Global Maintenance*); PCI range – 75 to 95

This alternative application should be applied to Local pavement sections that are within a PCI range of 75 to 95; the benefit of applying HDMB is the extension of life it provides prior to having a slurry seal applied. HDMB is comprised of a mixture of fine aggregates and UV-blocking polymers suspended in a non-ionic asphalt emulsion. HDMB application life-cycles are averaging 7 to 8 years without surface oxidation and are preventing 400% less cracking within a section during that timeframe. HDMB can be applied on conventional and/or rubber asphalts, retains its aesthetics longer than Type 1 / Type 2 slurry and does not require the sweeping or removal of loose aggregate. It is applied through specialized equipment that can uniformly disperse a thixotropic material along a retractable spray bar; applications are guaranteed for five (5) years.

Slurry Seals (Global Maintenance*); PCI range – 60 to 85

Surface treatments applied to pavements with minimal surface distress to provide new wearing surfaces and extend pavement life. Generally consists of a mixture of conventional or latex-modified emulsified asphalt, well-graded fine aggregate, mineral filler and water placed over an existing AC surface; Slurry seal application life-cycles are averaging 4 to 5 years. Type II Slurry is recommended for Local streets.

Cape Seals (Global Maintenance*); PCI range – 40 to 60

This is an application of a single layer of asphalt binder to a road surface immediately followed by a single layer of cover aggregate (chips). The single layer chip seal is then followed with a slurry seal application; Conventional cape seal application life-cycles are averaging 6 to 7 years. For sections that have lower PCI's in this range, leveling courses should be considered.

Overlays (Major Maintenance*); PCI range – 20 to 60

AC Overlay – Placement of a layer of hot-mixed asphalt concrete over the existing pavement surface (may include pavement fabric). Grinding (milling) is performed prior to the overlay to reduce the total height of asphalt and assure alignment with existing gutter lines. This also includes "dig-outs" and crack sealing prior to the application of an overlay. This treatment provides a new wearing surface and increased structural strength to the pavement section. A conventional overlay should be designed for a ten-year life.

Asphalt Rubber Hot-Mix Overlay - The ASTM definition is: Asphalt-Rubber is a blend of asphalt cement, reclaimed tire rubber and certain additives in which the rubber component is at least 15% by weight of the total blend and has reacted in the hot asphalt cement sufficiently to cause swelling of the rubber particles. Specifically, using crumb rubber modified binders in pavement application benefit local agencies in that cities find:

- Pavement resists cracking by being more flexible;
- Cost savings come from a longer life cycle (from Bucknam's experience typically 20% longer), decreased maintenance and the use of less material
- Improvement in skid resistance;
- Decreased noise; and
- It provides long-lasting color contrast for marking and striping
- Life cycles are averaging 8 to 12 years

Reconstruction (Major Maintenance*); PCI range – 0 to 20

Removal of the existing pavement section to a prescribed depth followed by the placement of a conventional flexible pavement section using a structural AC Hot Mix or AR Hot Mix or a full depth asphalt. Each classification of road has a typical design cross-section upon anticipation traffic loading. By performing a reconstruction the sections PCI resets at 100 and restarts the life-cycle deterioration of the section.

*Localized, Global and Major maintenance activities are default terms used within the StreetSaver pavement software. Specific pavement repair applications are placed within each maintenance activity in order to develop multi-year maintenance forecast recommendations.

ANNUAL BUDGET PROJECTIONS

The budgeting process was approached with the following in mind; generate three unique work programs for the next five (5) years based upon actual road pavement conditions in order to:

1. Demonstrate how an annual $2.5 Million/yr Street Bond budget performs against the 2018 conditions;
2. A "Increase PCI to 75" budget was generated for the City to demonstrate what level of annual Public Works maintenance and rehabilitation CIP funding is necessary to increase the citywide weighted PCI to 75 by FY 2024.

Based on current and future pavement maintenance needs, three annual work programs have been prepared and summarized below. Table 3 demonstrates the how today's conditions react to the City's annual pavement funding budget ($2.5 Million/yr). Table 4 demonstrates a $4.9 million/yr that is necessary to increase the City's PCI to 75 by FY 2024. The revenues shown below account for the cost of pavement preventive maintenance and rehabilitation, a 30% contingency applied to unit costs and 3% annual inflation.

Plan Year	PCI Before	PCI After	Slurry / Cape	Overlay / Recon	Total $
2019-20	66.5	68.1	$289,150	$2,194,779	$2,483,929
2020-21	66.9	69.0	$52,594	$2,386,347	$2,438,941
2021-22	67.4	69.6	$51,962	$2,439,541	$2,491,503
2022-23	68.2	69.9	$77,324	$2,404,206	$2,481,530
2023-24	68.9	70.6	$77,350	$2,403,695	$2,481,045
			$548,380	$11,828,568	$12,376,948

Table 3 – Citywide Projection Utilizing $2.5 Million / Yr Budget

Plan Year	PCI Before	PCI After	Slurry / Cape	Overlay / Recon	Total $
2019-20	66.5	69.1	$294,193	$4,592,006	$4,886,199
2020-21	67.6	70.2	$47,849	$4,894,083	$4,941,932
2021-22	69.1	72.1	$110,428	$4,813,919	$4,924,347
2022-23	70.8	73.3	$47,161	$4,817,953	$4,865,114
2023-24	72.0	74.9	$19,305	$4,826,468	$4,845,773
			$518,936	$23,944,429	$24,463,365

Table 4 – Necessary Funding to Increase Citywide PCI to 75

Additional detail and breakdown of budget projections are demonstrated in Section IV of this report. All work program budgets generated are presented in terms of current 2018 dollars. All repair activities were based on distresses observed at the time of the field survey. These are recommendations and are to be used as "the best case scenario" for improving the City of Monterey Park street network.

QUALITY CONTROL EFFORTS

As indicated in our scope of work, Bucknam performed numerous quality control checks in the field during survey efforts as well as specific site investigations requested by the City. Field check efforts were performed at the end of each week of survey. The City did not have a previous electronic copy of the previous PMP database; Bucknam developed the new StreetSaver database through the use of the City's previous 2015 MicroPAVER database and hardcopy reports. During in-house and field operations, we came across a minor amount of issues with the hard copy reports. These included public v. private streets designations, missing streets, incorrect pavement section widths, lengths and true areas; these were corrected through our field inspections.

Working with the City's project manager, we identified several private streets that needed to be removed from the Monterey Park PMP database; additionally, through our internal quality control efforts, we believe we have found all the necessary publicly owned streets that needed to be reported on under this project.

Utilizing the City's centerline GIS data provided solutions to segment length issues and total section area measurements.

FINDINGS AND RECOMMENDATIONS

Arterials

The actual workload requirements identified indicate that the Arterial street network is currently in "Very Good" condition. To maintain this condition, it is critical that preventive maintenance and overlay activities are funded at the levels identified in Table 3 to maintain a Very Good network weighted average PCI value.

Our arterial/collector findings for conditional data and recommendations for revenue expenditures are shown below:

- The Arterial/Collector network has a weighted PCI of 72.8;
- Currently, 32% of the arterial network (approx. 15.0 miles) qualify for overlay/reconstruction maintenance; 28% (approx. 13.2 miles) qualify for slurry seal preventive maintenance;
- Develop a proactive fiscal and planned approach to identify future arterial overlay projects based on the deterioration modeling within StreetSaver;
- Appropriate the necessary arterial CIP revenues at the levels shown within the Section IV Forecasted Maintenance Report for a minimum of five years to generate the results identified within this report.
- Reassess/re-evaluate the arterial rehabilitation budget program every two years to improve on CIP forecasts for 2018-19 and beyond to ensure the results shown in Table 3;
- Perform pavement inspections on the arterial network every two years in order to proactively track pavement deterioration rates and to improve upon the planning modes shown within this report.
- Demonstrated budget shown in Table 3 is ample improve upon the Arterial weighted PCI of 72.4 after five years, however, the citywide deferred backlog increases from a level of $10.6 million to $33.4 million after five years;
    - This is an indication that additional arterial overlay/rehabilitation funding is necessary to reduce the amount of deferred CIP projects on the network;
- Bucknam recommends that the City proactively budget pavement maintenance at the levels shown in Table 4 in order to improve upon the conditions found today

Locals

The actual workload requirements identified indicate that the Local street network is currently in "Good" condition. To proactively increase this condition, it is critical that preventive maintenance and overlay activities are funded at the levels identified in Table 4 to obtain a Very Good network weighted average PCI value.

Our Local findings for conditional data and recommendations for revenue expenditures are shown below:

- The Local network has a weighted PCI of 62.0;
- Currently, 53% of the local network (approx. 42.6 miles) qualify for overlay/reconstruction maintenance; 29% (approx. 22.9 miles) qualify for slurry seal preventive maintenance;
- Follow the proactive Local preventive/overlay fiscal plan approach shown in the Section IV reporting;
- Reassess/re-evaluate the Local rehabilitation budget program every two years to improve on budget forecasts for 2018-19 and beyond to ensure the results shown in Table 4;
- Perform pavement inspections on the Local network every three years to build a solid planning model within StreetSaver to track PCI deterioration (1/3 of the City each year);
- Demonstrated budget shown in Table 3 is ample to improve upon the Local weighted PCI; however, the citywide deferred backlog increases from a level of $10.6 million to $33.4 million after five years;
    - This is an indication that additional local overlay/rehabilitation funding is necessary to reduce the amount of deferred CIP projects on the network;
- Additional overlay/rehabilitation funding should focus on pavement sections within the PCI range of Good to Poor (PCI 70 to 26).

SECTION II
PAVEMENT MANAGEMENT PROGRAM – CAPITAL IMPROVEMENT PROGRAM

Bucknam performed the following services in accordance with the scope of services that was contracted with the City of Monterey Park. As a quick overview, the following tasks were performed to complete the work over the past several months:

2018 Pavement Management Work Efforts:

Task 1: Project Kickoff-Data Management
Task 2: Update of Maintenance Activities
Task 3: Pavement Condition Survey (approx. 126.1 miles)
Task 4: Budgetary Analysis and Capital Improvement Reports
Task 5: Executive Summary and Final CIP Reports
Task 6: Mapping of the Pavement Network

Pavement Management Update 2018

As a part of the 2018 update of the pavement management program, a major element of work was to complete a comprehensive assessment of the existing street network and PMP data within the City. This included assessing the City's existing 2006, 2010 and 2015 PMP reports, GIS centerline, street naming conventions and work history information. From there, Bucknam worked with the City to confirm public and private street listings which set the foundation for accurate CIP reporting. All data was then updated into the City's current StreetSaver database.

Work history information was provided by the City in the form of institutional knowledge, maps and Excel documents. This information was entered into the proper pavement segments that match the limits of those projects. From there, CIP pavement recommendations were performed (discussed and demonstrated below) where the pavement maintenance information the City provided (PMP material practices, unit costs, and capital budgets) were used to generate recommendations through the StreetSaver system.

Table 6 demonstrates PCI ranges identified within StreetSaver. Once a pavement inspection is complete, a PCI is calculated for each pavement section. Each PCI calculated falls within a defined PCI range category (Very Good, Poor, etc.). Furthermore, a weighted PCI was calculated for the each functional class within the network (arterials, locals, alleys).

The PCI is a condition rating that ranges from 100 (a new pavement section or recently overlaid or reconstructed) to 0 for a section that has structurally failed and deteriorated dramatically. Weighted average PCI of a given area/zone = pavement section PCI multiplied by its own area divided by the total square footage of the given area/zone. This information can also be represented through StreetSaver to show how much square footage or percentage of area falls within a PCI range category.

PCI RANGE	CONDITION
86-100	Excellent
71-85	Very Good
56-70	***Good (Monterey Park Network 2018 = 66.5)***
41-55	Fair
26-40	Poor
11-25	Very Poor
0-10	Failed

Table 5 - PCI Range
(Additionally, see page 26 for detailed description of PCI ranges)

These condition ranges are defined by the Army Corps of Engineers and defaulted within the StreetSaver software. The summary of all roads condition data and their representative PCI's can been seen in the Pavement Condition Report in Section III.

STRATEGY ASSIGNMENT TABLE

Once the appropriate activities from the above listings were selected by the City, a Maintenance Strategy Table was defined within the system that allocated the appropriate actions to the specific repair needs of the street. In defining the maintenance strategy list, emphasis was placed on defining pavement condition thresholds and using the PCI for the specific maintenance activities within these categories.

Strategy Assignment Table

All Streets		
PCI Range	**Description**	**Unit Cost**
20-100 Varies by Activity	Preventative, Stop Gap, Patching	Varies by Activity
60-85	Type II Slurry (Locals)	$0.19/SF
60-85	Type II Slurry (Arterials)	$0.38/SF
Minimal Level of Service (65)		
40-70	Cape Seal (Locals)	$0.50/SF
20-70	2" AC Grind & Overlay (Local)	$1.55/SF
20-70	2" ARHM Overlay (Arterial)	$1.73/SF
0-20	AC Recon 4" / 6" CAB	$7.90/SF
0-20	PCC Recon	$12.00/SF
	30% Contingency included within All Unit Costs	

Table 6 - Strategy Assignment Table

The Strategy Assignments List, shown in Table 6 was developed to identify the most critical segments in each of the work programs (Arterial, Collector and Local). Segment priorities were established by determining the range of PCI's requiring first attention based on the relative value of each segment's PCI, thus maximizing the annual maintenance budget. Also, distress quantity, area extent, type (load / climate) and distress severity levels were critical elements in the decision process for recommending maintenance. The assignment table is used as a guide within StreetSaver to recommend maintenance, however, further assessment by City staff and/or outside parties can override maintenance recommendations. This can be done by reviewing and assessing distress extents and their weighted percentages.

Once the strategy assignments were set within the system, budgets and work assignments were generated for each work program on an annual basis. Using pavement deterioration curves for each type of pavement surface and class of road, both current year and future years work requirements for each pavement segment within the City were determined. In forecasting the maintenance requirements in future years, the current PCI value is reduced annually for each pavement segment based on the StreetSaver deterioration curves within the City's database.

Likewise, maintenance activities performed in a given year increase the PCI value as they are applied to the segment. The overall program is dynamic in that each strategy consists of a cyclic series of actions that simulates the pavement anticipated life cycle.

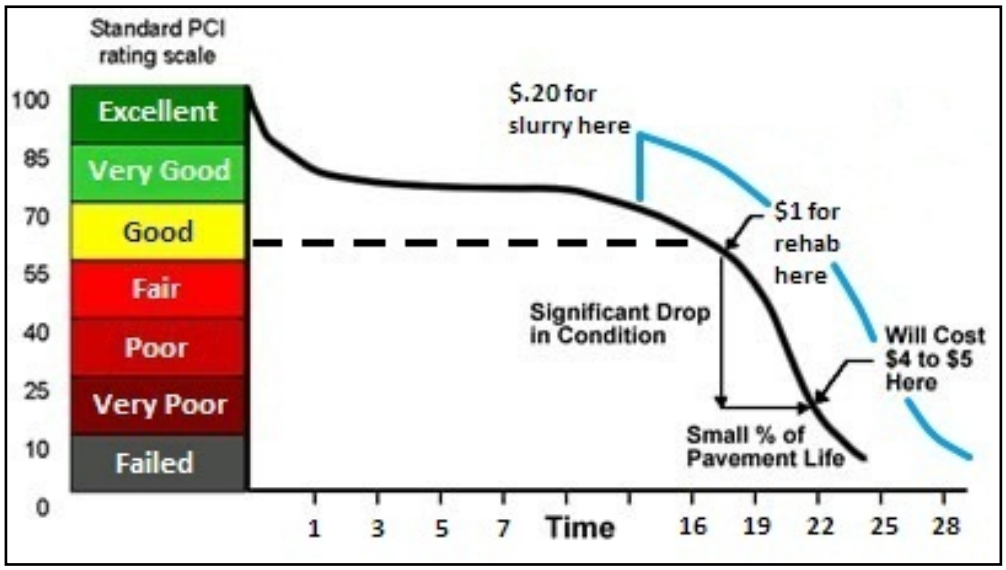

Figure 4 – Sample Pavement Life Cycle / Deterioration Rate

MULTI-YEAR ANNUAL WORK PROGRAM PROJECTIONS

The goal of these projections is to assist City policy makers in utilizing the recommendations of the StreetSaver system. By using the City of Monterey Park's current budgets and maintenance practices the system will develop "section unique" improvements and strategies. Each segment will be tied to a specific fiscal year. As shown in the following pages, we have assessed the budgets that have been projected to meet the maintenance and rehabilitations needed to maximize the City's return on investment. The budget forecasting goal for the City network focused on:

- Establishing a proactive multi-year Maintenance & Rehabilitation Program;
- Developing a preventive maintenance program; and
- Selecting the most cost-effective repairs based on City strategies

STREET BOND $2,500,000/YR BUDGET – This budget was generated for the City to demonstrate how the City's 5-Year Roadway Infrastructure funding allocation performs against the current citywide conditions. The City's annual potential/planned budget is funded through the following sources:

- Gas Tax
- SB1
- Measure R
- Measure M (Potential reimbursement revenue to payback Street Bonds)
- General Fund
- Proposition C
- Surface Transportation Program-Local (STPL)

INCREASE PCI TO 75 BUDGET – A "Increase PCI to 75" budget was generated for the City to demonstrate what level of annual Public Works maintenance and rehabilitation CIP funding is necessary to increase the citywide weighted PCI to 75 by FY 2024.

All multi-year budget projections include a 3% inflation rate for the term of the budget forecast.

ARTERIAL-COLLECTOR / LOCAL BUDGET PROJECTIONS

The annual projected revenues shown below only account for the cost of pavement maintenance and rehabilitation activities. A 30% contingency was applied to the pavement costs. Additional soft costs not included within the cost of pavement maintenance include:

- Right-of-way, curb & gutter, ADA ramp improvements;
- Utility improvements;
- Design, construction management, inspection, testing;
- Tree removals;

STREET BOND $2.5 MILLION /YR BUDGET – The City is currently considering issuing a potential "Street Bond" of $2.5 Million/yr to address the large amount of needed overlay CIP funding. The first key step in developing a proactive PMP is to model the City's existing conditions against this proposed annual budget. In doing this, PCI performance, deferred maintenance and pavement application uses are able to benchmarked and demonstrated in a positive or negative result. Bucknam utilized the City's $2.5 million/yr budget to establish a benchmark scenario for pavement funding; the City provided Bucknam with current 2018 unit costs for pavement maintenance applications currently being used by the City. Comparing the 2018 unit costs to the 2015 costs we found an approximate 35% reduction in total costs (i.e. slurry seal, overlay, etc.). This made a positive impact to the network by allowing more pavement sections to be recommended for work compared to the 2015 analysis. Additionally, our model focused 30% of the available funding to Arterials and 70% to Locals.

$2.5 MILLION/YR BUDGET PROGRAM (STREET BOND MODEL)

This budget program incorporates pavement sections that have a functional class of Arterial (A, C) and Local (L.

Plan Year	PCI Before	PCI After	Slurry / Cape	Overlay / Recon	Total $
2019-20	66.5	68.1	$289,150	$2,194,779	$2,483,929
2020-21	66.9	69.0	$52,594	$2,386,347	$2,438,941
2021-22	67.4	69.6	$51,962	$2,439,541	$2,491,503
2022-23	68.2	69.9	$77,324	$2,404,206	$2,481,530
2023-24	68.9	70.6	$77,350	$2,403,695	$2,481,045
			$548,380	**$11,828,568**	**$12,376,948**

Table 7 – Citywide Projection Utilizing $2.5 Million/Yr Budget

By modeling the existing pavement conditions against $2.5 Million/yr funding, we have found that one positive and one negative result occurs over the five year CIP. (See Figure 5 below). First, the weighted PCI for the entire network increases from a level of 66.5 to a level of 70.6 over the five year CIP.

DEFERRED MAINTENANCE

Delaying repairs on streets where pavement condition indicates a need creates deferred maintenance. Deferred maintenance includes pavement maintenance / rehabilitation that is needed across the entire network, but cannot be performed due to the lack of available funding and is pushed to the next budget cycle. The actual repairs that are being deferred are often referred to as a "backlog".

As maintenance is deferred, the opportunity to apply life extending preventive pavement applications is lost and the ultimate cost of rehabilitation multiples.

Secondly, the resulting deferred maintenance backlog increases from $10.6 million to $33.4 million after the five years program which indicates that an annual $2.5 Million pavement budget is not ample enough to decrease the high amount of deferred rehabilitation maintenance on the pavement network.

Limited funding equals deferred projects which does not allow necessary overlay projects to be completed on the arterial, collector, and local networks; if the City continues to fund rehabilitation maintenance at these levels, high deferred maintenance costs will create a stagnation in the network PCI where it will remain at a level within the low-70's for numerous years.

Currently, within the calculated citywide deferred maintenance 7% of the costs are for slurry, cape and stop gap maintenance and 92% for grind/overlay and reconstruction.

As shown, this projection model does increase PCI but does not meet the initial goal of maintaining or decreasing the City's deferred maintenance/rehabilitation. In order for these scenarios to produce these results proactive continuous funding is necessary; on an annual basis, the City should monitor the management of overlay deferred maintenance. The potential delay in projects and the resulting buildup of more overlay work in the five-year time frame is not a debt that City will want to accept.

Through Bucknam's analysis of the previous pavement database, work history dates and our experience with AC Overlay deterioration rates, it is important to point out that pavement sections that were overlaid in the early part of the mid-2000's (FY's 2005-2007) will need proper overlay maintenance approximately around fiscal year 2019-20 and beyond.

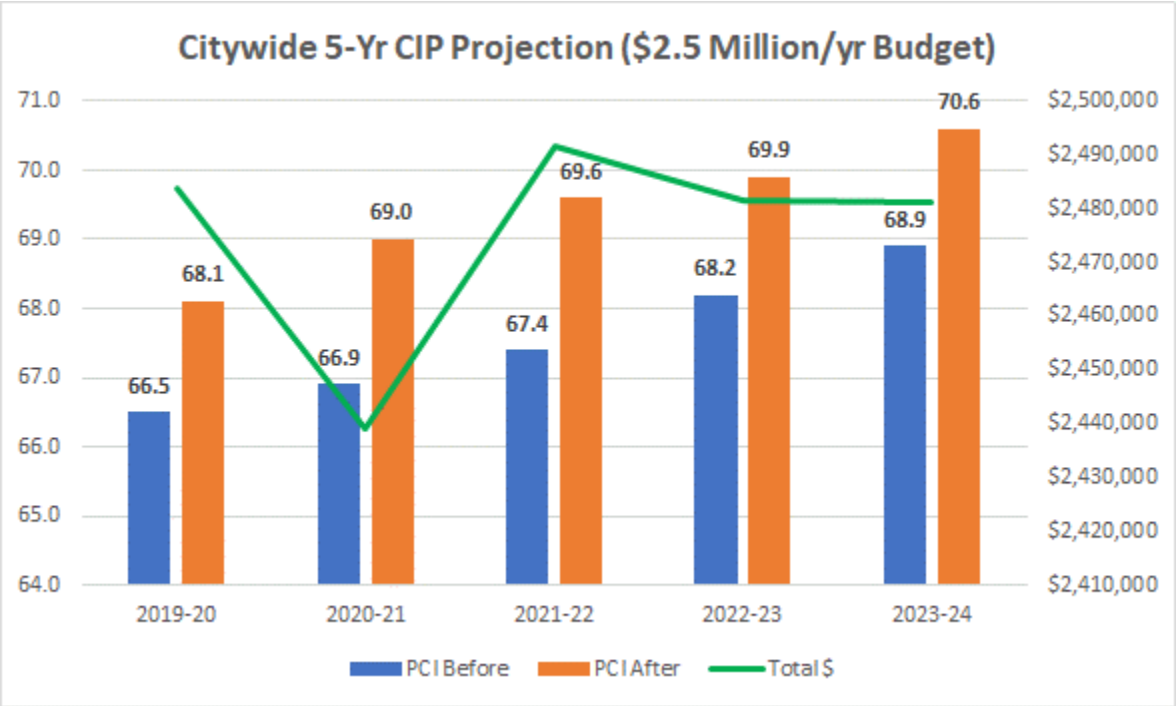

Figure 5 – Resulting Network PCI ($2.5 Million/yr Budget)

The resulting "decrease of the weighted PCI" shown above for the entire network demonstrates how applying inadequate capital funds to specific areas of the network allows the City's pavement to deteriorate at a rate that is not conducive to a successful PMP. Additionally, even with the limited budget, the City should continue to implement localized maintenance (i.e. alternative High Density Mineral Bond (HDMB) applications, Asphalt Zipper deep patching, leveling courses, crack sealing, etc.) prior to any major slurry seal and/or overlay maintenance. By performing stop gap measures to individual pavement sections prior to conventional slurry and overlay applications the overall performance of the sections condition sustain itself longer than if no stop gap maintenance was performed.

INCREASE PCI TO 75 PROGRAM (FIVE YEAR MODEL)

With the City striving to show proactive rehabilitation across all qualifying pavements, the $4.9 Million budget program was applied to current conditions to show the potential return on investment.

Again, we used the "$2.5 Million/yr" 5-yr PMP model (shown above) as a cornerstone for our modeling within the "Street Bond Increase PCI" program. Building upon the short falls of the previous reporting model we increased the amount of funding available for overlay/rehabilitation efforts and focused our recommendations within geographic zones/neighborhoods.

The "Street Bond" program incorporates pavement sections that have a functional class of Arterial (A, C) and Local (L).

Plan Year	PCI Before	PCI After	Slurry / Cape	Overlay / Recon	Total $
2019-20	66.5	69.1	$294,193	$4,592,006	$4,886,199
2020-21	67.6	70.2	$47,849	$4,894,083	$4,941,932
2021-22	69.1	72.1	$110,428	$4,813,919	$4,924,347
2022-23	70.8	73.3	$47,161	$4,817,953	$4,865,114
2023-24	72.0	74.9	$19,305	$4,826,468	$4,845,773
			$518,936	$23,944,429	$24,463,365

Table 8 – Necessary Funding to Increase PCI to 75

Referring to Table 8, it is noted that the weighted PCI increases proactively through the five-year projection (66.5 to 74.9). Additionally, the annual deferred maintenance total increase from $8.1 million to $21.8 million at the end of the five-years. If the City utilizes an average annual budget of $4,893,000/yr for slurry, overlay, and reconstruction maintenance as shown above, the City will be able to "increase" the current conditions and will continue to see a sustaining of deferred maintenance (mostly overlay maintenance) by fiscal year 2025.

We recommend that a stronger focus be placed on the Local network improvements due to the fact that the Local network is larger in total square footage (3,891,445 SF larger) and has a lower weighted PCI than the arterials. We still recommend consistent maintenance to the arterial network, i.e. localized patching, ARHM through the use of awarded SB 1. Proposition C and Measure R funds. But again, with the Local network showing a higher degree of negative results, a new focus for neighborhood area maintenance and proactive overlays should be considered.

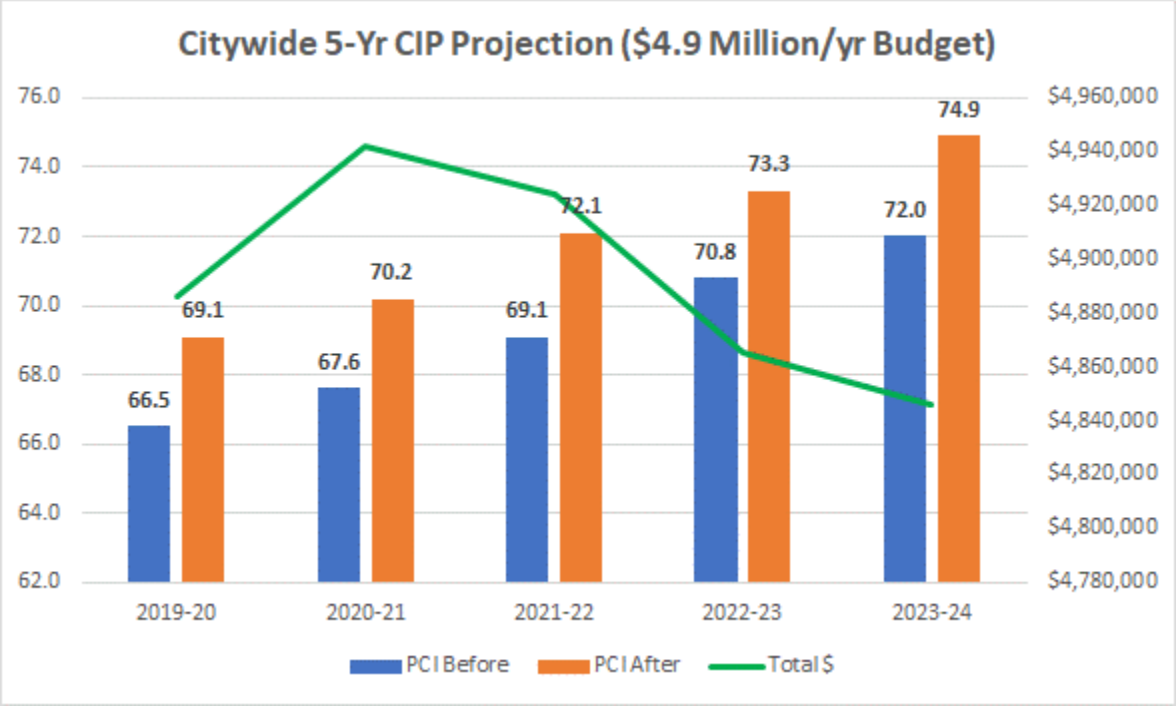

Figure 6 – Resulting Network PCI (Increase PCI to 75 Budget)

The City should consider establishing a Local slurry/cape seal maintenance "neighborhood" strategy for several reasons. First, preventive maintenance applications applied five plus (5+) years after rehabilitation, like those mentioned above, will help to sustain high levels of condition while reducing annual expenditures. Secondly, with a citywide maintenance neighborhood methodology established, four beneficial impacts occur:

1) Planned / Maintenance areas are addressed through a multi-yr maintenance cycle which creates a dedicated project schedule for City staff and constituent inquiries;
2) Deferred overlay maintenance can be addressed in a more effective manner due to accrued savings of revenues (reduced construction logistical costs, volume-based costs, etc.)
3) A preventive maintenance strategy is more cost-effective in a long-term PMP rather than implementing a maintenance approach that addresses only the "worst-first" streets.
4) All maintenance alternatives are available due to the increased funding and focused maintenance per year.

The Local maintenance model that has been developed under the "Street Bond" budget can be used as a benchmark to monitor the City's annual budget allocations as the network continues to mature and age; the proper amount of funding for overlay maintenance needs to be the City's highest priority.

Again, it is recommended that the City continue to monitor the deterioration rates for the applications of Grind & Overlay, Cape Seal and Type II slurry seal to ensure the City is generating the greatest return-on-investment and extend life-cycles; this should be done through frequent inspections and deterioration studies.

PAVEMENT MANAGEMENT PROGRAM REPORTS

In addition to the annual budget scenario, this report contains a comprehensive and complementary assemblage of pavement management reports ranging from summary reports to annual maintenance and rehabilitation schedules (Forecasted Maintenance Report, Section IV). Collectively as well as individually, the reports represent reasonable projections of pavement maintenance needs and performance based on visual condition assessments, unit cost estimates, and pavement deterioration models.

It is important to note that pavement segment dimensions and surface area (recorded during 2006, 2010, 2015 and 2018 inspections), along with the action and repair costs, as presented within the reports are accurate within tolerable limits. This is noteworthy due to the "implied" accuracy of reporting length and width to the nearest foot, surface area to the nearest square foot, and action and repair unit costs and project estimates to the nearest penny and dollar, respectively.

NEXT STEPS

As with any infrastructure management software program, time investments need to be made by key Public Works staff to maintain the integrity of the data as well as the accuracy. Bucknam can perform training sessions in the use of the StreetSaver system and demonstrate how to generate standard maintenance reports to assist City staff in developing yearly budgets, project level analysis, and CIP projections. This will be key to future staff management of the pavement program and reporting. City personnel need to maintain their commitment to the preventive maintenance system, while working toward reducing the City's present backlog of rehabilitation projects.

In order to ensure that report outputs are accurate and credible, it is essential that the integrity of all data files be maintained. This will require performing all necessary updates when changes are made to scheduling scenarios, unit cost information, historical data, etc. In addition, the entire pavement network will have to be re-inventoried at regular intervals. This typically includes surveying arterial and collectors every <u>two years</u> and Locals every <u>three</u>. One recommendation the City may consider to keep the program "managed" is:

- Survey arterials every two years; and
- Survey Locals every three years

This will not only allow work to be scheduled based on the most current condition data available, but will provide City personnel with a means to monitor actual rates of pavement deterioration so appropriate modifications can be made to the system curves. To be compliant with the METRO requirements, the City must generate a triennial Arterial and Collector network pavement management report indicating condition ratings.

Bucknam will be supporting the City with staff level support to assist in the continuous updates with the StreetSaver system. This will include work history updates, generating reports from the system, unit cost updates, and future inspections.

CONDITION DISTRIBUTION REPORT

This report graphically depicts the distribution of the pavement condition throughout the street network by area.

The condition scheme ranges from "Excellent" to "Failed"; with a "Excellent" condition corresponding to a pavement at the beginning of its life cycle, and a "Failed" condition representing a badly deteriorated pavement with virtually no remaining life.

The table below shows the general description for each pavement condition:

Condition Description – PCI Range – Description

Condition Description	PCI Range	Description
Excellent	86-100	Minor to low distress, no significant distress
Very Good	71-85	Low severity distresses with expection of utility patches in good condition or slight hairline cracks; minor weathering found
Good	56-70	Slight to moderately weathered, low to moderate distress severities, utility patching commonly found; moderate distress
Fair	41-55	Severly weathered or moderate levels of distress, generally limited to utility patching and climate related distress
Poor	26-40	Moderate to high distresses including load related types such as alligator cracking, greater distress extents
Very Poor	11-25	Severly distresses, large quanities of distortion or alligator cracking
Failed	0-10	Failure of the pavement, distress has surpassed tolerable rehabilitation limits

2018 City of Monterey Park weighted average PCI is 66.5.

CALCULATION OF PCI

In order to calculate a Pavement Condition Index (PCI) value within StreetSaver, specific street section data needs to be inputted into StreetSaver to define the survey limits, asphalt types, pavement age and metrics. Pavement "sections" are pavement segments within the defined branch that have consistent pavement street classifications, construction/maintenance histories and use. Representative inspection samples are then selected and visually surveyed to locate distress data. This data is used to calculate the pavement sections Pavement Condition Index (PCI) which includes distress type, extent of the distress and its severity.

The PCI is a condition rating that ranges from 100 (pavement section that is in perfect condition) to 0 for a section that has structurally failed and deteriorated dramatically. The PCI is calculated from three major data entries from our inspectors:

1. Distress Type (one of 20 AC or 19 PCC types); these include alligator cracking, bleeding, block cracking, corrugations, depressions, long/trans cracking, patch/utility cut, potholes, rutting, weathering, raveling, etc.
2. Distress Quantity (the square footage, length or count of a specific distress)
3. Distress Severity (the level of severity determined for each distress found; low, medium or high)

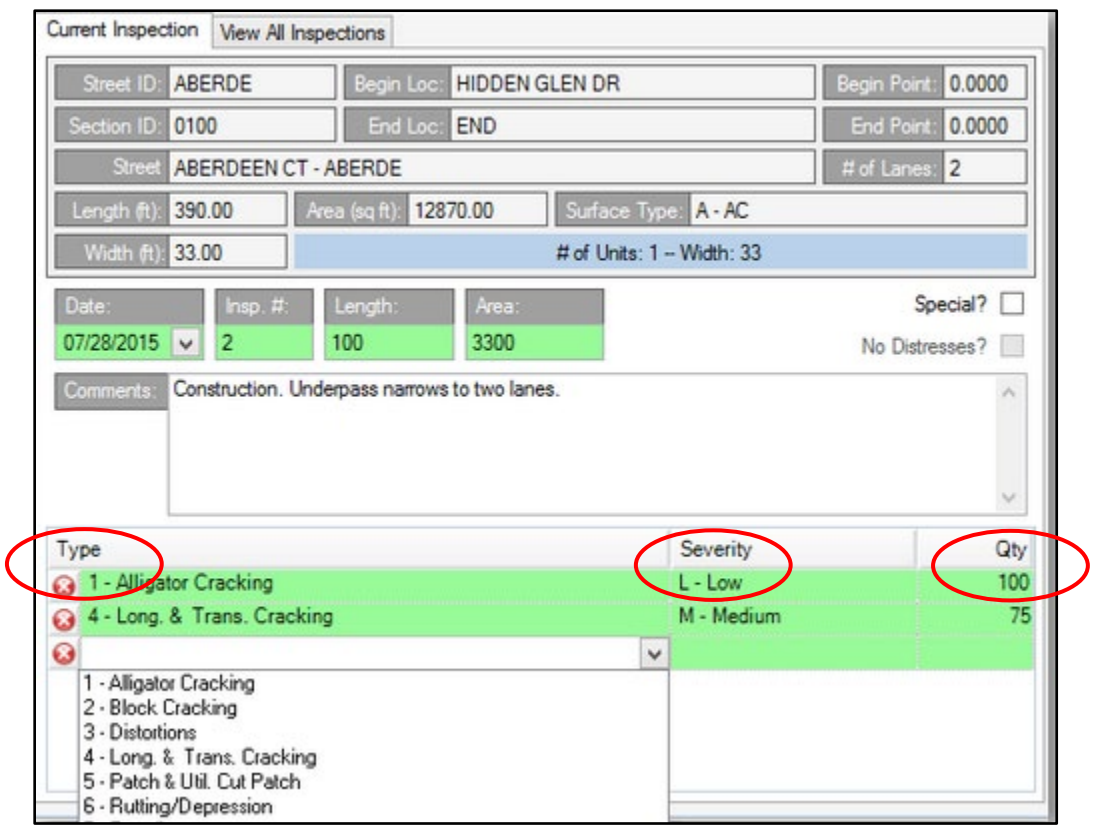

Figure 7 – PCI Calculation Worksheet

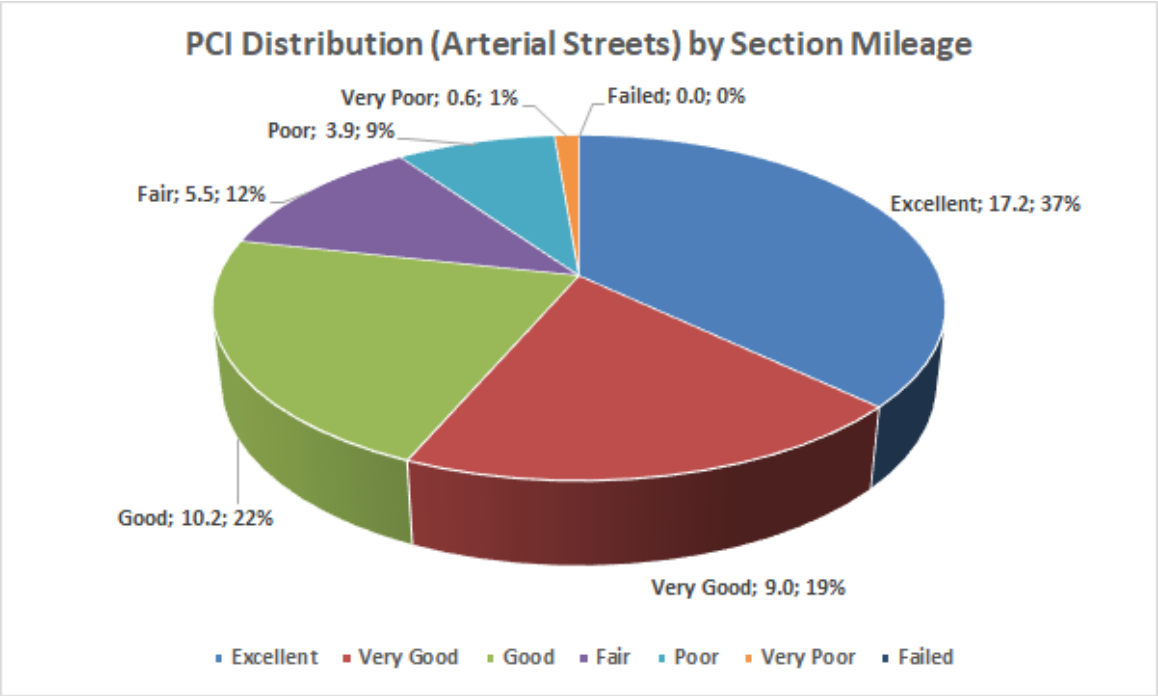

Figure 8 – Arterial Condition Distribution

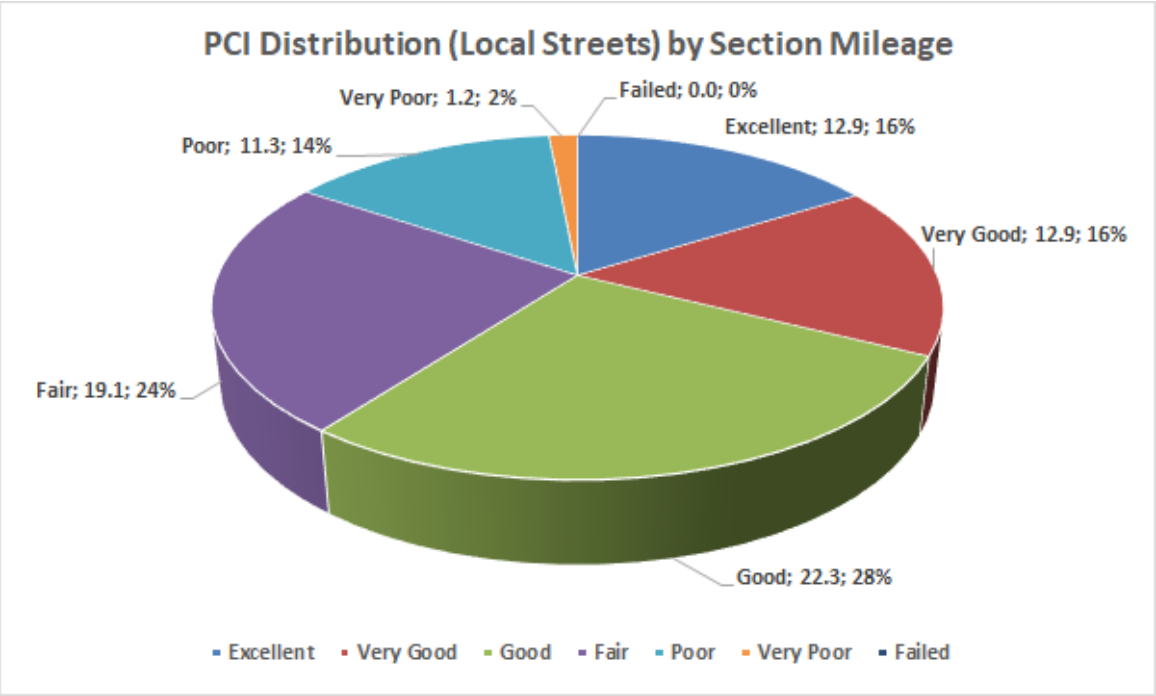

Figure 9 – Local Condition Distribution

SECTION III

CITYWIDE
PAVEMENT CONDITION INDEX REPORT

A. PCI Report Definitions
B. Citywide PCI Map
C. A to Z
D. PCI Order

PAVEMENT CONDITION INDEX REPORT

Listed alphabetically by street name or PCI, this report provides the City with a listing of pertinent inventory and pavement condition data for each inventory unit within the City's pavement network. The Pavement Condition Index (PCI) Report notes the names, limits, classification, dimension, surface type, and lane configuration of each inventory unit.

Detailed descriptions of the information appearing on this report are presented below:

BRANCH NAME - The name of each inventory unit appears in this column. Generally, the inventory unit name is taken directly from a street sign; however, where no street signs are posted, the name appearing on the network map is noted instead.

A sample set of street name suffix abbreviation definitions is presented below:

AVE -	Avenue	CT -	Court	CIR -	Circle
DR -	Drive	LN -	Lane	RD -	Road
ST -	Street	WY -	Way	EB -	East Bound
NB -	North Bound	SB -	South Bound	WB -	West Bound
TER -	Terrace	PL -	Place		

FROM - A description of the beginning limit of each inventory unit appears in this column. If the beginning limit exists between intersections, then the beginning limit description may be an address, post mile marker, or a distance from a known point of reference (e.g., "500' N/MAIN ST").

TO - A description of the ending limit of each inventory unit appears in this column. Like BEGIN limit, the END limit description may consist of a street name, an address, or a distance from a known point of reference. In the case of cul-de-sacs, or dead-ends, the END limit consists of and address, or a directional reference, such as "NORTH END," when no address is available.

STREET CLASSIFICATION - The codes for three street classifications are represented below. Basically, units are classified according the LA County MPAH and City classifications.

CODE	DESCRIPTION
A	Primary Arterial
C	Collector / Secondary
L	Local

SURFACE TYPE - A code was assigned to each inventory unit to describe surface type.

CODE	DESCRIPTION
AC	Asphalt Concrete
PCC	Concrete

LENGTH - The length of the section within each branch.

UNITS - The unit of measurement for the section length, typically linear feet (LF).

AREA - The area of each section within a branch.

UNITS - The unit of measurement for the section area, typically square feet (SF).

PCI - Pavement Condition Indices were calculated for inventory units based on severity and extent of distress manifestations observed within the inventory unit. Ranging between 0 and 100, a PCI of "100" corresponds to a pavement at the beginning of its life cycle, while a PCI of "0" corresponds to a badly deteriorated pavement which is at or near the end of its life cycle.

PCI CLIMATE, LOAD AND OTHER – reflects "Section Extrapolated Distress"; these values are shown within the Sample Distresses tab within the PCI window. Distresses are aggregated based on the type and severity level. For random samples, distress quantities are adjusted to reflect the extrapolated value based on the sections total area. Extrapolated distress deducts are classified as resulting from Climate, Load and Other distresses. The Distress Classification portion of the tab shows the "percent" of extrapolated distress deduct belonging to Climate, Load and Other (these %'s are shown within the PCI reports herein). These values are beneficial in that they support the decision whether recommend slurry seal, overlay or reconstruction project for street sections.

INSPECTION DATE – Represents the most recent inspection date performed on a given sections. PCI shown is historical in value and may not indicate what "today's" PCI is due to variance in time. Pavement deterioration calculations can be performed on a section(s) to demonstrate a deteriorated PCI based upon a new current date.

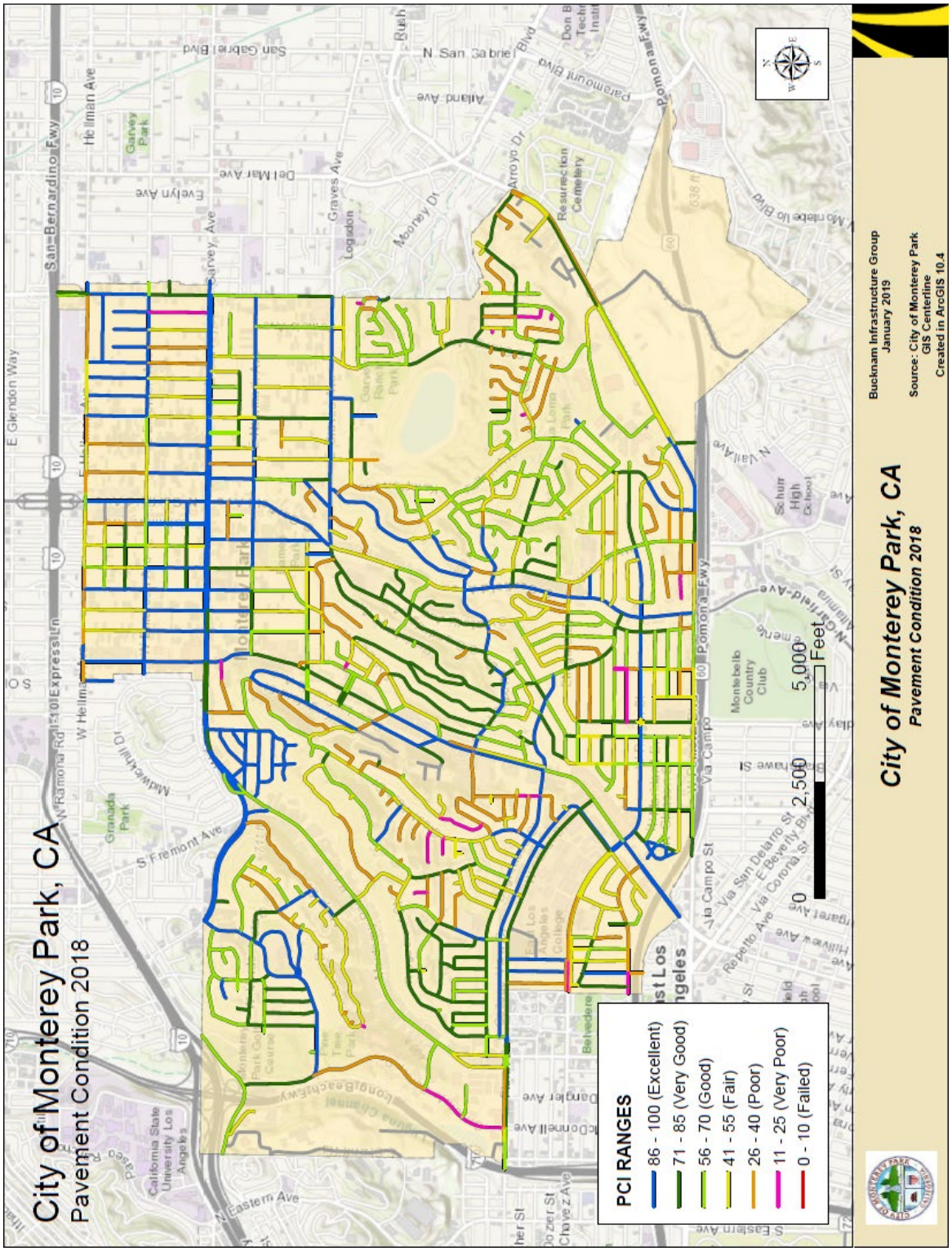

Figure 10 – Monterey Park 2018 PCI Map

SECTION IV
FORECASTED MAINTENANCE REPORT

A. $2.5 Million/Yr Budget, Five Year Plan (2019-2024)

FORECASTED MAINTENANCE REPORT

Section by section street listing sorted by street classification, plan year then alphabetically; this report presents the year and action corresponding to the next scheduled work activity for specific segments within the pavement network. Sections not shown are considered as deferred maintenance.

$2,500,000 BUDGET – This budget was generated for the City to demonstrate how the City's 5-Year Roadway Infrastructure funding allocation performs against the current citywide conditions. The City's annual potential/planned budget is funded through the following sources:

- Gas Tax
- SB1
- Measure R
- Measure M (Potential reimbursement revenue to payback Street Bonds)
- General Fund
- Proposition C
- Surface Transportation Program-Local (STPL)

We have sorted the following report by street classifications for easy review (Arterial – Local, A to Z order).

The annual projected revenues shown below only account for the cost of pavement maintenance and rehabilitation activities. A 30% contingency was applied to the pavement costs. Additional right-of-way, utility, curb & gutter, ADA ramps, tree removals, etc. were not included in these cost projections.

In general sections are chosen first and foremost on available budget; secondly, the square footage of each section plays a large factor. The software initially chooses the draft sections that will increase PCI, sustain PCI or slow PCI deterioration within the budgeted timeframe. Additionally, the types of distress, extents of distress and severities of distress (high, medium, low) also determine how sections are/can be selected.

FORECASTED MAINTENANCE REPORT
$2.5 MILLION/YR BUDGET