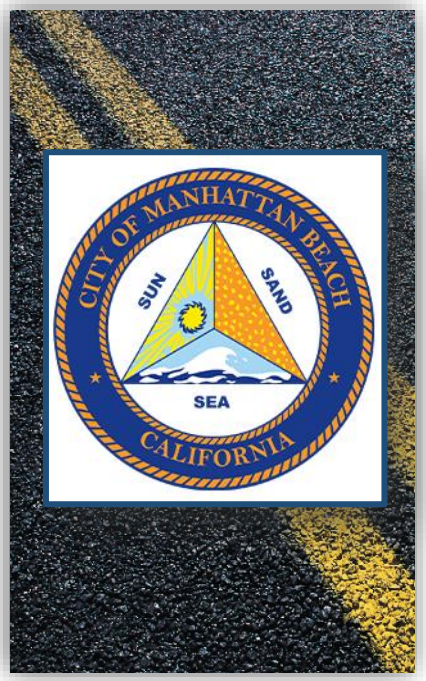
FINAL REPORT

UPDATE OF
PAVEMENT MANAGEMENT PROGRAM
(Citywide)

FY 2024-2029



Submitted to:
City of Manhattan Beach, CA
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BUCKNAM
INFRASTRUCTURE GROUP, INC

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Acronym Listing

American Society for Testing and Materials (ASTM)
Army Corps of Engineers (ACOE)
Asphalt Concrete (AC)
Asphalt Rubber Hot Mix (ARHM)
Average Daily Traffic (ADT)
Capital Improvement Program (CIP)
Geographic Information System (GIS)
Los Angeles County MTA (METRO)
Maintenance and Repair (M&R)
Pavement Condition Index (PCI)
Pavement Management Program (PMP)
Portland Cement Concrete (PCC)
Remove & Replace (R&R)

SECTION I
EXECUTIVE SUMMARY

2024 UPDATE OF PAVEMENT MANAGEMENT PROGRAM

This report reflects the continued commitment and proactive management of the City's Pavement Management Program (PMP); the last major update to the City's PMP was performed in 2021. As the City of Manhattan Beach continues to show growth in its population, demographics, infrastructure and maintenance needs, the street network is demonstrating similar needs in regard to capital revenues and capital improvement program management.

Today, the City is currently utilizing the pavement management program, StreetSaver, to manage the 106 miles of AC/PCC sections within PMP network. This software is essential to the City in that it assists Public Works staff in identifying what levels of annual funding are needed to maintain and/or improve the pavement conditions across the network. These funds are vital for the annual arterial / collector street capital improvement program projects as well as for cost-effectively managing the local network through proactive cyclical maintenance/rehabilitation and scheduling. Under this project, the City has incorporated the unique Pavement Management – GIS MyRoads® PMP web-portal and GIS layers that assist the City in spatially analyzing pavement conditions and economic needs for a given pavement segment or citywide analysis.

The Manhattan Beach PMP has been developed to assist City personnel by providing current data on the City street networks and to develop cost-effective maintenance / rehabilitation strategies to maintain a desirable level of pavement performance on a network scale; this optimizes the expenditure of limited fiscal resources. The PMP efforts in 2024 consisted of analyzing the City's previous PMP dataset for quality and usability. City staff also provided key information pertaining to the ongoing maintenance/rehabilitation efforts that have occurred throughout the City since 2021. In doing this, we were tasked to generate an updated Capital Improvement Program report that identified deficiencies and recommendations in the current operating and maintenance efforts put forth by the City.

For the 2024 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 sections and analyzed historical maintenance / rehabilitation 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 qualifying street segments 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; and*
- *Pavement network and conditional data presented in* ***ArcMap and MyRoads®*** that are compatible with City's existing GIS Enterprise

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 Manhattan Beach 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 pavement network is $206,063,200 (calculated by AC/PPC reconstruction cost x citywide square footage). This value clearly indicates that the City's pavement network is the most valuable and essential asset to Manhattan Beach. The City's use of slurry seal, 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 Manhattan Beach'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; FY 2024-29.

A. CITY'S PAVEMENT NETWORK

The Manhattan Beach Arterial/Collector pavement network consists of approximately 15.6 section miles of streets, 3,399,559 SF of AC/PCC pavement that is made up of 181 pavement sections. The Local network consists of approx. 90.6 section miles of streets, 11,181,051 SF of pavement which includes 1,218 pavement sections. Combined, the entire network consists of 106.2 section miles of streets, 14,580,610 SF and 1,399 total pavement sections. A section mile represents the length of a given pavement segment based upon its starting and ending point (typically intersection centerline points, curb returns, distinct pavement age/type variances).

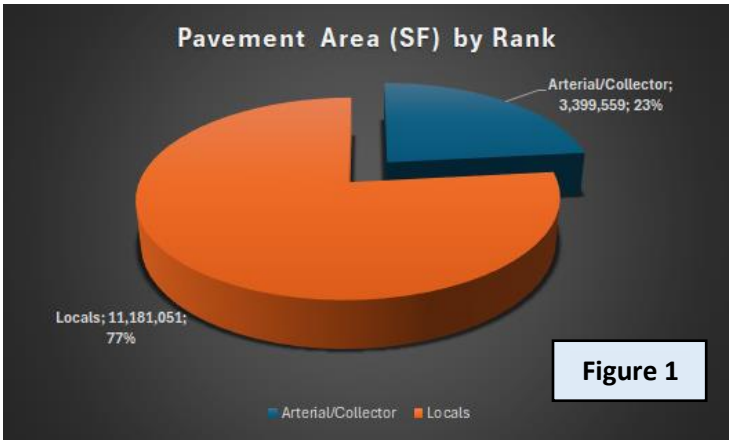


Figure 1

The City's pavement network is broken down into manageable groups that have similar characteristics, such as pavement rank, surface type and logical segmentation. Pavement segments are identified by their branch and section numbers. Pavement "branches" that have a common usage, such as Aviation Blvd., defines a "branch" within StreetSaver. Pavement "sections" are pavement segments within the defined branch that have consistent pavement rankings, 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 equals the pavement sections PCI multiplied by its own area then divided by the total square footage of the given area/zone. Table 1 summarizes the section conditions found within the City of Manhattan Beach pavement network by rank.

- **The weighted avg. PCI for the ARTERIAL / COLLECTOR network is 80.3**
- **The weighted avg. PCI for the LOCAL network is 71.2**

The weighted PCI value associated with the Arterial and Local routes shown through our survey analysis is timely in that it demonstrates the results of proactive pavement management. Furthermore, it is showing that a moderate amount of preventative, slurry seal, and overlay work will be needed over the next several years to achieve a the level of condition (PCI) at a "preventative maintenance" state.

Section length and area values were revised from the previous PMP reports based upon City verification of public and private streets, field edits during surveys, and true area calculations.

Rank	SF	Mi.	2024 PCI	2021 PCI	2018 PCI
Arterial/Collector	3,399,559	15.6	80.3	78.0	70.6
Locals	11,181,051	90.6	71.2	67.0	66.3
Citywide	**14,580,610**	**106.2**	**73.3**	**70.0**	**67.3**

Table 1 – Past and Present PCI Results and Comparisons

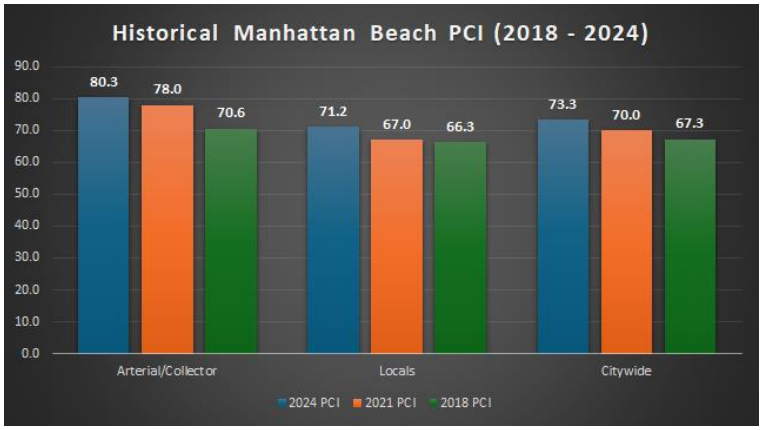


Figure 2 – Historical PCI Findings (FY 2021-2024)

B. CURRENT CITYWIDE CONDITIONS (ARTERIALS-COLLECTORS, LOCALS)

The overall condition of the City's pavement network is "Fair" with a weighted average PCI of 73.3 based on the surface area of each segment (this is a 3.3 PCI increase or a 5% increase compared to 2021 results). The distribution of the City's overall pavement network is shown in Section III of this report (Condition Distribution). The condition terms / PCI ranges below are heavily used by the majority of SoCal local agencies and represent typical PCI triggers for maintenance/rehabilitation activities (slurry seals, overlays, reconstructions).

Condition	PCI Range	Arterials	Locals	Total Mi.	% of Network
Very Good	(86-100)	6.9	20.2	27.1	25.5%
Good	(75-85)	4.6	18.8	23.4	22.0%
Fair	(60-74)	2.2	30.5	32.7	30.8%
Poor	(41-59)	1.7	17.2	18.9	17.8%
Very Poor	(0-40)	0.2	3.9	4.1	3.9%
		15.6	90.6	106.2	

Table 2 – Condition Distribution by Section Mileage for All Streets

For comparison, Bucknam performed pavement management studies for several other Los Angeles County agencies and have included their weighted PCI values (right). Also, the current LA County average PCI, that is based on 88 local agencies, is 66.

Table 3

Neighboring City PCI's (Citywide 2023 & 2024 PMP's)			
Alhambra	76.0	Duarte	77.3
South Gate	55.5	Monterey Park	65.7
Lynwood	71.6	Covina	73.4
South Pasadena	63.8	Commerce	65.5
El Segundo	74.4	Compton	58.0
Sierra Madre	76.5	Gardena	81.2

As shown above, a large majority of segments are evenly distributed through three of condition categories (Very Good to Fair). For a network to be in a "preventive" condition status you would typically see Very Good to Good section percentage totals at the 60% to 70% range; Manhattan Beach's network currently shows 48% of its sections within these PCI ranges. These findings indicate that the proper funding of the network over the past several years has not been ample and needs to be increased over the next five years to improve the overall PCI above 75+; this will allow Public Works managers/staff to proactively establish preventative and rehabilitation schedules that will generate further high-value ROI for the City. At a minimum, to sustain this asset, continued amounts of overlay rehabilitation and slurry seal maintenance needs to be budgeted for and performed across all areas of the pavement network.

As shown in Table 2, over 53% of the City's entire network falls within the fair to very poor condition categories based on the PCI findings, highlighting the need for continued funding of proactive slurry seal & overlay projects. More overlay rehabilitation activity will increase the City's overall weighted PCI while reducing deferred maintenance costs in future fiscal years. Overlay projects applied to appropriate, qualifying segments is necessary to improve the City's network and achieve a preventative condition status as described above. A network-wide preventative condition status is typically a network with a weighted average PCI over 75.

Regarding the Local network, detailed inspection analysis shows that 25% (22.4 miles) of the Local pavement networks require slurry seal maintenance activity while 33% (29.5 miles) requires overlay rehabilitation or full reconstruction.

With the major amount of Local sections needing rehabilitation the City should proactively appropriate the necessary amount of annual overlay funding to improve the network to a higher condition level. The Local network will continue to be a major contributor to the high amount of deferred rehabilitation cost burdens unless appropriate pavement funding is applied.

In regard to the Arterial / Collector network, detailed inspection analysis shows that 32% (5.0 miles) of the pavement network requires slurry seal maintenance activity while 13% (2.2 miles) requires overlay rehabilitation or full reconstruction. Over the past three years the Arterial / Collector weighted PCI has sustained at a high level (80+); one of the best in the County. This is due to the considerable amount of arterial CIP overlay projects that have been applied to the network since 2018. With the overall arterial PCI in the low-80's, proactive planning and application of scheduled overlay projects needs to be sustained; this will maintain the overall conditions while freeing up additional funding for deferred Local overlay projects.

Through our assessment of the City's annual pavement management budget allocation needs (Tables 4 & 5 below) we have identified the necessary annual funding levels to maintain or improve the City's PCI by FY 2029.

This Pavement Management Program update recommends pavement management strategies for each pavement segment based on the existing surface conditions. However, as large overlay and reconstruction projects are considered for funding, the City should make a final determination of the segment-specific pavement management approach based on subgrade R-values, structural design, and distress severities and extents.

PCI conditions reflect "surface" conditions; additional sub-surface data such as coring data, R-Values and ground penetrating radar (GPR) will provide the City with enhanced AC/PCC structural data that will assist in project prioritization.

Our 2024 findings indicate that the PMP network has been proactively managed over the past several years. This is evident in the improvement of the citywide weighted PCI since 2021 and moderate amounts of deferred maintenance/rehabilitation projects. As the City strives to implement a stronger preventative state of M&R, cost efficient Arterial/Local rehabilitation and proactive use of available SB1/Gas Tax/Prop. C/Measure M/Measure R overlay funding should remain the focus.

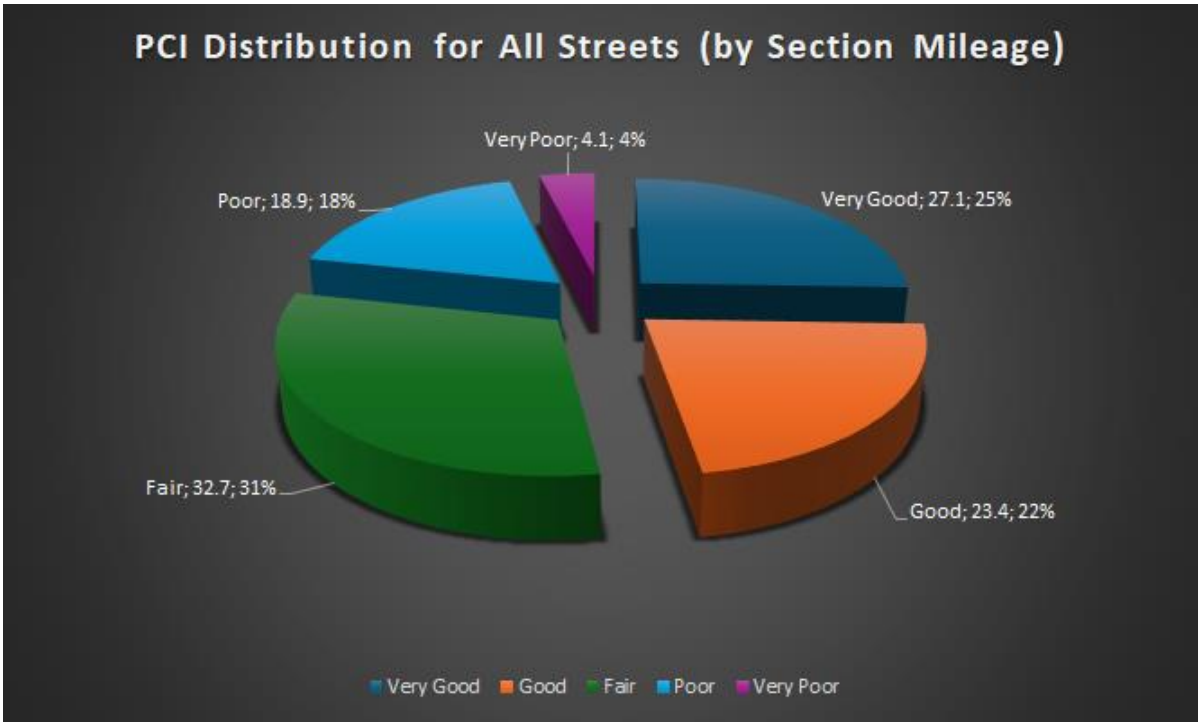


Figure 3 – PCI Distribution by Section Mileage (All Streets)

C. MAINTENANCE / REHABILITATION STRATEGY DEVELOPMENT

Based on the results of the condition survey and input from the City, pavement maintenance/rehabilitation strategies were developed. The City and Bucknam staff discussed and identified a distribution of benchmark pavement application unit cost that would be applied to the network over the next five years. The overriding goal of the PMP is to prevent the decrease in street conditions and not allow an increase in the deferred maintenance costs over the five-year program. These application unit costs are essential to the economic modeling performed.

Bucknam identified the required level of funding to 1) Maintain the current PCI of 73 and 2) Increase the PCI to 78. 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 rehabilitation 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, in most cases, that pavement sections with a PCI greater than 65 will typically be recommended for preventive maintenance (i.e. slurry seal). This recommendation is indicated in Table 7, Section II.

Bucknam developed two multi-year Capital Improvement Programs for the City based on the pavement records, yearly capital expenditures, available funding and the most recent 2024 inspections. These recommendations and results are shown in Section II of this report.

As shown above in Figure 3, 48% of the City's streets are in Very Good to 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 typical types of work that can be programmed as part of the long-term maintenance requirements of the City's street network.

General Repairs-Stop Gap (Localized Maintenance*); PCI Range – 20 to 95

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.

Microsurfacing - (Global Maintenance*); PCI Range – 60 to 85

Microsurfacing is similar to slurry seal. It consists of the application of a mixture of water, asphalt emulsion, aggregate (very small crushed rock), and chemical additives to an existing asphalt concrete pavement surface. Polymer is commonly added to the asphalt emulsion to provide better mixture properties. The major difference between slurry seal and microsurfacing is in how they "break" or harden. Slurry relies on evaporation of the water in the asphalt emulsion. The asphalt emulsion used in microsurfacing contains chemical additives which allow it to break without relying on the sun or heat for evaporation to occur. Thus, microsurfacing is an application that hardens quicker than slurry seals and can be used when conditions would not allow slurry seal to be successfully placed. Streets that have a lot of shade and streets that have a lot of traffic are good candidates for microsurfacing (*source - LA County of Public Works*).

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 65

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. City is currently considering this application as an alternative cost-saving tool.

Overlays (Major Rehabilitation*); PCI Range – 20 to 65

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 Rehabilitation*); PCI Range – 0 to 20

Reconstruction of an existing pavement section includes demolition and removal of the asphalt to a prescribed depth, grading, sub-base compaction, application of a binder/surface course followed by the placement of a conventional flexible pavement section using a structural AC Hot Mix, ARHM or a full depth asphalt. Each classification of road has a typical design cross-section based on anticipated traffic loading. Reconstruction resets a roadway section PCI to 100 and restarts the life-cycle deterioration curve 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.

D. ANNUAL BUDGET PROJECTIONS

The budgeting process was approached with the following in mind; generate two (2) unique work programs for the next five (5) years based upon actual road pavement conditions in order to:

1. Identify the required annual citywide budget to "increase PCI" within five years; and

2. Identify the required annual citywide budget to "maintain current PCI" within five years;

Plan Year	PCI	Slurry / Cape	Overlay / Recon	Total $	Deferred Backlog
Current	73.3				$15,871,500
2024-25	76.0	$920,800	$2,980,000	$3,900,800	$12,868,400
2025-26	76.0	$0	$2,856,600	$2,856,600	$12,917,300
2026-27	77.0	$1,194,500	$2,752,800	$3,947,300	$12,518,800
2027-28	77.0	$0	$2,645,100	$2,645,100	$13,469,500
2028-29	78.0	$1,034,200	$2,449,200	$3,483,400	$14,485,800
		$3,149,500	$13,683,700	$16,833,200	

Table 4 – Necessary Funding to Increase PCI to 78

Plan Year	PCI	Slurry / Cape	Overlay / Recon	Total $	Deferred Backlog
Current	73.3				$15,871,500
2024-25	74.0	$920,800	$1,981,600	$2,902,400	$14,115,500
2025-26	75.0	$0	$2,577,800	$2,577,800	$14,872,200
2026-27	76.0	$1,194,500	$2,614,400	$3,808,900	$14,647,500
2027-28	75.0	$0	$2,005,100	$2,005,100	$15,385,400
2028-29	74.0	$1,034,200	$1,654,300	$2,688,500	$16,998,100
		$3,149,500	$10,833,200	$13,982,700	

Table 5 – Necessary Funding to Maintain PCI of 73

Our findings within Table 4 demonstrate the continued ROI that will result if proper annual funding is applied. By applying approximately $3,366,600/yr ($16,833,200 over five years), the City will continue to see positive results with overall PCI, leveling off of deferred preventative maintenance and overlay rehabilitation.

DEFERRED MAINTENANCE (BACKLOG)
Delaying repairs on streets, where pavement condition indicates a need, creates deferred maintenance (backlog). Backlog 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. Unique budget scenarios created in StreetSaver calculate annual deferred maintenance amounts based on the available/projected budget applied and section SF's that fall within preventative, slurry seal, overlay and reconstruction PCI ranges.

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 2024 dollars. The annual costs shown above only include materials and labor for the pavement. Curb and gutter, striping, project management, mobilization, construction management are not included. 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 Manhattan Beach street network.

E. QUALITY CONTROL EFFORTS

Quality control efforts for this PMP update, begin at the notice-to-proceed; this involved a full assessment of the previous PMP final reports, spreadsheets as well as available GIS data associated with the City of Manhattan Beach street network.

As indicated in our scope of work, Bucknam performed numerous quality control checks in the field during survey efforts. Field check efforts were performed at the end of each week of survey; 10% of the pavement inspection set was resurveyed by a second team to ensure the quantities and distress types were collected properly (approx. 11 miles).

Through our internal/field quality control efforts, we also found multiple sections that were missing from the PMP network, these sections were added from the PMP and GIS networks. Additionally, through our field survey efforts and internal true area pavement section calculations we adjusted section lengths, widths and true area SF's to enhance PMP section accuracies (this resulted in minor Arterial/Collector, Local section mile / total SF area adjustments). The previous 2021 PMP Final Report demonstrated 15,288,200 SF. Based on our updated calculations, the 2024 PMP Final Report demonstrates the citywide SF to be 14,580,600; a -707,600 SF variance.

F. FINDINGS AND RECOMMENDATIONS

Arterials/Collectors

The actual workload requirements identified indicate that the Arterial/Collector street network is currently in "Good" condition (PCI = 80.3). To sustain this condition, it is essential that preventive maintenance and overlay rehabilitation activities are funded at the levels identified in Table 5.

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

- The Arterial/Collector network has a weighted PCI of 80.3;
- Currently, 13% of the arterial/collector network (approx. 2.2 miles) require overlay/reconstruction rehabilitation; 32% (approx. 5.0 miles) require slurry seal maintenance;
- At a minimum, Arterial/Collector maintenance projects should focus on achieving and maintaining a PCI of 65+ within the next five years;
    - Develop a proactive fiscal and planned approach to identify arterial/collector overlay projects based on the deterioration modeling within StreetSaver;
    - Maintain arterial/collector revenues at the levels shown within the Section IV Forecast Maintenance & Rehabilitation (FMR) Report for a minimum of five years to generate the results identified within this report;
- Reassess/re-evaluate the arterial/collector rehabilitation budget programs every two years to improve on CIP forecasts for 2025-26 and beyond to ensure the results shown in Table 4 and 5;
- Perform pavement inspections on the arterial/collector network every three years to build a solid planning model within StreetSaver/MyRoads® to track PCI deterioration;
- Demonstrated budget shown in Table 5 is ample to sustain the Arterial/Collector weighted PCI of 80 through five years, however, the citywide deferred maintenance (backlog) increases from a level of $15.9 million to $17.0 million after five years (see Section 1, page 9 for backlog definition);
    - Unique budget scenarios created in StreetSaver calculate annual deferred maintenance amounts based on the available/projected budget applied and section SF's that fall within preventative, slurry seal, overlay and reconstruction PCI ranges;
- Bucknam recommends that the City proactively budget overlay rehabilitation projects at the levels shown in Table 4 in order to improve upon the conditions found today as well as minimize the impact of a moderate increase deferred maintenance across the City.

Locals

The actual workload requirements identified indicate that the Local street network is currently in "Fair" condition (PCI = 71.2). To improve this condition, it is essential that preventive maintenance and overlay activities are funded at the levels identified in Table 4 to increase the network weighted average PCI value within the "Good" category.

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

- The Local network has a weighted PCI of 71.2;
- Currently, 33% of the Local network (approx. 29.5 miles) require overlay/reconstruction rehabilitation; 25% (approx. 22.4 miles) require slurry seal maintenance;
- At a minimum, Local maintenance projects should focus on achieving and maintaining a weighted PCI above a level of 65+ within the next five years;
    - Current Local Forecast Maintenance & Rehabilitation (FMR) recommendations should be followed as shown in Section IV of this report;
    - Develop a proactive fiscal and planned approach to identify Local overlay projects based on the deterioration modeling within StreetSaver;
- Increase Local revenues at the levels shown within the Section IV Forecast Maintenance/Rehabilitation (FMR) Report for a minimum of five years to generate the results identified within this report;
- Reassess/re-evaluate the Local rehabilitation budget programs every two years to improve on budget forecasts for 2025-26 and beyond to ensure the results shown in Table 4 or 5;
- Perform pavement inspections on the Local network every three years to build a solid planning model within StreetSaver/MyRoads® to track PCI deterioration;
- Demonstrated budget shown in Table 4 is sufficient to improve the Local weighted PCI as it includes necessary increased overlay funding. Additionally, the citywide deferred maintenance decreases from a level of $15.9 million to $14.5 million after five years (see Section 1, page 9 for backlog definition);
    - Unique budget scenarios created in StreetSaver calculate annual deferred maintenance amounts based on the available/projected budget applied and section SF's that fall within preventative, slurry seal, overlay and reconstruction PCI ranges;
- Bucknam recommends that the City allocate budget for overlay rehabilitations at the levels shown in Table 4 in order to improve upon the conditions found today as well as minimize the impact of a high increase of deferred maintenance across the City.

SECTION II
PAVEMENT MANAGEMENT PROGRAM – CAPITAL IMPROVEMENT PROGRAM

Bucknam Infrastructure Group, Inc. (Bucknam) performed the following services in accordance with the scope of services that was contracted with the City of Manhattan Beach. As a quick overview, the following tasks were performed to complete the work over the past several months:

2024 Pavement Management Work Efforts:

Task 1: Project Kickoff-Data Management
Task 2: Update of Maintenance Activities
Task 3: Pavement Condition Survey (approx. 106.2 miles)
Task 4: Budgetary Analysis and Capital Improvement Reports
Task 5: Executive Summary and Final CIP Reports
Task 6: Mapping of the Pavement Network

A. PAVEMENT MANAGEMENT PROGRAM UPDATE 2024

As a part of the 2024 update of the pavement management program, a major element of work was to complete a comprehensive assessment of the existing street network and PMP database utilized by the City. This included assessing the City's existing 2021 StreetSaver dataset, GIS, street naming conventions and work history information. From there, Bucknam worked with the City to confirm walking PCC, public and private street listings which set the foundation for accurate CIP reporting. All data was then updated within the City's StreetSaver database.

Work history information was provided by the City in the form of completed bid documents, institutional knowledge, and CIP maps and Excel documents. This information was entered into the proper pavement segments that match the limits of those projects.

Table 6 demonstrates PCI ranges utilized for PCI calculations and budgetary reporting. 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 each functional class within the network (arterials and locals).

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 equals the pavement sections PCI multiplied by its own area then 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	Very Good
75-85	Good
60-74	*Fair (2024 Manhattan Beach = 73.3)*
41-59	Poor
0-40	Very Poor

Table 6 – Pavement Condition Index (PCI) Ranges

These condition ranges are defined by the Army Corps of Engineers and utilized within the StreetSaver software. The summary of all roads condition data and their representative PCI's can be seen in the Pavement Condition Report in Section III. The condition terms / PCI ranges above are heavily used by the majority of SoCal local agencies and represent typical PCI triggers for maintenance/rehabilitation activities (slurry seals, overlays, reconstructions).

From there, CIP pavement recommendations were performed (discussed and demonstrated below) where the pavement maintenance/rehabilitation practices utilized by the City were used to generate recommendations through the StreetSaver system.

B. MAINTENANCE STRATEGY ASSIGNMENTS

The City was requested to provide a pavement maintenance list that demonstrated what pavement applications were currently being used and to provide their associated unit costs; from there a Maintenance Strategy Assignment table was defined within the system that provided recommended actions to the specific repair needs of a street or a grouping of streets.

Maintenance Strategy Assignments

All Streets			
PCI Range	**Description**	**Unit Cost/SF**	**Unit Cost/SY**
20-100 Varies by Activity	Preventative, Stop Gap, Patching	Varies by Activity	Varies by Activity
65-85	Type II Slurry (Locals)	$0.50/SF	$4.50/SY
65-85	Type II Slurry (Arterials)	$0.80/SF	$7.20/SY
Minimal Level of Service (65)			
40-65	Cape Seal (Locals)	$2.25/SF	$20.25/SY
20-65	2" Grind / Overlay (Local)	$3.75/SF	$33.75/SY
20-65	2.5" Grind-ARHM Overlay (Arterial)	$5.50/SF	$49.50/SY
0-20	AC CIR Reconstruction (Locals)	$12.85/SF	$115.65/SY
0-20	AC CIR Reconstruction (Arterials)	$14.50/SF	$130.50/SY
0-20	PCC Reconstruction	$22.50/SF	$202.50/SY
25% Contingency included within All Unit Costs			

Table 7 – Maintenance Strategy Assignments

The Strategy Assignments List, shown in Table 7, 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 and severity 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/rehabilitation 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.

Strategy Assignment Notes

1. Unit cost values were assessed and reviewed by City staff and benchmarked with neighboring LA County cities;
2. 25% contingency costs were applied to pavement material costs; additional soft costs that were not included were:
    a. Mobilization / demobilization
    b. Right-of-way improvements
    c. Curb & gutter improvements
    d. ADA ramp improvement
    e. Utility improvement
    f. Tree removals
3. Bucknam applied a 4% inflation rate on the annual budget within forecast maintenance & rehabilitation projections (Section IV)

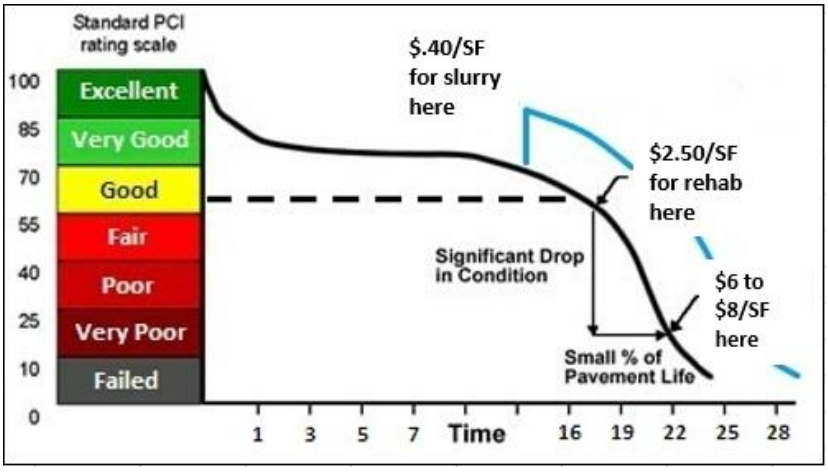


Figure 4 – Sample Pavement Life Cycle

C. 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 Manhattan Beach's current budgets and maintenance practices the system will develop "section unique" improvements and strategies. Qualifying segments 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

City obtains various amounts of pavement funding through the following sources:

- Gas Tax;
- Proposition C;
- Measure R; and
- Measure M

INCREASE PCI BUDGET – A recommended budget was generated for the City to demonstrate the necessary funding that is required to increase the current weighted PCI level of 73 to 78 within five years.

MAINTAIN PCI BUDGET – The Maintain PCI budget was generated for the City to demonstrate what level of annual funding is required to sustain the overall weighted PCI of 73 for the next five years.

***All multi-year budget projections include a 4% inflation rate for the term of the budget forecast**.*

ARTERIAL-COLLECTOR / LOCAL / ALLEY BUDGET PROJECTIONS

INCREASE PCI TO 78 PROGRAM (FIVE YEAR MODEL)

With the City striving to show proactive rehabilitation across all qualifying pavements, a $16.8 Million/5-Yr budget program was applied to current conditions to show a potential higher return on investment. We used the "Maintain PCI Budget" PMP model (shown on Page 2-7) as a basis for our modeling. Building upon the results of the Maintain PCI budgetary model we increased the amount of funding allocated for overlay/rehabilitation efforts to increase the PCI to the 78 target. The "Increase PCI" program incorporates pavement sections that have a functional class of Arterial (A, C), Local (L) and Alley (O).

Plan Year	PCI	Slurry / Cape	Overlay / Recon	Total $	Deferred Backlog
Current	73.3				$15,871,500
2024-25	76.0	$920,800	$2,980,000	$3,900,800	$12,868,400
2025-26	76.0	$0	$2,856,600	$2,856,600	$12,917,300
2026-27	77.0	$1,194,500	$2,752,800	$3,947,300	$12,518,800
2027-28	77.0	$0	$2,645,100	$2,645,100	$13,469,500
2028-29	78.0	$1,034,200	$2,449,200	$3,483,400	$14,485,800
		$3,149,500	$13,683,700	$16,833,200	

Table 8 – Necessary Funding to Increase PCI to 78

Referring to Table 8, it is noted that the weighted PCI increases proactively through the five-year term (73.3 to 78.0). Additionally, the annual deferred maintenance/backlog total decreases from $15.9 million to $14.5 million at the end of the five-years. If the City utilizes an average annual budget of $3,366,600/yr for slurry, overlay, and reconstruction projects as shown above, the City will be able to "increase" the current conditions and will continue to see a moderate decrease in deferred maintenance by fiscal year 2030. We recommend that a focus be placed on the Local network improvements due to the fact that the weighted PCI is now in the low 70's. We still recommend consistent Arterial/Collector based approach to maintenance within this term as well.

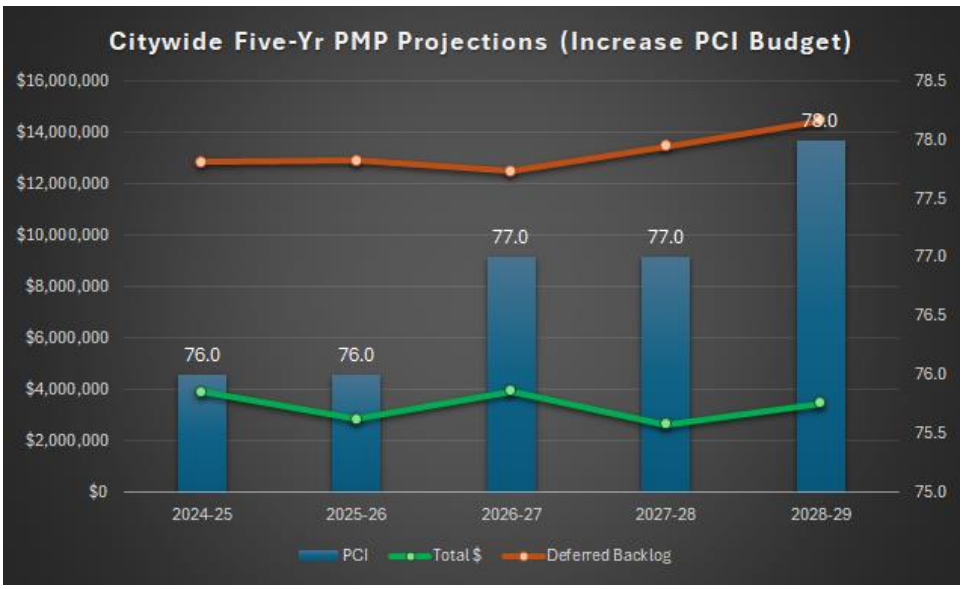


Figure 5 – Five Year Projection; Increase PCI to 78 Budget

MAINTAIN PCI PROGRAM (FIVE YEAR MODEL)

With the City striving to show proactive maintenance/rehabilitation across all City pavements, a budget program was generated to show the greatest return on investment through the application of slurry seal, grind/overlay and alternative overlay rehabilitations. Our goal under this model is to maintain the current 2024 weighted PCI of 73.3 after a five-year program. This model will calculate the necessary funding to achieve this goal.

We used the City's recent unit costs as well as benchmarked unit costs from neighboring LA County cities within our modeling as a cornerstone within the recommended program. Assessing all work history, current PCI and relevant unit costs for construction, an annual budget was calculated and identified. The Maintain Program incorporates pavement sections that have a functional class of Arterial (A, C), Local (L) and Alley (O).

Plan Year	PCI	Slurry / Cape	Overlay / Recon	Total $	Deferred Backlog
Current	73.3				$15,871,500
2024-25	74.0	$920,800	$1,981,600	$2,902,400	$14,115,500
2025-26	75.0	$0	$2,577,800	$2,577,800	$14,872,200
2026-27	76.0	$1,194,500	$2,614,400	$3,808,900	$14,647,500
2027-28	75.0	$0	$2,005,100	$2,005,100	$15,385,400
2028-29	74.0	$1,034,200	$1,654,300	$2,688,500	$16,998,100
		$3,149,500	$10,833,200	$13,982,700	

Table 9 – Necessary Funding to Maintain PCI of 73

Referring to Table 9, it is noted that the weighted PCI consistently remains at a PCI of 73/74 pace throughout the five-year projection. Furthermore, the resulting deferred maintenance shows that it increases from $15.9 million to $17 million after the five years program which indicates that an annual average budget of $2,796,500/yr is not ample to chip away at the deferred maintenance on the network. If the City were to reduce their annual funding to a level of $1,500,000/yr major overlay projects would continue to be delayed thus increasing the overall deferred maintenance to a level of $22 million after five years.

DEFERRED MAINTENANCE (BACKLOG)

Delaying repairs on streets where pavement condition indicates a need creates deferred maintenance (backlog). Backlog 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. Unique budget scenarios created in StreetSaver calculate annual deferred maintenance amounts based on the available/projected budget applied and section SF's that fall within preventative, slurry seal, overlay and reconstruction PCI ranges.

We recommend that a stronger focus be placed on the Local network improvements within the first three years due to the fact that the network has a worse weighted PCI than the Arterials/Collector. We still recommend comprehensive maintenance to the Arterial/Collector network through

localized patching, slurry seal and through the use of SB1/Measure M/Measure R funds.

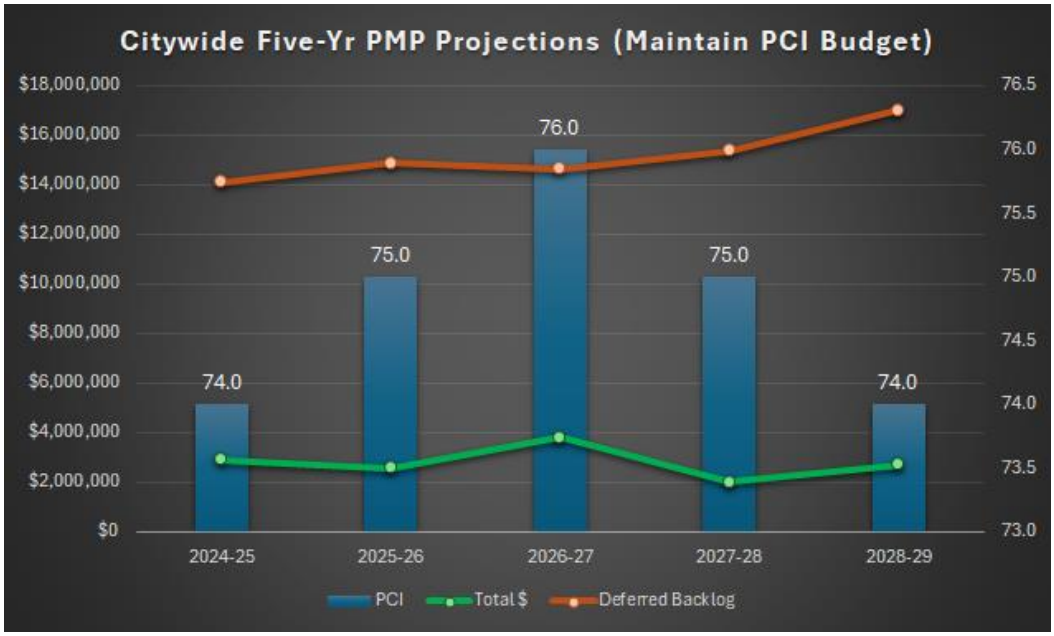


Figure 6 – Five-Year Projection; Maintain PCI of 73 Budget

As mentioned above, a continued Local slurry/overlay M&R "zone" strategy should be utilized for several reasons. With the City applying continued local maintenance efforts, four beneficial impacts occur:

1) Planned / Maintenance areas are addressed every five years which creates a dedicated project schedule for City staff and constituent inquiries;
2) Deferred overlay rehabilitation can be addressed in a more effective manner due to accrued revenues
3) A preventative 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 within one zone per year.

On the negative side, if low weighted PCI values occur within a given zone, all streets within that zone may not be able to be addressed with maintenance when that zone is scheduled for maintenance. The deferred maintenance will have to be scheduled for future years or simply will have to wait until the zone cycle repeats.

Additionally, it is recommended that the City continue to monitor the potential application of Cape Seal and/or High Density Mineral Bond (HDMB) as asphalt application alternatives for the specific local sections. Specific sections are now qualifying for maintenance that warrants a stronger application rather than a typical slurry seal. With a five-year cycle in motion, it is essential to address local sections that have PCI's less than 65 with the proper rehabilitation since crews will not be back within that area for five to six years.

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 (Forecast Maintenance & Rehabilitation (FMR) 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 1999-2021, and 2024 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 tools and demonstrate how to generate standard common-sense reports to assist City staff in developing yearly budgets, project level analysis, and CIP projections. This will be key to future 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 deferred 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 two years and locals every three.

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 Pavement Management report indicating condition ratings, inspection dates and forecasted maintenance/rehabilitation recommendations.

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

D. CONDITION DISTRIBUTION REPORT

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

The condition scheme ranges from "Very Good" to "Very Poor"; with a "Very Good" condition corresponding to a pavement at the beginning of its life cycle, and a "Very Poor" 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
Very Good	86-100	Minor to low distress, no significant distress; Low severity distresses with expection of utility patches in good condition or slight hairline cracks; minor weathering found
Good	75-85	Slight to moderately weathered, low to moderate distress severities, utility patching commonly found; moderate distress extents
Fair	60-74	Severly weathered or moderate levels of distress, generally limited to utility patching and climate related distress
Poor	41-59	Moderate to high distresses including load related types such as alligator cracking, greater distress extents
Very Poor	0-40	Severly distresses, large quanities of distortion or alligator cracking; Failure of the pavement, distress has surpassed tolerable rehabilitation limits

2024 City of Manhattan Beach weighted average PCI is 73.3 (Fair).

E. 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)

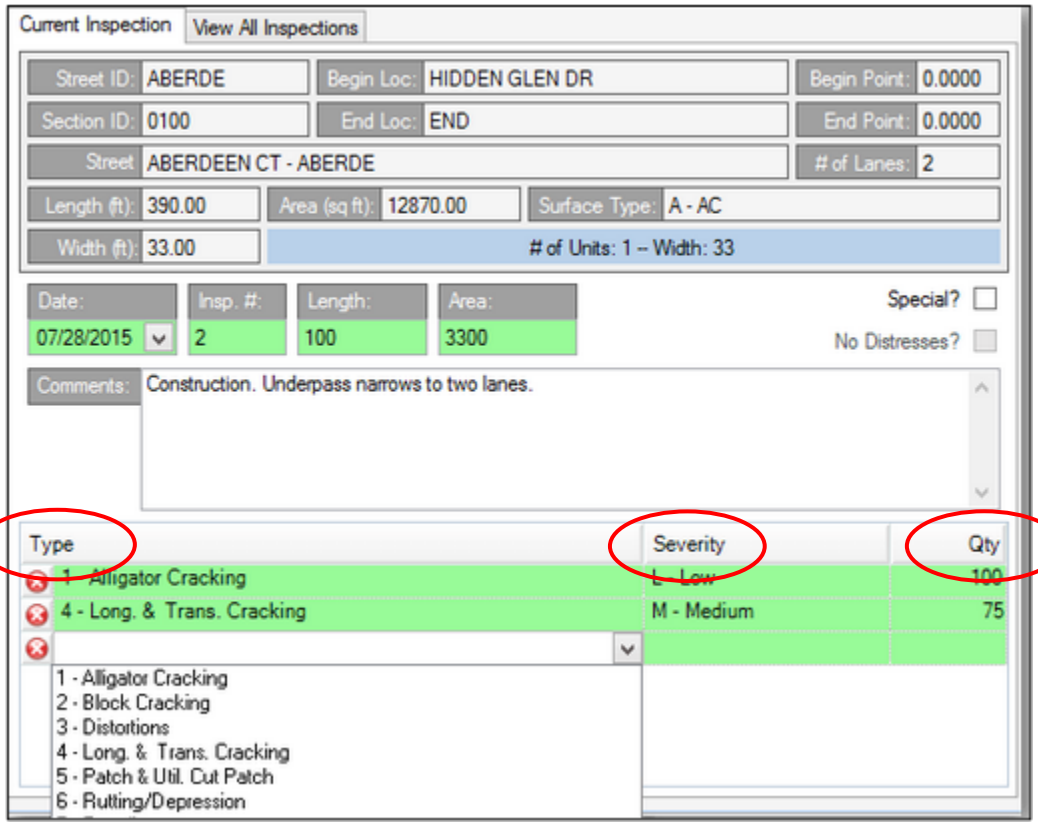


Figure 7 – PCI Calculation Worksheet

Manhattan Beach MyRoads® Web-Portal – Bucknam's MyRoads® is a great match for the City of Manhattan Beach's PMP today and the future. **MyRoads® brings your PMP data to life within a dynamic dashboard!** Bucknam now provides all our PMP clients with a unique and agency driven "MyRoads®" web-portal that provides instantaneous access to your pavement management database. This "dashboard" allows users to toggle through individual sections via GIS mapping selections, zone queries, rank selection, PCI ranges, etc. to review all section metrics, latest/previous inspections, work histories generate filtered PCI reports and identify potential maintenance / rehabilitation costs based upon your unique needs.

Bucknam has shown below the Manhattan Beach MyRoads® account actively working! This tool will be accessed by City staff simply through a Username/Password methodology. As changes are made to the Manhattan Beach PMP database the MyRoads® dataset is changed to reflect work history edits, PCI inspections and section changes.

In summary, MyRoads® allows the user to perform the following dynamic functions:

- Query specific pavement segment(s) to view current/historic PCI, work history inspection;

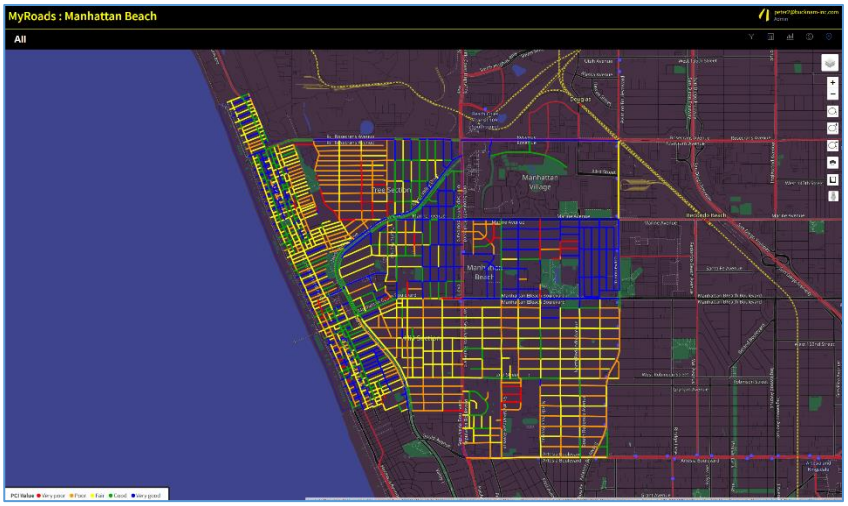


Figure 8 – Manhattan Beach MyRoads® PMP Portal

- Filter for pavement sections within a defined zone, PCI range and/or functional class;
- Select a pavement section or grouping of section through the on-board GIS tool;
- Enter slurry, overlay & reconstruction unit costs to determine preliminary cost of maintenance and resulting citywide PCI
    - Display critical street / sidewalk / ROW assets along pavement section(s) that are critical to Engineering Bid development and solicitation (ADA ramps, utilities, manholes, trees, etc.
- Displays all final GIS project maps (PCI, work history, 5-yr forecasted maintenance, etc.);
- Bucknam will train Manhattan Beach's staff on the simple use of the MyRoads® dashboard**.**

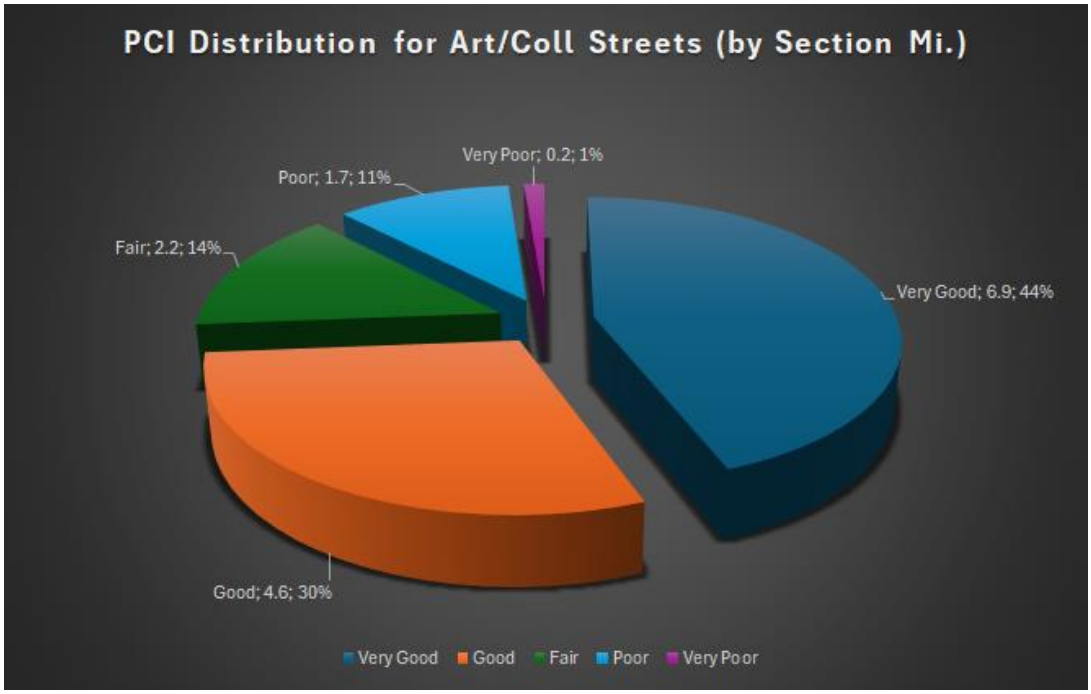


Figure 9 – Arterial/Collector Condition Distribution

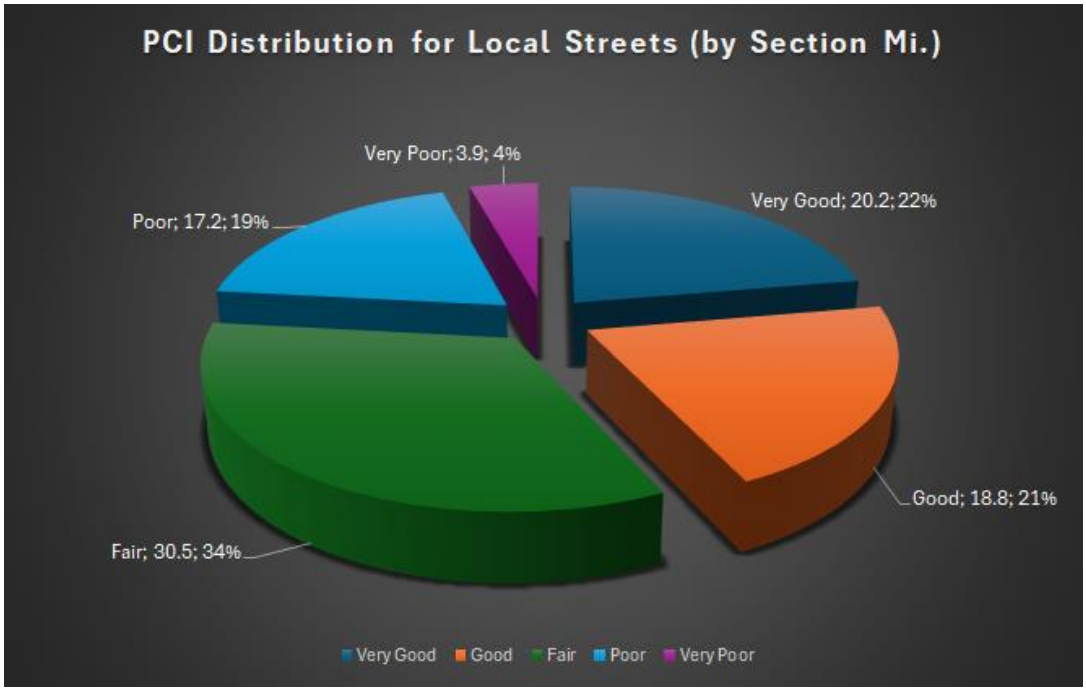


Figure 10 – Local Condition Distribution

F. SAMPLE DISTRESS PHOTOS – RECOMMENDED TREATMENT (FIGURE 11)

Bucknam Infrastructure Group

1. Alligator Cracking

Cracks that form a chicken wire or alligator scale like pattern.

Low Severity: Thin parallel longitudinal cracks that may come together at certain points, but full alligator pattern is not present yet.
Medium Severity: Further development of cracks into alligator pattern. Cracks are starting to spall.
High Severity: Alligator pattern is heavily developed, and cracks are spalled to the point where individual pieces may become separated.

Typical Recommendation: Low severity, R&R – Patching, crack sealing; high severity R&R-overlay

2. Bleeding

Bleeding occurs when incorrectly mixed asphalt is applied and in hot weather the asphalt or tar rises to the surface.

Severity is determined by the amount of asphalt/tar present.

Typical Recommendation: Low severity, apply coarse sand; high severity, grind or heat planer excess, resurfacing may be necessary

3. Block Cracking

Longitudinal and transverse cracks that intersect to form smaller than 10x10 ft blocks. Creates uniform blocks with straight edges.

Low Severity: Cracking is less than 3/8 inches.
Medium Severity: Cracking between 3/8 and 3 inches.
High Severity: Cracking is over 3 inches.

Typical Recommendation: Low severity, crack sealing; high severity, R&R-overlay

4. Bumps and Sags

Small, localized, and linear upward or downward displacements of pavement, which can be caused by a variety of factors.

Severity is determined by the extent to which ride quality is diminished.

Typical Recommendation: R&R - Patching

5. Corrugation

Closely spaced Bumps and or Sags that form a washboard effect in the pavement.

Severity is determined by the extent to which ride quality is diminished.

Typical Recommendation: Low severity, R&R – Patching; high severity, R&R-overlay

6. Depression

Localized area of pavement with a lower elevation than the surrounding pavement.

Low Severity: depth of ½ to 1 inch.
Medium Severity: depth of 1 to 2 Inches.
High Severity: depth greater than 2 inches.

Typical Recommendation: R&R - Patching

7. Edge Cracking

Cracks that are parallel to the edge of the pavement that may cause a break up of pavement.

Low Severity: Low or Medium cracking with no breakup.
Medium Severity: Medium cracking with some breakup.
High Severity: Considerable breakup of pavement.

Typical Recommendation: R&R - Patching

8. Joint Reflective Cracking

Cracking that is reflected through AC pavement when it is overlaid on top of PCC pavement.

Low Severity: Cracking is less than 3/8 inches.
Medium Severity: Cracking between 3/8 and 3 inches.
High Severity: Cracking is over 3 inches.

Typical Recommendation: R&R - Overlay

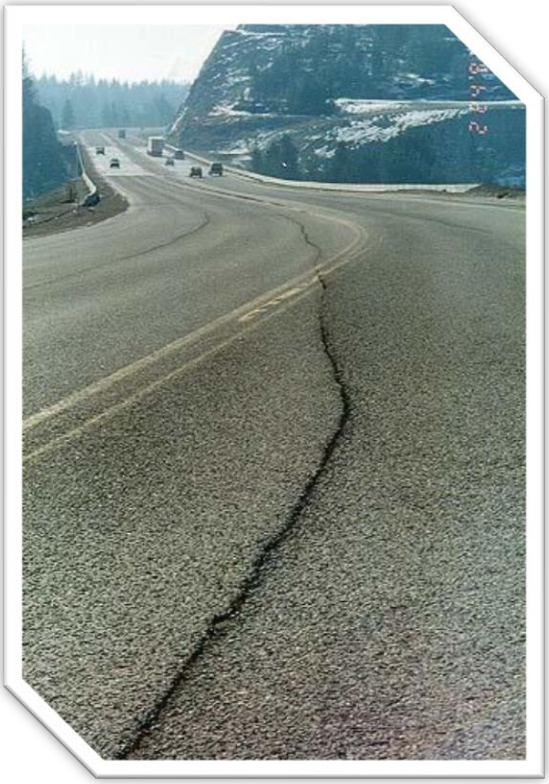
9. Lane / Shoulder Drop-off

Elevation change between pavement and shoulder.

Low Severity: Difference in elevation is between 1 and 2 inches.
Medium Severity: Difference in elevation is between 2 and 4 inches.
High Severity: Difference in elevation is over 4 inches.

Typical Recommendation: R&R – Patching or edge grinding

10. Linear & Transverse Cracking



Cracks that are generally either parallel or perpendicular to traffic.

Low Severity: Cracking is less than 3/8 inches.
Medium Severity: Cracking is between 3/8 and 3 inches.
High Severity: Cracking is over 3 inches.

Typical Recommendation: Low severity, crack sealing; high severity, R&R - Overlay

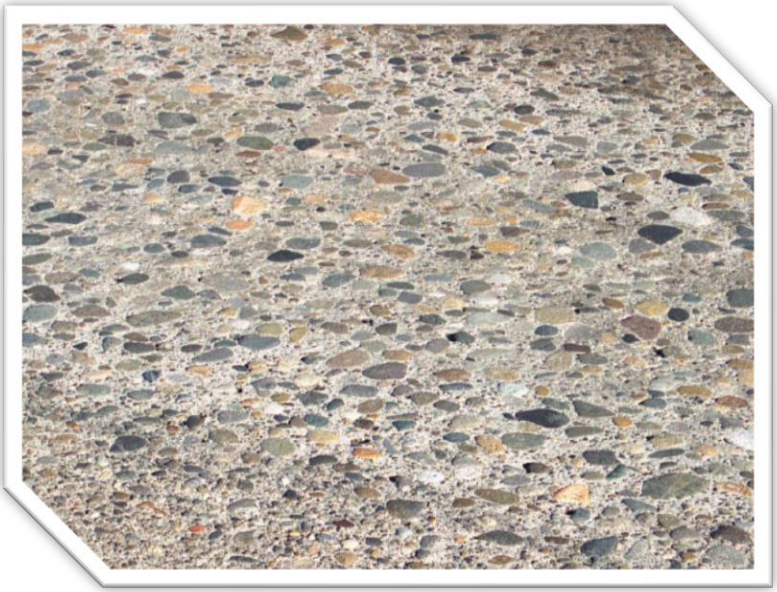
11. Patching

Area of pavement that has been replaced.

Severity is determined by the quality of the patch and the extent to which ride quality is diminished.

Typical Recommendation: R&R – structural / non-structural overlay

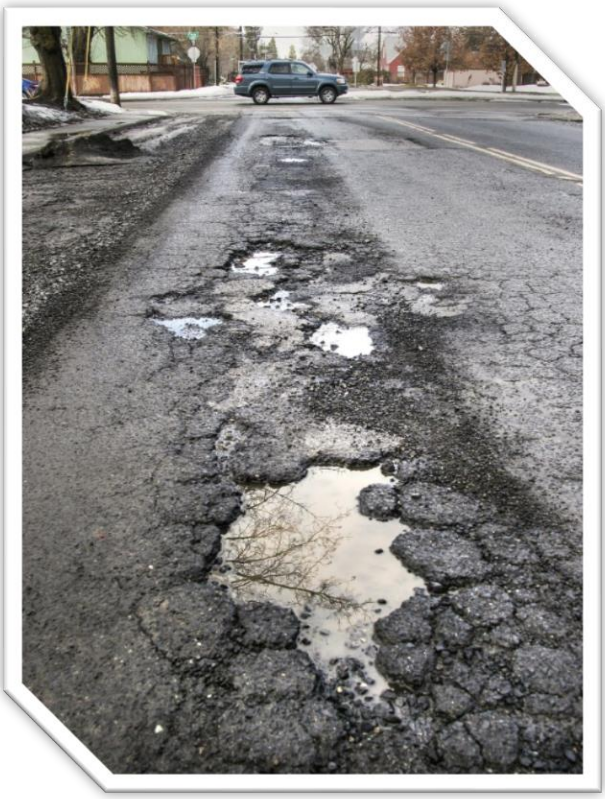
12. Polished Aggregate



Distress where traffic smooths the pavement surface so friction is diminished and cars can slide.

There are no Severity Levels for this distress.

13. Pothole



Severity Measured using the following Matrix.

	Average Diameter (in.) (mm)		
Maximum Depth Of Pothole (in.) (mm)	4 to 8 in. (100 to 200 mm)	8 to 18 in. (200 to 460 mm)	18 to 30 in. (460 to 760 mm)
1/2 to ≤ 1 in. (13 to 25 mm)	L	L	M
> 1 to ≤ 2 in. (25 to 50 mm)	L	M	H
> 2 in. (50 mm)	M	M	H

Typical Recommendation: low severity Pothole fill or R&R – Patching, high severity should be R&R-Overlay. Severities shown are Low (L), Medium (M) and High (H).

14. RR Crossing

Pavement distresses caused by railroad crossings.

Severity is determined by the extent to which ride quality is diminished.

Typical Recommendation: R&R - Patching

15. Rutting

Linear depressions along wheel paths caused by traffic.

Low Severity: Depth is ¼ to ½ inches.
Medium Severity: Depth is ½ to 1 inch.
High Severity: is greater than 1 inch.

Typical Recommendation: Pavement with deeper ruts should be leveled and overlaid

16. Shoving

Displacement of pavement creating a "wave" over a more solid surface.

Severity is determined by the extent to which ride quality is diminished.

Typical Recommendation: R&R - Patching

17. Slippage Cracking

Half-moon shaped cracks where wheels cause pavement to slide.

Low Severity: Average crack width is less than 3/8 inch.
Medium Severity: Crack width is between 3/8 and 3/2 inches.
High Severity: Crack width is greater than 3/2 inches.

Typical Recommendation: R&R - Patching

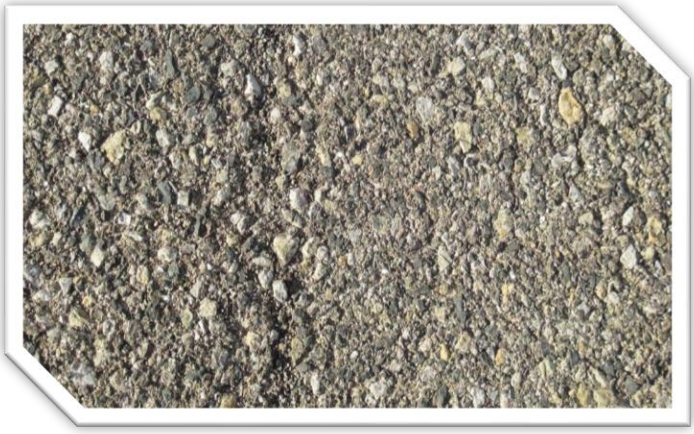
18. Swell

Upward Bulges creating "wave-like" patterns.

Severity is determined by the extent to which ride quality is diminished.

Typical Recommendation: Low severity, R&R – Patching; high severity, R&R-overlay

19. Weathering



The wearing away of the asphalt binder.

Low Severity: Aggregate is starting to be exposed.
Medium Severity: Aggregate is exposed up to ¼ of its width.
High Severity: Aggregate is exposed to greater than ¼ of its width.

Typical Recommendation: naturally occurring, slurry seal

20. Raveling

The further weathering of asphalt so that coarse aggregate is separating out of pavement.

Medium Severity: Considerable loss of aggregate.

High Severity: Almost complete removal of coarse aggregate.

Typical Recommendation: Low severity, R&R – Patching; high severity, R&R-overlay

PORTLAND CEMENT CONCRETE (PCC)

1. Blowup

Buckling at cracks or joints where there is not enough room for slab expansion.

Severity is determined by the extent to which ride quality is diminished.

2. Corner Break

Crack close to corner of slab that creates a corner piece.

Low Severity: Crack is less than ½ inches wide.
Medium Severity: Crack is between ½ and 2 inches wide.
High Severity: Crack is wider than 2 inches.

3. Divided Slab

Slab that is broken up into four or more pieces by cracks.

Severity is determined by the following matrix. Severities shown are Low (L), Medium (M) and High (H).

Severity Of Majority Of Cracks	Number Of Pieces In Cracked Slab		
	4 to 5	6 to 8	More than 8
L	L	L	M
M	L	M	H
H	M	H	H

4. Durability Cracking

Pattern of cracks parallel to joints caused by freeze-thaw expansion of large aggregate.

Low Severity: Durability cracking covers less than 15 percent of slab.
Medium Severity: Durability cracking covers more than 15 percent of the slab.
High Severity: Durability cracking covers more than 15 percent of slab and most pieces have come out.

5. Faulting

Elevation Difference between slabs.

Low Severity: Elevation difference is between 1/8 and 3/8 inch.
Medium Severity: Elevation is between 3/8 and ¾ inch.
High Severity: Elevation is greater than ¾ inch.

6. Joint Seal Damage

Damage to sealant between joints that allows soil, rock, or water infiltration.

Low Severity: Joint sealant has only minor damage.
Medium Severity: Joint sealant is in fair condition. Water can infiltrate and vegetation may be present.
High Severity: Joint sealant is in poor condition. It may be missing and rocks may be present.

7. Lane / Shoulder Drop-Off

The Elevation difference between pavement and shoulder.

Low Severity: Elevation difference is between 1 and 2 inches.
Medium Severity: Elevation difference is between 2 and 4 inches.
High Severity: Elevation difference is greater than 4 inches.

8. Linear Cracking

Cracks that divide slab into two or three pieces.

Low Severity: Crack is less than ½ inch wide.
Medium Severity: Crack is between ½ and 2 inches wide.
High Severity: Crack is wider than 2 inches.

9. Large Patch

Patch that is larger than 5.5 sq ft.

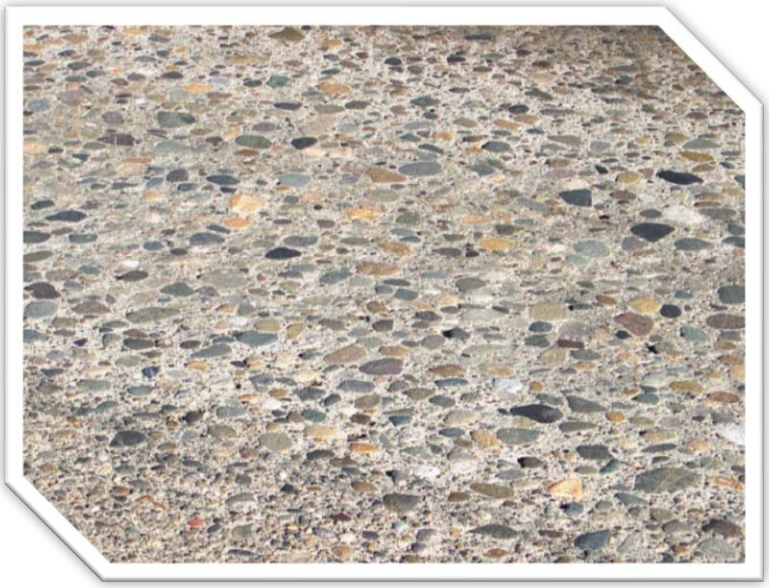
Low Severity: Patch has little or no deterioration.
Medium Severity: Patch is moderately deteriorated.
High Severity: Patch is badly deteriorated.

10. Small Patch

Patch that is smaller than 5.5 sq ft.

Low Severity: Patch has little or no deterioration.
Medium Severity: Patch is moderately deteriorated.
High Severity: Patch is badly deteriorated.

11. Polished Aggregate



Distress where traffic smooths the pavement surface so friction is diminished and cars can slide.

There are no Severity Levels for this distress.

12. Popouts

Small piece of pavement that breaks loose from surface.

There are no Severity Levels for this distress, however popouts must cover 3 per sq. meter of the slab.

13. Pumping

Ejection of material from slab foundation through joints or cracks along with water.

There are no Severity Levels for this distress.

14. Punchout

Localized area of a slab that is broken into many pieces.
Severity is determined by the following matrix. Severities shown are Low (L), Medium (M) and High (H).

Severity of Majority of Cracks	Number of Pieces		
	2 to 3	4 to 5	> 5
L	L	L	M
M	L	M	H
H	M	H	H

SECTION III

CITYWIDE
PAVEMENT CONDITION INDEX REPORT

A. 2024 Manhattan Beach PCI Map
B. Name Order (A to Z)
C. PCI Order (0-100)

A. PAVEMENT CONDITION INDEX REPORTS - DEFINITIONS

Listed alphabetically by street name or PCI, these reports provide 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.

FUNCTIONAL CLASSIFICATION (FC) - The codes for four 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
R	Local
O	Alley

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

CODE	DESCRIPTION
A-AC	Asphalt Concrete
C-AC/PCC	Asphalt Concrete over PCC
O-AC/AC	Asphalt Concrete over original AC construction
PCC	Portland Cement Concrete
S-ST	Surface treatment applied to original surface

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 ENVIRONMENT (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 Environment (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 (*Source: Pavement Management for Airports, Roads and Parking Lots – M.Y. Shadin, 2004*)

Asphalt Distresses	Cause Classification	PCC Distresses	Cause Classification
Alligator cracking	Load	Blow up	Climate
Bleeding	Other	Corner break	Load
Block cracking	Climate	Divided Slab	Load
Bumps/Sags	Other	Durability cracking	Climate
Corrugation	Other	Faulting	Other
Depression	Other	Joint Seal cracking	Climate
Edge cracking	Load	Lane Shoulder Drop-off	Climate
Joint Reflection cracking	Climate	Linear cracking	Load
Lane Shoulder Drop-off	Climate	Small Patching	Other
L&T cracking	Climate	Large Patching	Other
Patch/Utility cut	Other	Polished Agg	Load
Polished Agg	Other	Popouts	Other
Pothole	Climate	Pumping	Other
RR Crossing	Other	Punchout	Load
Rutting	Load	RR Crossing	Other
Shoving	Other	Scaling/crazing	Other
Slippage cracking	Other	Shrinkage cracking	Other
Swell	Other	Corner Spall	Other
Raveling	Other	Joint Spall	Other
Weathering	Climate		

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 (located within Manhattan Beach's StreetSaver database).

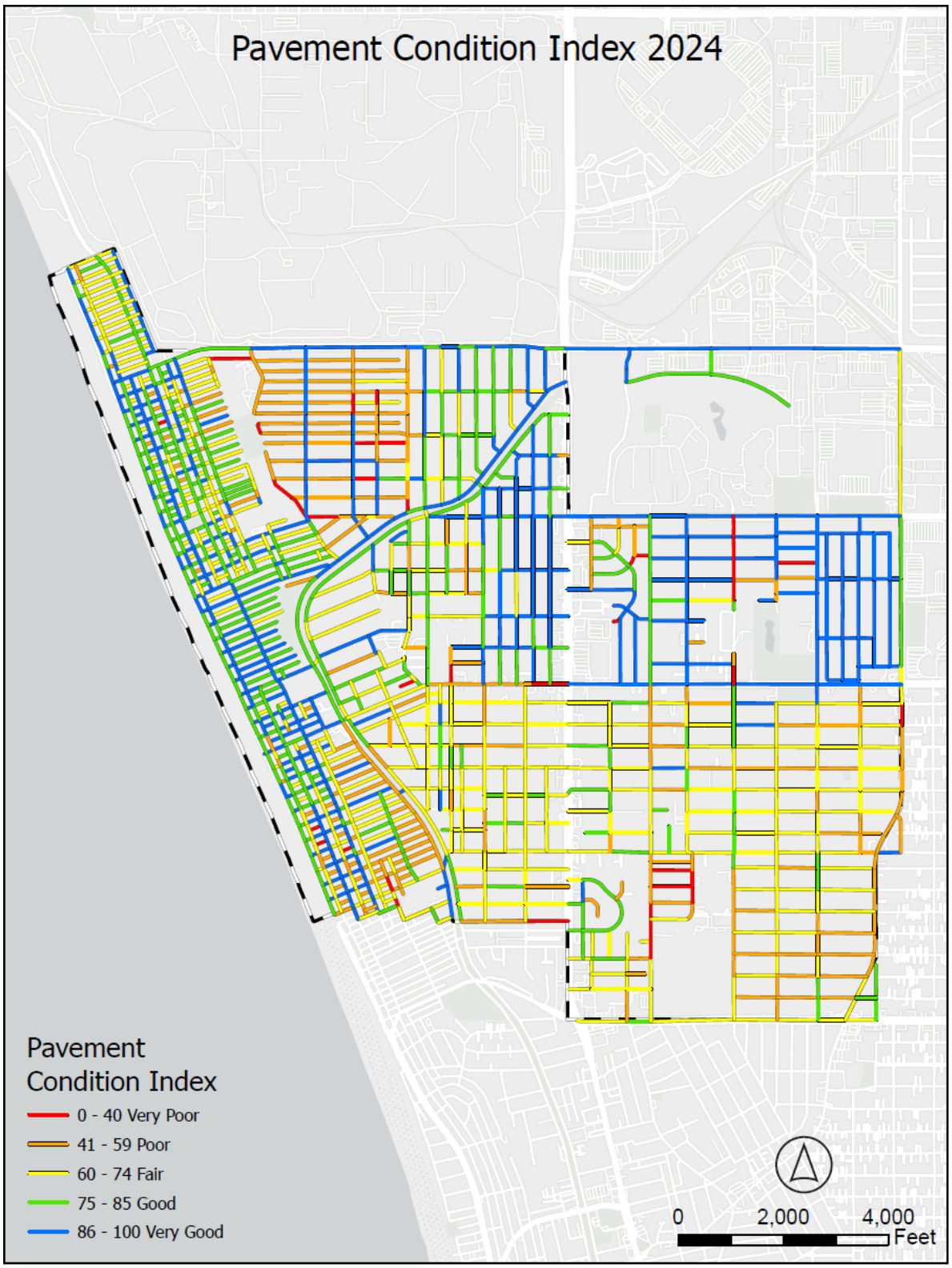


Figure 13 – 2024 Manhattan Beach Pavement Condition Index (PCI) Map

SECTION IV
FORECAST MAINTENANCE & REHABILITATION (FMR) REPORT

A. Increase PCI Budget, Five Year Plan – FY 2024-2029

A. FORECAST MAINTENANCE / REHABILITATION (FMR) REPORT

Listed in chronological order by plan year then alphabetically by street name, this report presents the year and action corresponding to the next recommended work activity for specific segments within the pavement network.

INCREASE PCI BUDGET – A recommended budget was generated for the City to demonstrate the necessary funding that is required to increase the current weighted PCI level of 73 to 78 within five years.

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

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.

All multi-year budget projections include an annual 4% unit cost inflation rate for the term of the budget forecast, as well as a 25% contingency on material costs which typically cover additional project costs for contract administration, design, construction management.

Maint. Type	2024	2025	2026	2027	2028
Type II Local	$0.50	$0.52	$0.54	$0.56	$0.58
Type II Artr	$0.80	$0.83	$0.87	$0.90	$0.94
Cape Seal	$2.25	$2.34	$2.43	$2.53	$2.63
2" ARHM Overlay	$5.50	$5.72	$5.95	$6.19	$6.43
AC Overlay	$3.75	$3.90	$4.06	$4.22	$4.39
AC Recon L	$12.85	$13.36	$13.90	$14.45	$15.03
AC Recon A	$14.50	$15.08	$15.68	$16.31	$16.96
PCC Recon	$22.50	$23.40	$24.34	$25.31	$26.32

The City of Manhattan Beach makes all final decisions on what pavement sections are scheduled for improvement and within which fiscal year.