Five-Year Pavement Management Plan for City-Maintained Streets

CITY OF LARKSPUR

June 21, 2013

Pavement Engineering Inc.
San Luis Obispo ~ Petaluma ~ Redding

Pavement Engineering Inc.
Civil Engineering · Landscape Architecture
CalTrans/AMRL QC/QA · Construction Management

June 21, 2013 Project No. 130067-01

Ms. Mary Grace Houlihan
City of Larkspur
400 Magnolia Avenue
Larkspur, CA 94939

Subject: Development of a Five-Year Pavement Maintenance Plan for City Maintained Streets

Dear Mary Grace:

We have completed the assessment and development of a five-year plan to maintain the City's paved streets.

Included in this report is our assessment, which includes our project approach, findings and recommendations. To assist the City with its review, we also have included several appendices containing background and reference information.

It has been a pleasure working with a forward-thinking City Council and staff who are dedicated to maximizing the quality and safety of its pavement in a fiscally responsible way. We appreciate the opportunity to contribute to that process.

If you have any questions, please call me. Our goal is to go the extra mile and deliver the services that give you and the City confidence that its streets are managed with the highest degree of honesty, trust and professionalism.

Very truly yours,
PAVEMENT ENGINEERING INC.

Joseph L. Ririe, P.E.
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
JOSEPH L. RIRIE
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SECTION 1 - ASSESSMENT

Background

The City of Larkspur maintains 32.2 centerline miles of road, or approximately 4,691,960 square feet of pavement with an estimated replacement cost of $60,672,000. Larkspur's residential streets, which comprise the bulk of the City's roads at 20.2 centerline miles, are in very poor condition with an overall weighted system Pavement Condition Index (PCI) of 39.

Each year, the Metropolitan Transportation Commission (MTC) compiles and reports a moving three-year average for all Bay Area cities. The last report was released in October of 2012 and lists PCIs from 2011 for 109 agencies. At the time of the report, the City of Larkspur had a PCI of 44, tying it with the City of St. Helena and putting both cities at the bottom of list.

The City of Larkspur has dedicated $400k/year toward pavement improvements and wants to develop a multi-year pavement management plan that reflects the true condition of its roads, offers strategies for rehabilitating these assets in a serviceable and safe condition and provides data for monitoring the effectiveness of applied treatments.

Assessment Approach

On March 13th through 15th of 2013, Joe Ririe, P.E., of Pavement Engineering's engineering staff visually reviewed the City's maintained streets. Each road was assessed to verify its condition and determine the next suitable pavement maintenance treatment and the timing of the treatment.

To simplify the approach, PEI used a few broad categories of treatments. The treatments include slurry seals, heavy maintenance, thin overlays, heavy overlays and reconstruction. The intent was to assign a general category that encompasses several maintenance options, which provide flexibility during the design process and an accurate budget estimate for the work. This information helps the City identify pavement needs and prioritize future work.

Costs

Included in PEI's approach is an updated analysis of costs. PEI reviewed and assigned estimated costs for each of the selected treatments. Our costs are based on bid results from the fall of 2012 and our experience with the paving industry.

The StreetSaver® system has a decision tree matrix that assigns a treatment and cost to each street based on the calculated PCI. PEI reviewed the existing unit costs and made adjustments as necessary.

Soft costs were added to each unit cost to ensure that the allocated budget includes all associated costs pertaining to the cost of improving the selected street segment. Soft costs include a 10 percent contingency and 15 percent design, inspection and administration fee. A summary of the revised costs are provided in the table below.

Summary of Unit Price Changes

Treatment	Arterial		Collector		Local		Hillside Local	
	Old (per sf)	New (per sf)	Old (per sf)	New (per sf)	Old (per sf)	New (per sf)	Old (per sf)	New (per sf)
Crack Seal (LF)	$ 1.20	$ 2.53	$ 1.20	$ 1.27	$ 1.20	$ 1.27	---	$ 1.27
Slurry Seal (SF)	$ 0.31	$ 0.51	$ 0.31	$ 0.44	$ 0.31	$ 0.44	---	$ 0.89
Heavy Maintenance (SF)	---	$ .21	---	$ 1.27	---	$ 1.27	---	$ 2.53
Thin OL with Mod Digout (SF)	$ 2.56	$ .06	$ 0.33	$ 4.43	$ 2.22	$ 3.80	---	$ 7.59
Heavy OL with Digout (SF)	$ 4.78	$ 7.59	$ 4.22	$ 5.69	$ 4.00	$ 5.06	---	$ 10.12
Reconstruct (SF)	$ 10.44	$ 5.18	$ 7.11	$ 12.65	$ 4.44	$ 10.12	---	$ 20.24

Note: "**New"** Unit Costs include a **10% Contingency** and **15% for Soft Costs**

The StreetSaver® program recognizes the need for differing unit prices for each functional classification type: arterial, collector and local/residential. However, during our assessment, we recognized the need for an additional classification that would account for the higher costs required to maintain pavements in the hilly region of Larkspur. These streets will require a contractor to expend addition effort to work, move and stage equipment along the narrow, windy roads. For this assessment, we called the classification “Hillside Local.”

To account for the additional costs associated with the Hillside Local pavements in StreetSaver®, PEI prorated the unit costs assigned in the decision tree matrix. Since 22 percent of the pavement area is assigned to the Hillside Local classification, we calculated the value used for residential/local streets based on 22 percent of the Hillside Local unit price and 78 percent of the Local unit price. While this is not 100 percent accurate, it does provide realistic budget numbers that can be used for future projections.

Although costs provided in the summary spreadsheets developed from our visual review also used the units costs listed in the table above, we did not prorate the unit costs for the Local streets. The appropriate unit cost, whether Local or Hillside Local, was applied.

Neighborhoods

During our assessment, we discovered that the City of Larkspur was sub-divided into smaller areas. As part of our work, PEI refined and defined these areas with city staff. A map, included in this report, was developed that shows the areas.

Our experience has shown that sub-dividing a city into smaller, “bite-size” pieces is an excellent pavement management approach. Smaller areas can be managed and analyzed individually. In addition, the sub-divided areas can be used to select work based on geographical location, which saves mobilization costs during the construction phase, thus saving additional funds for other streets.

SECTION 2 – FINDINGS

System Summary

The City's StreetSaver® pavement management program generated the following data:

Breakdown by Functional Classification

Functional Classification	Replacement Cost	Centerline Miles	Lane Miles	Pavement Area (square feet)	Average PCI
Arterial	$12,380,000	4.13	10.01	815,549	59
Collector	16,399,000	7.82	15.65	1,296,371	35
Residential	31,893,000	20.22	38.09	2,580,040	34
Totals	**60,672,000**	**32.17**	**63.75**	**4,691,960**	**39**

The City's arterial system is in better condition with a weighted PCI of 59 compared to the overall weighted PCI for the entire city (39). This is a preferred strategy when managing pavements with a limited budget. It's important to keep the most used streets in a more serviceable condition. Unfortunately, because the arterial streets make up only 13 percent of the entire street system, their better condition does not positively impact the overall PCI.

The City's streets are shown by neighborhood in the table below. The arterials are broken out separately because they generally are eligible for federal and state grants.

The neighborhoods include all of the collector streets contained within the boundaries, and each was given a weighted average PCI. The table lists the neighborhoods in order of worst first.

Breakdown by Neighborhood

Classification	Average PCI	Total Cost
Arterial	58.6	$6,176,339
Neighborhood	**Average PCI**	**Total Cost**
Industrial	13.9	$231,604
South Eliseo	19.1	2,267,762
Larkspur Landing	19.6	662,458
South Magnolia	30.2	2,115,504
Hillview	30.4	669,041
Riviera Circle	31.1	1,059,444
Madrone Canyon	31.9	2,170,409
Loop	33.3	1,427,331
Greenbrae Hills	35.4	1,889,169
Murray Park	40.9	513,067
Old Town	46.4	480,490
Palm Hill	47.8	664,213
Heatherwood Gardens	50.7	230,783
Creekside	51.6	565,960
North Magnolia	55.3	337,570
Baltimore Park	63.7	147,447

As part of our assessment, PEI identified the next appropriate treatment for every City street and an approximate time to apply that treatment. This information is contained in the spreadsheets in this report in the column labeled PEI Year. The numbers in the column represent how many years from today the treatment should be applied. For example, a listing of 1 to 2 means that the treatment should be applied as part of this or next year's project. The purpose is to optimize the timing of the treatment. Applying the right treatment at the right time will improve pavement performance and extend pavement service life. A 0 (zero) indicates that the pavement needs immediate attention and the optimal timing is past.

SECTION 3 – RECOMMENDATIONS

Discussion

Before presenting our recommendations, it would be helpful to provide information on pavement maintenance strategies.

Pavement Maintenance Strategies

Although good pavement management involves applying the right treatment to the right pavement using the right materials, the old adage "timing is everything" applies to pavement management, too. As pavement deteriorates with time, the type and cost of maintenance treatments change, so understanding timing relative to treatment becomes fundamentally important in extending pavement service life and protecting your pavement investment.

Pavement deteriorates primarily due to fatigue from heavy wheel loads and aging from the oxidizing effects of water and sunlight. Employing maintenance strategies is critically important to impede the deterioration process. Equally important is knowing when to apply those treatments.

There are three general approaches to managing treatment timing, each with different outcomes.

<u>Worst-first management</u>

The first and most common is the "worst first," or crisis-management approach, which focuses on the worst pavements while ignoring the rest. After all, it's pavement in the worst condition that gets the most complaints, but while the worst-first approach eliminates some problems immediately, it creates more in the future. Good pavements that are ignored now become the worst pavements in the future and will require more costly treatments to rehabilitate. This approach works for a short time and is only an effective strategy when managing a pavement in predominantly poor condition.

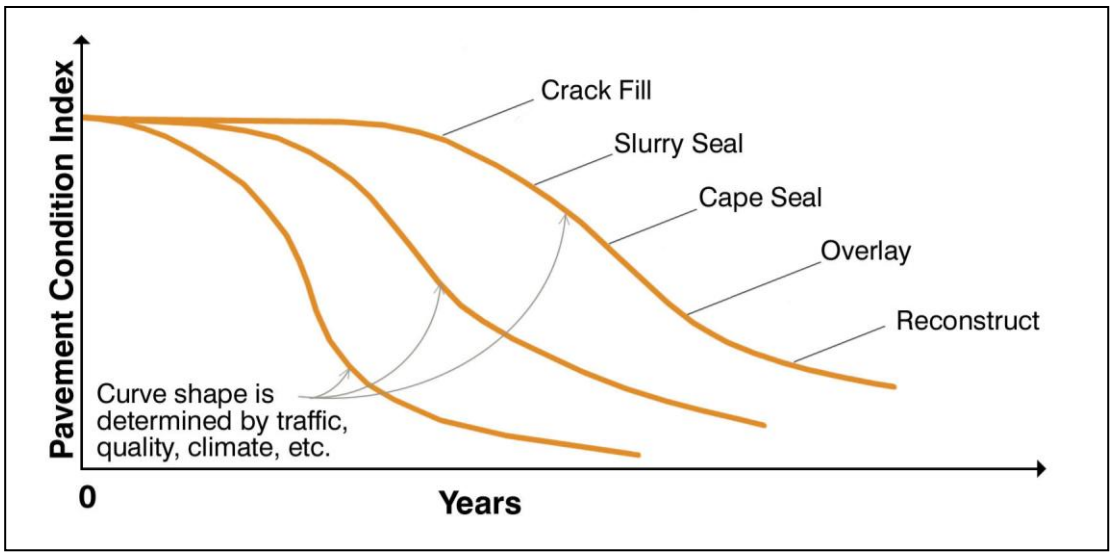
<u>Best-first management</u>

The second approach is "best first," which focuses all the effort and budget on maintaining pavements in the best condition while ignoring the rest. This management approach typically costs less initially, but eventually even the best pavements reach a critical point where more aggressive maintenance and or rehabilitation treatments are necessary. This approach is not sustainable. It can be effective over short time periods to keep good pavement good, buy time and free up funds for pavement that is in worst condition.

Critical-point management

The third approach is what PEI calls "critical-point" management. Each pavement is unique and, as such, is somewhere on a deterioration curve. Eventually it intersects at a critical point where a specific treatment must be applied or the pavement risks falling into a condition where that treatment will no longer be effective and will require the next, more costly treatment to maintain or rehabilitate it. Knowing where a pavement is on the curve and where that "critical point" is determines the next-needed treatment and the timing of the treatment. The critical-point approach is by far the most cost-effective pavement management plan.

Pavement Preservation Timing



Selecting the right approach will depend on the current condition of your system. This process is dynamic, and when managing a pavement system, you can expect the strategy to change overtime depending on condition and budget constraints.

Recommendations

For the City of Larkspur system, PEI recommends a two-pronged approach. The first prong is to use any available funding and focus on the City's collector and local/residential streets on a neighborhood by neighborhood basis. Given that so many neighborhoods are in poor condition, we recommend the City allocate its money starting with the worst neighborhood and continuing down the list.

The City has approximately $1,000,000 available for pavement rehabilitation for FY 2013-2014. Following the proposed strategy, we recommend that the FY 2013-2014 project include the Industrial and Larkspur Landing neighborhoods. The cost of these projects is estimated at $894,062. Focusing on these neighborhoods allows completion

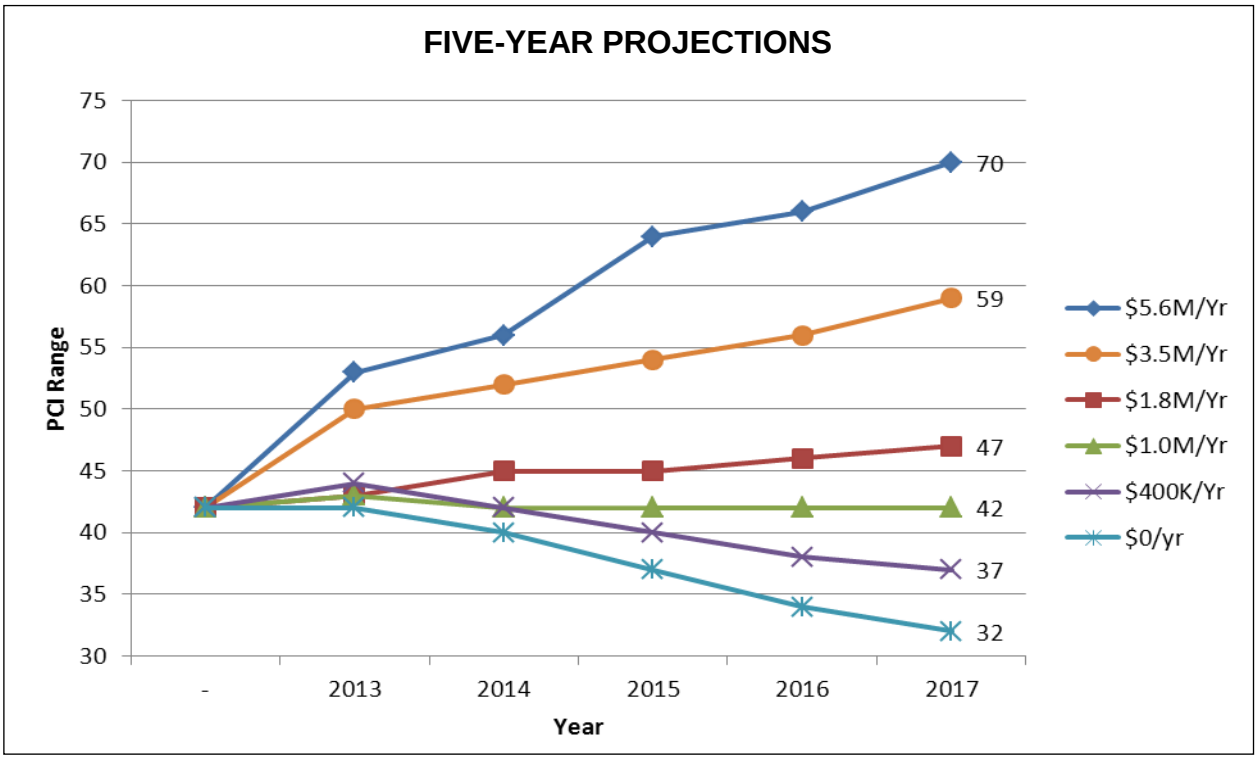
of all the recommendations for the streets within each neighborhood. If the City does these projects before the end of the year, the current PCI will increase from 39 to 42.
The second prong is to seek out federal and state grants for the City's arterial streets. As part of our assessment, PEI identified the next appropriate treatment and determined an approximate time for the treatment. This list is in Appendix C. Projects can be identified from the list depending on available funds.

If the City follows this approach for the next four to five years, then adjustments can be implemented to address the maintenance needs of the streets they improve between now and then. In other words, the City will begin to evolve from a worst-first strategy to more of a critical-point PCI strategy.

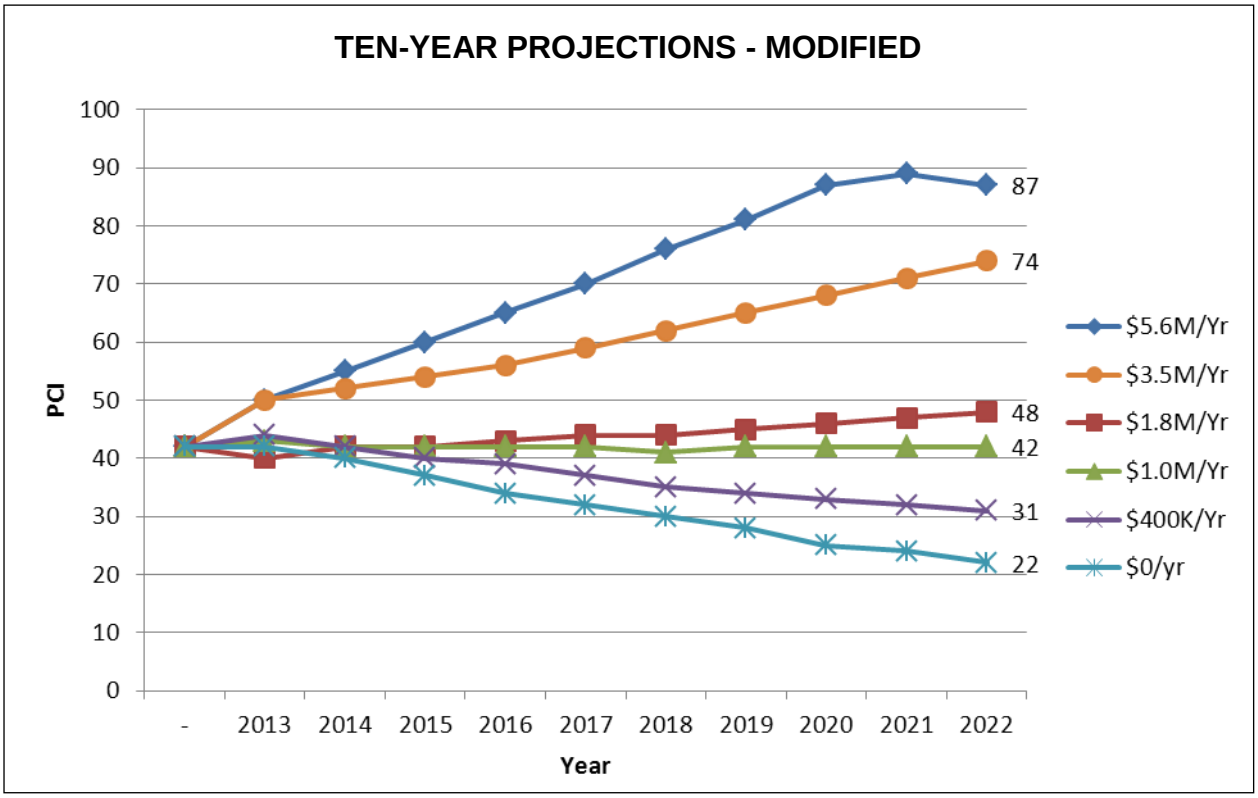
This plan should be updated in two to three years to provide feedback on the effectiveness of this approach and selected treatments.

Analysis for Future Funding

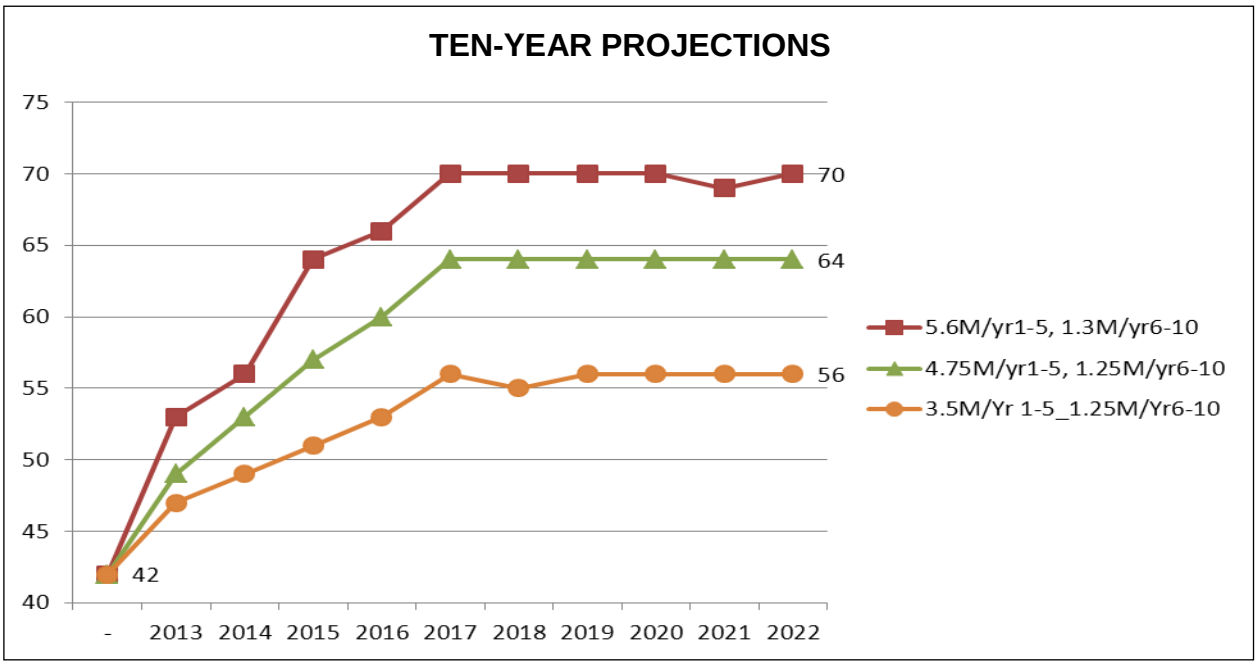
PEI ran several scenarios using the StreetSaver® program. The scenarios consisted of five- and ten-year PCI projections simulating different funding levels. For these projects, PEI used 42 as the starting PCI assuming that the city would go forward with



the recommended project for FY 2013-2014 outlined above. The results of the scenarios are shown below and on the next page.



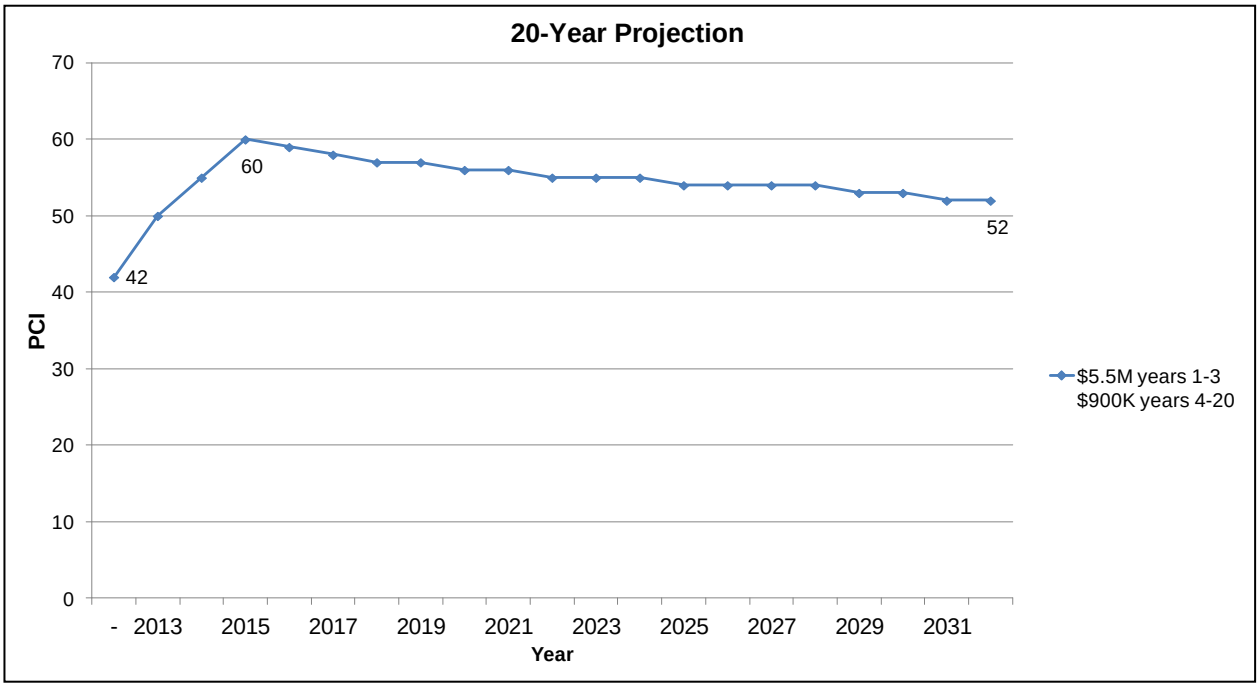
In additon, PEI generated three scenarios where the City invested a set amount for five years and then forcasted what annual investment it would take to maintain the achieved PCI. The graph is shown below.



For the above analysis, the cost to maintain the achieved PCI does not vary over the next five years no matter what spending level the City invests. The cost to maintain the system for five years is $1,250,000 to $1,300,000. This means the City has the option

to select the funding amount it wants to apply to the street system without consequence to the cost for maintaining achieved PCI, at least for the next few years.

After a discussion with City staff, another possible scenario that may be available to fund the pavement needs is a front-loaded type of a budget structure. For this analysis, PEI prepared a scenario where the City dedicated $5.5M per year for the first three years than applied a set amount of $900k per year for every year after that. In order to realize the full impact of the scenario, we used a 20-year time line. The result was that the City's weighted average PCI would increase from 42 to 60 after the first three years and then have a steady drop of 8 PCI points over the next 17 years to a 52. The slow drop is expected based on the previous scenario that shows the system requires about a $1.25M annual budget to maintain the PCI. A graph of the analysis is shown below:



Summary Future Projects

Based on our assessment and analysis of the findings, PEI recommends that the City pursue a worst-first selection approach for its local streets for the next few years. We recommend selecting future projects from the neighborhood listing sorted by PCI. If an entire neighborhood cannot be funded, then the City can decide to skip to the next neighborhood or further sub-divide the next neighborhood in order.

Additionally, the City needs to establish the annual funding level it wants to implement and maintain, depending on the amount of work the City can handle and its residents can endure. An annual budget of $5.6M likely will be too much. If managed carefully by spreading the work out geographically, the City might be able to spend $3.5M per year. However, spending $3.5M per year is projected to achieve a city wide PCI of only 56. If the City has a PCI goal, then it will need to maintain the $3.5M spending amount for a longer period of time. The estimated time can be determined based on the Ten-Year Projection graph.

APPENDIX A – PAVEMENT BASICS

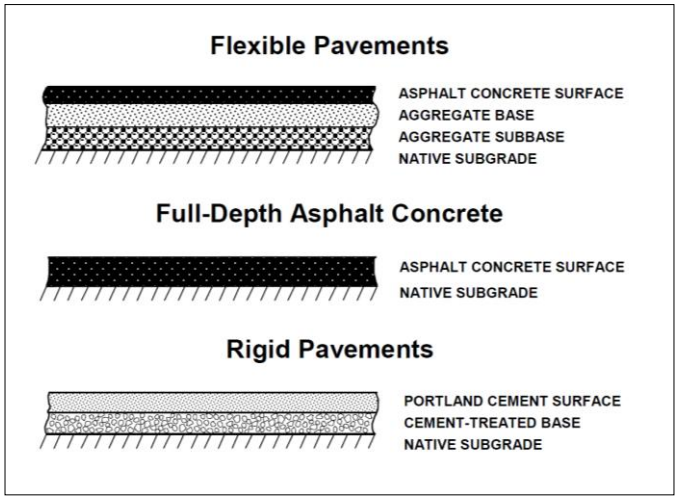
PAVEMENT BASICS

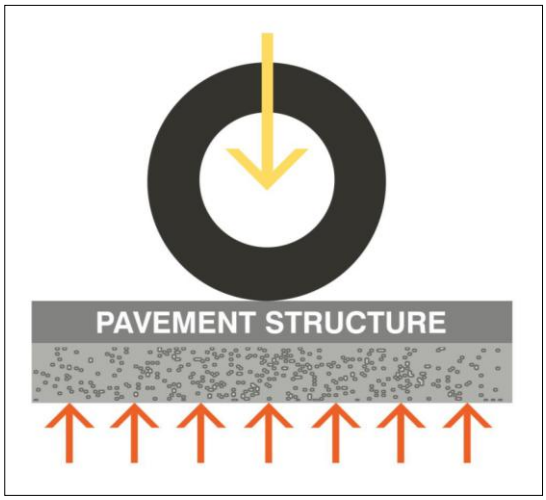
When it comes to maintaining pavements, it's important to understand the processes that cause deterioration and the steps you can take to protect, preserve and extend the service life of your City's roads and parking areas. After all, it's a huge capital expense.

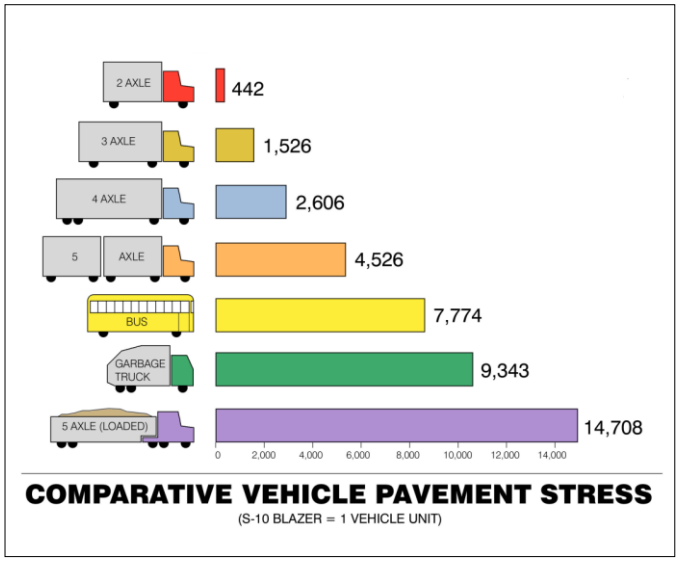
This primer covers four important pavement basics: structure; deterioration; distresses; and the Pavement Condition Index (PCI). Understanding what pavement is and how to preserve it potentially can save thousands of dollars over the typical lifespan of asphalt concrete surfaces.

Pavement Structures and Pavement Design

Pavements are a structural support system that acts like a beam. But unlike beams in buildings, which generally have static loads, a pavement structure flexes many times from traffic loading. The top of the pavement structure is compressed from the load while the lower portion expands or stretches. Each time a heavy vehicle passes over a pavement structure, it consumes some of the pavement's life and loses some of its







ability to flex. Over time and with repetitive loads, the asphalt layer begins to break down at the bottom where the pavement expands to absorb the load.

Cars and light trucks have little impact on the pavement structure. On the other hand, heavy trucks have significant impacts on the pavement due to the high axle weights. The impact of trucks is measured in equivalent single 18,000-pound axle loads (ESALs) that is then converted into a Traffic Index (TI) used for

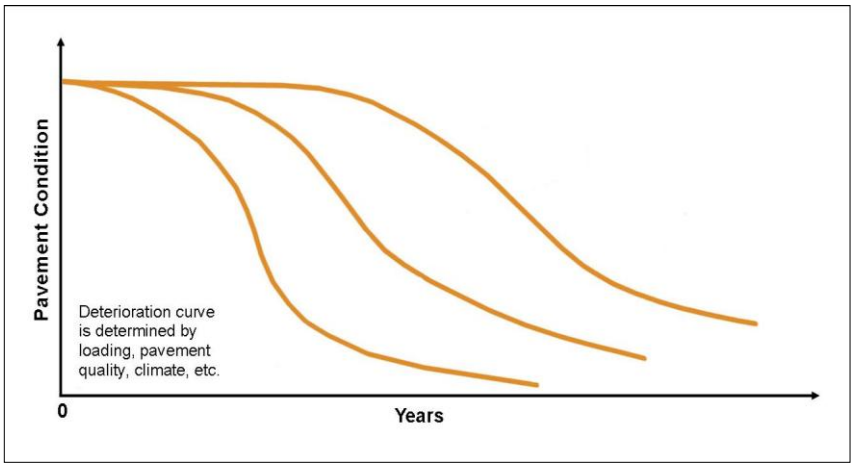
design. The design TI is the total number of ESALs that the pavement will support before it begins to fail, regardless of the passage of time. For example, a design TI of 5 is equal to 7,160 ESALs. A design TI of 8 is equal to 372,000 ESALs. Normally, when designing new pavement, ESALs over a 20-year period are used. For rehabilitation, such as overlays, 10 years is the general rule of thumb.

The other element of pavement design is “beam support,” which is provided by the subgrade soils. The amount of support or the “support value” is designated by an R-value test.

Using the design TI and R-value, a pavement designer chooses various materials to construct the structural section. The most common pavement section is a thin layer of asphalt concrete over aggregate base(s). Many options are available depending on specific project requirements and conditions.

The design method used in California is based on 50 percent reliability. This means that the average pavement life of all pavements constructed using the same design procedure will last the design life. It also means that about half will not last that long and the other half will last longer. To express this concept, a design life is often expressed in a span of years, such as 17 to 23 years for a 20-year design life.

Pavement Deterioration



Each road and each pavement section is unique and, as such, is somewhere on a deterioration curve. Pavement quality, the impact of heavy wheel loads, environmental influences and time all impact a pavement’s lifespan or service life. Along that curve are critical points where a maintenance treatment must be applied or the pavement risks falling or deteriorating into a condition where that treatment will no longer be effective and will require the next, more costly treatment to maintain or rehabilitate it. The more effective the timing and treatment, the longer the pavement will last before it requires reconstruction.

Pavement deteriorates from two processes: ***fatigue*** and ***aging***. Because these processes occur simultaneously, the need for pavement rehabilitation will occur at approximately the same time, assuming the pavement is designed and constructed properly. This is called the “design life.” For most new pavements, the design life is 20 years.

Fatigue

Fatigue is a result of heavy wheel loads. Over time, as the pavement structure flexes or bends from the weight of trucks and repetitive traffic, it loses some of its flexibility. Eventually, the asphalt concrete layer begins to break on the lowest layer of the

pavement structure. This cracking progresses upward until it reaches the surface and appears as alligator cracking, named for its resemblance to the reptile's hide. Alligator cracking is a sure sign of structural failure that requires major rehabilitation.

Aging

Aging results from the environmental influences of sun and water, which oxidizes pavement. Asphalt concrete is composed of aggregates mixed with a binder. Even good quality aggregates experience some breakdown over time, and the asphalt concrete binder ages as well. As a binder's volatile components evaporate, it loses volume, and as the volume decreases, the pavement becomes brittle and begins to crack. These cracks are exacerbated by heavy wheel loads. Transverse cracking usually appears first, but cracking also shows up at weak areas, such as paving joints. Eventually, these cracks widen and increase over time until the pavement takes on a checkerboard appearance. Any cracking, of course, is a conduit for water that accelerates deterioration and dramatically shortens pavement life.

Pavement Distresses

Distresses are common to virtually the entire pavement as aging progresses. Some of the most common are ***weathering*** or ***raveling***; ***block cracking***; ***longitudinal and transverse cracking***; ***distortions***; ***patching*** and ***utility cuts***, and ***rutting*** or ***depressions***.

Weathering

Weathering or raveling can be the first sign of pavement deterioration. As a pavement's binder oxidizes, the fine aggregate components begin to wash away, revealing coarser aggregates. Eventually, the asphalt becomes rough and uneven. It is a sign that either the asphalt binder has hardened appreciably or that a poor quality mixture is present. Weathering and raveling also can be caused by certain types of traffic or by oil dripping that softens the surface and dislodges the aggregates.

Longitudinal and Transverse Cracking

Longitudinal cracks run parallel to the pavement's centerline or laydown direction. They can be caused by a poorly constructed paving lane joint, by decreased support or thickness near the edge of the pavement, or by environmental influences such as temperature cycling or movement of the underlying layers. Longitudinal cracks can also appear as a reflective crack beneath the surface course, including cracks in PCC (Portland cement concrete) slabs.

Transverse cracks extend across the pavement at approximately right angles to the centerline. They can be caused by temperature cycling and reflective cracking.

Block Cracking

Block cracking is a combination of connecting longitudinal and transverse cracks that form a distinctive checkerboard pattern over large areas of pavement. The roughly rectangular segments may range in size from approximately 1 foot by 1 foot to 10 feet by 10 feet. It is caused mainly by asphalt concrete shrinkage and daily temperature cycling and indicates that the asphalt has hardened significantly. Block cracking is not associated with wheel loads.

Alligator Cracking

Alligator cracking is a series of small interconnecting cracks caused by the failure of the asphalt concrete surface under repeated traffic loading. Cracking begins at the bottom of the asphalt surface (or stabilized base) where tensile stress and strain are highest under wheel loads. Initially, the cracks propagate to the surface as a series of parallel longitudinal cracks that eventually connect after repeated traffic loading. The cracks form many-sided, sharp-angled pieces that resemble the skin of an alligator and generally are less than 2 feet on the longest side.

Distortions

Distortions usually are caused by corrugations, bumps, sags and shoving. They are localized, abrupt upward or downward displacements in the pavement surface, a series of closely spaced ridges and valleys or localized longitudinal displacements of the pavement surface. Distortions can be unsightly and always affect ride quality.

Patching and Utility Cuts

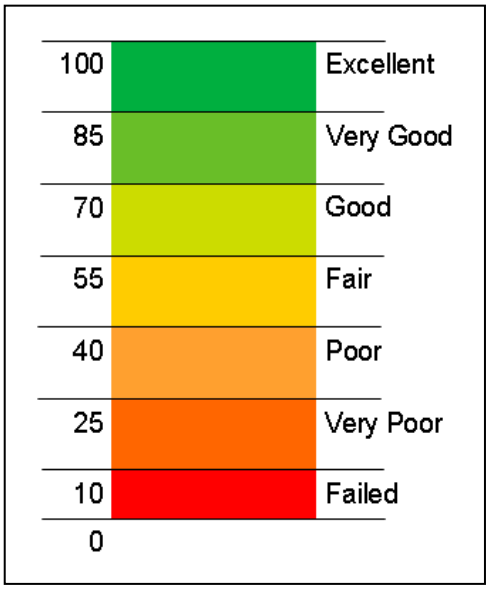
A patch is an area of pavement that has been replaced with new material to repair the existing pavement. A patch is considered a defect no matter how well it's constructed, because a patched area usually does not perform as well as the original pavement section. Generally, some roughness and unevenness is associated with this type of distress**.**

Rutting and Depressions

A rut is a surface depression in the wheel paths. Pavement uplift may occur along the sides of the rut, but in many instances, ruts are noticeable only after a rainfall when the paths are filled with water. Rutting stems from a permanent deformation in any of the pavement layers or subgrades that is caused by movement of the materials due to traffic loads. Significant rutting can lead to major structural failure.

Depressions are localized areas where the pavement structure is lower than the surrounding area but the transition is not abrupt enough to be considered a distortion. They are often referred to as "bird baths."

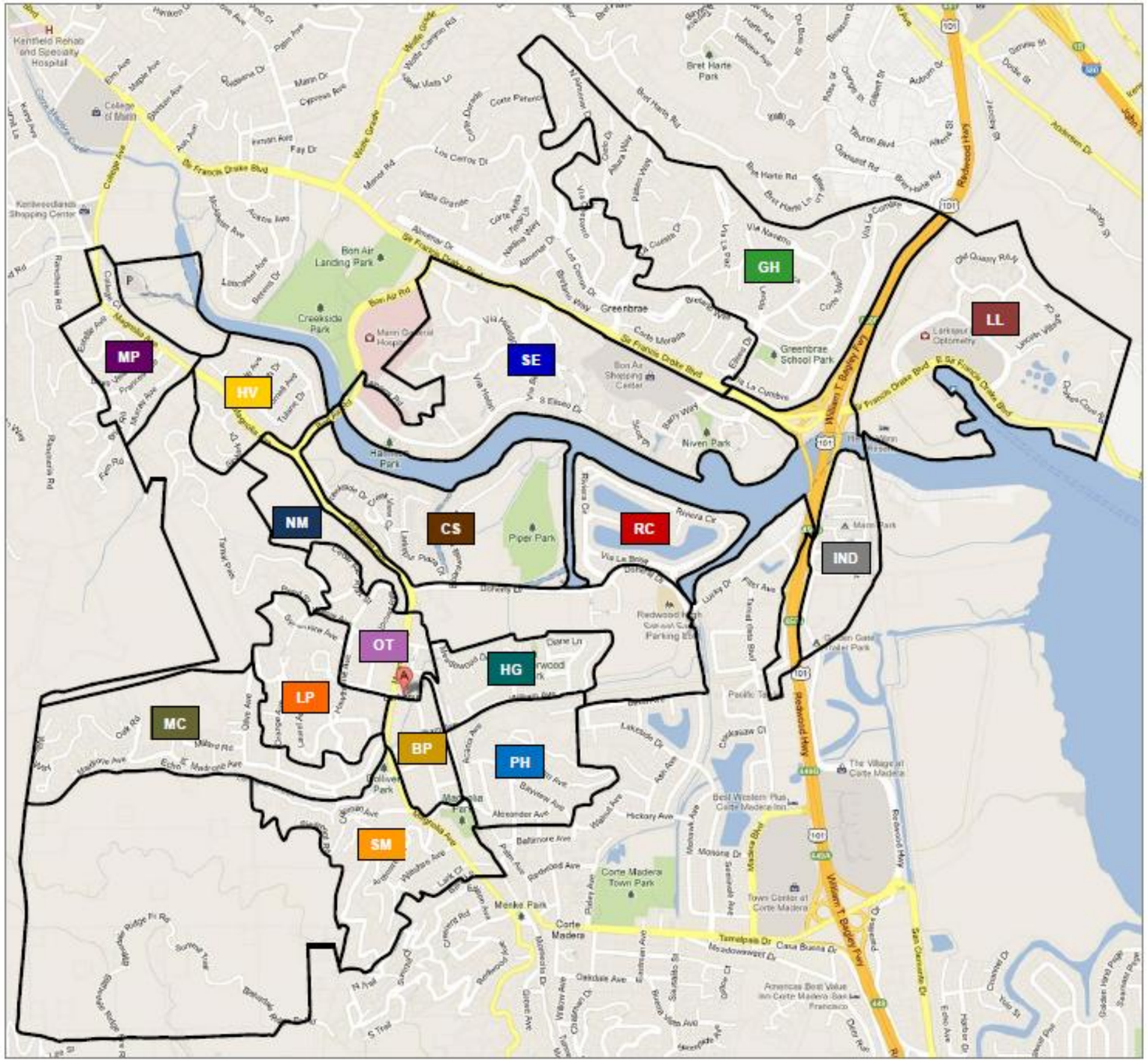
The Pavement Condition Index



One of the most effective tools for evaluating pavement is the Pavement Condition Index or the PCI, which was developed by the United States Army Corps of Engineers during World War II and later standardized by the American Society for Testing and Materials as ASTM Standard D6433. When combined with other weighted pavement investigation information, a PCI provides an objective and rational basis for determining maintenance and repair needs and priorities.

The PCI is a composite numerical rating between 0 and 100 that describes pavement condition based on the type, extent and severity of pavement distresses. A PCI of between 91 and 100 describes pavement in excellent condition, whereas a PCI below 30 is pavement that has failed or reached the end of its service life. Most pavement falls somewhere in between.

APPENDIX B – NEIGHBORHOOD MAP



CITY OF LARKSPUR

Neighborhood Map

Baltimore Park	BP
Creekside	CS
Greenbrae Hills	GH
Heatherwood Gardens	HG
Hillview	HV
Industrial	IND
Larkspur Landing	LL
Loop	LP
Madrone Canyon	MC
Murray Park	MP
North Magnolia	NM
Old Town	OT
Palm Hill	PH
Riviera Circle	RC
South Eliseo	SE
South Magnolia	SM

APPENDIX C – SUMMARIZED FINDINGS

City of Larkspur
Five-Year Pavement Maintenance Plan
Project No. 130067-01

Alphabetical Listing

PEI Area ID	RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
PH	Acacia Ave	Alexander	End	1,190	18	21,420	THIN OVERLAY	$81,396.00	2 TO 3	64	100
NM	Ajax St	Hawthorne	Cedar	330	18	5,940	HEAVY MAINTENANCE	$7,543.80	1 TO 2	45	90
BP	Alexander Ave	Holcomb	Magnolia	600	37	22,200	HEAVY MAINTENANCE	$28,194.00	1 TO 2	72	90
PH	Alexander Ave	PEPPER	BRIDGE/ ACACIA	346	20	6,920	HEAVY MAINTENANCE	$8,788.40	1 TO 2	71	90
PH	Alexander Ave	BAYVIEW	PEPPER	625	20	12,500	THIN OVERLAY	$55,375.00	4 TO 5	71	100
GH	Altura Way	S CITY LIMIT	CIELO	295	31	9,145	THIN OVERLAY	$34,751.00	0	3	100
GH	Altura Way	CIELO	PASEO	737	31	22,847	THIN OVERLAY	$86,818.60	1 TO 2	3	100
GH	Altura Way	PASEO	N CITY LIMIT	328	31	10,168	THIN OVERLAY	$38,638.40	2 TO 3	3	100
MP	Arbor St	Murray Ave	Frances Ave	270	15	4,050	THIN OVERLAY	$15,390.00	1 TO 2	30	100
MC	Ardmore Rd	WILTSHIRE (E)	PARK WAY	189	14	2,646	THIN OVERLAY	$20,083.14	0 TO 1	17	100
MC	Ardmore Rd	PARK WAY	WILTSHIRE (W)	1,251	14	17,514	THIN OVERLAY	$132,931.26	2 TO 3	17	100
BP	Baltimore Ave	Holcomb	Magnolia	768	40	30,720	HEAVY MAINTENANCE	$39,014.40	1 TO 2	73	90
SE	Barry Way	DRAKES LANDING RD	PVT RD (340FT S/O DRKS LNDG)	340	46	15,640	HEAVY OVERLAY	$88,991.60	0	48	100
SE	Barry Way	SIR FRANCIS DRAKE	DRAKES LANDING RD	310	46	14,260	THIN OVERLAY	$63,171.80	2 TO 3	48	100
MP	Bayo Vista Ave	HILLCREST AVE	607' S/O HILLCREST AVE	607	17	10,319	THIN OVERLAY	$39,212.20	0 TO 1	5	100
PH	Bayview Ave	ALEXANDER	CTY LMT-70FT N/O BALTIMORE	343	20	6,860	THIN OVERLAY	$26,068.00	2 TO 3	45	100
PH	Bayview Ave	PEPPER	ALEXANDER	647	20	12,940	THIN OVERLAY	$49,172.00	4 TO 5	45	100
PH	Birch Ave	CITY LIMIT	300 W' OF CITY LIMIT	300	24	7,200	SLURRY	$3,168.00	5	91	90
A	Bon Air Rd	Magnolia	Bon Air Bridge E/O	1,052	60	63,120	HEAVY OVERLAY	$479,080.80	0 TO 1	74	100
A	Bon Air Rd	Bon Air Bridge E/O	City Limit N	308	50	15,400	THIN OVERLAY	$77,924.00	2 TO 3	14	100
A	Bon Air Rd	SIR FRANCIS DRAKE BLVD	380' TO CITY LIMIT	380	70	26,600	HEAVY OVERLAY	$201,894.00	2 TO 3	94	100
SM	Branch Ave	Magnolia	End	280	16	4,480	THIN OVERLAY	$34,003.20	2 TO 3	12	100
GH	Bretano Way	Eliseo Dr	VIA HERMOSA	850	22	18,700	THIN OVERLAY	$82,841.00	2	11	100
MP	Briar Rd	City Limit-120 ft S/O Blck Log	City Limit-95 ft N/O Uppr Bria	400	18	7,200	THIN OVERLAY	$27,360.00	1 TO 2	11	100
MC	Bridge Rd	Madrone	W Baltimore	700	16	11,200	SLURRY	$9,968.00	0	55	90
OT	Cane St	Holcomb	Magnolia	515	24	12,360	HEAVY MAINTENANCE	$15,697.20	1 TO 2	48	90
OT	Cedar Ave	AJAX ST	NORTH END	441	16	7,056	THIN OVERLAY	$26,812.80	1	28	100
OT	Cedar Ave	SOUTH END	AJAX ST	759	16	12,144	HEAVY MAINTENANCE	$15,422.88	2 TO 3	28	90
HG	Chantcleer Ave	William	Meadowood	960	24	23,040	HEAVY MAINTENANCE	$29,260.80	1 TO 2	59	90
SM	Chevy Chase Ct	Wiltmore	End	633	20	12,660	SLURRY	$11,267.40	0 TO 1	81	90
GH	Cielo Dr	Altura Way	End	885	22	19,470	SLURRY	$8,566.80	0	91	90
SM	Coleman Ave	Piedmont Rd	Piedmont Rd	720	12	8,640	THIN OVERLAY	$65,577.60	3 TO 4	45	100
MP	College Ave	WOODLAND ROAD	COLLEGE CT	900	40	36,000	SLURRY	$15,840.00	0	88	90
MP	College Ct	Magnolia Ave	Both Ends	800	25	20,000	THIN OVERLAY	$76,000.00	2	28	100
HV	Cornell Ave	Harvard Dr	Tulane	700	30	21,000	THIN OVERLAY	$79,800.00	2 TO 3	20	100
GH	Corte Alejo	La Cuesta Dr	End	265	23	6,095	THIN OVERLAY	$23,161.00	3 TO 4	51	100
GH	Corte Amado	City Limit-195 ft E/O Vista Gr	End	400	22	8,800	SLURRY	$3,872.00	0	81	90
GH	Corte Baristo	Paseo Way	End	440	22	9,680	SLURRY	$4,259.20	0	87	90
RC	Corte Del Bayo	Riviera Cir	End	730	26	18,980	THIN OVERLAY	$72,124.00	2 TO 3	27	100
RC	Corte Del Coronado	Riviera Cir	End	336	23	7,728	THIN OVERLAY	$29,366.40	2 TO 3	25	100
SE	Corte Del Norte	Via Hidalgo	End	210	24	5,040	THIN OVERLAY	$19,152.00	1 TO 2	13	100
SE	Corte Encanto	El Portal	End	400	28	11,200	THIN OVERLAY	$42,560.00	0 TO 1	12	100
GH	Corte Fedora	Eliseo Dr	End	466	23	10,718	THIN OVERLAY	$40,728.40	2 TO 3	47	100
GH	Corte Gracitas	Via Barranca	End	325	23	7,475	THIN OVERLAY	$28,405.00	0	12	100
SE	Corte Lenosa	Via Hidalgo	End	400	30	12,000	THIN OVERLAY	$45,600.00	1	15	100
GH	Corte Loyola	La Cuesta	End	290	23	6,670	THIN OVERLAY	$25,346.00	2 TO 3	41	100
SE	Corte Oriental	Via Casitas	End	300	32	9,600	THIN OVERLAY	$36,480.00	0	5	100
SE	Corte Ortega	Via Belardo	End	350	34	11,900	THIN OVERLAY	$45,220.00	0 TO 1	15	100
GH	Corte Placida	VIA LA CUMBRE	END	560	23	12,880	HEAVY MAINTENANCE	$16,357.60	1 TO 2	74	90
GH	Corte Placida	VIA LA CUMBRE	END	560	23	12,880	THIN OVERLAY	$48,944.00	4 TO 5	74	100
GH	Corte Precita	Paseo Way	End	405	22	8,910	THIN OVERLAY	$33,858.00	3 TO 4	72	100
GH	Corte Ramon	Via La Paz	End	910	23	20,930	SLURRY	$9,209.20	0 TO 1	77	90
SE	Corte Real	S Eliseo Dr	End	660	32	21,120	THIN OVERLAY	$80,256.00	0	5	100
SE	Corte Solano	El Portal	End	350	24	8,400	THIN OVERLAY	$31,920.00	0 TO 1	13	100
GH	Corte Toluca	Eliseo Dr	End	800	22	17,600	THIN OVERLAY	$66,880.00	3 TO 4	57	100
CS	Creekside Dr	Magnolia Ave	282 ft N/O Magnolia Ave	282	41	11,562	THIN OVERLAY	$51,219.66	2 TO 3	56	100
CS	Creekside Dr	282 ft N/O Magnolia Ave	Larkspur Plaza Dr	1,141	28	31,948	THIN OVERLAY	$141,529.64	2 TO 3	72	100
HV	Dartmouth Dr	Magnolia Ave	Harvard Dr	900	32	28,800	THIN OVERLAY	$109,440.00	0 TO 1	20	100
SE	Del Monte	SIR FRANCISC DRAKE BLVD	DRAKE'S LANDING ROAD	205	57	11,685	THIN OVERLAY	$44,403.00	2 TO 3	45	100
HG	Diane Ln	William	Midway	1,230	22	27,060	HEAVY MAINTENANCE	$34,366.20	1 TO 2	58	90

City of Larkspur
Five-Year Pavement Maintenance Plan
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Alphabetical Listing

PEI Area ID	RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
CS	Doherty Dr	Magnolia	Canal Bridge W/O	1,275	38	48,450	SLURRY	$21,318.00	5	81	90
RC	Doherty Dr	Canal Bridge W/O	Riviera Cir (West Entrance)	1,421	29	41,209	SLURRY	$18,131.96	0 TO 1	14	90
RC	Doherty Dr	Riviera Cir (W)	Lucky Dr	1,439	36	51,804	THIN OVERLAY	$229,491.72	2 TO 3	54	100
SE	Drakes Landing Rd	Barry	Sir Francl Drake	844	37	31,228	THIN OVERLAY	$118,666.40	0 TO 1	37	100
OT	East Ward Street	Meadowood	Magnolia	500	33	16,500	HEAVY MAINTENANCE	$20,955.00	1 TO 2	55	90
MC	Echo Pl	Madrone	End	165	25	4,125	HEAVY MAINTENANCE	$10,436.25	3 TO 4	70	90
LP	Eden Ln	Myrtle	End	265	18	4,770	THIN OVERLAY	$36,204.30	0 TO 1	48	100
CS	Edgewater Pl	CREEKSIDE DR	74' NW	74	25	1,850	THIN OVERLAY	$7,030.00	2 TO 3	50	100
SE	El Portal Dr	Sir Francis Drake Blvd	Via Casitas	650	60	39,000	THIN OVERLAY	$172,770.00	0 TO 1	5	100
GH	Eliseo Dr	Pavement Change	End	405	24	9,720	THIN OVERLAY	$36,936.00	0	1	100
GH	Eliseo Dr	VIA LERIDA	VIA HERMOSA	407	24	9,768	SLURRY	$4,297.92	0	51	90
GH	Eliseo Dr	VIA HERMOSA	PAVEMENT CHANGE	948	24	22,752	THIN OVERLAY	$86,457.60	3 TO 4	51	100
PH	Elm Ave	ELM ((NB) ONE WAY LOOP)	PALM	461	18	8,298	SLURRY	$3,651.12	0 TO 1	43	90
PH	Elm Ave	PEPPER	END	3,115	18	56,070	HEAVY MAINTENANCE	$71,208.90	1 TO 2	43	90
PH	Elm Ave	ACACIA	END	3,700	18	66,600	THIN OVERLAY	$253,080.00	2 TO 3	43	100
MP	Estelle Ave	Magnolia Ave	Cty Lim-570 ft N/O Magnolia	570	25	14,250	THIN OVERLAY	$63,127.50	1 TO 2	27	100
MC	Foley Ln	Madrone	Bridge	82	16	1,312	SLURRY	$1,167.68	0	35	90
MP	Frances Ave	Magnolia Ave	Cty Lim-1000 ft S/O Magnolia	1,000	25	25,000	THIN OVERLAY	$110,750.00	1 TO 2	15	100
HG	Garden Way	William	Heather	240	20	4,800	THIN OVERLAY	$18,240.00	2 TO 3	48	100
HV	Harvard Dr	CORNELL	WEST END	906	30	27,180	THIN OVERLAY	$103,284.00	0 TO 1	19	100
HV	Harvard Dr	EAST END	CORNELL	694	30	20,820	THIN OVERLAY	$79,116.00	1 TO 2	19	100
MC	Hatzic Ct	Wilson	End	650	16	10,400	THIN OVERLAY	$78,936.00	2 TO 3	49	100
HG	Hawkins Wy	Meadowood	End	200	24	4,800	HEAVY MAINTENANCE	$6,096.00	1 TO 2	33	90
OT	Hawthorne Ave	WALNUT	KING ST	531	20	10,620	HEAVY MAINTENANCE	$13,487.40	1 TO 2	39	90
OT	Hawthorne Ave	KING ST	SYCAMORE AVE	479	20	9,580	THIN OVERLAY	$36,404.00	1 TO 2	39	100
OT	Hawthorne Ave	SYCAMORE AVE	LOCUST	990	20	19,800	HEAVY MAINTENANCE	$25,146.00	1 TO 2	39	90
LP	Hazel Ave	TAMALPAIS	LAUREL (N)	512	12	6,144	THIN OVERLAY	$46,632.96	1 TO 2	24	100
LP	Hazel Ave	LAUREL (N)	LAUREL (S)	1,088	12	13,056	HEAVY MAINTENANCE	$33,031.68	1 TO 2	24	90
HG	Heather Way	Dianne	Chanticleer	975	15	14,625	HEAVY MAINTENANCE	$18,573.75	1 TO 2	41	90
MP	Hillcrest Ave	ESTELLE	490' NE	490	17	8,330	THIN OVERLAY	$31,654.00	1	91	100
MP	Hillcrest Ave	FRANCES AVE	PAVEMENT CHANGE	379	17	6,443	THIN OVERLAY	$24,483.40	1 TO 2	15	100
A	Holcomb Ave	Cane	William (N/O)	607	27	16,389	HEAVY MAINTENANCE	$36,219.69	1 TO 2	45	90
A	Holcomb Ave	William (N/O)	Alexander	1,093	20	21,860	HEAVY MAINTENANCE	$48,310.60	1 TO 2	62	90
LP	Holly Ave	Willow	South End	600	18	10,800	THIN OVERLAY	$81,972.00	0 TO 1	9	100
I	Industrial Way	Redwood Hwy	End	592	36	21,312	HEAVY OVERLAY	$107,838.72	0 TO 1	15	100
MC	Jones Way	Madrone	End	300	12	3,600	THIN OVERLAY	$27,324.00	0 TO 1	9	100
OT	King St	Magnolia	Hawthorne	695	36	25,020	THIN OVERLAY	$110,838.60	0	71	100
OT	King St	Monte Vista	Magnolia	275	18	4,950	THIN OVERLAY	$21,928.50	2	47	100
GH	La Cuesta Dr	Corte Ramon	City Limit	1,300	27	35,100	THIN OVERLAY	$133,380.00	0 TO 1	11	100
BP	La Rosa Way	Holcomb	Monte Vista	300	27	8,100	HEAVY MAINTENANCE	$10,287.00	1 TO 2	42	90
SM	Lark Ct	Magnolia	End	610	25	15,250	THIN OVERLAY	$115,747.50	0 TO 1	12	100
LL	Larkspur Landing Cir	Sir Francis Drake East (W	Sir Francis Drake East (E	2,900	38	110,200	HEAVY OVERLAY	$627,038.00	0 TO 1	18	100
CS	Larkspur Plaza Dr	Doherty	End	1,885	34	64,090	THIN OVERLAY	$283,918.70	0 TO 1	8	100
LP	Laurel Ave	HAZEL	HAZEL	975	12	11,700	HEAVY MAINTENANCE	$29,601.00	1 TO 2	29	90
LP	Laurel Ave	HAZEL	NORTH END	345	12	4,140	THIN OVERLAY	$31,422.60	1 TO 2	29	100
HG	Liberty St	Midway	Diane	350	24	8,400	HEAVY MAINTENANCE	$10,668.00	1 TO 2	58	90
NM	Locust Ave	King	Ward	700	36	25,200	THIN OVERLAY	$111,636.00	1 TO 2	34	100
NM	Locust Ave	Ward	Hawthorne	920	20	18,400	HEAVY MAINTENANCE	$23,368.00	1 TO 2	36	90
PH	Loma Vista Ave	Elm	Alexander	736	14	10,304	THIN OVERLAY	$39,155.20	4 TO 5	49	100
SE	Lower Via Casitas	Eliseo Dr	Via Casitas	800	20	16,000	THIN OVERLAY	$60,800.00	0	5	100
MC	Madrone Ave	Redwood (W/O)	End	830	20	16,600	THIN OVERLAY	$125,994.00	1 TO 2	36	100
MC	Madrone Ave	JONES	OLIVE	848	20	16,960	HEAVY MAINTENANCE	$42,908.80	1 TO 2	18	90
MC	Madrone Ave	OLIVE	MAGNOLIA	2,260	20	45,200	THIN OVERLAY	$343,068.00	1 TO 2	21	100
MC	Madrone Ave	REDWOOD	JONES	746	20	14,920	THIN OVERLAY	$113,242.80	3 TO 4	30	100
A	Magnolia Ave	BON AIR	DOHERTY	2,400	30	72,000	SLURRY	$36,720.00	0	59	90
A	Magnolia Ave	COLLEGE	MURRY AVE	1,301	40	52,040	THIN OVERLAY	$263,322.40	1 TO 2	33	100
A	Magnolia Ave	BON AIR	CREEKSIDE	788	30	23,640	THIN OVERLAY	$119,618.40	2 TO 3	59	100
LP	Magnolia Ave	MADRONE	PIEDMONT RD	951	40	38,040	THIN OVERLAY	$288,723.60	1 TO 2	65	100
LP	Magnolia Ave	KING ST	MADRONE	625	40	25,000	THIN OVERLAY	$189,750.00	2 TO 3	65	100
NM	Magnolia Ave	POST	WARD	379	40	15,160	THIN OVERLAY	$67,158.80	3	89	100

City of Larkspur
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Alphabetical Listing

PEI Area ID	RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
NM	Magnolia Ave	DOHERTY	WARD	787	40	31,480	SLURRY	$13,851.20	5	89	90
OT	Magnolia Ave	Ward (S/O)	King (S/O)	713	36	25,668	THIN OVERLAY	$113,709.24	2	63	100
SM	Magnolia Ave	Piedmont Rd (N/O)	City Limit (S)	1,235	36	44,460	THIN OVERLAY	$337,451.40	2 TO 3	73	100
A	Magnolia Ave (NB&SB)	MURRY AVE	DARTMOUTH	1,009	60	60,540	THIN OVERLAY	$306,332.40	3 TO 4	66	100
A	Magnolia Ave (NB)	BON AIR (NB)	DARTMOUTH (NB)	995	30	29,850	THIN OVERLAY	$151,041.00	0 TO 1	66	100
A	Magnolia Ave (SB)	DARTMOUTH (SB)	BON AIR (SB)	2,034	30	61,020	THIN OVERLAY	$308,761.20	2 TO 3	66	100
SM	Marina Vista Ave	1950FT W/O SUMMIT	CITY LIMIT-33FT W/O SUMMIT	1,917	16	30,672	THIN OVERLAY	$232,800.48	0	6	100
SM	Marina Vista Ave	ARDMORE	1950FT W/O SUMMIT	1,729	16	27,664	THIN OVERLAY	$209,969.76	0 TO 1	6	100
HG	Meadowood Dr	E. WARD	End	1,375	33	45,375	HEAVY MAINTENANCE	$57,626.25	1 TO 2	53	90
HG	Midway Rd	Heather	Diane	425	24	10,200	HEAVY MAINTENANCE	$12,954.00	1 TO 2	46	90
MC	Millard Rd	Olive	End	850	16	13,600	THIN OVERLAY	$103,224.00	3 TO 4	20	100
BP	Monte Vista Ave	Alexander	King	1,530	36	55,080	HEAVY MAINTENANCE	$69,951.60	1 TO 2	59	90
MP	Murray Ave	ARBOR	CITY LIMIT (S/O MAGNOLIA)	344	25	8,600	THIN OVERLAY	$32,680.00	1 TO 2	33	100
MP	Murray Ave	MAGNOLIA	ARBOR	806	25	20,150	THIN OVERLAY	$76,570.00	2 TO 3	33	100
LP	Myrtle Ave	Hawthorne	Eden	150	16	2,400	SLURRY	$2,136.00	3	88	90
GH	N Almenar Dr	City Limit-1600 ft N/O Los Cer	End	1,095	22	24,090	THIN OVERLAY	$91,542.00	0 TO 1	21	100
HG	Niven Way	Meadowood	End	315	24	7,560	THIN OVERLAY	$28,728.00	1 TO 2	37	100
MC	Oak Rd	Wilson Way	Redwood Ave	435	20	8,700	THIN OVERLAY	$66,033.00	3 TO 4	42	100
MC	Olive Ave	Madrone	End	1,149	32	36,768	THIN OVERLAY	$279,069.12	2 TO 3	38	100
MC	Onyx St	Madrone	Hawthorne	890	26	23,140	THIN OVERLAY	$175,632.60	1	29	100
LP	Orange Ave	225FT S/O TAMALPAIS AVE	TAMALPAIS AVE	225	29	6,525	THIN OVERLAY	$49,524.75	0 TO 1	9	100
LP	Orange Ave	MADRONE	225FT S/O TAMALPAIS AVE	1075	29	31,175	THIN OVERLAY	$236,618.25	1 TO 2	9	100
SM	Owlswood Dr	Wiltshire	End	550	15	8,250	THIN OVERLAY	$62,617.50	0	7	100
LP	Palm Ave	Walnut	Onyx	550	12	6,600	THIN OVERLAY	$50,094.00	2 TO 3	45	100
PH	Palm Ct	Elm	End	280	14	3,920	HEAVY MAINTENANCE	$4,978.40	1 TO 2	18	90
SM	Park Way	Magnolia	Ardmore	325	22	7,150	THIN OVERLAY	$54,268.50	2 TO 3	27	100
GH	Parkside Way	Eliseo	End	1,195	29	34,655	THIN OVERLAY	$131,689.00	0 TO 1	18	100
GH	Paseo Way	1362 ft N/O La Cuesta	Altura	538	22	11,836	SLURRY	$5,207.84	0	15	90
GH	Paseo Way	La Cuesta	1362 ft N/O La Cuesta	1,362	22	29,964	THIN OVERLAY	$113,863.20	1 TO 2	85	100
PH	Pepper Ave	Elm	City Lim-108 ft S/O Alexander	762	20	15,240	THIN OVERLAY	$57,912.00	4 TO 5	26	100
SM	Piedmont Ct	Piedmont	End	900	16	14,400	THIN OVERLAY	$109,296.00	0 TO 1	23	100
SM	Piedmont Rd	MAGNOLIA	COLEMAN (E)	430	33	14,190	THIN OVERLAY	$107,702.10	3 TO 4	39	100
SM	Piedmont Rd	COLEMAN (E)	END	670	33	22,110	THIN OVERLAY	$167,814.90	4 TO 5	39	100
CS	Piper Park	DOHERTY DR	PARKING LOT	486	33	16,038	THIN OVERLAY	$60,944.40	1 TO 2	94	100
MC	Polhemus Way	Wilson	End	660	17	11,220	THIN OVERLAY	$85,159.80	1	44	100
NM	Post St	Magnolia	End	120	45	5,400	SLURRY	$2,376.00	5	92	90
HG	Ranch Ln	William	End	308	17	5,236	HEAVY MAINTENANCE	$6,649.72	1 TO 2	46	90
MC	Redwood Ave	Madrone	End	863	26	22,438	THIN OVERLAY	$170,304.42	3 TO 4	59	100
A	Redwood Hwy	City Limit (S)	Industrial Way (N/O)	1,105	40	44,200	HEAVY OVERLAY	$335,478.00	0 TO 1	59	100
A	Redwood Hwy	Industrial Way (N/O)	End (N)	1,595	40	63,800	HEAVY OVERLAY	$484,242.00	2 TO 3	36	100
OT	RICE LANE	MAGNOLIA AVE	WARD ST	673	12	8,076	THIN OVERLAY	$30,688.80	0 TO 1	19	100
I	Rich St	Redwood Hwy	PCC Section	390	22	8,580	RECONSTRUCT	$86,829.60	0	6	100
I	Rich St	Rich	Industrial	270	36	9,720	THIN OVERLAY	$36,936.00	0	19	100
MC	Ridgeway Lane	MADRONE AVE	140'	140	7	980	SLURRY	$872.20	3 TO 4	0	90
RC	Riviera Cir	Doherty (West Entrance)	Corte Del Bayo	1,059	37	39,183	THIN OVERLAY	$148,895.40	2 TO 3	32	100
RC	Riviera Cir	Corte Del Bayo	Corte Del Coronado	1,904	30	57,120	THIN OVERLAY	$217,056.00	2 TO 3	34	100
RC	Riviera Cir	Corte Del Coronado	Doherty (East Entrance)	1,800	30	54,000	THIN OVERLAY	$205,200.00	2 TO 3	24	100
SE	S Eliseo Dr	Bon Air	Corte Real (E/O)	1,708	36	61,488	THIN OVERLAY	$272,391.84	0 TO 1	27	100
SE	S Eliseo Dr	Corte Real (E/O)	End	2,117	36	76,212	THIN OVERLAY	$337,619.16	4 TO 5	17	100
HG	S Green	Meadowood	End	250	24	6,000	HEAVY MAINTENANCE	$7,620.00	1 TO 2	29	90
SM	Shady Ln	W Baltimore	End	250	16	4,000	THIN OVERLAY	$30,360.00	0	57	100
A	Sir Francis Drake Blvd	Larkspur Ldg 529 feet W/O W En	Larkspur Ldg E/O East Entr	1,987	60	119,220	HEAVY OVERLAY	$904,879.80	1 TO 2	69	100
A	Sir Francis Drake Blvd	Larkspur Ldg E/O East Entr	City Limit E	1,474	56	82,544	HEAVY OVERLAY	$626,508.96	2 TO 3	74	100
A	Sir Francis Drake Blvd	City Limit	Hwy 101 SB Off-Ramp	1,350	56	75,600	HEAVY OVERLAY	$573,804.00	3 TO 4	65	100
A	Sir Francis Drake Blvd	Hwy 101 SB Off-Ramp	1017 W/O Larkspur Ldng	910	38	34,580	HEAVY OVERLAY	$262,462.20	3 TO 4	76	100
A	Sir Francis Drake Blvd	1017 W/O Larkspur Ldng	529 W/O Larkspur Ldng	488	38	18,544	HEAVY OVERLAY	$140,748.96	3 TO 4	80	100
HV	Skylark Dr	Magnolia Ave	817 ft W/O Magnolia Ave	817	28	22,876	SLURRY	$10,065.44	5	92	90
HV	Skylark Dr	817ft W/O Magnolia Ave	End	653	24	15,672	SLURRY	$6,895.68	5	92	90
HV	Stanford Ct	Tulane	End	100	25	2,500	THIN OVERLAY	$9,500.00	0 TO 1	22	100
LP	Sycamore Ave	Hawthorne	Bond	1,200	24	28,800	THIN OVERLAY	$218,592.00	0 TO 1	8	100

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Alphabetical Listing

PEI Area ID	RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
LP	Tamalpais Ave	ORANGE AVENUE	END	693	20	13,860	THIN OVERLAY	$105,197.40	0 TO 1	17	100
PH	Taylor Ln	Alexander	City Limit (135' S/O Alexander	135	20	2,700	THIN OVERLAY	$10,260.00	4 TO 5	54	100
HV	Tulane Dr	DARTMOUTH	WEST END	750	30	22,500	THIN OVERLAY	$85,500.00	0 TO 1	14	100
HV	Tulane Dr	HARVARD	DARTMOUTH	1,210	30	36,300	THIN OVERLAY	$137,940.00	2 TO 3	14	100
SM	Upper Ardmore	Wiltshire	End	928	14	12,992	THIN OVERLAY	$98,609.28	0	6	100
SE	Upper Via Casitas	Via Casitas	S Eliseo Dr	500	32	16,000	THIN OVERLAY	$60,800.00	0	7	100
GH	Via Barranca	VIA LERIDA	VIA LA PAZ	411	24	9,864	THIN OVERLAY	$37,483.20	4	51	100
GH	Via Barranca	VIA LA PAZ	WEST END	255	24	6,120	THIN OVERLAY	$23,256.00	4 TO 5	51	100
GH	Via Barranca (EB)	VIA LERIDA	ELISEO DR	909	24	21,816	THIN OVERLAY	$82,900.80	3 TO 4	51	100
GH	Via Barranca (WB)	ELISEO DR	VIA LERIDA	909	24	21,816	THIN OVERLAY	$82,900.80	1 TO 2	51	100
SE	Via Belardo	S Eliseo Dr	Via Casitas	570	30	17,100	THIN OVERLAY	$64,980.00	0 TO 1	11	100
SE	Via Casitas	Via Holon	End	820	32	26,240	THIN OVERLAY	$116,243.20	0	8	100
SE	Via Casitas	El Portal Dr	Via Holon	774	32	24,768	THIN OVERLAY	$109,722.24	0	10	100
SE	Via Casitas	Lower Via Casitas	El Portal Dr	574	55	31,570	THIN OVERLAY	$139,855.10	0	5	100
GH	Via Cheparro	City Limit	End	490	20	9,800	SLURRY	$4,312.00	0	81	90
GH	Via Hermosa	ELISEO DR	BRETANO	335	22	7,370	THIN OVERLAY	$32,649.10	0 TO 1	12	100
GH	Via Hermosa	BRETANO	VIA LA CUMBRE	465	22	10,230	THIN OVERLAY	$45,318.90	1 TO 2	12	100
SE	Via Hidalgo	CORTE DEL NORTE	VIA CASITAS	410	32	13,120	THIN OVERLAY	$49,856.00	0 TO 1	34	100
SE	Via Hidalgo	BON AIR RD	CORTE DEL NORTE	1,620	32	51,840	THIN OVERLAY	$196,992.00	1 TO 2	34	100
SE	Via Holon	S Eliseo Dr	Via Casitas	570	32	18,240	THIN OVERLAY	$69,312.00	0	8	100
RC	Via La Brisa	Riviera Cir (E)	238ft W/O Riviera Cir (E)	238	32	7,616	THIN OVERLAY	$28,940.80	0 TO 1	74	100
RC	Via La Brisa	238ft W/O Riviera Cir (E)	Riviera Cir (W)	967	30	29,010	THIN OVERLAY	$110,238.00	0 TO 1	14	100
A	Via La Cumbre	Eliseo Dr	Eliseo (985' E/O Eliseo)	985	32	31,520	THIN OVERLAY	$159,491.20	0 TO 1	44	100
A	Via La Cumbre	Eliseo (985' E/O)	Via Hermosa (233' S/O)	834	16	13,344	SLURRY	$6,805.44	0 TO 1	81	90
A	Via La Cumbre	Via Hermosa (233' S/O)	Eliseo (985' E/O)	834	16	13,344	SLURRY	$6,805.44	0 TO 1	53	90
A	Via La Cumbre (NB)	VIA HERMOSA (20' N/O -NB LANE)	CITY LMT N FULL WIDTH	2,329	16	37,264	HEAVY MAINTENANCE	$82,353.44	1 TO 2	58	90
A	Via La Cumbre (NB)	VIA HERMOSA (20' N/O -NB LANE)	CITY LMT N FULL WIDTH	2,329	16	37,264	THIN OVERLAY	$188,555.84	3 TO 4	58	100
A	Via La Cumbre (SB)	VIA HERMOSA (233' S/O FULL WIDTH)	475' S/O CITY LMT SB LANE ONLY	2,224	16	35,584	THIN OVERLAY	$180,055.04	1 TO 2	18	100
A	Via La Cumbre (SB)	CITY LMT N	475' S/O CITY LMT SB LANE ONLY	475	16	7,600	HEAVY MAINTENANCE	$16,796.00	1 TO 2	18	90
A	Via La Cumbre (SB)	CITY LMT N	475' S/O CITY LMT SB LANE ONLY	475	16	7,600	THIN OVERLAY	$38,456.00	4 TO 5	18	100
GH	Via La Paz	SOUTH END	VIA BARRANCA	280	22	6,160	THIN OVERLAY	$23,408.00	0	6	100
GH	Via La Paz	VIA BARRANCA	DIVIDED ROAD	665	22	14,630	THIN OVERLAY	$55,594.00	0 TO 1	6	100
GH	Via La Paz	START DIVIDED RD (SB)	END DIVIDED RD (SB)	532	16	8,512	THIN OVERLAY	$32,345.60	1 TO 2	6	100
GH	Via La Paz	START DIVIDED RD (NB)	END DIVIDED RD (NB)	575	16	9,200	THIN OVERLAY	$34,960.00	2	6	100
GH	Via La Paz	END DIVIDED RD (NB/SB)	END	380	22	8,360	THIN OVERLAY	$31,768.00	2	6	100
GH	Via Lerida	Bretano Way	Via Navarro	1,400	24	33,600	THIN OVERLAY	$127,680.00	0 TO 1	1	100
GH	Via Navarro	801ft W/O Eliseo Dr	Via Lerida	399	22	8,778	THIN OVERLAY	$33,356.40	0	9	100
GH	Via Navarro (EB)	801FT W/O ELISO DR	ELISEO DR	801	14	11,214	THIN OVERLAY	$42,613.20	1 TO 2	14	100
GH	Via Navarro (WB)	ELISEO DR	801FT W/O ELISO DR	801	14	11,214	THIN OVERLAY	$42,613.20	0	14	100
LL	Victoria Way	Larkspur Landing Cir	End	250	28	7,000	HEAVY OVERLAY	$35,420.00	0 TO 1	37	100
SM	W Baltimore Ave	Magnolia	Width Chg (515' W/O Magnolia)	515	44	22,660	THIN OVERLAY	$171,989.40	0 TO 1	3	100
SM	W Baltimore Ave	BRIDGE RD	END	1,125	16	18,000	HEAVY MAINTENANCE	$45,540.00	1 TO 2	39	90
SM	W Baltimore Ave	WIDTH CHANGE (515' W/O MAGNOLIA)	BRIDGE RD	395	16	6,320	THIN OVERLAY	$47,968.80	2 TO 3	39	100
LP	Walnut Ave	Hawthorne	Palm	1,100	10	11,000	HEAVY MAINTENANCE	$27,830.00	1 TO 2	41	90
NM	Ward St	Magnolia	Hawthorne	700	36	25,200	THIN OVERLAY	$111,636.00	0 TO 1	23	100
A	William Ave	Magnolia	Holcomb	800	22	17,600	HEAVY MAINTENANCE	$38,896.00	1 TO 2	55	90
A	William Ave	Holcomb	High School	1,900	24	45,600	HEAVY MAINTENANCE	$100,776.00	1 TO 2	36	90
OT	Willow Ave	Hawthorne	Holly	650	20	13,000	THIN OVERLAY	$49,400.00	0 TO 1	23	100
MC	Wilson Way	Pvmt Chg (1400' W/O Oak)	Polhemus	704	20	14,080	THIN OVERLAY	$106,867.20	0	4	100
MC	Wilson Way	Polhemus (N/O)	End	426	20	8,520	THIN OVERLAY	$64,666.80	0	11	100
MC	Wilson Way	Oak	Pvmt Chg (1400' W/O Oak)	1,400	20	28,000	THIN OVERLAY	$212,520.00	3 TO 4	41	100
SM	Wiltshire Ave	ARDMORE (E)	ARDMORE (W)	1,075	20	21,500	THIN OVERLAY	$163,185.00	0 TO 1	21	100
SM	Wiltshire Ave	MAGNOLIA	ARDMORE (E)	325	20	6,500	THIN OVERLAY	$49,335.00	2 TO 3	21	100
HV	Yale Ave	Harvard Dr	Tulane Dr	500	25	12,500	THIN OVERLAY	$47,500.00	0 TO 1	8	100

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By Neighborhood - Arterials

RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Bon Air Rd	Magnolia	Bon Air Bridge E/O	1,052	60	63,120	HEAVY OVERLAY	$479,080.80	0 TO 1	74	100
Bon Air Rd	Bon Air Bridge E/O	City Limit N	308	50	15,400	THIN OVERLAY	$77,924.00	2 TO 3	14	100
Bon Air Rd	SIR FRANCIS DRAKE BLVD	380' TO CITY LIMIT	380	70	26,600	HEAVY OVERLAY	$201,894.00	2 TO 3	94	100
Holcomb Ave	Cane	William (N/O)	607	27	16,389	HEAVY MAINTENANCE	$36,219.69	1 TO 2	45	90
Holcomb Ave	William (N/O)	Alexander	1,093	20	21,860	HEAVY MAINTENANCE	$48,310.60	1 TO 2	62	90
Magnolia Ave	BON AIR	DOHERTY	2,400	30	72,000	SLURRY	$36,720.00	0	59	90
Magnolia Ave	COLLEGE	MURRY AVE	1,301	40	52,040	THIN OVERLAY	$263,322.40	1 TO 2	33	100
Magnolia Ave	BON AIR	CREEKSIDE	788	30	23,640	THIN OVERLAY	$119,618.40	2 TO 3	59	100
Magnolia Ave (NB&SB)	MURRY AVE	DARTMOUTH	1,009	60	60,540	THIN OVERLAY	$306,332.40	3 TO 4	66	100
Magnolia Ave (NB)	BON AIR (NB)	DARTMOUTH (NB)	995	30	29,850	THIN OVERLAY	$151,041.00	0 TO 1	66	100
Magnolia Ave (SB)	DARTMOUTH (SB)	BON AIR (SB)	2,034	30	61,020	THIN OVERLAY	$308,761.20	2 TO 3	66	100
Redwood Hwy	City Limit (S)	Industrial Way (N/O)	1,105	40	44,200	HEAVY OVERLAY	$335,478.00	0 TO 1	59	100
Redwood Hwy	Industrial Way (N/O)	End (N)	1,595	40	63,800	HEAVY OVERLAY	$484,242.00	2 TO 3	36	100
Sir Francis Drake Blvd	Larkspur Ldg 529 feet W/O W En	Larkspur Ldg E/O East Entr	1,987	60	119,220	HEAVY OVERLAY	$904,879.80	1 TO 2	69	100
Sir Francis Drake Blvd	Larkspur Ldg E/O East Entr	City Limit E	1,474	56	82,544	HEAVY OVERLAY	$626,508.96	2 TO 3	74	100
Sir Francis Drake Blvd	City Limit	Hwy 101 SB Off-Ramp	1,350	56	75,600	HEAVY OVERLAY	$573,804.00	3 TO 4	65	100
Sir Francis Drake Blvd	Hwy 101 SB Off-Ramp	1017 W/O Larkspur Ldng	910	38	34,580	HEAVY OVERLAY	$262,462.20	3 TO 4	76	100
Sir Francis Drake Blvd	1017 W/O Larkspur Ldng	529 W/O Larkspur Ldng	488	38	18,544	HEAVY OVERLAY	$140,748.96	3 TO 4	80	100
Via La Cumbre	Eliseo Dr	Eliseo (985' E/O Eliseo)	985	32	31,520	THIN OVERLAY	$159,491.20	0 TO 1	44	100
Via La Cumbre	Eliseo (985' E/O)	Via Hermosa (233' S/O)	834	16	13,344	SLURRY	$6,805.44	0 TO 1	81	90
Via La Cumbre	Via Hermosa (233' S/O)	Eliseo (985' E/O)	834	16	13,344	SLURRY	$6,805.44	0 TO 1	53	90
Via La Cumbre (NB)	VIA HERMOSA (20' N/O -NB LANE)	CITY LMT N FULL WIDTH	2,329	16	37,264	HEAVY MAINTENANCE	$82,353.44	1 TO 2	58	90
Via La Cumbre (NB)	VIA HERMOSA (20' N/O -NB LANE)	CITY LMT N FULL WIDTH	2,329	16	37,264	THIN OVERLAY	$188,555.84	3 TO 4	58	100
Via La Cumbre (SB)	VIA HERMOSA (233' S/O FULL WIDTH)	475' S/O CITY LMT SB LANE ONLY	2,224	16	35,584	THIN OVERLAY	$180,055.04	1 TO 2	18	100
Via La Cumbre (SB)	CITY LMT N	475' S/O CITY LMT SB LANE ONLY	475	16	7,600	HEAVY MAINTENANCE	$16,796.00	1 TO 2	18	90
Via La Cumbre (SB)	CITY LMT N	475' S/O CITY LMT SB LANE ONLY	475	16	7,600	THIN OVERLAY	$38,456.00	4 TO 5	18	100
William Ave	Magnolia	Holcomb	800	22	17,600	HEAVY MAINTENANCE	$38,896.00	1 TO 2	55	90
William Ave	Holcomb	High School	1,900	24	45,600	HEAVY MAINTENANCE	$100,776.00	1 TO 2	36	90
						TOTAL COST:	$6,176,338.81			

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By Neighborhood - Baltimore Park

RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Alexander Ave	Holcomb Ave	Magnolia Ave	600	37	22,200	HEAVY MAINTENANCE	$28,194.00	1 TO 2	72	90
Baltimore Ave	Holcomb Ave	Magnolia Ave	768	40	30,720	HEAVY MAINTENANCE	$39,014.40	1 TO 2	73	90
La Rosa Way	Holcomb Ave	Monte Vista	300	27	8,100	HEAVY MAINTENANCE	$10,287.00	1 TO 2	42	90
Monte Vista Ave	Alexander Ave	King St	1,530	36	55,080	HEAVY MAINTENANCE	$69,951.60	1 TO 2	59	90
						TOTAL COST:	$147,447.00			

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By Neighborhood - Creekside

RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Creekside Dr	Magnolia Ave	282 ft N/O Magnolia Ave	282	41	11,562	THIN OVERLAY	$51,219.66	2 TO 3	56	100
Creekside Dr	282 ft N/O Magnolia Ave	Larkspur Plaza Dr	1,141	28	31,948	THIN OVERLAY	$141,529.64	2 TO 3	72	100
Doherty Dr	Magnolia	Canal Bridge W/O	1,275	38	48,450	SLURRY	$21,318.00	5	81	90
Edgewater Pl	CREEKSIDE DR	74' NW	74	25	1,850	THIN OVERLAY	$7,030.00	2 TO 3	50	100
Larkspur Plaza Dr	Doherty	End	1,885	34	64,090	THIN OVERLAY	$283,918.70	0 TO 1	8	100
Piper Park	DOHERTY DR	PARKING LOT	486	33	16,038	THIN OVERLAY	$60,944.40	1 TO 2	94	100
						TOTAL COST:	$565,960.40			

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By Neighborhood - Greenbrae Hills

RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Altura Way	S CITY LIMIT	CIELO	295	31	9,145	THIN OVERLAY	$34,751.00	0	3	100
Altura Way	CIELO	PASEO	737	31	22,847	THIN OVERLAY	$86,818.60	1 TO 2	3	100
Altura Way	PASEO	N CITY LIMIT	328	31	10,168	THIN OVERLAY	$38,638.40	2 TO 3	3	100
Bretano Way	Eliseo Dr	VIA HERMOSA	850	22	18,700	THIN OVERLAY	$82,841.00	2	11	100
Cielo Dr	Altura Way	End	885	22	19,470	SLURRY	$8,566.80	0	91	90
Corte Alejo	La Cuesta Dr	End	265	23	6,095	THIN OVERLAY	$23,161.00	3 TO 4	51	100
Corte Amado	City Limit-195 ft E/O Vista Gr	End	400	22	8,800	SLURRY	$3,872.00	0	81	90
Corte Baristo	Paseo Way	End	440	22	9,680	SLURRY	$4,259.20	0	87	90
Corte Fedora	Eliseo Dr	End	466	23	10,718	THIN OVERLAY	$40,728.40	2 TO 3	47	100
Corte Gracitas	Via Barranca	End	325	23	7,475	THIN OVERLAY	$28,405.00	0	12	100
Corte Loyola	La Cuesta	End	290	23	6,670	THIN OVERLAY	$25,346.00	2 TO 3	41	100
Corte Placida	VIA LA CUMBRE	END	560	23	12,880	HEAVY MAINTENANCE	$16,357.60	1 TO 2	74	90
Corte Placida	VIA LA CUMBRE	END	560	23	12,880	THIN OVERLAY	$48,944.00	4 TO 5	74	100
Corte Precita	Paseo Way	End	405	22	8,910	THIN OVERLAY	$33,858.00	3 TO 4	72	100
Corte Ramon	Via La Paz	End	910	23	20,930	SLURRY	$9,209.20	0 TO 1	77	90
Corte Toluca	Eliseo Dr	End	800	22	17,600	THIN OVERLAY	$66,880.00	3 TO 4	57	100
Eliseo Dr	Pavement Change	End	405	24	9,720	THIN OVERLAY	$36,936.00	0	1	100
Eliseo Dr	VIA LERIDA	VIA HERMOSA	407	24	9,768	SLURRY	$4,297.92	0	51	90
Eliseo Dr	VIA HERMOSA	PAVEMENT CHANGE	948	24	22,752	THIN OVERLAY	$86,457.60	3 TO 4	51	100
La Cuesta Dr	Corte Ramon	City Limit	1,300	27	35,100	THIN OVERLAY	$133,380.00	0 TO 1	11	100
N Almenar Dr	City Limit-1600 ft N/O Los Cer	End	1,095	22	24,090	THIN OVERLAY	$91,542.00	0 TO 1	21	100
Parkside Way	Eliseo	End	1,195	29	34,655	THIN OVERLAY	$131,689.00	0 TO 1	18	100
Paseo Way	1362 ft N/O La Cuesta	Altura	538	22	11,836	SLURRY	$5,207.84	0	15	90
Paseo Way	La Cuesta	1362 ft N/O La Cuesta	1,362	22	29,964	THIN OVERLAY	$113,863.20	1 TO 2	85	100
Via Barranca	VIA LERIDA	VIA LA PAZ	411	24	9,864	THIN OVERLAY	$37,483.20	4	51	100
Via Barranca	VIA LA PAZ	WEST END	255	24	6,120	THIN OVERLAY	$23,256.00	4 TO 5	51	100
Via Barranca (EB)	VIA LERIDA	ELISEO DR	909	24	21,816	THIN OVERLAY	$82,900.80	3 TO 4	51	100
Via Barranca (WB)	ELISEO DR	VIA LERIDA	909	24	21,816	THIN OVERLAY	$82,900.80	1 TO 2	51	100
Via Cheparro	City Limit	End	490	20	9,800	SLURRY	$4,312.00	0	81	90
Via Hermosa	ELISEO DR	BRETANO	335	22	7,370	THIN OVERLAY	$32,649.10	0 TO 1	12	100
Via Hermosa	BRETANO	VIA LA CUMBRE	465	22	10,230	THIN OVERLAY	$45,318.90	1 TO 2	12	100
Via La Paz	SOUTH END	VIA BARRANCA	280	22	6,160	THIN OVERLAY	$23,408.00	0	6	100
Via La Paz	VIA BARRANCA	DIVIDED ROAD	665	22	14,630	THIN OVERLAY	$55,594.00	0 TO 1	6	100
Via La Paz	START DIVIDED RD (SB)	END DIVIDED RD (SB)	532	16	8,512	THIN OVERLAY	$32,345.60	1 TO 2	6	100
Via La Paz	START DIVIDED RD (NB)	END DIVIDED RD (NB)	575	16	9,200	THIN OVERLAY	$34,960.00	2	6	100
Via La Paz	END DIVIDED RD (NB/SB)	END	380	22	8,360	THIN OVERLAY	$31,768.00	2	6	100
Via Lerida	Bretano Way	Via Navarro	1,400	24	33,600	THIN OVERLAY	$127,680.00	0 TO 1	1	100
Via Navarro	801ft W/O Eliseo Dr	Via Lerida	399	22	8,778	THIN OVERLAY	$33,356.40	0	9	100
Via Navarro (EB)	801FT W/O ELISO DR	ELISEO DR	801	14	11,214	THIN OVERLAY	$42,613.20	1 TO 2	14	100
Via Navarro (WB)	ELISEO DR	801FT W/O ELISO DR	801	14	11,214	THIN OVERLAY	$42,613.20	0	14	100
						TOTAL COST:	$1,889,168.96			

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By Neighborhood - Heatherwood Gardens

RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Chanticleer Ave	William	Meadowood	960	24	23,040	HEAVY MAINTENANCE	$29,260.80	1 TO 2	59	90
Diane Ln	William	Midway	1,230	22	27,060	HEAVY MAINTENANCE	$34,366.20	1 TO 2	58	90
Garden Way	William	Heather	240	20	4,800	THIN OVERLAY	$18,240.00	2 TO 3	48	100
Hawkins Wy	Meadowood	End	200	24	4,800	HEAVY MAINTENANCE	$6,096.00	1 TO 2	33	90
Heather Way	Dianne	Chanticleer	975	15	14,625	HEAVY MAINTENANCE	$18,573.75	1 TO 2	41	90
Liberty St	Midway	Diane	350	24	8,400	HEAVY MAINTENANCE	$10,668.00	1 TO 2	58	90
Meadowood Dr	E. WARD	End	1,375	33	45,375	HEAVY MAINTENANCE	$57,626.25	1 TO 2	53	90
Midway Rd	Heather	Diane	425	24	10,200	HEAVY MAINTENANCE	$12,954.00	1 TO 2	46	90
Niven Way	Meadowood	End	315	24	7,560	THIN OVERLAY	$28,728.00	1 TO 2	37	100
Ranch Ln	William	End	308	17	5,236	HEAVY MAINTENANCE	$6,649.72	1 TO 2	46	90
S Green	Meadowood	End	250	24	6,000	HEAVY MAINTENANCE	$7,620.00	1 TO 2	29	90
						TOTAL COST:	$230,782.72			

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By Neighborhood - Hillview

RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Cornell Ave	Harvard Dr	Tulane	700	30	21,000	THIN OVERLAY	$79,800.00	2 TO 3	20	100
Dartmouth Dr	Magnolia Ave	Harvard Dr	900	32	28,800	THIN OVERLAY	$109,440.00	0 TO 1	20	100
Harvard Dr	CORNELL	WEST END	906	30	27,180	THIN OVERLAY	$103,284.00	0 TO 1	19	100
Harvard Dr	EAST END	CORNELL	694	30	20,820	THIN OVERLAY	$79,116.00	1 TO 2	19	100
Skylark Dr	Magnolia Ave	817 ft W/O Magnolia Ave	817	28	22,876	SLURRY	$10,065.44	5	92	90
Skylark Dr	817ft W/O Magnolia Ave	End	653	24	15,672	SLURRY	$6,895.68	5	92	90
Stanford Ct	Tulane	End	100	25	2,500	THIN OVERLAY	$9,500.00	0 TO 1	22	100
Tulane Dr	DARTMOUTH	WEST END	750	30	22,500	THIN OVERLAY	$85,500.00	0 TO 1	14	100
Tulane Dr	HARVARD	DARTMOUTH	1,210	30	36,300	THIN OVERLAY	$137,940.00	2 TO 3	14	100
Yale Ave	Harvard Dr	Tulane Dr	500	25	12,500	THIN OVERLAY	$47,500.00	0 TO 1	8	100
						TOTAL COST:	$669,041.12			

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By Neighborhood - Industrial

RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Industrial Way	Redwood Hwy	End	592	36	21,312	HEAVY OVERLAY	$107,838.72	0 TO 1	15	100
Rich St	Redwood Hwy	PCC Section	390	22	8,580	RECONSTRUCT	$86,829.60	0	6	100
Rich St	Rich	Industrial	270	36	9,720	THIN OVERLAY	$36,936.00	0	19	100
						TOTAL COST:	$231,604.32			

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By Neighborhood - Larkspur Landing

RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Larkspur Landing Cir	Sir Francis Drake East (W	Sir Francis Drake East (E	2,900	38	110,200	HEAVY OVERLAY	$627,038.00	0 TO 1	18	100
Victoria Way	Larkspur Landing Cir	End	250	28	7,000	HEAVY OVERLAY	$35,420.00	0 TO 1	37	100
						TOTAL COST:	$662,458.00			

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By Neighborhood - Loop

RoadName	FROM	TO	Length	Width	Area	Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Eden Ln	Myrtle	End	265	18	4,770	THIN OVERLAY	$36,204.30	0 TO 1	48	100
Hazel Ave	TAMALPAIS	LAUREL (N)	512	12	6,144	THIN OVERLAY	$46,632.96	1 TO 2	24	100
Hazel Ave	LAUREL (N)	LAUREL (S)	1,088	12	13,056	HEAVY MAINTENANCE	$33,031.68	1 TO 2	24	90
Holly Ave	Willow	South End	600	18	10,800	THIN OVERLAY	$81,972.00	0 TO 1	9	100
Laurel Ave	HAZEL	HAZEL	975	12	11,700	HEAVY MAINTENANCE	$29,601.00	1 TO 2	29	90
Laurel Ave	HAZEL	NORTH END	345	12	4,140	THIN OVERLAY	$31,422.60	1 TO 2	29	100
Magnolia Ave	MADRONE	PIEDMONT RD	951	40	38,040	THIN OVERLAY	$288,723.60	1 TO 2	65	100
Magnolia Ave	KING ST	MADRONE	625	40	25,000	THIN OVERLAY	$189,750.00	2 TO 3	65	100
Myrtle Ave	Hawthorne	Eden	150	16	2,400	SLURRY	$2,136.00	3	88	90
Orange Ave	225FT S/O TAMALPAIS AVE	TAMALPAIS AVE	225	29	6,525	THIN OVERLAY	$49,524.75	0 TO 1	9	100
Orange Ave	MADRONE	225FT S/O TAMALPAIS AVE	1,075	29	31,175	THIN OVERLAY	$236,618.25	1 TO 2	9	100
Palm Ave	Walnut	Onyx	550	12	6,600	THIN OVERLAY	$50,094.00	2 TO 3	45	100
Sycamore Ave	Hawthorne	Bond	1,200	24	28,800	THIN OVERLAY	$218,592.00	0 TO 1	8	100
Tamalpais Ave	ORANGE AVENUE	END	693	20	13,860	THIN OVERLAY	$105,197.40	0 TO 1	17	100
Walnut Ave	Hawthorne	Palm	1,100	10	11,000	HEAVY MAINTENANCE	$27,830.00	1 TO 2	41	90
						TOTAL COST:	$1,427,330.54			

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By Neighborhood - Madrone Canyon

RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Ardmore Rd	WILTSHIRE (E)	PARK WAY	189	14	2,646	THIN OVERLAY	$20,083.14	0 TO 1	17	100
Ardmore Rd	PARK WAY	WILTSHIRE (W)	1,251	14	17,514	THIN OVERLAY	$132,931.26	2 TO 3	17	100
Bridge Rd	Madrone	W Baltimore	700	16	11,200	SLURRY	$9,968.00	0	55	90
Echo Pl	Madrone	End	165	25	4,125	HEAVY MAINTENANCE	$10,436.25	3 TO 4	70	90
Foley Ln	Madrone	Bridge	82	16	1,312	SLURRY	$1,167.68	0	35	90
Hatzic Ct	Wilson	End	650	16	10,400	THIN OVERLAY	$78,936.00	2 TO 3	49	100
Jones Way	Madrone	End	300	12	3,600	THIN OVERLAY	$27,324.00	0 TO 1	9	100
Madrone Ave	Redwood (W/O)	End	830	20	16,600	THIN OVERLAY	$125,994.00	1 TO 2	36	100
Madrone Ave	JONES	OLIVE	848	20	16,960	HEAVY MAINTENANCE	$42,908.80	1 TO 2	18	90
Madrone Ave	OLIVE	MAGNOLIA	2,260	20	45,200	THIN OVERLAY	$343,068.00	1 TO 2	21	100
Madrone Ave	REDWOOD	JONES	746	20	14,920	THIN OVERLAY	$113,242.80	3 TO 4	30	100
Millard Rd	Olive	End	850	16	13,600	THIN OVERLAY	$103,224.00	3 TO 4	20	100
Oak Rd	Wilson Way	Redwood Ave	435	20	8,700	THIN OVERLAY	$66,033.00	3 TO 4	42	100
Olive Ave	Madrone	End	1,149	32	36,768	THIN OVERLAY	$279,069.12	2 TO 3	38	100
Onyx St	Madrone	Hawthorne	890	26	23,140	THIN OVERLAY	$175,632.60	1	29	100
Polhemus Way	Wilson	End	660	17	11,220	THIN OVERLAY	$85,159.80	1	44	100
Redwood Ave	Madrone	End	863	26	22,438	THIN OVERLAY	$170,304.42	3 TO 4	59	100
Ridgeway Lane	MADRONE AVE	140'	140	7	980	SLURRY	$872.20	3 TO 4	0	90
Wilson Way	Pvmt Chg (1400' W/O Oak)	Polhemus	704	20	14,080	THIN OVERLAY	$106,867.20	0	4	100
Wilson Way	Polhemus (N/O)	End	426	20	8,520	THIN OVERLAY	$64,666.80	0	11	100
Wilson Way	Oak	Pvmt Chg (1400' W/O Oak)	1,400	20	28,000	THIN OVERLAY	$212,520.00	3 TO 4	41	100
						TOTAL COST:	$2,170,409.07			

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By Neighborhood - Murry Park

RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Arbor St	Murray Ave	Frances Ave	270	15	4,050	THIN OVERLAY	$15,390.00	1 TO 2	30	100
Bayo Vista Ave	HILLCREST AVE	607' S/O HILLCREST AVE	607	17	10,319	THIN OVERLAY	$39,212.20	0 TO 1	5	100
Briar Rd	City Limit-120 ft S/O Blck Log	City Limit-95 ft N/O Uppr Bria	400	18	7,200	THIN OVERLAY	$27,360.00	1 TO 2	11	100
College Ave	WOODLAND ROAD	COLLEGE CT	900	40	36,000	SLURRY	$15,840.00	0	88	90
College Ct	Magnolia Ave	Both Ends	800	25	20,000	THIN OVERLAY	$76,000.00	2	28	100
Estelle Ave	Magnolia Ave	Cty Lim-570 ft N/O Magnolia	570	25	14,250	THIN OVERLAY	$63,127.50	1 TO 2	27	100
Frances Ave	Magnolia Ave	Cty Lim-1000 ft S/O Magnolia	1,000	25	25,000	THIN OVERLAY	$110,750.00	1 TO 2	15	100
Hillcrest Ave	ESTELLE	490' NE	490	17	8,330	THIN OVERLAY	$31,654.00	1	91	100
Hillcrest Ave	FRANCES AVE	PAVEMENT CHANGE	379	17	6,443	THIN OVERLAY	$24,483.40	1 TO 2	15	100
Murray Ave	ARBOR	CITY LIMIT (S/O MAGNOLIA)	344	25	8,600	THIN OVERLAY	$32,680.00	1 TO 2	33	100
Murray Ave	MAGNOLIA	ARBOR	806	25	20,150	THIN OVERLAY	$76,570.00	2 TO 3	33	100
						TOTAL COST:	$513,067.10			

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By Neighborhood - North Magnolia

RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Ajax St	Hawthorne	Cedar	330	18	5,940	HEAVY MAINTENANCE	$7,543.80	1 TO 2	45	90
Locust Ave	King	Ward	700	36	25,200	THIN OVERLAY	$111,636.00	1 TO 2	34	100
Locust Ave	Ward	Hawthorne	920	20	18,400	HEAVY MAINTENANCE	$23,368.00	1 TO 2	36	90
Magnolia Ave	POST	WARD	379	40	15,160	THIN OVERLAY	$67,158.80	3	89	100
Magnolia Ave	DOHERTY	WARD	787	40	31,480	SLURRY	$13,851.20	5	89	90
Post St	Magnolia	End	120	45	5,400	SLURRY	$2,376.00	5	92	90
Ward St	Magnolia	Hawthorne	700	36	25,200	THIN OVERLAY	$111,636.00	0 TO 1	23	100
						TOTAL COST:	$337,569.80			

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By Neighborhood - Old Town

RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Cane St	Holcomb	Magnolia	515	24	12,360	HEAVY MAINTENANCE	$15,697.20	1 TO 2	48	90
Cedar Ave	AJAX ST	NORTH END	441	16	7,056	THIN OVERLAY	$26,812.80	1	28	100
Cedar Ave	SOUTH END	AJAX ST	759	16	12,144	HEAVY MAINTENANCE	$15,422.88	2 TO 3	28	90
East Ward Street	Meadowood	Magnolia	500	33	16,500	HEAVY MAINTENANCE	$20,955.00	1 TO 2	55	90
Hawthorne Ave	WALNUT	KING ST	531	20	10,620	HEAVY MAINTENANCE	$13,487.40	1 TO 2	39	90
Hawthorne Ave	KING ST	SYCAMORE AVE	479	20	9,580	THIN OVERLAY	$36,404.00	1 TO 2	39	100
Hawthorne Ave	SYCAMORE AVE	LOCUST	990	20	19,800	HEAVY MAINTENANCE	$25,146.00	1 TO 2	39	90
King St	Magnolia	Hawthorne	695	36	25,020	THIN OVERLAY	$110,838.60	0	71	100
King St	Monte Vista	Magnolia	275	18	4,950	THIN OVERLAY	$21,928.50	2	47	100
Magnolia Ave	Ward (S/O)	King (S/O)	713	36	25,668	THIN OVERLAY	$113,709.24	2	63	100
RICE LANE	MAGNOLIA AVE	WARD ST	673	12	8,076	THIN OVERLAY	$30,688.80	0 TO 1	19	100
Willow Ave	Hawthorne	Holly	650	20	13,000	THIN OVERLAY	$49,400.00	0 TO 1	23	100
						TOTAL COST:	$480,490.42			

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By Neighborhood - Palm Hill

RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Acacia Ave	Alexander	End	1,190	18	21,420	THIN OVERLAY	$81,396.00	2 TO 3	64	100
Alexander Ave	PEPPER	BRIDGE/ ACACIA	346	20	6,920	HEAVY MAINTENANCE	$8,788.40	1 TO 2	71	90
Alexander Ave	BAYVIEW	PEPPER	625	20	12,500	THIN OVERLAY	$55,375.00	4 TO 5	71	100
Bayview Ave	ALEXANDER	CTY LMT-70FT N/O BALTIMORE	343	20	6,860	THIN OVERLAY	$26,068.00	2 TO 3	45	100
Bayview Ave	PEPPER	ALEXANDER	647	20	12,940	THIN OVERLAY	$49,172.00	4 TO 5	45	100
Birch Ave	CITY LIMIT	300 W' OF CITY LIMIT	300	24	7,200	SLURRY	$3,168.00	5	91	90
Elm Ave	ELM ((NB) ONE WAY LOOP)	PALM	461	18	8,298	SLURRY	$3,651.12	0 TO 1	43	90
Elm Ave	PEPPER	END	3,115	18	56,070	HEAVY MAINTENANCE	$71,208.90	1 TO 2	43	90
Elm Ave	ACACIA	END	3,700	18	66,600	THIN OVERLAY	$253,080.00	2 TO 3	43	100
Loma Vista Ave	Elm	Alexander	736	14	10,304	THIN OVERLAY	$39,155.20	4 TO 5	49	100
Palm Ct	Elm	End	280	14	3,920	HEAVY MAINTENANCE	$4,978.40	1 TO 2	18	90
Pepper Ave	Elm	City Lim-108 ft S/O Alexander	762	20	15,240	THIN OVERLAY	$57,912.00	4 TO 5	26	100
Taylor Ln	Alexander	City Limit (135' S/O Alexander	135	20	2,700	THIN OVERLAY	$10,260.00	4 TO 5	54	100
						TOTAL COST:	$664,213.02			

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By Neighborhood - Riviera Circle

RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Corte Del Bayo	Riviera Cir	End	730	26	18,980	THIN OVERLAY	$72,124.00	2 TO 3	27	100
Corte Del Coronado	Riviera Cir	End	336	23	7,728	THIN OVERLAY	$29,366.40	2 TO 3	25	100
Doherty Dr	Canal Bridge W/O	Riviera Cir (West Entrance)	1,421	29	41,209	SLURRY	$18,131.96	0 TO 1	14	90
Doherty Dr	Riviera Cir (W)	Lucky Dr	1,439	36	51,804	THIN OVERLAY	$229,491.72	2 TO 3	54	100
Riviera Cir	Doherty (West Entrance)	Corte Del Bayo	1,059	37	39,183	THIN OVERLAY	$148,895.40	2 TO 3	32	100
Riviera Cir	Corte Del Bayo	Corte Del Coronado	1,904	30	57,120	THIN OVERLAY	$217,056.00	2 TO 3	34	100
Riviera Cir	Corte Del Coronado	Doherty (East Entrance)	1,800	30	54,000	THIN OVERLAY	$205,200.00	2 TO 3	24	100
Via La Brisa	Riviera Cir (E)	238ft W/O Riviera Cir (E)	238	32	7,616	THIN OVERLAY	$28,940.80	0 TO 1	74	100
Via La Brisa	238ft W/O Riviera Cir (E)	Riviera Cir (W)	967	30	29,010	THIN OVERLAY	$110,238.00	0 TO 1	14	100
						TOTAL COST:	$1,059,444.28			

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By Neighborhood - South Eliseo

RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Barry Way	DRAKES LANDING RD	PVT RD (340FT S/O DRKS LNDG)	340	46	15,640	HEAVY OVERLAY	$88,991.60	0	48	100
Barry Way	SIR FRANCIS DRAKE	DRAKES LANDING RD	310	46	14,260	THIN OVERLAY	$63,171.80	2 TO 3	48	100
Corte Del Norte	Via Hidalgo	End	210	24	5,040	THIN OVERLAY	$19,152.00	1 TO 2	13	100
Corte Encanto	El Portal	End	400	28	11,200	THIN OVERLAY	$42,560.00	0 TO 1	12	100
Corte Lenosa	Via Hidalgo	End	400	30	12,000	THIN OVERLAY	$45,600.00	1	15	100
Corte Oriental	Via Casitas	End	300	32	9,600	THIN OVERLAY	$36,480.00	0	5	100
Corte Ortega	Via Belardo	End	350	34	11,900	THIN OVERLAY	$45,220.00	0 TO 1	15	100
Corte Real	S Eliseo Dr	End	660	32	21,120	THIN OVERLAY	$80,256.00	0	5	100
Corte Solano	El Portal	End	350	24	8,400	THIN OVERLAY	$31,920.00	0 TO 1	13	100
Del Monte	SIR FRANCISC DRAKE BLVD	DRAKE'S LANDING ROAD	205	57	11,685	THIN OVERLAY	$44,403.00	2 TO 3	45	100
Drakes Landing Rd	Barry	Sir Franci Drake	844	37	31,228	THIN OVERLAY	$118,666.40	0 TO 1	37	100
El Portal Dr	Sir Francis Drake Blvd	Via Casitas	650	60	39,000	THIN OVERLAY	$172,770.00	0 TO 1	5	100
Lower Via Casitas	Eliseo Dr	Via Casitas	800	20	16,000	THIN OVERLAY	$60,800.00	0	5	100
S Eliseo Dr	Bon Air	Corte Real (E/O)	1,708	36	61,488	THIN OVERLAY	$272,391.84	0 TO 1	27	100
S Eliseo Dr	Corte Real (E/O)	End	2,117	36	76,212	THIN OVERLAY	$337,619.16	4 TO 5	17	100
Upper Via Casitas	Via Casitas	S Eliseo Dr	500	32	16,000	THIN OVERLAY	$60,800.00	0	7	100
Via Belardo	S Eliseo Dr	Via Casitas	570	30	17,100	THIN OVERLAY	$64,980.00	0 TO 1	11	100
Via Casitas	Via Holon	End	820	32	26,240	THIN OVERLAY	$116,243.20	0	8	100
Via Casitas	El Portal Dr	Via Holon	774	32	24,768	THIN OVERLAY	$109,722.24	0	10	100
Via Casitas	Lower Via Casitas	El Portal Dr	574	55	31,570	THIN OVERLAY	$139,855.10	0	5	100
Via Hidalgo	CORTE DEL NORTE	VIA CASITAS	410	32	13,120	THIN OVERLAY	$49,856.00	0 TO 1	34	100
Via Hidalgo	BON AIR RD	CORTE DEL NORTE	1,620	32	51,840	THIN OVERLAY	$196,992.00	1 TO 2	34	100
Via Holon	S Eliseo Dr	Via Casitas	570	32	18,240	THIN OVERLAY	$69,312.00	0	8	100
						TOTAL COST:	$2,267,762.34			

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By Neighborhood - South Magnolia

RoadName	FROM	TO	Length	Width	Area	PEI Recommended Treatment	PEI Cost	PEI Year	Current PCI	Estimated PCI After Treatment
Branch Ave	Magnolia	End	280	16	4,480	THIN OVERLAY	$34,003.20	2 TO 3	12	100
Chevy Chase Ct	Wiltmore	End	633	20	12,660	SLURRY	$11,267.40	0 TO 1	81	90
Coleman Ave	Piedmont Rd	Piedmont Rd	720	12	8,640	THIN OVERLAY	$65,577.60	3 TO 4	45	100
Lark Ct	Magnolia	End	610	25	15,250	THIN OVERLAY	$115,747.50	0 TO 1	12	100
Magnolia Ave	Piedmont Rd (N/O)	City Limit (S)	1,235	36	44,460	THIN OVERLAY	$337,451.40	2 TO 3	73	100
Marina Vista Ave	1950FT W/O SUMMIT	CITY LIMIT-33FT W/O SUMMIT	1,917	16	30,672	THIN OVERLAY	$232,800.48	0	6	100
Marina Vista Ave	ARDMORE	1950FT W/O SUMMIT	1,729	16	27,664	THIN OVERLAY	$209,969.76	0 TO 1	6	100
Owlswood Dr	Wiltshire	End	550	15	8,250	THIN OVERLAY	$62,617.50	0	7	100
Park Way	Magnolia	Ardmore	325	22	7,150	THIN OVERLAY	$54,268.50	2 TO 3	27	100
Piedmont Ct	Piedmont	End	900	16	14,400	THIN OVERLAY	$109,296.00	0 TO 1	23	100
Piedmont Rd	MAGNOLIA	COLEMAN (E)	430	33	14,190	THIN OVERLAY	$107,702.10	3 TO 4	39	100
Piedmont Rd	COLEMAN (E)	END	670	33	22,110	THIN OVERLAY	$167,814.90	4 TO 5	39	100
Shady Ln	W Baltimore	End	250	16	4,000	THIN OVERLAY	$30,360.00	0	57	100
Upper Ardmore	Wiltshire	End	928	14	12,992	THIN OVERLAY	$98,609.28	0	6	100
W Baltimore Ave	Magnolia	Width Chg (515' W/O Magnolia)	515	44	22,660	THIN OVERLAY	$171,989.40	0 TO 1	3	100
W Baltimore Ave	BRIDGE RD	END	1,125	16	18,000	HEAVY MAINTENANCE	$45,540.00	1 TO 2	39	90
W Baltimore Ave	WIDTH CHANGE (515' W/O MAGNOLIA)	BRIDGE RD	395	16	6,320	THIN OVERLAY	$47,968.80	2 TO 3	39	100
Wiltshire Ave	ARDMORE (E)	ARDMORE (W)	1,075	20	21,500	THIN OVERLAY	$163,185.00	0 TO 1	21	100
Wiltshire Ave	MAGNOLIA	ARDMORE (E)	325	20	6,500	THIN OVERLAY	$49,335.00	2 TO 3	21	100
						TOTAL COST:	$2,115,503.82			

APPENDIX D – TYPICAL PAVEMENT MAINTENANCE AND REHABILITATION

PAVEMENT MAINTENANCE PROCEDURES

Developing maintenance strategies for and agency's pavement can extend the life of these surfaces by several years by slowing the pavement aging process. Maintenance procedures protect pavement from the adverse effects of water and to some extent vehicle traffic.

Maintenance strategies that protect pavement and impede aging include crack sealing, slurry seals, digouts (patch paving) and cape seals. As with all maintenance procedures, there are tradeoffs between appearance, effectiveness and cost, but correcting surface layer problems promptly, before the pavement degrades significantly, is the key to long-lasting pavement.

Crack Sealing

Crack sealing is the first line of defense against premature pavement aging because it prevents surface water from getting beneath the asphalt concrete layer into the aggregate bases where structural damage occurs. This procedure involves routing small cracks, cleaning and sealing with a hot, flexible rubberized material that bonds to the crack and moves with the pavement. Cracking sealing can be applied with or without other procedures to maximize pavement life.

Slurry Seals

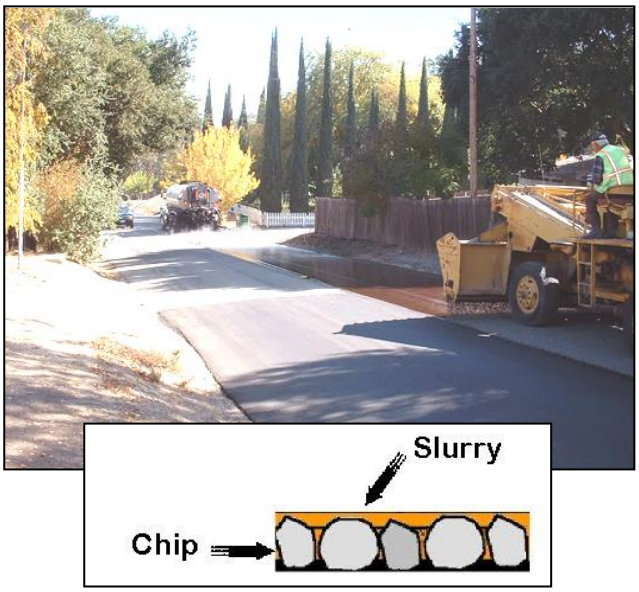
A slurry seal is an emulsion of oil and aggregate, but it has a much higher concentration of aggregate than a seal coat and is more durable. In addition to filling in cracks and depressions and creating a uniform, dense mat, it provides a weather-tight surface with improved skid resistance that is effective in high traffic areas. A typical slurry seal lasts between three and five years.

There are three types of slurry seals depending on the coarseness of the largest aggregate. Type I slurry seal has aggregates less than 1/8 of an inch, Type II has aggregates less than 1/4 of an inch, and Type III has aggregates less than 5/16 of an inch. The most commonly used slurry seals for residential streets are Type I or Type II.

Digouts

Digouts are small areas of deteriorated pavement that are removed by cold planning or cutting with a special saw and replaced with new asphalt concrete that is installed in at least two lifts (two layers). The digout depth depends on the street type and construction.

Cape Seals



Cape seals are used on residential and collector streets to maintain pavement that may need a more expensive overlay when sufficient funds are not available.

Cape seals consist of a chip seal overcoated with a slurry seal. The chip seal consists of small angular rock (chips) approximately 1/4 inch to 3/8 inch maximum size that are embedded into a thick application of asphalt emulsion. Most chip seals incorporate polymer-modified binders and are placed over low to moderate alligator cracks and block cracks. Depending on the type distress or defect covered by the chip seal, small areas of disbanding or failure may occur that will require patching.

Because cape sealed surfaces are fairly coarse when compared to new paving, they may not be acceptable to some Agencies.

INTERIM PAVEMENT HOLDING PROCEDURES

When pavements have extensive cracking and are beyond their design life, interim holding measures, including ***skin patches*** and ***thin overlays***, are used as a stop gap prior to major rehabilitation. Skin patches are thin lifts of fine asphalt concrete placed over deteriorated areas. Thin overlays consist of an asphalt concrete layer with 3/8-inch aggregate that generally is 3/4 to 1-inch-thick.

PAVEMENT REHABILITATION PROCEDURES

For asphalt pavement that has reached the end of its service life, there several options that can restore existing pavement quality or add additional structure support. Some of the more common rehabilitation procedures include ***conventional overlays***; **pulverization and resurfacing**; ***asphalt rubber hot mix (ARHM) overlays***; ***mill and fill*** (removal and replacement); and ***reconstruction.***

Conventional Overlays

Conventional overlays generally consist of surface preparation, such as crack filling, base repairs and leveling courses, varying thicknesses of asphalt concrete and pavement fabric.

Pavement fabric can be used both as a water inhibiting membrane and to retard reflective cracking; however, it is not acceptable at intersections with heavy truck breaking, on steep grades (generally over 8 percent) and in areas where subsurface water might be trapped.

Asphalt concrete thickness is established by the structural requirement obtained through a deflection analysis (see pavement investigations section) and reflective cracking criteria. Reflective cracking criteria require the thickness of the overlay to be a minimum of half the thickness of the existing bonded layers. Pavement fabric can account for 0.10 ft of the reflective cracking criteria if the structural requirements from the deflection analysis are met.

If well constructed and designed to meet structural and reflection cracking criteria, conventional overlays have an expected service life of between 7 and 13 years.

Pulverization and Resurfacing

Pulverization and resurfacing is an intermediate step between overlays and reconstruction. The procedure involves regarding the surface flush with facilities, such as ramps, curbs and gutters, and recycling the existing concrete into an aggregate base to increase the pavement structure. This method strengthens the existing base, improves a road's cross section and profile and eliminates the stress history and cracking of the old asphalt

concrete pavement. This rehabilitation procedure also eliminates bumps, humps and rutting

Pulverization and resurfacing has a life expectancy of between 13 and 18 years. The life expectancy is slightly less than full reconstruction because some residual deficiencies in thickness or quality of the unaffected layers may still exist. Testing is necessary to determine if pulverization is a viable alternative (see pavement investigation section). This testing includes measuring the existing structural section and testing the native soil for bearing capacity (R-value).

RHMA Overlays

RHMA is the short for rubberized hot mix asphalt. This mix combines crumb rubber with traditional asphalt binders to produce a more flexible paving material than conventional dense graded hot mix asphalt (HMA). Caltrans has developed design criteria for using this material based on accelerated performance testing. Basically, 1 inch of RHMA is equal to 2 inches of HMA and is applicable for both structural and reflective cracking.

RHMA costs approximately 1.75 times as much as conventional asphalt and provides a similar service life to that of conventional hot mix asphalt, or 7 to 13 years.

RHMA does come with limitations. Generally it is used only when vertical constraints such as curb and gutter restrict the thickness of an overlay. RHMA also has more open surface than conventional hot mix asphalt and is more difficult to obtain a high quality finished product.

Mill and Fill (Asphalt Concrete Removal and Replacement)

On some thick asphalt concrete pavements, the most economical rehabilitation approach is to remove some of the existing asphalt concrete surface. The replacement material can be either conventional HMA or RHMA, depending on the design criteria. If the underlying base is sufficient to support anticipated loading, the asphalt layer can be removed and replaced. In some cases, due to drainage or other physical constraints, additional asphalt concrete cannot be placed.

This procedure extends pavement life and creates a smooth ride by eliminating the effects of tire ruts and any asphalt movement that occurred over the years. Depending on existing conditions, this procedure has life of between 15 and 20 years.

Reconstruction

When pavement has severe cross-section deficiencies or requires significant structural strengthening, reconstruction may be the only alternative. Generally, existing pavement materials are recycled and incorporated into the new pavement structure. Structural section material alternatives include treated soils, full depth asphalt concrete, recycled materials and Portland cement concrete.

APPENDIX E – GLOSSARY OF TERMS

Glossary of Terms

AASHTO – American Association of State Highway Transportation Officials. This organization sets standards and publishes specifications, test protocols and guidelines which are used in highway design and construction throughout the United States.

ADA – Americans with Disabilities Act. With regard to pavement, the Act provides regulations governing accessibility related to handicapped parking, ramps, etc.

Aggregate - materials such as sand, gravel, rock or crushed stone. Aggregate of varying size and composition is used with a binding agent to produce asphalt concrete or Portland cement concrete.

Aggregate base - a layer of material, usually quarried rock or recycled asphalt concrete that is laid on top of native soil or an aggregate subbase. It provides a foundation to support the surface layer of asphalt concrete or Portland cement concrete.

Aggregate subbase – a layer of evenly spread and compacted crushed stone laid on a base of native soil that provides the main load-bearing layer of a pavement, aids drainage and prevents settlement that leads to surface defects such as rutting.

Alligator cracking – a series of interconnecting cracks in the surface of asphalt pavement caused by heavy wheel loads (fatigue) that looks like an alligator hide. It is a clear sign of structural failure.

Asphalt – a material obtained through petroleum processing that is a generic term for asphalt concrete.

Asphalt concrete – a composite mix of aggregate and asphalt binder that is the most frequently used surface material for road and parking lot construction.

ASTM – American Society of Testing and Materials. This organization develops uniform methods and standards for product quality.

Base – a layer of materials, usually aggregate, placed just beneath the asphalt concrete surface layer and above the subbase that provides additional load distribution and helps with drainage.

Blacktop - a generic term for asphalt concrete.

Block cracking – a combination of longitudinal and transverse cracking in asphalt concrete that generally results as the binding agent evaporates and the asphalt hardens and shrinks. It has a distinctive checkerboard pattern.

Cape seal – a combination of a chip (aggregate) layer overcoated with a slurry seal. The chip seal is placed first followed within a few days by the slurry seal that binds the chips and prevents loose aggregate. A cape seal provides a new wear surface, prevents water damage to the roadbed and addresses some pavement defects.

Chip seal - a two-step process that combines a layer of aggregate followed by a high viscosity emulsion seal coat. Used primarily on low-volume roads, it covers surface imperfections, improves surface friction and adds a new wear surface.

Core test – measures existing pavement thickness to determine the structural capacity for road reconstruction or the thickness of the subgrade layer (foundation) for new roadway construction. It involves coring through multiple layers of pavement to determine composition, characteristics of the native soil and moisture content. Core test data is referred to as the R-value (resistance value), which determines how deep the subgrade needs to be to support the aggregate base and asphalt concrete surface layer that will carry the expected amount of traffic and wheel loads.

Crack seal – an inexpensive emulsion of hot rubberized asphalt used to seal longitudinal, transverse and block cracking to prevent water from seeping beneath the asphalt to the subgrade where structural damage occurs. It also seals against abrasive dirt and sand.

Deflection test - a non-destructive method to determine the overall structural capacity and properties of existing pavement. The test measures the resilience of the subgrade, base and surface layers, determines how flexible the pavement structure is and how it has been affected by the type and volume of traffic and other factors such as temperature and moisture.

Digout – a localized repair or patch that involves digging out or excavating an area of damaged pavement, such as a pothole, and replacing it with new asphalt concrete. It is designed to prevent damage to the subgrade.

Dynaflect® - a dynamic-force generator equipped with a motion-sensing device that applies a vertical oscillating force on a pavement section to measure the magnitude of deflection.

ESAL - Equivalent Single Axle Load. One ESAL is equal to one 18,000-pound axle. An ESAL determines the impact of heavy wheel loads that are quantified as a Traffic Index, which helps determine how much loading a pavement will support before it begins to fail.

Fatigue – pavement deterioration caused by repetitive heavy wheel loads that result in cracking from the bottom of the pavement structure upward. It usually appears as alligator cracking.

Flexible pavement – a structural section of road made up of asphalt concrete and one or more layers of aggregate that is designed to distribute loading to the underlying subgrade. If properly designed, flexible pavement can expand or stretch to absorb heavy loads.

Fog seal – an inexpensive, short-lived treatment of diluted asphalt emulsion applied to an oxidized (weathered) asphalt concrete pavement to seal and restore flexibility to the pavement surface.

Full-depth asphalt – a pavement structure using hot mix asphalt (HMA) for both the base and surface materials.

HMA – Hot Mix Asphalt - a high quality, temperature-controlled hot mixture of asphalt binder and aggregate, ranging from coarse to very fine particles, that can be compacted into a uniform dense mass. It can be made from new or recycled material.

HMAC - Hot Mix Asphalt Concrete.

Laydown – the portion of a paving process where HMA is placed or "laid down" by a paving machine.

Lime treatment – a modifier for or additive to soil subgrade that increases its R-value, improves performance and adds years to pavement life.

Longitudinal cracking - cracks in asphalt concrete pavement that run parallel to the pavement's centerline or laydown direction. It results primarily from environmental aging.

Maintenance – regularly timed pavement preservation treatments necessary for safety and to extend service life, typically for up to five years. Maintenance treatments can include crack sealing, seal coats, slurry seals, chip seals and overlays or any combination of these and other treatments.

Mill and fill – a pavement rehabilitation process that involves milling (removing) the surface layer of pavement to a predetermined depth and filling it with new or recycled HMA. It creates a smooth ride by eliminating tire ruts and other defects.

Milling - the controlled removal an existing asphalt pavement layer to correct and restore the surface to a specified profile.

MTC – Metropolitan Transportation Commission. MTC is the regional planning organization for roads and transit in the San Francisco Bay Area.

Native subgrade - the base or soil upon which the pavement structure is built. It can be augmented by structural fill material.

Nuclear gauge – a non-destructive device that measures the density of in-place HMA to determine the level of compaction.

OGFC – Open Graded Friction Course. OGFC is a non-structural wear course used primarily on HMA to improve wet weather skid resistance, reduce the potential for hydroplaning, reduce water splash and spray and reduce night time wet pavement glare.

Overlay – a pavement rehabilitation process for severely deteriorated pavement that overlays bituminous asphalt concrete on top of existing pavement to strengthen its overall structure, improve ride and extend service life.

Pavement – the surface layer of a structural section of road that carries traffic. It is composed either of asphalt concrete or Portland cement concrete.

Pavement Management System (PMS) – a system developed by Caltrans to assess the condition of pavement biennially and prioritize pavement maintenance and rehabilitation consistent with available funding.

PCC – Portland Cement Concrete. PCC is rigid and more durable than flexible asphalt pavement, and as such, is a pavement alternative for areas affected by heavy wheel loads from buses, garbage trucks and service vehicles.

Potholes – bowl-shaped holes caused by water damage that may extend into the base.

Profilograph - a device used to measure pavement surface roughness. The data collected by a profilograph is used to calculate the International Roughness Index (IRI), which is expressed in units of inches/mile or millimeters/meter. IRI values range from 0 (equivalent to driving on a plate of glass) upwards to several hundred (a very rough road). The IRI value is used for road management to monitor road safety and quality issues.

Pulverization – a mechanized process that transforms the existing flexible pavement surface layer and a portion of the underlying granular layer into a uniform granular material suitable for use as a base layer

R-value - Resistance Value. R-value is a measure of resistance to deformation under loading of saturated soil.

Raveling – also called weathering, raveling is the progressive and gradual deterioration of the HMA layer. It results as the asphalt concrete binder oxidizes, separating it from the coarser aggregates and making the surface rough and uneven

Reconstruction - replacing an existing pavement structure that has reached the end of its service life or is badly deteriorated with a new, equivalent pavement structure that may use new or recycled paving materials or a combination of both.

Recycling – A process of milling (removing) the top asphalt concrete surface, which is pulverized, sized, and mixed with an additive, reshaped and compacted, and reapplied as a new surface.
Reflective cracking - cracks that generally occur on pavements where an asphalt concrete surface is placed over jointed Portland cement concrete. Reflective cracking occurs directly over underlying cracks or joints but also can occur over existing HMA pavement cracks, cement or lime stabilized base, etc.

Rehabilitation – a process that extends the service life of existing pavement by placing additional surfacing (overlay) or other treatment to restore an existing roadway to structural or functional adequacy for a minimum of 10 years. Rehabilitation may include partial or complete removal and replacement of portions of the structural section.

Rejuvenation – an emulsion similar to a fog seal applied to an oxidized (weathered) pavement to restore flexibility to an existing HMA pavement surface. The emulsion may include asphalt, polymer latex and other additives.

RHMA – Rubberized Hot Mix Asphalt. RHMA is a type of asphalt that combines granulated (crumb) rubber with hot asphalt to form an elastic binder with less susceptibility to temperature changes. RHMA is generally specified to retard reflection cracking, resist thermal stresses created by wide temperature variations and add flexibility to a structural overlay.

Rigid pavement - a structural section of road constructed of rigid Portland cement concrete that is designed to distribute axle loads over a relatively wide area.

Rutting - longitudinal surface depressions in the wheel path of a pavement often caused by an inadequate structural foundation.

Seal coat – a mix of approximately 85% emulsion and 15% aggregate used to seal rough or raveled pavement in areas with traffic speeds less than 15 mph. A seal coat fills in minor cracks and provides a smooth finish that protects against the environment.

Service life – the approximate lifespan of newly constructed pavement before major rehabilitation or reconstruction is required. Because of traffic, climate and other variables, service life may be considerably shorter or longer than that for which is was designed.

Slurry coat – a mix of approximately 15% emulsion and 85% aggregate used to seal rough or raveled pavement in areas with traffic speeds greater than 15 mph. A slurry seal fills in cracks and provides a smooth finish that protects against the environment. It has roughly twice the lifespan of a seal coat.

Structural section – the designed layers of materials placed over native subgrade to support estimated traffic loads over a specified period of time. Generally, the structural section normally consists of a subbase, base and pavement surface.

Subbase – a layer of aggregate designed in thickness and quality placed on top of the native soil or subgrade that serves as a foundation for the base layer.
Subgrade – the native soil or portion of the roadbed on which a pavement surface, subbase, base or layer of other material is placed.

Traffic Index (TI) — determines how much loading a pavement will support before it begins to fail. It is a measure of the number of Equivalent Single Axle Loads (ESALs) expected in the traffic lane over the pavement design life. One ESAL is equivalent to one 18,000-pound axle.

Transverse cracking – cracks in asphalt concrete pavement that run at right angles to the pavement's centerline or laydown direction. It results primarily from environmental aging.

Washboard – also called corrugations, the regularly spaced rough transverse "bumps" caused by an unstable surface course.

Weathering - also called raveling, weathering is the progressive and gradual deterioration of the HMA layer. It results as the asphalt concrete binder oxidizes, separating it from the coarser aggregates and making the surface rough and uneven.