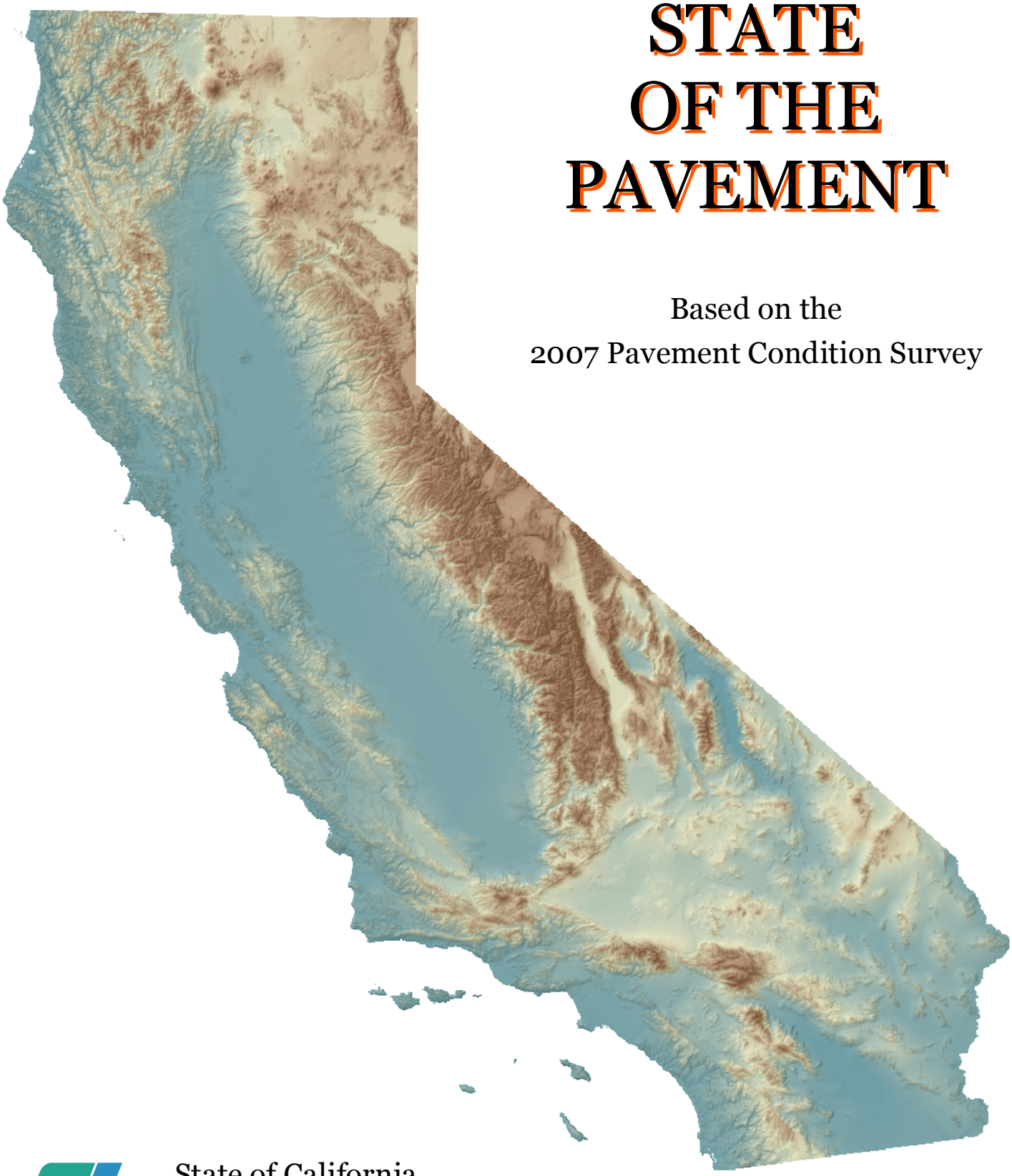
# 2007 STATE OF THE PAVEMENT

Based on the
2007 Pavement Condition Survey



State of California
Department of Transportation
Division of Maintenance

# California
# State of the Pavement Report, 2007

California Department of Transportation
Division of Maintenance
March 2008

# Acknowledgments

This report is prepared by the California Department of Transportation, Division of Maintenance, Offices of Roadway Rehabilitation and Roadway Maintenance. It summarizes the 2007 pavement condition and expenditures on the State Highway System for Department management and others.

**Division of Maintenance** - Steve Takigawa, Chief
Mike Evans, Assistant Division Chief

**Office of Roadway Rehabilitation** - Susan Massey, Chief

**Pavement Rehabilitation Branch**
Leo Mahserelli, Program Advisor
Rob Marsh, Program Advisor
Brian Weber, Program Advisor
Ron Jones, Program Advisor

**Pavement Management Information Branch** - Bob Moore, Chief
Jeff Duket, Research Program Specialist II (Geographic Information Systems)
Dario Moreno, Research Program Specialist II (Geographic Information Systems)
Rostam Assadi-Shehni, Research Analyst II

**Storm Damage**
Jim Varney, Program Advisor

**Office of Roadway Maintenance** – Agustin Rosales, Chief

**Pavement Condition Survey (PCS)** – Jan Bullinger, PCS Team Supervisor
Moises Campos, Pavement Evaluator
Daniel Lem, Pavement Evaluator
Tom Portlock., Pavement Evaluator
William Nie, Pavement Evaluator
Dennis Vonada, Pavement Evaluator
Adam Steiger, Pavement Evaluator

**Roadway Maintenance Pavements** - Douglas Mason, Sr. Transportation Engineer

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The completed 2007 Pavement Condition Report can be downloaded from the Roadway Maintenance intranet page: http://onramp.dot.ca.gov/hq/maint/roadway/index.htm

The 2006/07 Fiscal Year-End Report for HM-1 Major Maintenance Contracts is available from: http://onramp.dot.ca.gov/hq/maint/roadway/HM1_Pave_Contracts_0607.xls

For useful data and mapping relating to maintenance and pavement rehabilitation, please visit: URL: http://onramp.dot.ca.gov/hq/maint/roadway_rehab/gis/index.htm

Pavement condition information is available from:

California Department of Transportation, Division of Maintenance, Office of Roadway Rehabilitation, Pavement Management Information Branch, 1120 'N' Street, MS-31, Sacramento, CA 95814, or by telephone at (916) 651-2011.

Copies of this report may be obtained from:
URL: http://onramp.dot.ca.gov/hq/maint/roadway_rehab/index.htm

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# Executive Summary

To effectively manage the pavement on the State Highway System, the California Department of Transportation conducts a Pavement Condition Survey (PCS). The 2007 PCS, which began in January 2006 and was completed in November 2007, identified 12,998 lane miles of distressed pavement requiring Capital Preventive Maintenance (CAPM) and rehabilitation work. The 2007 PCS was delayed more than 12 months due to changes in data collection by the University of California, Davis and Caltrans Division of Research and Innovation. Also, there were failures with the data collection equipment that caused unscheduled equipment repairs. Because the survey spanned almost 2 years, it is identified as the 2007 survey. The 2007 survey is 3% lower than the 13,392 distressed lane miles in the adjusted 2005 survey. The majority of this distressed pavement was on Class 1 roads, but as a percentage of total lane miles for each class, Class 3 roads had the highest percentage.

The survey also measured the International Ride Index (IRI). This is generally accepted as a worldwide pavement roughness measurement. The IRI measures a vehicle's up and down movement over the pavement in inches per one mile of driving. On a smooth road, such as a recently completed pavement rehabilitation project, the up and down movements are low. The percentage of vehicle miles traveled on rough-riding pavement (IRI >170) for National Highway System (NHS) Interstate, NHS non-Interstate, and non-NHS routes was unchanged from the 2005 survey to the 2007 survey.

Since this report has data that was collected from the beginning of 2006 to the end of 2007, the cost and expenditure information includes both the 2005/06 and 2006/07 Fiscal Years. This differs from previous State of the Pavement reports, which only included one year.

<u>2005/06 Fiscal Year</u>

In the 2005/06 Fiscal Year (FY), $667 million of rehabilitation and maintenance contracts were awarded. Of this amount, $596 million was for Roadway Rehabilitation and CAPM projects that repaired 2,012 lane miles of pavement. The remaining $71 million in Major Maintenance projects (Preventive and Base) repaired 1,338 lane miles of pavement.

<u>2006/07 Fiscal Year</u>

In the 2006/07 Fiscal Year, $740 million of rehabilitation and maintenance contracts were awarded. Of this amount, $586 million was for Roadway Rehabilitation and CAPM projects that repaired 1,114 lane miles of pavement. The $154 million in Major Maintenance projects (Preventive and Base) repaired 2,298 lane miles of pavement.

The cost of pavement CAPM projects awarded in 2006/07 FY averaged $178,000 per lane-mile and the cost of Roadway Rehabilitation projects average over $1,350,000 per lane-mile. The cost of Roadway Rehabilitation projects is substantially higher than those awarded in the 2004/05 FY, which averaged over $472,000 per lane-mile.

# California
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## Highway Condition and Needs

The California Department of Transportation (Department) is responsible for maintaining the State Highway System. The State Highway System has close to 15,000 centerline miles and over 49,000 lane miles.

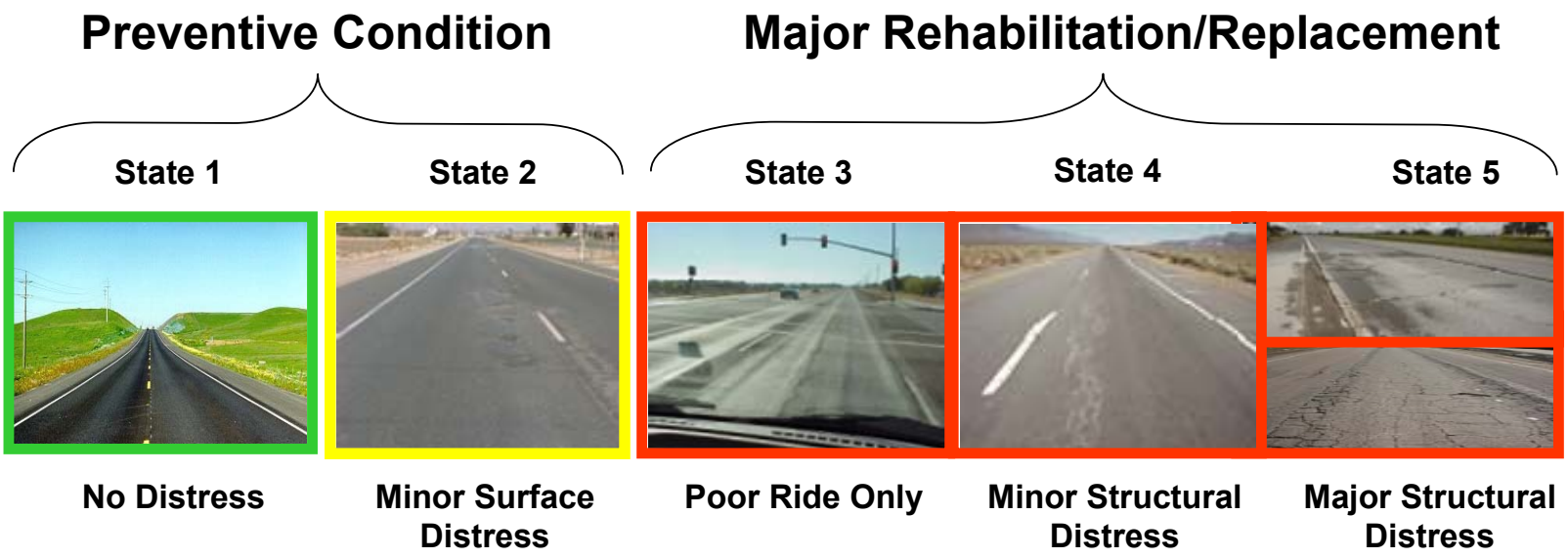
To effectively manage this pavement, the Department conducts an annual Pavement Condition Survey (PCS). The PCS consists of a visual inspection of the pavement surface using a team of pavement raters and an automated ride quality inspection using a van equipped with two high-speed Profilers developed by Pathway Services. For flexible pavement, the visual inspection is done by taking a 100-foot sample of the pavement for every change in pavement condition. The rater enters the extent and type of the distress into a database which is downloaded at the end of the day. The software suggests a drive-ahead distance based on the amount of the triggered distress entered. The evaluator drives ahead monitoring the condition of the pavement and stops at or near the suggested location. For rigid pavement, the concrete slabs are continuously rated and each section is approximately one mile in length.

For the ride quality inspection, data is automatically collected using lasers mounted in a special front rut bar to measure the road profile in each wheel path. For every 0.1 mile of travel a value called the international roughness index (IRI) is created. The IRI is a common value used throughout the world when discussing road roughness. The high-speed profiler is able to gather accurate data from speeds of 10 miles per hour (mph) to over 70 mph. In addition to IRI values, the profilers are able to accurately measure rutting, faulting and surface texture from the roadway surface. Data from the PCS is downloaded to a FoxPro database program called the Pavement Condition Report (PCR), which provides a detailed pavement inventory, identifies project needs, prioritizes pavement distress, and summarizes the condition of the system.

The original PCS was developed in the mid-1970's and new PCR software came into use in 1998. The original system was intended only to identify distressed pavement, i.e. pavement having major distress, minor distress or poor ride. All other surveyed pavement was considered to have little or no distress. In 2004, new functionality was added that further classifies pavement with minor distress or no distress into segments requiring base (corrective) maintenance, preventive maintenance or excellent pavement. Figure 1, Page 3, shows the different Pavement Condition States.

The PCR software has three basic reports; Inventory, Location Summary and Project Recommendations. The inventory report is the actual survey information broken down by direction, lane number and survey length. The location summary report combines the segments for each lane of a multi-lane freeway into one segment. This new segment is the same length as the inventory but is not divided into different lanes. The distress for this new segment is the worst of the multi-lanes. The project recommendation report goes one step further and combines the summary lengths into suggested projects. For two-lane roads and undivided highways, the

**FIGURE 1 - Pavement Condition States**




| | | |
|---|---|---|
| State 1: | Excellent condition with no, few potholes or cracks | - Future Preventive Maintenance project |
| State 2: | Good condition with minor potholes or cracks | - Preventive or Base Maintenance project |
| State 3: | Fair condition with moderate potholes and cracks | - CAPM project |
| State 4: | Poor condition with significant cracks | - CAPM project or Rehabilitation candidate |
| State 5: | Poor condition with extensive cracks | - Long Life or Rehabilitation/Reconstruction candidate |

directions are merged as well. The resultant segments are longer and the distress is the worst of the different summary segment lengths. The PCR is accessible on the Caltrans intranet.

Table 1 shows the distribution of lane miles by pavement condition classification. The results shown in Table 1 demonstrates major changes in the way the results are calculated. Previous versions of the PCR software included bridges in the calculated distressed pavement and pavement maintenance lane miles. The excellent pavement lane miles were calculated by subtracting the sum of these from the total system lane miles, which did not include bridges. This State of the Pavement (SOP) report shows the totals for all cases with bridge lane miles removed. The other major change in Table 1 is that the distressed lane miles and pavement maintenance lane miles are calculated using the Location Summary Report. In previous SOP reports, these were calculated from the Project Recommendation Report. This change results in less major distress and excellent lane miles and more pavement maintenance, minor and poor ride lane miles. For comparison purposes, the 2005 numbers shown in Table 1 have been adjusted by removing bridge lane miles and using the Location Summary Report.

"Major Structural Distress" indicates the pavement has severe cracking and may also have a poor ride. This type of distressed pavement is remedied by rehabilitation or reconstruction projects. "Minor Structural Distress" indicates the pavement has moderate cracking and may have a poor ride. This type of distressed pavement is remedied by Capital Preventive Maintenance (CAPM) or rehabilitation projects. "Poor Ride Quality (Only)" indicates the pavement exhibits few cracks but has a poor ride condition. This pavement is generally treated with CAPM strategies. Pavement Maintenance lane miles are the total for base (corrective) and preventive maintenance.

**TABLE 1 Pavement Condition Classification**

| Pavement Condition[2] | 2005 | | | 2007 | | |
|---|---|---|---|---|---|---|
| | Lane Miles[3] | Percent of Distressed Pavement | Percent of System | Lane Miles[4] | Percent of Distressed Pavement | Percent of System |
| Major Structural Distress | 9,023 | 67% | 18% | 8,102 | 62% | 16% |
| Minor Structural Distress | 4,012 | 30% | 8% | 3,914 | 30% | 8% |
| Poor Ride Quality (Only) | 357 | 3% | 1% | 981 | 8% | 2% |
| Total Distressed Pavement | 13,392 | 100% | 27% | 12,998 | 100% | 26% |
| | | | | | | |
| Pavement Maintenance | 18,715 | | 38% | 16,055 | | 32% |
| Excellent Pavement | 17,454 | | 35% | 20,424 | | 41% |
| Total System Lane Miles[1] | 49,561 | | 100% | 49,477 | | 100% |

*1. Excludes bridges, ramps and frontage roads*

*2. Pavement Condition has been adjusted for 2005 using pavement summary report.*

*3. Lane miles for 2005 have been adjusted by removing bridges*

*4. Lane miles are rounded to whole numbers.*

The 2007 PCS began in January 2006 and was completed in November 2007. The 2007 PCS was delayed more than 12 months due to changes in data collection by the University of California, Davis and Caltrans Division of Research and Innovation. Also, there were failures with the data collection equipment that caused unscheduled equipment repairs. As shown in Table 1, the PCS identified 12,998 lane miles of distressed pavement requiring CAPM and rehabilitation work. This is 3% lower than the 13,392 distressed lane miles in the adjusted 2005 survey. The majority of this distressed pavement was on Class 1 roads, but as a percentage of total lane miles for each class, Class 3 roads had the highest percentage. See Table 2.

**TABLE 2-Distressed Pavement by Highway Classification**

| Highway Classification | 2005 | | 2007 | |
|---|---|---|---|---|
| | **Distressed Pavement as a percentage of entire system lane miles** | **Distressed Pavement as a percentage of classification total lane miles** | **Distressed Pavement as a percentage of entire system lane miles** | **Distressed Pavement as a percentage of classification total lane miles** |
| Class 1 | 14% | 25% | 13% | 22% |
| Class 2 | 9% | 31% | 9% | 31% |
| Class 3 | 5% | 35% | 5% | 34% |

The 2007 survey also identified 16,055 lane miles requiring some type of pavement maintenance, which is also lower than what was identified in the 2005 survey. Nearly 60% of California pavements need some type of pavement rehabilitation or maintenance.

## Vehicle Miles Traveled on Rough/Smooth Pavements

The "smoothness" of pavement is measured using a standardized scale, called the International Ride Index (IRI). This is generally accepted as a worldwide pavement roughness measurement. The IRI measures a vehicle's up and down movement over the pavement in inches per one mile of driving. On a smooth road, such as a recently completed pavement rehabilitation project, the up and down movements are low.

The Federal Highway Administration (FHWA) *2002 Conditions and Performance Report* simplified the measurement of ride quality into two descriptive terms: "Good" or "Acceptable." To be rated acceptable, pavement performance must have an IRI value of less than or equal to 170 inches per mile. According to the FHWA IRI rating scale, the IRI value must be less than or equal to 95 inches per mile to be rated good.

Figure 2 shows the percentage of vehicle miles traveled (VMT) on rough riding pavement (IRI >170) for National Highway System (NHS) Interstate, NHS non-Interstate, and non-NHS routes. From 2005 to 2007, the percentage of VMT on rough-riding pavement decreased on NHS Interstate, NHS non-Interstate, and increased on non-NHS routes. Overall, the percentage of rough riding pavement was unchanged.

## FIGURE 2- Rough Pavement, 2002 – 2007

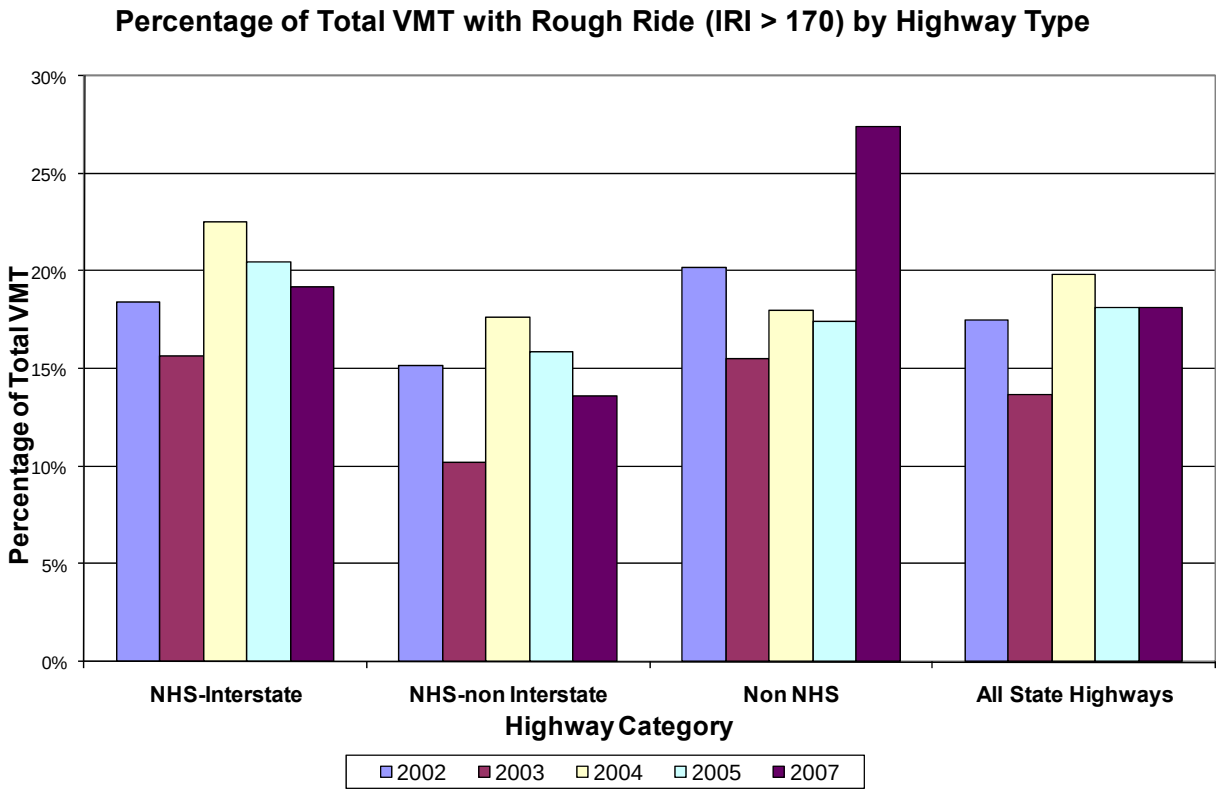
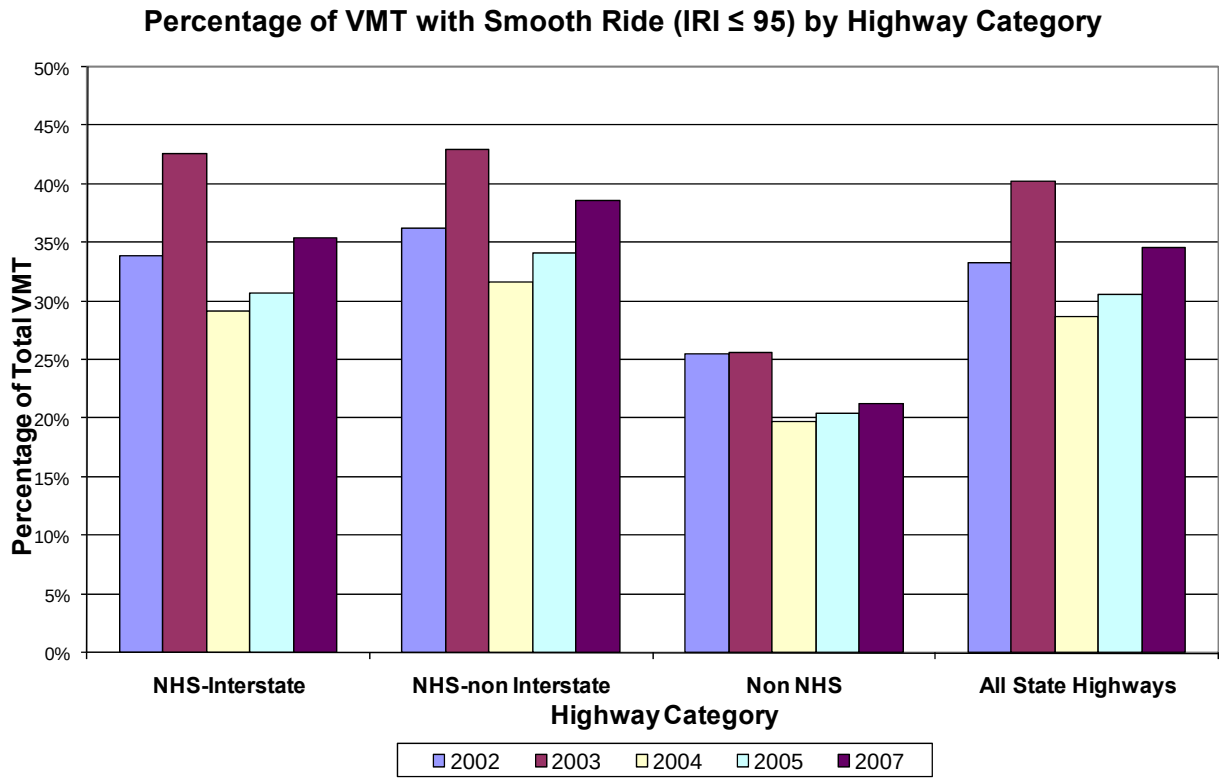


Figure 3 shows the percentage of VMT on smooth-riding pavement (IRI ≤ 95) for NHS Interstate, NHS non-Interstate, and non-NHS routes. From 2005 to 2007, the percentage of VMT on smooth pavement increased on all categories of state highway. Overall, the percentage of smooth-riding pavement increased from 31% to 35%.

## FIGURE 3- Smooth Pavement, 2002 – 2007




## Prioritizing Pavement Needs

As mentioned previously, surveyed pavement is classified into distressed lane miles requiring major or minor rehabilitation pavement maintenance and excellent pavement. Distressed lane miles are reported in the Department's *State Highway System Performance Measures*. Ride quality, structural distress, and Maintenance Service Level (MSL) are used to prioritize the distressed pavement lane mile roadway segments for rehabilitation and CAPM work and the pavement maintenance lane mile roadway segments for base and preventive maintenance work. The combination of ride quality data and structural distress data are used to identify strategies for repairing the pavement. That information is integrated with the MSL value to establish the 'Priority Number' assigned to that pavement. MSL describes the role a route fulfills within the state highway network and the volume of traffic it serves. Table 3 shows the Priority Matrix used to categorize the pavement condition. A matrix of 21 values results from the combination of ride quality, structural distress, and MSL. The value each pavement segment receives is used to identify whether a pavement requires maintenance or rehabilitation. When two pavement

segments have identical priority values, determining the site that will receive project development and funding depends on factors such as safety issues, traffic volume, project costs, and ongoing maintenance expenditures, as well as a detailed condition comparison.

## TABLE 3 Priority Matrix

| Ride Quality | Structural Distress | MSL 1 | MSL 2 | MSL 3 |
|---|---|---|---|---|
| | | Priority Number | Priority Number | Priority Number |
| Poor Ride | Major Rehabilitation | 1 | 2 | 11 |
| | Minor Rehabilitation | 3 | 4 | 12 |
| | None | 5 | 6 | 12 |
| Acceptable Ride | Major Rehabilitation | 7 | 8 | 13 |
| | Minor Rehabilitation | 9 | 10 | 14 |
| | Minor Maintenance | 31, 32, 33, 41, 42 | 31, 32, 33, 41, 42 | 31, 32, 33, 41, 42 |
| | No Distress | 98, 99 | 98, 99 | 98, 99 |

Pavements requiring major or minor rehabilitation, i.e., priority numbers less than or equal to 14 are remedied by projects requiring extensive repair strategies that usually improve the pavement's structural adequacy. For pavements requiring only maintenance work, i.e., priority numbers greater than 14 and less than 98, various strategies are implemented. A Major Maintenance Program priority matrix was implemented to rate this category of pavement. Preventive and Base Maintenance treatments will be performed on pavements based on the defects shown in Table 4. The pavement is categorized into work groups based on the type of treatment recommended for the distresses observed. The work groups are the basis for the Major Maintenance Budget Model and the allocation of funds to the twelve Caltrans Districts for Contract Major Maintenance. They will also be a basis for the proposed Pavement Level of Service rating system for all maintenance work (state forces and contract). This process links budget modeling, allocations and pavement ratings together using actual data collected through the Pavement Condition Survey.

## TABLE 4-Maintenance Program Treatment Matrix

| Maintenance Type | Work Group | Defect |
|---|---|---|
| Preventive | Fog Seals | Coarse Raveling, Weathering |
| | Premium Seal/Overlay | Low Alligator A, Low Alligator B (on High ADT Routes) |
| | Cracks – Crack Seal | Alligator A, Misc. Cracks |
| | Chip Seal/Slurry Seal | Alligator A, Low Alligator B (on Low ADT Routes), Misc. Cracks |
| Base | Overlay | Patching, Alligator A, High Alligator B |
| | Mill & Resurface | Wheel Rutting, High Alligator A, Shoving, Bleeding |
| | Potholes/Spalls | Potholes, Spalls |
| | Slab Replacement | Slab Cracking |
| | Mill and Resurface (Shoulder) | Joint Depression, Open Cracks, Alligator A & B, Raveling |

## Costs, Expenditures and Funding

Since this report has data that was collected from the beginning of 2006 to the end of 2007, the cost and expenditure information includes both the 2005/06 and 2006/07 Fiscal Years. This differs from previous State of the Pavement reports, which only included one year.

2005/06 FY

In the 2005/06 Fiscal Year (FY), $667 million of rehabilitation and maintenance contracts were awarded. Of this amount, $596 million was for Roadway Rehabilitation and CAPM projects that repaired 2,012 lane miles of pavement. The remaining $71 million in Major Maintenance projects (Preventive and Base) repaired 1,338 lane miles of pavement.
Figure 4 shows the accomplishments for Maintenance and Rehabilitation projects in terms of contract dollars awarded and lane miles of pavement repaired in the 2005/06 FY.

### FIGURE 4-Accomplishments /Contracts Awarded-2005/06 FY

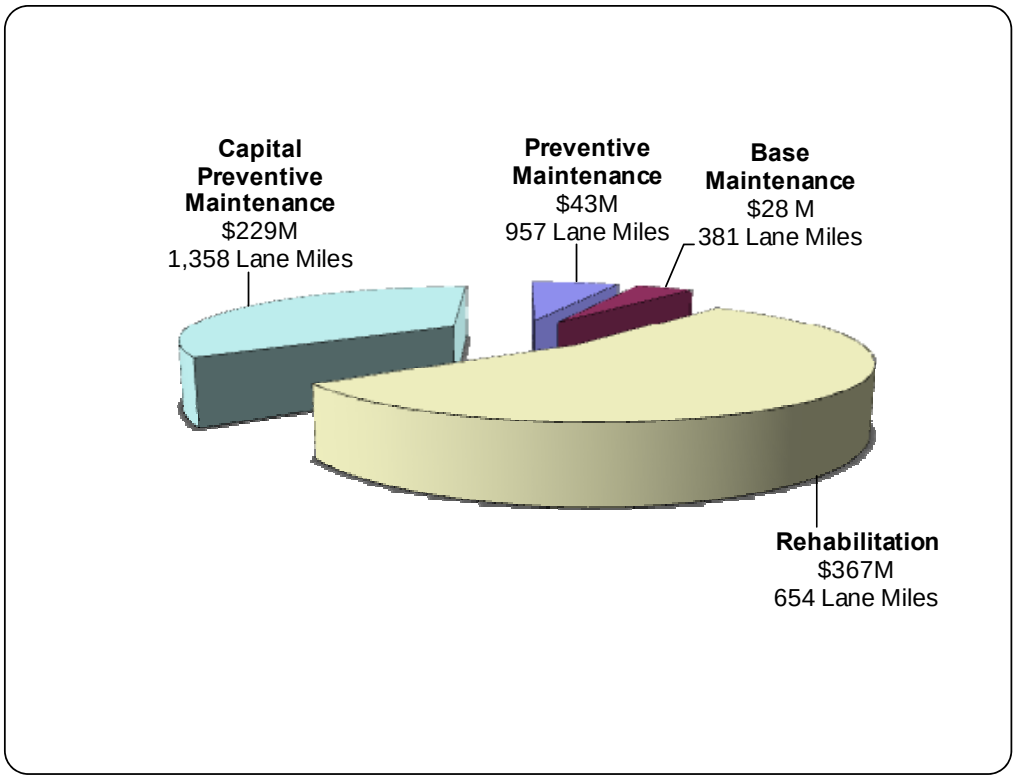


Figure 5 shows the cost and number of lane miles paved using a Preventive Maintenance (PM) strategy for Major Maintenance contracts awarded in the 2005/06 FY. A Major Maintenance contract performed on pavement in good condition is considered preventive. PM strategies for flexible pavements include seal coats such as chip seals, slurry seals, and micro surfacing, as well as thin asphalt concrete overlays (overlays equal to or less than 1 inch), and crack sealing. Similar PM treatments for concrete pavements include crack and joint sealing, spall repairs, and diamond grinding for smoothness and improved pavement texture. These treatments reduce the amount of water that may infiltrate the pavement, slow the rate of deterioration, and correct surface roughness.

## FIGURE 5-HM-1 Preventive Maintenance Projects by Strategy-2005/06 FY

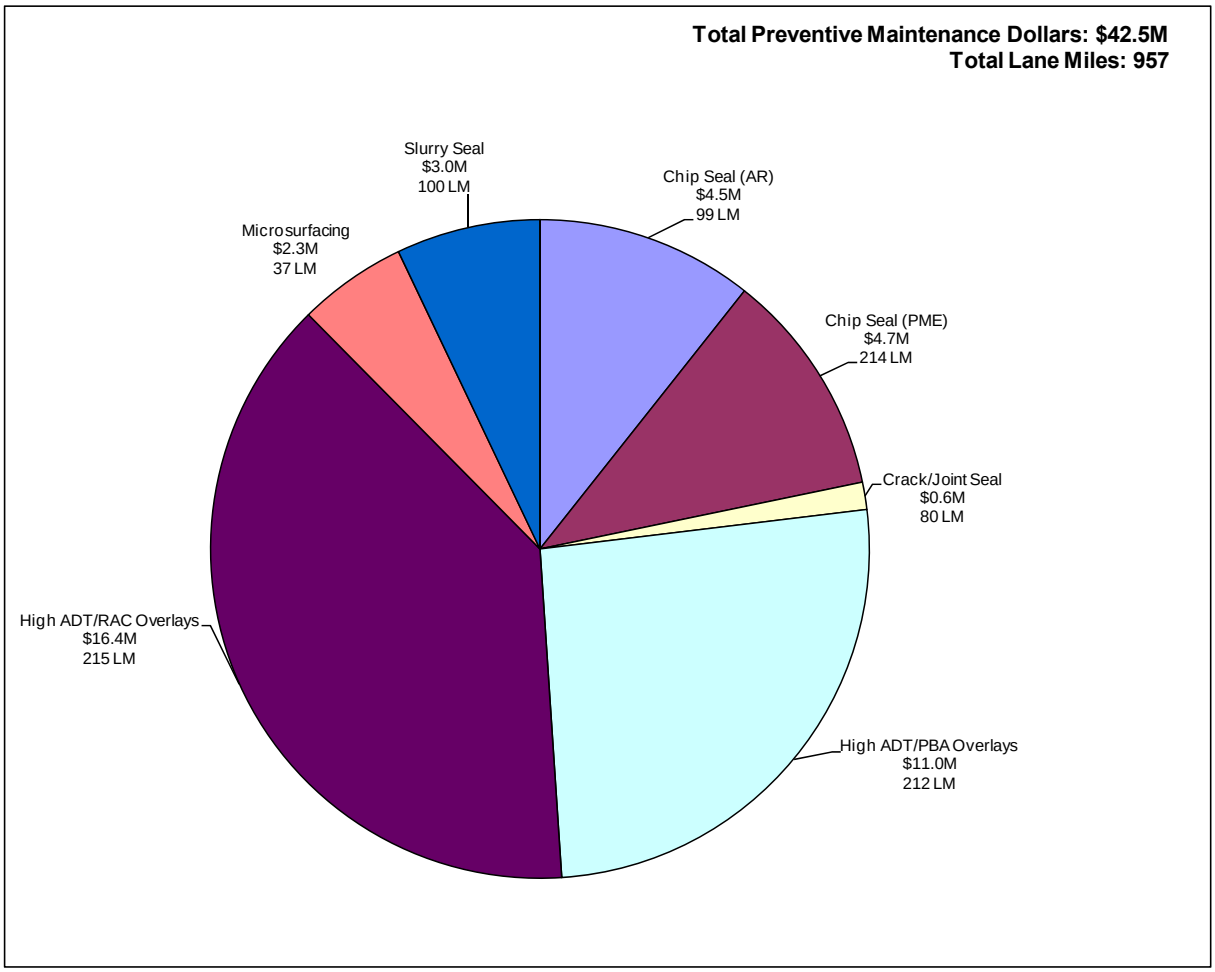
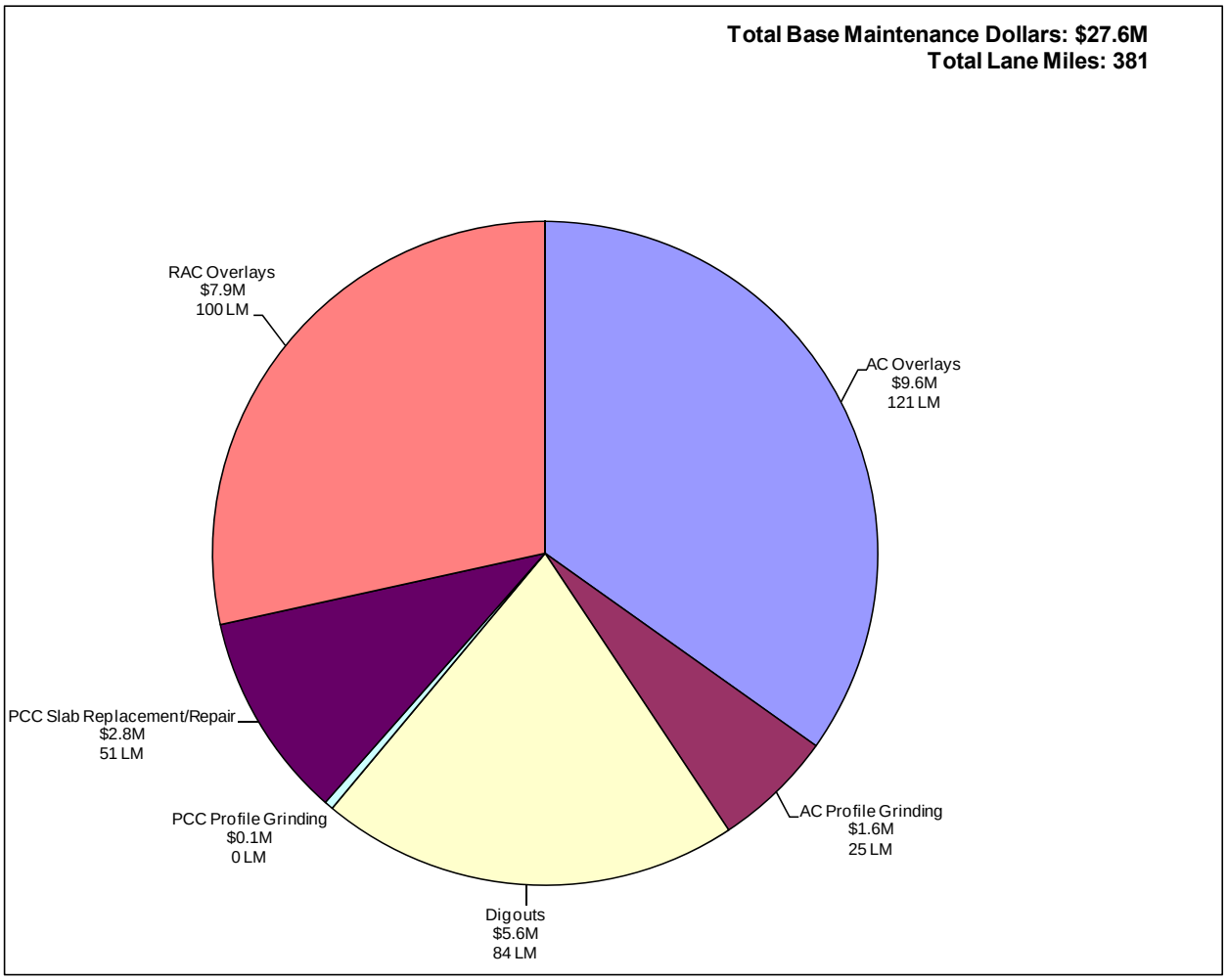


Figure 6 shows the contract dollars and the lane miles repaired using Base Maintenance strategies for Major Maintenance contracts awarded in the 2005/06 FY. Base Major Maintenance preserves the riding qualities, safety characteristics, and structural integrity of the roadways. Thin asphalt overlays, slab replacements and dig outs of pavement at spot locations are common strategies used for these projects.

## FIGURE 6-HM-1 Base Maintenance Projects by Strategy-FY 2005/06



2006/07 FY

In the 2006/07 FY, $740 million of rehabilitation and maintenance contracts were awarded. Of this amount, $586 million was for Roadway Rehabilitation and CAPM projects that repaired 1,114 lane miles of pavement. The $154 million in Major Maintenance projects (PM and Base) repaired 2,298 lane miles of pavement.

Figure 7 shows the accomplishments for Maintenance and Rehabilitation projects in terms of contract dollars awarded and lane miles of pavement repaired in the 2006/07 FY.

## FIGURE 7-Accomplishments /Contracts Awarded, 2006/07 FY

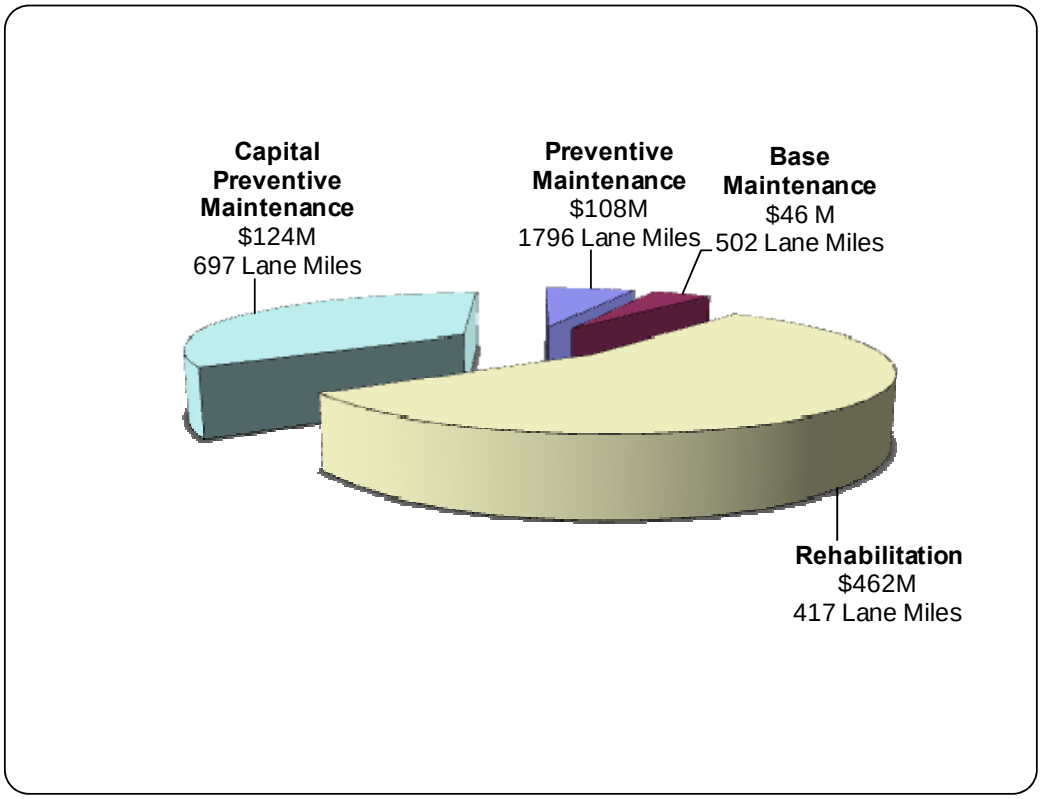


Figure 8 shows the cost and number of lane miles paved using a PM strategy for Major Maintenance contracts awarded in the 2006/07 FY.

## FIGURE 8-HM-1 Preventive Maintenance Projects by Strategy, 2006/07 FY

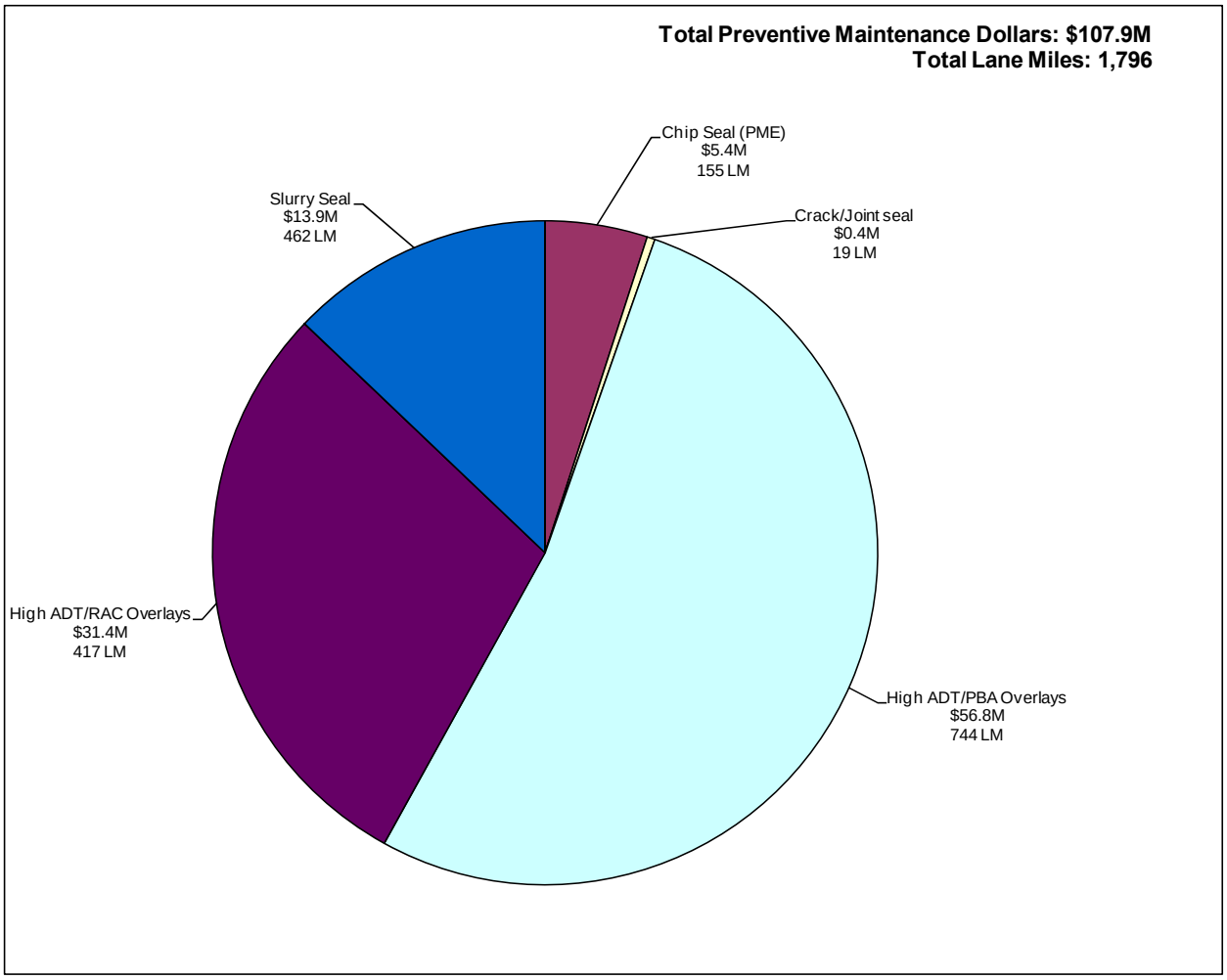
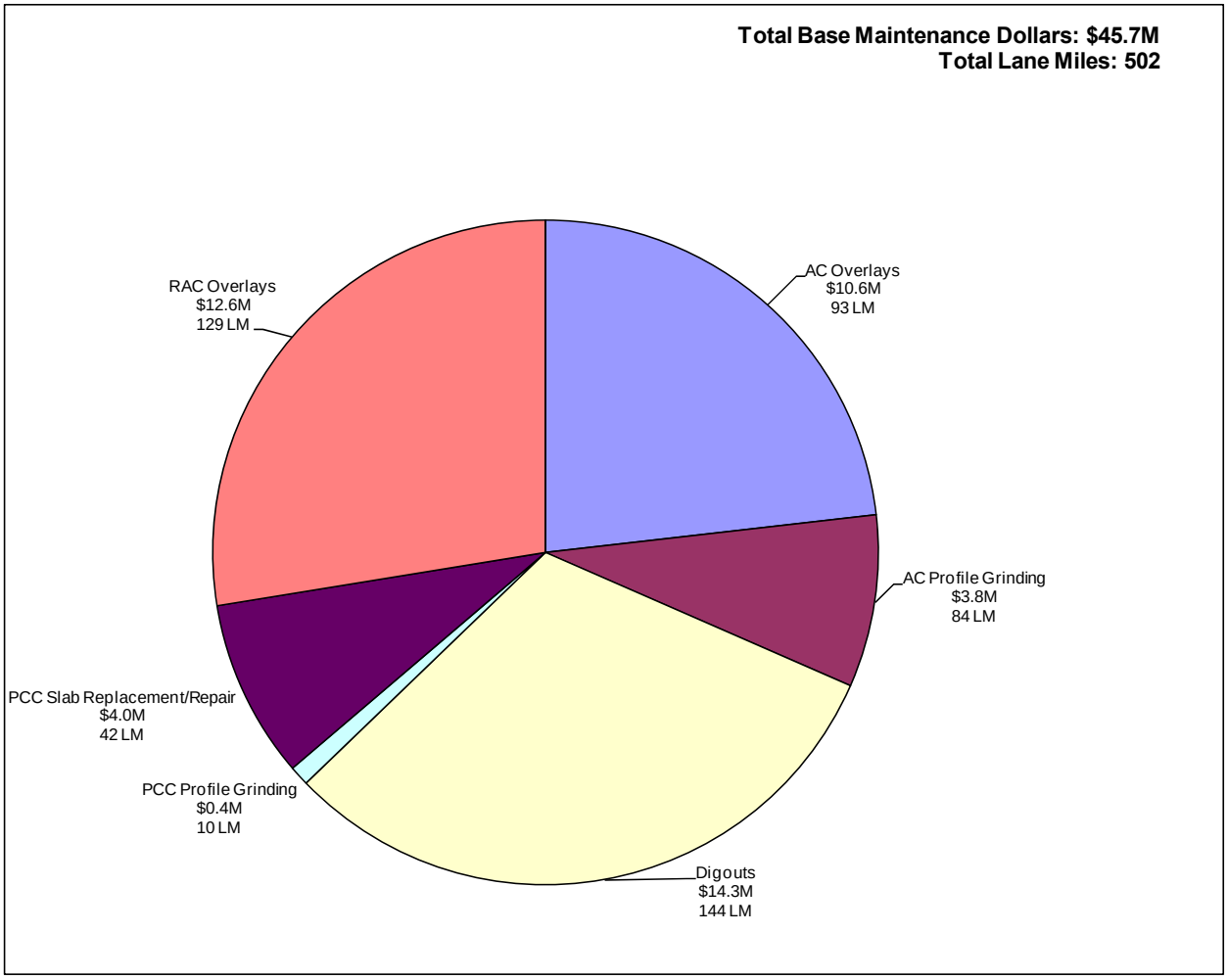


Figure 9 shows the contract dollars and the lane miles repaired using Base Maintenance strategies for Major Maintenance contracts awarded in the 2006/07 FY.

## FIGURE 9-HM-1 Base Maintenance Projects by Strategy, FY 2006/07



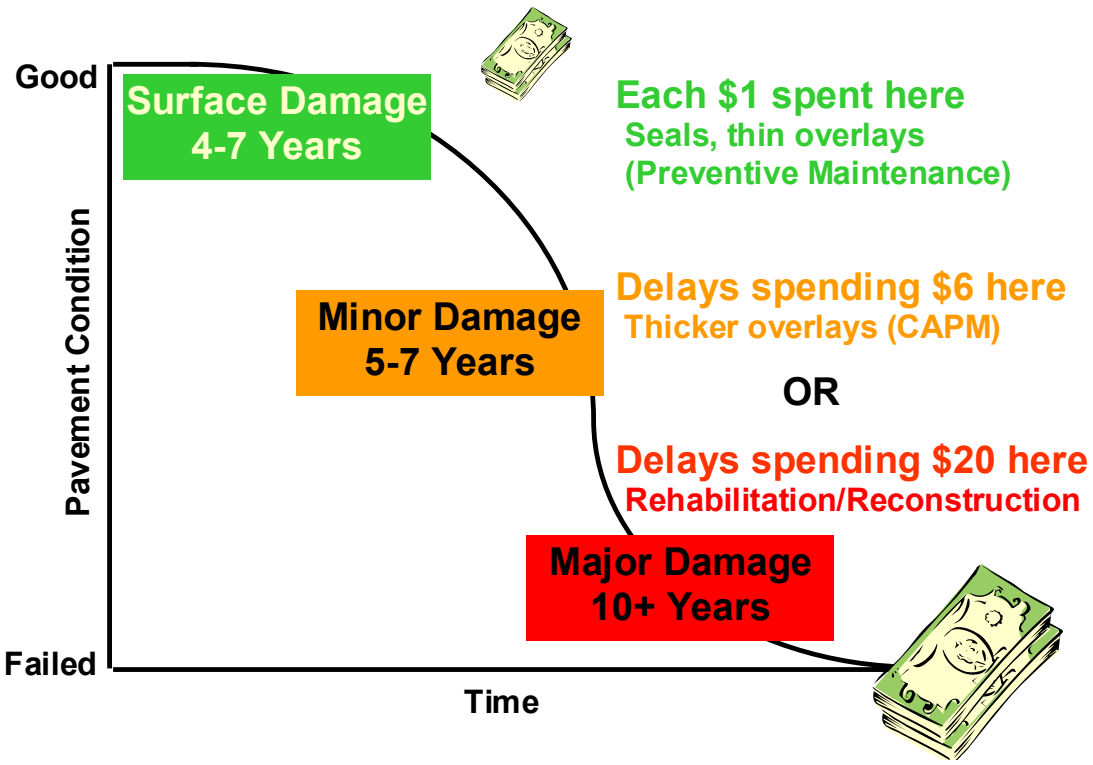

## Cost Effectiveness of Pavement Treatments

Figure 10 shows that six to twenty dollars of future money are saved for each dollar spent when the treatment is applied before the pavement deteriorates into a condition warranting a major rehabilitation or reconstruction project.

Preventive maintenance treatments keep good pavement in good shape and studies show that pavement in good condition costs less to maintain. Base maintenance treatments are used to remedy most minor surface problems. These maintenance strategies can maintain or extend a pavement's service life four to seven years depending on the traffic volumes and environmental conditions. Preventive and Base Major Maintenance project treatments cost, on average, between $20,000 and $100,000 per lane-mile.

A CAPM strategy (pavement grinding or asphalt concrete overlays greater than 1 inch, but less than 2 inches) is typically performed on pavement with minor distress. A moderate cost CAPM project can successfully restore pavement to an excellent condition and provide a service life of five to seven years. CAPM projects awarded in 2006/07 FY averaged $178,000 per lane-mile.

**FIGURE 10-Cost Effectiveness of Pavement Treatments**



Rehabilitation and reconstruction are the most expensive treatments. They remove and replace the pavement structural section rather than the pavement surface. A roadway that is rehabilitated should provide ten years or more of service life with relatively low maintenance expenditures. The costs for rehabilitation projects, including the upgrade of related facilities, awarded in the 2006/07 FY ranged from $377,000 to $4,000,000 per lane-mile with an average of $1,100,000 per lane-mile. (A summary of the various contracted Maintenance and Rehabilitation treatments for the past five years is provided in Table C, page 23.)

Long-life pavement strategies apply to roadways showing pavement distress with traffic volumes greater than 150,000 average daily traffic vehicles or greater than 15,000 average daily truck vehicles. Some long-life strategies include rigid pavement reconstruction, reconstruction of concrete pavement with asphalt concrete, and crack-seat and overlay strategies that provide longer life than the current practice. Long-life pavement design extends the pavement life to more than 35 years and reduces traffic interruptions and delays to the traveling public due to highway construction.

The State Highway System will eventually require substantial rehabilitation or replacement. By delaying rehabilitation, existing conditions deteriorate and the scope of work and costs needed to rehabilitate the facility continue to increase. If timely rehabilitation is not performed, the life of the facility is reduced and its replacement is needed sooner.

The Department is undertaking several efforts to improve the efficiency of how its pavements are designed, constructed, and maintained. Design improvements involve changing the method of designing pavements to allow designers to take site-specific information and tailor pavements to meet predetermined performance criteria regarding fatigue, ride quality, and durability. Construction improvements include developing end result and performance based specifications. These are intended to define the conditions that the pavement is expected to be in when constructed and then provide incentives and disincentives for work that is better or worse than expectations. Maintenance improvements involve better tracking of pavement performance to predict future maintenance needs and costs to facilitate the optimization of agency funds.

## Pilot Programs and Pilot Projects

Pilot programs are often initiated when changes are deemed necessary or when innovative treatments need to be evaluated. Pilot programs typically require the construction of pilot projects to evaluate the proposed change(s) especially if the change involves an improved maintenance or construction practice validating enhancements to pavement performance and/or life; and changes in material properties or sampling and testing. Some of the Department's current pavement pilot projects are discussed below.

### Rubberized Asphalt Concrete

In 2003, the Department set a statewide goal that 15% of the asphalt concrete pavement contracts awarded will incorporate rubberized asphalt concrete (RAC). RAC usage can produce a more

durable pavement with the same service life of conventional dense graded asphalt concrete, at half the thickness. Some benefits of RAC are a longer lasting pavement, with resistance to reflective cracking, and a smoother ride. In addition, RAC has the potential of significantly reducing tire noise. Utilizing RAC saves valuable resources and reduces the number of tires entering landfills.

During the 2006/07 FY, $42.9 million was invested in 85 Roadway Preservation and Base RAC projects. These projects repaired 767 lane miles of distressed pavement. Over the same time period, $13.0 million was awarded on four CAPM projects that preserved 157 lane miles.

Ground Penetrating Radar

The final report for the pilot research project to evaluate use of Ground Penetrating Radar (GPR) for obtaining network level pavement structure information was published in February 2006. The report titled "Pilot Project for the Fixed Segmentation of the Pavement Network" was done by the UC Pavement Research Center, University of California, Davis and Berkeley.

The goal of this pilot project was to study a small sample of the state highway network to determine the feasibility of expanding the pilot approach to the entire pavement network. Based on the success of this pilot project, it is planned to use GPR to survey the entire state system.

## Pavement Goals Versus Ten-Year Plan for Addressing Distressed Lane Miles

California Streets and Highways Code Section 164.6 requires the Department to prepare a Ten-Year State Highway Operation and Protection Plan (SHOPP) for rehabilitation and reconstruction of all State highways and bridges, and to set goals for each program. The SHOPP is updated every two years. The SHOPP's statewide pavement performance goal is to reduce the total distressed lane miles throughout the State to 5,500 by the 2015/16 FY (a reduction from 25% of the network needing rehabilitation to no more than 10%). Each District has developed a Ten-Year Plan to identify project needs and priorities to achieve its portion of the statewide goal.

Table 5 compares the Districts' distressed lane miles from the 2007 PCS to the Ten-Year Plan for Pavement Preservation performance goals.

## TABLE 5-Districts' Actual vs. Planned Goal for Distressed Lane Miles, 2007

| District | Actual Distressed Lane Miles per 2005 PCS* | Planned Distressed Lane Miles per Performance Goal** | Difference between Actual and Goal of Distressed Lane Miles |
|---|---|---|---|
| 1 | 429 | 320 | 109 |
| 2 | 967 | 540 | 427 |
| 3 | 1,349 | 560 | 789 |
| 4 | 1,594 | 599 | 995 |
| 5 | 934 | 372 | 562 |
| 6 | 1,451 | 611 | 840 |
| 7 | 1,737 | 712 | 1,025 |
| 8 | 2,153 | 660 | 1,493 |
| 9 | 153 | 146 | 7 |
| 10 | 1,206 | 449 | 757 |
| 11 | 651 | 297 | 354 |
| 12 | 374 | 234 | 140 |
| TOTAL | 12,998 | 5,500 | 7,498 |

** Lane Miles not surveyed in 2005 used 2004's distress*

*** from the current Ten-Year State Rehabilitation Plan*

## Five-Year Maintenance Plan

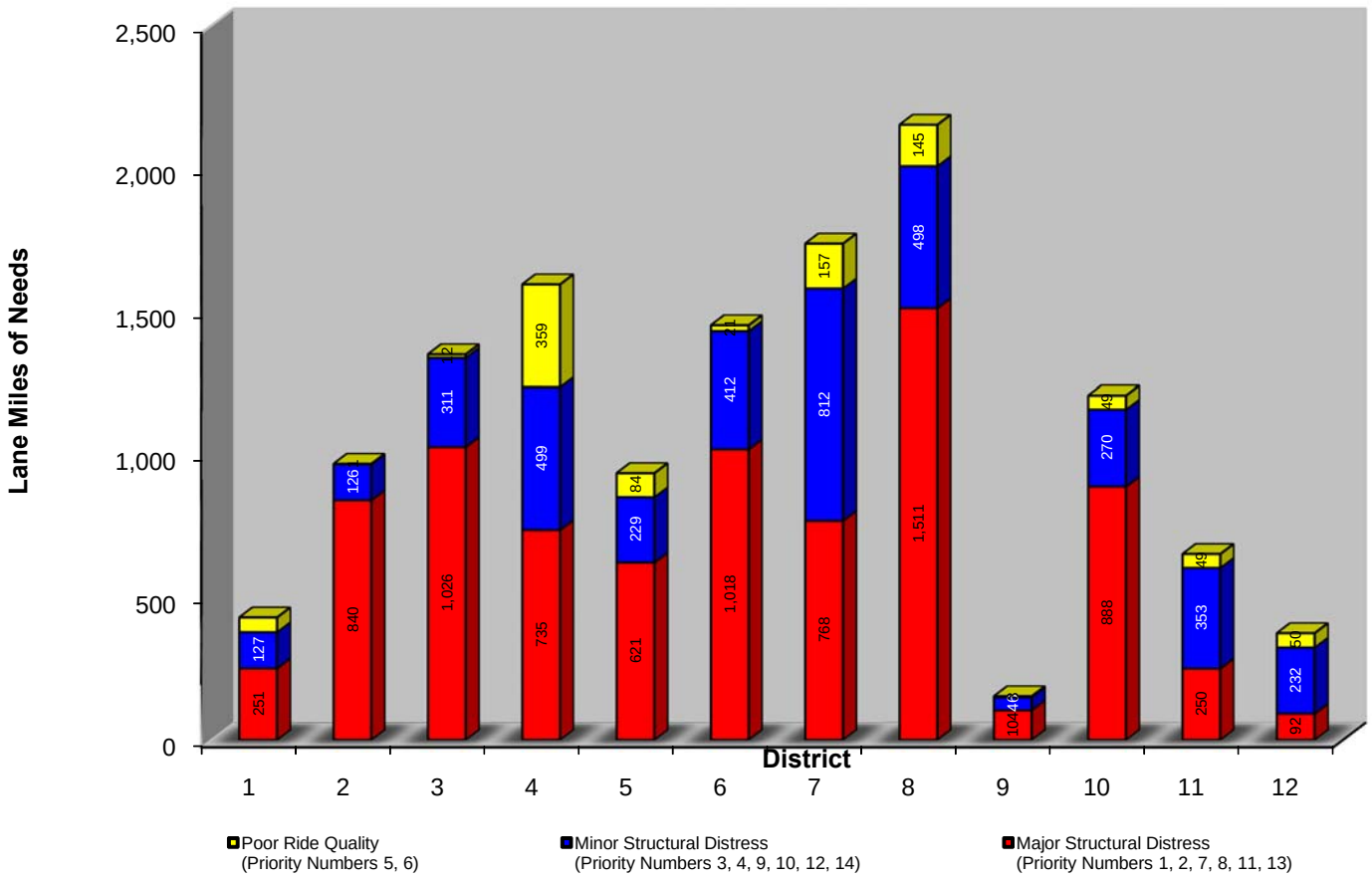
Streets and Highways Code Section 164.6 also requires the Department to prepare a five-year Maintenance Plan to address the maintenance needs of the State Highway System. Together, the 2008 SHOPP and the 2007/08 Maintenance Plan attempt to balance resources between SHOPP and maintenance activities to achieve identified milestones and goals at the lowest possible long-term total cost.

## District Pavement Condition

In 2007, the total lane miles of distressed pavement decreased by 415 miles from the adjusted 2005 survey. Each year a project location priority list, generated from the PCS data, is provided to the districts. From these lists, the districts develop their pavement preservation candidate lists. While the PCR suggests an initial project sequence, district knowledge of local needs and funding availability determines the project priorities for maintenance and rehabilitation projects. The field review determines the most cost-effective repair strategy.

A percentage distribution of distressed pavement, by district, from the 2007 PCS is presented in Figure 11. Total needs, as indicated by the bars, are still high – six of the twelve districts have distressed pavement greater than 25% of their total pavements.

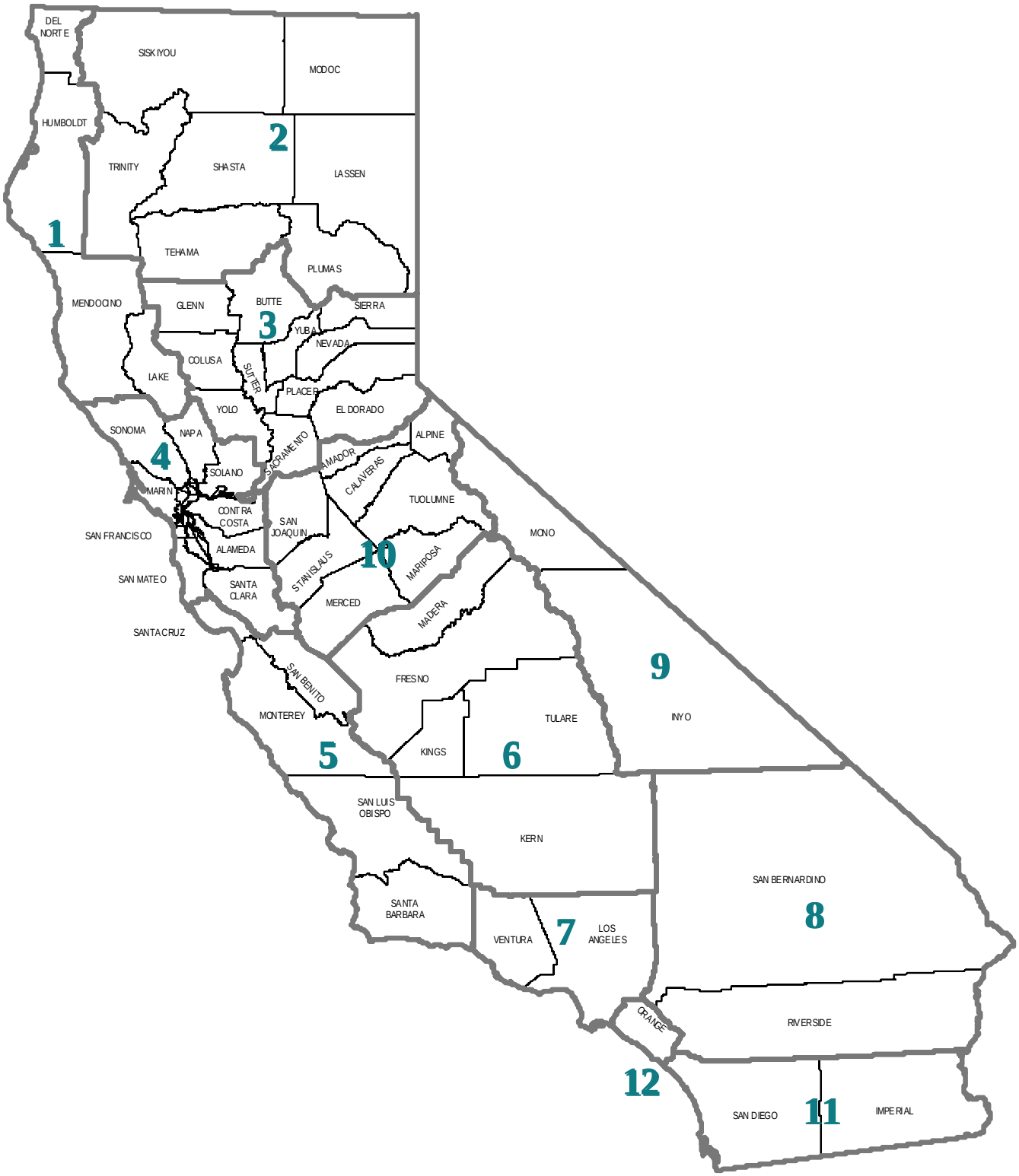
## FIGURE 11 - District Needs in Lane Miles, 2007 PCS




| District: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| System lane miles: | 2,330 | 3,995 | 4,307 | 5,976 | 3,187 | 5,718 | 6,269 | 6,641 | 1,777 | 3,472 | 3,937 | 1,950 |
| Distressed lane miles: | 511 | 983 | 1,489 | 1,887 | 877 | 1,361 | 2,219 | 2,189 | 240 | 1,226 | 556 | 307 |
| % of system: | 22% | 25% | 35% | 32% | 28% | 24% | 35% | 33% | 14% | 35% | 14% | 16% |

# Appendix

## Map of Caltrans Districts



## TABLE A Distribution of Centerline Miles and Lane miles, 2007.

| | Center line miles | | Lane Miles | | Distressed Lane Miles | | Major Structural Distress | Minor Structural Distress | Poor Ride Quality |
|---|---|---|---|---|---|---|---|---|---|
| **TOTAL** | 14,877 | 100% | 49,477 | 100% | 12,998 | 26% | 8,102 | 3,914 | 981 |
| **PRIORITY** | | | | | | | | | |
| Major Structural Distress | | | | | 8,102 | 16% | | | |
| Minor Structural Distress | | | | | 3,914 | 8% | | | |
| Poor Ride Quality | | | | | 981 | 2% | | | |
| NONE (Not Distressed) | | | | | 36,480 | 74% | | | |
| | | | | | 49,477 | 100% | | | |
| **MSL** | | | | | | | | | |
| 1 | 5,971 | 40% | 27,718 | 56% | 6,100 | 47% | | | |
| 2 | 5,312 | 36% | 14,216 | 29% | 4,478 | 34% | | | |
| 3 | 3,540 | 24% | 7,199 | 15% | 2,420 | 19% | | | |
| | 14,823 | 100% | 49,133 | 99% | 12,998 | 100% | | | |
| **DISTRICT** | | | | | | | | | |
| 1 | 927 | 6% | 2,330 | 5% | 429 | 3% | 251 | 127 | 51 |
| 2 | 1,719 | 12% | 3,995 | 8% | 967 | 7% | 840 | 126 | 1 |
| 3 | 1,452 | 10% | 4,309 | 9% | 1,349 | 10% | 1,026 | 311 | 12 |
| 4 | 1,361 | 9% | 5,950 | 12% | 1,594 | 12% | 735 | 499 | 359 |
| 5 | 1,148 | 8% | 3,168 | 6% | 934 | 7% | 621 | 229 | 84 |
| 6 | 2,027 | 14% | 5,755 | 12% | 1,451 | 11% | 1,018 | 412 | 21 |
| 7 | 1,075 | 7% | 6,267 | 13% | 1,737 | 13% | 768 | 812 | 157 |
| 8 | 1,871 | 13% | 6,568 | 13% | 2,153 | 17% | 1,511 | 498 | 145 |
| 9 | 739 | 5% | 1,777 | 4% | 153 | 1% | 104 | 46 | 3 |
| 10 | 1,303 | 9% | 3,466 | 7% | 1,206 | 9% | 888 | 270 | 49 |
| 11 | 980 | 7% | 3,989 | 8% | 651 | 5% | 250 | 353 | 49 |
| 12 | 275 | 2% | 1,903 | 4% | 374 | 3% | 92 | 232 | 50 |
| | 14,877 | 100% | 49,477 | 100% | 12,998 | 100% | 8,102 | 3,914 | 981 |
| **ROAD TYPE** | | | | | | | | | |
| Multi-Lane Divided | 5,609 | 38% | 30,335 | 61% | 6,819 | 52% | | | |
| Multi-Lane Undivided | 385 | 3% | 1,321 | 3% | 422 | 3% | | | |
| Two-Lane | 8,883 | 60% | 17,821 | 36% | 5,757 | 44% | | | |
| | 14,877 | 100% | 49,477 | 100% | 12,998 | 100% | | | |
| **CITY** | | | | | | | | | |
| City | 2,707 | 18% | 15,885 | 32% | 4,197 | 32% | | | |
| Non-city | 12,169 | 82% | 33,592 | 68% | 8,801 | 68% | | | |
| | 14,877 | 100% | 49,477 | 100% | 12,998 | 100% | | | |
| **NATIONAL HIGHWAY SYSTEM** | | | | | | | | | |
| NHS Interstate | 2,222 | 15% | 13,442 | 27% | 3,051 | 23% | | | |
| NHS non-Interstate | 4,792 | 32% | 17,484 | 35% | 3,935 | 30% | | | |
| Non-NHS roads | 7,863 | 53% | 18,552 | 37% | 6,012 | 46% | | | |
| | 14,877 | 100% | 49,477 | 100% | 12,998 | 100% | | | |
| **INTERMODAL CORRIDORS OF ECONOMIC SIGNIFICANCE (ICES)** | | | | | | | | | |
| ICES | 3,338 | 22% | 18,151 | 37% | 4,145 | 32% | | | |
| Non-ICES roads | 11,539 | 78% | 31,327 | 63% | 8,853 | 68% | | | |
| | 14,877 | 100% | 49,477 | 100% | 12,998 | 100% | | | |
| **PAVEMENT TYPE** | | | | | | | | | |
| Flexible | 12,179 | 82% | 33,138 | 67% | 8,988 | 69% | | | |
| Rigid | 2,699 | 18% | 16,348 | 32% | 4,010 | 31% | | | |
| | 14,879 | 100% | 49,486 | 99% | 12,998 | 100% | | | |

| Distress | Priority Numbers |
|---|---|
| Major Structural Distress | 1, 2, 7, 8, 11, 13 |
| Minor Structural Distress | 3, 4, 9, 10, 12, 14 |
| Poor Ride Qualilty | 5, 6 |

*(Excludes bridges, ramps and frontage roads)*

*Lane miles are rounded to whole numbers.*

**TABLE B**

## Distressed Lane Miles by Priority Group

| District | 2002 Major Structural Distress | 2002 Minor Structural Distress | 2002 Poor Ride Quality | 2003 Major Structural Distress | 2003 Minor Structural Distress | 2003 Poor Ride Quality | 2004 Major Structural Distress | 2004 Minor Structural Distress | 2004 Poor Ride Quality | 2005 Major Structural Distress | 2005 Minor Structural Distress | 2005 Poor Ride Quality | 2007 Major Structural Distress | 2007 Minor Structural Distress | 2007 Poor Ride Quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 243 | 95 | 20 | 273 | 69 | 12 | 427 | 53 | 6 | 464 | 43 | 4 | 251 | 127 | 51 |
| 2 | 709 | 171 | 15 | 858 | 114 | 2 | 952 | 86 | 1 | 932 | 51 | 0 | 840 | 126 | 1 |
| 3 | 842 | 220 | 46 | 1,119 | 142 | 27 | 1,091 | 129 | 7 | 1,333 | 120 | 36 | 1,026 | 311 | 12 |
| 4 | 879 | 450 | 121 | 1,041 | 365 | 144 | 1,202 | 348 | 57 | 1,468 | 323 | 96 | 735 | 499 | 359 |
| 5 | 621 | 156 | 32 | 772 | 139 | 16 | 880 | 117 | 28 | 747 | 110 | 20 | 621 | 229 | 84 |
| 6 | 1,093 | 312 | 40 | 1,249 | 204 | 30 | 993 | 203 | 7 | 1,199 | 159 | 3 | 1,018 | 412 | 21 |
| 7 | 815 | 724 | 254 | 1,003 | 657 | 142 | 1,432 | 438 | 94 | 1,627 | 526 | 65 | 768 | 812 | 157 |
| 8 | 1,441 | 256 | 70 | 1,483 | 186 | 50 | 1,979 | 186 | 13 | 2,021 | 158 | 10 | 1,511 | 498 | 145 |
| 9 | 130 | 62 | 0 | 112 | 40 | 0 | 155 | 55 | 0 | 180 | 60 | 0 | 104 | 46 | 3 |
| 10 | 735 | 203 | 19 | 833 | 162 | 16 | 900 | 76 | 1 | 1,128 | 99 | 0 | 888 | 270 | 49 |
| 11 | 107 | 218 | 9 | 137 | 233 | 7 | 113 | 301 | 5 | 296 | 253 | 6 | 250 | 353 | 49 |
| 12 | 54 | 109 | 87 | 58 | 100 | 32 | 133 | 137 | 22 | 124 | 175 | 8 | 92 | 232 | 50 |
| Totals | 7,669 | 2,976 | 710 | 8,938 | 2,411 | 478 | 10,257 | 2,125 | 239 | 11,518 | 2,078 | 249 | 8,102 | 3,914 | 981 |

## District Lane Miles by Pavement Condition Survey Year

| District | 2002 System Lane Miles | 2002 Distressed Ln Miles | 2002 Pct. of System | 2003 System Lane Miles | 2003 Distressed Ln Miles | 2003 Pct. of System | 2004 System Lane Miles | 2004 Distressed Ln Miles | 2004 Pct. of System | 2005 System Lane Miles | 2005 Distressed Ln Miles | 2005 Pct. of System | 2007 System Lane Miles | 2007 Distressed Ln Miles | 2007 Pct. of System |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2,330 | 358 | 15% | 2,330 | 354 | 15% | 2,330 | 485 | 21% | 2,330 | 511 | 22% | 2,330 | 429 | 18% |
| 2 | 3,992 | 894 | 22% | 3,992 | 974 | 24% | 3,995 | 1,038 | 26% | 3,995 | 983 | 25% | 3,995 | 967 | 24% |
| 3 | 4,284 | 1,108 | 26% | 4,284 | 1,288 | 30% | 4,285 | 1,227 | 29% | 4,307 | 1,489 | 35% | 4,309 | 1,349 | 31% |
| 4 | 5,957 | 1,450 | 24% | 5,958 | 1,550 | 26% | 5,958 | 1,605 | 27% | 5,976 | 1,887 | 32% | 5,950 | 1,594 | 27% |
| 5 | 3,187 | 809 | 25% | 3,187 | 927 | 29% | 3,187 | 1,024 | 32% | 3,187 | 877 | 28% | 3,168 | 934 | 29% |
| 6 | 5,734 | 1,446 | 25% | 5,751 | 1,483 | 26% | 5,751 | 1,203 | 21% | 5,718 | 1,361 | 24% | 5,755 | 1,451 | 25% |
| 7 | 6,106 | 1,792 | 29% | 6,106 | 1,802 | 30% | 6,158 | 1,964 | 32% | 6,269 | 2,219 | 35% | 6,267 | 1,737 | 28% |
| 8 | 6,492 | 1,767 | 27% | 6,575 | 1,719 | 26% | 6,575 | 2,178 | 33% | 6,641 | 2,189 | 33% | 6,568 | 2,153 | 33% |
| 9 | 1,777 | 192 | 11% | 1,777 | 152 | 9% | 1,777 | 210 | 12% | 1,777 | 240 | 14% | 1,777 | 153 | 9% |
| 10 | 3,452 | 957 | 28% | 3,462 | 1,011 | 29% | 3,471 | 976 | 28% | 3,472 | 1,226 | 35% | 3,466 | 1,206 | 35% |
| 11 | 3,909 | 334 | 9% | 3,923 | 377 | 10% | 3,927 | 419 | 11% | 3,937 | 556 | 14% | 3,989 | 651 | 16% |
| 12 | 1,888 | 249 | 13% | 1,904 | 190 | 10% | 1,904 | 292 | 15% | 1,950 | 307 | 16% | 1,903 | 374 | 20% |
| Totals | 49,108 | 11,356 | 23% | 49,249 | 11,827 | 24% | 49,318 | 12,621 | 26% | 49,561 | 13,845 | 28% | 49,477 | 12,998 | 26% |

## Statewide Pavement Needs by Survey Year and Priority Group

| Priority | 2002 Distressed Ln Miles | 2002 Pct. Of Needs | 2002 Pct. of System | 2003 Distressed Ln Miles | 2003 Pct. Of Needs | 2003 Pct. of System | 2004 Distressed Ln Miles | 2004 Pct. Of Needs | 2004 Pct. of System | 2005 Distressed Ln Miles | 2005 Pct. Of Needs | 2005 Pct. of System | 2007 Distressed Ln Miles | 2007 Pct. Of Needs | 2007 Pct. of System |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Major | 7,669 | 68% | 16% | 8,938 | 76% | 18% | 10,257 | 81% | 21% | 11,518 | 83% | 23% | 8,102 | 62% | 16% |
| Minor | 2,976 | 26% | 6% | 2,411 | 20% | 5% | 2,125 | 17% | 4% | 2,078 | 15% | 4% | 3,914 | 30% | 8% |
| Poor Ride | 710 | 6% | 1% | 478 | 4% | 1% | 239 | 2% | 0% | 249 | 2% | 1% | 981 | 8% | 2% |
| Total | 11,356 | 100% | 23% | 11,827 | 100% | 24% | 12,621 | 100% | 26% | 13,845 | 100% | 28% | 12,998 | 100% | 26% |

| Distress | Priority Numbers |
|---|---|
| Major Structural Distress | 1, 2, 7, 8, 11, 13 |
| Minor Structural Distress | 3, 4, 9, 10,12, 14 |
| Poor Ride Qualilty | 5, 6 |

Source: 2002-2005 as published in 2005 State of the Pavement Report. 2007 data from Location Summary Report.
Caltrans, Division of Maintenance, Office of Roadway Rehabilitation, Pavement Management Information Branch.
Lane miles are rounded to whole numbers.

## TABLE C Maintenance and Rehabilitation Cost and Usage, 2001-2006.

| Maintenance, Contracted | Average | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 |
|---|---|---|---|---|---|---|
| **Cost per Lane Mile, by Fiscal Year** | | | | | | |
| CHIP SEAL (AR) | $ 27,970 | $ 23,165 | $ 30,705 | $ 40,252 | $ 45,734 | N/A |
| CHIP SEAL (PMA) | $ 7,200 | $ 12,385 | $ 16,410 | N/A | N/A | N/A |
| CHIP SEAL (PME) | $ 14,720 | $ 16,908 | $ 14,464 | $ 20,229 | $ 22,017 | $ 34,572 |
| CRACK SEAL | $ 4,810 | $ 4,381 | $ 7,463 | $ 5,025 | $ 7,161 | $ 21,508 |
| * MICROSURFACING | $ 33,470 | $ 39,966 | $ 31,423 | $ 35,212 | $ 60,745 | N/A |
| * THIN BONDED WEARING COURSE | $ 63,500 | $ 66,360 | $ 79,598 | $ 56,195 | $ 51,849 | $ 76,393 |
| OPEN GRADE AC | $ 12,110 | $ 36,333 | N/A | N/A | N/A | N/A |
| RUBBERIZED AC SURFACING | $ 41,660 | $ 46,029 | $ 34,545 | $ 50,711 | $ 77,011 | $ 80,617 |
| SLURRY SEAL | $ 20,590 | $ 32,894 | $ 14,189 | $ 25,767 | $ 30,125 | $ 30,082 |
| THIN BLANKET | $ 41,270 | $ 35,225 | $ 28,392 | $ 65,678 | $ 77,037 | $ 81,423 |
| CAPE SEAL | $ 35,250 | N/A | N/A | $ 35,253 | N/A | N/A |
| DIGOUT | $ 55,330 | $ 16,510 | $ 43,936 | $ 93,756 | $ 67,107 | $ 99,066 |
| PCC GRIND | $ 92,640 | $ 26,363 | N/A | $ 40,279 | $ 118,647 | $ 44,240 |
| ** PCC SLAB EACH | $ 4,900 | $ 5,717 | $ 8,860 | $ 9,944 | N/A | N/A |
| ** PCC SLAB REPLACEMENT | N/A | N/A | N/A | N/A | $ 54,962 | $ 95,281 |
| **Lane Miles Treated, by Fiscal Year** | | | | | | |
| CHIP SEAL (AR) | 166 | 77 | 250 | 237 | 99 | N/A |
| CHIP SEAL (PMA) | 32 | 33 | 31 | N/A | N/A | N/A |
| CHIP SEAL (PME) | 415 | 385 | 447 | 614 | 214 | 155 |
| CRACK SEAL | 110 | 144 | 81 | 134 | 80 | 19 |
| * MICROSURFACING | 16 | 4 | 5 | 17 | 37 | N/A |
| * THIN BONDED WEARING COURSE | 85 | 11 | 20 | 97 | 212 | 744 |
| OPEN GRADE AC | 281 | 281 | N/A | N/A | N/A | N/A |
| RUBBERIZED AC SURFACING | 301 | 173 | 255 | 462 | 316 | 545 |
| SLURRY SEAL | 144 | 16 | 236 | 224 | 100 | 462 |
| THIN BLANKET | 256 | 342 | 80 | 456 | 146 | 177 |
| CAPE SEAL | 15 | N/A | N/A | 30 | - | - |
| DIGOUT | 208 | 257 | 458 | 34 | 84 | 144 |
| PCC GRIND | 17 | 24 | N/A | 26 | - | 10 |
| ** PCC SLAB EACH | 820 | 1,196 | 893 | 371 | N/A | N/A |
| ** PCC SLAB REPLACEMENT | N/A | N/A | N/A | N/A | 51 | 42 |
| TOTAL, CONTRACT MTCE. LANE MILES | 1,819 | 1,747 | 1,862 | 2,331 | 1,338 | 2,298 |

| Rehabilitation, Contracted | Average | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 |
|---|---|---|---|---|---|---|
| **Cost per Lane Mile, by Fiscal Year** | | | | | | |
| ACOL FLEX, CAPM | $ 131,600 | $ 125,112 | N/A | $ 235,093 | $ 166,215 | $ 181,017 |
| ACOL RIGID, CAPM | $ - | N/A | N/A | N/A | N/A | N/A |
| *** CPR, CAPM | $ 142,860 | N/A | $ 142,861 | N/A | N/A | N/A |
| GRINDING, CAPM | $ 89,260 | N/A | $ 58,335 | $ 119,558 | $ 179,164 | $ 280,821 |
| MILL AND REPLACE AC, CAPM | $ 226,350 | N/A | $ 87,423 | $ 111,772 | $ 253,507 | $ 180,955 |
| **** RUBBERIZED AC, CAPM | $ 128,420 | $ 145,178 | $ 129,115 | $ 134,765 | $ 104,607 | $ 82,816 |
| SLAB REPLACEMENT, CAPM | $ 308,060 | N/A | $ 244,784 | $ 371,333 | N/A | N/A |
| ACOL FLEX, REHABILITATION | $ 304,890 | $ 125,349 | $ 290,581 | $ 472,319 | $ 636,202 | $ 1,350,906 |
| ACOL RIGID, REHABILITATION | $ 39,500 | N/A | $ 129,382 | $ 28,628 | N/A | N/A |
| *** CPR, REHABILITATION | $ 239,980 | N/A | $ 154,403 | $ 324,400 | $ 241,146 | $ 1,182,941 |
| GRINDING, REHABILITATION | $ 692,870 | N/A | N/A | N/A | $ 692,871 | $ 614,091 |
| MILL AND REPLACE AC, REHABILITATION | $ 347,030 | $ 247,364 | $ 495,544 | $ 471,302 | $ 520,947 | $ 794,919 |
| RUBBERIZED AC, REHABILITATION | $ 232,980 | $ 280,329 | $ 221,897 | $ 137,947 | $ 524,724 | N/A |
| PCC OVERLAY | $ 979,710 | $ 979,710 | N/A | N/A | N/A | N/A |
| SLAB REPLACEMENT, REHABILITATION | $ - | N/A | N/A | N/A | N/A | N/A |
| **Lane Miles Treated, by Fiscal Year** | | | | | | |
| ACOL FLEX, CAPM | 109 | 130 | N/A | 59 | 138 | 390 |
| ACOL RIGID, CAPM | N/A | N/A | N/A | N/A | N/A | N/A |
| *** CPR, CAPM | 36 | N/A | 36 | N/A | N/A | N/A |
| GRINDING, CAPM | 478 | N/A | 109 | 623 | 703 | 128 |
| MILL AND REPLACE AC, CAPM | 126 | N/A | 136 | 67 | 173 | 22 |
| **** RUBBERIZED AC, CAPM | 197 | 62 | 146 | 236 | 344 | 157 |
| SLAB REPLACEMENT, CAPM | 52 | N/A | 95 | 10 | N/A | N/A |
| ACOL FLEX, REHABILITATION | 161 | 185 | 269 | 46 | 146 | 190 |
| ACOL RIGID, REHABILITATION | 71 | N/A | 88 | 55 | N/A | N/A |
| *** CPR, REHABILITATION | 171 | N/A | 394 | 23 | 96 | 94 |
| GRINDING, REHABILITATION | 209 | N/A | N/A | N/A | 209 | 66 |
| MILL AND REPLACE AC, REHABILITATION | 138 | 162 | 159 | 121 | 109 | 68 |
| RUBBERIZED AC, REHABILITATION | 82 | 99 | 81 | 53 | 94 | N/A |
| PCC OVERLAY | 21 | 21 | N/A | N/A | N/A | N/A |
| SLAB REPLACEMENT, REHABILITATION | N/A | N/A | N/A | N/A | N/A | N/A |
| Subtotal, CAPM | 946 | 192 | 427 | 995 | 1,358 | 697 |
| Subtotal, REHABILITATION | 906 | 467 | 1,085 | 298 | 654 | 417 |
| TOTAL CAPM/REHAB LANE MILES | 1,851 | 659 | 1,512 | 1,293 | 2,012 | 1,114 |
| TOTAL, ALL CONTRACT LANE MILES | 3,134 | 2,406 | 3,374 | 3,624 | 3,350 | 3,412 |

N/A - NOT AVAILABLE OR STRATEGY NOT UTILIZED

* PILOT PROJECTS

** FROM FY 02/03 TO 04/05, PCC SLABS ARE ACTUAL COUNT OF SLABS OR COST PER SLAB.
STARTING WITH FY 05/06, ACTUAL LANE MILES OF SLAB REPLACEMENT ARE USED AND COST IS PER LANE MILE.

*** CPR INCLUDES SLAB REPLACEMENTS (CAPM/REHAB); GRIND, SLAB REPLACE, ROUT AND SEAL CRACKS (REHAB & CAP
DOWEL BAR RETROFIT

**** INCLUDES RUBBERIZED OGAC PROJECTS

# Definitions/Glossary

AADT – Annual Average Daily Traffic – Average daily traffic over an entire year, estimated from a traffic sample collected over a one to seven day time period.

AC – Asphalt Concrete – Consisting of sand, gravel, and a petroleum binder; also called 'bituminous', 'flexible' or 'black' pavement.

ACOL – Asphalt Concrete Overlay – Placing layers of asphalt and inner membranes over an existing roadway. Typically, 6 inches of asphalt are added.

Alligator (Fatigue) cracking – Cracks in asphalt that are caused by repeated traffic loadings. The cracks indicate fatigue failure of the asphalt layer. When cracking is characterized by interconnected cracks, the cracking pattern resembles that of an alligator's skin.

Alligator A – A single or two parallel longitudinal cracks in the wheel path; cracks are not spalled or sealed; rutting or pumping is not evident.

Alligator B – An area of interconnected cracks in the wheel path forming a complete pattern; cracks may be slightly spalled; cracks may be sealed; rutting or pumping may exist.

Alligator C – An area of moderately or severely spalled interconnected cracks outside of the wheel path forming a complete pattern; cracks may be sealed.

AR – Asphalt Rubber – A mixture of asphalt concrete containing rubber 'crumbs' and synthetic binders.

Base Maintenance – A planned treatment, intended to temporarily correct a specific pavement distress or delay future need to rehabilitate the pavement.

BWC – Bonded Wearing Course, also known as a Thin Bonded Wearing Course (Nova Chip), is a polymer-modified emulsion typically used as a pavement preservation treatment.

CAPM – Capital Preventive Maintenance – Use of heavy maintenance treatments such as intermediate thickness asphalt blankets (flexible pavements), or grinding the pavement surface (rigid pavements) to provide five to seven years of additional pavement life.

Centerline mile – A mile of highway, without considering the number of lanes in the facility.

Chip Seal – A surface treatment in which the pavement is sprayed with asphalt (generally emulsified) and then immediately covered with aggregate and rolled with a pneumatic tire roller.

CPR – Concrete Pavement Restoration – May involve surface grinding, slab replacements, or full lane replacement.

Crack, seat, and overlay – The existing pavement is cracked into small pieces that are rolled (seated) into the existing roadbed and overlaid with asphalt.

# Definitions/Glossary

Grinding – Removing the irregularities in the surface of a pavement to improve ride quality, typically on rigid pavement.

Faulting – Slabs of Portland Cement Concrete (PCC) that are tilted, causing a drop off of the departure end of one slab onto the leading edge of the next slab.

Five-Year Maintenance Plan (Plan) – Required by Streets and Highways Code Section 164.6. A five-year plan that addresses the maintenance needs of the State Highway System, prepared each odd-numbered year, concurrent with the rehabilitation plan. The plan identifies only maintenance activities that, if not performed, could result in increased SHOPP costs in the future.

Flexible pavement – Pavement constructed from asphalt concrete, also known as 'bituminous' or 'black' pavement.

GPR – Ground Penetrating Radar – GPR technology produces an underground cross-sectional image of soils and subsurface features.

HA22 (currently known as highway program codes 201.120, 201.121 and 201.125) – The highway program(s) that funds long-term corrective strategies such as reconstruction or rehabilitation and capital preventive maintenance of pavements. HA22 program projects are an element of the four-year SHOPP.

HM1 – The highway program which funds Routine and Major Maintenance on the State highway network. HM1 programs are funded from Caltrans' annual operating budget.

ICES – Intermodal Corridors of Economic Significance – The ICES is California's primary goods movement system. ICES is an interconnected network of freight distribution routes within California that provides direct access among major highways, seaports, airports, rail yards and national and international markets.

IRI – International Roughness Index – A standardized method of measuring the roughness of the pavement surface, expressed in inches per mile or centimeters per kilometer, developed by the World Bank.

Lane mile – A pavement measuring one mile long and one lane wide. A mile stretch of a two-lane road equals two lane miles. A segment of road one mile long and four lanes wide is four lane miles. This is the unit of measure used to develop the total cost of pavement projects.

Long-life pavement – A pavement intended to last 35 years or more between rehabilitation treatments.

Maintenance – Work, either by contract or by State forces that preserves the riding qualities, safety characteristics, functional serviceability and structural integrity of the facilities that comprise the roadways on the State highway system.

# Definitions/Glossary

Maintenance Program – The program, within the California Department of Transportation, that is responsible for the preservation and keeping of rights of way, and each type of roadway, structure, safety convenience or device, planting, illumination equipment, and other facilities, in the safe and usable condition to which it has been improved or constructed.

MSL – Maintenance Service Level – For maintenance programming purposes, the State highway system has been classified as Class 1, 2, and 3 highways based on the MSL descriptive definitions:

MSL 1 – Contains route segments in urban areas functionally classified as Interstate, Other Freeway/Expressway, or Other Principal Arterial. In rural areas, the MSL 1 designation contains route segments functionally classified as Interstate or Other Principal Arterial.

MSL 2 – Contains route segments classified as an Other Freeway/Expressway, or Other Principal Arterial not in MSL 1, and route segments functionally classified as minor arterials not in MSL 3.

MSL 3 – Indicates a route or route segment with the lowest maintenance priority. Typically, MSL 3 contains route segments functionally classified as major or minor collectors and local roads, routes segments with relatively low traffic volumes. Route segments where route continuity is necessary are also assigned MSL 3 designation.

Major Maintenance – Use of various types of surface treatments, such as thin blankets and chips seals, to extend the service life of a pavement, usually by four to seven years. These treatments keep the roadway in a safe, useable condition but do not include structural capacity improvement or reconstruction.

Major Maintenance Budget Model – Budget modeling, using data collected by the PCS, to determine annual needs by applying a cost to maintain the system in a "steady state" condition whereby existing needs are being eliminated at the same rate as new needs develop.

NHS – National Highway System – Includes five subsystems of roadways important to the nation's economy, defense, and mobility:

Interstate – The Eisenhower Interstate System of highways retains its separate identity within the NHS.

Other Principal Arterials – Highways in rural and urban areas that provide access between an arterial and a major port, airport, public transportation facility, or other intermodal transportation facility.

Strategic Highway Network (STRAHNET) – A network of highways that provide defense access, continuity and emergency capabilities for defense purposes.

Major Strategic Highway Network Connectors – Highways that provide access between major military installations and highways that are part of the STRAHNET.

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Intermodal Connectors – Highways that provide access between major intermodal facilities and the other four subsystems making up the NHS.

OGAC – Open Graded Asphalt Concrete or Open Graded Blanket – A surface layer of asphalt approximately 1 inch thick, containing few fine particles between the larger pieces of aggregate. This allows water to enter the voids and drain out through the edges of the pavement, reducing standing water on the pavement, and improving skid resistance in wet weather.

Pavement Performance Model – A model used to develop budget needs and to perform impact analyses in which the effects of different pavement management strategies and funding levels can be demonstrated.

PCC – Portland Cement Concrete – 'Rigid' pavement.

PCS – Pavement Condition Survey – An annual survey of the State highway system conducted by the California Department of Transportation.

PLOS – Pavement Level of Service – A needs based scoring system, using data collected by the Pavement Condition Survey, used to measure the pavement's condition with respect to maintenance target goals/priorities.

PMA – Polymer Modified Asphalt – A binder used in a seal coat or dense and open-graded AC.

PME – Polymer Modified Emulsion – A binder used in a seal coat or as a tack coat for construction.

Preventive Maintenance – A planned treatment on a road in good condition that is intended to preserve the system, retard future deterioration and prolong the service life.

Priority Number – A number assigned to a segment of pavement based on the combination of ride quality, structural condition, and MSL.

RAC – Rubberized asphalt concrete – Material produced for hot mix applications by mixing asphalt rubber or rubberized asphalt binder with graded aggregate. RAC may be dense-, gap-, or open-graded.

Raveling – Wearing away of the pavement surface caused by the dislodging of aggregate particles and loss of binder through weathering and aging.

Rigid pavement – Pavement constructed from Portland Cement Concrete (PCC).

Roadway Preservation – Keeping the roadway and appurtenant facilities in the safe and usable condition to which it has been improved or constructed.

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Roadway Preservation Program – The program, within the Department, that is responsible for preserving the State highway network.

Roadway Rehabilitation Program – The program, within the Department, that is responsible to rehabilitate roadways that ride rougher than established maximums and/or exhibit substantial structural distress. Work incidental to pavement rehabilitation or replacement of other highway appurtenances that are failing, worn out or functionally obsolete, such as drainage facilities, retaining walls, lighting, signal controllers, and fencing.

Routine maintenance – Low-level maintenance treatments, such as crack sealing, joint sealing, and minor patching, used to extend the life of a pavement.

Rutting – A longitudinal surface depression in the wheel path caused by the consolidation or lateral movement of roadbed material under heavy loads.

Seal coat – A sealant applied uniformly to the entire pavement surface, usually with embedded sand or gravel 'chips', primarily to prevent water infiltration, improve traction, and renew the pavement surface.

State Highway Operation and Protection Plan (Plan) – Required by Streets and Highways Code Section 164.6. A ten-year state rehabilitation plan, prepared each odd-numbered year, by the Department that identifies rehabilitation needs, schedules for meeting those needs, and strategies for cost control and program efficiencies.

State Highway Operation and Protection Program (SHOPP) – Required by Government Code Section 14526.5. A four-year listing of projects proposed for construction consistent with the goals and priorities in the latest Plan. SHOPP projects are limited to capital improvements relative to maintenance, safety and rehabilitation of State highways and bridges that do not add new capacity lanes to the system.

Slab – A unit of PCC pavement defined by surrounding expansion joints.

Slurry seal – A petroleum-based emulsion seal coat (with embedded fine aggregates) applied to the pavement surface.

Spalling – Spalling occurs at joints or cracks when incompressible materials are confined in the opening. It also occurs where uniform slab support is lacking and there is vertical movement due to wheel load impact. Spalling results in progressive widening of the joint or cracks, and ultimately, deterioration of aggregate interlock at the joint.

State highway network – The entire system of highways maintained by the Department. For pavement management purposes, excludes bridge decks and ramps.

State Highway System Performance Measures – A periodic report prepared by the Department to track a variety of performance and accountability measures for routine review by Department management and others.

# Definitions/Glossary

Vehicle miles traveled – The number of miles that residential vehicles are driven.