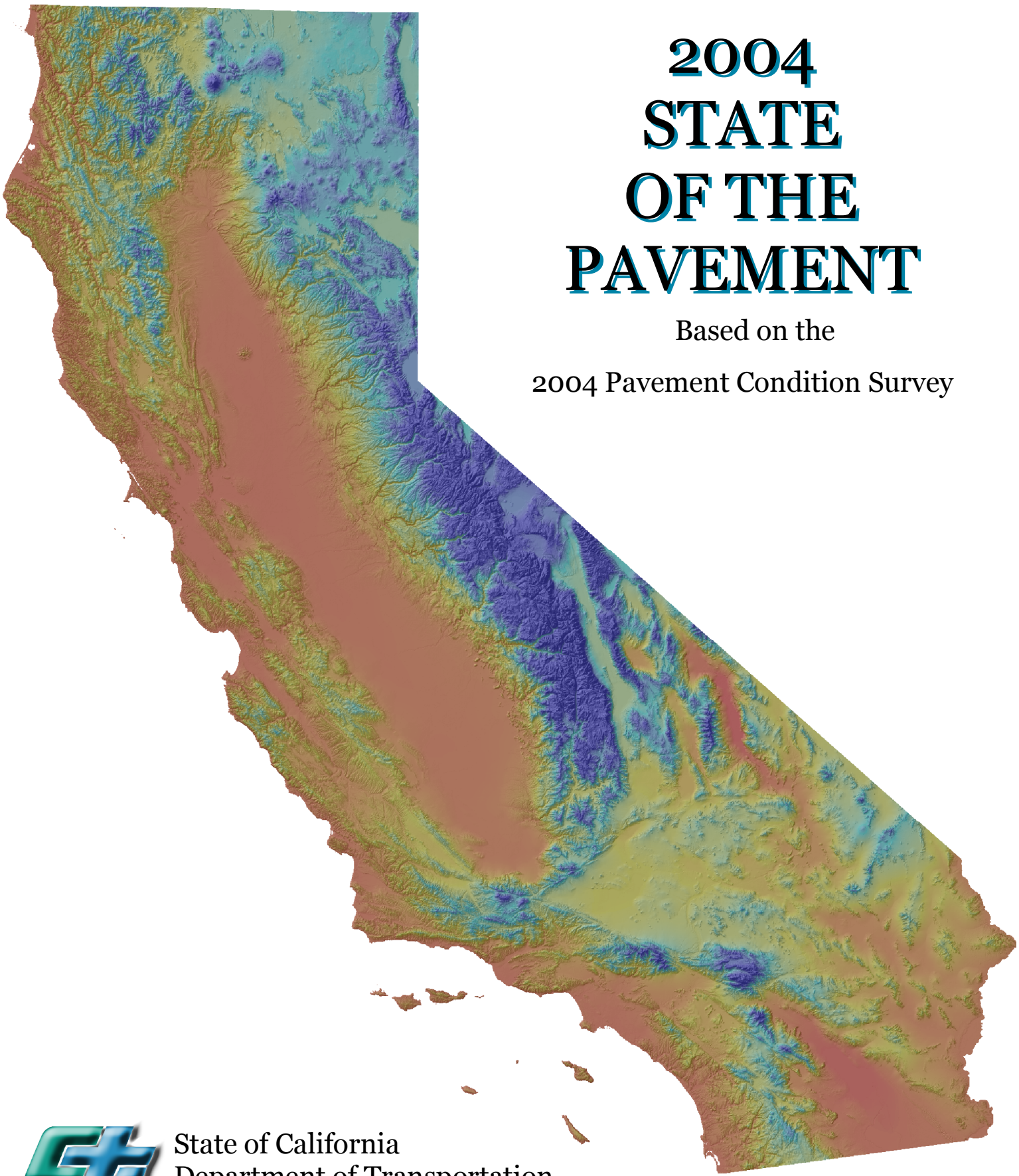

2004 STATE OF THE PAVEMENT

Based on the

2004 Pavement Condition Survey

State of California
Department of Transportation
Division of Maintenance

California
State of the Pavement Report, 2004

California Department of Transportation
Division of Maintenance
July 2005

Acknowledgment

This report is prepared by the California Department of Transportation, Division of Maintenance, Offices of Roadway Rehabilitation and Roadway Maintenance to summarize the 2004 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
Leo Mahserelli, Program Advisor
Rob Marsh, Program Advisor
Brian Weber, Program Advisor

Pavement Management Information Branch - Bob Moore, Chief
Jeff Duket, Research Program Specialist II (Geographic Information Systems)
Prem Gambhir, Transportation Engineering Technician
Carole Harris, Research Analyst II (Pavement Management System)
Dario Moreno, Research Analyst II (Geographic Information Systems)

Office of Roadway Maintenance - Lance Brown, Chief

Pavement Condition Survey (PCS) - John Poppe, Jr., PCS Team Coordinator
Moises Campos, Pavement Evaluator
Daniel Lem, Pavement Evaluator
Ray Lopez, Jr., Pavement Evaluator
William Nie, Pavement Evaluator
Dennis Vonada, Pavement Evaluator

Roadway Maintenance Pavements - Ray Morin, Senior Transportation Engineer

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The 2003/04 Fiscal Year-End Report for HM-1 Major Maintenance Contracts is available from: http://onramp.dot.ca.gov/hq/maint/roadway/rev_hm1_fy04_reports.pdf

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

Information about the Pavement Management System is available from:
California Department of Transportation, Division of Maintenance, Office of Roadway Rehabilitation, Pavement Management Information Branch, 1120 'N' Street, Room 3100, MS-31, Sacramento, CA, 95814, telephone (916) 654-2355 or Calnet 464-2355.

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

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California
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Highway Condition and Needs

The California Department of Transportation (the 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). A pavement rater crew conducts visual inspections of the pavement surface. In addition, a 'profile' van measures the ride quality via lasers. Using the PCS data, the Pavement Management System (PMS) provides a detailed pavement inventory, identifies project needs, prioritizes pavement distress, and summarizes the condition of the system. The original PMS was developed in the mid 1970s and new PMS software came into use in 1998. In 2004, new functionality was added to manage pavement in good condition with little or no distress.

The 2004 PCS began in January 2004 and was completed in February 2005. The PCS identified 12,624 lane miles of distressed pavement requiring Capital Preventive Maintenance (CAPM) and rehabilitation work. This is 7% higher than the 11,824 distressed lane miles reported in the 2003 survey. One of every four lane miles of California's highways needs repair.

TABLE 1. Pavement Distress Classification

Distress	2003			2004		
	Number of Distressed Lane Miles	% of Total Distressed Lane Miles	% of Total System Lane Miles	Number of Distressed Lane Miles	% of Total Distressed Lane Miles	% of Total System Lane Miles
Major Structural Distress	8,938	76%	18%	8,992	71%	18%
Minor Structural Distress	2,410	20%	5%	3,391	27%	7%
Poor Ride Quality (Only)	476	4%	1%	241	2%	<1%
Total	11,824	100%	24%	12,624	100%	25%
Total System Lane Miles	49,318*			49,561*		

** Excludes bridges, ramps and frontage roads*

Table 1 shows the distribution of triggered lane miles by distress classification. "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 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 (see page 8).

Vehicle Miles Traveled on Rough Pavements

The Department's Division of Maintenance conducted an Internet-based survey of California residents during December 2004 and January 2005. The survey was designed to evaluate satisfaction with and priorities for highway maintenance work and activities. When asked to grade the job the Department is doing in providing a smooth riding road, 33% of respondents rated the ride as rough.

The pavement's "smoothness" 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)'s *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.

CHART 1-a. VMT on Rough Pavement, 2001 – 2004

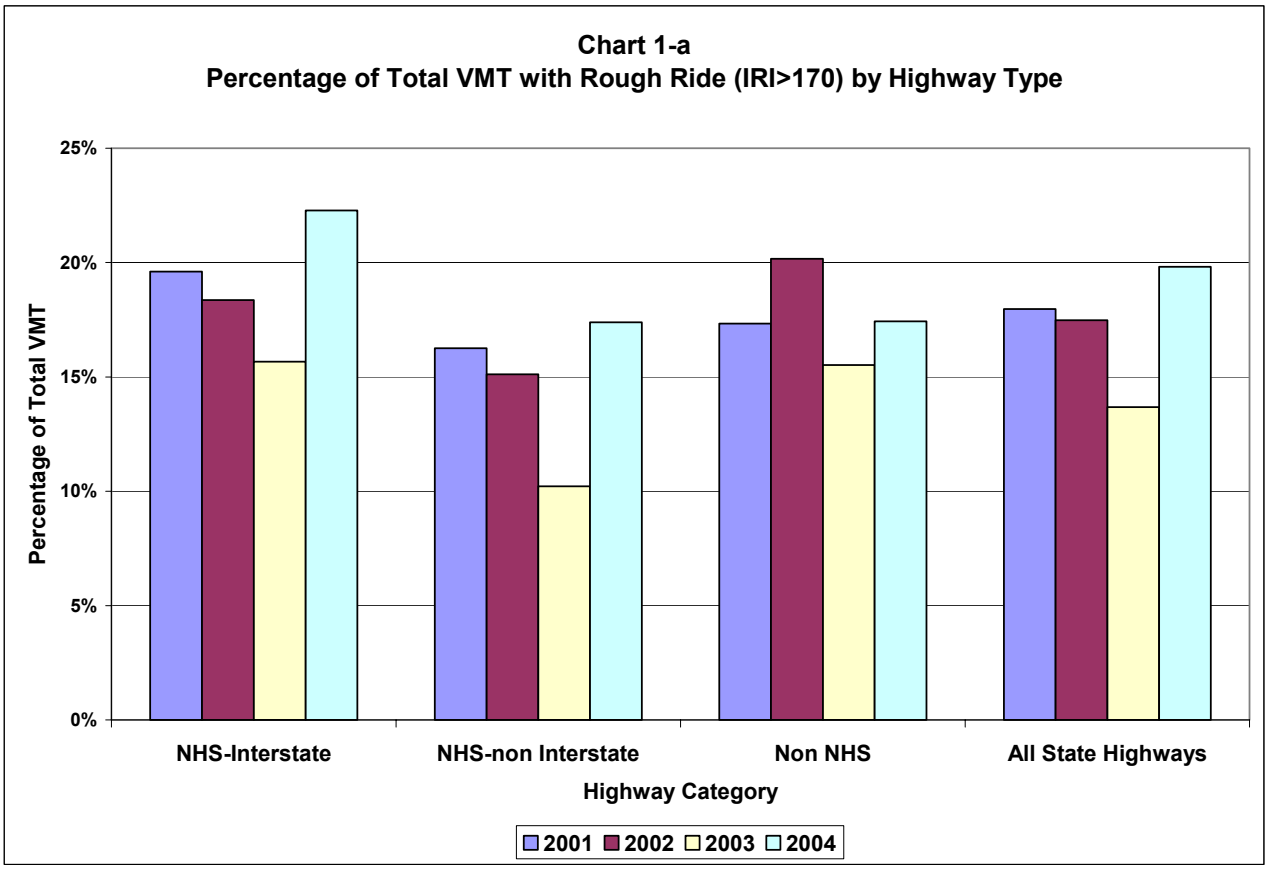


Chart 1-a shows the percentage of vehicle miles traveled (VMT) on rough-riding pavement (IRI >170) for National Highway System (NHS) Interstate, NHS non-Interstate, and non-NHS routes. From 2003 to 2004, the percentage of VMT on rough-riding pavement increased on NHS Interstate, NHS non-Interstate, and non-NHS routes from 16% to 22%, 10% to 17%, and 16% to 17%, respectively. On the entire State highway system, the rough-riding pavement increased from 14% to 20%.

CHART 1-b. VMT on Smooth Pavement, 2001 – 2004

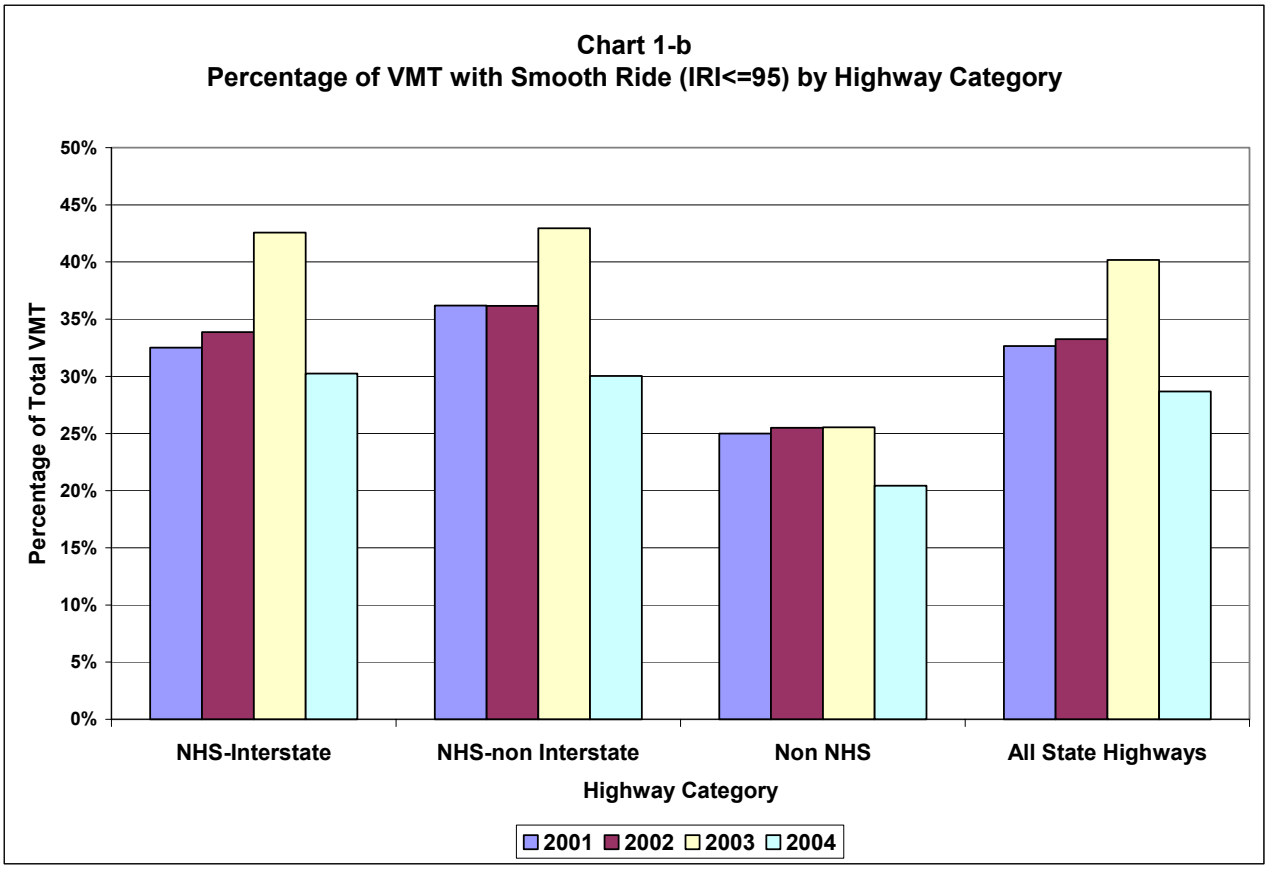


Chart 1-b shows the percentage of VMT on smooth-riding pavement (IRI <95) for NHS Interstate, NHS non-Interstate, and non-NHS routes. From 2003 to 2004, the percentage of VMT on smooth pavement decreased on the NHS from 43% to 30%; on non-NHS routes the decrease was from 26% to 20%. On the entire State highway system, the smooth-riding pavement decreased from 40% to 29%.

Costs, Expenditures and Funding

In the 2003/04 Fiscal Year (FY), $377 million of rehabilitation and maintenance contracts were awarded. Of this amount, $318 million was for Roadway Rehabilitation and CAPM projects that repaired 1,512 lane miles of pavement. The $59 million in Major Maintenance projects (Preventive and Corrective) repaired 1,862 lane miles of roadway and replaced 893 concrete slabs. Although these sums are greater than the prior two years, Rehabilitation and Maintenance projects continue to be under-funded and a backlog of projects accumulates.

CHART 2. Accomplishments – Contracts Awarded, 2003/04 FY

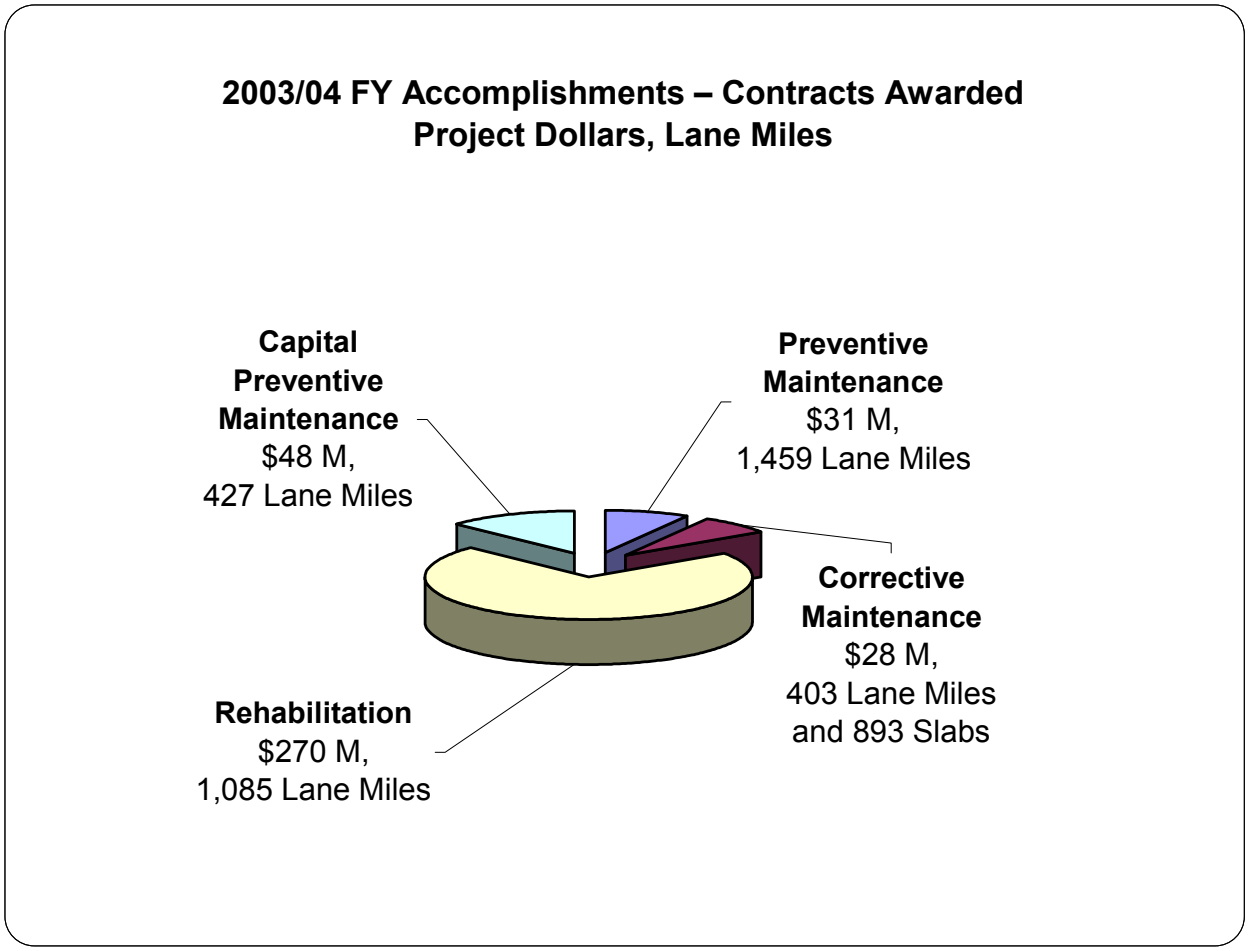


Chart 2 shows the accomplishments for Maintenance and Rehabilitation projects in terms of contract dollars awarded and lane miles of pavement repaired in the 2003/04 FY.

CHART 3. HM-1 Preventive Maintenance Projects by Strategy, 2003/04 FY

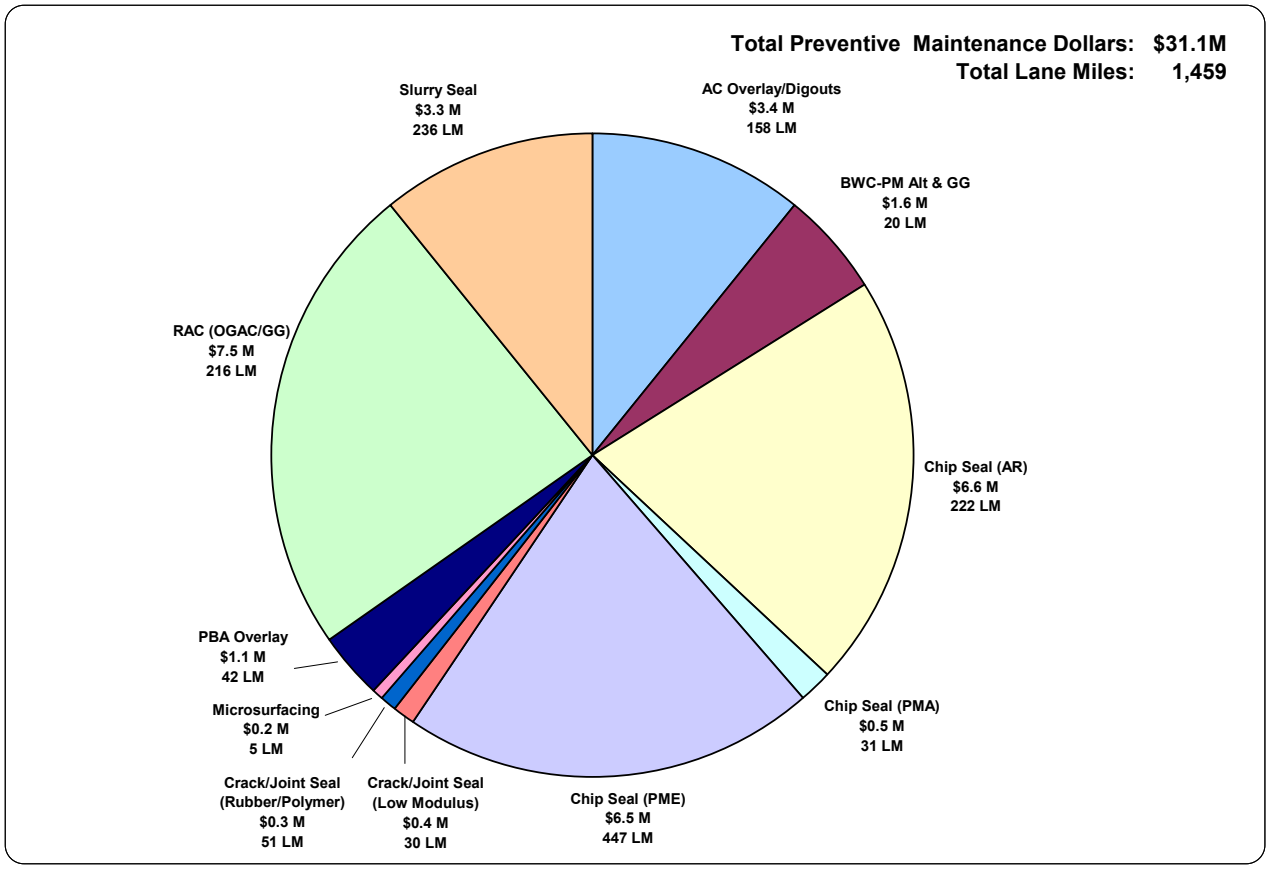


Chart 3 shows the cost and number of lane miles paved using a Preventive Maintenance (PM) strategy for Major Maintenance contracts awarded in the 2003/04 FY. A Major Maintenance contract performed on pavement in good condition is considered preventive. Preventive Maintenance strategies for flexible pavements 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.

CHART 4. HM-1 Corrective Maintenance Projects by Strategy, FY 2003/04

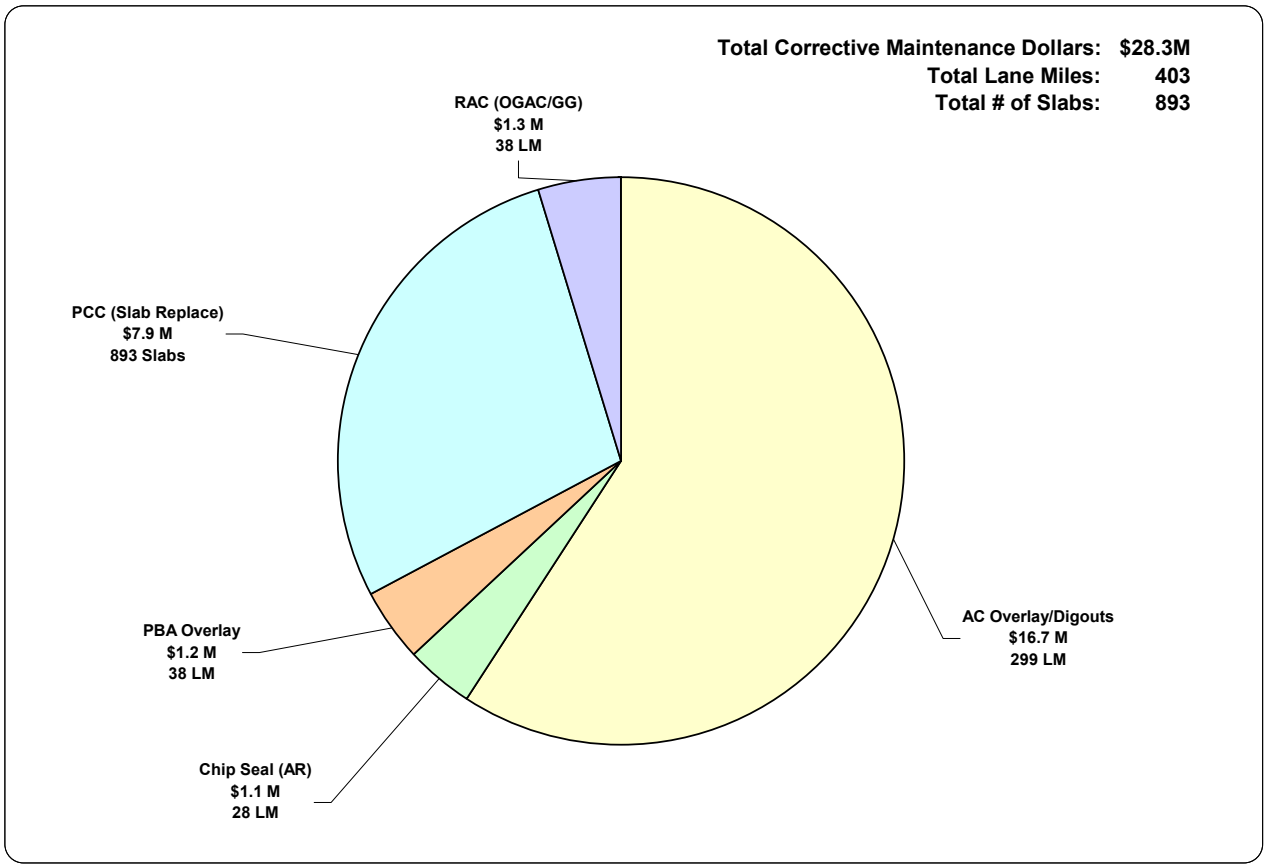


Chart 4 shows the cost and lane miles repaired using corrective strategies in Major Maintenance and contract dollars awarded in the 2003/04 FY. Corrective Major Maintenance preserves the riding qualities, safety characteristics, and structural integrity of the roadways. Thin asphalt overlays, slab replacements and dig outs of pavement at spot locations are common strategies used for these projects.

Cost Effectiveness

CHART 5. The Cost Effectiveness of Pavement Treatments

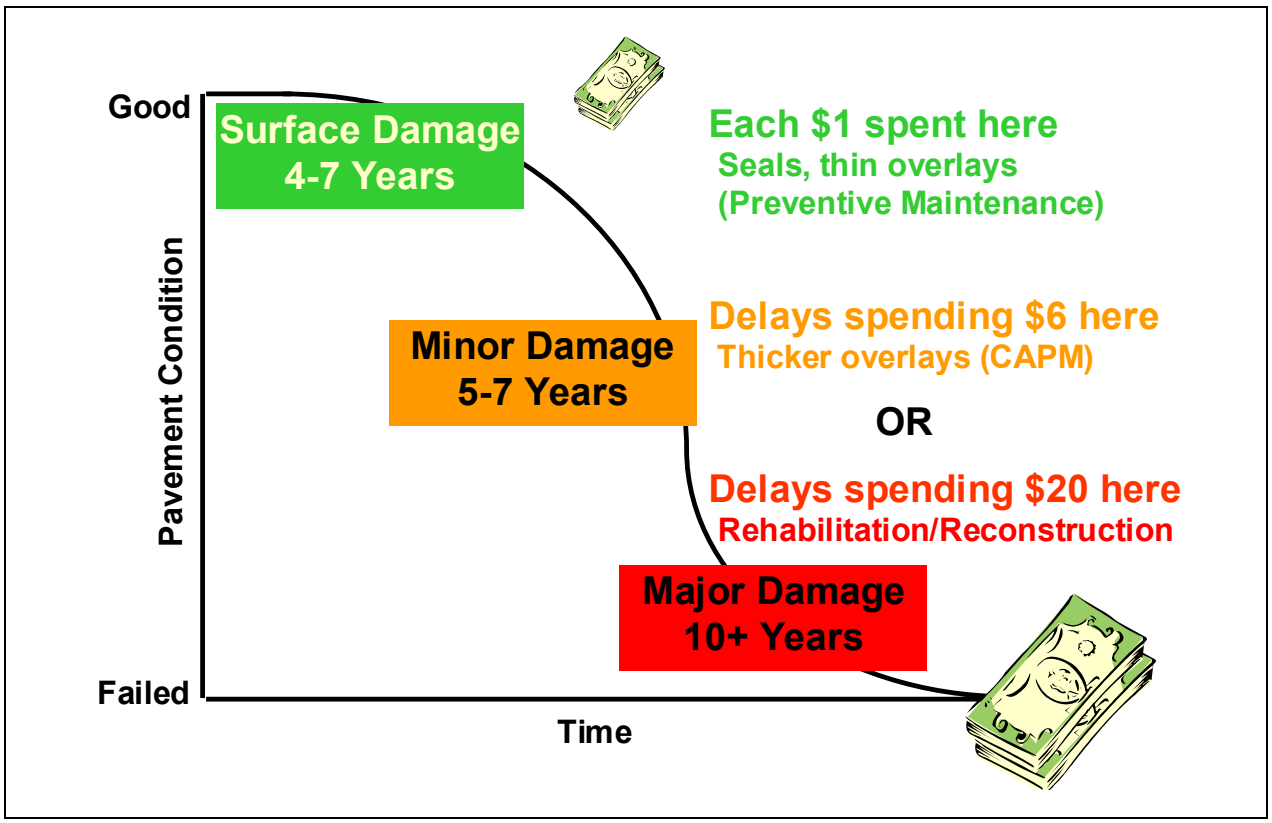


Chart 5 shows that six to twenty dollars of future money are saved for each dollar spent when the treatment is applied before the pavement deteriorates into a condition warranting a major rehabilitation or reconstruction project.

Preventive maintenance treatments keep good pavement in good shape and studies show that pavement in good condition costs less to maintain. Corrective 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 Corrective Major Maintenance project treatments cost, on average, between $10,000 and $45,000 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 the 2003/04 FY averaged $104,000 per lane-mile.

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 2003/04 FY ranged from $129,000 to $496,000 per lane-mile with an average of $256,000 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 in the PMS and 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 thirty-five 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 enhancing the pavement management system to better track pavement performance and 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 changes 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.

Warranty Projects

The purpose of a one-year warranty is to provide protection for both materials and workmanship. Under a warranty specification, the contractor is responsible for quality control and quality assurance as quality is measured based on actual product performance. In the 2003/04 FY, five projects were awarded at a cost of $3.5 million. Under these contracts, 169 lane miles of pavement had a one-year warranty. The 2003/04 FY was the fifth year of the Department's one-

year warranty pilot program. The five-year evaluation process of the pilot program will be completed shortly.

Quiet Pavements

Traffic noise is a public concern. The FHWA Noise Abatement Criteria states that when traffic noise levels meet or exceed 67 dBA, noise abatement should be provided for residential areas. Studies show that 75% of highway noise comes from vehicle tires contacting the pavement. In the past, noise barriers or soundwalls were the only solution for noise reduction. Presently, the Department is using pavement surface treatments as an alternative noise abatement strategy.

One quiet pavement strategy for rigid pavements is diamond grinding. For flexible pavements the strategy could be an open graded friction course. The cost of a soundwall is about $1.3 million per mile, while diamond grinding is $70,000 per lane-mile and a quiet pavement overlay is less than $50,000 per lane-mile. According to the "I-80 Davis OGAC Pavement Noise Study," the noise levels for open graded friction courses can last 5 years. The 30 mm open graded friction course constructed in 1999 continues to maintain a 4.5 dBA noise level reduction. Currently, the Department is pursuing quiet pavement pilot projects and research that correlates IRI to acoustic measurements.

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). Rubberized asphalt concrete 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 2003/04 FY, $38.7 million was invested in ten Roadway Preservation RAC projects. These projects repaired over 227 lane miles of distressed pavement. Over the same time period, $8.8 million was awarded on nineteen Major Maintenance RAC projects that preserved 255 lane miles.

Ground Penetrating Radar

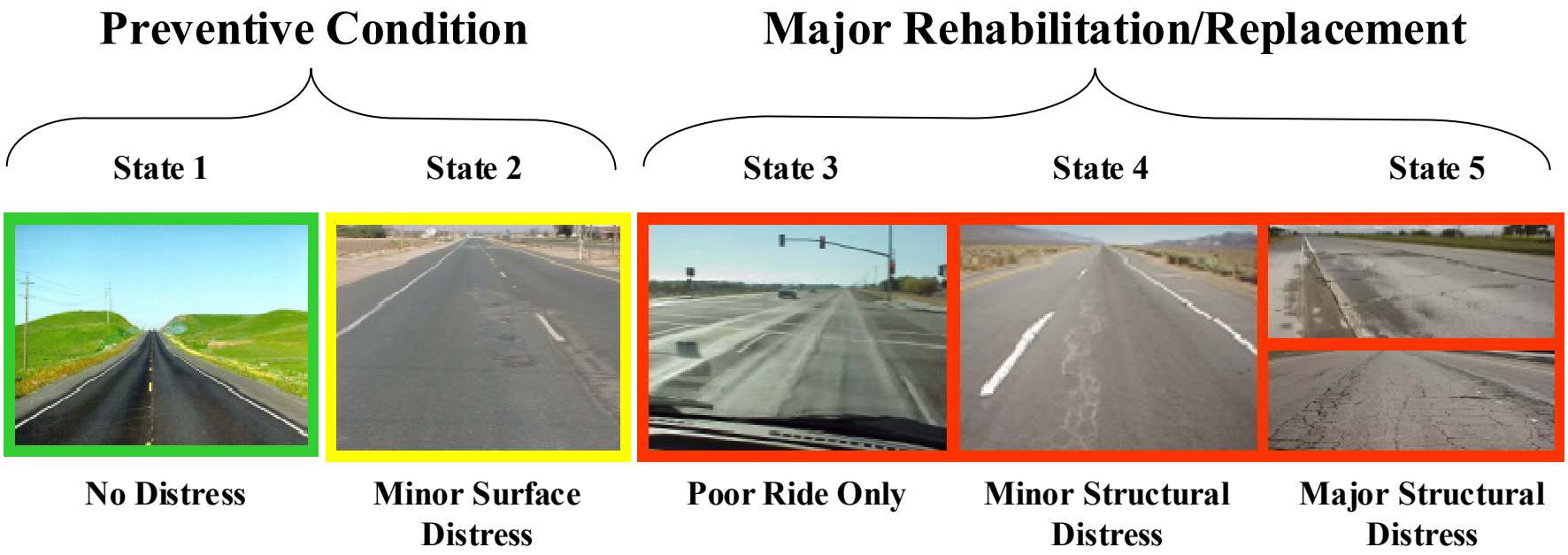
An analysis conducted on the Department's current PMS in 2002 determined additional data collection is needed for the development of reliable pavement performance models to assist Caltrans in closing the gaps between desired and current pavement management capabilities.

During the 2004/05 FY, a pilot research project was started to evaluate the use of Ground Penetrating Radar (GPR) for obtaining network level pavement structure information. Ground Penetrating Radar can potentially be used to determine pavement thicknesses and material types in a rapid and non-destructive manner. Infrasense, Inc., carried out the survey, in Sacramento and Yolo Counties, in consultation of University of California-Davis. Ground penetrating radar

data was collected in March 2005 for 681 lane miles of pavement. The analysis was done for 307 lane miles of this data. Along with GPR data, Global Positioning System (GPS) coordinates, Distance Measuring Instrument (DMI), and post-miles were recorded to precisely locate the segment of interest. Ground Penetrating Radar data was averaged over 200 feet of scans associated with each 0.1 mile increment at the start of the selected road segments. At each 0.1 mile point the analyzed data gives type of pavement surface, mean and standard deviation of the thickness, and latitude and longitude GPS coordinates. The GPR data will be compared to core samples at 76 locations to be drilled in June and July 2005. Part of this data will be used for calibration of GPR to evaluate the pavement thickness. The remaining core sampling data will be used to compare and test the values predicted by the GPR method.

Assessment of the Department's current PMS also identified a need to modify how pavement condition data is collected and reported. One recommendation to improve the data collection procedure was to divide each mile into "sample units" and inspect the same sample units each year. A survey performed year after year over fixed pavement sections is a key to successful pavement management. Ground Penetrating Radar sends a signal in to the ground and registers the amount of time it takes to bounce back. The signal is time density dependent, which gives a three dimensional view of the subsurface of a pavement; therefore GPR can possibly be used to segment large portions of the highway network into homogeneous sections.

EXHIBIT 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 Corrective 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

Distressed Lane Miles

The number of distressed lane miles (those with poor structural condition or with poor ride quality) is an important indicator of the State highway system's pavement condition. This indicator is used to prioritize the road maintenance and repairs. This gauge of the pavement condition is reported in the Department's *State Highway System Performance Measures*. Distressed lane miles are placed into groups as shown on Exhibit 1 (previous page).

Preventive Maintenance is receiving additional emphasis to delay development of significant structural distress. This year, a Major Maintenance Program priority matrix was implemented to rate pavement that has few or no defects and does not fall into the priorities for rehabilitation or CAPM strategies. Preventive and Corrective Maintenance treatments will be performed on pavements based on the defects as shown in the following table.

TABLE 2. Major Maintenance Program Priority Matrix

Maintenance Type	Work Group	Defect
Preventive	Fog Seals	Coarse Raveling, Weathering
	Premium Seal/Overlay	Low Alligator A, Low Alligator B, High ADT
	Cracks – Crack Seal	Alligator A, Misc. Cracks
	Chip Seal/Slurry Seal	Alligator A, Low Alligator B, Low ADT, Misc. Cracks
Corrective	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

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 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.

Priority Assignment

Ride quality, structural distress, and Maintenance Service Level (MSL) are used to prioritize roadway segments. The primary criterion used to establish the overall condition of an individual segment of pavement and evaluate the need to repair a highway is ride quality. Ride quality is based on pavement roughness (see Vehicle Miles Traveled on Rough Pavements, page 2). Another criterion used to assign a priority value to a roadway segment is the pavement's structural distress. Distress types are unique to each of the two pavement types: flexible pavements, or rigid pavements. The combination of individual distresses (such as cracking, spalling, and potholes) observed on a pavement are then evaluated for severity, and broadly

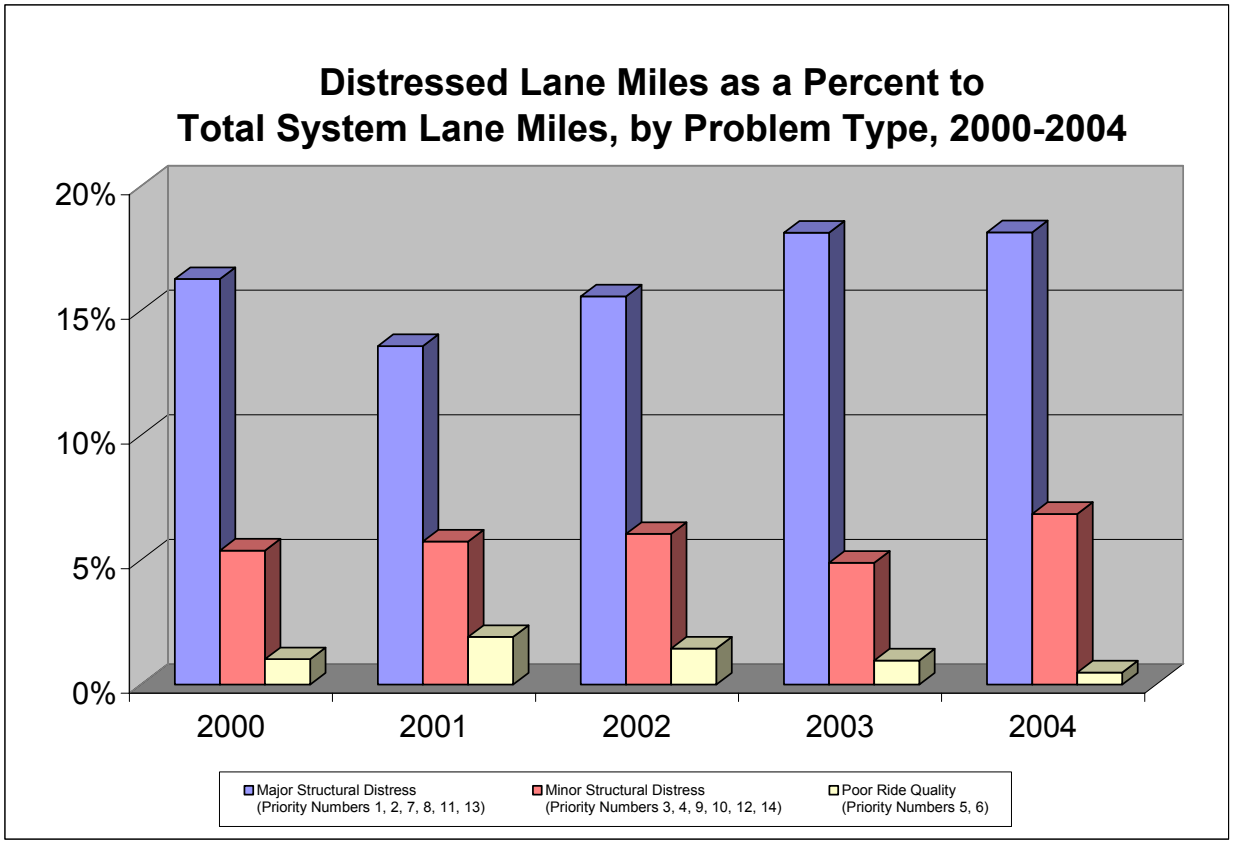
classified into overall levels of structural distress ('None', 'Minor', or 'Major'). The combination of ride quality data and structural distress data are used to identify strategies for repairing the pavement. That information is integrated with the MSL value to establish the 'Priority Number' assigned to that pavement. Maintenance Service Level describes the role a route fulfills within the state highway network and the volume of traffic it serves.

A matrix of twenty-one values results from the combination of ride quality, structural distress, and MSL. The value each pavement segment receives is used to identify the class of treatment a pavement requires, either maintenance or rehabilitation (see Exhibit 1, page 12). In the case of two pavement segments with identical priority values, the site that will receive project development and funding depends upon factors such as safety issues, traffic volume, project costs, and ongoing maintenance expenditures as well as a detailed condition comparison.

TABLE 3. Priority Matrix, 2004

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

CHART 6. Distressed Lane Miles as a Percent to Total System Lane Miles, by Problem Type, 2000-2004



A distribution of lane miles with pavement needs by priority group for the surveys performed from 2000 through 2004 is presented in Chart 6. Although the 2004 survey shows the number of lane miles with poor ride quality decreased from the 2003 survey, there was an increase of approximately fifty lane miles of distressed pavement with major structural problems and nearly 1,000 lane miles of distressed pavement with minor structural problems. The percentages shown in Chart 6 are the percent of the distressed lane miles to the total system miles (excluding bridges).

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 (Plan) for rehabilitation and reconstruction of all State highways and bridges, and to set goals for each program. This Plan is updated every two years. The Plan'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 3. District Actual vs. Planned Goal for Distressed Lane Miles, 2004

District	Actual Distressed LaneMiles per the 2004 Pavement Condition Survey	Planned Distressed Lane Miles per the Performance Goal*
1	486	320
2	1,039	540
3	1,226	560
4	1,606	599
5	1,025	372
6	1,203	611
7	1,964	712
8	2,178	660
9	209	146
10	976	449
11	419	297
12	292	234
TOTAL	12,624	5,500

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

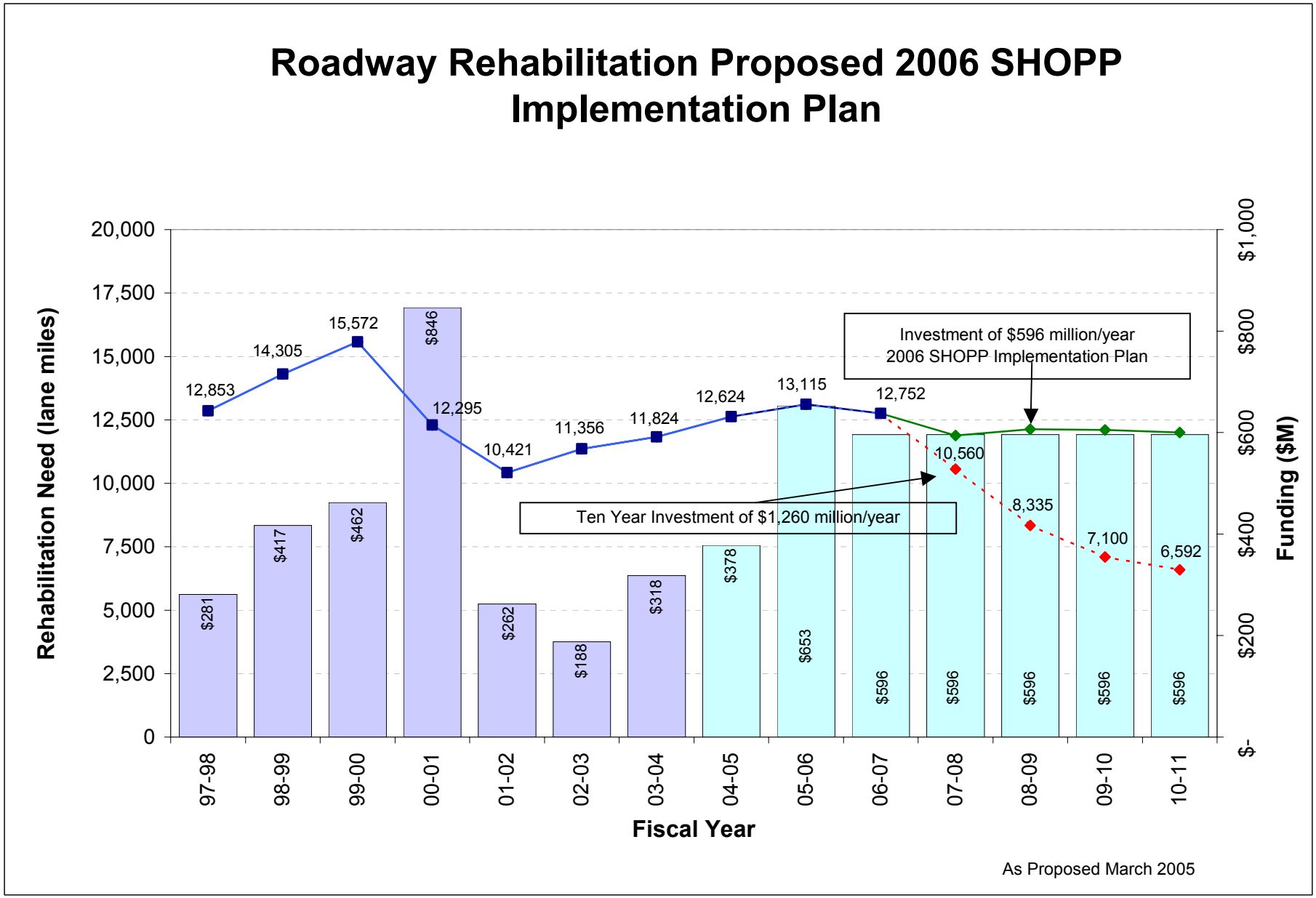
Table 3 compares the Districts' distressed lane miles from the 2004 PCS to the Ten-Year Plan for Pavement Preservation performance goals. According to this data, only one District is nearing it performance goal. Two Districts have reached seventy percent of their goals and another District has achieved sixty-six percent of its goal. The other Districts are 525 to 1,520 lane miles from reaching their goals. To reach the statewide goal, all urban districts need to retire distressed lane miles.

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 2005 Plan and the 2005 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.

The 2005 Maintenance Plan recommends a permanent funding increase in the annual Maintenance budget for preventive maintenance that will produce a future SHOPP cost avoidance of $546 million for roadway projects. The 2005 Maintenance Plan also proposes to emphasize preservation. The 2005 Plan implements this recommendation by including $53 million of roadway projects to preserve 1,350 lane miles of pavement.

CHART 7. Roadway Rehabilitation Proposed 2006 SHOPP Implementation Plan



Roadway Rehabilitation Proposed 2006 SHOPP Implementation Plan

Of the 12,624 distressed lane miles identified by the 2004 PCS, almost 9,000 lane miles (71%) have major structural distress. Complete roadway rehabilitation is needed to correct these deficiencies. As in the prior two years, the funding level for Roadway Rehabilitation projects was considerably reduced.

Chart 7 (previous page) shows the relationship between expenditures awarded on Roadway Rehabilitation projects and the number of distressed lane miles. Actual dollars awarded versus actual distressed lane miles are shown in purple for fiscal years 1997/98 through 2003/04. In the 1999/00 FY, the state had 15,572 distressed lane miles of pavement. With an increase of dollars awarded for rehabilitation projects, the lane miles of distressed pavement decreased to 10,421 in the 2001/02 FY. The blue bars, from fiscal year 2004/05 to 2010/11, show the planned Roadway Rehabilitation expenditures and the expected number of distressed lane miles.

Distressed lane miles increased from 10,421 to 12,624 because of funding shortfalls in the fiscal years 2001/02 through 2004/05. The Department recommended funding level of $596 million for the fiscal years 2006/07 through 2010/11 will maintain the current pavement condition. The estimated cost for roadway rehabilitation and preservation work of $1,260 million per year would allow the Department to reduce the current inventory of distressed and rough riding pavement from 12,624 lane miles to 5,500 lane miles in the 2015/16 FY.

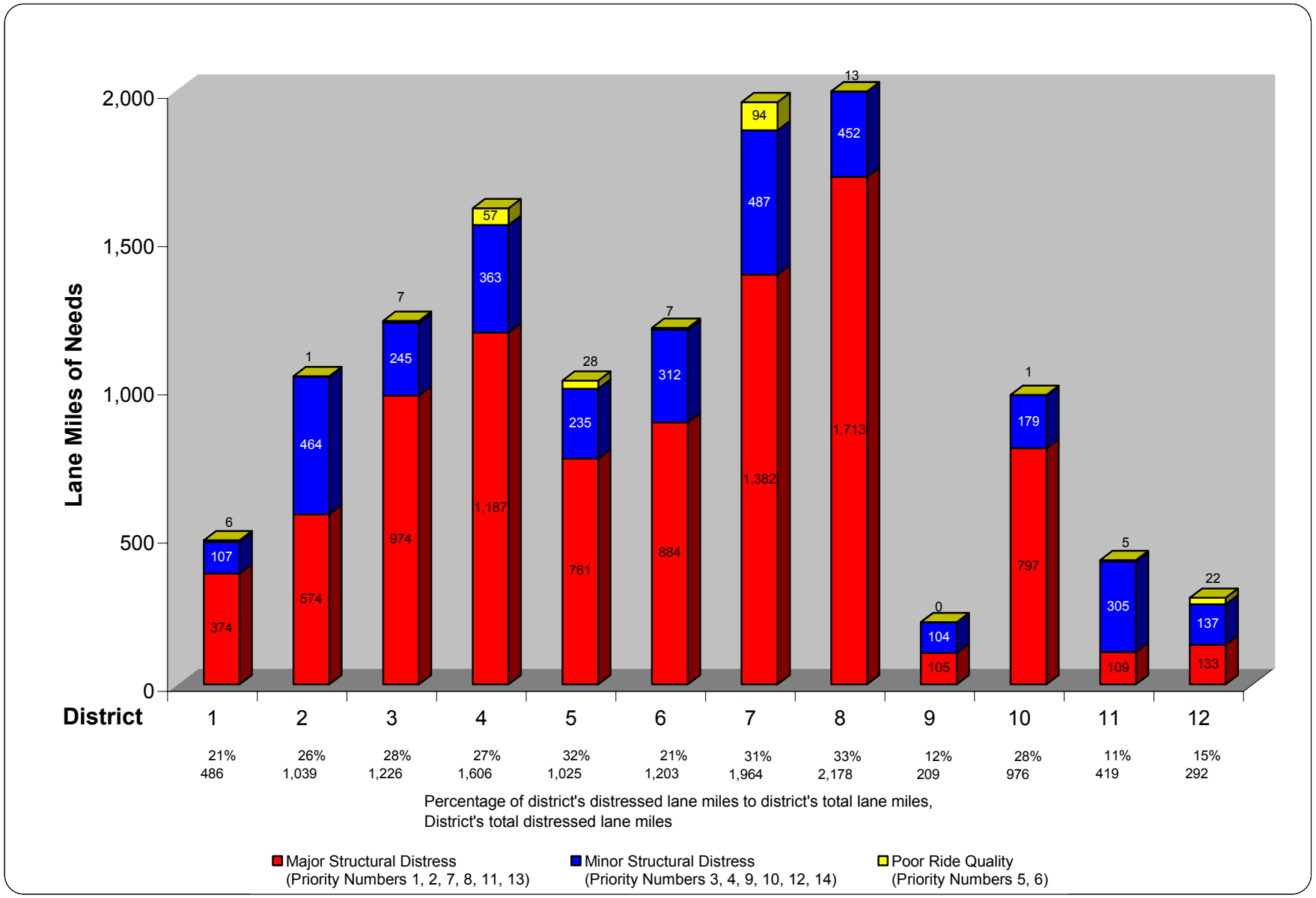
District Pavement Condition

In 2004, the total lane miles of distressed pavement increased by 800 miles. Districts 5 (San Luis Obispo), 7 (Los Angeles), and 8 (San Bernardino/Riverside) have the greatest needs. Districts 1 (Eureka), 5, 7, 8, and 12 (Orange) each had increases of over 100 distressed lane miles compared to the 2003 Pavement Condition 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 PMS 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 2004 PCS is presented in Chart 8 (next page). Total needs, as indicated at the bottom of the bars, are still high – seven of the twelve districts have distressed pavement greater than 25% of their total pavements. Eight districts have distressed pavement where major structural distress accounts for over 70% of their damaged inventory.

CHART 8. District Needs in Lane miles, 2004 PCS



Appendix

Map of Caltrans Districts

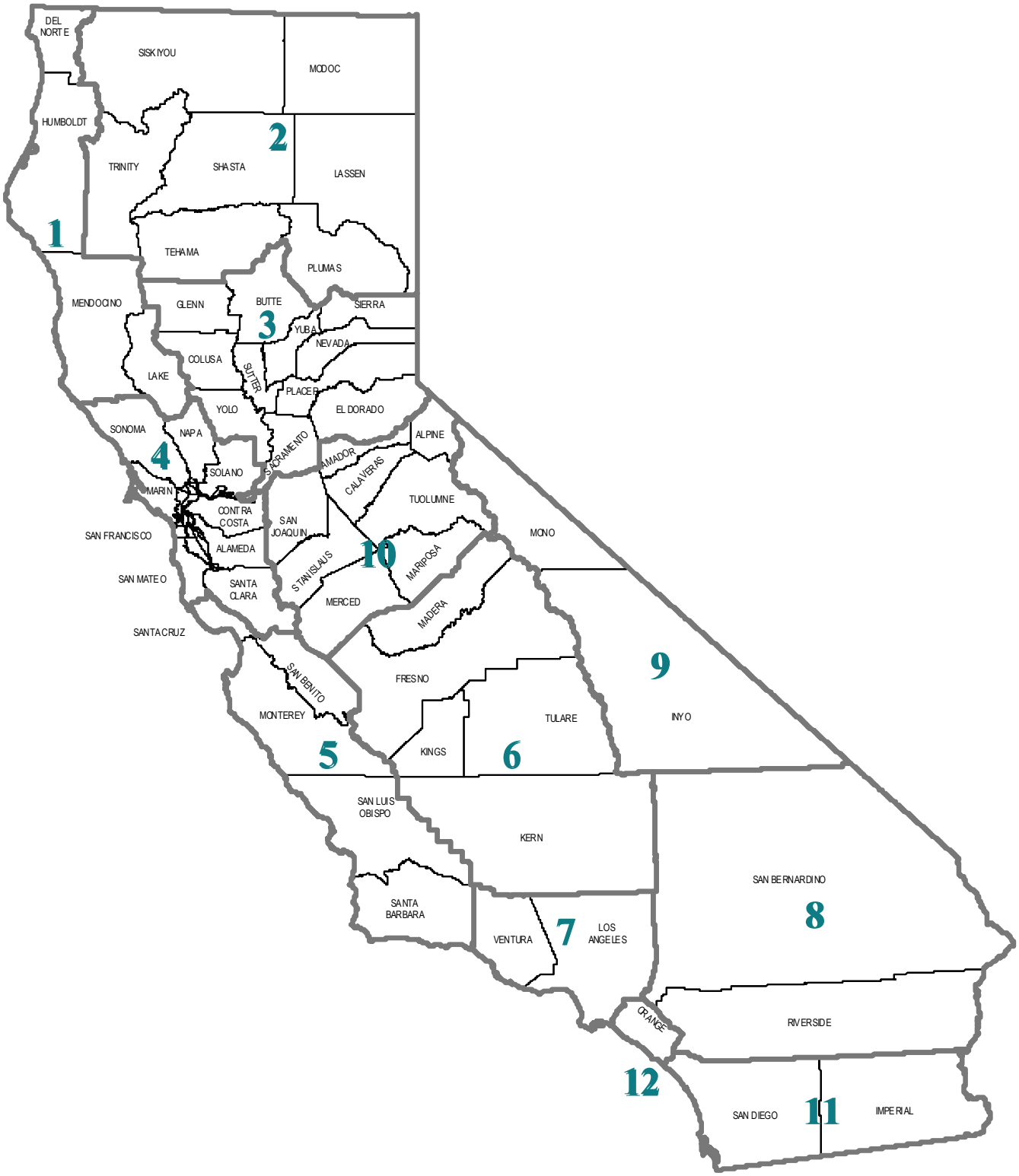


TABLE A. Distribution of Centerline Miles and Lane miles, 2004

	Center line miles		Lane Miles		Distressed Lane Miles		Major Structural Distress	Minor Structural Distress	Poor Ride Quality
TOTAL	14,897	100%	49,561	100%	12,624	25%	8,992	3,391	241
PRIORITY									
Major Structural Distress					8,992	18%			
Minor Structural Distress					3,391	7%			
Poor Ride Quality					241	0%			
NONE (Not Distressed)					36,937	75%			
					49,561	100%			
MSL									
1	5,969	40%	27,767	56%	6,137	49%			
2	5,353	36%	14,355	29%	4,107	33%			
3	3,537	24%	7,192	15%	2,380	19%			
	14,859	100%	49,314	100%	12,624	100%			
DISTRICT									
1	927	6%	2,330	5%	486	4%	373.56	106.58	5.61
2	1,719	12%	3,995	8%	1,039	8%	573.96	464.04	1.49
3	1,455	10%	4,307	9%	1,226	10%	974.25	245.44	6.65
4	1,368	9%	5,976	12%	1,606	13%	1,186.60	363.10	56.76
5	1,149	8%	3,187	6%	1,025	8%	761.20	235.38	28.12
6	2,017	14%	5,718	12%	1,203	10%	884.02	312.26	6.64
7	1,078	7%	6,269	13%	1,964	16%	1,382.31	487.24	94.35
8	1,892	13%	6,641	13%	2,178	17%	1,712.50	452.46	13.12
9	739	5%	1,777	4%	209	2%	105.41	104.03	0.00
10	1,304	9%	3,472	7%	976	8%	796.64	178.97	0.66
11	973	7%	3,937	8%	419	3%	108.71	305.34	5.06
12	278	2%	1,950	4%	292	2%	132.96	136.57	22.20
	14,897	100%	49,561	100%	12,624	100%	8,992	3,391	241
ROAD TYPE									
Multi-Lane Divided	5,615	38%	30,378	61%	6,694	53%			
Multi-Lane Undivided	391	3%	1,344	3%	1,327	11%			
Two-Lane	8,891	60%	17,838	36%	4,603	36%			
	14,897	100%	49,561	100%	12,624	100%			
CITY									
City	2,780	19%	16,240	33%	5,565	44%			
Non-city	12,117	81%	33,320	67%	7,059	56%			
	14,897	100%	49,561	100%	12,624	100%			
NATIONAL HIGHWAY SYSTEM									
NHS Interstate	2,237	15%	13,579	27%	3,286	26%			
NHS non-Interstate	4,776	32%	17,413	35%	3,822	30%			
Non-NHS roads	7,884	53%	18,569	37%	5,516	44%			
	14,897	100%	49,561	100%	12,624	100%			
INTERMODAL CORRIDORS OF ECONOMIC SIGNIFICANCE (ICES)									
ICES	3,328	22%	18,102	37%	4,008	32%			
Non-ICES roads	11,569	78%	31,459	63%	8,616	68%			
	14,897	100%	49,561	100%	12,624	100%			
PAVEMENT TYPE									
Flexible	12,224	82%	33,322	67%	8,217	65%			
Rigid	2,675	18%	16,247	32%	4,407	35%			
	14,899	100%	49,569	99%	12,624	100%			

	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)

TABLE B

Distressed Lane Miles by Priority Group

	2000			2001			2002			2003			2004		
District	Major Structural Distress	Minor Structural Distress	Poor Ride Quality	Major Structural Distress	Minor Structural Distress	Poor Ride Quality	Major Structural Distress	Minor Structural Distress	Poor Ride Quality	Major Structural Distress	Minor Structural Distress	Poor Ride Quality	Major Structural Distress	Minor Structural Distress	Poor Ride Quality
1	179	96	18	199	84	33	243	95	20	273	69	12	374	107	6
2	587	102	1	752	125	22	709	171	15	858	114	2	574	464	1
3	832	308	40	544	204	56	842	220	46	1,119	142	27	974	245	7
4	1,500	531	81	809	492	158	879	450	121	1,041	365	144	1,187	363	57
5	625	114	11	513	151	24	621	156	32	772	139	16	761	235	28
6	1,008	281	2	1,093	292	123	1,093	312	40	1,249	204	30	884	312	7
7	1,182	616	653	909	620	238	815	724	254	1,003	657	142	1,382	487	94
8	1,449	324	42	1,095	319	99	1,441	256	70	1,483	186	50	1,713	452	13
9	73	45	0	119	58	0	130	62	0	112	40	0	105	104	0
10	638	152	11	477	128	32	735	203	19	833	162	16	797	179	1
11	146	255	3	122	167	57	107	218	9	137	233	7	109	305	5
12	111	189	91	36	177	92	54	109	87	58	100	32	133	137	22
Totals	8,330	3,013	952	6,668	2,818	935	7,669	2,976	710	8,938	2,410	476	8,992	3,391	241

District Lane Miles by Pavement Condition Survey Year

	2000			2001			2002			2003			2004		
District	System Lane Miles	Distressed Ln Miles	Pct. of System	System Lane Miles	Distressed Ln Miles	Pct. of System	System Lane Miles	Distressed Ln Miles	Pct. of System	System Lane Miles	Distressed Ln Miles	Pct. of System	System Lane Miles	Distressed Ln Miles	Pct. of System
1	2,329	293	13%	2,330	316	14%	2,330	358	15%	2,330	354	15%	2,330	486	21%
2	3,992	689	17%	3,992	899	23%	3,992	894	22%	3,995	973	24%	3,995	1,039	26%
3	4,305	1,180	27%	4,284	804	19%	4,284	1,108	26%	4,285	1,288	30%	4,307	1,226	28%
4	5,916	2,112	36%	5,957	1,459	24%	5,958	1,450	24%	5,958	1,549	26%	5,976	1,606	27%
5	3,194	750	23%	3,187	688	22%	3,187	809	25%	3,187	926	29%	3,187	1,025	32%
6	5,678	1,292	23%	5,734	1,508	26%	5,751	1,446	25%	5,751	1,483	26%	5,718	1,203	21%
7	6,156	2,450	40%	6,106	1,767	29%	6,106	1,792	29%	6,158	1,802	29%	6,269	1,964	31%
8	6,462	1,815	28%	6,492	1,512	23%	6,575	1,767	27%	6,575	1,719	26%	6,641	2,178	33%
9	1,754	118	7%	1,777	178	10%	1,777	192	11%	1,777	152	9%	1,777	209	12%
10	3,469	801	23%	3,452	637	18%	3,462	957	28%	3,471	1,011	29%	3,472	976	28%
11	3,899	405	10%	3,909	347	9%	3,923	334	9%	3,927	377	10%	3,937	419	11%
12	1,683	390	23%	1,888	305	16%	1,904	249	13%	1,904	190	10%	1,950	292	15%
Totals	48,837	12,295	25%	49,108	10,421	21%	49,249	11,356	23%	49,318	11,824	24%	49,561	12,624	25%

Statewide Pavement Needs by Survey Year and Priority Group

	2000			2001			2002			2003			2004		
Priority	Distressed Ln Miles	Pct. Of Needs	Pct. of System	Distressed Ln Miles	Pct. Of Needs	Pct. of System	Distressed Ln Miles	Pct. Of Needs	Pct. of System	Distressed Ln Miles	Pct. Of Needs	Pct. of System	Distressed Ln Miles	Pct. Of Needs	Pct. of System
Major	8,330	68%	17%	6,668	64%	14%	7,669	68%	16%	8,938	76%	18%	8,992	71%	18%
Minor	3,013	25%	6%	2,818	27%	6%	2,976	26%	6%	2,410	20%	5%	3,391	27%	7%
Poor	952	0	2%	935	0	2%	710	0	1%	476	0	1%	241	0	0%
Total	12,295	100%	25%	10,421	100%	21%	11,356	100%	23%	11,824	100%	24%	12,624	100%	25%

	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

Notes:

Source: 2000-2004 Pavement Condition Surveys, Pavement Management System.

Caltrans, Division of Maintenance, Office of Roadway Rehabilitation, Pavement Management Information Branch.

TABLE C. Maintenance and Rehabilitation Cost and Usage, 2000-2004

Maintenance, Contracted	Average	99/00	00/01	01/02	02/03	03/04
Cost per Lane Mile, by Fiscal Year						
CHIP SEAL (AR)	$ 26,530	$ 18,488	$ 29,864	$ 30,403	$ 23,165	$ 30,705
CHIP SEAL (PMA)	$ 17,390	$ 19,155	$ 13,800	$ 25,179	$ 12,385	$ 16,410
CHIP SEAL (PME)	$ 14,830	$ 14,784	$ 12,456	$ 15,547	$ 16,908	$ 14,464
CRACK SEAL	$ 5,840	$ 8,717	$ 7,308	$ 1,310	$ 4,381	$ 7,463
* MICROSURFACING	$ 34,280	N/A	$ 21,573	$ 44,147	$ 39,966	$ 31,423
* THIN BONDED WEARING COURSE	$ 72,890	N/A	N/A	$ 72,697	$ 66,360	$ 79,598
OPEN GRADE AC	$ 35,320	$ 33,142	$ 33,260	$ 38,550	$ 36,333	N/A
RUBBERIZED AC SURFACING	$ 45,390	$ 45,069	$ 42,852	$ 58,440	$ 46,029	$ 34,545
SLURRY SEAL	$ 18,840	$ 14,711	$ 16,032	$ 16,367	$ 32,894	$ 14,189
THIN BLANKET	$ 32,560	$ 32,504	$ 37,241	$ 29,424	$ 35,225	$ 28,392
DIGOUT	$ 35,230	N/A	N/A	$ 45,230	$ 16,510	$ 43,936
PCC GRIND	$ 26,360	N/A	N/A	N/A	$ 26,363	N/A
** PCC SLAB EACH	$ 5,140	$ 3,393	$ 3,352	$ 4,377	$ 5,717	$ 8,860
Lane Miles Treated, by Fiscal Year						
CHIP SEAL (AR)	191	320	245	63	77	250
CHIP SEAL (PMA)	90	146	158	84	33	31
CHIP SEAL (PME)	637	880	1,047	426	385	447
CRACK SEAL	169	115	322	185	144	81
* MICROSURFACING	46	N/A	142	31	4	5
* THIN BONDED WEARING COURSE	41	N/A	N/A	92	11	20
OPEN GRADE AC	511	1,006	538	217	281	N/A
RUBBERIZED AC SURFACING	123	137	25	25	173	255
SLURRY SEAL	161	204	122	226	16	236
THIN BLANKET	601	479	1,251	853	342	80
DIGOUT	247	N/A	N/A	26	257	458
PCC GRIND	24	N/A	N/A	N/A	24	N/A
** PCC SLAB EACH	1,416	1,895	2,374	722	1,196	893
TOTAL, CONTRACT MTCE. LANE MILES	2,595	3,287	3,850	2,228	1,747	1,862

Rehabilitation, Contracted	Average	99/00	00/01	01/02	02/03	03/04
Cost per Lane Mile, by Fiscal Year						
ACOL FLEX, CAPM	$ 112,390	$ 86,540	$ 128,468	$ 109,431	$ 125,112	N/A
ACOL RIGID, CAPM	$ 81,040	N/A	$ 81,042	N/A	N/A	N/A
*** CPR, CAPM	$ 106,990	$ 71,118	N/A	N/A	N/A	$ 142,861
GRINDING, CAPM	$ 87,020	$ 48,754	$ 79,551	$ 161,434	N/A	$ 58,335
MILL AND REPLACE AC, CAPM	$ 87,420	N/A	N/A	N/A	N/A	$ 87,423
RUBBERIZED AC, CAPM	$ 112,360	$ 59,778	$ 115,376	N/A	$ 145,178	$ 129,115
ACOL FLEX, REHABILITATION	$ 252,610	$ 251,344	$ 271,009	$ 324,775	$ 125,349	$ 290,581
ACOL RIGID, REHABILITATION	$ 293,720	$ 198,570	$ 568,194	$ 278,715	N/A	$ 129,382
*** CPR, REHABILITATION	$ 256,470	$ 163,172	N/A	$ 451,835	N/A	$ 154,403
GRINDING, REHABILITATION	$ 150,460	$ 89,613	N/A	$ 211,306	N/A	N/A
MILL AND REPLACE AC, REHABILITATION	$ 255,510	$ 214,847	$ 98,103	$ 221,692	$ 247,364	$ 495,544
RUBBERIZED AC, REHABILITATION	$ 185,650	$ 131,707	$ 176,176	$ 118,139	$ 280,329	$ 221,897
PCC OVERLAY	$ 979,710	N/A	N/A	N/A	$ 979,710	N/A
SLAB REPLACEMENT	$ 244,780	N/A	N/A	N/A	N/A	$ 244,784
Lane Miles Treated, by Fiscal Year						
ACOL FLEX, CAPM	402	730	529	218	130	N/A
ACOL RIGID, CAPM	102	N/A	102	N/A	N/A	N/A
*** CPR, CAPM	300	863	N/A	2	N/A	36
GRINDING, CAPM	303	244	795	64	N/A	109
MILL AND REPLACE AC, CAPM	136	N/A	N/A	N/A	N/A	136
RUBBERIZED AC, CAPM	529	401	1,506	N/A	62	146
ACOL FLEX, REHABILITATION	471	769	756	378	185	269
ACOL RIGID, REHABILITATION	188	179	307	179	N/A	88
*** CPR, REHABILITATION	190	159	N/A	16	N/A	394
GRINDING, REHABILITATION	149	119	N/A	178	N/A	N/A
MILL AND REPLACE AC, REHABILITATION	148	132	267	20	162	159
RUBBERIZED AC, REHABILITATION	78	61	113	36	99	81
PCC OVERLAY	21	N/A	N/A	N/A	21	N/A
SLAB REPLACEMENT	95	N/A	N/A	N/A	N/A	95
Subtotal, CAPM	1,772	2,238	2,931	283	192	427
Subtotal, REHABILITATION	1,339	1,419	1,442	807	467	1,085
TOTAL CAPM/REHAB LANE MILES	3,111	3,657	4,373	1,090	659	1,512
TOTAL, ALL CONTRACT LANE MILES	5,223	6,944	8,223	3,318	2,406	3,374

N/A - NOT AVAILABLE OR STRATEGY NOT UTILIZED

* PILOT PROJECTS

** PCC SLABS ARE ACTUAL COUNT OF SLABS OR COST PER SLAB

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

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.

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.

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

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.

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

HM1 – The highway program that 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 thirty-five 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.

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.

Definitions/Glossary

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

Definitions/Glossary

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 – The keeping of the roadway and appurtenant facilities in the safe and usable condition to which it has been improved or constructed.

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

Definitions/Glossary

Roadway Rehabilitation Program – The program, within the California Department of Transportation, 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.

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.

Slab – A unit of Portland Cement Concrete (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 California Department of Transportation. For pavement management purposes, excludes bridge decks and ramps.

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