California
State of the Pavement Report, 2002

California Department of Transportation
Division of Maintenance
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Acknowledgment

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Copies of this report may be obtained from:
URL: http://www.dot.ca.gov/hq/maint/2002_SOP.pdf
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Highway Condition and Needs

The 2002 Pavement Condition Survey (PCS) began in January 2002 and was completed in November. The total distressed lane miles (pavement which requires Major Maintenance or rehabilitation work) reported was 11,356, an increase of 9% from the 10,421 lane miles reported in the 2001 survey.

Table 1
Pavement Problem Classification

	2001			2002		
	Lane Miles	Percent of Problems	Percent of System	Lane Miles	Percent of Problems	Percent of System
Major Structural Problems	6,668	64%	14%	7,670	68%	16%
Minor Structural Problems	2,818	27%	6%	2,976	26%	6%
Poor Ride Quality (Only)	935	9%	2%	710	6%	1%
Totals	10,421			11,356		
Total System Lane Miles	49,107*			49,249*		
* Excludes bridge miles						

The largest portion of rehabilitation needs exist on non-interstate principal arterial and minor arterial highways. These are predominantly multi-lane divided highways in urban areas, two-lane highways, and city streets within the highway system. Intermodal Corridors of Economic Significance (ICES) make up almost 30% of the total lane miles of distressed pavement. Districts 4 (San Francisco), 7 (Los Angeles), and 8 (San Bernardino/Riverside) have the greatest needs; but there is a significant increase in distressed pavement in Districts 3 (Marysville), 5 (San Luis Obispo), and 10 (Stockton).

In 2002, the total lane miles of distressed pavement increased by more than 900 miles. Districts 3, 5, 8, and 10 each had increases of over 100 distressed lane miles compared to the 2001 Pavement Condition Survey.

Vehicle Miles Traveled on Rough Pavements

According to nation-wide surveys, ride quality is a primary indicator of customer satisfaction. A longstanding measure is the total vehicle miles of travel occurring on pavements with ‘unacceptable’ ride. A pavement with an International Roughness Index (IRI) score of greater than 200 inches of surface roughness per mile is considered by most motorists to be uncomfortable or ‘unacceptable’. New or recently rehabilitated pavement should provide an ‘excellent’ ride to the motorist which corresponds to less than 75 inches of surface roughness per mile.

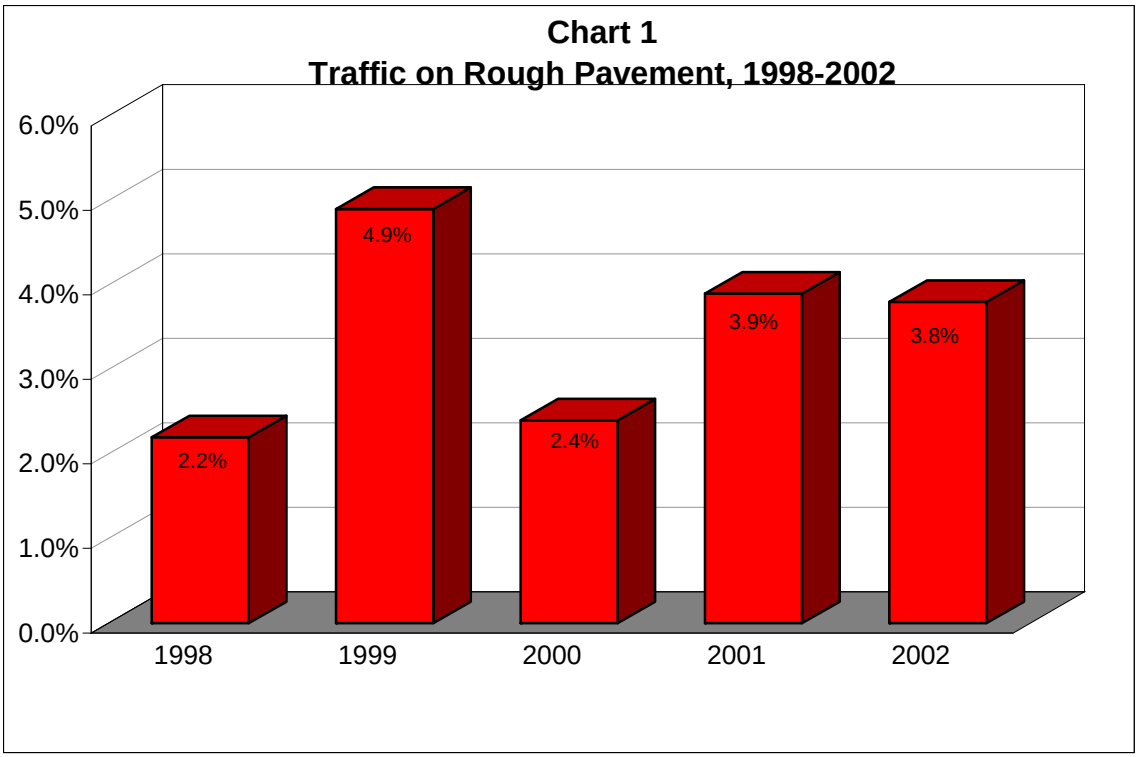


Chart 1 shows 3.8% of the vehicle miles traveled in 2002 were on rough pavement. California has nearly 452 million vehicle miles traveled per day. Travel on rough-riding pavement is a small percentage of the overall vehicle miles traveled.

Costs, Expenditures and Funding

In the 2001/02 Fiscal Year (FY), a total of $325 million was awarded to both maintenance and rehabilitation projects. Of this amount, $262 million was spent on roadway rehabilitation projects; $226 million was awarded on twenty-seven roadway rehabilitation projects, which repaired 807 pavement lane miles and $36 million was awarded on twelve CApital Preventive Maintenance (CAPM) projects that repaired 284 lane miles of roadway. Over the same period, expenditures for the Major Maintenance program were $63 million. The Major Maintenance program preserved 1,348 lane miles using Preventive Maintenance (PM) strategies on the pavement at a cost of $32 million and 879 lane miles along with 722 slab replacements using corrective strategies costing $31 million. Using dedicated funds for PM, Caltrans successfully leveraged the dollars and preserved more lane miles.

Due to budget shortfalls, the dollars spent on roadway rehabilitation projects were drastically reduced from the previous year. In the 2000/01 FY, $846 million was awarded on major roadway rehabilitation projects while just $262 million was awarded in the 2001/02 FY; this was a reduction of $584 million. Also, in prior years, the Major Maintenance program approached or exceeded $100 million. In the 2001/02 FY, only $63 million was awarded on Major Maintenance projects.

Chart 2
2001/02 FY Accomplishments - Contracts Awarded
Project Dollars and Lane Miles

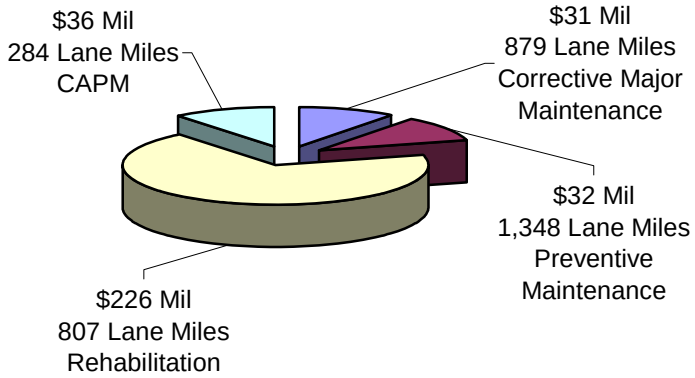


Chart 2 shows the breakdown of accomplishments for Rehabilitation, CAPM, Corrective Major Maintenance, and PM projects and dollars awarded in the 2001/02 FY.

Chart 3
01/02 FY – HM-1 Preventive Maintenance
$32 Million
1,348 Lane Miles

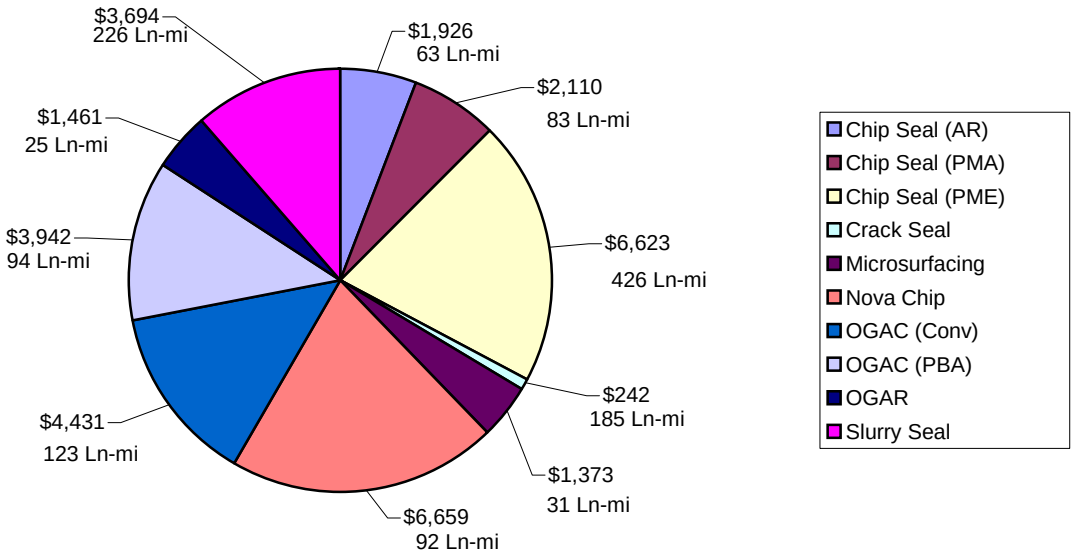


Chart 3 (previous page) shows the cost and number of lane miles repaired using a PM strategy for Major Maintenance contracts awarded in the 2001/02 FY. Preventive Maintenance treatments seal the pavement, to prevent water from penetrating the surface, which may lead to structural damage. Typical preventive treatments include modified binder (rubberized and polymer) asphalt overlays, chip seals, slurry seals, micro surfacing, thin bonded wearing course, and recycled materials.

Chart 4
01/02 FY – HM-1 Corrective Major Maintenance
$31 Million
879 Lane Miles

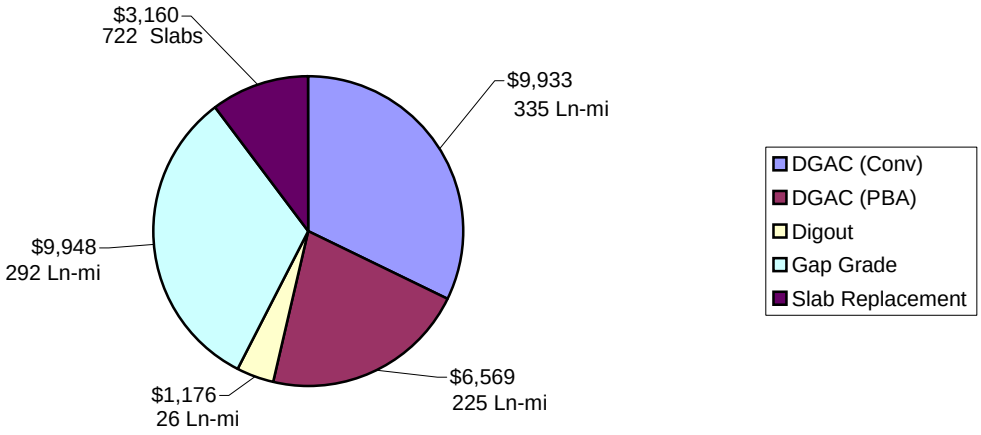


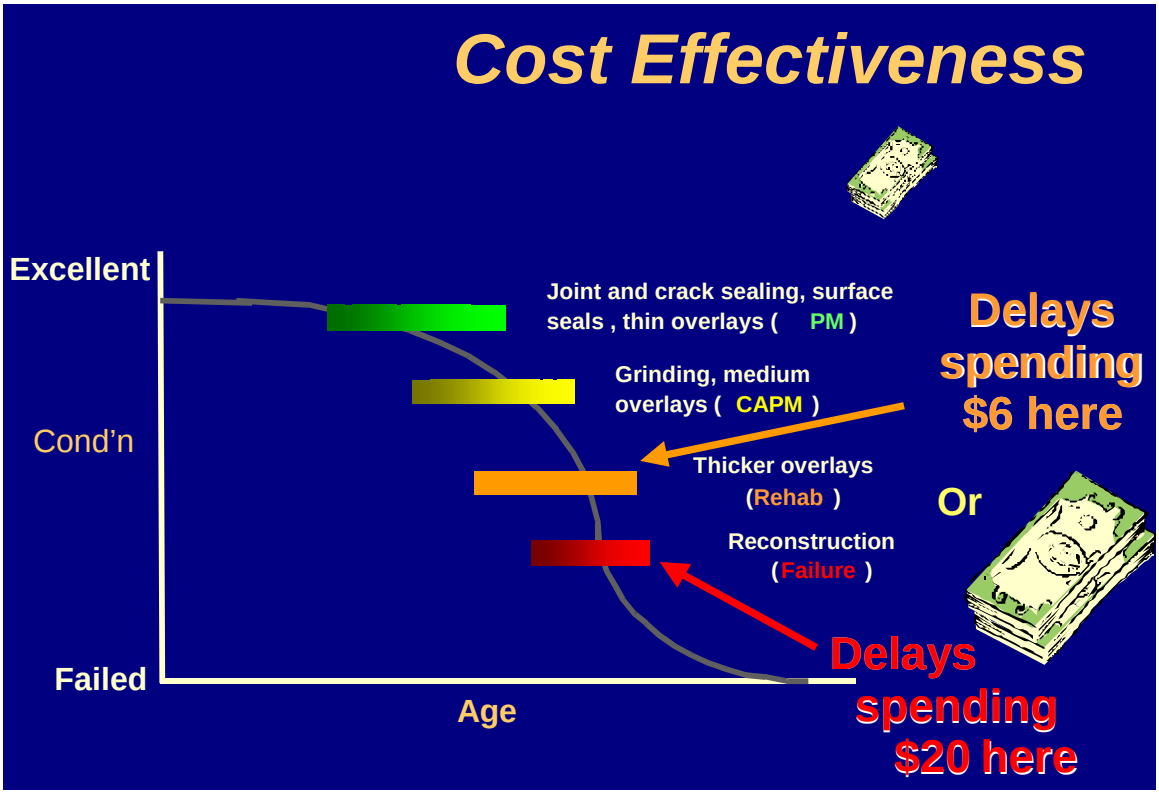
Chart 4 shows the cost and number of lane miles repaired using corrective strategies for Major Maintenance contracts awarded in the 2001/02 FY. Corrective Major Maintenance is used when the structural integrity of the pavement has been compromised. Asphalt or rubberized asphalt overlays, slab replacements, dig outs, and overlays are the strategies usually used in Corrective Major Maintenance projects.

As shown on Chart 5 (page 5), Caltrans determined that for every $1 spent on PM or CAPM, $3 to $20 is saved if the treatment is applied at the right time, before the pavement deteriorates into a major rehabilitation or reconstruction project. In addition, reconstruction in urban areas is more expensive. Instead of the estimated $200,000 per lane mile, the costs may exceed $1 million per lane mile. In contrast, a PM strategy will typically cost $50,000 to $100,000 per lane mile, covering many more miles for the equivalent dollar.

A significant savings for PM comes from a reduction in time spent in design and construction. Prior to PM, Caltrans did as much Corrective Major Maintenance as the limited budget allowed until full rehabilitation, or, in the worst-case, reconstruction was needed. Time spent waiting until the pavement can by fully rehabilitated allows time for the pavement condition to deteriorate further. Since PM projects are pavement only, they require less design time and can be delivered faster. During construction, pavement

surfaces are renovated using thinner treatments, which contributes to faster production rates. Also, less construction working days reduces the disruption to the traveling public.

Chart 5



Major contract maintenance treatments are used to correct most minor surface problems. These maintenance strategies typically cost between $7,000 and $46,000 per lane mile. A Major Maintenance contract performed on pavement in good condition is considered preventive. The service life for PM varies from five to fifteen years depending on the traffic volumes and environmental conditions. If the pavement has failed, then a maintenance contract project would be expected to last about a year on an urban freeway.

A CAPM contract performed on failed pavement is considered a corrective treatment. A CAPM used on pavement that has failed provides a service life of five to seven years. This strategy will hold the pavement condition until the full rehabilitation can be constructed. CAPM projects cost $70,000 to $210,000 per lane mile, with an average of $135,000 per lane mile.

Rehabilitation is the most expensive treatment that corrects the pavement structural section rather than the pavement surface. Cost for rehabilitation, including upgrade of related facilities is approximately $120,000 to $710,000 per lane mile with an average of $270,000 per lane mile. Long-life strategies using deep sections (twelve inches or more) of asphalt concrete (AC), Portland Cement Concrete (PCC) pavement replacement, or overlays are also available. Long-life pavements offer significant user cost savings through reduction of impacts on highway traffic users over the life of the pavement, but at a significantly higher "up-front" cost.

The 2001/02 FY was the third year for contracting 'warranty projects'. Three projects, one open-graded rubber asphalt overlay and two polymer modified emulsion (PME) chip seal projects, were awarded at a cost of $2.8 million. Under these contracts, 102 lane miles of pavement have a one-year warranty.

Pavement Goals Versus Ten-Year Plan for Distressed Lane Miles

Under the Streets and Highways Code Section 164.6, the Department is required to prepare a Ten-Year State Rehabilitation Plan for rehabilitation and reconstruction of all state highways and bridges and to set goals for each program. The 2001 Ten-Year Plan highlighted over $6 billion in needs for pavement rehabilitation. The statewide pavement performance goal is to reduce the distressed lane miles to 5,500 by the 2011/12 FY.

The challenge is that out of 11,356 distressed lane miles, over 7,500 lane miles have major structural damage. Complete roadway rehabilitation is needed to correct these deficiencies, which costs from three to ten times the expense of CAPM treatments.

Chart 6
Roadway Rehabilitation 2002 SHOPP Utilization vs. Needs, through 2012/2013 FY (Meets Goal in the 2011/12 FY)

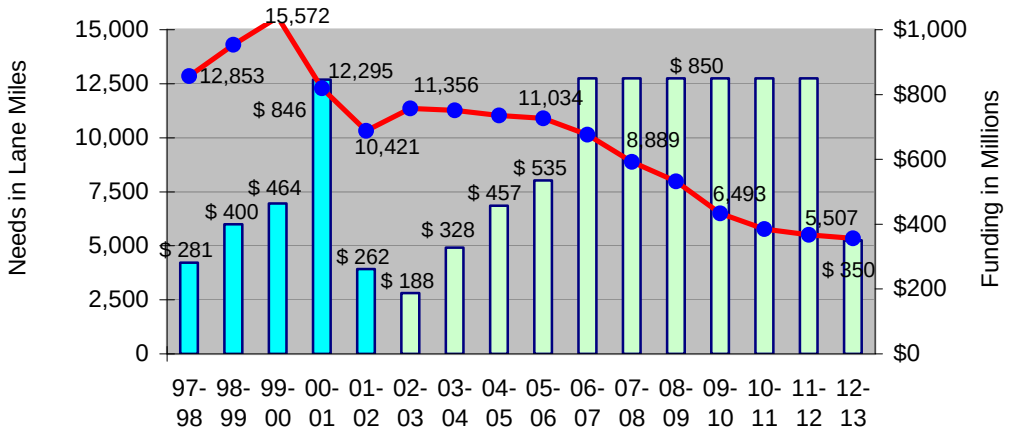


Chart 6 shows the relationship between dollars awarded on roadway rehabilitation projects and the number of distressed lane miles. Actual dollars awarded versus actual distressed lane miles are shown in blue for the fiscal years 1997/98 through 2001/02. In the 1999/00 FY, the state had 15,572 distressed 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 bars shown in green, from the fiscal years 2002/03 to 2012/13, represent programmed and anticipated dollars needed to reach a statewide goal of 5,500 distressed lane miles by the fiscal year 2011/12.

Table 2
2002 District Actual vs. Planned
Ten Year Goal for Distressed Lane Miles

District	2002 Pavement Condition Survey Lane Miles	2011/2012 FY Performance Goal Lane Miles
1	358	320
2	894	540
3	1,108	560
4	1,450	599
5	809	372
6	1,446	611
7	1,792	712
8	1,767	660
9	192	146
10	957	449
11	334	297
12	249	234
	11,356	5,500

Table 2 shows the status of the Districts' pavement performance goals from the 2002 Pavement Management System (PMS). According to this data, four Districts are within 50 lane miles of reaching their performance goals. The other Districts are from 350 to 1,100 lane miles from reaching their goal. To reach the statewide goal, all urban districts must retire distressed lane miles in order to maintain a downward trend. However, as funds for pavement decreases, the Districts' distressed lane miles will begin to increase.

Funding allocated to the pavement rehabilitation program in the Ten-Year SHOPP Plan must be maintained through adjustments for increases in construction costs. Those costs depend upon many factors such as materials and construction methods. Additionally, traffic management, Federal Highway Administration-required improvements to highway appurtenances (realignment, electrical, signs, drainage, and sound mitigation, etc.), and construction-cost inflation has a major impact on the repair costs.

State Highway Pavement Condition

State Highway System

The California Department of Transportation (Caltrans) is responsible for maintaining the state highway system, which has close to 15,000 centerline miles and over 49,000 lane miles of pavement. The Pavement Management System (PMS) analyzes the pavement network and identifies the rate of deterioration on the highway system. The PMS provides a detailed pavement inventory, identifies project needs, prioritizes pavement distress needs, and summarizes the condition of the system.

The bulk of California's pavements, approximately 75%, were constructed during the fifteen-year period between 1959 and 1974. These pavements were designed with a twenty-year life expectancy, based on estimates of expected traffic volume and loads.

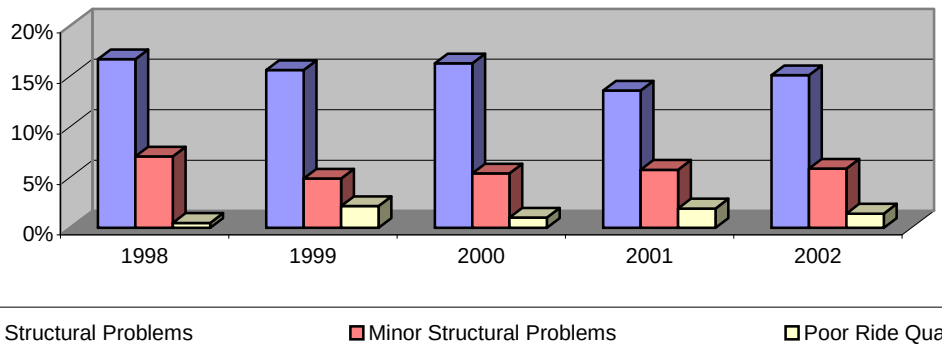
Pavement Condition

The pavement condition is evaluated using ride score (IRI) and the pavement surface condition. The 2002 Pavement Condition Survey (PCS) identified 11,356 lane miles of distressed pavement related to ride quality or structural problems. This is a 9% increase from the 2001 State of the Pavement Report, which showed 10,421 lane miles of pavement needs. The 2002 PCS shows a 21% decrease in lane miles of pavements with a ride quality problem.

Distressed Lane Miles

A distribution of lane miles with pavement needs by priority group for the surveys performed from 1998 through 2002 are presented in Chart 7. From 2001 to 2002 there was an increase of over 1,000 lane miles with major structural problems. In 2001 there were 6,629 lane miles of distressed pavement and in 2002 this number increased to 7,670 lane miles. The percentages shown in Chart 7 are the percent of the distressed lane miles to the total system miles (49,249 lane miles, excluding bridges).

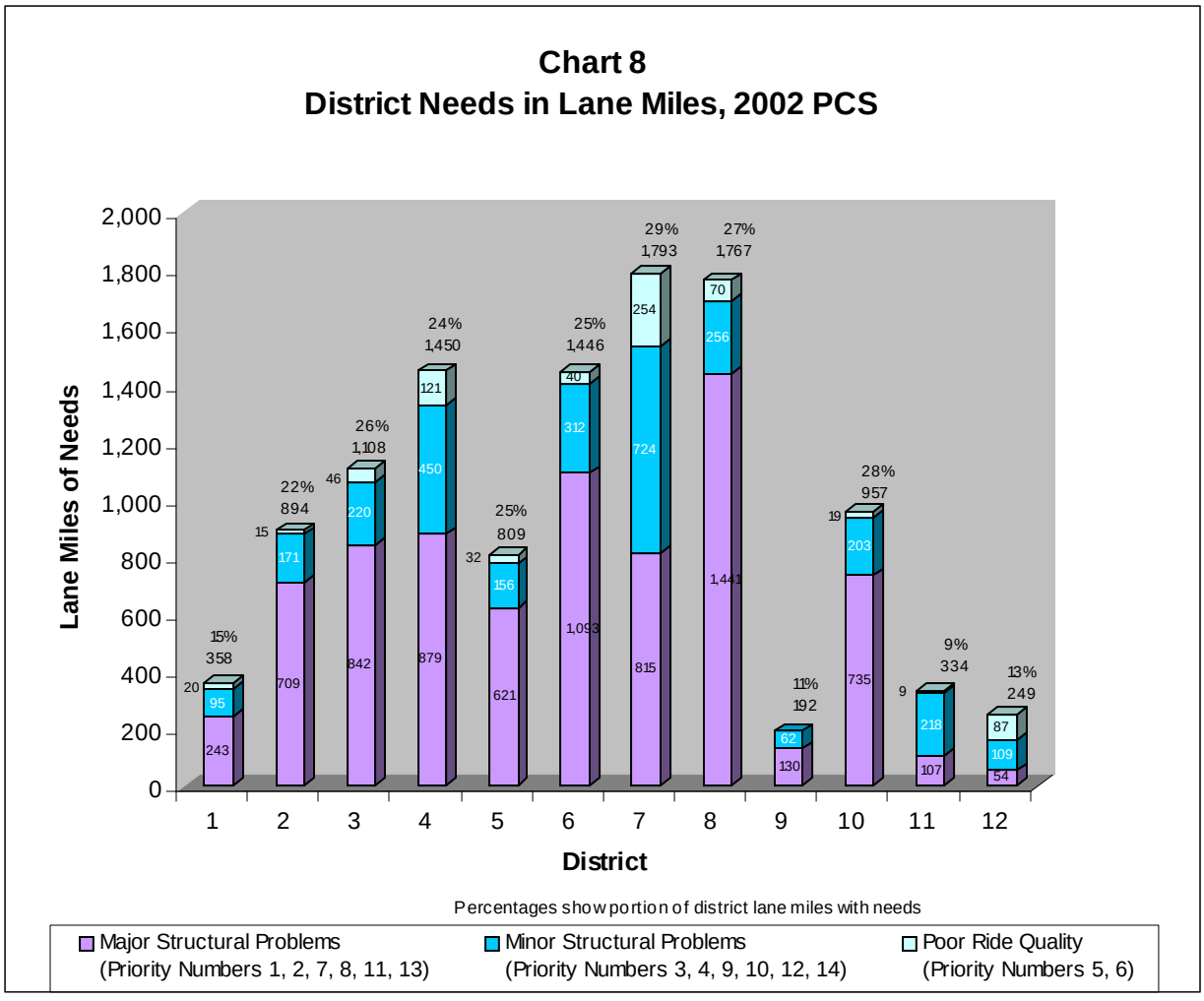
Chart 7
Distressed Lane Miles Compared to Total Lane Miles, by Problem Type, 1998-2002



District Pavement Condition

A percentage distribution of distressed pavement, by district, from the 2002 PCS is presented in Chart 8. Total needs, as indicated at the top of the bars, are still high for Districts 4, 6, 7, and 8 with distressed pavement greater than 1,400 lane miles each. Nine of the twelve districts have distressed pavement where major structural damage accounts for 61% to 82% of their damaged inventory. Of the 11,356 distressed lane miles of pavement in the State, 68% have major structural damage.

Each of the twelve districts reviews their priorities annually. The mission is to match their priorities with their allocations. Starting in 2003, the Districts will be able to identify not only the pavement needing rehabilitation strategies; but, also pavement needing maintenance treatments. A Major Maintenance priority matrix is being developed for pavement in good condition. This development will provide a means to efficiently use PM funds and prioritize non-distressed pavement, as 100% of the pavement inventory will be given a priority rating to develop potential project locations. Historically, the priority matrix only identified the distressed lane miles of pavement that would be corrected with rehabilitation or CAPM strategies.



Pavement Preservation

Pavement preservation is the top priority in California. An effective pavement preservation program protects the taxpayer's investment and improves customer perception. Pavement preservation on the 49,000 lane miles of California highways includes a wide range of PM techniques that are applied when the pavement is in good condition. PM strategies for flexible pavements include seal coats such as chip seals, slurry seals, micro surfacing, thin overlays, and crack sealing. Recycled materials show great potential in the PM project mix. Similar PM treatments for concrete pavements include crack and joint sealing, dowel bar retrofit, partial depth slab 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, or correct surface roughness. Timely application of these surface treatments can maintain or extend a pavements service life five to ten years before it requires a significant maintenance effort.

Caltrans is committed to using recycled content tire products in its pavement projects. The Department's goal is to use rubberized asphalt pavement when it is a viable alternative to conventional asphalt concrete. Rubberized asphalt concrete (RAC) usage may extend pavement life and help to address waste and landfill issues. Some benefits of RAC are a longer lasting pavement, a smoother ride, and better resistance to cracking than other types of pavement surfaces, while requiring less frequent maintenance. In addition, RAC has the potential to reduce noise levels to a point where a soundwall may not be needed in some locations.

Appendix

Pavement Condition Survey

To effectively manage the state's pavements, the California Department of Transportation (Caltrans) conducts an annual Pavement Condition Survey (PCS). The PCS uses a full-time crew of pavement raters that travel the state to observe and report the condition of pavements using an objective sampling process. The rating crew conducts a visual inspection of the pavement surface collecting distress data information, such as the severity and extent of various structural pavement defects for most lanes. In addition, a 'profile' van travels the highways collecting ride quality information for the pavement. Applying the rating process uniformly to every highway in the state gives an accurate picture of the condition of the network and a useful time-series of data.

The Pavement Condition Survey that provides the data for the Pavement Management System (PMS) has been engineered to improve both the quantity and quality of data available to users throughout Caltrans. The pavement condition is continuously monitored and reported. The field data collected is transferred to the Caltrans headquarters PMS at which time the ride quality and pavement surface condition is analyzed.

California Pavement Management System

The PMS provides a systematic, objective evaluation of pavement condition for identification of maintenance and rehabilitation needs. Significant capabilities of the California PMS include: description of current pavement inventory condition, project identification and prioritization. PMS is the tool used to measure progress in achieving Caltrans' pavement performance goal of reducing total pavement needs to 5,500 lane miles by the end of the 20011/12 FY, and improve the condition of the remaining pavements with needs.

The PMS currently in use in California was developed in the mid 1970s. Its original design intent was to repair highway segments with severe problems, a 'worst-first' approach to pavement maintenance and rehabilitation. The approach limited the number of lane miles that could be repaired, because of the high cost of rehabilitation treatments. Temporary repair using a 'heavy maintenance' strategy such as slab replacement or AC digouts and replacement, must occasionally be substituted for reconstruction of a facility. Use of maintenance dollars for 'heavy maintenance' prevents treatment of other miles that are appropriate candidates for a maintenance treatment. An update to the PMS is currently under development. The enhanced PMS will identify pavement that would be candidates for Preventive Maintenance along with segments triggered for rehabilitation.

Pavement locations are classified by the conditions found in each lane, using both ride quality and visible surface condition. The strengths of the existing system are it's repeatable reporting of the inventory condition and the emphasis it places on maintaining an 'acceptable' ride quality. A prioritized list of potential projects is provided to the district offices for review and to allow them to add local information. While the PMS suggests an initial project sequence, district knowledge of local needs and funding

availability is used to select specific projects, re-order project priorities, and design maintenance and rehabilitation projects. The principal factor limiting pavement maintenance and rehabilitation has been lack of funds

Maintenance Service Level

Caltrans uses a three-class system, termed 'Maintenance Service Level' (MSL), to distinguish the role various highways fulfill within the state highway network. Maintenance Service Level 1 (MSL 1) highways consist of Interstate highways, freeways, and other principal arterial routes (major routes) with high traffic volumes of over 5,000 vehicles per day. Maintenance Service Level 2 (MSL 2) routes are routes with moderate volumes of 1,000 to 5,000 vehicles per day, typically connecting MSL 1 routes or providing route continuity between MSL 1 routes. Maintenance Service Level 3 (MSL 3) routes have low traffic volumes, or serve as collectors for MSL 1 and MSL 2 routes. Traffic volumes on MSL 3 routes are usually 1,000 vehicles, or less, per day.

Priority Assignment

Two criteria, ride quality and structural condition, (based on pavement surface condition) are used to establish the overall condition of an individual segment of pavement. That information is combined with the MSL value to establish the 'Priority Category' assigned to that pavement. The Priority Category indicates the class of work (Rehabilitation, CAPM, or Major Maintenance) likely to be used to repair a pavement. The shift to identifying work by the type of repair, existing needs, and funding identified for a given type of repair has reduced the reliance on the Priority Category as an indicator of the urgency for performing repair work.

One of the primary criteria for evaluating the need to repair highway is ride quality. Ride quality is sampled by driving a van equipped with a laser profilograph over pavement at highway speed. Pavement roughness is measured using a standardized scale, called the International Ride Index (IRI). The IRI is reported as inches of surface roughness per mile of pavement, with 'unacceptable' rides typically having more than 200 inches of roughness per mile.

Another criteria for repairing the highway is pavement surface distress. Distress types are unique to each of the two predominant pavement types: flexible (AC) pavements, or rigid (PCC) pavements. The combinations of individual distresses observed on a pavement are then evaluated for severity, and broadly classified into overall levels of structural distress, such as 'None', 'Minor', or 'Major'. The combination of ride quality data and pavement surface distress data are used to identify strategies for repairing the pavement. The actual corrective strategy that will provide the most cost-effective repair of a pavement segment is determined by project site reviews and project cost analysis.

Finally, the MSL is used to assign a priority value based upon the role the route fulfills within the state highway network. Therefore, MSL 1 highways receive higher priority for repair than MSL 2 highways, pavement conditions being equal. MSL 3 highways receive

the lowest priority ranking for rehabilitation. Current policy states that MSL 3 highways may receive rehabilitation by exception only, on a case-by-case basis.

A matrix of fourteen values results from the combination of MSL, ride quality, and structural condition. The value each pavement segment receives is used to identify the class of treatment a pavement requires, either maintenance or rehabilitation. 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.

The matrix below shows priority values based on ride quality, distress, and maintenance service level, and includes the lane miles in each group, the percentage of network needs within the priority group, and the portion of total system lane miles within the priority group.

2002 HA-22 Rehabilitation Program Priority System

Ride Quality	Structural Problem	Needs by Priority Category (lanemiles, percent of needs, percent of system)								
		Maintenance Service Level								
		1 AADT>5,000			2 AADT 1,000 to 5,000			3 AADT < 1000		
Poor Ride	Major	1			2			11		
		843	7.4%	1.7%	843	7.4%	1.7%	358	3.2%	0.7%
	Minor	3			4			12		
		869	7.7%	1.8%	292	2.6%	0.6%	100	0.9%	0.2%
	None	5			6			N/A		
		523	4.6%	1.1%	187	1.6%	0.4%	- - - -		
Acceptable Ride	Major	7			8			13		
		2321	20.4%	4.7%	2071	18.2%	4.2%	1234	10.9%	2.5%
	Minor	9			10			14		
		977	8.6%	2.0%	476	4.2%	1.0%	262	2.3%	0.5%

Priority values of 1, 2, 7, 8, 11, and 13 include pavements in MSL 1, 2, or 3 having major structural distress. These pavements are candidates for rehabilitation funding. Priority values 3, 4, 9, 10, 12, and 14 are found on MSL 1, 2, and 3 with minor structural distress. They are candidates for maintenance strategies, or strategies funded under CAPM. Priorities 5 and 6 have no structural problems but the pavement has a poor ride. Overlaying or grinding the pavement may be strategies for correcting a pavement with poor ride.

Rehabilitation / CAPM Priority Matrix	
Defect	**Priority Number**
Major Structural Damage	1, 2, 7, 8, 11, 13
Minor Structural Damage	3, 4, 9, 10, 12, 14
Poor Ride Quality	5, 6

Preventive Maintenance is receiving additional emphasis to delay development of significant structural distress. A Major Maintenance program priority matrix is being developed. The new matrix will identify pavement that has little or no defects and does not fall into the priorities for rehabilitation or CAPM strategies. Corrective, preventive or routine maintenance will be performed on pavements based on the defects as shown in the following table.

Major Maintenance Program Priority Matrix		
Maintenance Type	**Defect**	**Treatment**
Corrective	Patching	Thin Blanket / Modified Binder
	All. A Cracks & Rutting	Thin Blanket / Modified Binder w/Leveling
	Rutting	Mill & Resurface
	Bleeding	Mill & Resurface / OGAC
	Coarse Ravel	Mill & Resurface / Resurface OGAC w/Heavy Tack Coat
	High All. A & B, Open Cracks	Thin Blanket / Gap Graded AR
	Shoulder Displacement	Shoulder Repair / Shoulder Joint Mill, Fill & Seal
	Slab Cracking	Slab Replacement / Lateral Stabilization
Preventive	Fine Ravel	Fog Seal
	All. A, No All. B Cracks	Chip Seal / Slurry or Overlay / Micro surfacing, BWC, AC Surfacing
	No or Low All. A, Low All. B	Chip Seal / AR / Slurry or Overlay / Micro surfacing, BWC, AC Surfacing
	Slab Cracking	Crack Seal
	Maintain Shoulders & Joints	Fog Seal
	Unsealed Cracks or Joints	Crack Seal

Road Type Descriptions

There are four road types defined on the state highway network. Highways within city limits that are subject to traffic controls such as stop signs or signals, also serving as surface streets, are termed ‘City highways’. Roads with one lane in each direction, for a total of two lanes are labeled ‘Two-lane’, and highways with more than one lane in each direction are labeled ‘Multi-lane’. Multi-lane highways are subdivided further into those with a median separating the lanes traveling opposite directions, ‘Multi-lane Divided’, and those without medians, ‘Multi-lane Undivided’.

National Highway System

The Federal classification system was modified under legislation for the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). That legislation established a new 'National Highway System' (NHS) definition. Congress was charged with responsibility for defining the highway segments to be included within a 'NHS'. While the definition of the NHS excludes many state highways, the majority of the system, about 60% or roughly 30,000 of its lane miles, are classified NHS. Applied to California, the new definition results in three highway groups: Interstate NHS highways, non-interstate NHS highways, and non-NHS highways. However, statistics for the federal classifications are presented in Table A (page 17).

How Pavement Ages

Several factors are responsible for the degradation of pavements over time, affecting the service life of the pavement. The initial design of the pavement, based on anticipated traffic volumes and loads, is a major factor influencing its life. Cumulative traffic volume, especially truck traffic, is another major factor in the life of pavements. Finally, environmental factors such as moisture infiltration into the supporting base, and heat and cold cycles, affect how well the subsurface is able to support the pavement. The routine maintenance effort applied to a pavement also affects pavement life.

Damage appears slowly at first, and then gradually accelerates, accumulating to become visible as structural distress and tangible as reduced ride quality. If distress is observed and corrected in a timely manner, low cost strategies will restore the road to nearly its original condition. However, if early treatment is neglected or postponed, the accumulated damage will require a more costly repair treatment. Recognizing that damage accumulates and accelerates is key to understanding the need for early, low-level, low-cost preventive maintenance treatments.

Map of Caltrans Districts

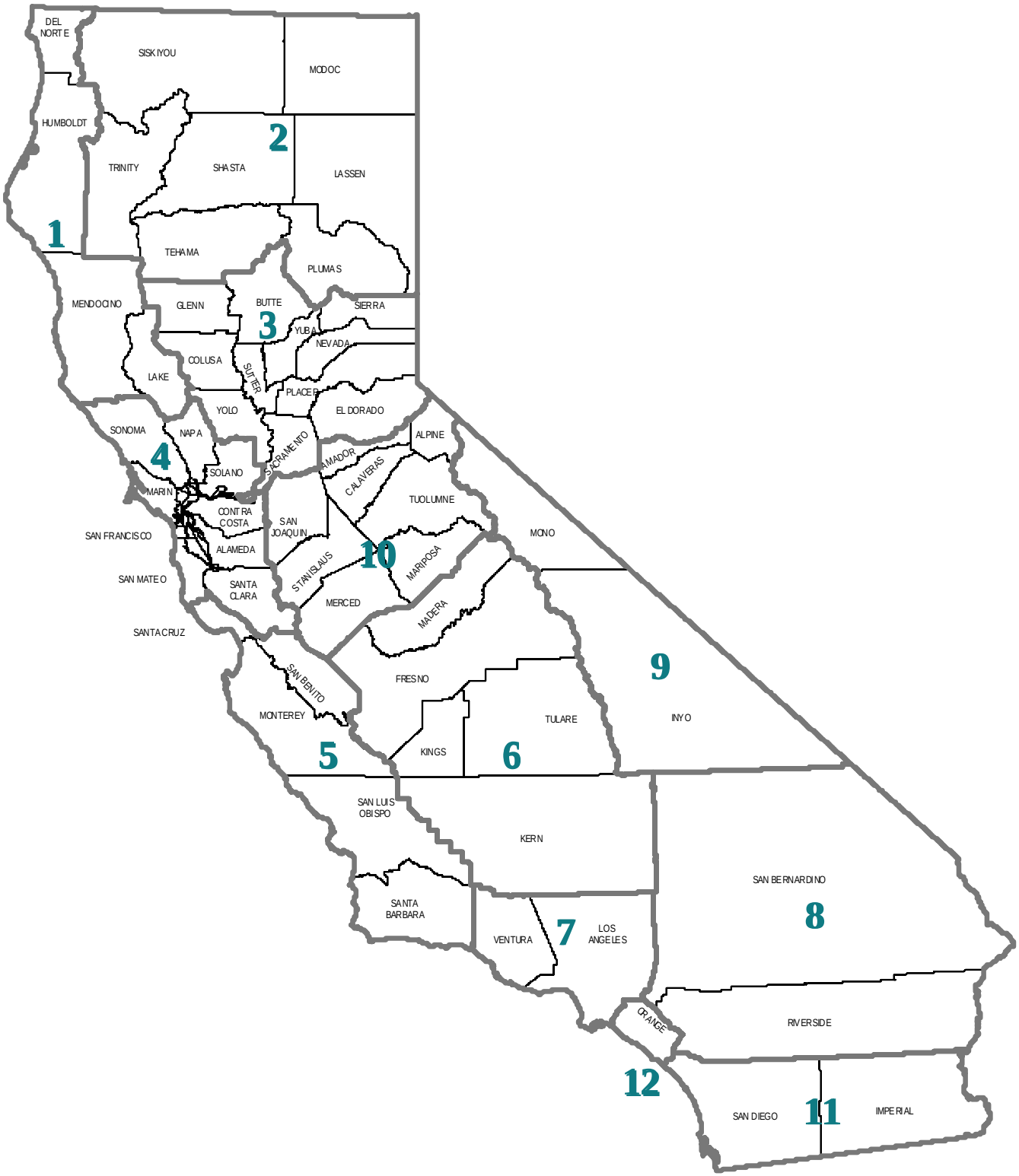


TABLE A

Distribution of Centerline Miles and Lane miles, 2002

	Center line miles		Lane Miles		Distressed Lane Miles		Major Structural Problems	Minor Structural Problems	Poor Ride Quality
TOTAL	14,910	100%	49,249	100%	11,356	23%	7,670	2,976	710
PRIORITY									
Major Structural Problems					7,670	16%			
Minor Structural Problems					2,976	6%			
Poor Ride Quality					710	1%			
NONE (Not Distressed)					37,893	77%			
(Excludes Bridges)					49,249	100%			
MSL									
1	5,970	40%	27,521	56%	5,559	49%			
2	5,377	36%	14,417	29%	3,842	34%			
3	3,545	24%	7,213	15%	1,955	17%			
	14,893	100%	49,152	100%	11,356	100%			
DISTRICT									
1	927	6%	2,330	5%	358	3%	243	95	20
2	1,718	12%	3,992	8%	894	8%	709	171	15
3	1,462	10%	4,284	9%	1,108	10%	842	220	46
4	1,368	9%	5,958	12%	1,450	13%	879	450	121
5	1,149	8%	3,187	6%	809	7%	621	156	32
6	2,026	14%	5,751	12%	1,446	13%	1,093	312	40
7	1,084	7%	6,106	12%	1,792	16%	815	724	254
8	1,884	13%	6,575	13%	1,767	16%	1,441	256	70
9	739	5%	1,777	4%	192	2%	130	62	0
10	1,304	9%	3,462	7%	957	8%	735	203	19
11	973	7%	3,923	8%	334	3%	107	218	9
12	279	2%	1,904	4%	249	2%	54	109	87
	14,910	100%	49,249	100%	11,356	100%	7,669	2,976	710
ROAD TYPE									
Multi-Lane Divided	5,587	37%	29,974	61%	6,006	53%			
Multi-Lane Undivided	395	3%	1,360	3%	375	3%			
Two-Lane	8,928	60%	17,916	36%	4,974	44%			
	14,910	100%	49,249	100%	11,356	100%			
CITY									
City	2,774	19%	15,955	32%	3,753	33%			
Non-city	12,136	81%	33,293	68%	7,602	67%			
	14,910	100%	49,249	100%	11,356	100%			
NATIONAL HIGHWAY SYSTEM									
NHS Interstate	2,223	15%	13,285	27%	2,300	20%			
NHS non-Interstate	4,805	32%	17,328	35%	4,162	37%			
Non-NHS roads	7,882	53%	18,636	38%	4,894	43%			
	14,910	100%	49,249	100%	11,356	100%			
INTERMODAL CORRIDORS OF ECONOMIC SIGNIFICANCE (ICES)									
ICES	3,317	22%	17,824	36%	3,479	31%			
Non-ICES roads	11,593	78%	31,425	64%	7,877	69%			
	14,910	100%	49,249	100%	11,356	100%			
PAVEMENT TYPE									
Flexible	12,202	82%	32,952	67%	8,052	71%			
Rigid	2,710	18%	16,304	32%	3,304	29%			
	14,912	100%	49,256	99%	11,356	100%			

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

TABLE B

Distressed Lane Miles by Priority Group

	1998			1999			2000			2001			2002		
District	Major Structural Problems	Minor Structural Problems	Poor Ride Quality	Major Structural Problems	Minor Structural Problems	Poor Ride Quality	Major Structural Problems	Minor Structural Problems	Poor Ride Quality	Major Structural Problems	Minor Structural Problems	Poor Ride Quality	Major Structural Problems	Minor Structural Problems	Poor Ride Quality
1	304	154	18	303	110	71	179	96	18	199	84	33	243	95	20
2	955	200	0	875	188	31	587	102	1	752	125	22	709	171	15
3	656	206	2	1,112	318	99	832	308	40	544	204	56	842	220	46
4	1,197	785	103	1,438	570	320	1,500	531	81	809	492	158	879	450	121
5	942	202	24	935	175	80	625	114	11	513	151	24	621	156	32
6	967	231	16	1,980	350	186	1,008	281	2	1,093	292	123	1,093	312	40
7	1,348	1,149	100	1,063	487	474	1,182	616	653	909	620	238	815	724	254
8	2,073	504	40	1,290	493	136	1,449	324	42	1,095	319	99	1,441	256	70
9	38	12	0	205	93	0	73	45	0	119	58	0	130	62	0
10	865	197	9	1,144	189	39	638	152	11	477	128	32	735	203	19
11	228	251	27	119	197	126	146	255	3	122	167	57	107	218	9
12	146	290	66	139	170	67	111	189	91	36	177	92	54	109	87
Totals	9,719	4,181	405	10,603	3,340	1,629	8,330	3,013	952	6,668	2,818	935	7,669	2,976	710

District Lane Miles by Pavement Condition Survey Year

	1998			1999			2000			2001			2002		
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	2,334	476	20%	2,334	484	21%	2,329	293	13%	2,330	316	14%	2,330	358	15%
2	4,001	1,155	29%	4,001	1,094	27%	3,992	689	17%	3,992	899	23%	3,992	894	22%
3	4,311	865	20%	4,311	1,529	35%	4,305	1,180	27%	4,284	804	19%	4,284	1,108	26%
4	5,917	2,085	35%	5,917	2,329	39%	5,916	2,112	36%	5,957	1,459	24%	5,958	1,450	24%
5	3,197	1,167	37%	3,197	1,190	37%	3,194	750	23%	3,187	688	22%	3,187	809	25%
6	5,691	1,215	21%	5,691	2,517	44%	5,678	1,292	23%	5,734	1,508	26%	5,751	1,446	25%
7	6,147	2,596	42%	6,147	2,024	33%	6,156	2,450	40%	6,106	1,767	29%	6,106	1,792	29%
8	6,464	2,616	40%	6,464	1,918	30%	6,462	1,815	28%	6,492	1,512	23%	6,575	1,767	27%
9	1,758	50	3%	1,758	298	17%	1,754	118	7%	1,777	178	10%	1,777	192	11%
10	3,474	1,071	31%	3,474	1,371	39%	3,469	801	23%	3,452	637	18%	3,462	957	28%
11	3,904	507	13%	3,904	442	11%	3,899	405	10%	3,909	347	9%	3,923	334	9%
12	1,686	502	30%	1,686	376	22%	1,683	390	23%	1,888	305	16%	1,904	249	13%
Totals	48,883	14,305	29%	48,883	15,572	32%	48,837	12,295	25%	49,108	10,421	21%	49,249	11,356	23%

Statewide Pavement Needs by Survey Year and Priority Group

	1998			1999			2000			2001			2002		
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	9,719	68%	20%	10,603	68%	22%	8,330	68%	17%	6,668	64%	14%	7,669	68%	16%
Minor	4,181	29%	9%	3,340	21%	7%	3,013	25%	6%	2,818	27%	6%	2,976	26%	6%
Poor	405	0	1%	1,629	0	3%	952	0	2%	935	0	2%	710	0	1%
Total	14,305	100%	29%	15,572	100%	32%	12,295	100%	25%	10,421	100%	21%	11,356	100%	23%

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

Notes:

Source: 1998-2002 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, 1998-2002

Maintenance, Contracted	Average	97/98	98/99	99/00	00/01	01/02
Cost per Lane Mile, by Fiscal Year						
CHIP SEAL (AR)	$ 23,280	$ 14,354	N/A	$ 18,488	$ 29,864	$ 30,403
CHIP SEAL (PMA)	$ 16,390	$ 7,423	N/A	$ 19,155	$ 13,800	$ 25,179
CHIP SEAL (PME)	$ 10,960	$ 6,895	$ 5,132	$ 14,784	$ 12,456	$ 15,547
CRACK SEAL	$ 4,360	$ 2,666	$ 1,799	$ 8,717	$ 7,308	$ 1,310
* MICROSURFACING	$ 32,860	N/A	N/A	N/A	$ 21,573	$ 44,147
* THIN BONDED WEARING COURSE	$ 72,700	N/A	N/A	N/A	N/A	$ 72,697
OPEN GRADE	$ 27,920	$ 11,092	$ 23,570	$ 33,142	$ 33,260	$ 38,550
RUBBERIZED AC SURFACING	$ 41,280	$ 27,755	$ 32,266	$ 45,069	$ 42,852	$ 58,440
SLURRY SEAL	$ 15,720	$ 12,537	$ 18,945	$ 14,711	$ 16,032	$ 16,367
THIN BLANKET	$ 28,760	$ 19,857	$ 24,751	$ 32,504	$ 37,241	$ 29,424
DIGOUT	$ 45,230	N/A	N/A	N/A	N/A	$ 45,230
** PCC SLAB EACH	$ 3,810	$ 4,391	$ 3,517	$ 3,393	$ 3,352	$ 4,377
Lane Miles Treated, by Fiscal Year						
CHIP SEAL (AR)	164	28	N/A	320	245	63
CHIP SEAL (PMA)	112	59	N/A	146	158	84
CHIP SEAL (PME)	966	1,152	1,326	880	1,047	426
CRACK SEAL	292	350	488	115	322	185
* MICROSURFACING	87	N/A	N/A	N/A	142	31
* THIN BONDED WEARING COURSE	92	N/A	N/A	N/A	N/A	92
OPEN GRADE	447	306	168	1,006	538	217
RUBBERIZED AC SURFACING	61	7	112	137	25	25
SLURRY SEAL	118	22	14	204	122	226
THIN BLANKET	1,026	1,530	1,015	479	1,251	853
DIGOUT	26	N/A	N/A	N/A	N/A	26
** PCC SLAB EACH	1,230	225	934	1,895	2,374	722
TOTAL, CONTRACT MTCE. LANE MILES	3,188	3,454	3,123	3,287	3,850	2,228

Rehabilitation, Contracted	Average	97/98	98/99	99/00	00/01	01/02
Cost per Lane Mile, by Fiscal Year						
ACOL FLEX, REHABILITATION	$ 245,140	$ 182,230	$ 196,359	$ 251,344	$ 271,009	$ 324,775
ACOL FLEX, CAPM	$ 101,810	$ 67,693	$ 116,937	$ 86,540	$ 128,468	$ 109,431
ACOL RIGID, REHABILITATION	$ 348,490	N/A	N/A	$ 198,570	$ 568,194	$ 278,715
ACOL RIGID, CAPM	$ 161,730	$ 231,758	$ 172,378	N/A	$ 81,042	N/A
MILL AND REPLACE AC	$ 158,450	$ 107,325	$ 150,264	$ 214,847	$ 98,103	$ 221,692
RUBBERIZED AC, REHABILITATION	$ 142,010	N/A	N/A	$ 131,707	$ 176,176	$ 118,139
RUBBERIZED AC, CAPM	$ 74,290	$ 45,968	$ 76,032	$ 59,778	$ 115,376	N/A
GRINDING, REHABILITATION	$ 150,460	N/A	N/A	$ 89,613	N/A	$ 211,306
GRINDING, CAPM	$ 78,610	$ 47,703	$ 55,609	$ 48,754	$ 79,551	$ 161,434
*** CPR, REHABILITATION	$ 307,500	N/A	N/A	$ 163,172	N/A	$ 451,835
*** CPR, CAPM	$ 71,120	N/A	N/A	$ 71,118	N/A	N/A
PCC OVERLAY	$ 751,680	$ 646,154	$ 857,200	N/A	N/A	N/A
Lane Miles Treated, by Fiscal Year						
ACOL FLEX, REHABILITATION	649	504	838	769	756	378
ACOL FLEX, CAPM	569	572	798	730	529	218
ACOL RIGID, REHABILITATION	222	N/A	N/A	179	307	179
ACOL RIGID, CAPM	151	180	172	N/A	102	N/A
MILL AND REPLACE AC	208	301	322	132	267	20
RUBBERIZED AC, REHABILITATION	70	N/A	N/A	61	113	36
RUBBERIZED AC, CAPM	524	57	134	401	1,506	N/A
GRINDING, REHABILITATION	149	N/A	N/A	119	N/A	178
GRINDING, CAPM	265	122	102	244	795	64
*** CPR, REHABILITATION	87	N/A	N/A	159	N/A	16
*** CPR, CAPM	291	8	N/A	863	N/A	2
PCC OVERLAY	22	42	3	N/A	N/A	N/A
Subtotal, REHABILITATION	1,385	847	1,163	1,419	1,442	807
Subtotal, CAPM	1,823	939	1,205	2,238	2,931	283
TOTAL REHAB/CAPM LANE MILES	3,208	1,786	2,368	3,657	4,373	1,090
TOTAL, ALL CONTRACT LANE MILES	5,843	5,240	5,491	6,944	8,223	3,318

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.

ALL A – 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.

ALL B – 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.

ALL C – 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 eight 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 (Continued)

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.

HA22 – The highway program that funds reconstruction or rehabilitation of pavements (currently known as 201.120 and 201.125).

HM1 – the highway program that funds routine maintenance on the state highway network.

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 one mile long and one lane wide. 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.

Longer-life pavement – a pavement intended to last twenty years or more between rehabilitation treatments.

Maintenance – use of low-cost to moderate-cost treatments to extend the life of a pavement up to seven years.

Maintenance Program – the program, within the California Department of Transportation, that is responsible for preserving the state highway network.

MSL – Maintenance Service Level – a three-value system of indicating the service provided by a route segment within the state highway network, consisting of MSL 1, MSL 2, and MSL 3 highways. A single route may have different MSL values on different segments, largely dependent upon traffic volume and functional class.

MSL 1 – Class 1 roads are rural principal arterial highways and their extensions into urbanized areas. Annual average daily traffic (AADT) of over 5,000 vehicles per day. Includes interstate highways and major freeways.

MSL 2 – Class 2 roads are minor arterials. Traffic volume is intermediate, 1,000 to 5,000 vehicles per day.

MSL 3 – Class 3 roads are collectors and low-volume roads, and logical segments added for route continuity. Annual average daily traffic (AADT) of less than 1,000 vehicles per day.

Definitions/Glossary (Continued)

Major Maintenance – Intermediate-level treatments such as thin or intermediate 'blankets' of asphalt to extend the life of a pavement, usually by four to seven years. These treatments offer moderate improvement in the structural capacity of the pavement.

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.

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.

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.

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).

Routine maintenance – Low-level maintenance treatments, such as crack sealing, joint sealing, and minor patching.

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.

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