2013 State of the Pavement Report

Based on the 2013 Pavement Condition Survey

California Department of Transportation

Division of Maintenance

Pavement Program

Caltrans

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Acknowledgments

This report is prepared by the California Department of Transportation, Division of Maintenance, Pavement Program, Office of Planning and Programming and Office of Pavement Management and Performance. It summarizes the 2013 pavement condition survey on the entire Caltrans network.

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The completed 2013 Pavement Condition Report can be downloaded from the Division of Maintenance intranet page:
URL: http://onramp.dot.ca.gov/hq/maint/pavement/planprogram.shtml

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EXECUTIVE SUMMARY

The age of the California State Highway System (SHS) is over a half century, so the California Department of Transportation (Caltrans) must continually monitor its condition using the Pavement Condition Survey (PCS) and keep it in good shape using high-tech strategies and innovative treatments.

About 16% of California's highway miles (7,820 lane miles) are in poor condition, which is an improvement of 9% from the previous PCS, and 12,364 lane miles need low cost preventive maintenance to keep it in good condition. The remaining 29,534 lane miles had no distress. This examination shows that the system is recovering and continues to monitor the health of a 60-year-old system.

In the last four years, Caltrans delivered about $3.9 billion in pavement projects on almost 18,000 lane miles. However, these funds may not be available in the future and Caltrans will need to leverage dollars to do more with less. The "2013 Ten-Year Plan" anticipates pavement needs to be $2.8 billion per year over the next decade, although only $685 million per year is available, i.e., only twenty-three cents of every dollar. Consequently, distressed lane miles could increase from 16 percent today to 34 percent in the next 10 years.

The aging SHS's 50,000 lane miles need to be maintained even while carrying nearly 35 million vehicles per year. Consequently, Caltrans is turning to advanced technology to keep the system in top condition. The state-of-the-art Pavement Management System software (PaveM) can improve pavement performance data, and similar to any other health maintenance system, it targets future repairs that do the most good for the least amount of money.

By employing aggressive, quick and preventive treatments, Caltrans can avoid more costly medicine in the future. For example, preventive maintenance costs an average of $106,000 per lane mile, while major rehabilitation work is 8 times more expensive. Annual spending for preventive maintenance has been steady since 2008 and the National Highway System (NHS) routes with smooth ride has increased by about 14 percent since 2005. This improvement to poor ride on the NHS is due to more than seven thousand lane miles of capital pavement projects completed since 2005.

Innovative treatments allow Caltrans to trim its pavement costs and overcome the future challenges of maintaining the SHS. Savings, for example, could come through recycling. Caltrans uses recycled tires in some pavement, reducing the pressure on landfills. According to the "2012 Crumb Rubber Report," nearly 35 percent of all Caltrans flexible pavement was designed with rubberized asphalt.

Another example is targeting $36 million for cold-in-place recycling. Together, these types of projects reduce the pressure on aggregate mines and greenhouse gas (GHG) emissions. According to the April 2013 report "Caltrans Activities to Address Climate Change" it is

estimated that that over 61,000 tons of GHG emissions are reduced annually using these innovative projects.

Another new pavement management technology to monitor the health of the pavement is PaveM. This software combines Ground Penetrating Radar (GPR) information with automated highway pavement condition survey (APCS) data. The GPR is used to determine the existing pavement structure and the APCS collects pavement data at highway speeds using lasers and cameras. PaveM can recommend the best strategies, predict how long the pavement will last and recommend more cost effective treatments.

CHAPTER 1 – HIGHWAY CONDITION AND NEEDS

The SHS has about 15,000 centerline miles and 50,000 lane miles. In the past, Caltrans conducted the PCS once a year to measure the changes in the pavement condition. However, in 2008, the data collection method was changed to provide pavement performance data for the future Pavement Management System (PMS). The 2013 PCS was started in August 2011 and completed in April 2013. A map of all Caltrans Districts is shown in Appendix 1.

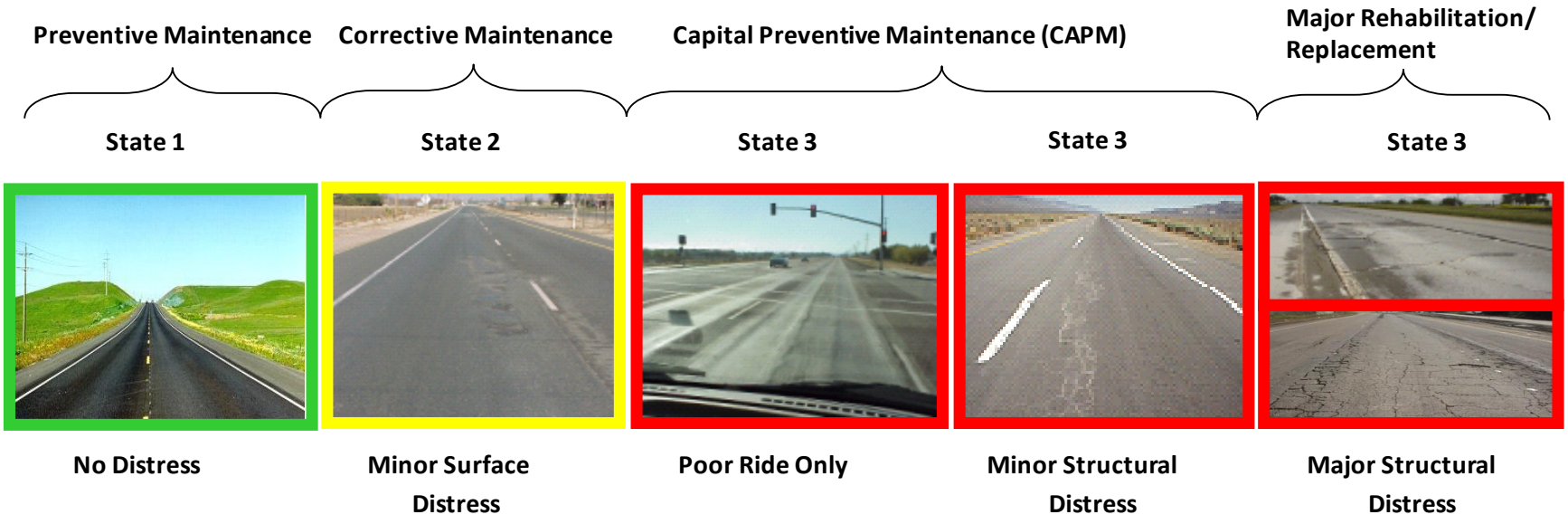
To maintain the health of the system and assist in tracking pavement performance, the pavement condition data has been mapped to condition states. As shown in Figure 1, there are pictures of the three different pavement condition states with corresponding colors of green, yellow and red. These condition states are:

State 1: Green Pavement in good/excellent condition with no or few potholes or cracks. This pavement requires a preventive maintenance pavement project.

State 2: Yellow Pavement is in fair condition with minor surface distress that only needs corrective maintenance. The types of minor surface distress include minor cracking, slab cracking, raveling and potholes. The repair is a corrective maintenance pavement project.

State 3: Red Pavement includes major distress (pavement in poor condition with extensive cracks), minor distress (pavement in poor condition with significant cracks), and poor ride only. The severity of distressed pavement is defined by both the visual appearance of the pavement and the IRI. The ride quality is based on the FHWA standard that defines an acceptable IRI as 170 or less. The repair is a Pavement Rehabilitation or Reconstruction, lane replacement project or a Capital Preventive Maintenance (CAPM) project.

The examination of the SHS begins with the red, yellow and green condition states broken down by the lane miles. Table 1 shows the lane miles based on the 2013 pavement condition compared to 2011 PCS and Table 2 further breaks this comparison down by road class. The District breakdown by roadway class comparing the 2011 to 2013 PCS is shown in Appendix 3.



State 1: Good/excellent condition with few potholes or cracks ⇨ Preventive maintenance project

State 2: Fair condition with minor cracking or slab cracking ⇨ Corrective maintenance project

State 3: Poor condition with significant to extensive cracks or poor ride only ⇨ CAPM , rehabilitation or reconstruction project

Figure 1. Pavement Condition States

As shown in Table 1, the PCS identified that about 16% of California's highway miles **(7,820 lane miles)** are in poor condition, which is **an improvement of 9%** from the previous PCS. Table 1 also shows that there are 12,364 lane miles in need of low cost preventive maintenance to keep it in good condition. The results are that the system is recovering as major and minor distress dropped 4,510 lane miles from the previous 2011 PCS. This recovery was partially due to $3.9 billion in pavement projects on nearly 18,000 lane miles as shown on Table 6. The breakdown of the distressed lane miles by district and survey year is shown on Figure 1. Figures 3 & 4 show the distressed, maintenance and good lane miles for the 2011 and 2013 surveys, respectively.

Table 1. 2013 Pavement Classification by Condition

Pavement Condition	2011			2013		
	Lane Miles*	Percent of Distressed Pavement	Percent of System	Lane Miles*	Percent of Distressed Pavement	Percent of System
Major Structural Distress	5,594	45	11	2,635	34	5
Minor Structural Distress	4,253	34	9	2,702	34	6
Poor Ride Quality (Only)	2,486	20	5	2,483	32	5
Total Distressed Pavement	12,333	100	25	7,820	100	16
Pavement Maintenance	11,053	–	22	12,364	–	25
Good/Excellent Pavement	26,132	–	53	29,534	–	59
Total System Lane Miles*	49,518	–	100	49,720	–	100

* Excludes bridges, ramps and frontage roads.

Table 2. 2013 Pavement Classification by Road Class

Pavement Condition	2011				2013			
	Class 1*	Class 2	Class 3	Total	Class 1	Class 2	Class 3	Total
Major Structural Distress	2,001	2,082	1,510	5,594	959	1,103	573	2,635
Minor Structural Distress	1,918	1,123	1,212	4,253	757	939	1,006	2,702
Poor Ride Quality (Only)	938	789	758	2,486	833	1,427	224	2,483
Total Distressed Pavement	4,858	3,994	3,481	12,333	2,549	3,469	1,803	7,820
Pavement Maintenance	4,331	4,061	2,661	11,053	5,081	4,061	2,214	12,364
Excellent Pavement	16,663	5,905	3,563	26,132	18,385	8,258	2,891	29,534
Total System Lane Miles*	25,852	13,961	9,705	49,517	26,015	16,797	6,907	49,720

*Excludes bridges, ramps and frontage roads.

Caltrans is moving towards advanced technology to keep the system in top condition. In the PaveM software, the APCS will add new features to monitor the health of the system. The APCS will show downward pictures of the pavement cracking, the roadway photo log type pictures, and the square area or quantity of each pavement distress. In addition, the APCS will increase worker safety and collect the data twice as fast. This new technology will help predict the future condition and identify the pavement preservation treatments.

For this report, the team of pavement raters visually inspected the pavement surface and used high tech lasers to collect the International Roughness Index (IRI) data that measures ride quality. For asphalt pavement visual inspection, the samples were taken at the beginning of each post mile. For concrete pavement visual inspection, the concrete slabs are continuously rated in one mile segments. In the 2011 PCS, concrete slab faulting was imported from the 2007 PCS for those lanes visually rated. In the 2013 PCS, concrete slab faulting was determined from the profilers, which measured the faulting height and number of faults.

To monitor the pavement smoothness, the IRI data measures the relative up and down movement of the vehicle. On a smooth road, such as a newly paved rehabilitation project, the up and down movement is low. On rough pavements, IRI values are high. This IRI is collected in each wheel path on the road in inches per mile. This IRI van gathers accurate data from speeds of 10 miles per hour (mph) up to 70 mph and the IRI is computed for every tenth of a mile. The Federal Highway Administration (FHWA) Standard of greater than 170 inches per mile is also the Caltrans standard for poor ride.

Monitoring the health of the SHS began in the mid-1970's when the original PCS was developed. In 1998, the PCS was further enhanced by developing a program called Pavement Condition Report (PCR). The PCR shows the pavement locations that have good or poor condition. This software allows you to choose any highway route and post mile in the state and get the pavement condition.

The original system only identified distressed pavement, i.e. pavement having major distress, minor distress or poor ride. All other surveyed pavement was considered to have little or no distress. In 2004, the PCR software was upgraded to include preventive maintenance, corrective maintenance or excellent pavement. California was one of the few states to prioritize the pavement locations that were in good shape.

Today, the state-of-the-art Pavement Management System software (PaveM) is being deployed. Similar to any other health maintenance system, it targets future repairs that do the best for the least amount of money.

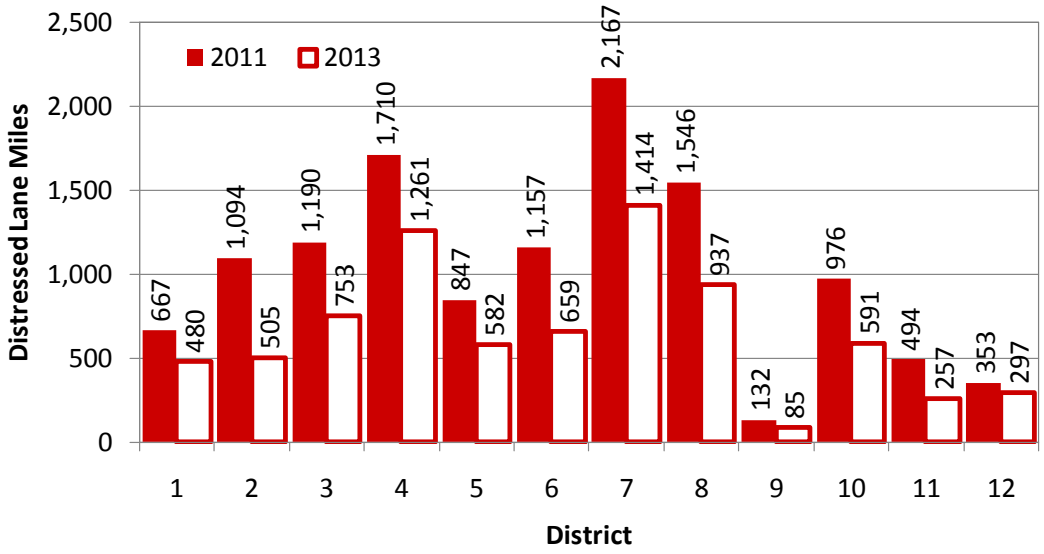
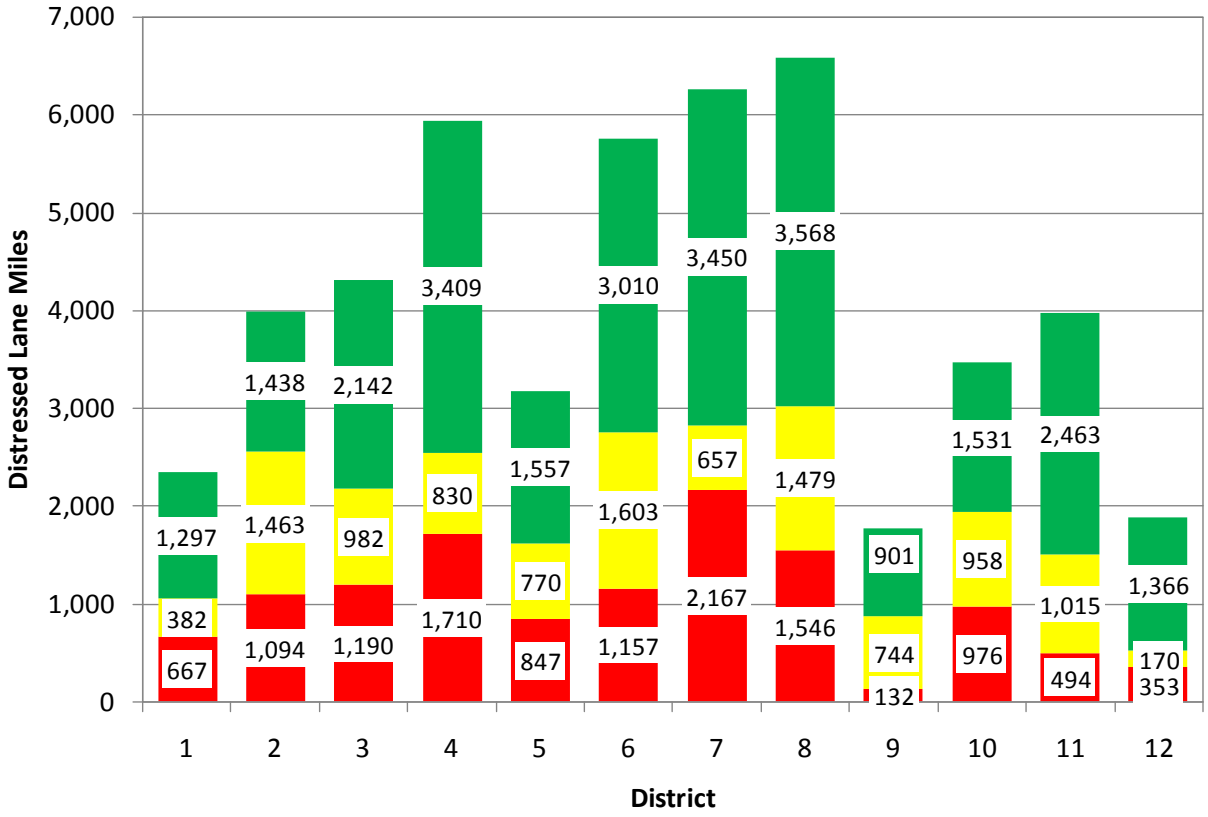


Figure 2. Distressed Lane Miles by District and Survey Year

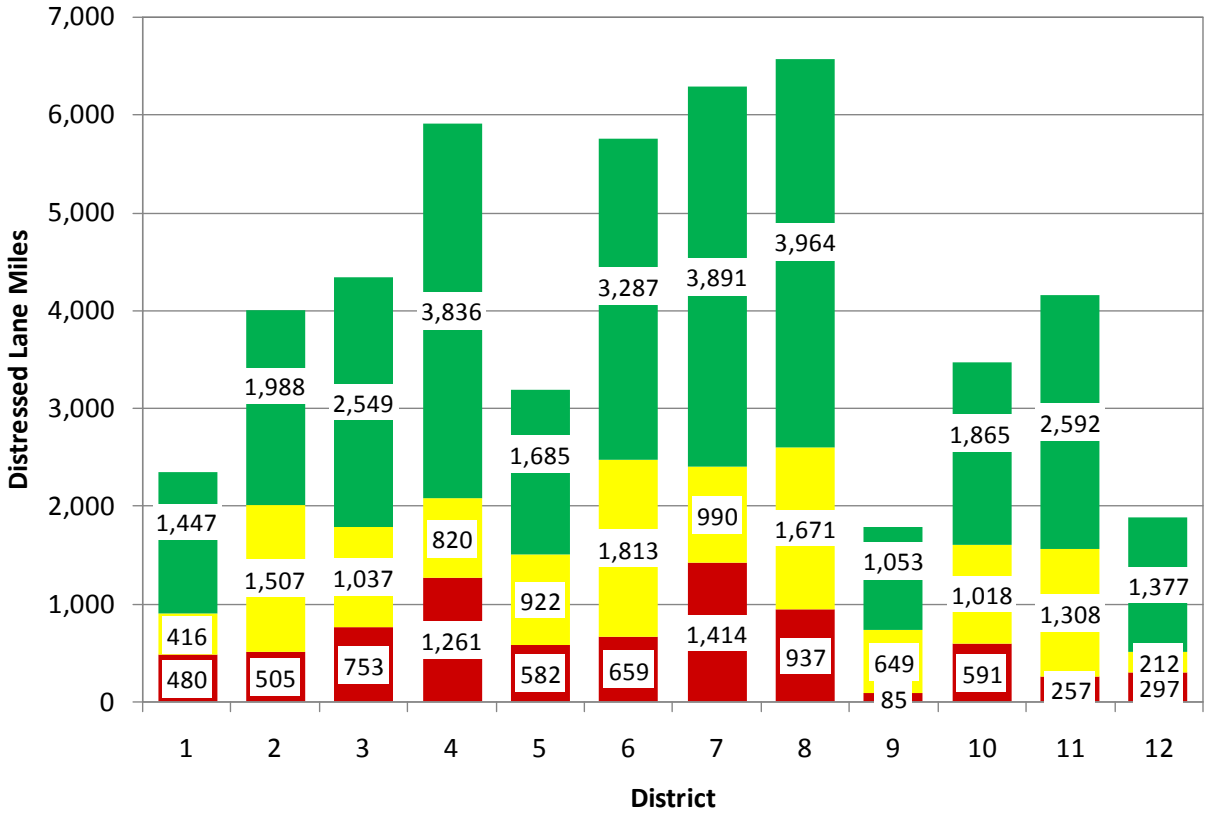
Using the 2011 and 2013 PCS, the health of each Caltrans district can be compared as shown in Figure 2. All districts have improved the health by targeting pavement projects at the right locations and reducing the distressed lane miles. The most notable improvements in distressed lane mile reduction were made by Districts 2, 3, 4, 6, 7 and 8.

Further analysis is shown in Figure 3 and 4. Figure 3 shows the 2011 PCS and Figure 4 shows the 2013 PCS where the districts are compared by green, yellow and red lane miles. There are signs of recovery since most districts reduced their lane miles of red pavement and increased their green lane miles. This comparison shows that the urban districts are reducing their red lane miles and that smaller districts are maintaining their pavements in good shape.



District	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
System Lane Miles	2,345	3,995	4,314	5,949	3,174	5,770	6,274	6,593	1,777	3,465	3,972	1,889	49,518
Major Structural Distress	152	699	623	506	433	722	706	860	45	643	129	76	5,594
Minor Structural Distress	312	359	455	492	326	392	721	455	86	281	235	141	4,253
Poor Ride Quality	203	36	113	712	88	44	740	231	1	52	130	136	2,486
Distressed Lane Miles	667	1,094	1,190	1,710	847	1,157	2,167	1,546	132	976	494	353	12,333
Pavement Maintenance	382	1,463	982	830	770	1,603	657	1,479	744	958	1,015	170	11,053
Good/Excellent Pavement	1,297	1,438	2,142	3,409	1,557	3,010	3,450	3,568	901	1,531	2,463	1,366	26,132
% Distressed Lane Miles	28%	27%	28%	29%	27%	20%	35%	23%	7%	28%	12%	19%	25%

Figure 3. Pavement Condition by District (2011)



District	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
System Lane Miles	2,343	4,001	4,339	5,917	3,189	5,759	6,295	6,571	1,787	3,474	4,158	1,886	49,720
Major Structural Distress	75	248	308	218	217	328	414	385	7	302	93	40	2,635
Minor Structural Distress	212	208	289	332	268	247	403	319	78	191	87	69	2,702
Poor Ride Quality	193	49	155	711	97	85	597	233	0	98	77	188	2,483
Distressed Lane Miles	480	505	753	1,261	582	659	1,414	937	85	591	257	297	7,820
Pavement Maintenance	416	1,507	1,037	820	922	1,813	990	1,671	649	1,018	1,308	212	12,364
Good/Excellent Pavement	1,447	1,988	2,549	3,836	1,685	3,287	3,891	3,964	1,053	1,865	2,592	1,377	29,534
% Distressed Lane Miles	20%	13%	17%	21%	18%	11%	22%	14%	5%	17%	6%	16%	16%

Figure 4. Pavement Condition by District (2013)

CHAPTER 2 – VEHICLE MILES TRAVELED ON ROUGH/SMOOTH PAVEMENT

Similar to Caltrans, the Federal Highway Administration (FHWA) monitors the National Highway System (NHS) health using IRI and Vehicle Miles Travelled (VMT). FHWA simplified the IRI or ride quality into "Good" or "Acceptable" in the 2008 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance – Report to Congress (FHWA, 2008). To be rated "Good," the IRI is below 95 inches per mile, and to be rated "Acceptable," the IRI is equal to or greater than 95 inches per mile but below or equal to 170 inches per mile.

Due to its multilane freeways, California has some of the highest VMTs in the nation. The percent VMT on rough riding pavement is shown on Figure 5. Annual spending for preventive maintenance has been steady since 2008 and the 2013 NHS routes with smooth ride have increased by about 14 percent since 2005. For Interstate routes, the improvement is 17%. This improvement in smooth ride on the NHS is due to more than seven thousand lane miles of capital pavement projects completed since 2005. The types of pavement strategies that improved the smooth ride included asphalt overlays, grinding and mill/replace asphalt.

For non NHS routes, the percent pavement with rough ride or "Poor" rating (IRI > 170 inches per mile) increased for the 2007 PCS but decreased for the 2011 and 2013 PCS surveys. The VMT on smooth riding or "Good" pavement is shown on Figure 6. As expected, Figure 6 shows the opposite of the rough pavement chart. This chart shows that the high-tech strategies and innovative treatments from the pavement rehabilitation projects decreased the percentage of IRI above 170 inches per mile, and at the same time improved lower IRI values as well.

In addition, the health of each Caltrans District as measured by IRI is shown on Table 3. This table compares the 2011 to the 2013 PCS and shows the lane miles by 3 ranges of IRI: "Good" when IRI is below 95, "Acceptable" when IRI is equal to or above 95 and below or equal to 170, and "Poor" when IRI is above 170 inches per mile. Further breakdown is shown in Appendix 4 that shows IRI by NHS routes.

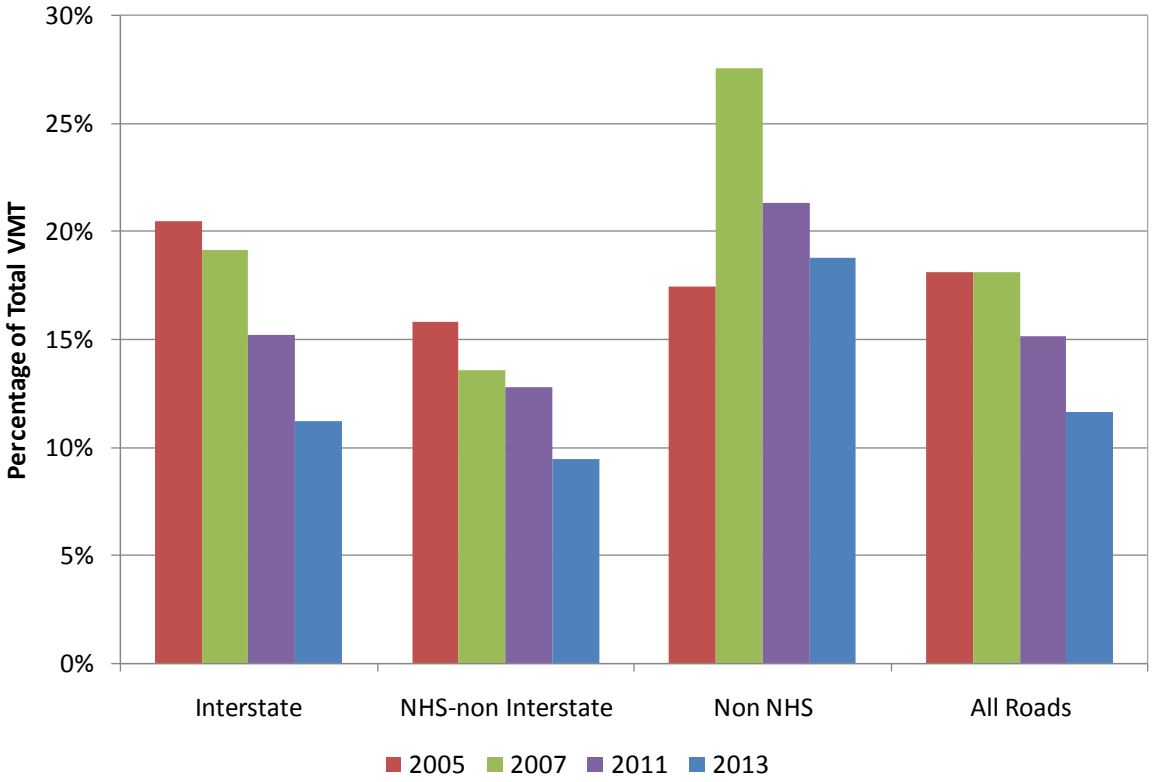


Figure 5. Rough Pavements by Total VMT (IRI > 170 inches per mile)

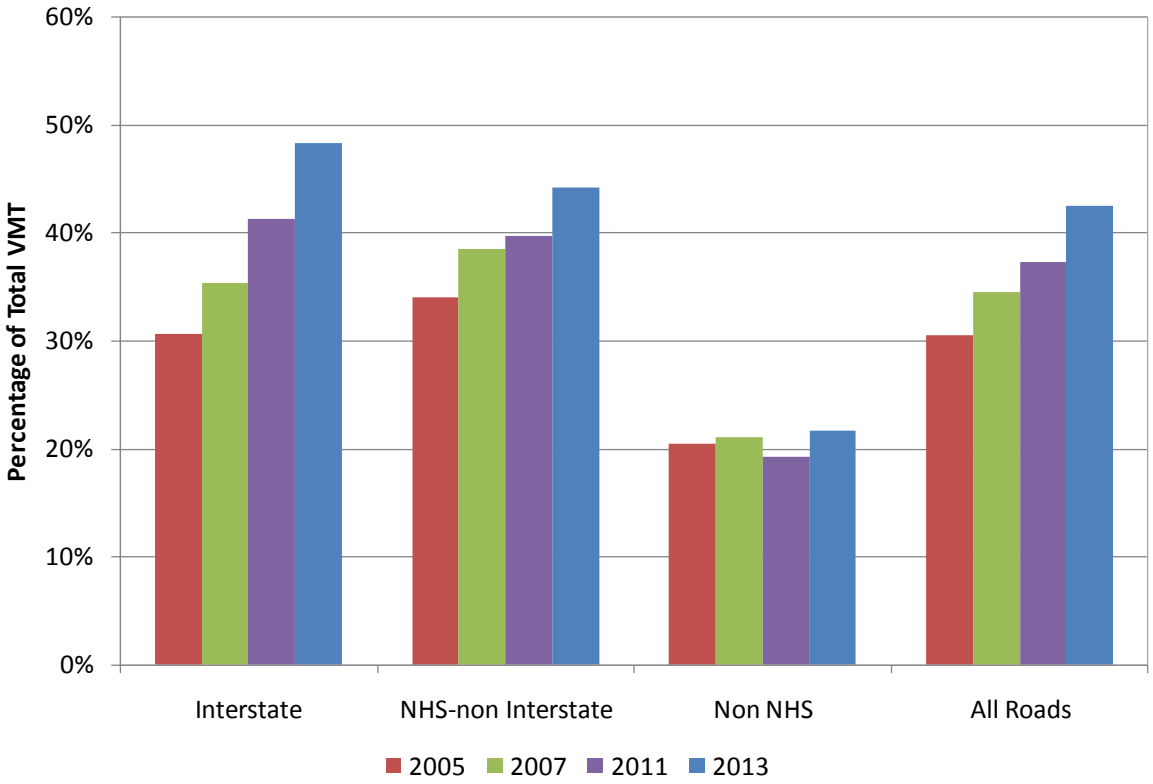


Figure 6. Smooth Pavements by Total VMT (IRI < 95 inches per mile)

Table 3. IRI Distribution by District

District	2011 PCR Lane Miles				2013 PCR Lane Miles			
	1-94	95-170	>170	TOTAL*	1-94	95-170	>170	TOTAL*
District 1	772	995	513	2,280	828	997	422	2,246
District 2	2,058	1,502	327	3,887	2,078	1,523	269	3,871
District 3	1,684	1,978	494	4,157	2,041	1,657	476	4,174
District 4	1,527	2,757	1,336	5,620	1,837	2,643	1,124	5,604
District 5	1,428	1,256	301	2,985	1,363	1,336	332	3,031
District 6	3,132	2,273	267	5,673	3,110	2,182	272	5,564
District 7	1,197	2,990	1,716	5,902	1,665	2,849	1,238	5,753
District 8	2,756	2,875	630	6,261	2,795	2,956	528	6,279
District 9	1,320	473	57	1,851	1,297	449	66	1,811
District 10	1,315	1,761	358	3,433	1,519	1,485	310	3,314
District 11	1,600	1,950	215	3,764	1,894	1,844	128	3,866
District 12	506	1,152	265	1,923	501	1,069	266	1,835
Total	19,295	21,963	6,479	47,737	20,927	20,990	5,432	47,349

*Excludes locations where IRI was not collected, bridges and no MSL.

CHAPTER 3 – PRIORITIZING PAVEMENT NEEDS

In order to diagnose the right pavement treatment, the Pavement Condition Priority Matrix (Table 4) sets the priority value for each pavement lane mile on the SHS. This priority matrix uses the combination of ride quality or IRI, structural distress and Maintenance Service Level (MSL) to examine the pavement. The MSL describes the functions of the route within the state highway network and the volume of traffic it serves. For maintenance programming purposes, the State highway system has been classified as MSL 1, 2 and 3 highways with the following definitions:

MSL 1 – Contains route segments in urban areas functionally classified as Interstate, Other Freeway/Expressway, or Other Principal Arterial. In rural areas, 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 with relatively low traffic volumes. Route segments where route continuity is necessary are also assigned MSL 3 designation.

The next step in the examination is that the 'Priority Number' is assigned to that pavement to show which pavement lane miles are in critical condition and which are in good shape. The choices for ride quality are poor or acceptable and the structural distress is major, minor, or none.

After the ride quality, structural distress and MSL are known, the value of each pavement lane mile is used to identify whether a pavement requires a maintenance, rehabilitation or CAPM project. The IRI and the cracking levels provide the "tipping point" where a project is in the red condition state as a CAPM project or rehabilitation project. For example, the IRI is categorized as poor ride and the structural distress is:

- **Major distress:** priority numbers 1, 2 or 11 then rehabilitation is selected.
- **Minor distress:** priority numbers 3, 4 or 12 then CAPM treatment is selected.
- **Poor ride only (no other distress):** priority numbers 5 or 6 then CAPM is selected.

Major distress prioritizes the distressed pavement lane miles in critical condition for rehabilitation. They are remedied by projects requiring extensive repairs that usually improve the pavement's structural condition. Those locations with minor distress are in satisfactory condition for CAPM work and use surface treatments. Projects with acceptable ride and no distress with priority greater than 14 and less than 98 are maintenance projects. These lane

miles are in basically good shape with minor surface distress, as shown on Figure 1 as the yellow state, and only require preventive and corrective maintenance work.

Table 4. Pavement Condition Priority Matrix

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

For pavements requiring only maintenance work, i.e., priority numbers greater than 14 and less than 98, various treatments are performed. A Major Maintenance Program Treatment Matrix is used to rate this category of pavement. Preventive and corrective maintenance treatments are based on the work group and distresses shown in Table 5.

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 Caltrans Districts target allocation of funds for major maintenance contracts. This process links budget modeling, allocations and pavement ratings together using actual data collected through the PCS.

Table 5. Major Maintenance Program Treatment Matrix

Maintenance Type	Work Group	Distress
Preventive	Premium Seal/Overlay	Low Alligator A, Low Alligator B (on High ADT Routes)
	Cracks – Crack Seal	Alligator A, Misc. Cracks
	Chip Seal/Slurry Seal	Alligator A, Low Alligator B (on Low ADT Routes), Miscellaneous Cracks
Corrective	Overlay	Patching, Alligator A, High Alligator B
	Mill & Resurface	Wheel Rutting, High Alligator A, Bleeding
	Slab Replacement	Slab Cracking
	Mill and Resurface (Shoulder)	Joint Depression, Open Cracks, Alligator A & B

When two pavement segments have identical priority values, determining the site that will receive project development and funding depends on factors such as traffic volume, project costs, and ongoing maintenance expenditures, as well as a detailed pavement condition comparison. The distribution of distressed lane miles is shown in Appendix 2.

CHAPTER 4 – COSTS, EXPENDITURES AND FUNDING

In the last four years, Caltrans delivered almost $3.9 billion in pavement projects on nearly 18,000 lane miles. However, these funds may not be available in the future and Caltrans is leveraging dollars to do more with less. Table 6 summarizes the State Highway Operations and Protection Plan (SHOPP) and maintenance (HM1) projects awarded from FY 2009/10 to FY 2012/13.

Table 6. Pavement Projects Awarded (Capital Cost Only) from FY 2009/10 to FY 2012/13

Type of Pavement Project	FY 2009/10		FY 2010/11		FY 2011/12		FY 2012/13		Total*	
	Million Dollars	Lane Miles	Million Dollars	Lane Miles	Million Dollars	Lane Miles	Million Dollars	Lane Miles	Million Dollars	Lane Miles
FUNDING										
Maint Total	$242	3,327	$332	3,231	$274	2,449	$202	2,051	$1,050	11,058
SHOPP										
CAPM	$66	325	$553	2,323	$375	1,314	$198	546	$1,192	4,506
Rehab	$216	185	$485	851	$783	895	$158	222	$1,642	2,153
SHOPP Total	$282	510	$1,038	3,174	$1,158	2,209	$356	768	$2,834	6,659
Maint & SHOPP Total	$524	3,837	$1,370	6,405	$1,432	4,658	$558	2,819	$3,881	17,717

*The dollars do not include support costs.

To determine the costs per lane mile for various types of projects and to predict future pavement distress, Caltrans keeps track of the projects awarded. Figure 7 is a summary of the 2011/12 Capital Preventive Maintenance (CAPM) and rehabilitation projects, which are in the SHOPP, and maintenance (HM1) projects awarded and lane miles constructed. $1.4 billion of rehabilitation, CAPM and HM1 contracts were awarded on all state highways as follows: $783 million for rehabilitation to repair 895 lane miles of pavement; $375 million for CAPM to repair 1,314 lane miles of pavement and $274 million for HM1 to repair 2,449 lane miles of pavement. Eighty-one percent of the total dollar amount was spent on NHS routes. Figure 8 shows the cost and number of lane miles using a maintenance strategy for contracts awarded in the 2011/12 FY, whereas Figure 9 shows the cost and number of lane miles paved using both rehabilitation and CAPM strategies for contracts awarded in the 2011/12 FY.

Figure 10 shows the HM1, CAPM and rehabilitation projects in terms of contract dollars awarded and lane miles constructed for the 2012/13 FY. In the 2012/13 FY, a total of $558 million of rehabilitation, CAPM and HM1 contracts were awarded on all state highways as follows: $158 million for rehabilitation to repair 222 lane miles of pavement; $198 million for CAPM to repair 546 lane miles of pavement and $202 million for HM1 to repair 2,051 lane miles of pavement. Eighty percent of the total dollar amount was spent on NHS routes. Figure 11 shows the cost and number of lane miles using a maintenance strategy for contracts awarded in the 2012/13 FY, whereas Figure 12 shows the cost and number of lane miles paved using both rehabilitation and CAPM strategies for contracts awarded in the 2012/13 FY.

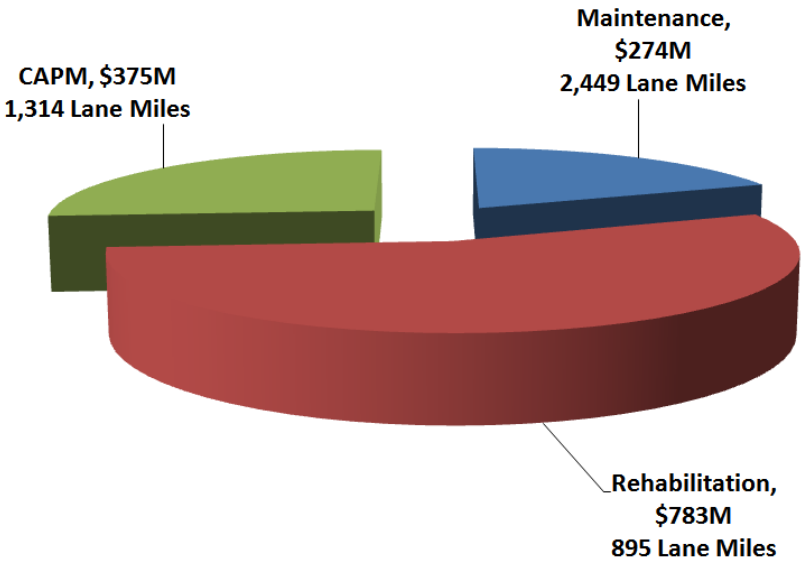


Figure 7. Accomplishments /Contracts Awarded – FY 2011/12

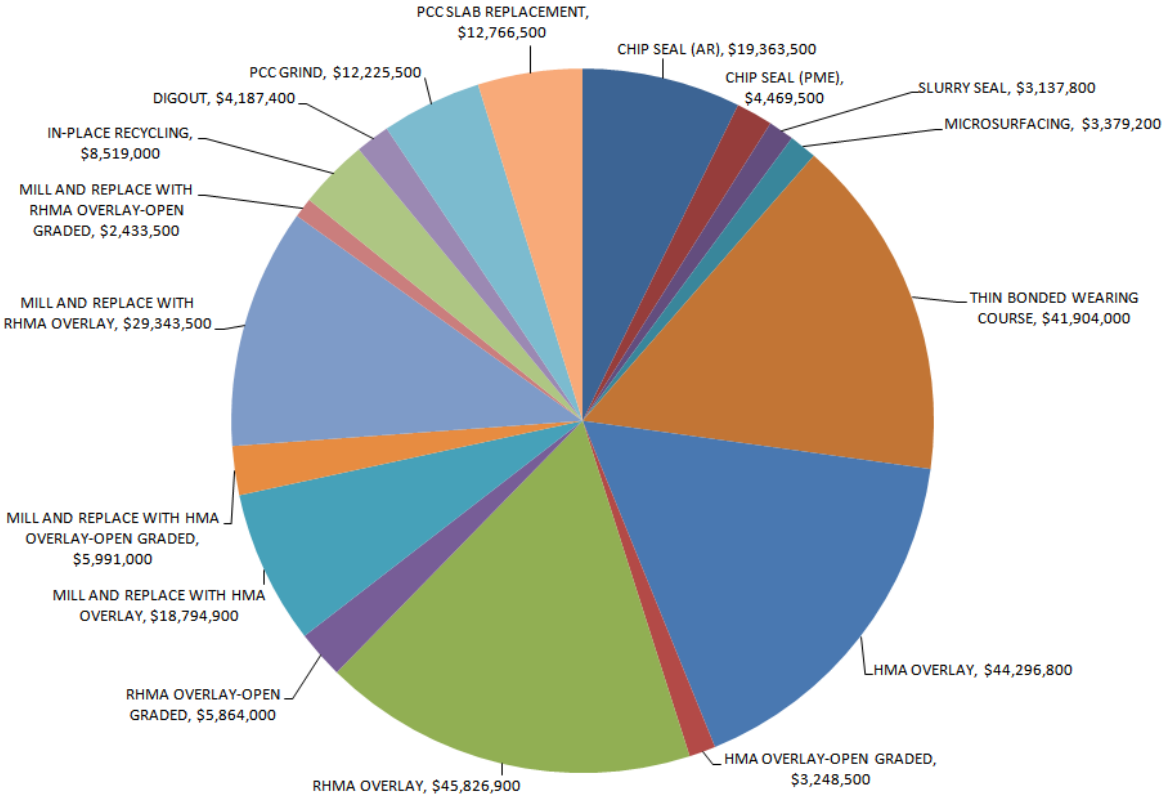


Figure 8. Maintenance (Preventive and Corrective) Projects by Strategy – FY 2011/12

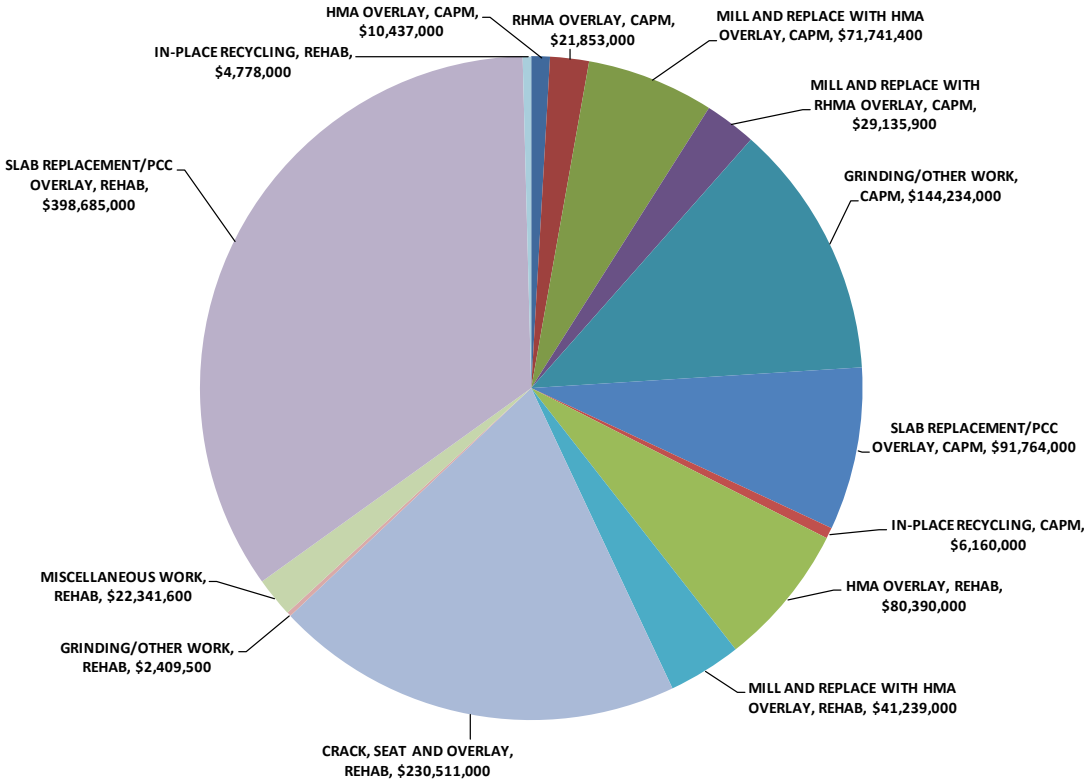


Figure 9. Rehabilitation and CAPM Projects by Strategy – FY 2011/12

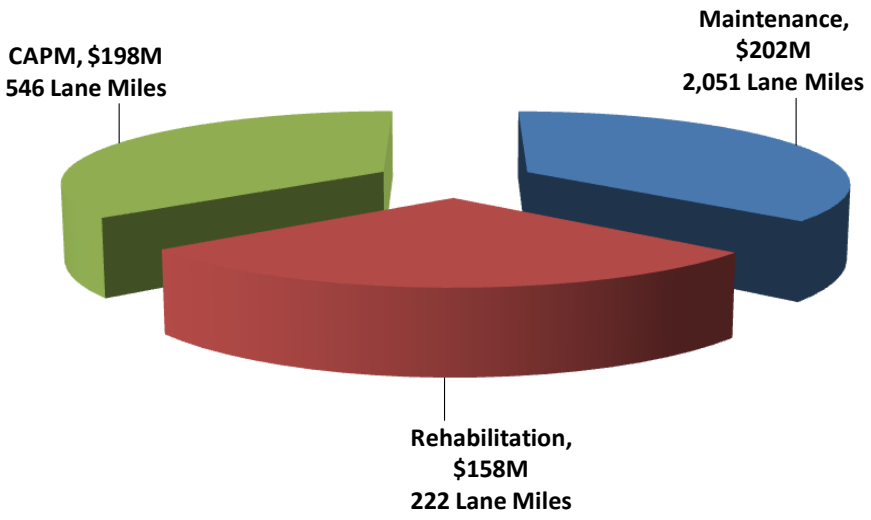


Figure 10. Accomplishments /Contracts Awarded – FY 2012/13

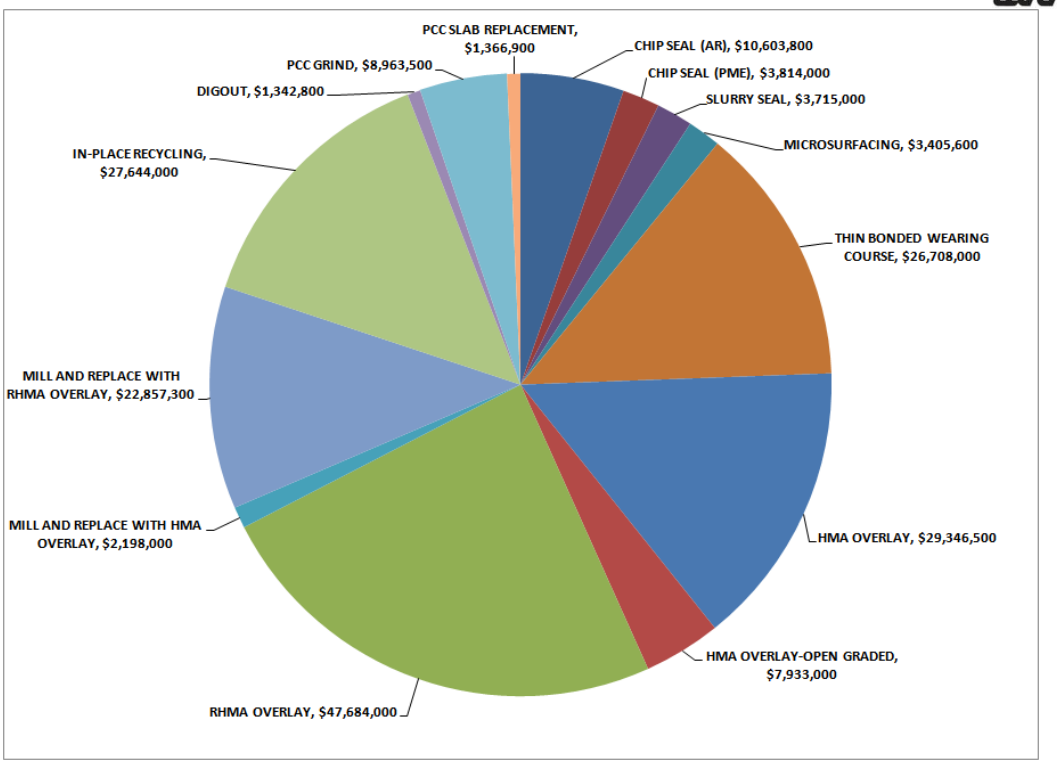


Figure 11. Maintenance (Preventive and Corrective) Projects by Strategy – FY 2012/13

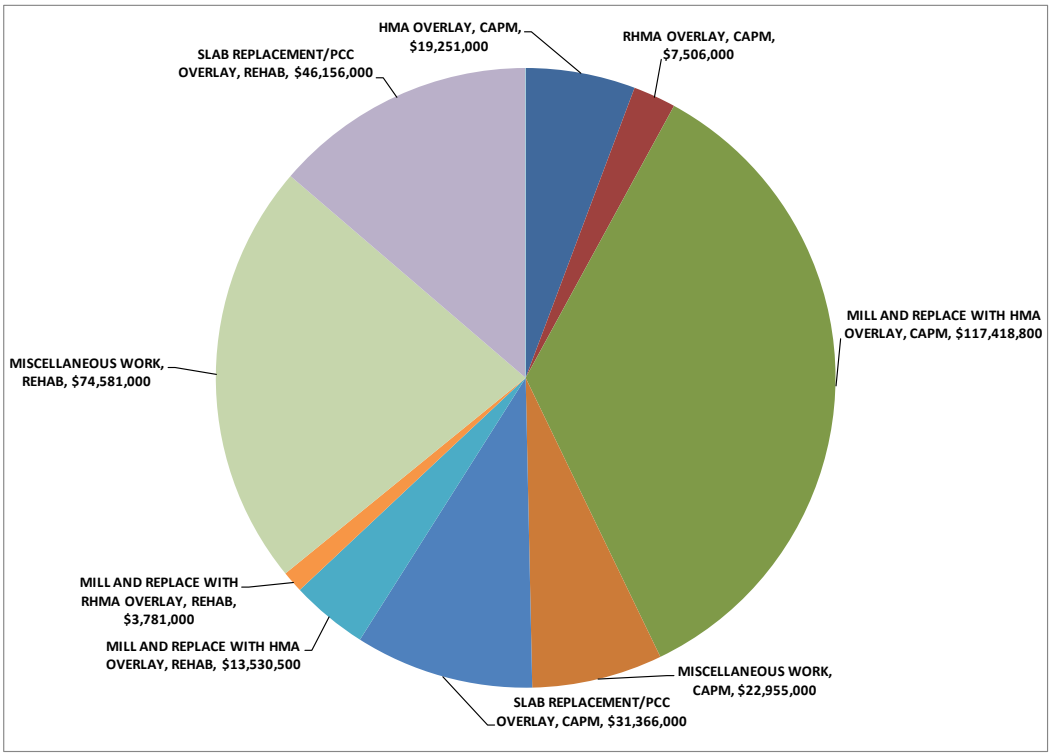


Figure 12. Rehabilitation and CAPM Projects by Strategy – FY 2012/13

CHAPTER 5 - MAINTENANCE AND REHABILITATION FINANCIAL PLANS

Five-Year Maintenance Plan

Streets and Highways Code Section 164.6 requires Caltrans to prepare a Five-Year Maintenance Plan to address the maintenance needs of the State Highway System. There are two long-term goals: (1) reduce the current backlog of pavement needing preventive/corrective maintenance to 5,000 lane miles or 10% of the inventory, and (2) reduce the deterioration rate of pavement becoming distressed to 500 lane miles, or 1 percent of the inventory. The annual pavement maintenance funding is $234 million with a treatment goal of 2,700 lane miles.

Ten-Year Rehabilitation Plan

Under the Streets and Highways Code Section 164.6, the Department is required to prepare a Ten-Year Rehabilitation Plan (TYP) for rehabilitation and reconstruction of all state highways and set performance measures and goals. This plan is to be updated every two years. The 2013 TYP's statewide pavement performance goal is to reduce the total distressed lane miles for the system to 5,500 by FY 2023/24.

To meet the statewide goal, all urban Districts will need to repair their distressed lane miles in critical condition to meet their goals. A sustained level of funding will help reduce these distressed lane miles. Table 7 compares the Districts' distressed lane miles at the time the 2013 PCS was collected to the 2013 TYP performance goal (Table 7). At the end of the ten years, in FY 2023/24, the districts will need to reduce their distressed lane miles by the difference to meet their performance goal. However, this table does not consider the new distressed lane miles that are added on each year to the SHS due to normal wear and environmental changes.

Table 7. 2013 Distressed Lane Miles vs. Ten-Year Plan Performance Goal

District	Distressed Lane Miles	Performance Goal*	Difference	Goal Met	System Lane Miles	% Distressed
1	480	320	160		2,343	5%
2	505	540	-35	X	4,001	8%
3	753	560	193		4,327	9%
4	1,261	599	662		5,907	12%
5	582	372	210		3,180	6%
6	659	611	48		5,748	12%
7	1,414	712	702		6,240	13%
8	937	660	277		6,558	13%
9	85	146	-61	X	1,787	4%
10	591	449	142		3,465	7%
11	257	297	-40	X	4,132	8%
12	297	234	63		1,883	4%
TOTAL	7,820	5,500	2,320		49,570	100%

* From the 2013 Ten-Year State Rehabilitation Plan

As shown in Table 7 Districts 2, 9 and 11 are below the 10% pavement performance goal and will be focusing on preventive maintenance as well as CAPM and rehabilitation projects.

Beginning in January 2013, the "2013 TYP," anticipates the pavement needs to be $2.8 billion per year over the next decade, although only $685 million per year in funding is predicted, i.e., only twenty-three cents of every dollar is actually available. Without increasing pavement funding and establishing an ongoing stable funding source, the distressed lane miles are predicted to increase from 16 percent today to 34 percent within the next 10 years (Figure 13).

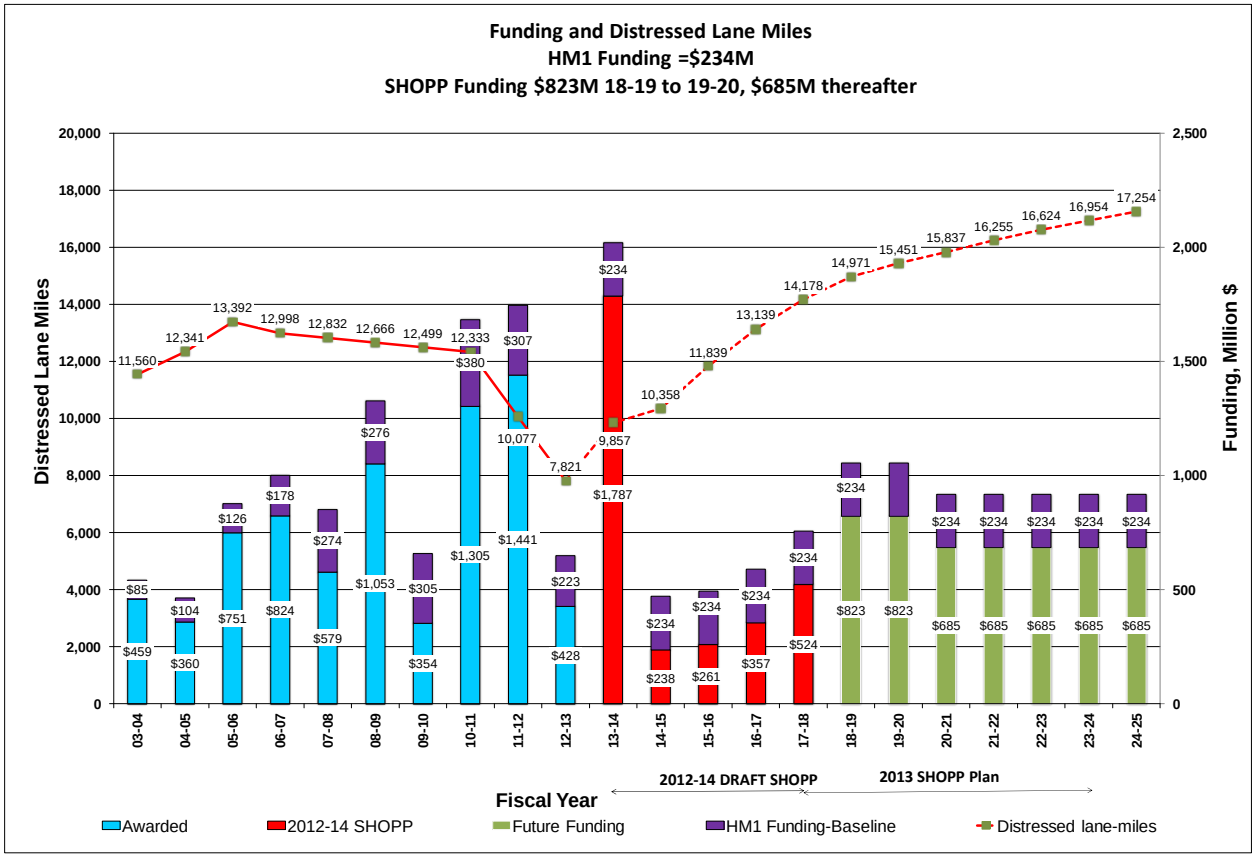


Figure 13. Funding and Distressed Lane Miles

The blue columns in Figure 13 represent past SHOPP project dollars awarded and the purple columns represent past and future HM1 dollars awarded. The red line represents the total number of distressed lane miles as it relates to funding. The red columns are 2012 and draft 2014 programmed SHOPP dollars and the green columns represent existing 2013 TYP fiscally constrained dollars. As pavement funding is increased, there is a direct correlation in the reduction of distressed lane miles.

CHAPTER 6 – COST EFFECTIVENESS OF PAVEMENT STRATEGIES

By employing aggressive, quick and preventive treatments, Caltrans can avoid more costly medicine in the future. For example, preventive maintenance costs an average of $106,000 per lane mile, while major rehabilitation work is 8 times more expensive. Figure 14 shows that a preservation treatment should be applied before the pavement gets worse and needs a major rehabilitation or reconstruction project.

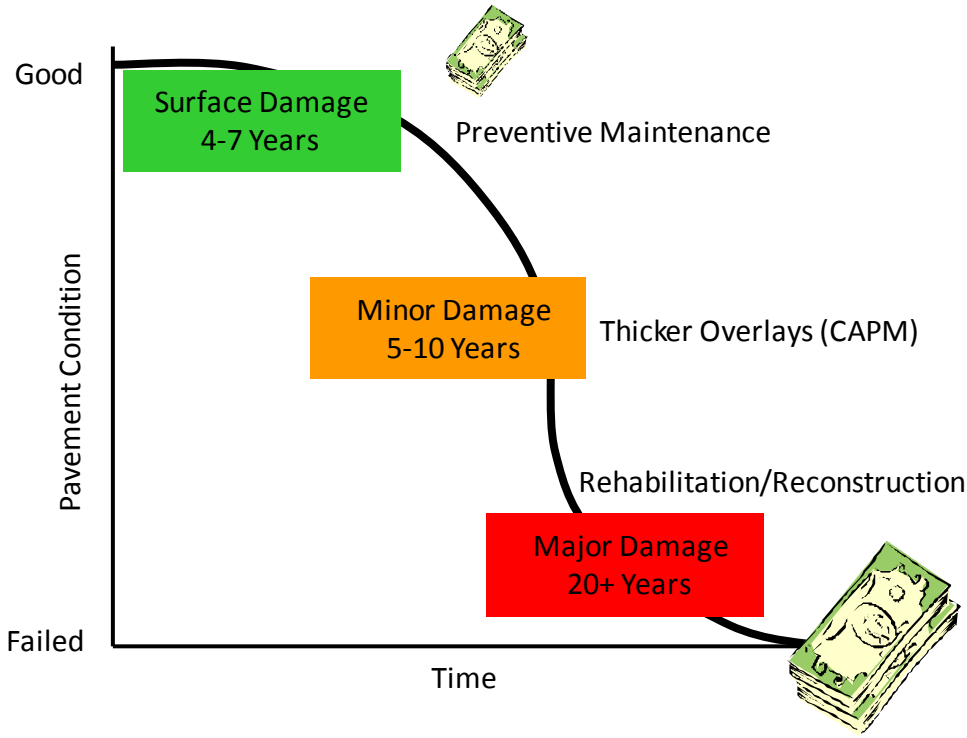


Figure 14. Cost Effectiveness of Pavement Strategies

Preventive maintenance treatments are applied to maintain "good" pavement in a state of good repair. Studies show that applying a preventive maintenance treatment to pavement in good condition extends the service life and minimizes the need for more costly pavement rehabilitation strategies. These preventive maintenance treatments can extend a pavement's service life four to seven years depending on the traffic volumes and environmental conditions. Awarded HM1 projects averaged $112,000 per lane mile in FY 2011/12 and $98,000 per lane mile in FY 2012/13. The average cost for the two years was $106,000 per lane mile.

A CAPM project can successfully restore pavement to an excellent condition and provide a service life of five to ten years. A CAPM strategy (pavement grinding, isolated slab replacements, or asphalt concrete overlays greater than 1.5 inch, but less than 2.5 inches) is typically performed on pavement with minor distress. Awarded CAPM projects averaged $286,000 per lane mile in FY 2011/12, and $364,000 per lane mile in FY 2012/13. The average cost for the two years was $309,000 per lane mile.

Similar to medical treatments, pavement rehabilitation and reconstruction are the most expensive. They remove and replace the pavement structure rather than the pavement surface. A roadway that is rehabilitated should provide twenty years or more of service life with relatively low maintenance expenditures. The costs for rehabilitation projects, including the upgrade of related facilities, awarded in FY 2011/12 averaged $874,000 per lane mile, and $710,000 per lane mile in FY 2012/13. The average cost for the two years was $842,000 per lane mile. Summaries of various contracted Maintenance and Rehabilitation treatments for the past five years are provided in Appendices 6 and 7.

CHAPTER 7 – RUBBERIZED ASPHALT CONCRETE & GREENHOUSE GAS REDUCTION FOR PAVEMENT

Innovative treatments allow Caltrans to trim its pavement costs and overcome the future challenges of maintaining the SHS. Cost savings, for example, could come through recycling. Caltrans uses recycled tires in some pavement, reducing the amount of waste tires ending up in California's landfills. According to the "2012 Crumb Rubber Report," nearly 35 percent of all Caltrans asphalt pavement was designed with rubberized asphalt. Starting in 2008, Public Resources Code (PRC) Section 42703 mandated an increase in the amount of rubber in our hot-mix asphalt to 35 percent by 2013, as shown in Figure 14. In 2011, Caltrans used about 7.5 million tons of asphalt containing rubber hot mix asphalt (RHMA). Caltrans has been using recycled tires in asphalt for more than 30 years.

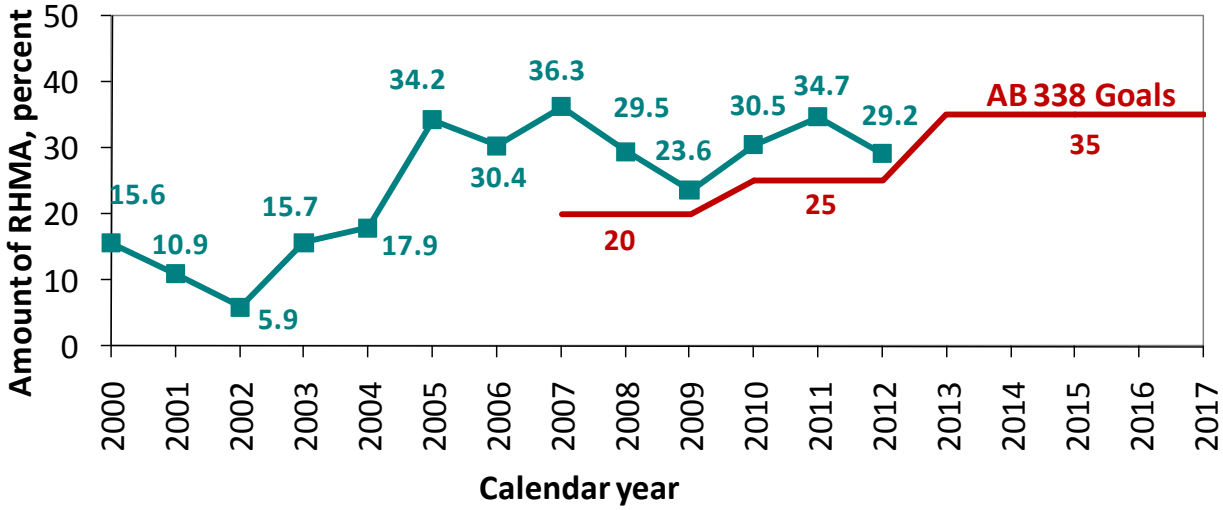


Figure 15. Asphalt Rubber Usage by Caltrans

Table 8 shows that in 2011, Caltrans placed about 2.6 million tons of asphalt containing RHMA compared to conventional asphalt. Caltrans has exceeded the PRC code mandates and currently recycles nearly 35 percent of rubber hot-mix asphalt. Last year, this allowed more than 4 million waste tires to be diverted from our landfills.

Table 8. Crumb Rubber Modifier Usage from Calendar Year 2008 to 2011

Type of Pavement Project	Calendar Year 2008			Calendar Year 2009			Calendar Year 2010			Calendar Year 2011		
	Total Tons	RHMA Tons	%	Total Tons	RHMA Tons	%	Total Tons	RHMA Tons	%	Total Tons	RHMA Tons	%
Maintenance	906,692	690,958	76.2	1,260,064	764,323	60.7	901,559	557,929	61.9	1,437,386	826,949	57.5
CAPM	605,759	453,327	74.8	295,357	112,644	38.1	420,125	303,579	72.3	2,126,531	1,287,345	60.5
Rehabilitation	2,073,430	224,191	10.8	2,202,330	361,084	16.4	691,082	174,950	25.3	2,000,231	397,086	19.9
Other	1,153,454	28,611	2.5	1,832,948	81,137	4.4	1,847,855	145,110	7.9	1,958,204	98,691	5.0
Total	4,739,335	1,397,088	29.5	5,590,698	1,319,189	23.6	3,860,621	1,181,569	30.6	7,522,352	2,610,071	34.7

The District breakdown is shown in Appendix 8. The total tons of all project types (HM1, CAPM, Rehab, and New Construction) are shown as recorded in the Caltrans Major Construction Payment and Information System each calendar year. The program breakdown is the following:

- **Maintenance:** HM1 funded
- **CAPM:** SHOPP funded
- **Rehab:** SHOPP Funded
- **Other:** All other program's projects not listed already above (Safety, Landscape, State Transportation Improvement Program, Protective Betterment, etc.)

Assembly Bill 32 (AB 32) requires the Greenhouse Gas (GHG) reduction for transportation related activities. Caltrans has been engaged in new technologies to reduce GHGs. After AB 32 was signed in 2006, Caltrans created a Climate Action Team (CAT) to promote GHG reduction in our daily operations. This CAT for sustainable pavements modified Caltrans standards to reduce emissions from the manufacturing of cement.

Caltrans is on the cutting edge of environmental and sustainability developments and has been engaged in numerous new paving technologies to reduce GHGs. By using different kinds of recycled materials, we are significantly reducing GHG emissions from our pavements and continue to evaluate and improve the performance of various paving materials.
According to the April 2013 report "Caltrans Activities to Address Climate Change" it is estimated that over 61,000 tons of GHG emissions are reduced annually using these types of projects. We have had successes in developing and using:

- Supplementary Cementitious Materials (SCM)
- Cold in-place recycling (CIR)
- Warm-mix Asphalt (WMA)
- Recycled asphalt pavement (RAP)
- Recycled asphalt shingles (RAS)

One of the goals for our CAT included lowering GHG emissions from cement production. Caltrans modified its standards to do just that. The "21st Century Concrete Guidelines for Design & Inspection" focused on GHG emissions associated with concrete production. These guidelines removed the cap for SCM and allowed slag or fly ash additives to concrete mixes. Less cement production reduces GHG emissions.

Caltrans is also moving forward with CIR recycling to remove old paving materials, reprocess it on site, and place it as a new roadway. This fiscal year, Caltrans has targeted $36 million to replace rural two-lane highways with CIR. The CIR process will increase safety, protect the environment, and repair highways in rural locations. This reduces the pressure on aggregate mines and GHG emissions.

In regards to WMA, the Federal Highway Administration's (FHWA) "Every Day Counts Initiative" has recognized Caltrans' as a "champion" with this technology. WMA allows asphalt mixes to be placed at lower temperatures. This extends the paving season, requires less fuel consumption, and increases worker safety by reducing odors and fumes. In the last three years, Caltrans has paved one million tons of asphalt using WMA technology in California.

New technology helps us reduce our use of California's diminishing supply of asphalt aggregates. By adding RAP to the asphalt, we decrease the mining of new aggregate materials, use fewer trucks to transport materials, and reduce the use of virgin asphalt binder.

As homes replace their old asphalt roof shingles, Caltrans proposes to use more RAS to recycle these shingles into new asphalt. Going forward, our goal is to develop specifications with up to 5 percent recycled asphalt shingles and up to 40 percent recycled aggregate materials.

Caltrans is working with the FHWA to analyze and assess the life-cycle of pavement to find *new* ways to extend service life while also reducing GHG emissions. In the last 10 years, long-life pavement has doubled the pavement service life to 40 years. Caltrans has adopted continuously reinforced concrete for high-traffic, goods movement corridors and we have implemented this strategy in several projects.

We are in the process of establishing sustainable pavement performance curves to measure the actual benefit-to-cost ratio of these pavement strategies. This will improve our decision making and ensure the efficient use of funds.

In regards to research, Caltrans has partnerships with several international pavement researchers at organizations such as the Danish Road Institute. Caltrans also partners with California University System research centers at:

- The California Pavement Preservation Center at California State University in Chico.
- The University of California Pavement Research Center in Davis.
- The Pavement Center at California State Polytechnic University in San Luis Obispo and California State University in Long Beach.

Studies show that smoother pavements reduce rolling resistance, lower carbon dioxide emissions, and increase fuel economy. Caltrans expects to complete its efforts with FHWA, other DOTs, and industry associations in the next three years on sustainable pavements by defining and developing strategies to reduce the GHG footprint even further. As new innovations and information become available, Caltrans will incorporate best practices into its current pavement strategies. These strategies will represent California's vision of a transportation system that not only meets our future mobility needs, but also our environmental priorities in GHG reduction.

CHAPTER 8 – ONGOING SYSTEM IMPROVEMENTS

As the age of the SHS heads into its senior years, Caltrans is using high-tech strategies and continually monitors the SHS through the PCS to keep it in good shape. The aging SHS's nearly 50,000 lane miles need to be maintained while carrying nearly 35 million vehicles per year. Consequently, Caltrans is turning to advanced technology to keep the system in top condition.

By using advanced technology, Caltrans can trim pavement costs and overcome the challenges of maintaining the SHS in the future. These innovative tools and best practices can optimize the pavement treatment strategies and improve the pavement design, construction, and maintenance. For example, life cycle cost analysis will be utilized to select the pavement alternatives with the lowest construction costs, the lowest maintenance cost and the lowest user costs. This will allow designers to take site-specific information and design pavement treatment strategies to meet performance measures. Construction improvements include performance-based specifications. These efforts will define the future pavement condition and provide incentives for improved construction methods.

Another technology is PaveM that combines ground penetrating radar (GPR) information with automated highway pavement condition survey (APCS) data. The GPR shows what is under the pavement and the APCS collects pavement surface condition data at highway speeds using lasers and cameras. PaveM will be used to recommend the best pavement strategies, predict how long the pavement will last and recommend more cost effective treatments.

Ground Penetrating Radar

For the internal health of the SHS, the GPR is similar to a cat scan that shows what is under the pavement. In 2012, this statewide GPR data collection was completed. Early in 2013, the Districts were trained on the GPR tool. The Districts were able to use the GPR tool to store their pavement core data samples that show the materials under the pavement surface. This pavement structure will be a major tool used by the pavement performance models. By using the GPR tool, the districts can provide a more accurate diagnosis and prescribe treatments to keep the SHS in better shape.

Automated Pavement Condition Survey

For the external health of the SHS, the APCS can be used to track the pavement surface condition of every lane mile on the SHS. In the spring of 2013, the District APCS training was completed. The districts can use APCS to predict how long the pavement will last. Along with the APCS data, there will be an "APCS Manual" that will describe these new distresses collected. This APCS manual will be completed in the fall of 2013.

PaveM

The state-of-the-art Pavement Management System software (PaveM) will utilize pavement performance data, and similar to any other health maintenance system, it targets future repairs

that do the most good for the least amount of money. GPR, APCS, traffic and climate data will be entered into PaveM to predict pavement performance. This application will also be optimizing the selection of pavement strategies based on pavement performance prediction, overall condition of the network and various budget scenarios. PaveM will utilize a web-based system with service-oriented architecture. The project is currently in a roll-out phase. District training has started in District 7 and more training sessions are scheduled for the fall of 2013 and spring of 2014.

CHAPTER 9 – FUTURE PLANS

Caltrans continues to use performance based management to insure investments are targeted towards prioritized needs and pavement is a priority for Caltrans. To keep the roads safe and smooth, with enough capacity to carry increasing amounts of traffic, we will need a stable funding source going forward.

Because of Proposition 1B and the American Recovery and Reinvestment Act (ARRA) funding, in addition to our SHOPP and HM1 funds, Caltrans was able to invest $2.0 billion into almost 7,500 lane miles during the last two fiscal years. The total number of distressed lane miles has dropped from 25% in 2011 to 16% in 2013. Both Proposition 1B and ARRA programs were established as "one time" funding sources, and these programs are sunsetting. Without a future increase in pavement funding, the total number of distressed lane miles is expected to jump to 34% over the next 10 years.

Caltrans is committed to ensuring California's SHS is maintained for future generations to use. We will continue to utilize pavement funds in an efficient manner, and collaborate with our partners to ensure the effectiveness of our strategies, while at the same time protecting the environment.

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APPENDIX

Appendix 1 – Map of Caltrans Districts

Appendix 2 – Centerline Miles, Lane Miles and Distressed Lane Miles in 2013

PRIORITY	Distressed Lane Miles	
Major Structural Distress	2,635	5.3%
Minor Structural Distress	2,702	6.0%
Poor Ride Quality Only	2,483	5.0%
No Distress/Minor Surface Damage	41,899	84%
TOTAL	49,720	100%

	Centerline Miles		Lane		Distressed Lane			Major Structural Distress		Minor Structural Distress		Poor Ride Quality	
	Miles	Percent	Miles	Percent	Miles	Percent (Total Distressed LM)	Percent (Category Lane Miles)	Miles	Percent (Category Lane Miles)	Miles	Percent (Category Lane Miles)	Miles	Percent (Category Lane Miles)
MSL													
1	5,917	40%	27,844	56%	2,805	36%	10%	1,064	4%	802	3%	938	3%
2	5,275	36%	14,122	28%	3,206	41%	23%	1,037	7%	624	4%	1,545	11%
3	3,437	23%	6,998	14%	1,810	23%	26%	534	8%	1,276	18%	0	0%
	14,630	99%	48,963	98%	7,821	100%	16%	2,635	5%	2,702	6%	2,483	5%
DISTRICT													
1	926	6%	2,343	5%	480	6%	20%	75	3%	212	9%	193	8%
2	1,719	12%	4,001	8%	505	6%	13%	248	6%	208	5%	49	1%
3	1,450	10%	4,339	9%	753	10%	17%	308	7%	289	7%	155	4%
4	1,344	9%	5,917	12%	1,261	16%	21%	218	4%	332	6%	711	12%
5	1,144	8%	3,189	6%	582	7%	18%	217	7%	268	8%	97	3%
6	2,017	14%	5,759	12%	659	8%	11%	328	6%	247	4%	85	1%
7	1,067	7%	6,295	13%	1,414	18%	22%	414	7%	403	6%	597	9%
8	1,845	12%	6,571	13%	937	12%	14%	385	6%	319	5%	233	4%
9	739	5%	1,787	4%	85	1%	5%	7	0%	78	4%	0	0%
10	1,304	9%	3,474	7%	591	8%	17%	302	9%	191	5%	98	3%
11	1,009	7%	4,158	8%	257	3%	6%	93	2%	87	2%	77	2%
12	268	2%	1,886	4%	297	4%	16%	40	2%	69	4%	188	10%
TOTAL	14,832	100%	49,720	100%	7,821	100%	16%	2,635	5%	2,702	5%	2,483	5%
ROAD TYPE													
Multi-Lane Divided	5,677	38%	30,802	62%	3,797	49%	12%	1,286	4%	926	3%	1,585	5%
Multi-Lane Undivided	395	3%	1,350	3%	281	4%	21%	105	8%	61	5%	114	8%
Two-Lane	8,760	59%	17,568	35%	3,743	48%	21%	1,244	7%	1,715	10%	784	4%
TOTAL	14,832	100%	49,720	100%	7,821	100%	54%	2,635	5%	2,702	5%	2,483	5%
CITY													
City	3,083	21%	17,888	36%	2,823	36%	16%	684	4%	684	4%	1,456	8%
Non-city	11,749	79%	31,831	64%	4,998	64%	16%	1,951	6%	2,018	6%	1,028	3%
TOTAL	14,832	100%	49,720	100%	7,821	100%	16%	2,635	5%	2,702	5%	2,483	5%
NATIONAL HIGHWAY SYSTEM													
NHS Interstate	2,368	16%	14,408	29%	1,495	19%	10%	562	4%	498	3%	435	3%
NHS non-Interstate	5,932	40%	21,706	44%	3,050	39%	14%	1,027	5%	607	3%	1,416	7%
Non-NHS roads	6,532	44%	13,606	27%	3,276	42%	24%	1,046	8%	1,598	12%	632	5%
TOTAL	14,832	100%	49,720	100%	7,821	100%	16%	2,635	5%	2,702	5%	2,483	5%
INTERMODAL CORRIDORS OF ECONOMIC SIGNIFICANCE (ICES)													
ICES	3,353	23%	18,376	37%	1,934	25%	11%	734	4%	627	3%	573	3%
Non-ICES roads	11,479	77%	31,343	63%	5,887	75%	19%	1,901	6%	2,075	7%	1,911	6%
TOTAL	14,832	100%	49,720	100%	7,821	100%	16%	2,635	5%	2,702	5%	2,483	5%
PAVEMENT TYPE													
Flexible	12,116	82%	33,182	67%	5,608	72%	17%	1,752	5%	2,039	6%	1,817	5%
Rigid	2,716	18%	16,538	33%	2,213	28%	13%	883	5%	663	4%	667	4%
TOTAL	14,832	100%	49,720	100%	7,821	100%	16%	2,635	5%	2,702	5%	2,483	5%

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

(Excludes bridges, ramps and frontage roads)

Lane miles are rounded to whole numbers.

Appendix 3 – Distribution of Lane Miles by Roadway Class in 2011 and 2013

2011 PCR Lane Miles	Major Distress			Minor Distress			Poor Ride Only			Distressed L M			Maintenance			Good/Excellent			Total Lane Miles			% Total Distressed Lane Miles		
	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3
District 1	41	43	68	49	49	214	21	141	41	111	233	323	126	138	117	838	355	103	1,075	727	543	2%	6%	9%
District 2	121	328	250	34	98	227	4	16	16	159	442	493	235	732	497	511	663	264	905	1,837	1,254	3%	11%	14%
District 3	118	321	183	145	165	145	21	71	20	284	558	348	294	467	221	1,137	762	244	1,715	1,786	813	6%	14%	10%
District 4	225	146	134	204	136	152	166	146	401	595	428	687	411	192	227	2,514	454	441	3,520	1,074	1,355	12%	11%	20%
District 5	155	166	113	85	121	120	6	49	33	246	336	266	273	277	220	647	670	238	1,166	1,283	724	5%	8%	8%
District 6	214	190	318	151	126	115	14	11	19	379	327	452	673	414	516	1,564	618	826	2,616	1,359	1,794	8%	8%	13%
District 7	462	120	125	608	65	48	467	148	124	1,537	333	297	430	153	75	2,481	636	333	4,447	1,122	705	32%	8%	9%
District 8	429	351	80	276	128	50	117	94	19	823	573	149	769	548	163	2,730	594	245	4,321	1,715	557	17%	14%	4%
District 9	8	31	6	4	39	43	0	1	0	12	71	49	200	282	261	654	150	98	866	503	408	0%	2%	1%
District 10	138	307	198	61	144	75	5	39	8	204	490	281	243	546	170	765	530	236	1,212	1,566	687	4%	12%	8%
District 11	46	56	27	174	44	17	59	45	27	279	144	71	555	298	163	1,818	254	391	2,652	696	625	6%	4%	2%
District 12	44	24	9	129	7	5	57	29	51	230	59	65	123	19	29	1,005	215	146	1,357	292	240	5%	1%	2%
Statewide	2,001	2,082	1,511	1,918	1,123	1,211	938	789	759	4,858	3,994	3,481	4,331	4,065	2,659	16,663	5,901	3,565	25,852	13,961	9,705	100%	100%	100%

2013 PCR Lane Miles	Major Distress			Minor Distress			Poor Ride Only				Distressed L M			Maintenance			Good/Excellent			Total Lane Miles			% Total Distressed Lane Miles		
	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Total	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3
District 1	9	24	43	11	21	180	20	132	41	193	40	176	264	207	109	99	815	447	185	1,063	732	548	2%	5%	15%
District 2	23	116	108	6	37	165	16	25	8	49	45	178	281	239	785	483	650	922	416	934	1,886	1,181	2%	5%	16%
District 3	65	158	85	21	116	152	39	93	24	155	126	367	261	334	493	210	1,332	989	228	1,792	1,848	699	5%	11%	14%
District 4	112	75	31	129	128	75	134	528	49	711	375	731	155	421	346	53	2,675	1,001	160	3,470	2,078	369	15%	21%	9%
District 5	61	69	87	18	98	152	5	74	18	97	84	241	257	278	401	242	807	731	147	1,170	1,374	646	3%	7%	14%
District 6	122	98	109	50	90	107	35	39	11	85	207	226	226	756	586	471	1,696	851	740	2,659	1,664	1,437	8%	7%	13%
District 7	273	136	5	273	100	30	301	241	55	597	847	477	90	621	334	35	2,956	813	122	4,424	1,624	247	33%	14%	5%
District 8	191	179	15	149	129	41	110	121	1	233	450	429	58	746	771	154	3,017	747	200	4,213	1,947	411	18%	12%	3%
District 9	1	5	1	1	23	54	0	0	0	0	2	28	55	258	207	184	616	264	173	876	499	411	0%	1%	3%
District 10	46	175	80	28	125	38	36	56	7	98	110	356	125	332	550	137	861	684	319	1,303	1,589	581	4%	10%	7%
District 11	43	43	8	27	49	11	16	50	11	77	85	142	30	726	437	145	1,930	462	200	2,741	1,041	375	3%	4%	2%
District 12	14	27	0	45	24	0	120	68	0	188	179	118	0	162	49	1	1,029	347	1	1,370	515	1	7%	3%	0%
Statewide	959	1,103	573	757	939	1,006	833	1,427	224	2,483	2,549	3,469	1,803	5,081	5,069	2,214	18,385	8,258	2,891	26,015	16,797	6,907	100%	100%	100%

Appendix 4 – 2011 and 2013 IRI Distribution by National Highway System

2011 PCR-Lane Miles	TOTAL															
	NHS-Interstate				NHS				Non-NHS				Total			
	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL
District 1	0	0	0	0	750	463	61	1,274	22	532	452	1,006	772	995	513	2,280
District 2	551	134	7	691	928	388	21	1,337	579	980	300	1,859	2,058	1,502	327	3,887
District 3	682	411	107	1,200	610	447	71	1,129	392	1,120	316	1,828	1,684	1,978	494	4,157
District 4	702	822	203	1,727	700	1,110	192	2,002	125	825	941	1,891	1,527	2,757	1,336	5,620
District 5	0	0	0	0	976	329	29	1,334	452	927	272	1,651	1,428	1,256	301	2,985
District 6	571	168	34	773	1,719	962	60	2,741	842	1,143	174	2,159	3,132	2,273	267	5,673
District 7	478	1,016	817	2,311	629	1,247	529	2,405	90	727	370	1,187	1,197	2,990	1,716	5,902
District 8	1,776	1,068	227	3,071	524	773	140	1,436	456	1,035	264	1,754	2,756	2,875	630	6,261
District 9	0	0	0	0	936	36	0	973	384	437	57	878	1,320	473	57	1,851
District 10	475	122	23	620	512	706	141	1,359	328	934	194	1,455	1,315	1,761	358	3,433
District 11	1,061	778	79	1,918	237	308	32	577	302	863	104	1,269	1,600	1,950	215	3,764
District 12	245	431	55	732	166	302	95	563	94	419	116	629	506	1,152	265	1,923
Total	6,541	4,951	1,550	13,042	8,688	7,071	1,370	17,129	4,067	9,941	3,558	17,566	19,295	21,963	6,479	47,737

2013 PCR-Lane Miles	TOTAL															
	NHS-Interstate				NHS				Non-NHS				Total			
	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL	1-94	95-170	>170	TOTAL
District 1	0	0	0	0	754	478	30	1,286	74	519	391	894	828	997	422	2,246
District 2	526	137	15	678	900	416	27	1,332	652	971	228	1,842	2,078	1,523	269	3,871
District 3	836	314	76	1,225	771	319	56	1,117	434	1,024	344	1,807	2,041	1,657	476	4,174
District 4	801	725	181	1,707	868	941	149	1,952	168	977	795	1,870	1,837	2,643	1,124	5,604
District 5	0	0	0	0	976	352	21	547	386	984	311	889	1,363	1,336	332	3,031
District 6	540	175	44	758	1,675	920	69	2,661	895	1,087	160	2,141	3,110	2,182	272	5,564
District 7	735	957	565	2,256	875	1,226	275	2,312	56	667	398	1,151	1,665	2,849	1,238	5,753
District 8	1,761	1,134	147	3,043	476	773	154	1,455	558	1,049	227	1,948	2,795	2,956	528	6,279
District 9	0	0	0	0	912	39	0	901	385	410	66	878	1,297	449	66	1,811
District 10	499	85	25	609	544	633	159	1,340	476	767	127	1,430	1,519	1,485	310	3,314
District 11	1,346	582	13	1,942	221	373	26	589	326	888	89	1,276	1,894	1,844	128	3,866
District 12	274	359	47	680	143	305	96	602	84	404	123	543	501	1,069	266	1,835
Total	7,318	4,468	1,113	12,900	9,115	6,775	1,061	16,950	4,493	9,747	3,258	17,499	20,927	20,990	5,432	47,349

*Excludes locations where IRI was not collected, bridges and no MSL.

Appendix 5 – Distressed Lane Miles by Priority Group

	2004			2005			2007			2011			2013		
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	427	53	6	464	43	4	251	127	51	152	312	203	75	212	193
2	952	86	1	932	51	0	840	126	1	699	359	36	248	208	49
3	1,091	129	7	1,333	120	36	1,026	311	12	623	455	113	308	289	155
4	1,202	348	57	1,468	323	96	735	499	359	506	492	712	218	332	711
5	880	117	28	747	110	20	621	229	84	433	326	88	217	268	97
6	993	203	7	1,199	159	3	1,018	412	21	722	392	44	328	247	85
7	1,432	438	94	1,627	526	65	768	812	157	706	721	740	414	403	597
8	1,979	186	13	2,021	158	10	1,511	498	145	860	455	231	385	319	233
9	155	55	0	180	60	0	104	46	3	45	86	1	7	78	0
10	900	76	1	1,128	99	0	888	270	49	643	281	52	302	191	98
11	113	301	5	296	253	6	250	353	49	129	235	130	93	87	77
12	133	137	22	124	175	8	92	232	50	76	141	136	40	69	188
Totals	10,257	2,125	239	11,518	2,078	249	8,102	3,914	981	5,594	4,253	2,486	2,635	2,702	2,483

District Lane Miles by Pavement Condition Survey Year

	2004			2005			2007			2011			2013		
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	2,330	485	21%	2,330	511	22%	2,330	429	18%	2,345	667	28%	2,343	480	20%
2	3,995	1,038	26%	3,995	983	25%	3,995	967	24%	3,995	1,094	27%	4,001	505	13%
3	4,285	1,227	29%	4,307	1,489	35%	4,309	1,349	31%	4,314	1,190	28%	4,339	753	17%
4	5,958	1,605	27%	5,976	1,887	32%	5,950	1,594	27%	5,949	1,710	29%	5,917	1,261	21%
5	3,187	1,024	32%	3,187	877	28%	3,168	934	29%	3,174	847	27%	3,189	582	18%
6	5,751	1,203	21%	5,718	1,361	24%	5,755	1,451	25%	5,770	1,157	20%	5,759	659	11%
7	6,158	1,964	32%	6,269	2,219	35%	6,267	1,737	28%	6,274	2,167	35%	6,295	1,414	22%
8	6,575	2,178	33%	6,641	2,189	33%	6,568	2,153	33%	6,593	1,546	23%	6,571	937	14%
9	1,777	210	12%	1,777	240	14%	1,777	153	9%	1,777	132	7%	1,787	85	5%
10	3,471	976	28%	3,472	1,226	35%	3,466	1,206	35%	3,465	976	28%	3,474	591	17%
11	3,927	419	11%	3,937	556	14%	3,989	651	16%	3,972	494	12%	4,158	257	6%
12	1,904	292	15%	1,950	307	16%	1,903	374	20%	1,889	353	19%	1,886	297	16%
Totals	49,318	12,621	26%	49,561	13,845	28%	49,477	12,998	26%	49,518	12,333	25%	49,720	7,821	16%

Statewide Pavement Needs by Survey Year and Priority Group

	2004			2005			2007			2011			2013		
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	10,257	81%	21%	11,518	83%	23%	8,102	62%	16%	5,594	45%	11%	2,635	34%	5%
Minor	2,125	17%	4%	2,078	15%	4%	3,914	30%	8%	4,253	34%	9%	2,702	35%	6%
Poor Ride	239	2%	0%	249	2%	1%	981	8%	2%	2,486	20%	5%	2,483	32%	5%
Total	12,621	100%	26%	13,845	100%	28%	12,998	100%	26%	12,333	100%	25%	7,820	100%	16%

Source: 2003-2007 as published in 2007 State of the Pavement Report. 2011 data from Location Summary Report.

Notes:

Lane miles are rounded to whole numbers.

Poor ride quality for 2007 is based on an IRI greater than 223 for asphalt pavement and 212 for concrete pavement.

Poor ride quality for 2011/2013 is based on an IRI greater than 170.

Distress	Priority Numbers
Major Structural Distress	1, 2, 7, 8, 11, 13
Poor Ride Qualilty	5, 6

Appendix 6 – Maintenance Cost and Usage (2010-2013)

Maintenance, Contracted	Average	09/10	10/11	11/12	12/13
Cost per Lane Mile, by Fiscal Year					
CHIP SEAL (AR)	$ 60,402	$ 62,431	$ 54,220	$ 70,773	$ 54,184
CHIP SEAL (PME)	$ 31,750	$ 34,110	$ 32,538	$ 34,302	$ 26,052
CHIP SEAL (PMA/PBA)	$ 30,574	$ 30,574	N/A	N/A	N/A
SLURRY SEAL	$ 34,467	$ 35,991	$ 29,561	$ 32,960	$ 39,354
MICROSURFACING	$ 57,971	$ 49,531	$ 46,458	$ 46,038	$ 89,858
THIN BONDED WEARING COURSE	$ 113,003	$ 93,941	$ 119,512	$ 132,700	$ 105,858
HMA OVERLAY	$ 103,433	$ 94,909	$ 106,680	$ 119,010	$ 93,134
HMA OVERLAY-OPEN GRADED	$ 99,059	$ 76,733	$ 120,154	$ 63,696	$ 135,653
RHMA OVERLAY	$ 101,530	$ 82,965	$ 94,615	$ 122,365	$ 106,177
RHMA OVERLAY-OPEN GRADED	$ 103,168	$ 87,090	$ 113,821	$ 108,593	N/A
MILL AND REPLACE WITH HMA OVERLAY	$ 127,941	$ 142,638	$ 119,840	$ 147,527	$ 101,759
MILL AND REPLACE WITH HMA OVERLAY-OPEN GRADEI	$ 124,987	N/A	$ 132,502	$ 117,471	N/A
MILL AND REPLACE WITH RHMA OVERLAY	$ 111,352	$ 104,905	$ 116,153	$ 105,363	$ 118,986
MILL AND REPLACE WITH RHMA OVERLAY-OPEN GRADI	$ 71,738	$ 73,429	$ 70,048	N/A	N/A
IN-PLACE RECYCLING	$ 157,251	$ 123,542	$ 169,084	$ 146,123	$ 190,255
DIGOUT	$ 845,049	$ 782,471	$ 2,143,571	$ 237,920	$ 216,232
PCC GRIND	$ 82,172	$ 59,947	$ 103,019	$ 91,645	$ 74,079
PCC SLAB REPLACEMENT	$ 1,552,001	$ 1,264,823	$ 1,696,386	$ 2,004,160	$ 1,242,636
Lane Miles Treated, by Fiscal Year					
CHIP SEAL (AR)	161	72	104	274	196
CHIP SEAL (PME)	221	432	176	130	146
CHIP SEAL (PMA/PBA)	34	34	N/A	N/A	N/A
SLURRY SEAL	205	462	168	95	94
MICROSURFACING	86	152	79	73	38
THIN BONDED WEARING COURSE	287	296	284	316	252
HMA OVERLAY	306	251	285	372	315
HMA OVERLAY-OPEN GRADED	76	86	107	51	58
RHMA OVERLAY	464	409	624	375	449
RHMA OVERLAY-OPEN GRADED	131	235	104	54	N/A
MILL AND REPLACE WITH HMA OVERLAY	87	43	154	127	22
MILL AND REPLACE WITH HMA OVERLAY-OPEN GRADEI	77	N/A	103	51	N/A
MILL AND REPLACE WITH RHMA OVERLAY	246	226	287	279	192
MILL AND REPLACE WITH RHMA OVERLAY-OPEN GRADI	46	70	42	27	N/A
IN-PLACE RECYCLING	100	22	175	58	145
DIGOUT	7	3	2	18	6
PCC GRIND	321	500	528	133	121
PCC SLAB REPLACEMENT	4	6	3	6	1
TOTAL-MAINT LANE MILES TREATED	2,750	3,299	3,225	2,440	2,037
TOTAL-OTHER MAINT LANE MILES	15	29	6	9	15
TOTAL-ALL MAINT LANE MILES	2,765	3,327	3,231	2,449	2,051

N/A - Not available or strategy not utilized

HMA-Hot Mixed Asphalt

RHMA-Rubberized Hot Mixed Asphalt

Appendix 7 – Rehabilitation Cost and Usage (2010-2013)

Rehabilitation, Contracted	Average	09/10	10/11	11/12	12/13
Cost per Lane Mile, by Fiscal Year					
HMA OVERLAY, CAPM	$ 259,305	$ 244,037	$ 244,347	$ 264,898	$ 283,938
RHMA OVERLAY, CAPM	$ 298,689	N/A	$ 218,013	$ 251,577	$ 426,477
MILL AND REPLACE WITH HMA OVERLAY, CAPM	$ 235,232	$ 172,273	$ 210,274	$ 263,271	$ 295,111
MILL AND REPLACE WITH RHMA OVERLAY, CAPM	$ 190,927	$ 109,891	$ 229,981	$ 232,908	N/A
1. GRINDING/OTHER WORK, CAPM	$ 226,141	$ 216,361	$ 245,163	$ 216,900	N/A
2. MISCELLANEOUS WORK, CAPM	$ 1,517,833	$ 2,757,000	$ 266,166	N/A	$ 1,530,333
PCC OVERLAY/SLAB REPLACEMENT, CAPM	$ 816,063	N/A	N/A	$ 968,997	$ 663,129
IN-PLACE RECYCLING, CAPM	$ 238,619	N/A	$ 271,904	$ 205,333	N/A
3 HMA OVERLAY, REHAB	$ 460,063	$ 326,925	$ 505,423	$ 547,840	N/A
3 RHMA OVERLAY, REHAB	$ 505,050	N/A	$ 505,050	N/A	N/A
MILL AND REPLACE WITH HMA OVERLAY, REHAB	$ 331,334	$ 198,538	$ 288,149	$ 407,742	$ 430,908
MILL AND REPLACE WITH RHMA OVERLAY, REHAI	$ 243,644	$ 317,750	$ 214,181	N/A	$ 199,000
CRACK, SEAT AND OVERLAY, REHAB	$ 880,477	$ 1,220,481	$ 440,718	$ 980,230	N/A
GRINDING/OTHER WORK, REHAB**	$ 506,049	$ 753,278	$ 575,443	$ 189,426	N/A
2. MISCELLANEOUS WORK, REHAB	$ 957,997	N/A	$ 1,089,520	$ 1,269,409	$ 515,062
PCC OVERLAY/SLAB REPLACEMENT, REHAB	$ 1,642,149	$ 2,462,763	$ 1,217,415	$ 1,085,448	$ 1,802,969
IN-PLACE RECYCLING, REHAB	$ 345,287	N/A	$ 349,289	$ 341,286	N/A
Lane Miles Treated, by Fiscal Year					
HMA OVERLAY, CAPM	76	8	187	39	68
RHMA OVERLAY, CAPM	94	N/A	177	87	18
MILL AND REPLACE WITH HMA OVERLAY, CAPM	261	11	363	273	398
MILL AND REPLACE WITH RHMA OVERLAY, CAPM	166	32	340	125	N/A
1. GRINDING/OTHER WORK, CAPM	646	266	1,007	665	N/A
2. MISCELLANEOUS WORK, CAPM	112	<1	209	N/A	15
PCC OVERLAY/SLAB REPLACEMENT, CAPM	71	N/A	N/A	95	47
IN-PLACE RECYCLING, CAPM	35	N/A	41	30	N/A
3 HMA OVERLAY, REHAB	130	17	226	147	N/A
3 RHMA OVERLAY, REHAB	20	N/A	20	N/A	N/A
MILL AND REPLACE WITH HMA OVERLAY, REHAB	65	24	103	101	31
MILL AND REPLACE WITH RHMA OVERLAY, REHAI	54	1	143	N/A	19
CRACK, SEAT AND OVERLAY, REHAB	113	64	39	235	N/A
GRINDING/OTHER WORK, REHAB**	48	19	113	13	N/A
2. MISCELLANEOUS WORK, REHAB	100	N/A	137	18	145
PCC OVERLAY/SLAB REPLACEMENT, REHAB	120	43	44	367	26
IN-PLACE RECYCLING, REHAB	20	N/A	25	14	N/A
Subtotal, CAPM	1,125	317	2,323	1,314	546
Subtotal, REHABILITATION	534	169	851	895	221
TOTAL-CAPM/REHAB LANE MILES TREATED	1,658	486	3,173	2,208	766
TOTAL-OTHER SHOPP LANE MILES	6	24	0	0	2
TOTAL-ALL SHOPP LANE MILES	1,665	510	3,173	2,208	768
TOTAL-ALL CONTRACT LANE MILES	4,430	3,837	6,404	4,658	2,819

N/A - Not available or strategy not utilized
HMA-Hot Mixed Asphalt
RHMA-Rubberized Hot Mixed Asphalt

1. PCC GRIND is the dominate strategy, may also include isolated slab replacement
2. May include hov lanes, drainage, or digouts
3. May include lane widening

Appendix 8 – RHMA Usage by District (2008 to 2011 Calendar Year)

	Calendar Year 2008				Calendar Year 2009				Calendar Year 2010				Calendar Year 2011				3-YR Average			
	Total Tons	HMA (tons)	RHMA (tons)	%	Total Tons	HMA (tons)	RHMA (tons)	%	Total Tons	HMA (tons)	RHMA (tons)	%	Total Tons	HMA (tons)	RHMA (tons)	%	Total Tons	HMA (tons)	RHMA (tons)	%
Maint	64	32	32	50.5%	14	14	0	0.0%	70	40	30	43.3%	56	19	37	65.4%	47	24	22	47.7%
CAPM	73	11	62	84.8%	0	0	0	0.0%	6	6	0	0.0%	113	49	64	56.5%	40	18	21	53.7%
Rehab	90	90	0	0.0%	92	7	85	91.9%	0	0	0	0.0%	10	0	10	96.7%	34	2	32	92.1%
Other	13	13	0	0.0%	115	115	0	0.0%	37	37	0	0.0%	30	30	0	0.0%	61	61	0	0.0%
D1 Combined	**240**	**146**	**94**	**39.2%**	**222**	**137**	**85**	**38.3%**	**113**	**83**	**30**	**26.7%**	**209**	**99**	**110**	**52.7%**	**181**	**106**	**75**	**41.4%**
Maint	111	90	21	19.0%	140	140	0	0.0%	105	105	0	0.0%	174	131	43	24.7%	140	125	14	10.2%
CAPM	9	9	0	0.0%	0	0	0	0.0%	6	6	0	0.0%	107	31	76	71.4%	38	12	25	67.7%
Rehab	148	119	29	19.7%	48	48	0	0.0%	6	6	0	0.0%	363	363	0	0.0%	139	139	0	0.0%
Other	23	23	0	0.0%	63	63	0	0.0%	114	99	15	13.0%	93	82	11	12.1%	90	81	9	9.6%
D2 Combined	**291**	**241**	**50**	**17.3%**	**252**	**252**	**0**	**0.0%**	**231**	**216**	**15**	**6.4%**	**737**	**606**	**131**	**17.7%**	**407**	**358**	**49**	**11.9%**
Maint	10	2	8	82.6%	152	143	9	5.8%	44	28	16	36.2%	62	40	22	35.2%	86	70	16	18.0%
CAPM	8	8	0	0.0%	167	111	56	33.5%	0	0	0	0.0%	499	224	275	55.2%	222	112	110	49.8%
Rehab	291	280	11	3.8%	280	280	0	0.0%	106	106	0	0.0%	606	522	84	13.8%	331	303	28	8.4%
Other	243	243	0	0.0%	352	352	0	0.0%	334	334	0	0.0%	377	321	56	14.8%	354	336	19	5.2%
D3 Combined	**552**	**533**	**19**	**3.4%**	**949**	**885**	**64**	**6.8%**	**484**	**468**	**16**	**3.4%**	**1,543**	**1,107**	**436**	**28.3%**	**992**	**820**	**172**	**17.4%**
Maint	37	20	17	46.2%	104	30	74	71.0%	99	36	63	63.7%	82	55	27	33.0%	95	40	55	57.6%
CAPM	21	5	16	77.3%	7	0	7	93.8%	288	93	195	67.6%	286	140	146	51.2%	194	78	116	59.9%
Rehab	570	441	129	22.6%	588	461	127	21.6%	141	120	21	14.9%	227	120	107	47.1%	319	234	85	26.7%
Other	279	280	-1	-0.3%	481	453	28	5.7%	489	398	91	18.6%	361	352	9	2.4%	444	401	43	9.6%
D4 Combined	**907**	**746**	**161**	**17.7%**	**1,181**	**945**	**236**	**20.0%**	**1,017**	**647**	**370**	**36.4%**	**955**	**666**	**289**	**30.3%**	**1,051**	**753**	**298**	**28.4%**
Maint	51	42	9	18.3%	63	27	36	57.5%	74	66	8	10.6%	171	148	23	13.3%	103	80	22	21.6%
CAPM	76	76	0	0.0%	0	0	0	0.0%	0	0	0	0.0%	105	105	0	0.0%	35	35	0	0.0%
Rehab	111	111	0	0.0%	146	146	0	0.0%	77	56	21	27.7%	88	50	38	42.9%	104	84	20	19.0%
Other	95	93	2	2.0%	117	117	0	0.0%	143	143	0	0.0%	108	108	0	0.0%	123	123	0	0.0%
D5 Combined	**333**	**322**	**11**	**3.4%**	**326**	**290**	**36**	**11.0%**	**294**	**265**	**29**	**9.9%**	**471**	**411**	**60**	**12.8%**	**364**	**322**	**42**	**11.5%**
Maint	173	18	155	89.6%	253	72	181	71.5%	67	6	61	91.0%	217	72	145	66.9%	179	50	129	72.0%
CAPM	90	17	73	81.1%	5	5	0	0.0%	35	8	27	77.6%	230	105	125	54.4%	90	39	51	56.3%
Rehab	210	181	29	13.8%	187	158	29	15.5%	82	35	47	57.3%	211	211	0	0.0%	160	135	25	15.9%
Other	38	38	0	0.0%	82	82	0	0.6%	262	262	0	0.0%	478	478	0	0.0%	274	274	0	0.1%
D6 Combined	**512**	**254**	**258**	**50.3%**	**527**	**317**	**210**	**39.8%**	**445**	**311**	**134**	**30.2%**	**1,136**	**866**	**270**	**23.8%**	**703**	**498**	**205**	**29.2%**
Maint	68	0	68	100.0%	84	19	65	77.4%	56	2	54	97.0%	84	0	84	100.0%	75	7	68	90.8%
CAPM	0	0	0	0.0%	15	0	15	99.7%	2	0	2	99.5%	398	81	317	79.6%	138	27	111	80.4%
Rehab	129	115	14	10.9%	353	306	47	13.3%	99	72	27	27.2%	366	210	156	42.7%	273	196	77	28.1%
Other	133	132	1	0.5%	66	61	5	7.8%	60	58	2	4.0%	46	34	12	26.8%	57	51	6	11.5%
D7 Combined	**329**	**247**	**82**	**25.0%**	**518**	**386**	**132**	**25.4%**	**216**	**131**	**85**	**39.3%**	**895**	**325**	**570**	**63.7%**	**543**	**281**	**262**	**48.3%**
Maint	114	0	114	99.7%	204	29	175	85.9%	150	0	150	100.0%	132	71	61	46.1%	162	33	129	79.4%
CAPM	54	0	54	99.7%	54	52	2	3.7%	20	4	16	80.5%	126	8	118	93.3%	67	21	45	67.9%
Rehab	449	449	0	0.0%	338	323	15	4.4%	93	92	1	0.8%	5	2	3	53.2%	145	139	6	4.2%
Other	93	93	0	0.0%	120	119	1	0.9%	64	64	0	0.0%	157	156	1	0.7%	114	113	1	0.7%
D8 Combined	**710**	**542**	**168**	**23.7%**	**715**	**522**	**193**	**27.0%**	**325**	**159**	**166**	**51.0%**	**420**	**238**	**182**	**43.4%**	**487**	**306**	**180**	**37.0%**
Maint	81	6	75	92.5%	22	9	13	59.6%	26	26	0	0.0%	63	11	52	82.2%	37	15	22	58.3%
CAPM	0	0	0	0.0%	8	8	0	0.0%	0	0	0	0.0%	37	24	13	34.5%	15	11	4	28.4%
Rehab	9	9	0	0.0%	127	87	40	31.4%	0	0	0	0.0%	20	20	0	0.0%	49	36	13	27.2%
Other	77	77	0	0.0%	215	177	38	17.7%	62	35	27	43.2%	6	6	0	0.0%	94	73	22	22.9%
D9 Combined	**167**	**92**	**75**	**45.0%**	**371**	**280**	**91**	**24.4%**	**88**	**61**	**27**	**30.2%**	**125**	**61**	**64**	**51.4%**	**195**	**134**	**61**	**31.1%**
Maint	61	5	56	91.9%	114	9	105	91.9%	103	16	87	84.9%	207	32	175	84.7%	141	19	122	86.7%
CAPM	245	12	233	95.0%	21	2	19	90.0%	10	0	10	100.0%	116	73	43	36.9%	49	25	24	49.1%
Rehab	18	14	4	23.3%	31	13	18	58.3%	53	20	33	61.8%	84	84	0	0.1%	56	39	17	30.5%
Other	82	55	27	33.0%	99	92	7	7.5%	31	24	7	23.3%	35	26	9	25.6%	55	47	8	14.3%
D10 Combined	**406**	**86**	**320**	**78.8%**	**266**	**116**	**150**	**56.3%**	**198**	**60**	**138**	**69.8%**	**441**	**214**	**227**	**51.4%**	**302**	**130**	**172**	**56.9%**
Maint	26	0	26	98.9%	47	2	45	95.9%	17	17	0	0.0%	77	30	47	61.2%	47	16	31	65.3%
CAPM	30	14	16	52.1%	0	0	0	0.0%	54	0	54	100.0%	110	0	110	100.0%	55	0	55	100.0%
Rehab	21	21	0	0.0%	10	10	0	0.0%	1	1	0	0.0%	21	21	0	0.0%	11	11	0	0.0%
Other	35	35	0	0.0%	82	82	0	0.0%	202	202	0	0.0%	239	239	0	0.0%	174	174	0	0.0%
D11 Combined	**112**	**70**	**42**	**37.1%**	**140**	**95**	**45**	**32.1%**	**273**	**219**	**54**	**19.6%**	**448**	**290**	**158**	**35.2%**	**287**	**201**	**86**	**29.8%**
Maint	110	1	109	99.1%	64	1	63	98.1%	93	3	90	96.9%	112	1	111	98.8%	90	2	88	97.9%
CAPM	0	0	0	0.0%	19	5	14	75.0%	1	0	1	100.0%	0	0	0	0.0%	7	2	5	75.9%
Rehab	26	18	8	30.0%	2	2	0	0.0%	33	8	25	74.8%	0	0	0	0.0%	12	3	8	71.4%
Other	44	44	0	0.0%	40	39	1	3.3%	50	47	3	5.9%	28	27	1	2.4%	39	38	2	4.2%
D12 Combined	**180**	**63**	**117**	**64.9%**	**125**	**46**	**79**	**63.0%**	**176**	**58**	**118**	**66.9%**	**141**	**29**	**112**	**79.5%**	**147**	**44**	**103**	**69.8%**
Maint	907	216	691	76.2%	1,260	496	764	60.7%	902	344	558	61.9%	1,437	610	827	57.5%	1,200	483	716	59.7%
CAPM	605	152	453	74.8%	296	183	113	38.1%	421	117	304	72.3%	2,126	839	1,287	60.5%	948	380	568	59.9%
Rehab	2,073	1,849	224	10.8%	2,202	1,841	361	16.4%	691	516	175	25.3%	2,000	1,603	397	19.9%	1,631	1,320	311	19.1%
Other	1,154	1,125	29	2.5%	1,833	1,752	81	4.4%	1,848	1,703	145	7.9%	1,959	1,860	99	5.0%	1,880	1,772	108	5.8%
Statewide	**4,739**	**3,342**	**1,397**	**29.5%**	**5,591**	**4,272**	**1,319**	**23.6%**	**3,861**	**2,679**	**1,182**	**30.6%**	**7,522**	**4,912**	**2,610**	**34.7%**	**5,658**	**3,954**	**1,704**	**30.1%**

*Tonnage in Thousands

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.

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) – It is also known as a Thin Bonded Wearing Course (Nova Chip). It 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, 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.

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

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

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

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

GPR (Ground Penetrating Radar) – It is a technology that produces an underground cross-sectional image of soils and subsurface features.

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

HMA (Hot Mixed Asphalt) – Consist of sand, gravel, and a petroleum binder; also called 'bituminous,' 'flexible' or 'black' pavement.

HMA Overlay – Placement of asphalt layers and inner membranes over an existing roadway. Typically, 6 inches of asphalt are added.

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

ICES (Intermodal Corridors of Economic Significance) – It 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 developed by the World Bank and expressed in inches per mile or centimeters per kilometer.

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

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

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

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

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

- MSL 1 – Contains route segments in urban areas functionally classified as Interstate, Other Freeway/Expressway, or Other Principal Arterial. In rural areas, the MSL 1 designation contains route segments functionally classified as Interstate or Other Principal Arterial.
- MSL 2 – Contains route segments classified as an Other Freeway/Expressway or Other Principal Arterial not in MSL 1, and route segments functionally classified as minor arterials not in MSL 3.
- MSL 3 – Indicates a route or route segment with the lowest maintenance priority. Typically, MSL 3 contains route segments functionally classified as major or minor collectors and local roads with relatively low traffic volumes. Route segments where route continuity is necessary are also assigned MSL 3 designation.

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

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

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

- ❖ Interstate – The Eisenhower Interstate System of highways retains its separate identity within the NHS.
- ❖ Other Principal Arterials – Highways in rural and urban areas that provide access between an arterial and a major port, airport, public transportation facility, or other intermodal transportation facility.

OGAC (Open Graded Asphalt Concrete) – It is also known as Open Graded Blanket. It is 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 predict pavement performance to develop budget needs and to perform impact analyses in which the effects of different pavement management strategies and funding levels can be demonstrated.

Pavement Preservation – According to the definition of the FHWA Pavement Preservation Expert Task Group, it is ”a program employing a network level, long-term strategy that enhances pavement performance by using an integrated, cost-effective set of practices that extend pavement life, improve safety and meet motorist expectations.”

Pavement Rehabilitation – According to the definition of the AASHTO Highway Subcommittee on Maintenance, it is “structural enhancements that extend the service life of an existing pavement and/or improve its load carrying capacity. Rehabilitation techniques include restoration treatments and structural overlays.”

PCC (Portland Cement Concrete) Pavement – Pavement constructed with PCC, also known as ‘concrete’ or ‘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 PCS to measure the pavement’s condition with respect to maintenance target goals/priorities.

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

Preventive Maintenance – According to the definition of the AASHTO Standing Committee on Highways in 1997, it is “a planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system (without significantly increasing the structural capacity).”

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

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

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

Rigid pavement – Pavement constructed with Portland Cement Concrete (PCC), also known as 'concrete' or 'PCC' pavement.

Roadway Classification (Class 1, 2, 3) – For planning purposes, the State highway system has been classified as Class 1, 2, and 3 based on the following definitions:

- Class 1 – Contains route segments classified as Interstate and other principal arterials, which are further subdivided as Goods, Truck, and the Strategic Highway Network (STRAHNET).
- Class 2 – Contains route segments classified NHS and the Interregional Road System (IRRS).
- Class 3 – All other routes not included in Class 1 and 2.

Roadway Preservation – The act of keeping 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 Department, that is responsible for preserving the State highway network.

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

Routine Maintenance – According to the definition of the AASHTO Highway Subcommittee on Maintenance, it "consists of work that is planned and performed on a routine basis to maintain and preserve the condition of the highway system or to respond to specific conditions and events that restore the highway system to an adequate level of service."

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

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

State Highway Operation and Protection Plan – It is required by Streets and Highways Code Section 164.6. A ten-year state rehabilitation plan, prepared each odd-numbered year by the Department to identify rehabilitation needs and schedule in order to meet those needs and strategies for cost control and program efficiencies.

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

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

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

Spalling – It 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. It results in progressive widening of the joint or cracks, and ultimately, deterioration of aggregate interlock at the joint.

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

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

VMT (Vehicle Miles Traveled) – The length of a highway segment multiplied by the Annual Average Daily Traffic divided by the number of lanes.