Final Report

California Statewide Local Streets and Roads Needs Assessment

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Executive Summary

California's local street and road system is reaching a point of crisis. City streets and county roads are where every trip begins and ends. Whether traveling by bike, bus, rail, truck or family automobile, Californians need the local system.

As the first comprehensive statewide study of California's local street and road system, this report provides critical analysis and information on the local transportation network's condition and funding needs.

The study's objective was to fully assess the condition of the local system and complete the overall transportation-funding picture for California's transportation network. We wanted answers to the following: What are the pavement conditions of local streets and roads? What will it cost to bring pavements to a Best Management Practices (BMP) or most cost-effective condition? How much will it cost to maintain them once we achieve the BMP or optimal pavement condition? What are the needs for the essential components to a functioning system? Is there a funding shortfall? If so, what is it? What are the solutions? This study collected existing road condition information to determine the future funding needs necessary to maintain the system in good condition.

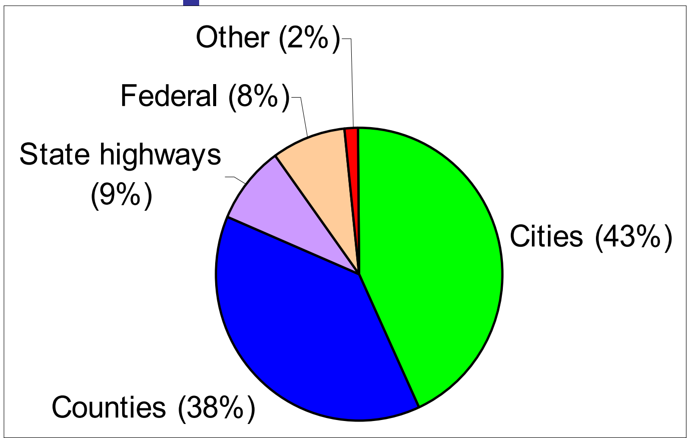


Figure 1. Breakdown of Maintained Centerline Miles

As owners and operators of 81 percent of the state's roads (Figure 1), cities and counties found that this study was of critical importance for several reasons. While federal and state governments' regularly assess their system needs, no such data existed for the local component of the state's transportation network. Historically, statewide transportation funding investment decisions have not been based on local pavement condition data, or adequate recognition for the local system. Further, recent actions to remove city and county discretion over federal and state funding have diminished resources available to the local system.

The goal is to use the findings of this study to educate policymakers at all levels of government about the infrastructure investments needed to provide California with a seamless transportation system. The findings of this study will provide credible and defensible analysis to support a dedicated, stable funding source for maintaining the local system at an optimum level. It will also provide for the most effective and efficient investment of public funds.

The study surveyed all of California's 58 counties and 478 cities in 2007-08. The response was outstanding. Information collected resulted in capturing data from more than 93% of the state's local streets and roads. Furthermore, since the majority of the data submitted came from recognized pavement management systems, the accuracy of the data is very high. Where no data existed, models were developed, tested, and used to estimate the pavement condition and funding needs.

The results show that California's local streets and roads are on the edge of a cliff. On a scale of zero (failed) to 100 (excellent), the statewide average pavement condition index (PCI) is 68 ("at risk category"). If current funding remains the same, the statewide condition is projected to deteriorate to a PCI of 58 in 10 years, and further to 48 ("poor" category) by 2033 (see Figure 2). Even more critical, the unfunded backlog will more than double from $37 billion to $79 billion by 2033.

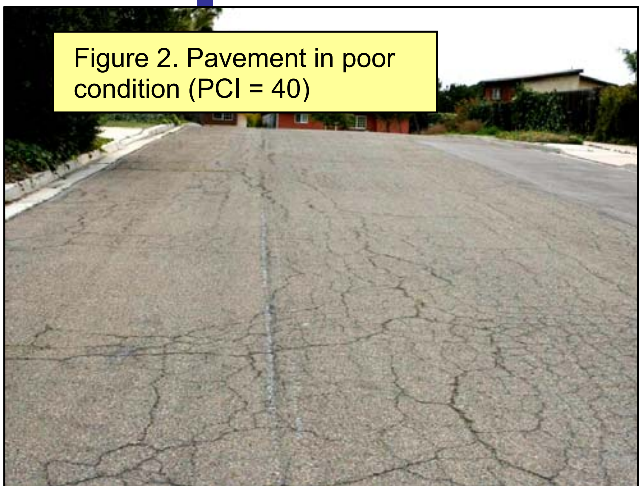


Figure 2. Pavement in poor condition (PCI = 40)

Based on the results of this study, approximately $51.7 billion of additional funding is needed to bring just the pavement condition of the state's local streets and roads to a level where the taxpayer's money can be spent cost-effectively.

To spend the taxpayer's money cost-effectively, it makes more sense to preserve and maintain our roads in good condition than to let them deteriorate, which will only make it more costly in the future. Consistent with that approach, the costs developed in this study are based on achieving a roadway pavement condition of what the industry calls Best Management Practices (BMPs). This condition represents improving the roadway condition to a level where roads need preventative maintenance treatments (i.e., slurry seals, chip seals, thin overlays). These treatments have the least impact on the public's mobility and commerce. Further, these treatment types are more environmentally friendly than the next level of construction that would be required (i.e. rehabilitation and reconstruction).

The importance of this approach is significant. As roadway pavement conditions deteriorate, the cost to repair them increases exponentially. For example, it costs twelve times less to maintain a BMP pavement compared to a pavement that is at the end of its service life. Even a modest resurfacing is four times costlier than a pavement in the BMP condition. With counties and cities on fixed budgets, employing maintenance practices consistent with BMP results in treating four to twelve times more road area. By bringing the roads to BMP conditions, cities and counties will be able to maintain streets and roads at the most cost-effective level. It is a goal that is not only optimal, but also necessary.

Although no similar statewide bridge needs assessment were available for inclusion in this study, a brief review indicates that approximately $2.6 billion of bridge projects have been identified and approved for funding. Of this, local agencies must provide 11.47% (approximately $300 million) as the local match.

This study helps answer the following key questions:

What are the pavement conditions of local streets and roads?

California's local streets and roads are on the edge. Currently at a PCI of 68, the pavement condition will decline to 48 (poor condition) by 2033 based on existing funding levels available to cities and counties.

What will it cost to bring pavements to a BMP or most cost-effective condition?

It will cost $67.6 billion to reach BMP in 10 years.

How much will it cost to maintain them once we achieve the BMP or optimal pavement condition?

Once the BMP condition is reached, it will cost approximately $1.8 billion a year to maintain them at that condition.

What are the needs for the essential components to a functioning system?

The transportation network includes essential safety and traffic components such as curb ramps, sidewalks, storm drains, streetlights and signals. These components require $32.1 billion over the next 10 years.

Is there a funding shortfall? If so, what is it?

Yes. The table below shows the pavement and essential component shortfall of $71.4 billion over the next 10 years.

Summary of 10 Year Needs and Shortfall (2008 $Billion)

Transportation Asset	Needs	Funding	Shortfall
Pavements	$ 67.6	$ 15.9	$ 51.7
Essential Components	$ 32.1	$ 12.4	$ 19.7
Totals	**$ 99.7**	**$ 28.3**	**$ 71.4**

What are the Solutions?

To bring the state's local street and road system to a best management practice level where the taxpayer's money can be spent cost effectively, we will need up to approximately $51.7 billion of additional funding for pavement alone and more than $71 billion, including the essential components, for a functioning system over the next 10 years. The sooner this is accomplished, the less funding will be required in the future.

The conclusions from this study are inescapable. Given existing funding levels available to cities and counties for maintaining the local system, California's local streets and roads will deteriorate rapidly within the next 25 years to a poor condition. Unless this condition is addressed, costs to maintain the local system will only continue to grow, while the quality of California's local transportation network deteriorates.

To bring the local system back into a cost-effective condition, thereby preserving the public's $271 billion pavement investment and stopping further costly deterioration, at least $7 billion annually in new money is needed to stop the further decline and deterioration of local streets and roads. This is equivalent to about a 38-cent gas tax increase. Or to put it another way, the average driver will pay an additional 50 cents a day for gas. It is imperative that cities and counties receive a stable and dedicated revenue stream for cost effective maintenance of the local system to avoid this crisis.

Chapter 1. Introduction

1.1 Background

California's 58 counties and 478[1] cities own and maintain 141,554[2] centerline-miles of local streets and roads. This is an impressive 81% of the state's total publicly maintained lane-miles (see Figure 1.1 below). Conservatively, this network is valued at $271 billion.

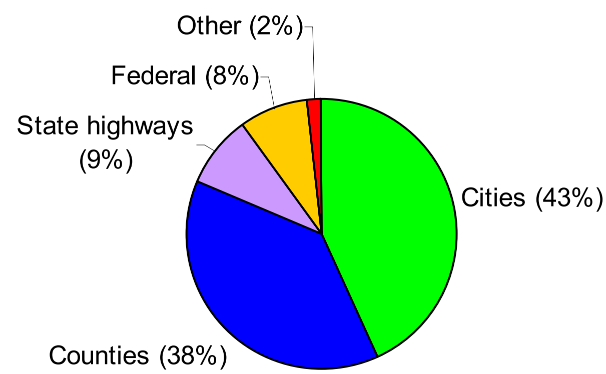


Figure 1.1 Breakdown of Maintained Road Centerline Miles by Agency[2]

Since lane-miles are more commonly used in pavement management analyses (the costs derived are based on areas, and lane-miles are a more accurate depiction of pavement areas) the table below shows the breakdown of lane-miles for local streets and roads by functional classification as well as for unpaved roads. Major streets or roads are those that are classified as arterials or collectors, and local streets or roads are those that are classified as residentials and alleys. Unpaved roads are defined as those that have either dirt or gravel surfaces.

Table1.1 Breakdown by Functional Classification & Unpaved Roads[2]

	Lane-miles			
	Major	Local	Unpaved	Total
Cities	76,629	100,912	887	178,428
Counties	51,821	72,652	14,563	139,036
Totals	**128,450**	**173,564**	**15,450**	**317,464**

Note: San Francisco is included as a city only.

[1] Two new cities, Wildomar and Menifee, were incorporated in 2008 and therefore not included in the original survey. However, their pavement network is included as part of the Riverside County's network.
[2] *2006 California Public Road Data – Statistical Information Derived from the Highway Performance Monitoring System*, State of California Department of Transportation, Division of Transportation System Information, July 2007.

There is no dispute that the transportation system has a significant role in the state's economy, as this road network is a critical contributor to maintaining California's status in the top 10 largest economies in the world[3]. The transportation system contributes to trade (import/exports), freight movement, retail, agriculture, tourism, mining, construction and manufacturing. In terms of jobs and trade, transportation and utilities comprise the largest sector in California in 2006 and second in terms of output[4].

Therefore, the maintenance of the transportation system should be a major concern for all Californian cities and counties.

In 1999, Senate Resolution 8[5] (Burton, 1999) requested the California Transportation Commission (CTC) to produce a "10 year needs assessment of the state's transportation system," that included the "unfunded rehabilitation and operations needs for state highways, local streets and roads, the state's intercity rail programs, and urban, commuter and regional transit systems, including ferry systems, over the next 10 years."

In the SR8 report, 57 counties and nearly 400 cities responded to a questionnaire regarding pavement rehabilitation. The estimated shortfall was an estimated $10.5 billion in unfunded needs, plus an annual shortfall of $400 million to keep up with annual maintenance and rehabilitation expenditures. This backlog, built up since the 1970s, represented nearly 8 years of rehabilitation needs. In addition, regional agencies also identified $13.1 billion in high priority local arterial expansion projects.

In the decade that has elapsed since then, the cost of rehabilitation has increased tremendously, but revenues have not kept up. Figure 1.2 illustrates the dramatic (more than ten-fold) increases in asphalt prices since 1997. Since the majority of local streets and roads are constructed of asphalt concrete (less than 0.5% are Portland cement concrete), this has a direct impact on the costs of maintenance and rehabilitation.

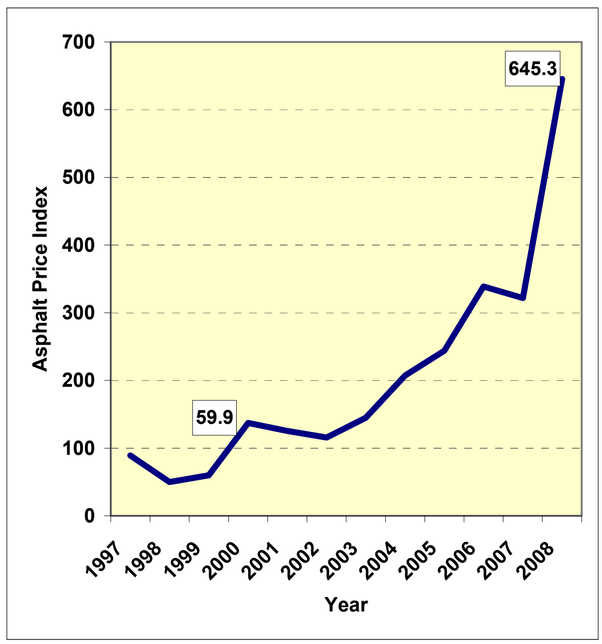


Figure 1.2 Caltrans Asphalt Price Index (1997 to 2008)[1]

However, increased material costs is not the only reason for increased maintenance costs. The cost of <u>*deferring*</u> maintenance is also a significant factor in higher maintenance costs. When agencies do not have sufficient funds to

[3] http://www.lao.ca.gov/2006/cal_facts/2006_calfacts_econ.htm

[4] http://www.census.gov/eos/www/naics/

[5] *Inventory of Ten-Year Funding Needs For California's Transportation Systems*, California Transportation Commission, May 5, 1999.

maintain their roads, maintenance efforts are delayed or postponed, which often results in a more expensive treatment later.

This study was commissioned to build upon, update the results of the previous study (SR8), and determine the funding needed to maintain the local streets and roads system for the next 10 years. However, state highways were not included as this was part of Caltrans State Highway Operation and Protection Plan (SHOPP).

1.2 Study Objectives

The objectives of this study may be summarized as a series of questions:

- What are the conditions of local streets and roads?
- What will it cost to bring them up to an acceptable condition?
- How much will it cost to ***maintain*** them in an acceptable condition for the next 10 years?
- Similarly, what are the needs for other essential components, such as safety, traffic and regulatory items?
- Is there a funding shortfall? If so, what is it?

Another objective was to develop a methodology that could be used for periodic updates by other agencies such as RTPAs or MPOs in the development of their Regional Transportation Plans.

A major goal of this study was to find the most cost-effective way of maintaining local streets and roads, and this is reflected in the methodology used (discussed in Chapter 3).

Finally, it was desirable to contact all 478 cities and 58 counties in California to get this information. Chapter 2 discusses in more detail the data collection efforts.

1.3 Study Assumptions

There were some important assumptions that were made during our analyses of the data received from cities and counties. These differ in several instances from those used in the SR8 report as well as Caltrans 2007 SHOPP[6]. Notably, they are:

1. The analysis period used in this study is 10 years, which is different from the SR8 report which only looked at a one-time backlog, but is consistent with SHOPP.

2. All numbers reported in this study are in constant 2008 dollars – this is consistent with both SHOPP and SR8.

3. The pavement condition goal was to reach a condition where best management practices (BMP) can occur. This translates to a PCI in the low 80's (on a scale of 0 to 100, where 0 is failed and 100 is excellent). SR8 defined the goal as reaching a statewide index of 70. Caltrans SHOPP defines performance goals quite differently, i.e. the goal is to reduce the percentage of distressed highways from 28% to 10%.

[6] *Ten Year State Highway Operation & Protection Plan (FY 2008/09 to 2017/18*), Caltrans.

4. Two scenarios are reported in this study for the pavement analysis:
   a. Impacts of existing budget
   b. Funds needed to reach goal within 10 years

   These scenarios were not analyzed in the SR8 report.

5. It is assumed that no new streets or roads are added within the analysis period. This is consistent with both the SHOPP and SR8 analyses.

6. Capital improvement projects are not included, e.g. realignments, widening, grade separations etc.

7. The inclusion of safety, traffic and regulatory components of the roadway system such as sidewalks, ADA ramps, storm drains etc were was not previously included in SR8, although they are included in Caltrans SHOPP.

8. A bridge needs assessment was not included in this study, although both the SHOPP and SR8 did. However, a brief summary of the bridge projects that have been identified and approved for funding is included in Chapter 5.

Table 1.2 below summarizes the assumptions used in this study as well as in SR8 and Caltrans SHOPP.

Table 1.2 Summary of Study Assumptions

Assumptions	This Study	SR 8 Report	Caltrans SHOPP
Analysis Period	10 years	One-time backlog	10 years
Cost Basis	2008 dollars	1999 dollars	2007 dollars
Goals	Best management practices (PCI* = low 80's)	PCI = 70 ("Good" condition)	% of distressed pavements < 10%
Total Scenarios Evaluated	2	1	1
Capital Improvement Projects	No	Yes	Only related to operational improvement
Essential Components**	Yes	No	Yes
Bridges	Partial	Yes	Yes

*PCI = pavement condition index (scale of 0 to 100, with 0 = failed and 100 = excellent).
** Includes safety, traffic and regulatory components

1.4 Report Structure

Chapter 2 of this report discusses the data collection efforts, including the survey methodology used.

Chapter 3 presents the pavement needs assessments.

Chapter 4 presents the needs assessment for safety, traffic and regulatory components.

Chapter 5 presents a short description of bridges and the local projects identified for funding.

Chapter 6 summarizes the findings.

The appendices contain detailed explanations and tables to support the discussions in the above chapters. Appendix F includes a discussion of the needs assessment approach for future updates.

1.5 Study Sponsors

This study was sponsored by the cities and counties of California, and managed by the County of Los Angeles, Department of Public Works. The Oversight Committee is composed of representatives from the following:

- League of California Cities (League)
- California State Association of Counties (CSAC)
- County Engineers Association of California (CEAC)
- County of Los Angeles Department of Public Works
- California Regional Transportation Planning Agencies (RTPA)
- California Rural Counties Task Force (RCTF)

Chapter 2. Data Collection

This chapter describes in detail the data collection efforts. The goal was to ensure participation by all 58 counties and 478[1] cities. SR 8 had set the bar high in 1999 by obtaining responses from 57 counties and nearly 400 cities, so this study could aim for no less.

2.1 Outreach Efforts

Tremendous efforts were made to reach all 536 agencies between April to August 2008. This included letters, emails, phone calls, and presentations at meetings and conferences by members of the Oversight Committee as well as by Nichols Consulting Engineers, Chtd. (NCE).

An initial database of over 900 contacts was compiled for all cities and counties. The data came from a variety of sources, i.e. the memberships of both CSAC and the League as well as NCE's contacts. Signup sheets from the Joint League Public Works Officers Institute/CEAC Spring conference in La Jolla (March 2008) were also included. The initial contacts focused on Public Works staff (Directors or engineers responsible for pavement/asset management) but later included City Managers, County Administrative Officers as well as RTPAs and MPOs (Metropolitan Planning Agencies).

Over 900 contact letters were mailed out the first week of April, 2008 (see Appendix A) with copies of the survey questionnaire and a fact sheet explaining the project. The letter was mailed out on Los Angeles County letterhead. Within 2 weeks, NCE made at least two follow-up phone calls to the recipients to ensure that they had received the letter and realized the importance of the study and survey. The original deadline for submittal of the survey questionnaire was April 30th, 2008.

However, by early May, it was clear from our follow up phone calls that most agencies needed more time to compile the information, particularly as the construction season commenced. Based on this input, the Oversight Committee decided to extend the deadline to August 31st, 2008 and assisted in making renewed efforts to get their members to respond.

In addition, presentations were made at a variety of meetings and conferences to "spread the word". This included the spring conference in La Jolla as well as chapter meetings of the American Public Works Association (APWA) and at RTPA meetings.

2.2 Project Website

A website was designed and developed for this study at www.SaveCaliforniaStreets.org (see Figure 2.1). The intent of this website was to act as both an information resource on this study as well as a repository of related reports that may be of interest to cities and counties. More importantly, it was a portal to the online survey that is described in Section 2.3.

Figure 2.1 Home Page of www.SaveCaliforniaStreets.org Website

The domain name was registered for five years (expires February 27, 2013) and can be used for future updates after this study is completed. The website currently contains the following information:

- Home page
- Project status
- Reports for downloading
- Related Links
- FAQ
- Contact Us
- Participate in study – includes link to www.surveygizmo.com, which contains the online questionnaire as well as the ability to upload reports and other files to our ftp site.

2.3 Survey Questionnaire

A survey questionnaire was prepared and finalized in early April 2008 (see Appendix A). Briefly, it included a request for the following information:

1. Contact name and information
2. Pavements
   a. Pavement management software used, if any
   b. Network inventory data
   c. Distress survey procedures

d. Pavement condition ratings and needs
3. Safety, Traffic and Regulatory Components
   a. Asset inventory
   b. Replacement costs
4. Funding sources and expenditures

The survey was also available online at www.surveygizmo.com so that agencies had the option to enter this information online. The advantage of this was that it automatically tracked the responses, and produced a database containing all the data.

Since the questionnaire was similar to others that had been sent out by the Metropolitan Transportation Commission in the San Francisco Bay Area and the Metropolitan Transportation Authority in Los Angeles County, agencies in these areas had the option of not filling out the questionnaire (in MTC's case), or only filling out portions (if you were in MTA's jurisdiction). Our analyses for these two regions depended to some extent on the data provided by MTC and MTA.

While the request for pavement information was relatively straightforward, there was more discussion on what elements of the safety, traffic and regulatory components should be collected. The original Request for Proposal identified the following elements to be of interest:

- **Storm drains**
- **Curb & gutters**
- **Sidewalks**
- **Traffic signals**
- **Street lights**
- Bicycle paths
- Bridges
- Corporate yards
- Curb medians
- Curb ramps
- Guardrails
- Heavy equipment
- Parking lots
- Pathways
- Public parks
- Sewer - pipelines
- Sound/retaining walls
- Speed bumps
- Storm damage costs
- Traffic circles
- Traffic signs
- Trees

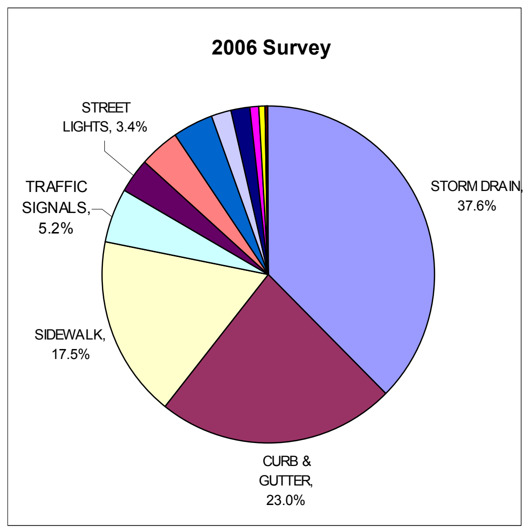


Figure 2.2 Replacement Costs of Safety, Traffic & Regulatory Components from MTC study[7]

However, a survey conducted by MTC in 2006[7] on over 100 agencies indicated that the top five categories (highlighted in bold/blue above) comprised almost 90% of the total value (see Figure 2.2). Therefore, it was agreed that the survey questionnaire would only include these five categories as well as the following six other categories:

- Curb ramps

[7] *Non-Pavement Needs Assessment*, Metropolitan Transportation Commission, Oakland, CA, October 2007.

- Sound/retaining walls
- Traffic signs
- NPDES (National Pollutant Discharge Elimination System) requirements
- Other ADA (American with Disabilities Act) compliance needs
- Other physical assets/expenditures that comprised >5% of total costs, e.g. heavy equipment, corporation yards, etc.

The intent of reducing the number of elements was to reduce the burden of data collection/reporting for the agencies by focusing only on those that represented the highest costs. However, the primary reason to include the costs of curb ramps, ADA and NPDES was to capture the impacts of the ever-changing regulatory climate.

2.4 Results of Data Collection

By September 2008, the data collection phase was essentially completed, although a late entry was received in early November. A total of 415 agencies responded to the survey – 56 counties and 359 cities. This represented more than 76% of the agencies surveyed, but more importantly, it represented more than 93% of the total centerline miles of local streets and roads in the state (see Figure 2.3). This was an incredible launch to this study; by comparison, many national surveys performed by the National Cooperative Highway Research Program (NCHRP) have survey responses of less than 30%.

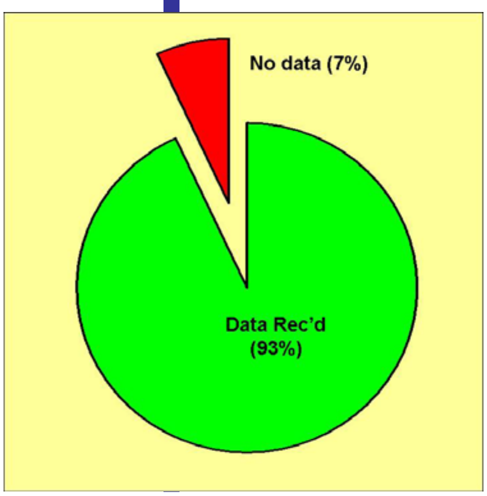


Figure 2.3 Responses to Survey (% centerline miles)

Both large and small (in terms of size of pavement network) agencies responded – the largest was the City of Los Angeles with over 6,500 miles, and the smallest was the City of Hidden Hills, with only 0.3 miles.

Many of the missing 130 agencies were contacted multiple times, either by NCE or by members of the Oversight Committee. In some instances, they reported no data available, or that they were currently performing an update of their system. More frequently, they reported a lack of resources to collect the information requested – this was particularly true of many of the smaller cities.

93% of the state's local streets and roads are included in this study.

Only two counties did not submit any data – San Benito County and Mono County. In the case of Mono County, NCE's archives contained a PMS database that was approximately five years old – this was used to project the current conditions. In the case of San Benito County, neighboring agencies were used to arrive at the current condition. This is further discussed in Chapters 3 and 4.

Of the data received, 97% of the responding agencies reported inventory data, and 93% reported information on their pavement needs. Encouragingly, 72% also reported some data on the safety, traffic and regulatory components – this was positive given that it was probably the first time a statewide survey had requested this information.

2.4.1 Are Data Representative?

Throughout the data collection phase, it was important to ensure that the data received were representative in nature. This was critical for the analyses – the criterion used was network size.

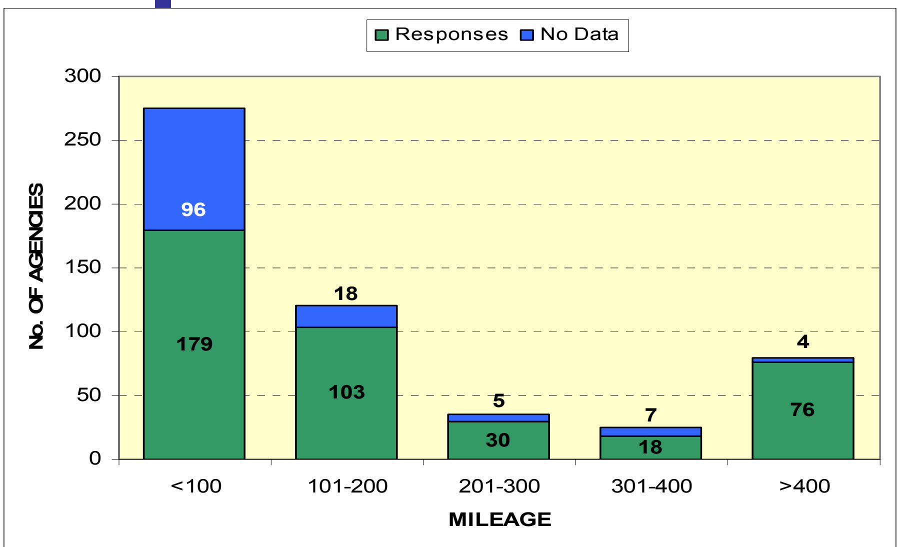


Figure 2.4 Distribution of Agency Responses by Network Size (Centerline miles)

The distribution of responses with respect to network size is shown in Figure 2.4. Small agencies are those that have less than 100 centerline miles; medium between 101 to 300 miles, and large agencies have more than 300 miles.

Figure 2.4 shows all the agencies who responded in green, and the ones who did not in blue. Clearly, the bulk of the agencies who did not respond had less than 100 miles of pavement network i.e. small cities, but we still had 179 responses (65%) in this size category, so our confidence in the responses were validated.

An important point to note is that small agencies account for a very small percentage of the state's pavement network. There are 275 Cities with less than 100 centerline miles of streets, and 167 Cities with less than 50 centerline miles of streets. However, they comprise only 8.7% and 3.2% of the total miles in the state, respectively. Their impact on the statewide needs is consequently minimal.

2.4.2 PMS Software

The survey responses showed that 85% of the responding agencies had some pavement management system (PMS) software in place (see Figure 2.5). The StreetSaver® (40%) and MicroPAVER (20%) software programs are the two main ones in the state, not surprising given their roots in the public domain and reasonable costs. StreetSaver® was developed and supported by the Metropolitan Transportation Commission (MTC) and MicroPAVER supported by the American Public Works Association (APWA).

The remaining agencies used a variety of PMS software, including:

- Cartegraph
- Stantec
- Infra Manager
- Windows PMS Pro
- Custom Excel/Access programs

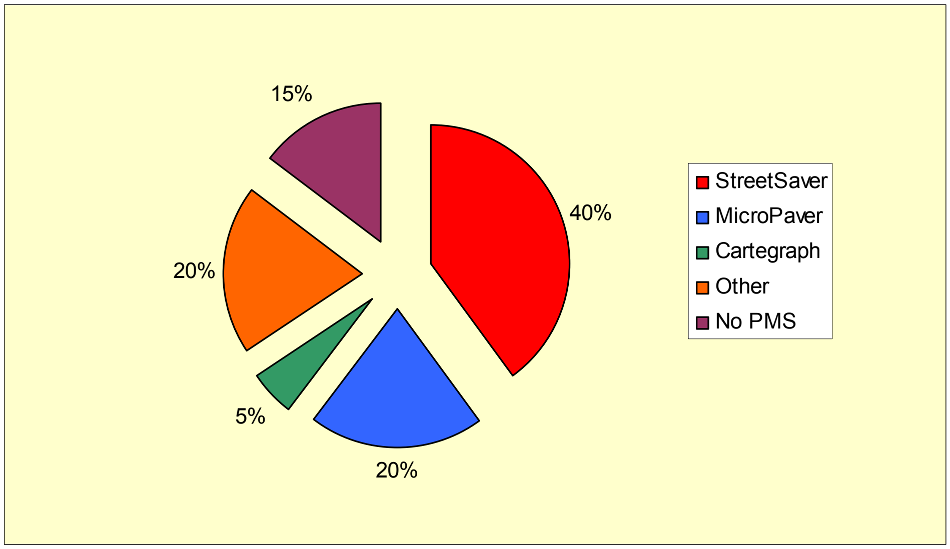


Figure 2.5 PMS Software Used from Survey Responses

2.4.3 Importance of PMS

It cannot be emphasized enough the importance of implementing and maintaining a pavement management system in an agency. Aside from the oft-mentioned benefits of one, it added tremendously to the quality of data received in this survey. The pavement distress survey procedures employed were probably the most important element. They were largely consistent and well-documented procedures (usually the StreetSaver® or MicroPAVER procedures) for collecting this information. Even those agencies which used other PMS software employed pavement distress survey procedures that were similar to those used by StreetSaver® or MicroPAVER.

Due to the widespread use of a PMS, the quality of the pavement data received contributed immensely to the validity of this study's results.

This resulted in a remarkable consistency in the pavement conditions reported, which in turn, allowed us to do an "apples and apples" comparison between agencies and reduced the complexity of this study. The quality of this information contributed immensely to the validity of the results of this study.

Equally important, almost all the medium and large agencies used a pavement management system, which lent more credibility to the results. Overall, 85% of the state's local pavement network was included in a PMS database.

2.4.4 Quality Assurance

The adage "garbage in, garbage out" applies to any data collection effort. Therefore, a quality assurance program was necessary to ensure that the data received was valid for our analyses. While it was not possible to check every single value supplied by the agencies in the surveys, several validation checks were made, particularly on those items that would have an impact on the analysis results. Examples are described below.

1. Inventory – an easy check was to validate the lengths (lane-miles, centerline miles) of the pavement network reported. This was compared with the lengths reported in the

HPMS (Highway Performance Monitoring System) data[2] and any significant differences (more than ±10%) were red-flagged and follow up phone calls made. Minor differences in these numbers were expected due to the many different ways that a pavement network can be sectionalized, e.g. bi-directional streets, double counting of intersections, inclusion or exclusion of unpaved roads, etc.

2. Lane-miles, areas and lane widths - Since we also asked for pavement areas, a quick check was to calculate the average lane-widths. Extreme values, such as widths more than 20 feet or less than 5 feet were flagged for follow up calls.

3. Math errors – surprisingly enough, there were multiple math errors, i.e. the individual components did not add up to the totals submitted.

4. Mismatching units – Particularly for the safety, traffic and regulatory components, the wrong units were used, e.g. feet instead of yards. Any extreme values identified became reasonable once the right units were applied.

5. Tests of reasonableness – in many cases, we had to use simple tests of reasonableness. For example, one medium sized city of 200 miles reported more than 1,300 traffic signals! Another small city with 33 miles reported future pavement expenditures of more than $500,000/mile, which is more than 20 times the state average. For the medium to large agencies, these results triggered a follow-up phone call to obtain explanations. In most instances, they were simple errors in data entry.

Our QA tests resulted in additional follow up calls to between 75 to 100 agencies. Again, we focused primarily on the medium to large agencies (i.e., more than 100 centerline miles) in this instance.

2.5 Summary

Overall, the number and quality of the survey responses received exceeded expectations and more than met the needs of this study. To obtain data on more than 93% of the state's local streets and roads network was a remarkable achievement. That 85% of the agencies that responded also had some pavement management system in place removed many obstacles in the technical analyses. In particular, the consistency in the pavement conditions reported contributed enormously to the validity of the study.

Finally, to obtain some data from 72% of the agencies on their safety, traffic and regulatory components was an encouraging first step.

Chapter 3. Pavement Needs Assessment

In this chapter, the methodology and assumptions used for the pavement needs assessment are discussed, and the results of our analyses presented.

3.1. Methodology

Since not all 536 cities and counties responded to survey, a methodology had to be developed to estimate the needs of the missing agencies. The following paragraphs describe in detail the methodology that was used in the study.

3.1.1. Filling In the Gaps

Inventory

Figure 3.1 on the next page outlines the first steps in "filling in the gaps". Briefly, this process was to determine the total miles (both centerline and lane-miles) and pavement areas, as this would be crucial in estimating the pavement needs for an agency.

1. If no centerline miles are reported, then the centerline miles reported in the HPMS[2] report was used.

2. From the HPMS, the statewide centerline mile average indicated that 37% of the pavements were classified as major and 63% as local. These averages were also used to determine the functional class breakdown.

3. If no lane-miles were reported, then statewide averages from the HPMS report were used to arrive at this information.

    a. For counties, the statewide average was approximately 2.1 lane-miles per centerline mile for major roads, and 2 lane-miles per centerline mile for locals.

    b. For cities, the statewide average was approximately 3 lane-miles per centerline mile for major roads, and 1.9 lane-miles per centerline mile for locals.

4. If no pavement areas were reported, again, statewide averages from the HPMS report were used to determine this value. The average lane width was 15.9 feet per lane for major roads and 15 feet per lane for local roads.

Steps 1 through 3 were also part of validation checks discussed in Chapter 2. Table 3.1 summarizes the results for all the counties (cities included in counties) for both major and local streets and roads.

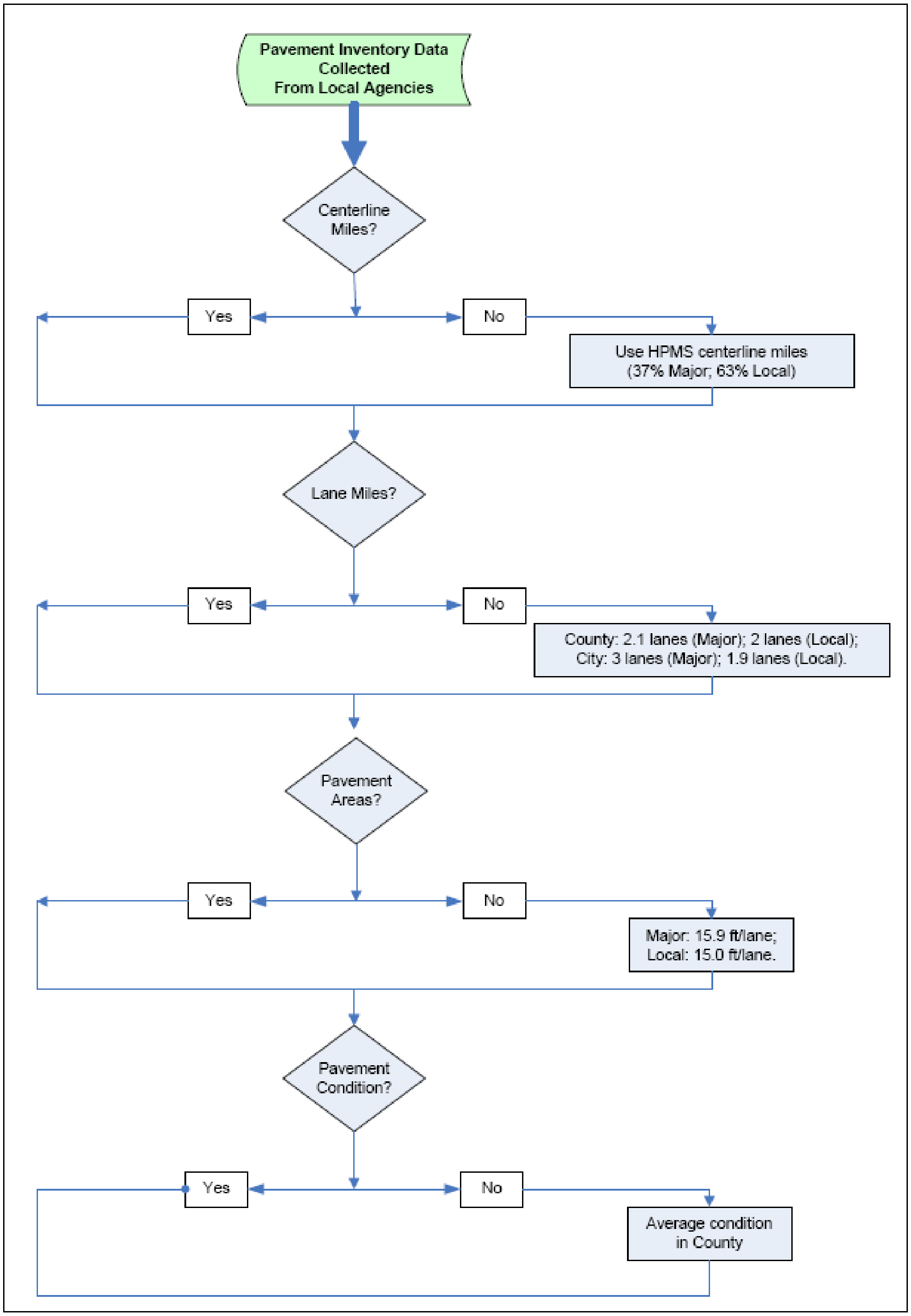


Figure 3.1 Flowchart to Estimate Pavement Inventory and Condition Data

Table 3.1 Summary of Inventory & Pavement Condition Data by County (Cities Incl.)

County*	Centerline Miles				Lane Miles				Current Average PCI**		
	All	Major	Local	Unpaved	All	Major	Local	Unpaved	All	Major	Local
Alameda County	3,473	1,279	2,194	0	7,933	3,716	4,217	0	66	66	66
Alpine County	135	38	15	82	270	75	30	164	40	40	40
Amador County	476	202	252	22	955	408	503	44	31	31	31
Butte County	1,783	522	986	274	3,684	1,195	1,943	545	70	72	68
Calaveras County	715	323	297	95	1,344	656	593	95	55	56	50
Colusa County	987	277	474	236	1,524	541	746	236	61	69	58
Contra Costa County	3,013	1,104	1,909	0	6,973	3,221	3,752	0	72	72	72
Del Norte County	334	79	146	109	675	178	290	207	70	70	70
El Dorado County	1,253	416	765	72	2,490	858	1,525	108	62	73	57
Fresno County	6,009	2,287	3,641	81	12,852	5,439	7,252	161	74	75	70
Glenn County	942	349	448	145	1,892	713	892	288	68	68	68
Humboldt County	1,477	526	225	725	2,972	1,153	441	1,377	61	55	73
Imperial County	2,994	1,244	1,743	6	6,088	2,610	3,468	11	74	74	74
Inyo County	1,684	208	353	1,124	2,933	435	363	2,136	75	75	74
Kern County	5,520	1,841	3,494	185	12,787	5,296	7,121	370	66	71	60
Kings County	1,328	425	833	70	2,796	962	1,694	140	63	70	59
Lake County	752	239	362	152	1,497	477	720	299	33	36	30
Lassen County	942	354	76	513	1,900	727	148	1,026	55	49	61
Los Angeles County	20,269	7,414	12,742	112	56,864	21,833	34,858	174	68	72	66
Madera County	1,827	567	1,195	66	3,652	1,185	2,354	113	48	58	43
Marin County	1,030	381	649	0	2,033	893	1,140	0	61	62	61
Mariposa County	560	207	353	0	1,142	435	706	0	53	53	53
Mendocino County	776	356	419	2	1,530	727	800	3	51	56	45
Merced County	2,229	822	1,244	163	4,710	1,828	2,556	326	57	64	54
Modoc County	1,515	394	631	490	3,041	800	1,260	980	42	52	32
Mono County	737	275	462	0	1,498	581	917	0	71	72	72
Monterey County	1,942	659	1,275	8	3,980	1,454	2,514	11	63	64	62
Napa County	739	273	466	0	1,500	635	865	0	53	53	53
Nevada County	771	285	338	148	1,564	595	673	296	72	70	74
Orange County	6,316	2,112	4,204	0	15,190	6,947	8,243	0	78	75	78
Placer County	1,989	559	1,370	60	4,099	1,262	2,717	120	79	79	79
Plumas County	700	233	259	208	1,407	474	516	416	71	71	71
Riverside County	7,114	2,555	4,243	316	15,583	6,638	8,321	624	71	71	72
Sacramento County	4,861	957	3,878	26	11,423	3,352	8,020	51	68	72	66
San Benito County	421	156	265	0	868	340	528	0	68	68	68
San Bernardino County	8,502	3,091	5,258	153	19,350	8,393	10,502	455	72	73	73
San Diego County	7,683	3,085	4,497	101	17,408	8,389	8,817	202	74	75	73
San Francisco County	855	316	539	0	2,044	983	1,061	0	62	62	62
San Joaquin County	3,318	1,204	2,095	19	7,040	2,899	4,102	39	70	69	69
San Luis Obispo Co	1,929	729	960	241	4,078	1,707	1,889	482	64	66	62
San Mateo County	1,826	676	1,151	0	3,889	1,806	2,082	0	69	69	69
Santa Barbara County	1,569	489	1,078	2	3,322	1,218	2,100	4	72	78	68
Santa Clara County	4,450	1,647	2,804	0	9,215	4,279	4,936	0	70	70	70
Santa Cruz County	883	400	483	0	1,837	884	953	0	52	56	48
Shasta County	1,694	1,109	354	231	3,501	2,361	702	438	64	62	74
Sierra County	499	182	106	211	1,001	368	211	423	73	73	73
Siskiyou County	1,516	557	463	497	3,066	1,154	919	993	57	61	51
Solano County	1,739	643	1,096	0	3,563	1,597	1,966	0	66	66	66

County*	Centerline Miles All	Centerline Miles Major	Centerline Miles Local	Centerline Miles Unpaved	Lane Miles All	Lane Miles Major	Lane Miles Local	Lane Miles Unpaved	Current Average PCI** All	Current Average PCI** Major	Current Average PCI** Local
Stanislaus County	2,820	963	1,815	42	5,974	2,295	3,596	83	60	61	64
Sutter County	1,196	281	752	163	2,439	627	1,486	326	73	65	71
Tehama County	1,197	328	595	274	2,401	658	1,194	549	69	69	64
Trinity County	919	283	410	226	1,837	565	819	452	52	57	48
Tulare County	3,988	1,363	2,514	110	8,209	3,025	4,964	220	66	72	67
Tuolumne County	532	211	284	37	1,228	511	643	74	62	62	62
Ventura County	2,410	856	1,549	4	5,333	2,405	2,919	9	64	66	61
Yolo County	1,352	439	791	122	2,709	1,026	1,507	175	69	72	67
Yuba County	724	282	340	102	1,504	592	709	204	74	74	74
Total or Average	141,554	49,916	83,613	8,025	317,465	128,451	173,564	15,450	68	70	67

* All cities within county are included.
** Average PCI is weighted by pavement area.

Current Pavement Condition

Table 3.1 above includes the current pavement condition index (PCI) for each county (including cities). Again, this is based on a scale of 0 (failed) to 100 (excellent). This is weighted by the pavement area, i.e. longer roads have more weight than short roads when calculating the average PCI.

For those agencies that did not report any current pavement condition, the average current pavement condition in that county/region was used. These were obtained from those agencies that utilized a PMS. Cities were determined separately from counties, i.e. a city's condition was based only on the average condition of cities within the county, but the county was based on surrounding like counties.

The only exception to this rule was for some cities in Los Angeles County; due to the large size of the county and differences in the rural and urban regions, an individual city's pavement condition came from the cities in the same geographic area, e.g. San Fernando Valley or the coast.

The average pavement condition index for streets and roads statewide is 68. This rating is considered to be in the "at risk" category.

From this table, we can see that the statewide weighted average PCI for all local streets and roads is 68, with major roads slightly better and local roads slightly worse. The PCI ranges from a high of 79 in Placer County to a low of 31 in Amador County. It should be emphasized that the PCI reported above is only the weighted average for each county and includes the cities within the county. This means that Amador County may well have pavement sections that have a PCI of 100, although the average is 31.

Another way of interpreting the PCI is to use condition categories to describe the PCI ranges. Figure 3.2 shows the most common thresholds – these were used in this study. The descriptions used for each category are typical of most agencies, although there are many variations on this theme. For example, it is not unusual for local streets to have slightly lower thresholds indicating that they are held to lower condition standards.

Figure 3.2 PCI Categories

The PCI can also be used as an indicator of the type of repair work that will be required. This is described in more detail in Section 3.1.3. To provide a sense of what the PCI values mean, Figures 3.3 to 3.7 are photographs of some pavements with different PCIs.

Figure 3.3 PCI = 98 (Excellent Condition)

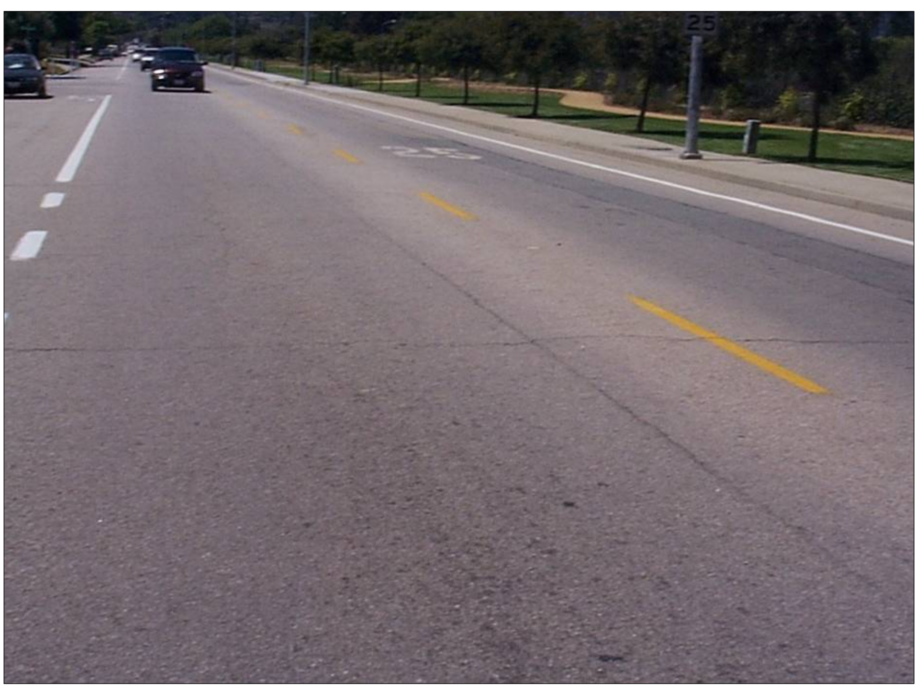


Figure 3.4 PCI = 82 (Good Condition)

Figure 3.5 PCI = 68 ("At Risk")

Figure 3.6 PCI = 40 (Poor Condition)

Figure 3.7 PCI <10 (Failed Condition)

3.1.2. What Does a PCI of 68 Mean?

An average pavement condition of 68 is not necessarily good news. While it seems just a couple of points shy of the “good/excellent” category, it has significant implications for the future. From the generalized pavement life cycle curve in Figure 3.8, a newly constructed pavement will have a PCI of 100. In the first five years of its life, there is a gradual and slow deterioration. As more time passes, this pavement deterioration begins to accelerate, until the steep part of the curve is reached at approximately 15 years (the exact timing will depend on the traffic volume, climate, pavement design, maintenance, etc).

From here, the pavement deterioration is very rapid – if repairs are delayed by just a few years, the costs of the proper treatment may increase significantly, as much as ten times. The financial advantages of maintaining pavements in good condition are many; they include saving the taxpayers’ dollars, less disruption to the traveling public as well as more environmental benefits.

Therefore, a PCI of 68 should be viewed with caution – it indicates that our local streets and roads are, as it were, poised on the edge of a cliff.

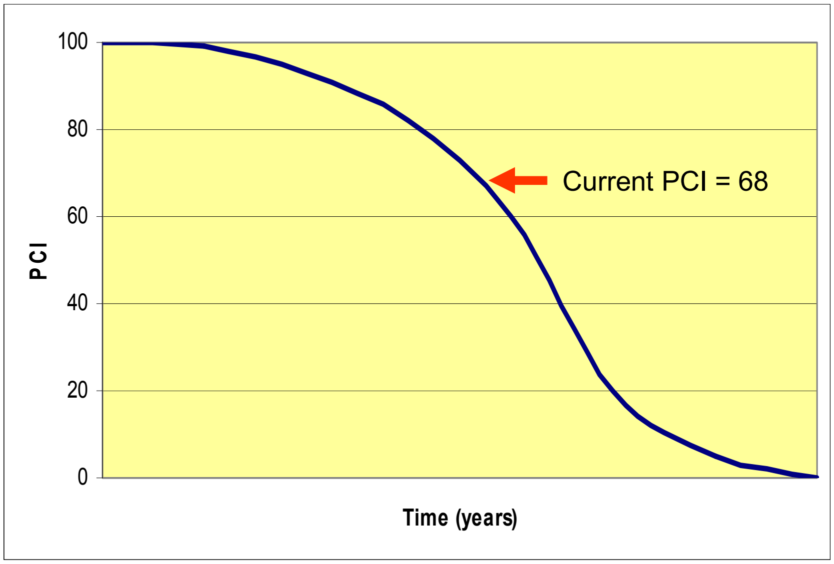


Figure 3.8 Generalized Pavement Life Cycle Curve

Figure 3.9 shows the distribution of pavement conditions by county. As can be seen, a majority of the counties in the state have pavement conditions that are either "At Risk" or in "Poor" condition. Some of the "green" counties are green due to recent population growth patterns. For example, San Bernardino County has experienced a significant increase in population growth that has resulted in an explosion of new subdivisions with new roads. Therefore, their pavement conditions are somewhat "skewed" due to the larger percentage of new roads with high PCIs. However, despite their color, none of the "green" counties have a PCI greater than 80; in fact, the majority are in the low 70's, indicating that they will turn "blue" in a few years.

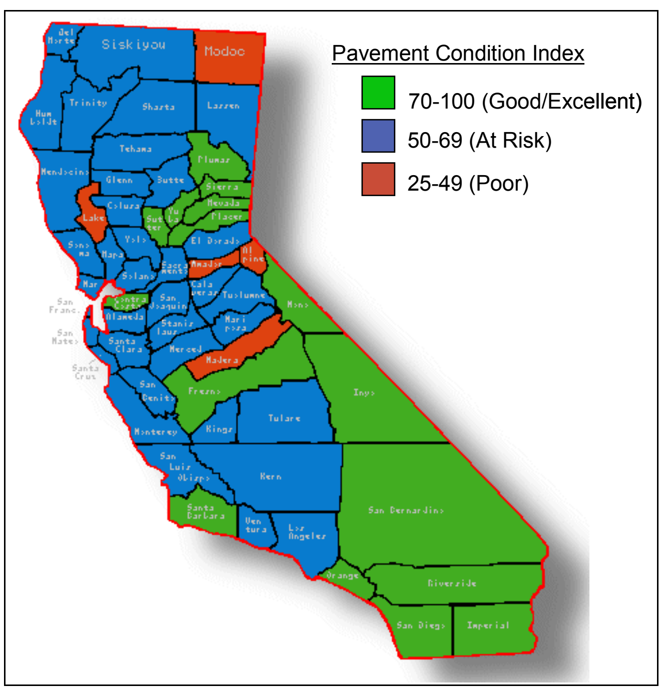


Figure 3.9 Average Pavement Condition by County

3.1.3. Needs Assessment Goal

To determine the pavement needs, we first need to define the goals that we would like to achieve. For instance, the funding required to achieve a PCI goal of 50 would be significantly less than that for say, a PCI of 75 since it would cost more to maintain pavements at a higher PCI. Of course, the tradeoff is that we end up with roads in "poor" condition that will cost more to improve and maintain in the long term.

Our goal is to bring streets and roads to a condition where best management practices (BMP) can occur.

In this study, the goal of the needs assessment is for all pavements to reach a condition where best management practices (BMP) can occur, i.e. where only the most cost-effective pavement preservation treatments are needed. Other benefits such as a reduced impact to the public in terms of delays and environment (dust, noise, energy usage) will also be realized.

In short, the BMP goal is to reach a PCI in the low 80s and the elimination of the backlog of work. The deferred maintenance or "backlog" is defined as work that is needed, but is not funded.

For this goal to be effective, it should also be attainable within a specific timeframe. Although four funding scenarios were included in our analysis, only two are included in this report for brevity:

1. Funding required to achieve BMP in 10 years
2. Impacts of existing funding on PCI and backlog

The second scenario was to determine the impacts of the existing funding with respect to the pavement condition as well as the deferred maintenance or backlog.

To perform these analyses, MTC's StreetSaver® pavement management system program was used. This program was selected because the analytical engine was able to perform the required analyses, and the default pavement performance curves were based on data from California cities and counties.

Once the current PCI and analysis goal were determined, two additional pieces of information were needed to perform the needs assessment:

1. The types of **maintenance and rehabilitation treatments** that are assigned to a pavement section during the analysis period. For example, if Main Street had a PCI of 45, then the required treatment may be an overlay at a cost of $26/square yard.

2. **Performance models** to predict the future PCI of the pavement sections with and without treatment.

Sections 3.1.4 and 3.1.5 describe both of these processes in more detail.

3.1.4 Maintenance and Rehabilitation Decision Tree

Assigning the appropriate maintenance and rehabilitation (M&R) treatment is a critical component of the needs assessment. It is important to know both the ***type*** of treatment as well as ***when*** to apply it. This is typically described as a decision tree.

Figure 3.10 summarizes the types of treatments and their costs in this study. Briefly, good to excellent pavements (PCI >70) are best suited for pavement preservation techniques, i.e. preventive maintenance treatments such as chip seals or slurry seals. These are usually applied at intervals of five to seven years depending on the traffic volumes.

As pavements deteriorate, treatments that address structural adequacy are required. Between a PCI of 25 to 69, asphalt concrete (AC) overlays are usually applied at varying thicknesses. Finally, when the pavement has failed (PCI<25), reconstruction is typically required. Note that if a pavement section has a PCI between 90 and 100, no treatment is applied.

The PCI thresholds shown in Figure 3.10 are generally accepted industry standards.

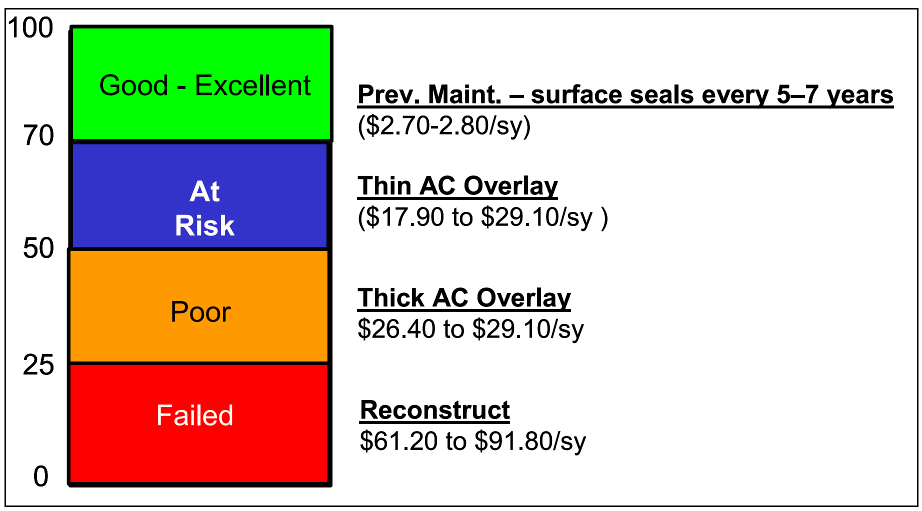


Figure 3.10 Final M&R Tree and Unit Costs

Multiple treatments may occur within the analysis period. For example, if Main Street were reconstructed in 2012, typical treatments over the analysis period may include a slurry seal every 5 years to preserve the pavement. Therefore, an accurate needs assessment must also include the cost of these seals in addition to the cost of reconstruction.

The unit costs shown in Figure 3.10 are statewide averages. The range in costs for each treatment is for the different functional classes of pavements, i.e. majors have a higher cost than locals.

Cost data from almost 50 agencies covering different climatic regions were examined. The intent was to determine if there was a regional difference in unit costs. From Figure 3.11, it can be seen that there were wide ranges in the costs for overlays and reconstruction, although there were no regional trends. The high end of an overlay could be as much as ten times more than the low end.

While it may make intuitive sense that unit costs should vary by geography or climate, the reality is that there are so many other factors that affect the cost, such as:

- Size of project
- Distance from hot mix plant/haul distances
- Asphalt prices
- Time of year

Even within the same county, there can be large variations in the unit cost for the same treatment. Only surface seals were fairly consistent in price. Therefore, we used the statewide averages for this study.

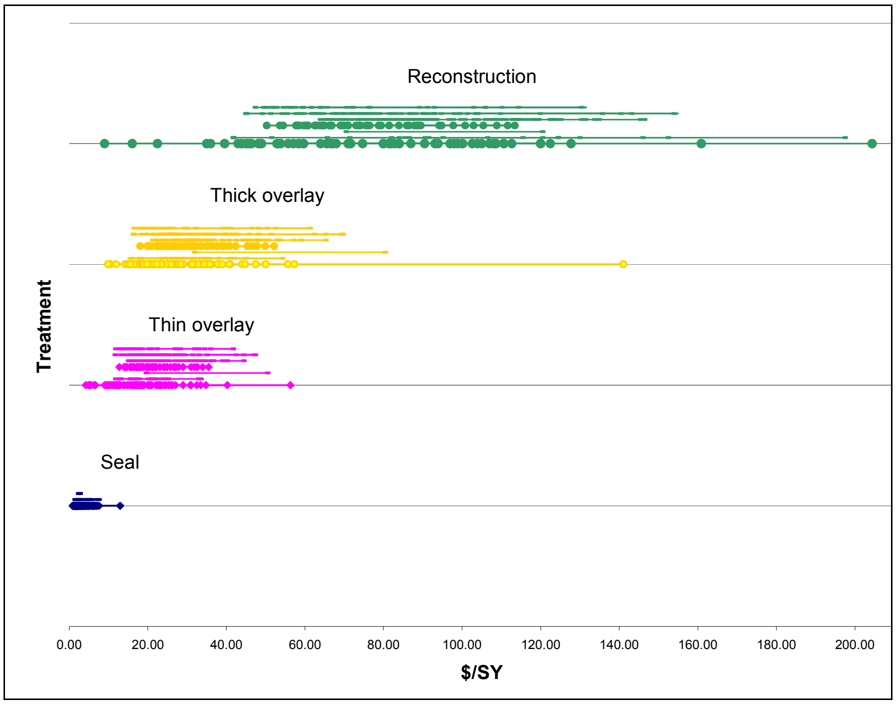


Figure 3.11 Range of Unit Costs for M&R Treatments

3.1.5 Pavement Performance (Prediction) Models

Since the analysis period is 10 years, the future condition of all the pavement sections have to be predicted or forecast. For example, if Main Street had a current PCI of 65 in 2008 and is to be overlaid in 2009, what will the PCI be in 2012? What if it was slurried in 2015?

To predict the future PCI, performance models were used. As was mentioned earlier, one of the reasons to use the StreetSaver® software was because the default performance models were developed using data from California cities and counties. Originally, it was the intent of this study to determine if regional prediction models could be developed, i.e. desert, mountains or coastal. However, raw performance data was not available so it was not possible to develop these curves. Therefore, the default StreetSaver® models were used.

The general form of the model is:

$$\mathbf{PCI = 100 - \rho / (\ln (\alpha/Age))\verb|^|(1/\beta)}$$

Where:

PCI = pavement condition index
α, β, ρ = regression coefficients depending on the functional class (major or local) and surface type of pavement (asphalt concrete, Portland cement concrete or surface treated only)
Age = age of pavement, years

The development of these performance equations can be found in the Technical Appendices of the StreetSaver® manual[8]. They included the analyses of thousands of data points from multiple cities and counties.

3.1.6 Escalation Factors

In addition, the use of an appropriate escalation factor for use in the analysis was examined. Table 3.2 summarizes the asphalt price index as well as the price for asphalt concrete every year since 1998. The average annual increase over the ten-year period is 7.1%.

However, subsequent discussions with other agencies and the Oversight Committee modified our decision to use constant 2008 dollars in our analyses. Therefore, an escalation factor was not used. Note too that the SHOPP as well as some Regional Transportation Plans also report their needs assessments in constant dollars.

[8] *Technical Appendices Describing the Development and Operation of the Bay Area Pavement Management System*, by Roger E. Smith, Texas A&M University, 1987.

Table 3.2 Price Index and Asphalt Concrete Unit Cost from 1998 (*ref. Caltrans*)

Year	Price Index		Asphalt Concrete		Average % of Change per Year (from 1998 to this year)
	Value	% of Change per Year (from 1998 to this year)	$/Ton	% of Change per Year (from 1998 to this year)	
1998	128.6		$38.78		
1999	139.2	8.2%	$40.14	3.5%	5.9%
2000	146.2	6.6%	$45.12	7.9%	7.2%
2001	154.1	6.2%	$43.89	4.2%	5.2%
2002	142.2	2.5%	$49.00	6.0%	4.3%
2003	148.6	2.9%	$48.35	4.5%	3.7%
2004	216.2	9.0%	$53.55	5.5%	7.3%
2005	268.3	11.1%	$75.72	10.0%	10.6%
2006	280.6	10.2%	$86.04	10.5%	10.4%
2007	261.1	8.2%	$85.48	9.2%	8.7%
2008	240.3	6.5%	$85.02	8.2%	7.3%
				Average	**7.1%**

3.1.7 Distribution of Pavement Areas by Condition Category

As an additional note, the responses to our survey provided us with only the average PCI. This did not offer any information on the distribution of PCIs within that particular network or database. For example, if City X reported an average PCI of 75, there was no corresponding information on what % of streets were actually 90, or 55 or 32. An infinite number of combinations were possible to arrive at an average of 75. This distribution was required to perform the needs analysis.

Therefore, we examined the distribution of PCIs for 128 agencies and arrived at Table B.1 in Appendix B – this appendix also contains a more detailed discussion of the development of the PCI distributions.

3.1.8 Unpaved Roads

The needs assessment for unpaved roads is much simpler – 74 agencies reported data on their unpaved road network, including their needs. This resulted in an average cost of $9,800 per centerline mile per year. Since StreetSaver®, like all pavement management software only analyzes paved roads, the average cost for unpaved roads from the survey was used for those agencies which did not report any funding needs.

An example of this calculation is also included in Appendix B.

3.1.9 Needs Calculations

The determination of pavement needs and backlog is based on four primary factors:

- Existing condition, i.e. PCI
- Appropriate treatment(s) to be applied from decision tree and unit costs
- Performance models
- Funding available during analysis period

The calculation of the pavement needs is conceptually quite simple. Once the PCI of a pavement section is known, a treatment and unit cost from (Figure 3.10) is applied. This is performed for all sections within the 10-year analysis period. A section may receive multiple treatments within this time period, e.g. Walnut Avenue may be overlaid in Year 1, and then slurried in Year 5 and again in Year 10.

The next step is to determine **when** this treatment is applied. In the case of the 10-year scenario, ten years is needed to achieve the goal; therefore, the appropriate treatments must be applied between Years 1 to 10.

However, the optimal time is when to get the "biggest bang for the buck". Therefore, a cost-benefit analysis is performed to determine the biggest bang. From Figure 3.12, when an overlay is applied, the PCI will improve to 100, and a new performance curve is determined. The "benefit" is the area under the curve, also known as the "effectiveness area".

This is divided by the equivalent uniform annual cost of the treatment and a weighting factor based on traffic volumes is then applied. The Weighted Effectiveness Ratio (WER) is calculated as follows:

$$WER = \frac{(Effectiveness\ Area / Year)}{EUAC / SY} * WF$$

where:
WER = Weighted effectiveness ratio
Effectiveness area = area under PCI curve shown in Figure 3.12
Year = years affected
WF = weighting factor based on traffic volumes (1.0 for major streets, 0.55 for local streets)
EUAC = equivalent uniform annual cost of treatment
SY = area of pavement section in sq. yards

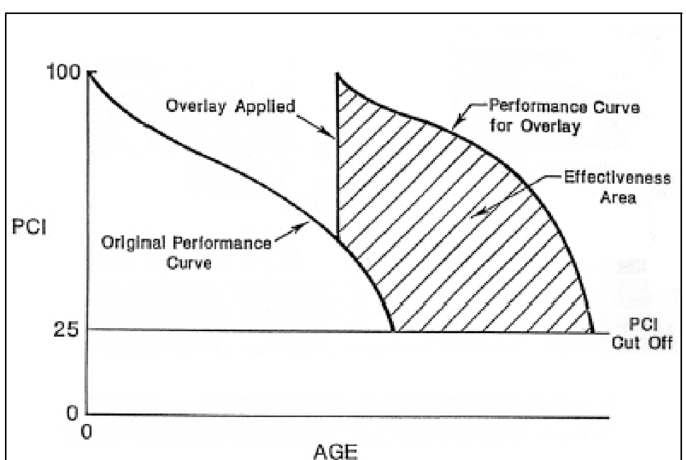


Figure 3.12 Calculation of Effectiveness Area[9]

The pavement sections are then prioritized by the WER, i.e. the sections with the highest WER will be selected for treatment first. This process is performed for all the sections in the database until the goals are achieved within the first ten years. The cost of all the treatments applied are then summed up annually.

The deferred maintenance or "backlog" is defined as work that is needed, but is not funded. It is possible to fully fund ALL the needs in the first year and thereby result in a backlog of zero. However, the funding constraint for the scenario is to achieve our BMP goal within 10 years. Assuming a constant annual funding level for each scenario, the backlog will gradually decrease to zero by the end of year 10.

Appendix B contains an example of the needs calculations.

3.1.10 Results

The results are summarized in Table 3.3 and indicate that $67.6 billion is required to achieve the BMP goals in 10 years. Again, this is in constant 2008 dollars. Detailed results by County for each scenario are included in Appendix C. The results for the cities and counties within MTC's jurisdiction (i.e. within Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano and Sonoma Counties) were provided by MTC.

Table 3.3 Cumulative Pavement Needs (2008 $)

Cumulative Needs (2008 dollars)		
Year No.	Year	Reach BMP Goal in 10 Years
1	2009	$ 6,763,602,217
2	2010	$13,527,204,434
3	2011	$20,290,806,651
4	2012	$27,054,408,868
5	2013	$33,818,011,085
6	2014	$40,581,613,302
7	2015	$47,345,215,519
8	2016	$54,108,817,736
9	2017	$60,872,419,953
10	2018	$67,636,022,170

3.1.11 Funding to Maintain Network at BMP

Additional analyses were performed to determine the funding required to *maintain* the pavement network after the BMP goal was reached in 10 years. An iterative process was used to calculate the funding level required to maintain the pavement condition at this level for an additional 15 years (i.e. a total analysis period of 25 years was used to determine this).

This was determined to be $1.8 billion annually, which is not too far from the existing funding level of $1.59 billion (see next section). This much smaller funding level is because only pavement preservation policies are required to maintain the pavement network once it has been improved. These policies cost significantly less, as was described in Section 3.1.4.

3.2 Existing Funding Sources

The survey also asked agencies to provide both their revenue sources as well as pavement expenditures for FY 2006/07, FY 2007/08 as well as estimating an annual average for future years. Local agencies identified a myriad of sources of funds for their pavement expenditures, broadly categorized into federal, state or local. They included the following examples (this is by no means an exhaustive list):

Federal

- Regional Surface Transportation Program (RSTP)
- Congestion Mitigation & Air Quality Improvement (CMAQ)
- Emergency Relief
- High Risk Rural Roads (HR3)
- Safe Routes to School (SRTS)
- Transportation Enhancement Activities (TE)
- Community Development Block Grants (CDBG)

State

- Gas taxes
- Proposition 1B
- Proposition 42/AB 2928
- State Transportation Improvement Program (STIP)
- AB 2766 (vehicle surcharge)
- Bicycle Transportation Account (BTA)
- Safe Routes to School (SR2S)
- Transportation Development Act (TDA)

Local

- General funds
- Local sales taxes
- Developers fees
- Various assessment districts – lighting
- Redevelopment
- Traffic impact fees
- Traffic safety/circulation fees
- Utilities
- Transportation mitigation fees
- Parking and various permit fees

Table 3.4 summarizes the percentage of funding sources from the different categories for FY 2006/07 to FY 2007/08 as well as the estimated sources for future years. Note that Prop. 1B funds were a significant percentage of the total (10%), equaling the federal category, but this is only a one-time funding source. Transportation funding from the American Recovery and Reinvestment Act (ARRA) was also included below. However, it was estimated that only 40% of the $1.6 billion (i.e. $640 million) would be spent on local streets and roads, and that this would be available only in FY 2008/09.

More than one-third of pavement funding comes from local sources.

The more important item to note is that local funding sources come from many sources, and include a range of original fees. Local funding sources form a significant percentage of the total funding, more than one-third.

Table 3.4 Sources of Funding Sources

Funding Sources	Annual Funding		
	FY 2006/07 & 07/08	Estimated for FY 08/09	Estimated for FY 09/10 onwards
State	41.0%	40.5%	52.9%
State – Prop 1B only	10.0%	0%	0%
Federal with ARRA*	10.8%	35.9%	10.4%
Local	38.1%	23.6%	36.8%

*ARRA for cities and counties is assumed to be 40% of $1.6 billion (FY 08/09)

The survey also asked for a breakdown of pavement expenditures into four categories:

- Preventive maintenance, such as slurry seals
- Rehabilitation and reconstruction, such as overlays
- Other pavement related activities e.g. curb and gutters
- Operations and maintenance

Table 3.5 shows the breakdown in pavement expenditures for cities, counties and cities/counties combined. These were consistent within 1-2% points for all the years reported.

Table 3.5 Percentage of Pavement Expenditures

	Percentage of Pavement Expenditures			
	Preventive Maintenance	Rehabilitation & Reconstruction	Other Pavement Related	Operations & Maintenance
Counties	13%	42%	8%	37%
Cities	14%	60%	9%	17%
Cities & Counties combined	14%	52%	9%	26%

Encouragingly, approximately 13-14% of pavement expenditures are for preventive maintenance, which indicates that many agencies are cognizant of the need to preserve pavements. The main difference between counties and cities is the percent allocated to operations and maintenance. This is expected, since county networks tend to have different characteristics from city streets, thereby incurring a higher percentage of operations and maintenance costs.

Cities and Counties are estimated to spend $1.59 billion annually on pavements.

On average, anticipated pavement expenditures for the next ten years are expected to be $7,426/centerline-mile for counties and $15,173/centerline-mile for cities (not including operations and maintenance). These values were used to estimate the expenditures for those agencies that did not report this information. The resulting total pavement expenditures for all 536 cities and counties were therefore estimated to be $1.59 billion annually. This value is used in the analysis discussed below.

To put this funding level in perspective, $1.59 billion/year is less than 0.06% of the total investment in the pavement network, which is estimated to be $271 billion.

3.2.1. Impacts of Existing Funding

The second scenario estimates what the impacts will be on the pavement condition and backlog if the existing funding ($1.59 billion/year) stays constant. The results are shown in Figure 3.13.

Under the existing funding scenario, the blue line shows that the PCI will gradually decrease to 58 by 2018; more troubling, the red bars show that backlog will increase from $37 billion to almost $58 billion in 10 years.

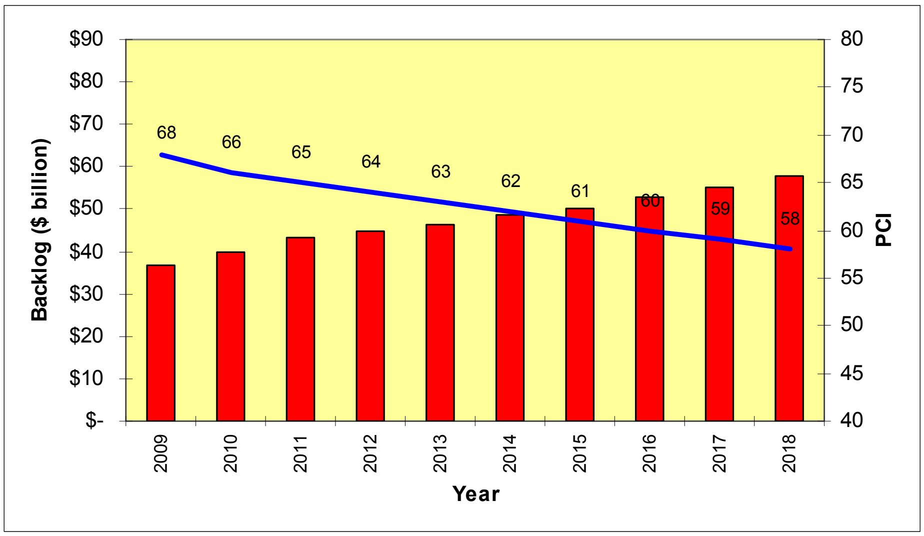


Figure 3.13 Impacts of Existing Funding on Pavement Condition and Backlog

3.3 Funding Shortfall

Given the needs results from Table 3.5 and the estimated available funding, it is a simple task to estimate the funding shortfall. Table 3.6 below shows this calculation – the shortfall is $51.7 billion. Clearly, the available funding is woefully inadequate in meeting BMP within the period analyzed.

Table 3.6 Shortfall Calculations (2008 dollars)

Scenario	10 Year Needs ($ billion)	Available Funding ($ billion)	Funding Shortfall ($ billion)
Achieve BMP Goal in 10 years	$ 67.6	$ 15.9	$ (51.7)

Chapter 4. Safety, Traffic & Regulatory Needs Assessment

The analyses for the safety, traffic and regulatory components are quite different from those for the pavement needs; regression techniques are employed instead.

A total of 246 survey responses were received, of which 188 were partial responses and 58 were complete responses. Agencies were asked to provide specific information on the inventory and replacement cost for their safety, traffic and regulatory components:

- Miles of pipelines for storm drains
- Other storm drain components (lump sum)
- Linear feet of curb and gutter
- Square feet of sidewalk
- Number of curb ramps
- Number of traffic signals
- Number of street lights
- Square feet of sound/retaining walls
- Traffic signs
- NPDES requirements (lump sum)
- ADA compliance needs (lump sum)
- Other (lump sum)

Additionally, mileage information (rural and urban centerline miles) was available from the Highway Performance Monitoring System (HMPS) and used in this analysis.

4.1 Data Quality Assurance

Before any analysis was performed, the survey responses were checked for errors and to make sure that all units were consistent. Unit costs were calculated based on the inventory and total cost data in order to compare the range of values. Where inconsistencies were found, the agencies were contacted and asked to clarify. Most agencies contacted responded either with corrections or further explanations that justified their responses. Examples of common errors were:

- Wrong units – response was in miles instead of linear feet.
- Typos – additional zeros
- Calculated units costs were too high or too low – most due to typos; some due to specific agency circumstances.

One issue of interest is the submission of partial responses. Most agencies left the answers of one or more of the twelve components blank. It could be assumed that these agencies are not responsible for such components; however, there is also the possibility that they do maintain those components but did not have accurate information to provide. To use the most accurate data, only complete responses were used in the analysis.

4.2 Regression Analysis

The costs of all 12 safety, traffic and regulatory components listed above were added to obtain the total replacement cost. This cost was used as the response variable. The objective of this analysis was to find a statistical model to predict the total replacement cost using either the mileage data from HPMS or the data from the survey responses as predictors. Numerous models were considered:

- Cost vs. Total Miles
- Cost vs. Urban Miles, Rural Miles
- Cost vs. Urban Miles
- Log Cost vs. Urban Miles
- $\sqrt{\ }$ Cost vs. Urban Miles
- Cost vs. Storm Drain, Curb & Gutter, Sidewalk, Curb Ramps, Traffic Signals, Street Lights, Sound/Retaining Walls, Traffic Signs
- Log Cost vs. Storm Drain, Curb & Gutter, Sidewalk, Curb Ramps, Traffic Signals, Street Lights, Sound/Retaining Walls, Traffic Signs
- Log Cost vs. Curb & Gutter, Street Lights, Sound/Retaining Walls
- Log Cost vs. Curb & Gutter, Street Lights

However, none of these models were adequate for various reasons. A more detailed discussion on the statistical analyses used is included in Appendix D.

4.2.1 Final Model

The final model considered total replacement cost as the response variable and total miles, agency type and climate type as predictors and was as follows:

log Cost = 17.9 + 0.00189 Total Miles – 2.09 Type_Rural + 0.682 Climate_Central

where:

Cost = total replacement cost, $
Total miles = total centerline-miles
Type_Rural = indicator variable and is equal to 1 if agency is rural, 0 otherwise
Climate_Central = indicator variable and is equal to 1 if agency is along the central coast, south coast or inland valley (see Figure D.1 in Appendix D).

It should be noted that:

- If the agency type is “Urban” or “Combined” or if the climatic region is other than “Central” the indicator variables will have a value of zero and the model will depend only on total miles.
- “log” refers to the natural logarithm

Conceptually, the model indicates that the replacement costs are decreased if an agency is considered rural (defined as an agency with less than 25% urban miles) and increased if it is within the central or south coast or inland valley regions. Intuitively, this makes sense, as rural agencies tend to have less safety, traffic and regulatory components. In addition, since the majority of the urban population resides in the central/south coast and inland valley, these agencies will have more safety, traffic and regulatory components and therefore, higher costs.

A more detailed discussion of the regression analysis is included in Appendix D.

As a check, the predicted or estimated replacement cost was compared with those provided by the survey respondents. Table 4.1 shows that the proposed equation provides a good estimate of the total replacement cost.

Table 4.1 Comparison of Reported and Calculated Costs

Total Replacement Cost ($ Million Reported)	Total Replacement Cost ($ Million Calculated)	Difference*
24,726	27,992	13%

*Comparison based on data from 58 complete responses.

4.3 Determination of Safety, Traffic and Regulatory Needs

The regression model obtained above estimates the total replacement cost for the safety, traffic and regulatory components. To estimate the needs, this cost needs to be converted to an annual amount based on the estimated service life of the different non-pavement assets.

Figure 4.1 shows the distribution of the replacement costs by asset. For agencies with no data, the total replacement cost will be calculated with the regression model and the replacement cost of each asset will be assigned using the percentages in Figure 4.1. For agencies that provided complete or partial data, the actual percentages will be used in the analysis.

Note that both ADA (0.4%) and NPDES (0.3%) categories are very small percentages of the total replacement cost. We believe that both of these are under-estimated because both costs are usually included in the pavement rehabilitation costs during a resurfacing or reconstruction contract, and few agencies actually extract this from the data that were provided.

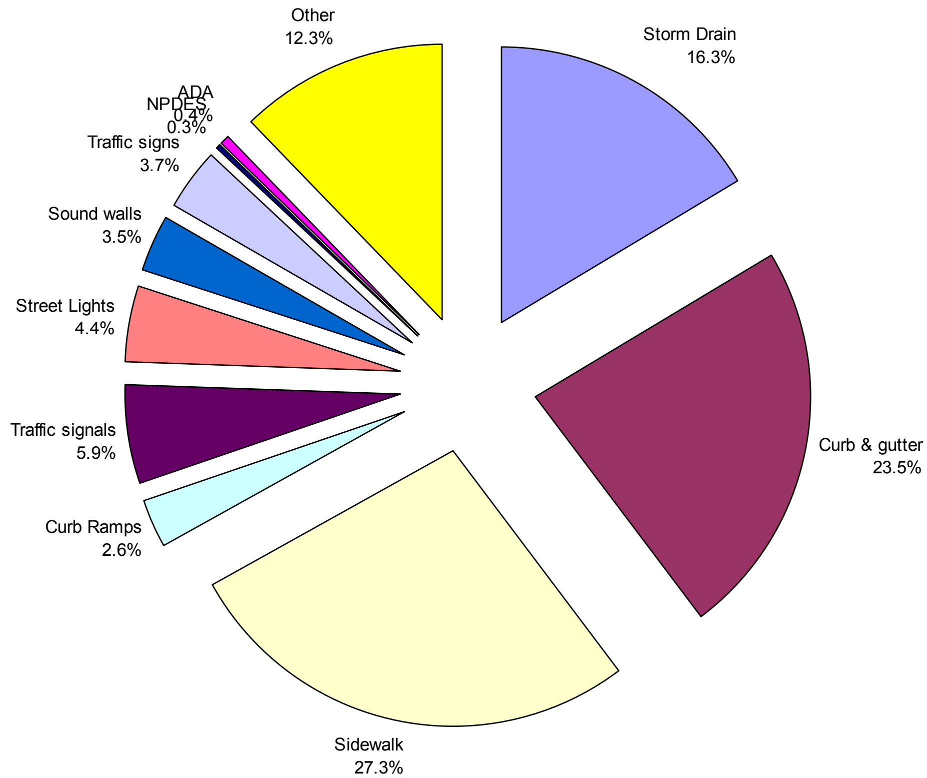


Figure 4.1 Distribution of Replacement Cost by Safety, Traffic and Regulatory Category

Table 4.2 shows the estimated service life of each asset based on industry standards[9]. The replacement costs of each asset will be divided by their respective service life to obtain the annual needs by asset category. The sum of all the needs will be the total annual needs. An example calculation is included in Appendix D.

Table 4.2 Service Lives of Safety, Traffic and Regulatory Components[9]

Asset	Service Life (Yrs)
Storm Drain	50
Curb & Gutter	35
Sidewalk	35
Curb Ramps	35
Traffic Signals	40
Street Lights	30
Sound/Retaining Walls	30
Traffic Signs	10

[9] Sources: Portland Transportation Assets Management, Handbook of Facility Assessment, Plastics Pipe Institute.

4.4 Results

The analysis to determine the available funding for safety, traffic and regulatory components is similar to that performed for the pavement analysis in Chapter 3. The average funding for cities was $21,712/centerline mile for cities and $1,402/centerline-mile for counties. The large difference between the two is expected, since it is the cities (mostly urban in nature) that have the most inventories in these categories.

However, there were a few agencies that reported revenues that were greater than their needs. In these cases, the shortfall was reported as zero (see Appendix E). Table 4.3 summarizes the results. Again, there is a significant shortfall of $19.7 billion. Appendix E contains the detailed results by county.

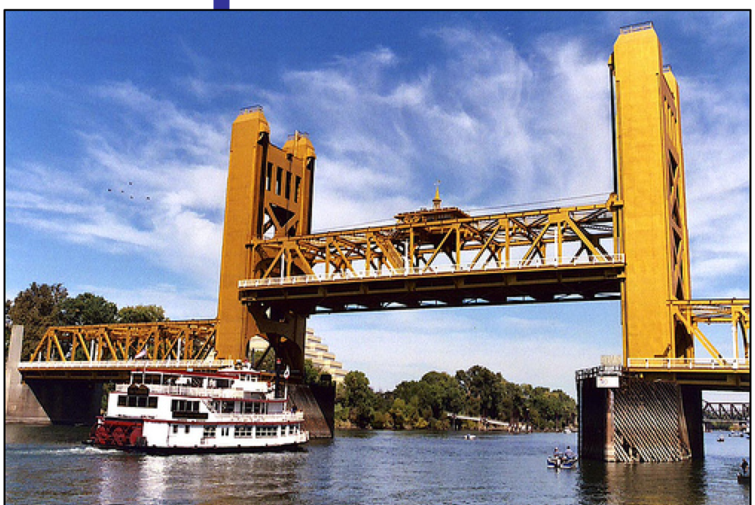
Table 4.3 Safety, Traffic and Regulatory Needs and Shortfall (2008 Dollars)

	10 year Needs ($ billion)	10 year Revenues ($ billion)	Shortfall ($ billion)
Safety, Regulatory & Operational Components	$ 32.1	$ 12.4	**$ (19.7)**

* Data from San Francisco Bay area provided by MTC.

Chapter 5. Bridges

Bridges are an integral part of the transportation system and therefore a study such as this one would be incomplete without a short discussion of their needs. Unfortunately, there has been no statewide local bridge needs assessment performed in California. Some MPOs such as MTC have performed bridge assessments[10] for their regions, but these are just pieces of the bigger picture.



Local bridges are defined as bridges that are owned by a county, city or town or by a local park. Transit or railroad bridges (e.g. bridges owned and maintained by BART – Bay Area Rapid Transit) are not included in this category. According to Caltrans, there are approximately 12,000 state bridges and 12,200 local bridges[11]. This does not include structures such as culverts that have a span of less than 20 feet.

Caltrans maintains a bridge management system (PONTIS) that contains inventory and condition data for all the bridges in the state, regardless of whether a city/county owns it. This condition data assists in determining what bridge repairs would be necessary (seismic retrofits, bridge replacements or maintenance).

However, there have been no comprehensive needs assessment performed with this data at the statewide level.

Bridge condition is typically characterized by a bridge health index or sufficiency rating, similar to the PCI used for pavements. The sufficiency rating ranges from zero (insufficient) to 100 and is based on four factors:

- Structural adequacy and safety
- Serviceability and functional obsolescence
- Essentiality for public use
- Special reductions i.e. detours, safety features

The sufficiency rating is used to determine eligibility for Federal Highway Bridge Program (HBP) funding. Structures are eligible for rehabilitation funding when the structure has a sufficiency rating ≤ 80, and replacement when the sufficiency rating is ≤ 50.

There are two primary sources of funding for local bridges – the Federal HBP and a local match. The local match is usually from local sales taxes, gas taxes or general funds. For those bridges in the mandatory seismic retrofit program, Proposition 1B (the Highway Safety, Traffic Reduction, Air Quality, and Port Security measure approved by the voters in November 2006) provides the funding for the local match. The HBP program provides approximately 88.53% of the total funding.

[10] *MTC Local Bridge Needs Update – Final Report*, Metropolitan Transportation Commission, April 2008.
[11] http://www.dot.ca.gov/hq/structur/strmaint/

The "needs" for bridges can be broadly categorized into preservation, rehabilitation, replacement and improvement needs. Improvement needs include safety, strengthening (including seismic strengthening), widening or raising a structure.

Solely based upon projects identified by local agencies and approved by Caltrans for future federal funding, the local streets and roads bridge needs total $2.6 billion. Of this amount, local agencies are required to finance 11.47 percent or approximately $300 million of which $133 million is to be financed from Proposition 1B and other approved State transportation funds.

Chapter 6. Summary

As outlined in Chapter 1, the study objectives were to determine the answers to a series of questions:

1. What are the conditions of local streets and roads?
2. What will it cost to bring them up to an acceptable condition?
3. How much will it cost to ***maintain*** them in an acceptable condition for the next 10 years?
4. Similarly, what are the needs for safety, regulatory and operational components?
5. Is there a funding shortfall? If so, what is it?

The results of this study are sobering. It is clear that California's local streets and roads are not just at risk; they are on the edge of a cliff with an average PCI of 68. With this pavement condition and the existing funding climate, there is a clear downward trend.

By 2018, with the current funding, the pavement condition index is expected to deteriorate to 58. Even more critically, the backlog will increase from $37 billion to $58 billion. This is assuming that construction costs do not outstrip the anticipated revenues. It also does not include any additional costs due to new roads/streets that will be added.

Table 6.1 summarizes the results from both Chapters 3 and 4 and the answers to Questions 2 to 5 above. The total funding needs over the next 10 years is $99.7 billion, and the resulting shortfall is $51.7 billion for pavements, and $19.7 billion for the safety, regulatory and operational components. The total shortfall is $71.4 billion.

Table 6.1 Summary of 10-Year Needs and Shortfall Calculations (2008 $ Billion)

Transportation Asset	Needs	Funding	Shortfall
Pavements	$ 67.6	$ 15.9	$ 51.7
Essential Components	$ 32.1	$ 12.4	$ 19.7
Totals	**$ 99.7**	**$ 28.3**	**$ 71.4**

The conclusions that can be drawn from this study are inescapable. Given existing funding levels, California's local streets and roads can be expected to deteriorate rapidly within the next 10 years. In addition, costs of any deferred maintenance will only continue to grow.

To bring the transportation network to an acceptable level will require more than double the existing level of funding, i.e. for pavements, it will require an increase of at least $51.7 billion and for safety, traffic and regulatory components, it will require $19.7 billion for a total of $71.4 billion.

However, once the BMP goal is reached, it will only require approximately $1.8 billion annually to maintain the pavement network at this level.

Finally, although a statewide bridge needs assessment was not included in this study, Caltrans has identified and approved $2.6 billion for bridge projects, of which approximately $300 million is the local match.