The Pothole Report: Can the Bay Area Have Better Roads?

June 2011

METROPOLITAN TRANSPORTATION COMMISSION

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Executive Summary

The condition of pavement on the Bay Area's local streets and roads is fair at best. The typical stretch of asphalt shows serious wear and will likely require rehabilitation soon. At 66 out of a possible 100 points, the region's average pavement condition index (PCI) score is now far closer to the 60-point threshold at which deterioration accelerates rapidly and the need for major rehabilitation becomes much more likely than to the 75-point score that MTC established as a target for roadway quality in its long-range *Transportation 2035 Plan* adopted in 2009. Indeed, despite efforts by the Commission and the region's local governments, overall conditions on our 42,500 lane-miles of city streets and county roads essentially are the same as they were in 2001, a decade ago.

Improved pavement quality can play a small but important role in meeting state targets for curbing greenhouse gas emissions. Not only does better pavement promote better vehicle fuel economy (and hence fewer emissions), but low-cost preventive maintenance also requires less asphalt and fewer heavy truck trips than major roadway rehabilitation projects, and new, cleaner application methods can also cut down on emissions. As the Bay Area works to achieve state targets for greenhouse gas emission reductions and to develop the Sustainable Communities Strategy mandated by state Senate Bill 375 (Steinberg, 2008), the time is right for an updated analysis of the region's local streets and roads.

Fresh Data, New Developments

Building on the foundation established in MTC's original *Pothole Report,* published in 2000, this update includes both a primer on the cost and life cycle of pavement and a comprehensive look at the current state of the Bay Area's local streets and roads network, featuring a jurisdiction-by-jurisdiction ranking of the 2010 PCI scores of the region's nine counties and 101 cities. This report also provides a briefing on two important new developments in the pavement management field:

- **Cold In-Place Recycling:** a relatively new and highly promising technique that has been shown to cut asphalt rehabilitation costs by 20 percent to 40 percent, and to reduce greenhouse gas emissions from pavement repair projects by eliminating the need to produce new paving material or transport it to the worksite; and
- **Complete Streets:** a design approach for urban neighborhoods in which the entire streetscape, from sidewalk to sidewalk, is geared for safe access and use by pedestrians, bicyclists and transit riders as well as motorists. Common ele-

ments typically include bike lanes, sidewalk bike racks, transit stops, pedestrian signals, street trees and curb ramps. Building Complete Streets requires a somewhat larger construction investment, but the benefits of this spending are spread to a wider spectrum of road users.

Scarce Funding Puts Premium on Prevention Practices

Funding for roadway maintenance typically comes from a range of sources, including the state gasoline tax, county sales taxes, and local sources such as city or county general funds, bonds and traffic-impact fees. But as the need for maintenance grows, the available funding from these sources has been shrinking. Not only are general fund contributions declining, but the state gas tax loses an average of 3 percent of its purchasing power each year due to inflation. County transportation sales taxes typically dedicate less than 25 percent of revenues to local street and road maintenance, and receipts from these taxes have fallen sharply in recent years due to the deep economic recession that began in 2007.

To help cities and counties get the biggest bang for their buck, MTC has long advocated pavement preservation. A municipality that spends $1 on timely maintenance to keep a section of roadway in good condition would have to spend $5 to restore the same road if the pavement is allowed to deteriorate to the point where major rehabilitation is necessary. All 109 Bay Area jurisdictions — and over 300 additional public agencies nationwide — now use MTC's StreetSaver® pavement management software to inventory their street networks, determine maintenance needs and devise maintenance programs based on available revenues.

Fixing the Fiscal Pothole

While pavement quality has rebounded slightly in recent years and now stands about where it did a decade ago, the challenge of boosting the regional average to "good" (a goal of MTC's *Transportation 2035 Plan*) is more daunting — and more expensive — than ever.

MTC estimates that meeting the Transportation 2035 goal of a local street and road network in "good" condition (average PCI score of 75) will require $25 billion, or $1 billion a year through 2035. This level of investment is nearly three times higher than the current $351 million spent annually by all sources on roadway maintenance. Fixing this fiscal pothole will be a local and regional challenge as we move toward adoption (in 2013) of *Plan Bay Area,* the comprehensive regional plan that will guide transportation investment in the nine Bay Area counties through 2040.

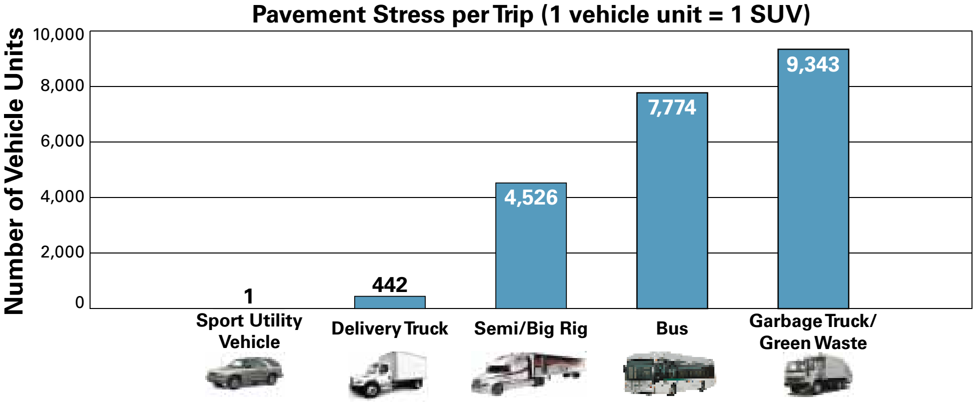
Pavement Preservation and Pavement Management

Streets and roads take a beating under the weight of traffic. The first sign of distress on surface pavement is usually cracking. While cracks may not immediately alter the pavement's ride quality, they expose the sub-base of the roadway to water leaking through the surface layer. In time, water erodes pavement strength and cracks begin to lengthen and multiply, forming networks of interconnected cracks referred to as "alligator cracking."

At this point, the pavement is no longer able to sustain the weight of traffic and the cracked pavement disintegrates, forming depressions more familiarly known as potholes. Since potholes result from damage to the roadway's sub-base, once they appear — regardless of whether or not they are patched — the roadway will continue to deteriorate until it reaches a failed state.

Heavy vehicles such as trucks and buses put far more stress on pavement than does a passenger car. A bus exerts more than 7,000 times the stress on pavement than does a typical sport utility vehicle. And a garbage truck exerts more than 9,000 times as much stress as an SUV. Not surprisingly, cracks appear more quickly on streets with large traffic volumes and/or heavy use by trucks and buses. And these roadways need maintenance more frequently than residential streets with comparatively light vehicle traffic.

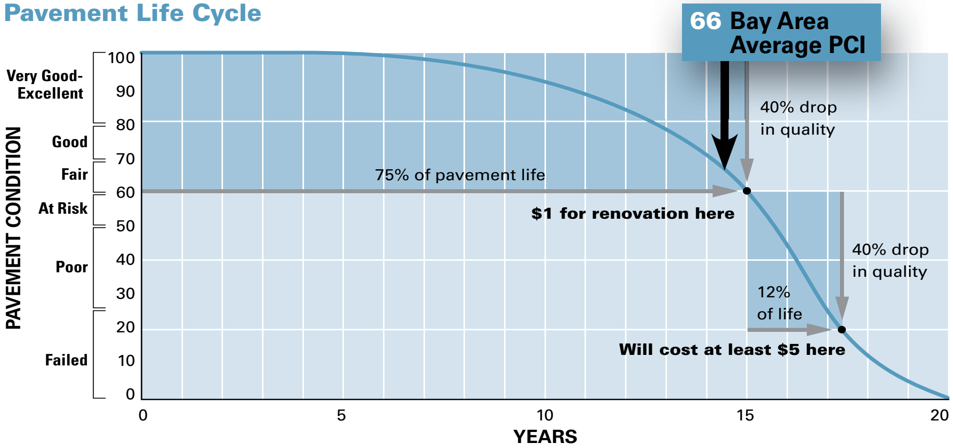
Relative Impact of Vehicle Types on Pavement Conditions



Source: Pavement Engineering, Inc.

About 28 percent of the Bay Area's local road mileage consists of arterial and collector roadways, which are heavily used by both trucks and buses. The pounding that pavement receives from trucks and buses can be especially problematic in more rural parts of the Bay Area, where many roadways have not been designed to accommodate heavy vehicles but which are nonetheless used by growing numbers of trucks carrying goods between farms and cities.

Pavement Life Cycle



Time varies depending on traffic, climate, pavement design, etc.

The most cost-effective way to maintain a roadway is to address cracks in the pavement as soon as they surface. Just as regular oil changes are far less expensive than a complete engine rebuild, it is five to 10 times cheaper to properly maintain streets than to allow them to fail and then pay for the necessary rehabilitation (see chart above). Deteriorating pavement carries private costs as well. A 2010 report by TRIP, a nonprofit organization that researches, evaluates and distributes technical data on highway transportation issues, estimated that drivers in the San Francisco-Oakland area pay an extra $706 in annual operating costs for each vehicle as a result of roadway conditions[1].

The Importance of Early Intervention

The Bay Area has long emphasized the importance of early intervention through the adoption of proactive maintenance strategies, better education in pavement preservation concepts, and regional policies that give cities and counties incentives to practice pavement preservation on their street and road networks. MTC's *Transportation 2035 Plan* reaffirms this overall approach by conditioning regional funds for local street and road maintenance not only on need and level of system usage but also on preventive-maintenance performance.

By contrast, cities and counties that spend almost all of their paving budgets to fix only a handful of failed roadways, instead of proactively maintaining a much larger percentage of their network that is still in good condition, are practicing what is known as a "Worst First" strategy. With this approach, the good roads for which maintenance is deferred soon fall into disrepair and require more extensive and costly treatments.

Best and Worst Bay Area Roads

Many factors affect a city's or county's pavement condition index, or PCI score. These include pavement age, climate and precipitation, traffic loads and available maintenance funding. A municipality with new housing developments and new streets may have a high overall PCI, while an older, urbanized jurisdiction may have a much lower PCI, even though both are practicing pavement preservation. Cities and counties that practice preventive maintenance will have lower long-term pavement costs and will safeguard their investment in local streets and roads. For a full listing of Bay Area jurisdictions' pavement conditions, please go to page 15.

Bay Area Jurisdictions With Best and Worst Pavement Conditions in 2010, Based on 3-Year Average PCI Scores

Best PCI Ratings	Worst PCI Ratings
Brentwood – **86**	Rio Vista – **42**
Belvedere – **84**	Larkspur – **45**
Dublin – **82**	Sonoma County – **45***
Los Altos – **82**	St. Helena – **46**
Foster City – **81**	Orinda – **49**

*Unincorporated area

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Jerry Bradshaw

El Cerrito streets have had a major makeover, funded in part by revenues from a voter-approved sales tax.

Bay Area governments' suppport for the preventive-maintenance philosophy — and their shift away from the ineffective "Worst First" strategy — has helped cities and counties squeeze the most out of existing resources. Indeed, the quality of Bay Area pavement (on average) actually increased slightly from 2005 to 2008, despite the fact that growth in maintenance revenues failed to keep pace with increases in the cost of paving materials.

El Cerrito: A Pavement Success Story

In 2006, the city of El Cerrito's local street network was in poor condition (single-year PCI score of 48) and the city had a backlog of more than $21 million in maintenance work. Four years later, the city had boosted its single-year PCI score to 85 and had trimmed its maintenance backlog to just $500,000. How did El Cerrito improve pavement conditions so much and so quickly?

After launching a public outreach campaign that included citizens, city council members and public works staff, El Cerrito won passage of a half-cent sales tax measure in 2008 for a Street Improvement Program. With $2.1 million in sales tax revenues, augmented by $10.5 million in bond proceeds and $1.8 million in grant funds, the city improved pavement conditions and created a direct, local source of revenue for future maintenance. The biggest impact of the Street Improvement Program was El Cerrito's ability to reduce its maintenance backlog. The city also resurfaced 68 percent of its streets, built over 400 new curb ramps and replaced 50 storm drain crossings.

El Cerrito's Pavement Program and Conditions, 2006 vs. 2010

	2006	2010
Single-year PCI score	48 (Poor)	85 (Very Good)
PCI: 3-year moving average	53 (At Risk)	62 (Fair)
Maintenance backlog	$21.2 million	$500,000
Annual budget needed to maintain PCI	$1.3 million	$500,000
Annual average funding level	$250,000	$500,000

Pavement Management Boosts Preservation Returns

Building on pavement preservation principles established by the Federal Highway Administration[2], MTC developed a pavement management software package called StreetSaver® to assist local agencies in maintaining their roadways. StreetSaver® integrates the three main pavement preservation components: preventive maintenance, minor rehabilitation (non-structural) and routine maintenance activities, as well as pavement rehabilitation and reconstruction.

Today, all 109 Bay Area jurisdictions — and more than 300 additional public agencies nationwide — use StreetSaver®. The software allows cities and counties to inventory their street networks, determine their maintenance needs and devise maintenance programs based on available revenues. The software develops a list of recommended treatments, classified as preventive maintenance, minor rehab or major rehab, or reconstruction, and prioritizes treatments based on a weighted effectiveness ratio. Within the constraints of each jurisdiction's budget, the software selects the most cost-effective treatments for implementation and defers the remainder.

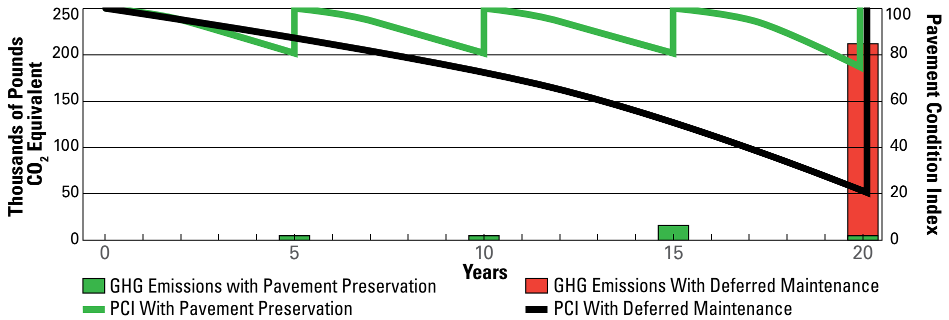
As with any other software package, StreetSaver®'s effectiveness depends on the input of reliable data. So for StreetSaver® to work, public works staff must promptly enter updated information about maintenance treatments once the treatments have been applied.

Reduced Greenhouse Gas Emissions

In addition to long-term cost savings, pavement preservation and pavement management strategies pay dividends by reducing the greenhouse gas emissions associated with both vehicle use and roadway construction. According to a June 2009 Caltrans report, *Prioritization of Transportation Projects for Economic Stimulus with Respect to Greenhouse Gases,* smooth pavement reduces GHG emissions by improving vehicles' fuel economy. The report also notes that more-frequent, low-cost treatments produce fewer emissions than do major rehabilitation projects made necessary by deferred maintenance (see graph below). This is due to the need to produce less asphalt or other paving materials, and the need for fewer truck trips to transport materials to and from the worksite.

Pavement rehabilitation and reconstruction requires large amounts of energy to acquire and process raw materials, transport materials to the construction site, apply the materials, and remove, haul away and discard old materials. Over a 20-year period, these processes combined produce an estimated 212,000 pounds of GHG emissions per lane mile of roadway. Pavement preservation treatments, by contrast, would emit about 30,100 pounds of GHGs over this time, even when done more frequently. This 20-year savings of more than 180,000 pounds of GHG emissions is equivalent to taking 15 cars off the road for a year for each lane mile that is properly maintained. And because preservation treatments keep the roadway in better condition, more motorists are able to travel at steady speeds — and fewer are required to slow down to avoid potholes — thus promoting better fuel economy and even lower GHG emissions.

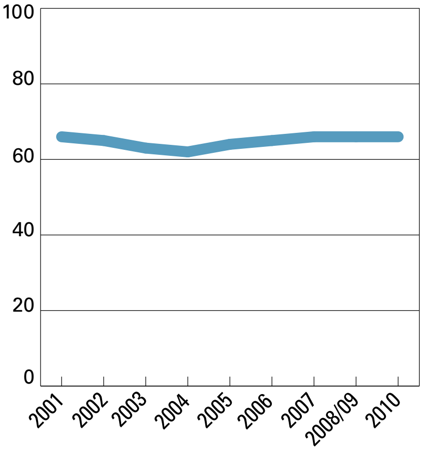
GHG Emissions With Pavement Preservation vs. Deferred Maintenance[3]



Benefits of a Pavement Management System

- Provide a systematic way of gauging pavement conditions, and present a series of steps for using this information to identify and schedule the most appropriate treatments.
- Help cities and counties make more efficient use of public funds by allowing them to immediately put any available new moneys to their most cost-effective use.
- Allow local governments to predict what conditions would be at different levels of funding, and to quantify the consequences of underfunded road maintenance.
- Allow local governments to establish performance-based funding allocation policies.
- Reduce governments' overall maintenance spending once the management system reaches its goal of getting all pavement segments to the condition where preservation is the primary strategy being applied.
- Build support for increased funding by systematically tracking pavement inventories, conditions and maintenance activities across multiple jurisdictions.

Bay Area Pavement Condition Index (PCI) Scores, 2001–2010*



*PCI scores are 3-year moving averages, except for 2001 and 2002, which are single-year scores, and 2008/09, which is a 3-year moving average computed from individual-year scores for 2006, 2007 and 2009.

Regional Pavement Condition Summary

The Bay Area's local street and road network comprises nearly 42,500 lane miles of roadway, and includes not only paved surfaces but also the curbs and gutters, sidewalks, storm drains, traffic signs, signals and lights that are necessary for functioning roadways. To replace this network would cost at least $50 billion. The roadway network provides access to jobs, homes, schools, shopping and recreation, and is vital to the region's livability and economic health. As with any asset, regular maintenance is required in order to ensure serviceability.

Every year, local jurisdictions analyze pavement conditions to help gauge their success in maintaining their local street and road networks. MTC, in turn, collects this information to determine regional state of repair. MTC and local jurisdictions use a Pavement Condition Index (PCI) score that rates segments of paved roadways on a scale from 0 to 100. MTC looks at the percentage of the region's roadways that fall into various condition categories, ranging from a low of "failed" to a high of "excellent." The classifications used in the regional pavement condition analysis are shown in the following table:

Very Good-Excellent (PCI = 80-100)	Pavements are newly constructed or resurfaced and have few if any signs of distress.
Good (PCI = 70-79)	Pavements require mostly preventive maintenance and have only low levels of distress, such as minor cracks or spalling, which occurs when the top layer of asphalt begins to peel or flake off as a result of water permeation.
Fair (PCI = 60-69)	Pavements at the low end of this range have significant levels of distress and may require a combination of rehabilitation and preventive maintenance to keep them from deteriorating rapidly.
At Risk (PCI = 50-59)	Pavements are deteriorated and require immediate attention including rehabilitative work. Ride quality is significantly inferior to better pavement categories.
Poor (PCI = 25-49)	Pavements have extensive amounts of distress and require major rehabilitation or reconstruction. Pavements in this category affect the speed and flow of traffic significantly.
Failed (PCI = 0-24)	Pavements need reconstruction and are extremely rough and difficult to drive.

The 2010 pavement condition analysis shows that Bay Area streets and roads have a three-year moving average PCI score of 66, which is unchanged from the same calculation for 2009. This score falls in the "fair" range, indicating that the typical city street or county road is becoming worn to the point where rehabilitation may be needed to prevent rapid deterioration. The stability of the Bay Area's average PCI score is mirrored in the percentage of lane miles included in the various pavement quality classifications in recent years. As the bar graph below shows, roadways in the "excellent" or "very good" ranges account for about one-third of the paved lane miles in the nine-county region. Another one-third falls in the "good" or "fair" ranges, while the final third is classified as "at-risk," "poor" or "failed."

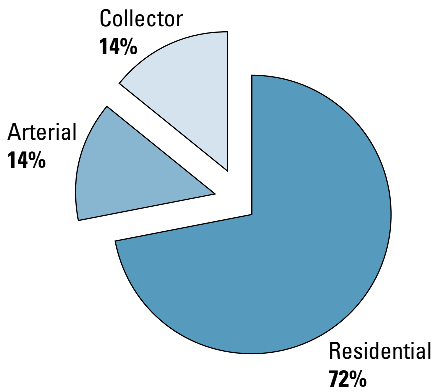
Functional Classifications

Just as there are different ranges of pavement quality, so too are there various classifications for local streets and roads. A roadway's "functional classification" is determined primarily by the number of vehicles that use it. About 70 percent of roadways are residential (see chart at right). These are the streets and roads that run through neighborhoods and carry few buses or trucks, other than waste management vehicles. Collector roadways serve to "collect" traffic from the residential streets and deposit them onto arterials, which carry the most car, truck and bus traffic, and which typically provide an outlet onto state highways or freeways. Arterials also function as alternatives to highways and freeways to relieve traffic congestion. Federal funding can be used only on roadways that have a functional classification of collector or arterial, or roughly 28 percent of the Bay Area street system.

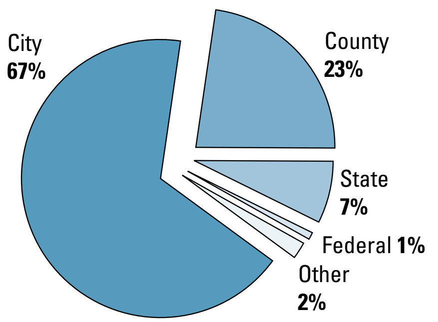
Local streets and roads, which are owned and maintained by cities or counties, account for 90 percent of the Bay Area's total lane mileage. State highways (including interstate highways) are maintained by Caltrans and comprise about 7 percent of total mileage. Roadways that fall under the responsibility of the federal government primarily include those in national parks, reserves, tribal lands and military installations. About 2 percent of roadways are either privately owned, or are owned and maintained by special districts such as the California Department of Parks and Recreation or the Golden Gate Bridge, Highway and Transportation District.

Bay Area Local Roadway Characteristics

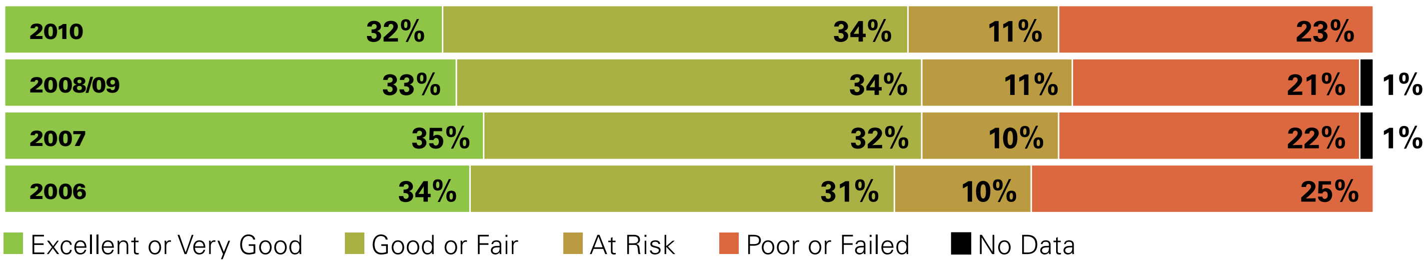
Functional Classification of Local Street and Road Network, by Percentage of Mileage



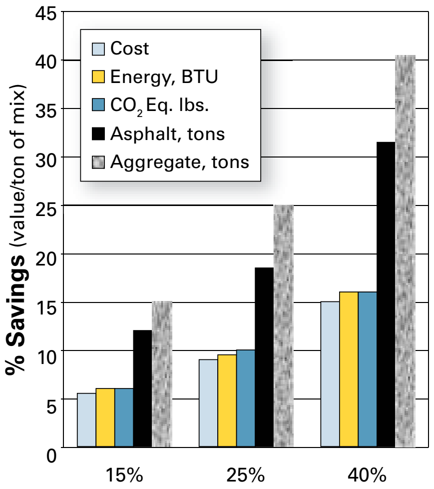
Ownership of Maintained Roads in Bay Area, by Percentage of Mileage (2008)



Pavement Conditions on Bay Area Local Roadways, 2006–2010 (% of lane miles)



Cost, Energy, Materials and Greenhouse Gas Reduction Associated with Recycled Asphalt Pavement (RAP)[4]



Recycled Asphalt Pavement (RAP) Mix (RAP as a percentage of total pavement material mix)

Pavement Recycling: Seeing Green in New Technology

State law obliges MTC and other regional agencies to work together with local governments to reduce greenhouse gas emissions related to transportation. Promising innovations in pavement maintenance, including alternative methods of construction and the use of sustainable materials and technologies, highlight an opportunity to not only move the GHG needle in the right direction but to reduce cities' and counties' long-term maintenance costs as well. And unlike other strategies for reducing GHG emissions, these innovations can deliver immediate benefits — with no large-scale behavioral changes required.

Cold In-Place Recycling

Several Bay Area municipalities already are experimenting with a relatively new technology known as Cold In-Place Recycling (CIR), which eliminates the need for the extraction and processing of raw materials, as well as the transportation and lay-down of finished asphalt-concrete (the main material in pavement resurfacing). On average, each lane mile paved with CIR instead of conventional hot-mix asphalt reduces CO_2 emissions by 131,000 pounds — or more than 400 percent — at a cost 20 to 40 percent below that of conventional techniques.

Because CIR requires the use of specialized machinery, local governments typically bid out these jobs to contractors who are experienced in the use of this equipment. A CIR "train" travels down the roadway, cold-planing the existing pavement to a depth of two to eight inches. As soon as the first machine scoops up the pavement, a second pulverizes and mixes it with additives, while a third machine replaces and then smooths the mix back onto the roadway.

MTC recently awarded a $2 million grant through its Climate Initiatives Program to help finance a joint CIR demonstration project by Sonoma County and the city of Napa, with the intention of piloting the use of this technology for possible applications elsewhere in the Bay Area. The grant includes funds for outreach to familiarize other jurisdictions with the benefits of CIR. Planned outreach elements include site visits, video and sample technical specifications for use by other cities and counties. All climate grants will be evaluated for effectiveness in reducing greenhouse gas emissions.

Off-Site Recycling

Another way in which road maintenance and construction are becoming more green is the off-site recycling of asphalt. In this process, workers remove asphalt and transport it to a plant for reprocessing, where machines grind up and mix the recycled material with fresh asphalt, and then apply the mix — known as recycled asphalt or RAP — to the roadways. (Graph at upper left shows cost, energy, materials and greenhouse reductions possible with RAP.)

Road Rehabilitation Equipment: Conventional vs. Cold In-Place Recycling

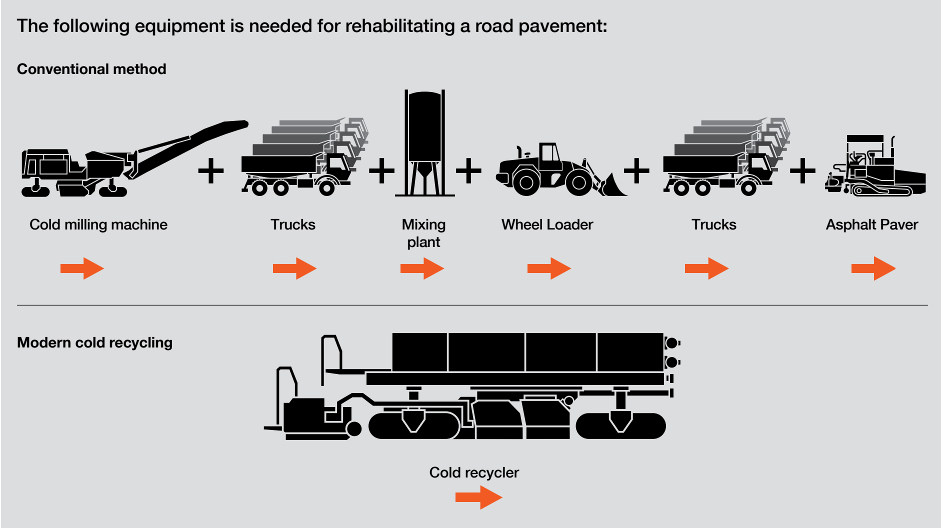


Illustration courtesy of Wirtgen Group

The image above shows the traditional paving equipment that would be replaced by Cold In-Place Recycling. Studies show that for each lane mile treated with CIR instead of conventional paving methods, the GHG emissions savings are equivalent to removing 11 cars from the road for one year. With 42,500 lane miles of local roadways in the Bay Area, the potential impact is enormous.

While off-site asphalt recycling does not deliver the scale of greenhouse gas reductions offered by CIR, it does limit the need to secure, process and transport virgin materials. The quality of recycled asphalt has improved greatly in recent years, and now meets or exceeds the quality of virgin materials. Caltrans has set a target of 15 percent recycled asphalt in highway paving projects statewide. Local jurisdictions across the nation are experimenting with even higher percentages of recycled asphalt.

Just as asphalt is being recycled and reused in roadway maintenance, other materials such as roofing shingles and rubber tires are getting second lives as roadway surfacing materials. Rubberized asphalt concrete — made with a combination of regular asphalt concrete and ground-up tires — produces highly durable, skid-resistant and quiet pavement surfaces while using a material that would otherwise end up in landfills. One lane mile of roadway paved with a two-inch-thick surface of rubberized asphalt concrete consumes about 2,000 scrap tires.

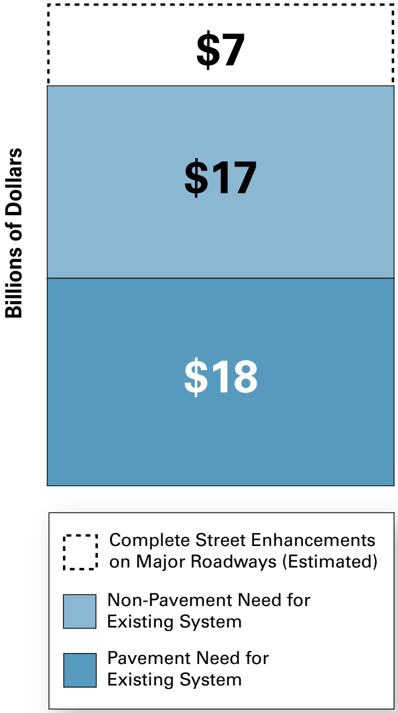
The state of California launched a Rubberized Asphalt Concrete (RAC) Grant Program through its CalRecycle initiative to decrease the environmental impacts from the illegal disposal and stockpiling of waste tires. Any California city or county is eligible to apply for a RAC grant through CalRecycle.[5]

Rubberized Asphalt Concrete

Photos courtesy of CalRecycle

According to the U.S. Environmental Protection Agency, about 12 million tires are converted into rubberized asphalt concrete annually.

Cost to Maintain Bay Area Local Streets and Roads, 2010-2035, Including Complete Streets Enhancements



Complete Streets: Safer, More Livable

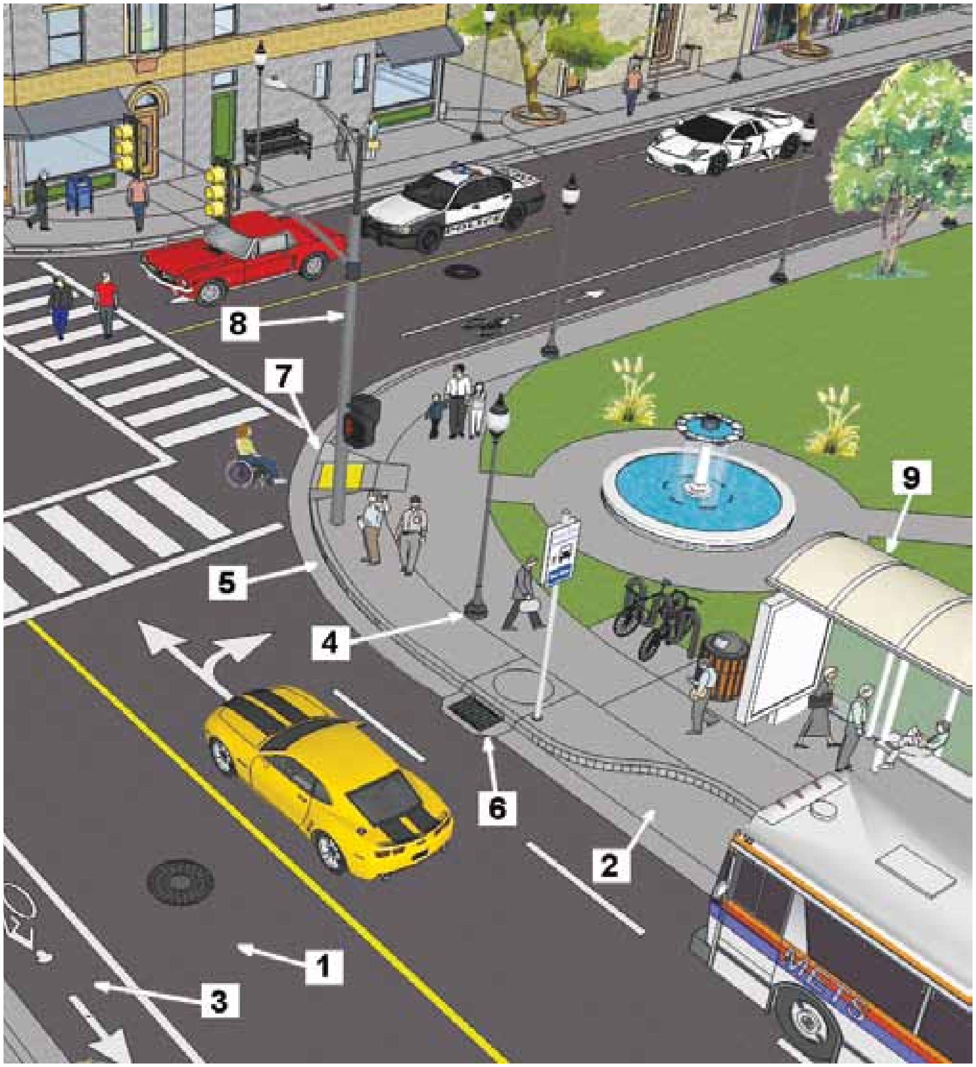
Pedestrians and bicyclists share the Bay Area's streets and roads with cars, trucks and buses. To make roadways — particularly those in urban areas — more pedestrian- and bicycle-friendly, a new design approach known as Complete Streets has emerged in recent years. While there is no standard template, common elements typically include bike lanes, sidewalk bike racks, transit stops, pedestrian signals, street trees and curb ramps. By incorporating these elements into Complete Streets, transportation agencies help ensure that people of all ages and abilities can use the street safely.

MTC has embraced the Complete Streets concept. MTC Resolution 3765, adopted in 2006 to promote routine accommodation of non-motorized travelers in project planning and design, led to development of a Complete Streets checklist which Bay Area cities and counties must submit with applications for regional funding. At the state level, Caltrans adopted Deputy Directive 64-R-1 in 2008, recognizing bicycle, pedestrian and transit modes as integral elements of the transportation system and considering all transportation improvements as opportunities to improve safety, access and mobility for all travelers. And a Federal Highway Administration safety review found pedestrian safety is improved by streets designed with sidewalks, raised medians, optimal bus stop placement, traffic-calming measures and treatments for disabled travelers[6]. One study cited by the National Complete Streets Coalition found that designing for pedestrian travel by installing raised medians and redesigning intersections and sidewalks reduced pedestrian injury and fatality risk by 28 percent[7].

Investing in Complete Streets

Because each street is unique, the cost of upgrading to a Complete Street can vary widely from project to project. But, on average, costs for Complete Street projects tend to run 15 percent to 25 percent higher than projects without these enhancements. This includes both the pavement (e.g., a bike lane) and non-pavement (e.g., street furniture and plantings) elements that make up a Complete Street. The illustration and table on page 13 show an example of a downtown Complete Street and its associated costs, as estimated by staff from the city of Santa Rosa.

Elements of an Urban Complete Street[8]



Based on *Transportation 2035 Plan* estimates of the cost to maintain existing pavement and non-pavement assets in the Bay Area, an additional $7 billion would be required to upgrade to Complete Street status just the region's major roadways, which account for about 28 percent of the local street and road network. (See chart on page 12.)

Example: Estimated Construction Costs for Urban Complete Street*

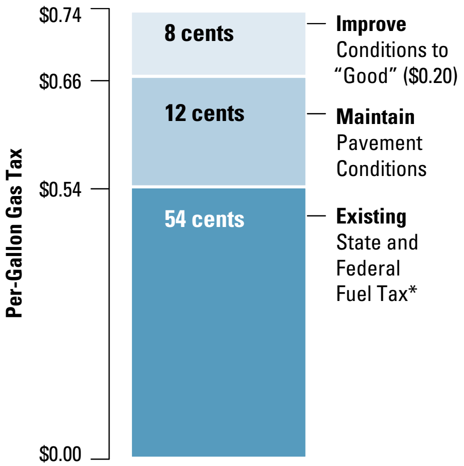
	Item	Total Cost Per Block Conventional Street	Total Cost Per Block Complete Street
1	Pavement Costs Attributed to Cars	$152,533	$152,533
2	Pavement Costs Attributed to Buses/Trucks	$238,333	$238,333
3	Pavement Costs Attributed to Bicycles		$47,667
	Subtotal Pavement Costs	***$390,866***	***$438,533***
4	Lights/Signs/ Markings	$41,600	$41,600
5	Curb and Gutter	$42,900	$42,900
6	Storm Drain	$153,439	$153,439
7	Sidewalk and ADA Ramp	$182,000	$182,000
8	Traffic Signal	$390,000	$390,000
9	Street Furniture and Plantings**		$187,590
	Subtotal Non-Pavement Costs	***$809,939***	***$997,529***
	Total Cost	**$1,200,805**	**$1,436,062**

* Estimate provided by city of Santa Rosa.

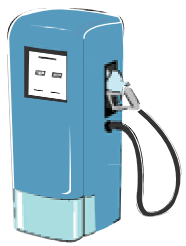
** Street Furniture and Plantings includes bike racks, street trees, lighted bus shelters, trash and recycle bins, benches and plant pots.

What Will It Take?

To improve the Bay Area's local streets and roads to a "good" pavement condition (PCI of 75), additional revenues roughly equal to a 20-cent increase in the gas tax — dedicated to local street and road maintenance — would be needed. The figure below illustrates the levels to which per-gallon gas taxes would need to rise in order to generate the funds necessary to maintain current pavement conditions, or to bring them up to a "good" level. To also improve the region's non-pavement assets to a "good" condition, an additional 18 cents per gallon would be required. (Note: These calculations do not include the cost of Complete Street-type upgrades.)



* Revenues from the existing fuel tax are dedicated to many purposes — streets and roads are only one of these.



Looking Forward: The Funding Picture

With a regionwide average PCI score of 66, the Bay Area's city streets and county roads are close to the tipping point on the pavement life-cycle curve, after which pavement may decline rapidly and repair costs increase (see illustration on page 5).

Predictable, long-term funding is imperative if cities and counties are to travel toward a pothole-free future. The Bay Area currently invests about $351 million annually in maintaining local streets and roads. If investment continues at this level, local streets and roads will, on average, deteriorate to poor condition (PCI of 45) by 2035. In order to bring the region's pavement conditions up to good condition (PCI of 75), the region would need to triple current maintenance expenditures to nearly $1 billion annually. The chart below details the average pavement conditions that are projected at each investment level.

Projected Pavement Conditions in 2035 Based on Annual Expenditure Level Scenarios

	Existing Funding	Maintain Current Pavement Condition	Improve Conditions*
Average Regional PCI** in 2035	45	66	75
Pavement Condition	Poor	Fair	Good
Average Annual Expenditure Level***	$351 million	$740 million	$975 million
Annual Expenditure/ Lane Mile	$8,000	$17,000	$23,000
Increase Over Current Expenditure Level (%)	0%	110%	177%

* *Improvements do not include Complete Street-type upgrades.*

** *PCI is the Pavement Condition Index (Scale of 0 to 100, with 100 being the highest PCI).*

*** *Average Annual Expenditure Level assumes a 3 percent inflation rate.*

Currently, revenue sources typically used to pay for roadway maintenance include state gas taxes, federal highway funds, county sales taxes, city and county general funds, bonds and traffic fees. As the various levels of government look to renew and/or reauthorize funding measures and long-range plans, attention to the cost of maintaining streets and roads at a good state of repair should remain a high priority.

Pavement Condition Index (PCI) for Bay Area Jurisdictions, 2006–2010

Jurisdiction	County	Total Lane Miles	3-Year Moving Average 2006	2007	2009[1]	2010[2]
Very Good (PCI=80–89)						
Brentwood	Contra Costa	416	85	84	85	86
Belvedere	Marin	24	81	79	82	84
Dublin	Alameda	240	80	80	81	82
Los Altos	Santa Clara	226	85	84	83	82
Foster City	San Mateo	121	82	83	82	81*
Santa Clara	Santa Clara	597	83	82	82	80*
San Pablo	Contra Costa	104	67	72	76	80
Good (PCI=70–79)						
Livermore	Alameda	655	79	79	78	78
Union City	Alameda	331	76	75	76	78
Contra Costa County	Contra Costa	1327	83	82	80	78
Redwood City	San Mateo	353	74	76	77	78*
Atherton	San Mateo	106	68	69	73	77
Brisbane	San Mateo	57	70	73	76	77
Daly City	San Mateo	254	70	73	75	77*
Pleasanton	Alameda	498	74	75	76	77
Burlingame	San Mateo	162	68	72	75	77*
Morgan Hill	Santa Clara	259	71	75	76	77
Emeryville	Alameda	47	76	79	76	77
Los Altos Hills	Santa Clara	113	74	75	76	77
Sonoma	Sonoma	68	80	79	79	77
Oakley	Contra Costa	229	83	80	78	76
Gilroy	Santa Clara	243	82	80	79	76*
Mountain View	Santa Clara	331	74	74	75	76
Dixon	Solano	129	81	77	76	76
Concord	Contra Costa	713	78	78	78	76
Vacaville	Solano	533	78	79	77	76*
Clayton	Contra Costa	95	75	77	76	75
Campbell	Santa Clara	218	78	76	75	75*
Sunnyvale	Santa Clara	636	80	77	74	75

Pavement Condition Index (PCI) for Bay Area Jurisdictions, 2006–2010 (continued)

Jurisdiction	County	Total Lane Miles	3-Year Moving Average 2006	2007	2009[1]	2010[2]
San Rafael	Marin	331	63	66	70	75
Santa Clara County	Santa Clara	1485	75	77	75	74
San Ramon	Contra Costa	398	74	73	74	74
American Canyon	Napa	102	76	76	75	74
Hercules	Contra Costa	128	75	74	73	73
Windsor	Sonoma	168	74	75	74	73
Novato	Marin	318	65	67	71	73*
Portola Valley	San Mateo	71	64	63	67	73
San Mateo	San Mateo	409	61	67	70	73*
Palo Alto	Santa Clara	470	N/A	N/A	72	73
Danville	Contra Costa	301	74	73	72	73
Walnut Creek	Contra Costa	436	72	74	73	73*
South San Francisco	San Mateo	296	67	71	72	73*
Fairfield	Solano	709	77	75	73	73
Alameda County	Alameda	997	69	71	72	72
Lafayette	Contra Costa	202	64	70	71	72
Corte Madera	Marin	64	73	73	73	72*
Cloverdale	Sonoma	64	69	71	72	71*
Saratoga	Santa Clara	281	70	71	72	71**
Hillsborough	San Mateo	164	64	66	69	71
Piedmont	Alameda	78	67	67	69	70
Cupertino	Santa Clara	303	69	70	70	70
Pinole	Contra Costa	119	71	71	70	70
Tiburon	Marin	68	64	67	68	70
Fair (PCI = 60–69)						
Fairfax	Marin	55	69	70	69	69
Yountville	Napa	17	67	65	67	69
Milpitas	Santa Clara	287	70	70	70	69
Hayward	Alameda	629	68	68	69	69
Antioch	Contra Costa	616	70	70	70	69
San Mateo County	San Mateo	635	65	67	68	69
Los Gatos	Santa Clara	218	72	73	72	69

Pavement Condition Index (PCI) for Bay Area Jurisdictions, 2006–2010 (continued)

			3-Year Moving Average			
Jurisdiction	**County**	**Total Lane Miles**	**2006**	**2007**	**2009**[1]	**2010**[2]
Monte Sereno	Santa Clara	27	65	70	68	69
Newark	Alameda	252	75	71	69	69**
Rohnert Park	Sonoma	206	68	67	67	69
Ross	Marin	22	64	65	69	67
San Carlos	San Mateo	175	68	69	70	67
Pleasant Hill	Contra Costa	242	62	65	65	67
Solano County	Solano	932	58	61	64	67
Healdsburg	Sonoma	93	66	66	67	67
Alameda	Alameda	275	63	63	62	66
Colma	San Mateo	23	67	72	67	65
Santa Rosa	Sonoma	1090	64	64	65	65
Sebastopol	Sonoma	47	67	67	66	65
Fremont	Alameda	1063	70	68	66	64
Pittsburg	Contra Costa	319	65	64	64	64
San Jose	Santa Clara	4182	63	63	63	64
Cotati	Sonoma	46	66	66	64	64*
San Francisco	San Francisco	2130	64	64	64	64
San Bruno	San Mateo	178	62	64	63	63
Benicia	Solano	190	70	68	66	63
Sausalito	Marin	54	69	68	65	63*
Menlo Park	San Mateo	200	62	62	62	63
El Cerrito	Contra Costa	145	53	50	50	62
Half Moon Bay	San Mateo	55	55	59	61	62
Suisun City	Solano	150	53	50	55	62
Mill Valley	Marin	117	64	62	60	61
Albany	Alameda	59	62	63	63	60
Calistoga	Napa	29	57	57	59	60*
Berkeley	Alameda	453	62	60	60	60*
Belmont	San Mateo	135	61	61	61	60

Pavement Condition Index (PCI) for Bay Area Jurisdictions, 2006–2010 (continued)

Jurisdiction	County	Total Lane Miles	3-Year Moving Average 2006	2007	2009[1]	2010[2]
At-Risk (PCI=50–59)						
Millbrae	San Mateo	124	60	57	57	59*
Pacifica	San Mateo	189	64	60	59	59*
Martinez	Contra Costa	233	57	57	59	59**
Moraga	Contra Costa	110	61	60	59	58**
Napa County	Napa	840	54	51	55	57*
Woodside	San Mateo	97	62	60	57	57
San Leandro	Alameda	392	62	60	58	57*
Napa	Napa	464	52	53	55	57
Oakland	Alameda	1963	56	57	59	56
Richmond	Contra Costa	549	46	50	53	55*
San Anselmo	Marin	80	59	58	57	55**
Petaluma	Sonoma	390	60	57	55	55
East Palo Alto	San Mateo	80	60	56	52	53
Vallejo	Solano	681	54	54	53	53
Marin County	Marin	848	48	49	50	52
Poor (PCI=25–49)						
Orinda	Contra Costa	193	46	47	48	49
St. Helena	Napa	51	58	53	48	46
Larkspur	Marin	64	51	48	47	45
Sonoma County	Sonoma	2718	44	44	44	45
Rio Vista	Solano	45	51	48	45	42***
Regional		**42,499**	**64**	**65**	**66**	**66**

Notes:

Where "NA" is indicated, the jurisdiction used pavement management software that does not use the PCI scale.

[1] Increased utilization of online reporting options by many jurisdictions in 2009 allowed MTC to collect and tabulate 2009 pavement condition data, even as 2008 data was still being compiled. To simplify reporting, MTC decided not to separately report 2008 data, electing instead to bring PCI data up to date as of 2009. The reported 2009 3-year moving average is computed from the individual-year scores for 2006, 2007 and 2009.

[2] The 2010 3-year moving average is computed from the individual-year scores for 2007, 2009 and 2010.

* 3-year moving average score is an estimate based on inspections done in 2008.

** 3-year moving average score is an estimate based on inspections done in 2007.

*** 3-year moving average score is an estimate based on inspections done in 2006.

Footnotes/Citations

[1] **(Page 5)** Press release reference:
www.tripnet.org/national/Urban_Roads_PR_092210.pdf

[2] **(Page 6) Pavement Preservation:** 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. (FHWA Pavement Preservation Expert Task Group; see Federal Highway Administration website:
www.fhwa.dot.gov/pavement/preservation/091205.cfm)

[3] **(Page 7)** Jim Chehovits & Larry Galehouse, "Energy Usage and Greenhouse Gas Emissions of Pavement Preservation Processes for Asphalt Concrete Pavements," *Proceedings of the International Conference for Pavement Preservation,* 2010

[4] **(Page 10)** Source: Meyer, Wendall L., FHWA Update, *Proceedings of the North Dakota Asphalt Conference,* 2010. Based on data from: Robinette, C. and J. Epps, "Energy, Emissions, Material Conservation and Prices Associated with Construction, Rehabilitation and Materials Alternatives for Flexible Pavement," *Proceedings of the 89th Annual TRB Meeting,* 2010

[5] **(Page 11)** More information about Cal Recycle and the Rubberized Asphalt Concrete Grant Program is available at **www.calrecycle.ca.gov**

[6] **(Page 12)** Federal Highway Administration website:
safety.fhwa.dot.gov/ped_bike/ped_transit/ped_transguide/ch3.cfm

[7] **(page 12)** National Complete Streets Coalition,
www.completestreets.org/complete-streets-fundamentals/factsheets/safety

[8] **(Page 13)** Urban Complete Streets graphic courtesy of Pavement Engineering, Inc., CA

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The Pothole Report:
Can the Bay Area Have Better Roads?
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Dakota Press, San Leandro, CA
Printing

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