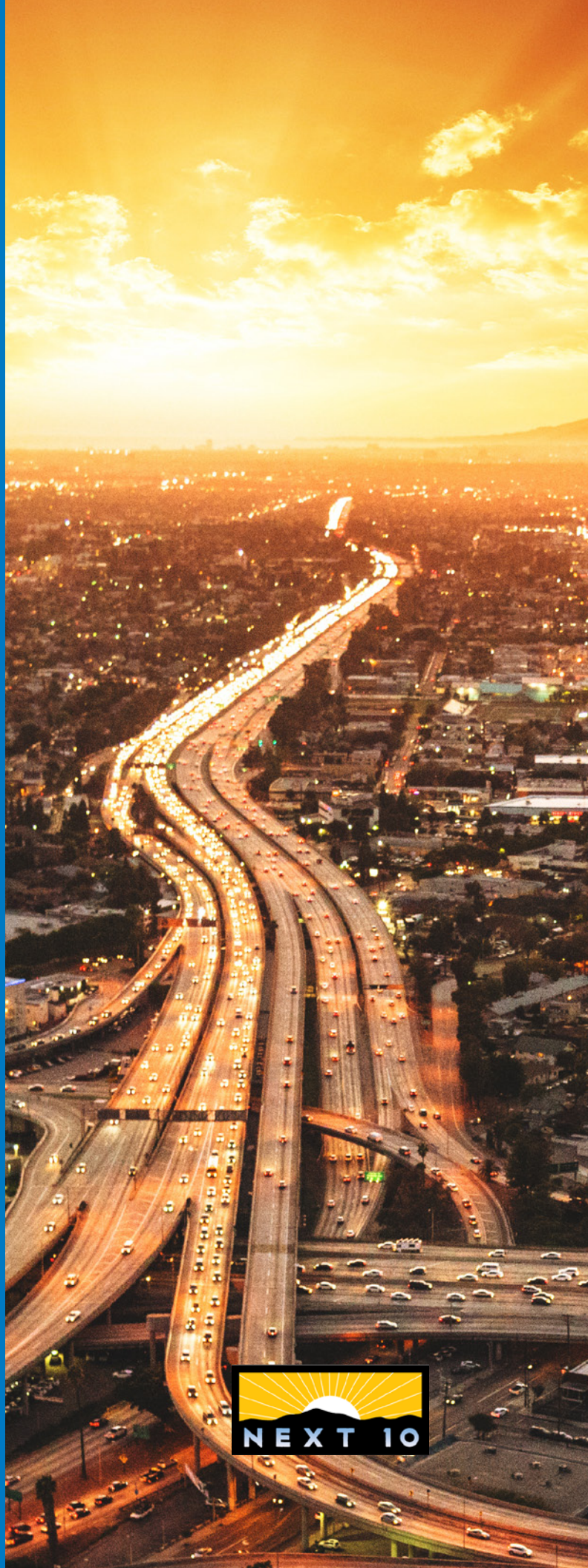
BEYOND THE GAS TAX

Funding California Transportation in the 21st Century

AN ISSUE BRIEF FROM

COMPARE 50



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NEXT 10 is an independent nonpartisan organization that educates, engages and empowers Californians to improve the state's future.

Next 10 is focused on innovation and the intersection between the economy, the environment, and quality of life issues for all Californians. We provide critical data to help infrom the state's effors to grow the economy and reduce greenhouse gas emissions. Next 10 was founded in 2003 by businessman and philanthropist F. Noel Perry.

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COMPARE 50

EXECUTIVE SUMMARY

California roads are among the worst in the nation, and funds to repair and improve roads are more necessary than ever.

258,000
ZEVs sold in California

4.34 Million
gallons of gas per day

335 Billion
vehicle-miles traveled in 2016

As more roadway repairs become backlogged, maintenance and repairs become more difficult and more expensive. However, the state's revenue from motor vehicle fuel taxes – which is used to fund roadway maintenance and transportation programs – continues to decline as a result of low gas prices, issues with the gas tax structure, and fuel use reduction driven by the state's efforts to reduce greenhouse gas emissions from transportation. In order to address the issue of poor roadway conditions while continuing to reduce transportation-related emissions, new funding mechanisms will be necessary.

California is committed to reducing greenhouse gas (GHG) emissions. The state has passed extensive legislation designed to reduce emissions and kick start the state's clean energy economy. With light-duty vehicles serving as the largest single source of the state's GHG emissions — emitting more than industrial activities and more than three times as much as agricultural activities[1]– California has created an ambitious set of programs geared towards reducing the GHG emissions and pollution of the transportation sector.

Nationwide, newer model-year vehicles are becoming more fuel-efficient, saving consumers hundreds of dollars each year. At the same time, California has been promoting the sale of zero emission vehicles (ZEV) with generous financial incentives and other perks, such as access to the high-occupancy vehicle (HOV) lane. These initiatives have kick-started the ZEV market – a market that's set to grow as California strives to put 1.5 million ZEVs on the road by 2025. However, meeting this goal will drive a revenue loss for transportation infrastructure of $572 million and $276 million in state and federal gasoline excise tax rev-

1 California Greenhouse Gas Emission Inventory – 2016 Edition. California Air Resource Board. < https://www.arb.ca.gov/cc/inventory/data/data.htm>

enues, respectively. As California transitions its economy away from fossil fuels, the state's vital transportation funding cannot continue to rely on the sale of gasoline.

The recent passing of Senate Bill 1 (Beall, hereinafter SB1) will provide an estimated $52.4 billion in transportation revenue over a ten-year period to begin to repair some of the state's failing infrastructure. This bill features a number of changes to California's roadway maintenance and vehicle fee structures, but will require further adjustments over time. While the passing of SB1 is a great start to bridge the transportation funding gap, it must serve as the start, rather than end, of a transportation funding discussion. The bill still falls short in addressing the $137-billion[2] backlog of repairs to state highways and bridges and local streets. If California is to adequately address the backlog of repairs and ensure that emission goals and roadway infrastructure maintenance can be cost-effectively and sustainably achieved, the state needs to look at new funding models designed for the 21st century.

This comparative brief analyzes statewide data in California and across the country to better understand trends in vehicle use, fuel efficiency, and transportation finance. Based on findings from across the country, the authors also identify policy options for providing alternative finance mechanisms to support road infrastructure in an increasingly fuel-efficient vehicle market.

Key Findings

Roadways Infrastructure

- 68 percent of the Golden State's roadways are in either poor or mediocre condition compared to the 24.4 percent national average. Half of California's public roads are in poor condition; only Rhode Island (54%) and Connecticut (57%) had higher percentages of roads in poor condition.[3]
- Most California roads are at least 40 years old, meaning they've reached or exceeded their designed useful life.
- In its 2017 Infrastructure Report Card, the American Society of Civil Engineers estimated that driving on poorly maintained roads costs each motorist $844 in vehicle repair costs per year in California — the highest behind Connecticut's $864 per motorist per year.
- Fuel taxes do not account for vehicle-specific road damage and heavy trucks disproportionately account for more costs and damages on roadways across multiple factors on a per-mile basis.

2 Senate Floor Analyses of SB1 – April 2017. California Senate Rules Committee. < https://leginfo.legislature.ca.gov/faces/billAnalysisClient.xhtml?bill_id=201720180SB1>

3 A state-by-state comparison of infrastructure is available at < http://www.infrastructurereportcard.org/infrastructure-super-map/>

- During the last 10 fiscal years, the federal government has had to borrow from the General Fund 7 times in order to cover the shortfall of the revenue generated from the federal excise tax versus needed funds for road maintenance.

Motor Vehicle Fuel Taxes

- Californians have been driving more than ever. Collectively, Californian motorists logged 335 billion vehicle-miles traveled in 2015 – a record high. On the other hand, refiner motor gasoline sales averaged 4.34 million gallons per day in 2015, which was only about half as much as 2002, the year with the highest daily average motor gasoline sales of 8.71 million gallons.
- Light-duty vehicles are becoming increasingly fuel-efficient. Compared to 10 years ago, new vehicles have an average improved fuel economy of 5.5 miles per gallon nationally, or 27.4% compared to vehicles of model year 2006.
- California has some of the highest state gasoline and state diesel fuel sales taxes. As of January 1, 2017, California's taxes on motor vehicle fuels, excluding the 18.4-cents-per-gallon federal excise tax, are:
    - 38.13-cents-per-gallon for gasoline (7th highest), and
    - 40.01-cents-per-gallon for diesel (8th highest)
- Motor Vehicle Fuel Tax Revenue has been on a decline. Whereas gasoline consumption in 2015 declined less than 2% compared to 2010, inflation-adjusted fuel tax revenue declined 20% in the same period. In 2016, motor vehicle fuel tax revenue accounted for just 3.3 percent of total tax revenue compared to 5.3 percent in 2010. The main contributing factors are:
    - Improved fuel efficiency of vehicles: light-duty vehicles have improved fuel efficiency by 27.4% in the last ten years, resulting in lower gasoline consumption, saving consumers a few hundred dollars per year on fuel.
    - Decrease in gasoline price in recent years: the decrease in gasoline price means lower gasoline sales tax revenue.
    - Decrease in state excise tax on gasoline: The current state excise tax of 27.8-cents-per-gallon is 7.7 cents lower compared to the state excise tax of 39.5-cents-per-gallon implemented in July 2013.
    - Adoption of zero emission vehicles: thought these vehicles are a minority of

all vehicles on the road, the state collects very little gasoline-related tax from plug-in hybrid electric vehicles and no gasoline-related tax from battery electric vehicles and fuel cell electric vehicles.

Zero Emission Vehicle Adoption:

- Having sold almost half of all the nation's Zero Emission Vehicles (ZEVs) to date, California has made truly remarkable progress toward ZEV adoption compared to the rest of the nation.
    - Almost 530,000 zero emission vehicles have been sold as of the end of 2016 in the United States; almost 258,000 of those ZEVs were sold in California alone..
- While issues such as lack of consumer awareness, lack of affordable options, and limited public infrastructure have challenged ZEV sales, year-over-year growth remains impressive.
- If the state meets its 2025 goal of putting 1.5 million ZEVs on the road, CARB estimates it would displace 1.5 billion gallons of motor fuels. If state gasoline and federal excise taxes were to remain unchanged at 38.13 cents and 18.4-cents-per-gallon, respectively, the displacement would mean a revenue loss of $572 million and $276 million.

Alternative Approaches to Vehicle Fuel Tax Based Revenue

As both California road conditions and fuel tax revenue continue to decline, this funding gap will be further exacerbated by continued fuel efficiency improvements and broader adoption of ZEVs. Growth of ZEVs in the marketplace will not only decrease fuel tax revenue but will also require investment in new infrastructure. The new transportation package helps create new revenue opportunities for transportation funding, but further measures will be necessary in order to close the gap in an evolving vehicle marketplace.

A number of tax reform considerations are outlined in this report and some have been incorporated into the newly passed SB1. SB1 addresses some of the opportunities outlined for additional transportation infrastructure finance outlined in this brief. Alternative approaches to help bridge the gap in funding include:

- **Flat Rate Fees:** Although it is the simplest and least costly scheme to implement, the flat rate fee approach is inefficient as it ignores relative road usage, favoring motorists who drive more. In addition, it does not address externalities such as congestion costs. Our current rate structure incorporates flat rate fees like the gasoline and diesel excise taxes.
- **Fuel Taxes Indexed to Inflation:** Although the cost to implement is low, this approach suffers the same pitfall as the current system - increasing fuel efficiency will continue to erode revenues in the long run. In addition, public perception that gasoline tax increases would place a high relative burden on the poor will continue to persist. Historically, California did not index its fuel tax rates to inflation. However, SB1 requires

these fees now be annually adjusted based on the California Consumer Price Index. The federal excise tax, however, has remained unchanged since 1993, over which period the Consumer Price Index has risen by 67% nationally and 70% in California.

- **Fund Toll Roads Through Public-Private Partnerships:**[4] Similar to the HOV/HOT Lanes Program that is currently in place in Los Angeles, this approach has the potential to be efficient, especially with real-time pricing updates. However, specificity of pricing comes at the cost of privacy and discriminates against motorists who may have a need but otherwise cannot afford the toll fees. SB1 does not include any specific provisions for expanded toll road programs, but this could provide opportunities for additional revenue over time.
- **Mileage Based User Tax:** While this approach has the potential to achieve the desired goal without compromising efficiency and equity, the collection costs of the necessary driving data are higher compared to other alternative approaches. Previous studies on mileage based user tax pilot programs also cite privacy concerns as potential hurdles. The new bill also does not incorporate mileage-based taxes, but California is currently piloting a road use fee program that could be utilized in the future.

The newly passed SB1 has already required fuel taxes rates to be indexed annually based on the California Consumer Price Index (CPI).[5] In addition, the newly created transportation improvement fee and road improvement fee (both additional to annual registration fees) are also subject to annual adjustments based on the California CPI. On the other hand, it is clear that SB1 favors a progressive rate instead of a flat rate fee, as demonstrated with the transportation improvement fee. Instead of requiring each motorist to pay the same fee, the transportation improvement fee is positively correlated to the market value of the vehicle. These changes to rate structures will help marginally increase annual fuel tax revenue and the newly created improvement fees will create a new source of revenue for the state's transportation infrastructure. However, the state can expect to see a continued trend in decreasing fuel tax revenue over time, which may call for additional changes to the rate structures and fee programs. This report further analyzes these alternative approaches for transportation infrastructure funding in light of both equity and efficiency considerations.

4 In the Public-Private Partnership (PPP) model, the government works with private firms to provide public goods and services. PPPs can potentially help government address infrastructure needs. The PPP model is currently more active internationally than in the U.S.

5 See Section 7360 (d); Section 7360 (e); Section 9250.6 (b); Section 60050 (c).

TRANSPORTATION INFRASTRUCTURE

The State of California Roads

California has one of the highest percentages of roads in suboptimal conditions. According to the American Society of Civil Engineer's 2013 Report Card for America Infrastructure, 68% of public roads in California were in either poor or mediocre condition, making the Golden State the seventh highest — behind Illinois, Connecticut, Wisconsin, Rhode Island, Oklahoma and Colorado — in terms of roads in suboptimal condition. Half of California's public roads are in poor condition, according to the state's updated 2017 Infrastructure Report; only Rhode Island (54%) and Connecticut (57%) had higher percentages of roads in poor condition.[6]

6 A state-by-state comparison of infrastructure is available at < http://www.infrastructurereportcard.org/infrastructure-super-map/>

Figure 1: The Need for a Transition to New Transportation Funding Options

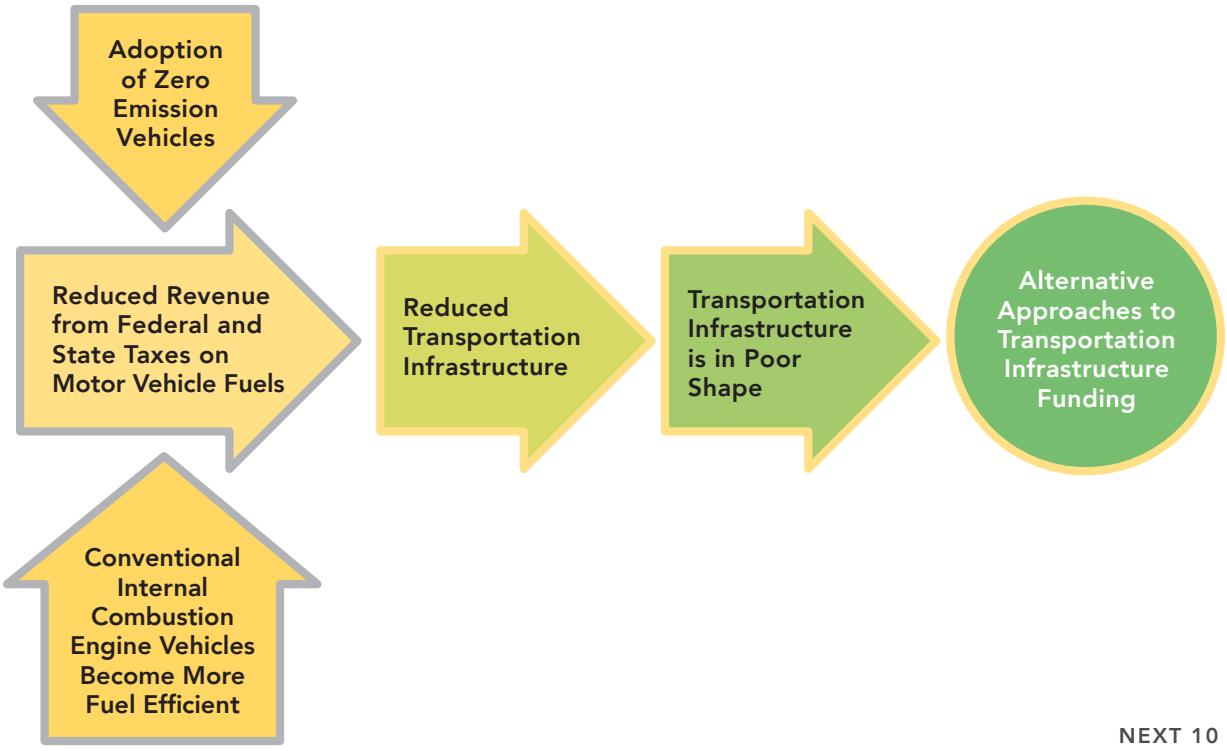

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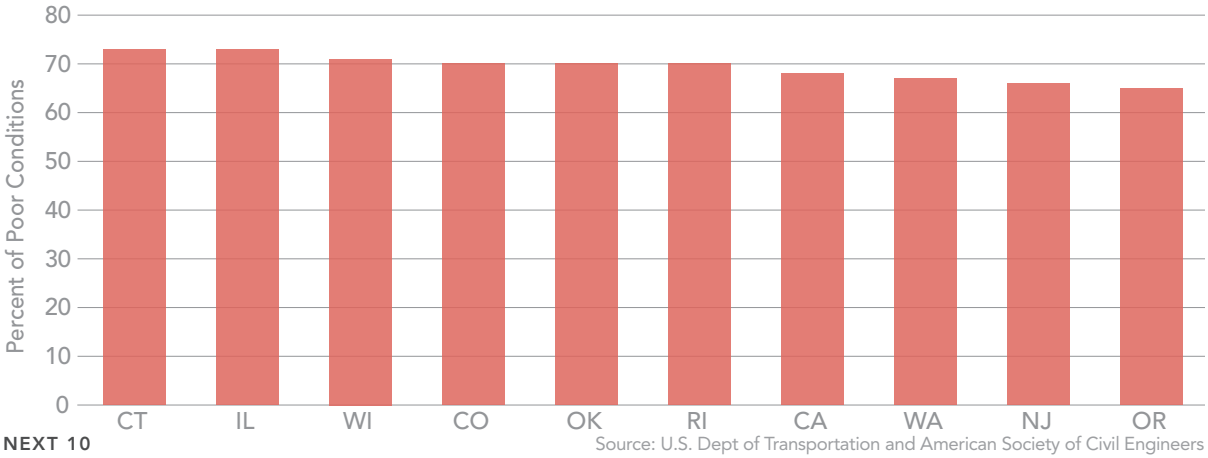
Figure 2: Percentage of Roads in Poor or Mediocre Condition, Top 10 States



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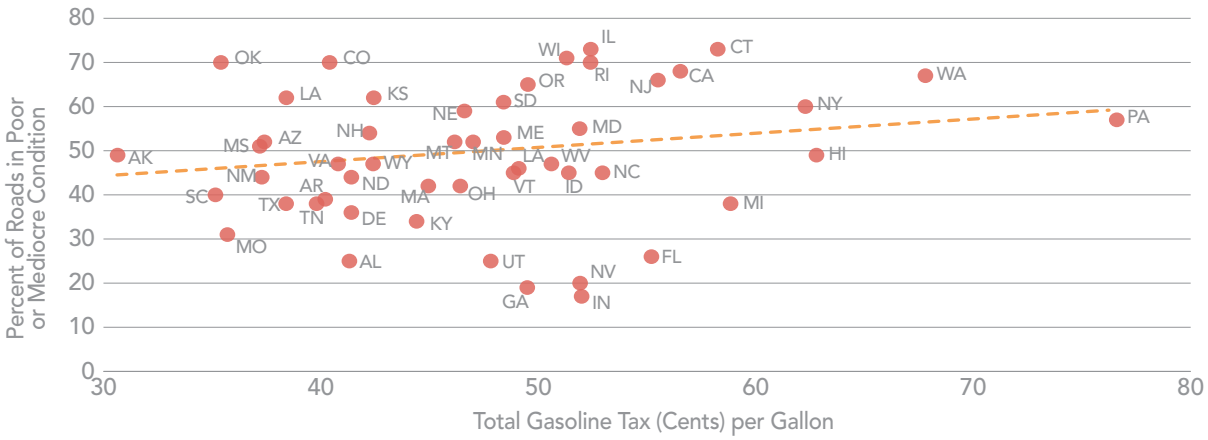
Source: U.S. Dept of Transportation and American Society of Civil Engineers

Figure 3: Gasoline Tax Revenue and Road Conditions Across the U.S.



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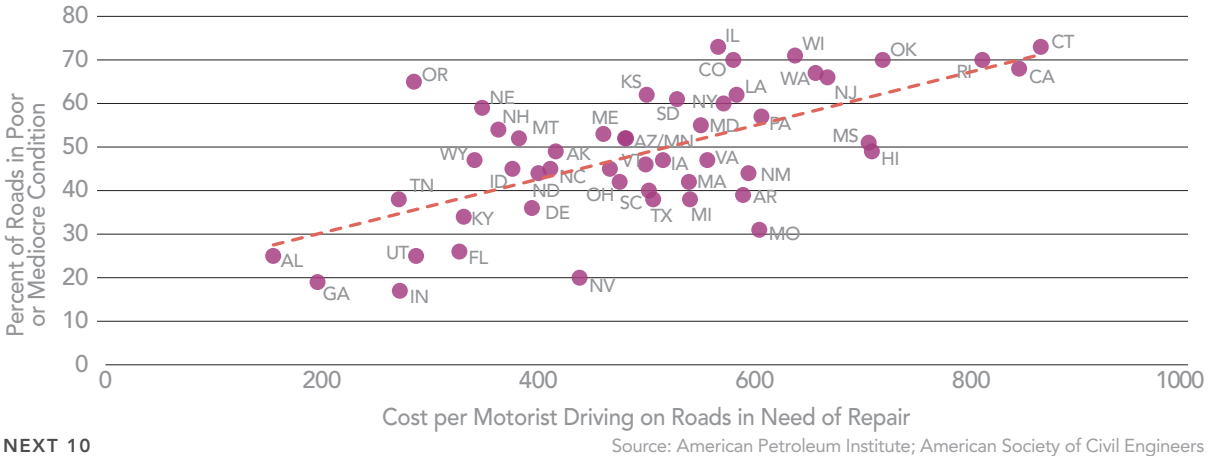
Source: American Petroleum Institute; American Society of Civil Engineers

Figure 4: Road Condition and Repair Cost per Motorist Across the U.S.



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Source: American Petroleum Institute; American Society of Civil Engineers

Poor roads mean higher costs for drivers. The 2017 Infrastructure Report estimated that driving on roads in need of repair costs each motorist $844 in vehicle repair costs per year in California — the highest behind Connecticut's $864 per motorist per year. Undoubtedly, California roads are in a dire situation, but funding for repairs has become increasingly scarce. If the 2025 goal of 1.5 million ZEVs is met, CARB estimates it would displace 1.5 billion gallons of motor fuels. If state gasoline and federal excise taxes were to remain unchanged at 38.13 cents and 18.4-cents-per-gallon, respectively, the displacement would mean a revenue loss of $572 million and $276 million.

The State of U.S. Roads

Highway revenue sources have been declining in the United States even as vehicle miles traveled hit a record high in 2016. The nation has been under-spending on road investment and maintenance for years and as a consequence, the state of the nation's roads has been worsening every year. Over a decade ago, evidence that the national budget for transportation infrastructure was inadequate prompted Congress to form the National Surface Transportation Policy and Revenue Study Commission to examine the needs of the nation's highways and study alternatives to the fuel tax as the primary source of revenue for the Highway Trust Fund (HTF). The commission ultimately recommended that the nation spend from $207 billion to $240 billion annually on highway capital investment through 2020.[7] A more recent study by the American Association of Civil Engineers called for a slightly lower transportation investment over a 10-year period (2016 to 2025). Based on these projections, the nation will need to spend roughly $204.2 billion annually to support roadway maintenance needs. The authors also report that Surface Transportation has the largest projected funding gap of all U.S. infrastructure systems.[8]

The situation has worsened since the commission's initial assessment, with an increase in the miles of roads classified as poor and a decrease, on average, in national spending. The 2015 Conditions & Performance Report to Congress showed that the percentage of roads in poor condition had risen since 2008, both in terms of sheer miles and miles weighted by use (vehicle miles traveled, or VMT).[9] Combined annual federal, state and local highway spending from 2006 to 2014 averaged $173.4 billion (in 2014 dollars), and in 2014, the total of $164.7 billion marked a 21-year low. Even to achieve the current level of transportation spending, the federal government has been diverting funds from other sources, highlighting the unsustainable nature of fuel tax-based revenue. According to the Congressional Budget Office (CBO), lawmakers have transferred $143 billion into the HTF since 2008.[10]

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7 Binder, S. J. et al. (2007). "Report of the National Surface Transportation Policy and Revenue Study Commission." Transportation for Tomorrow. December 2007. The publication is available at <http://transportationfortomorrow.com/final_report/pdf/final_report.pdf>

8 The 2017 Infrastructure Report Card is available at <http://www.infrastructurereportcard.org/the-impact/economic-impact/>

9 U.S. Department of Transportation (2015). "2015 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance." U.S. Department of Transportation Report to Congress. < https://www.fhwa.dot.gov/policy/2015cpr/es.cfm#2h>

10 Congressional Budget Office (2016). "Approaches to Make Federal Highway Spending More Productive." Congressional Budget Office. February 2016. <https://www.cbo.gov/publication/50150>

Beyond the impacts of rising fuel economy and competitively priced electric vehicles, the original federal gas tax law has other notable failings, including the fact that tax rates are not indexed to inflation. The federal tax rate of 18.4 cents a gallon, for instance, has remained unchanged since 1993, over which period the Consumer Price Index has increased 67.3%. Although those who oppose gasoline tax increases tend to cite the high relative burden on the poor, the Organization for Economic Cooperation and Development considers all types of sales and excise tax hikes among the least harmful to long-term growth.[11] In 2013, the suggestion to increase the excise tax on motor fuels by 35 cents and index prices to inflation featured in the CBO's list of "Options for Reducing the Deficit."[12]

Other factors not accounted for by the motor fuel tax are regional costs that are not linked merely to gasoline use. For one, roads do not experience the same rate of use, leading to widely differing maintenance costs from area to area. [13] Fuel taxes also do not account for vehicle-specific road damage. While passenger vehicles contribute the most to congestion and accidents in absolute terms, heavy trucks disproportionately account for more costs across multiple factors on a per-mile basis. In particular, the CBO identified urban trucks as leading contributors (on a per-mile basis) to pavement damage, congestion and noise. Additionally, most heavy trucks run on diesel, making them an outsized contributor to particulate matter emissions, which increase risks of cancer in nearby residential communities. By most metrics, heavy trucks contribute disproportionately to road costs and, based on a 2000 Federal Highway Administration study, federal user fees charged to truck owners only covered 80% of related costs. Since the federal Heavy Vehicle User Tax has not been updated since 1984, the effectiveness of truck user fees at the federal level has likely also eroded with inflation.

Although the current tax structure has several problems — some easier to fix than others — there remains the increasingly relevant question of how to replace or modify the fuel tax if use of gasoline vehicles plummets. Experts disagree on when this transition may occur, but widespread adoption of ZEVs would exacerbate revenue shortfalls. Solutions include increasing ZEV registration fees and emulating the current motor vehicle tax, in that use is linked to how much an individual driver pays. Increasingly, legislators are looking to tax vehicle miles traveled.

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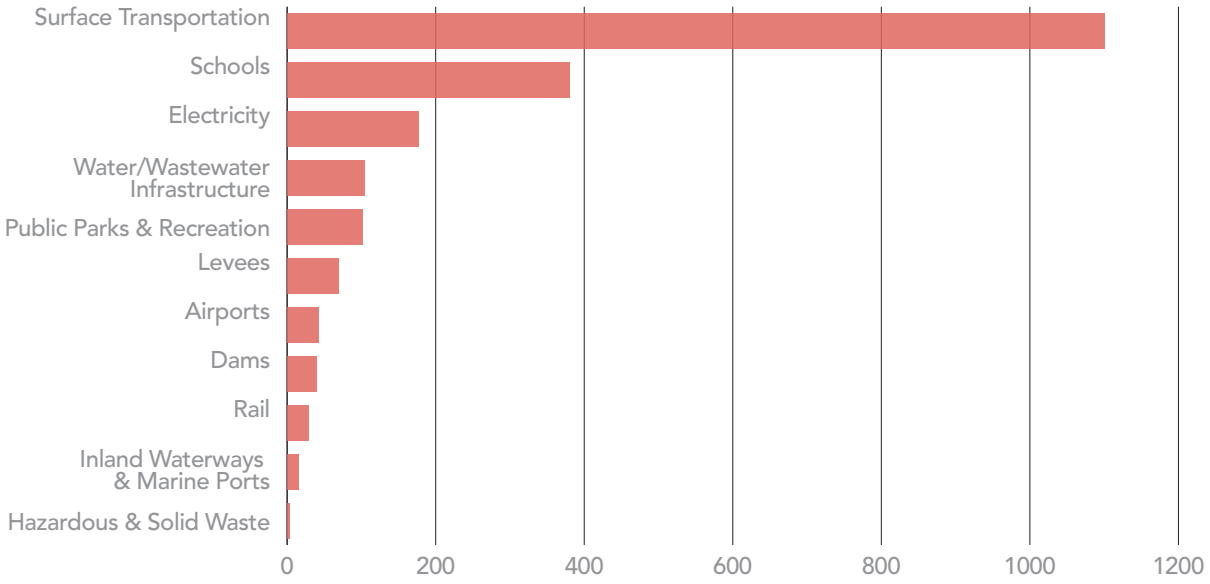
11 Hodge, S. A. (2012). "Raising Revenue: The Least Worst Options." Tax Foundation. Fiscal Fact No. 344, December 2012. <https://taxfoundation.org/raising-revenue-least-worst-options>

12 Congressional Budget Office (2013). "Options for Reducing the Deficit: 2014 to 2023." November 2013. Publication No. 44853. <https://www.cbo.gov/budget-options/2013/44853>

13 In a recent 10-year period in Los Angeles County, for example, average annual per capita spending on streets was $26,650 in Vernon and $15 in Compton. Although these cities are within eight miles of each other, Compton is a low-income, densely populated residential community, whereas Vernon has a high concentration of industrial concerns and a population of just 114. The wear and tear on each city's roads, along with available capital, are defining differences in determining the extent of road spending.

Figure 5: Projected Funding Gap in Billions of 2015 U.S. Dollars, 2016-2025



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Source: The American Society of Civil Engineers

Overview of California Transportation Revenues

Transportation funding in California comes from three main sources. Local government revenue makes up just over half of all transportation funding, 20 percent is from the federal government, and the remainder is from the state. At the state level, revenue comes primarily from excise taxes on gasoline and diesel. For gasoline, the state has a variable excise tax of 9.8 cents per gallon, and a base excise tax of 18 cents per gallon. For diesel, the state collects a 16 cents per gallon excise tax, and 4.75% sales tax on diesel fuel for transportation. The excise taxes on gasoline and diesel will increase slightly under the agreement in SB 1, as shown in Table 5.

Californians have been driving more than ever. The Federal Highway Administration estimates that in 2015, Californians drove a collective 335.5 billion vehicle miles, or almost 30 billion more than in 2000. On the other hand, gasoline consumption increased more or less proportionately until 2007 and has had a long downturn since then. Gasoline prices — as well as diesel prices — surged in late 2008, just as the Great Recession began. Higher fuel prices and financial strain during the recession caused vehicle miles traveled to decrease by 5 billion from 2008 to 2009. Meanwhile, gasoline consumption in the state decreased by almost 25 million barrels from 2006 (a record high) to 2009. Although vehicle miles traveled increased steadily as the economy recovered, gasoline consumption remained low.

Figure 6: Gasoline Consumption and Vehicle Miles Traveled in California, 2000-2015

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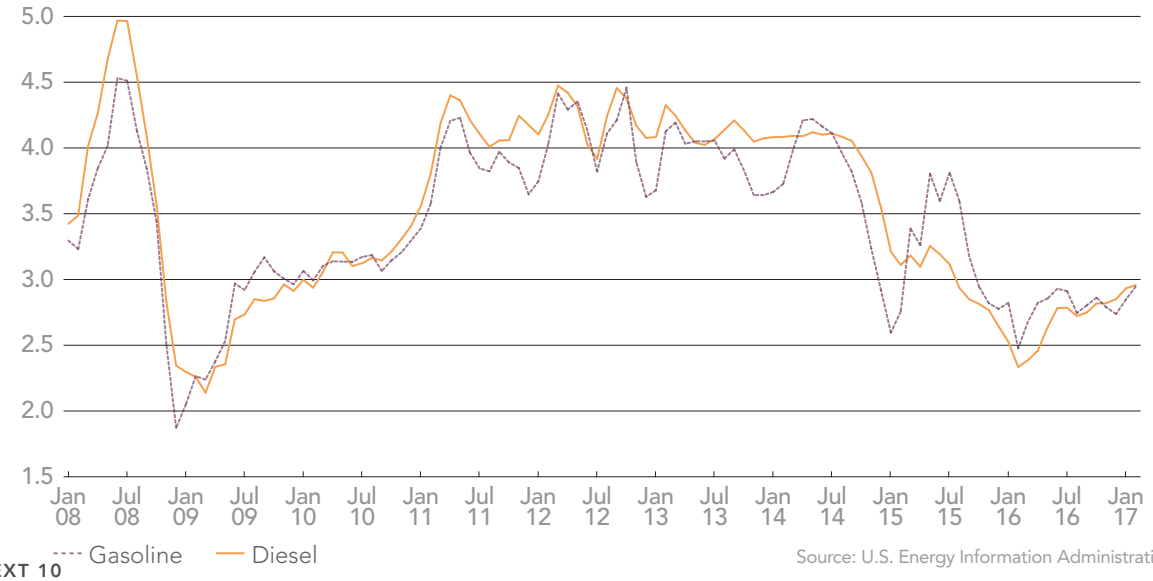
Source: US Energy Information Administration; Federal Highway Administration

Figure 7: Gasoline and Diesel Prices Per Gallon in California, Jan-08-Feb-17



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Source: U.S. Energy Information Administration

While Figure 6 implies that oil consumption in 2015 was about the same as in 2000, the graph clearly indicates that sales (and, by proxy, consumption) have been freefalling since the late 2000s. The message is clear: Despite more miles driven than ever, motor vehicle fuel consumption has tapered off since 2008 or so as fuel economy has continued to improve. In addition, although gasoline-based vehicles still dominate the market, vehicles powered by alternative fuels, especially zero emission vehicles, have become increasingly popular, which further erodes the fuel tax revenue.

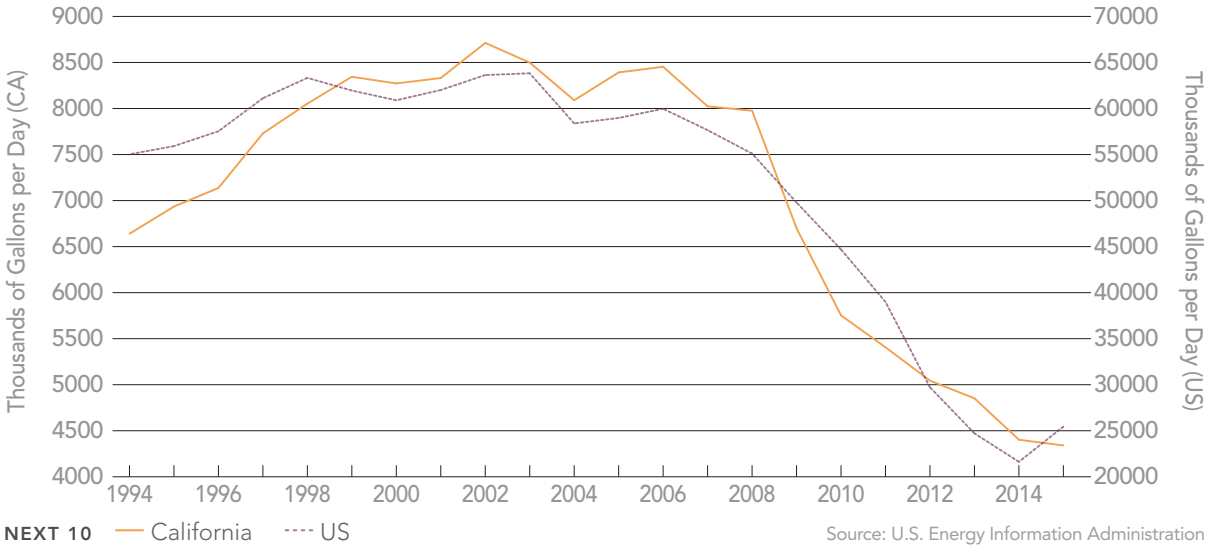
Because of improved vehicle fuel economy and inflation, the purchasing power of gasoline taxes (heretofore not indexed for inflation) has declined significantly, which in turn has resulted in a shrinking share of funding for road repairs. Motor fuel taxes are the largest source of revenue for transportation infrastructure funding at both the federal and state levels. In response, several states have abandoned the fixed-rate model in favor of rate structures that vary with gasoline prices, inflation, fuel economy and other indicators. According to the Institute on Taxation and Economic Policy, 57% of the U.S. population lives in states where gasoline tax rates are variable.14 However, in California, linking the gasoline excise tax has resulted in shortfalls as oil prices tumbled. While fuel prices have begun to rally at the time of this writing, the passage of SB1 means that all tax rates and fees that were marked for future increases will also be adjusted every three years for inflation.

In fiscal year 2013-14, gasoline and license taxes constituted 46.7% of state and local road spending, the 11th highest rate in the U.S. On the other hand, tolls and user fees made up only 7.4% of state and local road spending, which is significantly lower than the 11.1% U.S. average. How is it that California has one of the highest motor fuel taxes yet some of the worst roads? In addition to the shrinking revenue due to more fuel-efficient vehicles, the federal excise tax not keeping pace with inflation, and state excise tax revenue declining, two components have contributed to the deterioration: aging roads and increased maintenance costs. Most California roads are at least 40 years old, meaning they've reached or exceeded their designed useful life.15 Older roads tend to require more repair. Furthermore, despite efforts to reduce costs and increase efficiencies, maintenance and replacement costs continue to rise.

14 "Informing the Debate Over Tax Policy Nationwide" (2017). Institute on Taxation and Economic Policy. January 2017. <http://www.itep.org/pdf/variablerategastax0117.pdf>

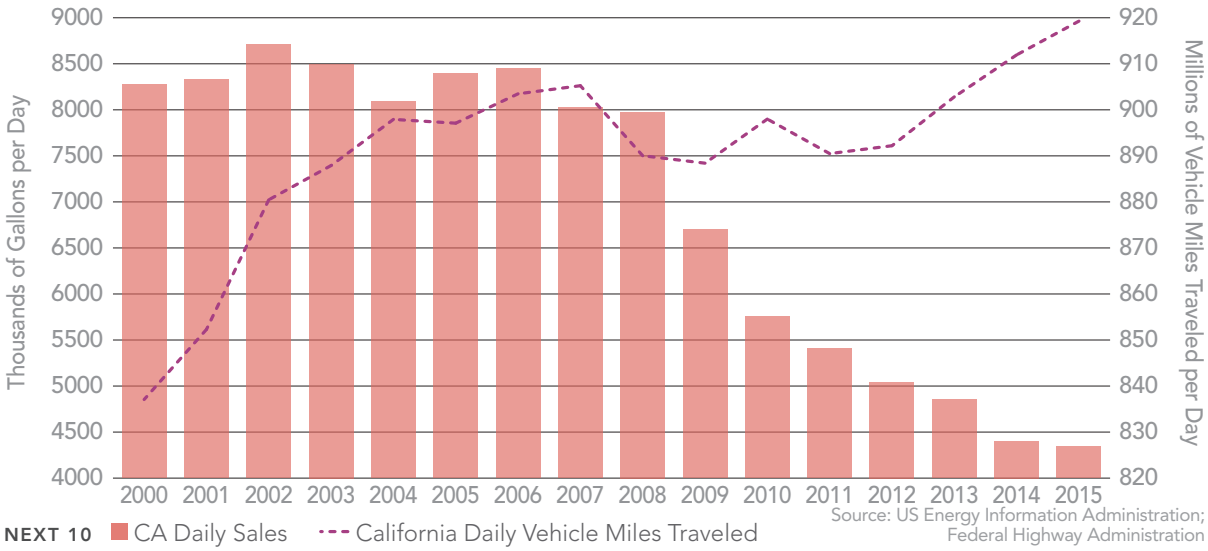
15 Typically, roads have an expected useful life of 30 to 40 years. But road quality, application and environmental factors contribute to differences in their actual useful life. For example, an asphalt road will have a different useful lifespan than a concrete road. Heavy use, extreme temperatures and climate also shorten the useful life of roads.

Figure 8: Daily Refiner Motor Gasoline Sales to End Users in California and the U.S., 1994-2015



Source: U.S. Energy Information Administration

Figure 9: Daily Refiner Motor Gasoline Sales and Vehicle Miles Traveled in California, 2000-2015



Source: US Energy Information Administration; Federal Highway Administration

If the gasoline sales price were constant, increased vehicle miles traveled coupled with decreasing gasoline consumption would imply a shift in consumer preference toward vehicles (such as hybrids and ZEVs) with better fuel economy, and/or would imply that vehicles were becoming more fuel efficient in part because of Obama administration rules. Indeed, there had been notable and consistent increases in adjusted fuel economy[16] since model year 2004, according to the EPA.[17] For example, 2016 light-duty vehicles had an improved fuel economy of 5.5 miles per gallon, or 27.4%, over similar 2006 vehicles.

16 The EPA adjusted fuel economy in its model to reflect real-world performance. In comparison, unadjusted laboratory values are used as the basis for EPA greenhouse emissions and National Highway Traffic Safety Administration corporate average fuel economy (CAFE) standards compliance.

17 U.S. Environmental Protection Agency (2016). "Light-Duty Automotive Technology, Carbon Dioxide Emissions,

Figure 10: United States Carbon Dioxide Emissions and Fuel Economy, 1975-2016

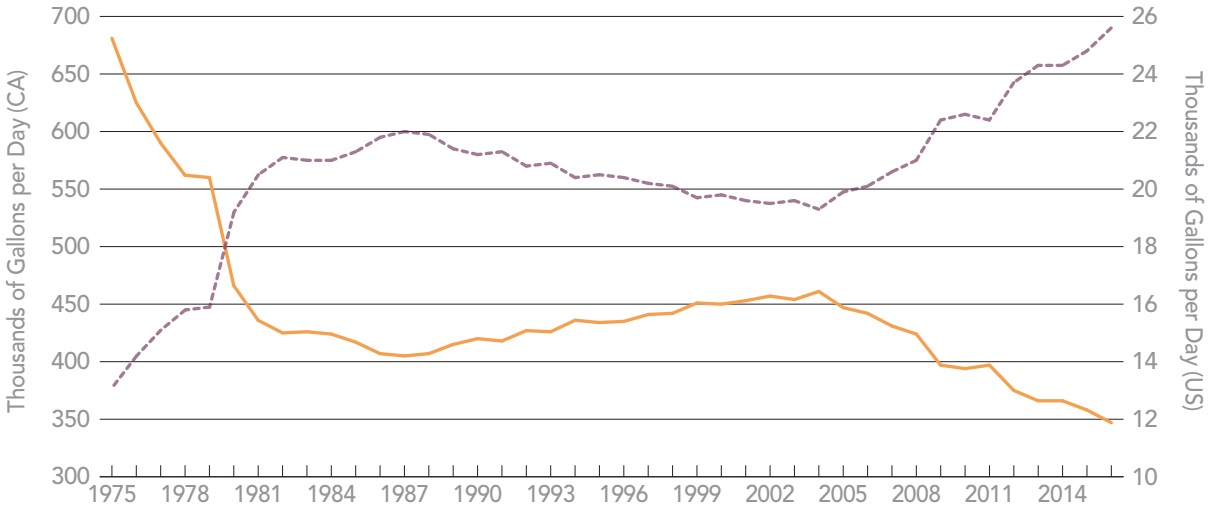


Table 1: Adjusted CO2 Emissions and Adjusted Fuel Economy

Category	2006	2016	Change (%)
Adjusted CO2 Emissions (g/mi)	442	347	-21.5%
Adjusted Fuel Economy (MPG)	20.1	25.6	27.4%

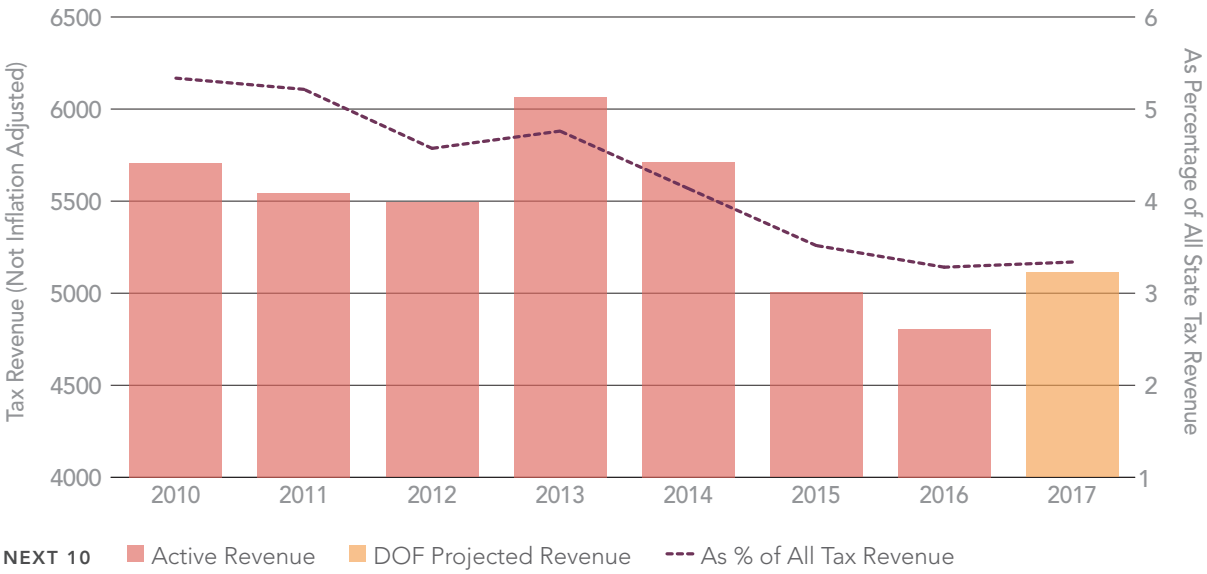
Source: Environmental Protection Agency (2016 data are preliminary)

Table 2: Fuel Savings

	MY 2006	MY 2016	Change (gallons)	Annual Fuel Savings (At $3/Gallon)
Adj. Fuel Economy (MPG)	20.1	25.6	5.5	--
10,000 VMT annually	498	391	-107	$321
12,000 VMT annually	597	469	-128	$385
15,000 VMT annually	746	586	-160	$481

Source: Environmental Protection Agency (2016 data are preliminary)

Figure 11: California Motor Vehicle Fuel Tax Revenue in Millions of Dollars, 2010-2017



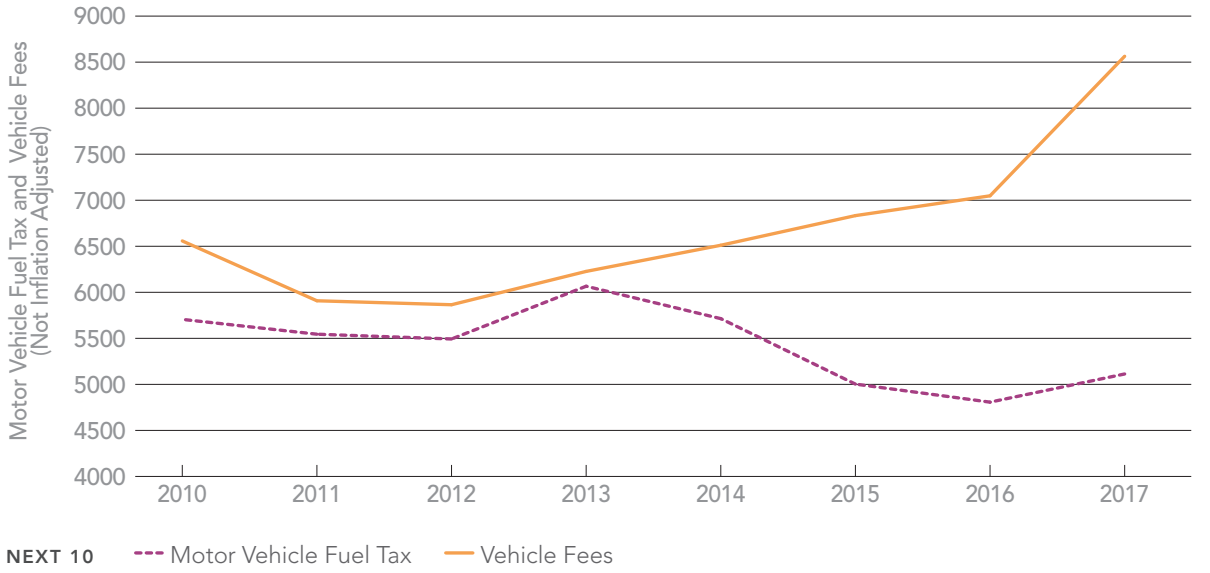
Source: California Department of Finance; Note: 2017 figures are DOF predictions

The improvement in fuel economy naturally translates to lower gasoline consumption. A 2016 vehicle uses 21.5% less gasoline than a 2006 vehicle, which means a savings of a few hundred dollars per year on fuel, as illustrated in Table 3.

This discussion assumes a constant gasoline price. If gasoline price per gallon, consumer gasoline tax, and miles traveled were all held constant through the years, fuel tax revenue would decrease simply through improved fuel economy. Increased fuel efficiency, however, tells only part of the story. Motor vehicle fuel tax revenue has plummeted since 2013 without adjusting for inflation. Accounting for inflation shows that fuel tax revenue has still been declining since 2010. Furthermore, fuel tax revenue as a percentage of all state tax revenue has been on a steady decline. In 2010, fuel tax revenue made up slightly more than 5% of total state tax revenue; in 2016, the share dropped to slightly above 3%.

The slump in fuel tax revenue is more apparent compared with revenue from vehicle license fees, the major source of revenue from California motorists. Although both categories decreased from 2010 to 2012, revenue from vehicle fees has been trending up while revenue from motor vehicle fuel has continued its downward trajectory. With the passing of SB1, which creates the Transportation Improvement Fee and Road Improvement Fee, tax revenue from vehicle license fees will see a dramatic boost starting 2018.

Figure 12: California Motor Vehicle Fuel Tax Revenue and Vehicle Fees in Millions of Dollars, 2010-2017

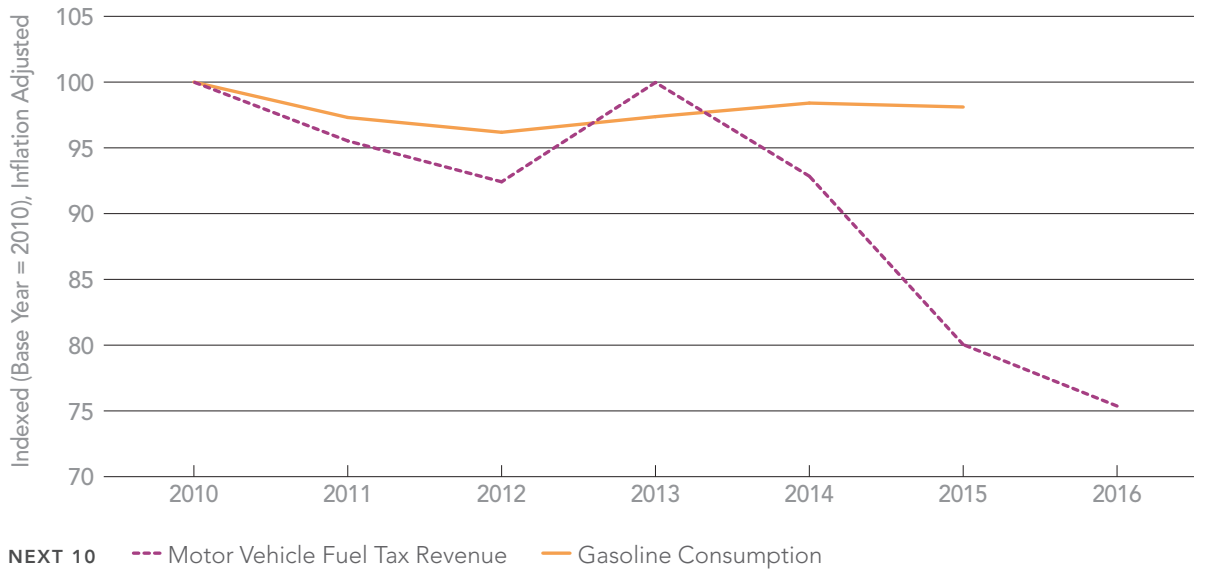


Source: California Department of Finance; Note: 2017 figures are DOF predictions

Gasoline consumption may be declining, but the decline is modest compared with that of fuel tax revenue (inflation-adjusted). Whereas gasoline consumption in 2015 declined less than 2% compared to 2010, inflation-adjusted fuel tax revenue declined 20% in the same period. Most of the decline can be attributed to improved vehicle fuel economy. In addition, the federal excise tax has been 18.4-cents-per-gallon since 1993, over which period the Consumer Price Index has risen by 67% nationally and 70% in California. Using the Consumer Price Index for California,18 18.4 cents in 2016 is equivalent to 10.8 cents in 1993, the year the federal excise tax was last raised. With the passing of SB1, fuel taxes are required to be adjusted annually according to the CPI. However, while indexing fuel taxes to inflation is a good start, as discussed earlier, should fuel economy continues to improve and should alternative fueled vehicles and zero emission vehicles become more popular, gasoline and diesel fuel sales can be expected to continue to decrease. The continuous decrease in gasoline and diesel fuel sales means the taxable base would continue to dwindle and the California government would need to implement new transportation revenue sources.

18 CPI for calendar year averages.

Figure 13: California Gasoline Consumption and Motor Vehicle Fuel Tax Revenue, Indexed (2010-2016)

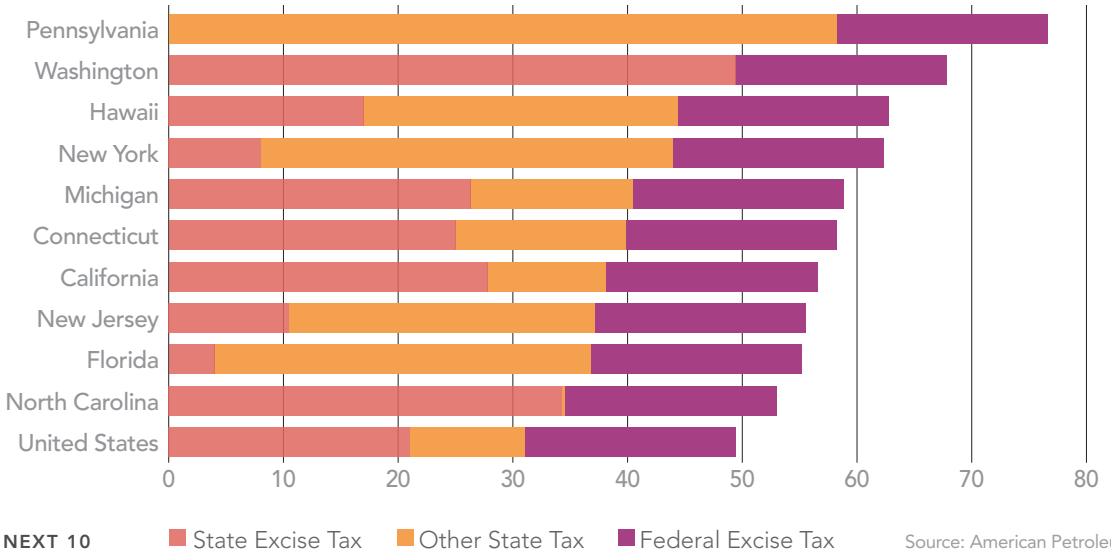


Source: US. EIA and California Department of Finance

Even before the passing of SB1, California already holds one of the highest gasoline taxes — only six states have higher gas taxes19 (and California has the eighth-highest diesel fuel tax). As of January 2017, the gasoline tax in California was 38.13-cents-per-gallon, or 23% higher than the U.S. average of 31.04 cents. The state diesel tax is 40.01-cents-per-gallon, or 29% higher than the U.S. average of 31.01 cents.

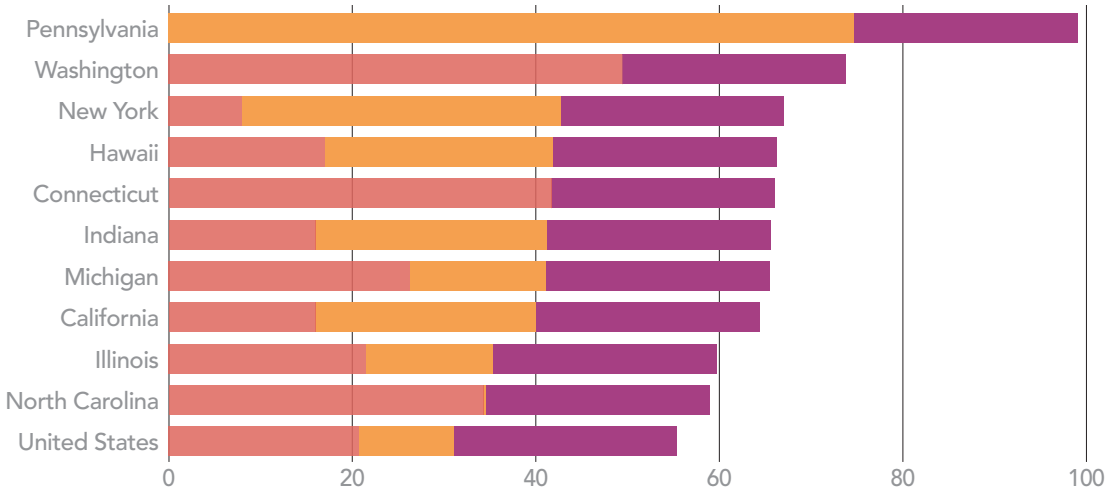
19 Excluding the federal excise tax, California's state gasoline tax totaled 38.13-cents-per-gallon as of January 2017. The six states with higher state gasoline tax per gallon are: Pennsylvania (58.20 cents), Washington (49.40 cents), Hawaii (44.39 cents), New York (43.88 cents), Michigan (40.44 cents), and Connecticut (39.85 cents).

Figure 14: Top 10 States & U.S. Average State Gasoline Tax as of Jan. 1, 2017



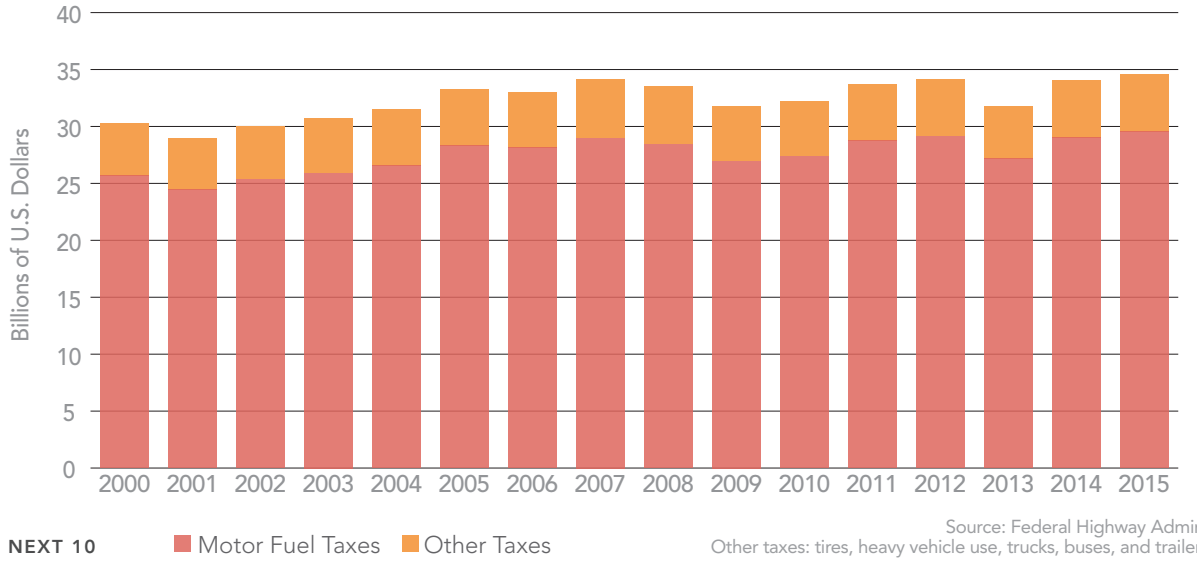
NEXT 10 Source: American Petroleum Institute

Figure 15: Top 10 States & U.S. Average State Diesel Tax as of Jan. 1, 2017



NEXT 10 Source: American Petroleum Institute

Figure 16: Highway Account Funding Sources – Motor Fuels Taxes vs. Other Taxes, 2000-2015



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Source: Federal Highway Admin.
Other taxes: tires, heavy vehicle use, trucks, buses, and trailers

Federal Excise Tax (Highway Trust Fund)

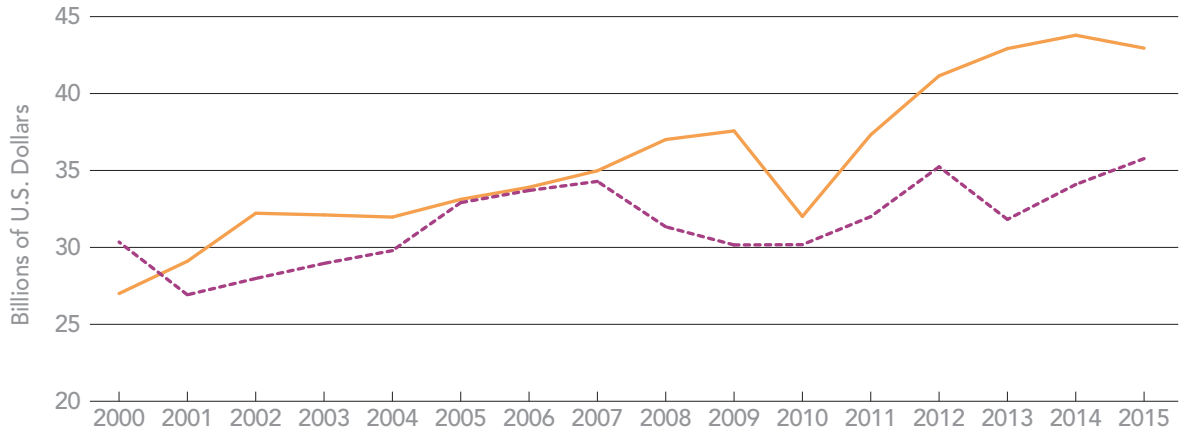
Of the 18.4-cent-per-gallon federal excise tax on gasoline and 24.4-cent-per-gallon federal excise tax on diesel,20 the Highway Trust Fund (HTF) receives 18.3 cents from gasoline and 24.3 cents from diesel, and the Leaking Underground Storage Tank Trust Fund receives 0.1 cent from both gasoline and diesel. The federal excise taxes on gasoline and diesel fuel21 are the primary sources, via the HTF, of federal spending on highways, but those and other taxes paid by highway users do not yield sufficient revenue.22 About 88% of the federal excise tax goes into the Highway Account, and the rest goes into the Transit Account. Gasoline and diesel excise taxes make up most of the HTF; the remainder comes from excise taxes on categories such as tires and heavy vehicle use. The Federal Highway Administration appropriates funding from the HTF to each state and given the current state of the HTF, California cannot heavily depend on the HTF to fund its highway maintenance needs. Therefore, new funds from SB1 can provide considerable relief in lieu of the shortcomings of the HTF.

20 There are also federal excise taxes on biodiesel (24.4 cents), liquid natural gas (24.3 cents), ethanol (18.4 cents), compressed natural gas (18.3 cents) and propane (18.3 cents). Because vehicles based on these fuels have only a marginal combined market share, these taxes are not discussed in this paper.

21 Before 2005, motor fuel tax receipts included those from gasohol (a mixture of gasoline and ethyl alcohol). In 2005, the gasohol tax was combined with the gasoline tax.

22 Congressional Budget Office (2011). "Alternative Approaches to Funding Highways." March 2011.

Figure 17: Highway Account Tax Receipts vs. Expenditure, 2000-2015



NEXT 10 --- Tax Receipts — Expenditures

Source: Federal Highway Admin.

Although fuel tax receipts for the Highway Account have remained relatively stable for the last few years, highway expenditures have risen greatly because of increasing construction costs and deteriorating roads. Taxes on gasoline and diesel fuel do not yield sufficient revenue to support federal spending. Whenever there is a shortfall, funding to the Highway Account is transferred from the federal General Fund. In the last 10 years, there have been three transfers to the General Fund and seven transfers out. Total transfers from the General Fund totaled $53.5 billion. Dinan and Austin (2012) of the CBO projected that the HTF will have a budget shortfall of $92 billion by 2025.23

State Taxes on Motor Fuel

State taxes on motor fuel typically consist of an excise tax, and other taxes and fees.24 As of January 2017, the California state excise taxes on gasoline and diesel were 27.8-cents-per-gallon and 16-cents-per-gallon, respectively. Under SB1, those rates will be increased by $0.12 and $0.20 per gallon, respectively starting on November 1, 2017. Other current state taxes and fees on gasoline and diesel are 10.33-cents-per-gallon and 24.01-cents-per-gallon, respectively. Similar to the Federal Highway Trust Fund, California devotes its taxes on motor fuel to transportation infrastructure, namely highway maintenance and mass transit.

23 Dinan, T., and Austin, D. (2012). "How Would Proposed Fuel Economy Standards Affect the Highway Trust Fund?" Washington, D.C.: CBO.

24 Other state taxes include a 1.4 cpg UST fee (gasoline and diesel), a 2.25% sales tax on gasoline and a 9.67% sales tax on diesel.

It is worth noting that the total state gasoline tax decreased from 42.35-cents-per-gallon in July 2015 to 38.13 cents in January 2017. The reason is that the state sales tax, which is 2.25% of gasoline's sales price, has decreased in proportion to the recent slump in gasoline price. In addition, the state excise tax on gasoline, which is not dependent on fuel prices, has also had consecutive decreases. Although the state excise tax on diesel fuel has been increasing, overall state motor fuel tax revenue has declined recently amid decreases in gasoline prices and the gasoline excise tax.

On the whole, current financing mechanisms are unsustainable, and road wear costs are becoming less and less correlated with fuel consumption based revenues. As the Golden State leads the way forward in ZEV (zero emissions vehicle) adoption, the gap between revenues and road wear will only increase. The recent passage of SB 1 means that owners of ZEVs for model year 2020 and after will pay an additional $100 in annual vehicle registration fees.

Table 3: Transfers from (+) and to (-) the General Fund, 2005 to 2015 (Thousands of Dollars)

Year	Transfer
2005	-
2006	-1,367,756
2007	-213,261
2008	+7,589,400
2009	+6,258,289
2010	+13,688,447
2011	-1,094,807
2012	+1,316,907
2013	+5,141,823
2014	+17,308,349
2015	+4,850,484
Total	**+53,477,875**

Source: Table FE-210, Highway Statistics 2015, Federal Highway Administration

Table 4: State Excise Tax (Cents per Gallon), Gasoline and Diesel Fuel, July 1, 2013 to June 30, 2017

Year	Gasoline	Diesel
July 1, 2013, to June 30, 2014	39.5	10.0
July 1, 2014, to June 30, 2015	36.0	11.0
July 1, 2015, to June 30, 2016	30.0	13.0
July 1, 2016, to June 30, 2017	27.8	16.0

Source: Board of Equalization

Zero-Emission Vehicle Adoption in California Overview

Committed to reducing greenhouse gas (GHG) emissions, California has passed a series of laws that seek to gradually improve energy efficiency and increase the use of renewable energy while mitigating risks associated with climate change. Transportation is the state's largest single source of GHG emissions. According to the California Air Resources Board, in 2014 light-duty vehicle transportation alone accounted for about one-fourth of all GHG emissions. In 2012, Gov. Jerry Brown issued Executive Order B-16-12, which calls for 1 million zero-emission vehicles (ZEVs) by 2020 and 1.5 million ZEVs in California by 2025. The 2013 ZEV Action Plan was produced to help the State meet these goals:25, 26

Table 5: ZEV Road Map, Years 2020 and 2025

2020	The state's ZEV infrastructure will be able to support up to 1 million vehicles.
	The costs of ZEVs will be competitive with those of conventional combustion vehicles.
	ZEVs will be accessible to mainstream consumers.
	There will be widespread use of ZEVs for public transportation and freight transport.
2025	Over 1.5 million ZEVs will be on California roads, and their market share will be expanding.
	Californians will have easy access to ZEV infrastructure.
	The ZEV industry will be a strong and sustainable part of California's economy.
	California's clean, efficient ZEVs will annually displace at least 1.5 billion gallons of petroleum fuels.

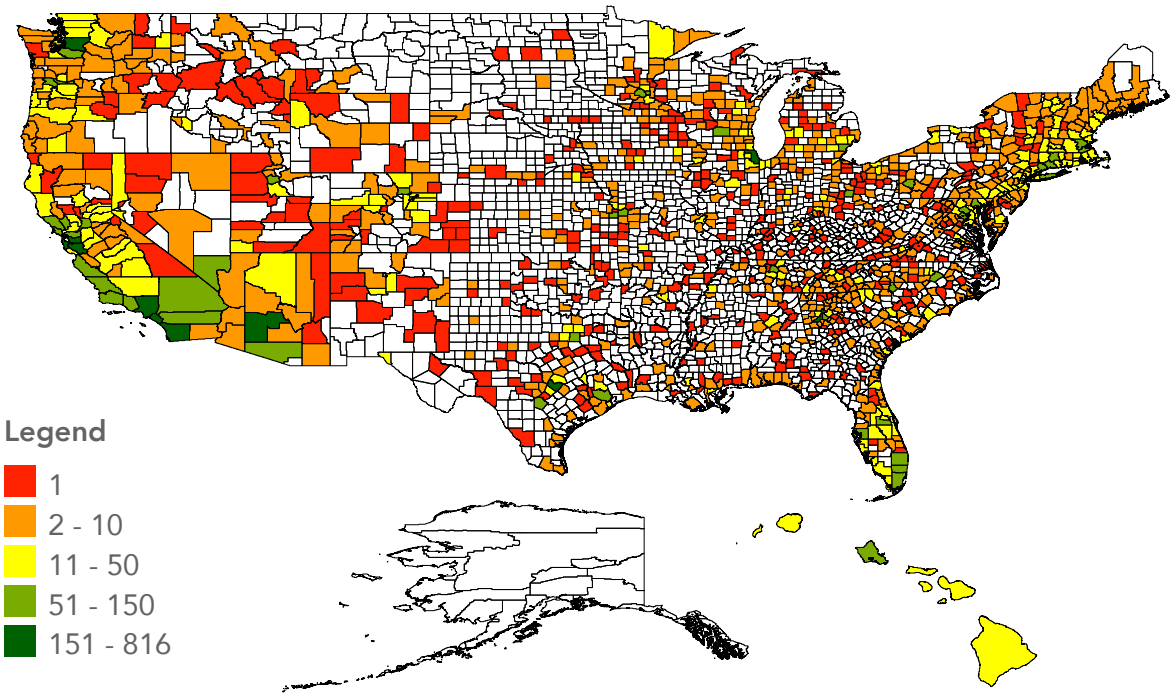
Source: 2013 ZEV Action Plan

If California is to meet its GHG reduction goals, accelerating the market for ZEVs will play an important role alongside continued gains in fuel efficiency for internal combustion engine vehicles. So far, California has witnessed an exponential growth in ZEVs; total ZEV registrations nearly doubled from 2013 to 2014.27 The updated 2016 ZEV Action Plan28 has only reaffirmed the state's enthusiasm toward bolstering ZEVs, and now California accounts for roughly half of all ZEVs sold in the United States.

While California strives towards putting 1.5 million ZEVs on the road by 2025, challenges to sales remain. One relevant issue is infrastructure. California has the most public electric vehicle charging stations and outlets in the nation, but more are needed to avoid dampening ZEV sales. Based on March 16, 2017 data from the Alternative Fuels Data Center, California

25 ZEVs typically comprise Battery Electric Vehicles (BEVs), Plug-in Hybrid Electric Vehicles (PHEVs) and Fuel Cell Electric Vehicles (FCEVs).
26 The 2013 ZEV Action Plan is available at < https://www.opr.ca.gov/docs/Governor's_Office_ZEV_Action_Plan_(02-13).pdf>
27 California Green Innovation Index, 2016, pg. 28.
28 The 2016 ZEV Action Plan is available at < https://www.gov.ca.gov/docs/2016_ZEV_Action_Plan.pdf>

Figure 18: Number of Public Charging Stations; United States, as of March 16, 2017



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had 12,370 charging outlets, or about 30% of all outlets in the United States. Although this is a notable increase over the 8,303 outlets in November 2015, given that California's share of cumulative ZEV sales (as of the end of 2016) is almost 50%, the state has a relative lack of charging outlets per ZEV compared with other states. Indeed, current data indicate that there are only 0.05 public charging outlets per ZEV, placing California ahead of only New Jersey and Alaska. To keep up with growing adoption of ZEVs, California will have to invest in additional charging station infrastructure, adding further costs to the state's transportation infrastructure needs.

Despite infrastructure challenges, with the introduction of long-range, affordable ZEVs such as the Chevy Bolt and Tesla Model 3, it is expected that ZEVs will become more mainstream and demand will increase. As the demand for conventional vehicles declines, the demand for gasoline will drop. This poses potential problems in funding transportation infrastructure and maintenance. In addition, the continued increased efficiency of gasoline vehicles further depresses gasoline tax revenue, which is the main source of funding for the Highway Maintenance Program. If California is to hit its ZEV targets, a new method for funding transportation infrastructure and maintenance will be needed as fuel-efficiency and ZEV adoption continue to increase.

Some Reform Considerations

In a 2011 publication,[29] the CBO framed various highway-funding options in terms of their equity and efficiency. Considerations of equity try to determine whether the tax follows the "user pays" criterion and whether it induces larger relative burdens on low-income or rural motorists. Equity can be defined in terms of the equality of outcomes or opportunity, however, and even then; it depends on the metric used. For example, if equity is stated in terms of share of income, per the CBO[30], fuel taxes occupy smaller share of low-income and high-income households than those in the middle. If equity is stated in terms of an indirect consumer burden, fuel taxes are regressive, because they add to prices of shipped goods. If the latter stance is taken, market controls to eliminate the effect could be prohibitively costly.

Efficiency considerations include whether the tax in question addresses fuel-related (primarily pollution and dependence on foreign oil) and mileage-related costs (primarily road wear, congestion, accidents and pollution). Collection costs and privacy issues are other considerations. Efficiency considerations can be at odds with equity considerations. For instance, many poor families own older, less fuel-efficient cars. How does one satisfy the condition of limiting pollution while not imposing higher relative burdens on the poor? Rural families, on the other hand, live in less-populated areas and tend to drive more than urban residents. This raises the question of how a tax can address mileage-related costs but not impose a higher relative burden on rural motorists.

Another issue, most salient to road usage-based taxes (including VMT taxes and toll roads) is whether the method of tracking usage passes the "Big Brother" test. At its most efficient, a fee system would charge drivers based on "mileage, road and vehicle characteristics, and traffic conditions, and… would be set to reflect the cost of each trip to the highway agency and the public."31 A fully price-discriminating system, such as that described, would set prices to the maximum that a given pool of drivers is willing to pay, but would also require significant tracking. Although there are ways to limit the level of direct access given to government agencies, and administration through third-party contractors has been studied, trust in government is near historic lows. Given the tense political climate, alongside numerous revelations of government breaches of privacy in recent memory, now may be a particularly challenging time to get voter support for reforms that could be construed as a way for the government to increase its surveillance on citizens. There also remains the fact that price discrimination can be a double-edged sword — although the result can be efficient, the poor may find the costs a disincentive to traveling to and living in urban areas, which would serve only to exacerbate regional income inequality.

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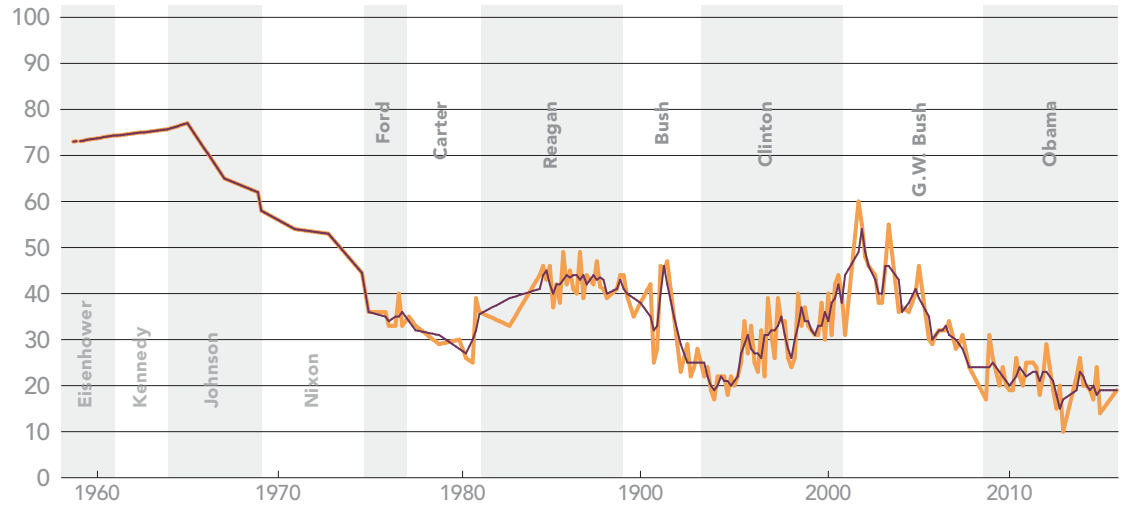
29 Congressional Budget Office (2011). "Alternative Approaches to Funding Highways." Congressional Budget Office. March 2011. <https://www.cbo.gov/sites/default/files/112th-congress-2011-2012/reports/03-23-highwayfunding.pdf>

30 Ibid.

31 Meyer, M. D. et al. (2006). "The Fuel Tax and Alternatives for Transportation Funding." Committee for the Study of the Long-Term Viability of Fuel Taxes for Transportation Finance. Transportation Research Board of the National Academies. Special Report 285. <http://onlinepubs.trb.org/onlinepubs/sr/sr285.pdf>

Figure 19: Percent Who Trust the Government in Washington Above or Most of the Time



NEXT 10 — Individual Polls — Moving Average [32]

Source: Pew Research Center

Given these challenges, it is not likely that any single system could fulfill all the mentioned considerations. Any overhaul will require an analysis of tradeoffs among the various requirements. Table 6 summarizes key equity and efficiency considerations for common transportation tax reform options. Some of these conditions can be met in other ways; in the instance of unequal outcomes for the poor, more assistance in retrofitting older vehicles and targeted rebates for emission-free vehicles could be made available for low income individuals. Legislators should also consider tailored solutions to other issues as well. For instance, in high-congestion areas, cities have introduced congestion pricing, including tolls on bottlenecks and cordon areas. Local governments have also funded transportation projects with sales tax increases. Both Orange County and Los Angeles County have instituted temporary half-cent sales taxes increases to fund transportation projects, both of which have been recently renewed by voters.

32 "Beyond Distrust: How Americans View Their Government." (2015). Pew Research Center. November 23, 2015. Accessed March 28, 2017. <http://www.people-press.org/2015/11/23/1-trust-in-government-1958-2015/>

Table 6: Evaluation of Common Transportation Tax Reform Options

Consideration	Criterion	Index Fuel Taxes to Inflation	Flat Rate Fees	Toll Roads	VMT Tax
Equity/Fairness	User pays	Yes	No	Yes	Yes
	Larger relative burden on low-income people	Yes	Yes	Yes	Yes
	Larger relative burden on individuals who drive a lot	Yes	No	No	Potentially
Externalities	Accounts for general pollution and oil dependence costs	Yes	Potentially	Potentially	Potentially
	Accounts for vehicle specific pollution and oil dependence costs	Yes	No	Yes	Potentially
	Accounts for congestion costs	No	No	Yes	Potentially
	Accounts for vehicle specific road wear costs	Mostly*	No	Yes	Yes
Implementation	Collection Costs	Low	Low	Low	Medium to High
	Privacy Costs	Low	Low	Low to Medium	Low to Medium

*Since fuel bases taxes inherently don't cover zero emissions vehicles, this solution can't completely account for some usage based costs.
Source: The Congressional Budget Office and Beacon Economics, LLC

Recent Policy and Possible Alternatives

While the $52 billion California transportation bill will enable much needed repairs to roads, the bill fails to address the underlying causes of the state's funding woes. The estimated $4.7 billion to $5.66 billion of annual revenues that are expected to result from the program over the first five years still fall short of recent annual transportation revenue deficits. Further, as the state currently faces an estimated $137 billion deferred maintenance deficit, the best that can be hoped for is that the transportation package will arrest further road deterioration. Still, the measures included in the package make some initial steps toward addressing some problems inherent to gasoline-based taxes.

Some new measures to be phased in as part of SB1 include excise tax increases for diesel fuel and gasoline, starting November 2017. New excise tax rates will also be tied to inflation, and additional revenues from the gasoline rate increase will be placed into the Road Maintenance and Rehabilitation Program, which will address basic road maintenance and rehabilitation, critical safety projects, in addition to other existing transportation programs. Prior to the passage of SB 1, only six states indexed gasoline tax rates to inflation: Florida, Rhode Island, Maryland, Utah, Georgia and Michigan.[33] While California had imposed an additional gasoline price-based excise tax in 2010, this further exacerbated state revenue shortfalls as gasoline prices plummeted in following years. The Senate Bill addresses this by re-establishing the original rate of $0.173 per gallon, and eliminating required annual adjustments. These measures will at least succeed in stabilizing gasoline excise tax revenues.

The strengths and weaknesses of the measure are much the same as those that prevail in the current system. Still, gasoline taxes do address pollution-related costs, and even if the relationship is not strong, revenues have a direct relationship to road wear. Although this will be increasingly less true, since alternative cars are gaining traction, an inflation-adjusted gasoline tax would still charge gasoline-powered car drivers commensurate to road use. On the other hand, inherent collection and privacy costs remain low, making it at least a low-cost option to quickly increase transportation revenue.

The bill does also attempt to address the growing presence of zero emissions vehicles on the road by tacking on an additional $100 to annual registration fees for owners of ZEV models made in 2020 and after. With this change, the state will join 10 other states that have introduced extra charges for plug-in vehicles.[34] The measure is controversial, as no rationale has been offered for the specific amount and the fee is seen by some as a disincentive to ZEV ownership. Bills that apply special fees to electric vehicles have appeared in several U.S. states recently, in some cases supported by the oil industry and Koch-brothers funded organizations such as Americans for Prosperity. Advocates argue these fees often don't make financial sense. EVs cause less road damage given their light weight, and improve air quality, while benefitting public health. What's more, with small sales figures compared to gas-powered vehicles, EV fees barely make a dent in existing funding shortfalls.

In a letter sent to Senator Jim Beal voicing opposition to the registration fee, the Union of Concerned Scientists (UCS) posited that the fee could result in owners of hybrid and zero-emissions vehicles paying more than a fuel efficient car. Citing fairness and environmental concerns, the UCS recommended that the state instead impose an energy-equivalent fuel tax that would instead tax vehicle owners at different rates based on average energy efficiency rates (mpg/mpge) for a given model.

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33 "Informing the Debate Over Tax Policy Nationwide" (2017). Institute on Taxation and Economic Policy. January 2017. <http://www.itep.org/pdf/variablerategastax0117.pdf>

34 Cobb, J. (2016). "10 States That Charge Extra Fees on Plug-In Cars." July 6, 2016. <http://www.hybridcars.com/10-states-that-charge-extra-fees-on-plug-in-cars/>

Further, a new annual Transportation Improvement Fee will be introduced in 2018 that will be tiered to vehicle market value and will apply to all vehicles. While tiered rates will at least improve equity outcomes for this measure, flat rate fees are not ideal solutions for a number of reasons. The flat rate vehicle registration increase, blind to relative road use, treats someone who drives thousands of miles a month in the same way as someone who drives hundreds of miles. For the same reason, a flat rate charge is also inefficient, because there is no clear connection between road use charges and costs. It is also blind to externalities, including congestion costs. The advantages of the option relate to low transaction costs: the bureaucratic and technical infrastructure already exists for imposing vehicle registration fees, and no additional information is required of the driver.

Another aspect of the recent transportation bill that has generated some controversy relates to provisions that relate to the commercial trucking industry. The bill articulates a "useful life" period for trucks in the advent of changing regulations. Truck owners would not be required to replace or modify the vehicle before they have reached 13 years from the vehicle's model year or until they reach 800,000 vehicle miles traveled. Heavy duty trucks are typically diesel powered, making the freight industry a primary contributor to particulate matter emissions.

Heavy duty trucks also contribute disproportionately to road wear and tear, and as mentioned previously, a 2000 FHA estimate indicated that federal truck user fees covered only 80% of related wear and tear to roads. While the diesel excise tax increase will be almost twice that of the gasoline tax increase, half of the 20 cent diesel fuel excise tax increase has been earmarked for a Trade Corridor Enhancement Fund, which focuses on infrastructure improvements on highway and rail corridors that have a high volume of freight movement. In effect, owners of gasoline powered vehicles would pay an additional 12 cents per gallon into the newly established Road Maintenance and Rehabilitation Fund, while drivers of diesel powered vehicles contribute only 10 cents per gallon to the fund. This could further increase the disparity between how much truck drivers pay for road maintenance versus actual damage incurred.

In sum, many of the provisions of the recent bill that relate to transportation revenues stabilize the fund, but fail to account adequately for user specific costs. In terms of efficiency weaknesses, there remain the problems that road damage is increasingly linked to miles traveled more than energy use, fuel efficiency gains will continue to erode revenues over the long run, and the state has yet to offer taxes that would fairly tie taxes for alternative fuel vehicles to actual road use. Increasingly, the state and nation have been looking towards solutions that would relate more closely to actual use, including road pricing mechanisms (toll charges) and mileage-based pricing mechanisms (VMT taxes). Some alternative options for funding transportation infrastructure include:

Fund Toll Roads Through Private-Public Partnerships (P3s)

Although few details have emerged on President Trump's infrastructure plan, one of the president's key campaign promises was that the purported $1-trillion infrastructure spending package would not be funded by tax increases. Trump has indicated that tax credits, with a focus on projects capable of paying for themselves (toll roads, airports, etc.), would induce the private sector to finance projects. This idea has been touted by many politicians before Trump, and for good reason, given the difficulty of introducing new and higher taxes on the national level. According to a survey by HNTB Corp., 72% of Americans would support tolls to fund transportation projects if there are inadequate funds from other sources.35 Domestically, the use of P3s to fund public infrastructure has evolved rather slowly. One possible reason being that the P3 market does not have the same relevance in the U.S. as in other countries could be that it is simply not mature enough. Per a 2009 report by the Federal Reserve Bank of Minneapolis, the United States does not have the regulatory or statutory framework necessary to facilitate such projects. The article also points out that "PPPs don't necessarily offer an inherently better model for infrastructure than traditional government procurement. But PPPs offer a new source of capital and a way around the endless political tussle for funding that is responsible for much of the infrastructure problem."36 Still, the devil is in the details of implementation. According to the Public-Private Partnership in Infrastructure Resource Center, road concession arrangements with the private sector fall into three general categories:

- **Real Tolls:** Road users pay for the use of the asset, or roadway/highway. In this model, the asset is often developed by the private vendor and made available to the public through a long-term lease with the public authority.
- **Shadow Tolls:** The rate paid to the private vendor by the public authority is metered to road use. This is usually implemented through a banding mechanism, which ties shadow toll payments to various levels of traffic.
- **Availability/Performance Base Mechanisms:** The public authority pays the private vendor for making the road available for public use, and potentially suffers a deduction for non-availability of roads.

Although each tolling system offers advantages and disadvantages in terms of efficiency, equity and risk considerations, real tolls remain the most common arrangement in the United States. Specifically, the two most common fall under the General Tolling and HOV/HOT Lanes Program. From a financing standpoint, real tolls have the advantage of removing operating and construction costs from government agencies. On the other hand, since risks are not shared with the private sector, only low-risk and profitable projects occur — which are not necessarily criteria that match up well with all transportation infrastructure

35 "America Thinks: Tolling 2016." HNTB Companies. Accessed March 27, 2017. <http://www.hntb.com/getattachment/Newsroom/News-Releases/Highway-congestion-drives-support-for-tolls/AT_Tolling_Factsheet_916.pdf.aspx>

36 "Public-Private Partnerships: For Whom the Road Tolls?" Federal Reserve Bank of Minneapolis. Accessed April 14, 2017. < https://www.minneapolisfed.org/publications/the-region/publicprivate-partnerships-for-whom-the-road-tolls>

needs. Additionally, the success of privately owned tolls roads seems to be more sensitive to the health of the economy compared to the alternative approaches. When the economy is doing poorly, motorists who would normally pay for the toll roads may switch to using non-toll roads (at the expense of facing traffic congestion). However, the same vehicle miles traveled are still logged and the government will still incur comparable repair costs. Particularly, compared to the other alternative approaches, where motorists still have to pay as long as they still drive (or own the vehicles in the case of the flat rate fee), toll roads are merely optional to these motorists. The 2009 Minneapolis Fed article cites that "some recent PPPs are already struggling from the recession. Macquarie Infrastructure Group announced in February that traffic on a number of its U.S. tollways was disappointing; use of the Indiana Toll Road had slumped by 15 percent in the second half of 2008, and cash flows reportedly were barely covering interest payments by the end of the year. In February, MIG announced a half-year loss of $1.7 billion, much of it from heavy write-downs on the value of its toll roads."

But under the most general circumstances, toll roads may potentially be more efficient than many alternatives and have the potential to have fully variable road pricing with electronic toll collection. Toll ways commonly have real-time pricing updates to account for congestion and have the potential to vary pricing by vehicle to differences in fuel economy, pollution costs and other externalities. However, the implementation of toll only roads could result in limiting the accessibility of some areas to only those who can afford it.

Furthermore, as in the case of all usage-based taxes, specificity of pricing comes at the cost of privacy. Publicly administered toll booth photographs and EZ pass information have been used as evidence criminal cases in New Jersey,37 and a new toll system to be rolled out in Massachusetts will include a "hot list" feature. This feature could flag and track vehicles in public safety emergencies, including Amber Alerts.38 While Massachusetts state officials are working to draft a list of all situations that would warrant using the hot list feature, state legislators are already looking to introduce new bills that would prevent the Department of Transportation from sharing data unless required by warrant.

Institute a Mileage-Based User Tax

Another option that the state is still reviewing is the feasibility of replacing gasoline taxes with a mileage-based user tax. At the time of this writing, Caltrans is nearing the end of a pilot study that could offer some insights into costs and how such a program would be implemented. While a number of similar trials have already taken place, there is not yet consensus on how a mileage-based tax should be implemented, and there are several alternative plans that have been proposed. Some methods proposed for the California Road

37 Park, M. (2007). E-ZPass details popping up in trials. The Baltimore Sun. August 31, 2007. Accessed April 3, 2017. <http://articles.baltimoresun.com/2007-08-31/news/0708310082_1_zpass-toll-records-electronic-toll>

38 Darrow, B. (2016). Massachusetts' Automated Toll System Raises Privacy Concerns. Fortune - Fortune 500 Daily & Breaking Business News. August 22, 2016. Accessed April 4, 2017. <http://fortune.com/2016/08/22/automated- tolls-raise-privacy-concerns/>

Charge Pilot Program include: time permits, mileage permits, post-pay odometer charges, automated distance charging without location information, and automated distance charging with general location information. At the simplest level, a driver would install a device that works alongside the vehicle's odometer, and make annual tax payments based on mileage. Current technologies allow for much more sophisticated tracking, however, and if drivers would consent to sharing location data as well, the result could be a complete price-discriminating tax structure that satisfies all externality considerations (pollution, oil dependence, congestion and road wear costs). A VMT tax would also stand up well to long-run changes in gasoline consumption trends and would satisfy the user-pays criterion in the advent of mainstream ZEV use.

However, any completely price-variable tax structure comes with fiscal and privacy costs. In terms of fiscal costs, it is obvious that a fundamental overhaul of highway administration would have high upfront costs. Trials run in recent years can lend insights into short-run costs, but trials don't reflect the economies of scale and efficiency gains that would be obtained in the long-run. Over the duration of Oregon's 2013 road use charge pilot program, annual costs to collect per mile were estimated at 20% to 50% of revenue — for comparison, the state estimates the cost to collect fuel taxes at 0.5% of revenue. Since this was a pilot program, and cost savings would probably come into effect over a longer period, this is probably the upper limit of what collection costs would be in a mature system. Also, because of greater price discrimination, per-mile charges collected for the 10,000 study participants were 28% higher than the fuel tax would have generated.39 In the context of this example, higher operating costs did outpace higher revenue, but it is difficult to say whether that would be true for a mature system.

Although there would be an obvious increase in privacy costs compared with gasoline use taxes, the degree depends on the details of implementation. In our base case, in which a device is installed to track mileage, the only personal information that the administering agency obtains beyond what is already disclosed is annual miles traveled. In this case, privacy costs are relatively low. But privacy and security costs may be much higher if location-tracking technology were introduced. Public demand for assurance against security breaches might be high, given growing threats of cyber-attacks and terrorism. The technology would also need to be robust enough to limit the possibility of fraud and evasion efforts.

Although mileage-tracking technology has existed for more than a decade, government hesitance in embracing it is understandable. Unlike with other proposed reforms, using a mileage-tracking device would require taxpayers and government to enter new territory — a transformation that has inherent risks and high upfront costs. Therefore, mileage-tracking programs have been the subjects of extensive study across the nation. The largest hurdle for governments that has been identified in these studies is the ability to ensure

39 Whitty, J. M. and Capps, D. F. (2014). "Road Usage Charge Pilot Program 2013 and Per-Mile Charge Policy in Oregon." Oregon Department of Transportation. May 2014. <http://www.oregon.gov/ODOT/HWY/RUFPP/docs/RUCPP%20Final%20Report%20-%20May%202014.pdf>

public trust. In 2013, authors of the Oregon study noted "citizens consistently showed a high sensitivity to government mandates for use of GPS in road pricing proposals, yet they routinely used mobile devices with little or no concern." This mistrust appears, at least to some extent, to be grounded in a lack of understanding of the technologies that would be involved. In a multi-state pilot conducted by the Transportation Research Board, 70% of participants had a positive view of mileage-based taxes, up from 42% at the outset. Similarly, 58% of participants of the Oregon study reported coming away with a more or much more positive view of road use charging, with no participant reporting a less positive view of the program.40 Overall, hands-on experience seems to improve attitudes toward mileage tracking. For a vehicle-miles-tracking program to be accepted by the broader population, more study will be necessary to better understand how to allay fears of the public and establish trust in such programs.

40 Ibid.

CONCLUSION

$52.4 Billion
SB1 revenue over 10 years

$9.8 Billion
current annual shortfall

$137 Billion
total existing project backlog

The transportation sector is the greatest contributor of GHG emissions in the state of California, and as such, promoting the adoption of ZEVs has been critical to the state's plan to meet its emission reduction goals (as laid out in AB32 and SB32). However, greater adoption of ZEVs and increasing fuel efficiency for conventional vehicles comes with a decrease in gas tax revenue, which is one of the main sources of funding for transportation infrastructure and maintenance. With 68 percent of California roads in suboptimal condition, this challenge will require a solution that allows the state to moves toward a reduction in fuel consumption and associated emissions while addressing our growing infrastructure needs. California needs to explore alternatives to the current fuel tax scheme in order to meet growing infrastructure and repair needs, while also promoting ZEVs and fuel-efficient vehicles as part of the state's commitment to reducing greenhouse gas emissions.

The recent transportation bill, SB1, provides a temporary solution to a growing, permanent problem. The estimated $4.7 billion to $5.66 billion of annual revenues that are expected to result from the program over the first five years still fall short of recent annual transportation revenue deficits. Further, as the state currently faces an estimated $137 billion deferred maintenance deficit, the best that can be hoped for is that the transportation package will arrest further road deterioration. These provisions do not address key trends highlighted in our report: Road damage is increasingly linked to miles traveled more than energy use, fuel efficiency gains will continue to erode revenues over the long run, and the state has yet to offer taxes that would fairly tie taxes for alternative fuel vehicles to actual road use. A more lasting solution would require a system that could tie revenues more fairly to road damage and other externalities. Part of this should involve a greater effort to identify where gaps between road use and damage exist – particularly in the case of heavy-duty trucks- and attempt to better align the two.

Moving transportation administration and investment away from the public sector through tolls, as suggested by President Trump, has the potential to offset costs to taxpayers, but the profit motive would cause private companies to favor low-risk, profitable projects that may not fully align with the infrastructure needs of the state. On the other hand, the mileage-based user tax, as is currently being explored by the state, is the most equitable (in terms of charging the most to drivers that use the roads the most) but there are privacy and tracking concerns that would present a hurdle to adoption and implementation. There appears to be a current disconnect between what information consumers are willing to share on smart phone applications and with private vendors, and attitudes toward disclosing the same information to public agencies. Additional research will be necessary in order to address fears of the public and establish program trust. Moving forward, legislators will need to introduce clear boundaries on how personal location data can be used and what protections will be required for users.

It also bears reiterating that both of the two major alternatives highlighted in this overview (toll roads and VMT taxes) present tradeoffs between efficiency and equity. Therefore, it is not likely that any single system can offer a perfect solution. As legislators weigh options currently on the table, they should prioritize flexibility as well as efficiency. Some concerns can be addressed through more tailored solutions to specific issues, as well: the state already provides higher rebates for emission-free vehicles to low income individuals to help address some equity concerns, and legislators could consider establishing congestion pricing in key areas, to more evenly distribute road use costs.

As the vehicle market continues to move toward more fuel-efficient vehicles and ZEVs, California – and states across the country – will be faced with a growing shortfall of fuel tax revenue to support increasing needs for transportation infrastructure. Pilots to test some of the alternative measures outlined in this brief will help arm the state with the information it needs to designed improved programs that will more sustainably, effectively, and equitably deliver needed funds to the state's roads and infrastructure.