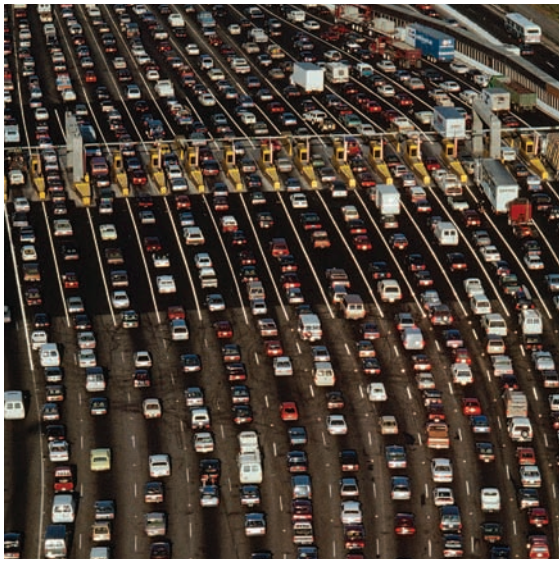
PPIC PUBLIC POLICY INSTITUTE OF CALIFORNIA

Driving Change

Reducing Vehicle Miles Traveled in California



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SUMMARY

Senate Bill (SB) 375, adopted in 2008, calls on regional transportation planning agencies and local governments to develop strategies for reducing greenhouse gas emissions from passenger vehicles by reducing per capita vehicle miles traveled (VMT). Three specific strategies, traditionally used to reduce traffic congestion and improve air quality, are to be employed to help reduce emissions:

Higher-density development, particularly in areas well-served by transit;

Investments in alternatives to solo driving, such as transit, biking, walking, and carpooling; and

Pricing policies that raise the cost of driving and parking.

Although SB 375 is expected to reduce emissions only modestly relative to vehicle efficiency standards and low-carbon fuels, it is also expected to improve public health and reduce energy and water use by encouraging denser development and more "livable" communities. The integration of these three approaches is consistent with an emerging research consensus that policies integrating all three strategies have a much greater chance of reducing VMT than any one approach on its own. This report reviews the opportunities and challenges of each of these strategies and assesses California's recent experience and future prospects for successfully integrating them.

On balance, California has started with the right approach by attempting to integrate its emission-reduction policies. However, recent experiences within the state and elsewhere have revealed numerous challenges—some quite formidable. On the plus side, more local governments are undertaking climate change activities, and many local planners see significant potential for reducing VMT, especially in localities that have experience in implementing these strategies and in more populous areas of the state. Also, planners are beginning to recognize the importance of using multiple approaches. And transit ridership in California is increasing, with recent transit investments appropriately directed toward higher-density areas.

But red flags abound, potentially limiting California's ability to reduce VMT. Employment density (the number of jobs per square mile) is low and declining, and employment density matters more than residential density for encouraging transit use as an alternative to driving. Furthermore, major transit investments since the early 1990s have not produced an overall reduction in VMT, and densities around new stations have not increased. The vast majority of commuters still drive to work, even if they live or work near a transit station. And planners are skeptical about pricing policies—a key component of integrated strategies—especially in localities with higher-income households, which tend to be less sensitive to changes in the cost of driving and parking. Finally, funding transit investments and operations remains a perennial challenge.

If California is to make the most of SB 375, several priorities require attention. Regions and localities should encourage greater commercial (that is, nonresidential) development around transit stations. Pricing policies need to accompany land use and transportation strategies, despite public resistance. State or federal leaders need to raise general road use fees (either the traditional gas tax or a new VMT-based fee), both to provide incentives to reduce driving and to help fill the widening gap in transportation funding. And, finally, regional strategies must recognize the wide variation in attitudes and conditions among localities and address the lack of coordination (even among transit systems within the same region) that exists today.

This report is based on reviews of the research literature, our survey of local governments and planning agencies, and our analysis of population, employment, and transportation data. The report draws heavily on two companion papers: "Views from the Street" (Bedsworth, Hanak, and Stryjewski 2011) and "Making the Most of Transit" (Kolko 2011). To find these and other related resources, please visit the report's publication page: http://www.ppic.org/main/publication.asp?i=948

Introduction

> In the communities of the future, homes and jobs, recreation and education, shopping and health care, will be more accessible with less dependency on the single-occupant vehicle.
>
> —California Air Resources Board (2010)

With the adoption of Senate Bill (SB) 375 in late 2008, California became one of the first states in the nation to establish an explicit policy aimed at reducing the amount of driving by passenger vehicles—or vehicle miles traveled (VMT)—in an attempt to reduce the greenhouse gas (GHG) emissions that contribute to global warming.[1] Achieving this goal will entail a major behavioral shift for Californians, often known for their love affair with the automobile. Per capita VMT and associated GHG emissions in California have been increasing for decades, but the new targets in the state's largest metropolitan areas envision per capita GHG emission reductions from passenger vehicles on the order of 7 to 8 percent by 2020 and 13 to 16 percent by 2035 (California Air Resources Board 2010). Although some of these reductions can be achieved by improving traffic flow (which reduces emissions by increasing fuel efficiency), most will need to come from reductions in the length and frequency of automobile trips.[2]

Three broad policy strategies, traditionally used to reduce traffic congestion and improve air quality, will now also aim to reduce GHG emissions:

Integrating land use and transportation decisions to bolster the effectiveness of transportation policy and investments (e.g., development or redevelopment around transit stations);

Investing in alternatives to solo driving, such as public transit, biking, walking, and carpooling; and

Using pricing incentives to manage traffic and parking.

Because meeting SB 375 targets will require using these strategies more aggressively than in the past, the new law could bring major shifts in the way state, regional, and local governments make transportation and land use decisions.

In particular, SB 375 envisions collaboration between regional transportation authorities and local governments. California's regional transportation authorities—the Metropolitan Planning Organizations (MPOs)—are responsible for demonstrating compliance with SB 375, whereas local governments—cities and counties—oversee most transportation spending and have authority over land use. Rather than sanctions for noncompliance, SB 375 includes regulatory incentives to encourage local governments to collaborate with MPOs by easing requirements for the environmental review of suitable development projects under the California Environmental Quality Act (CEQA).

In calling for collaboration between the agencies responsible for transportation planning and governments responsible for land use planning, SB 375 reflects the emerging research consensus that integrating transportation, land use, and related policies has greater potential to reduce VMT than any one of the approaches taken alone. The success of SB 375 hinges on how well California's regional and local governments can integrate these policies to promote a behavioral shift from solo driving by California residents.

In terms of climate policy, SB 375 is expected to achieve only modest benefits, accounting for 8 percent of all GHG emission reductions in the transportation sector by 2020 and approximately 3 percent of all emission reductions economy-wide (California Air Resources Board 2008). Yet by reducing the distances between residences and other destinations, reducing the amount of time people spend in their cars, and enhancing "walkability," SB 375 is likely to meet the broader social goal of building more livable, healthy communities.[3] In addition, by facilitating the development of denser communities, SB 375 may help meet other sustainability goals, including reduced energy and water use.

This report reviews the role of transportation in California's climate policy; synthesizes current knowledge

about the effectiveness of land use, transit, and pricing policies; and tries to gauge how well California is positioned to implement an integrated strategy for VMT reduction. The first section reviews the role of transportation in California's climate change policy, describing efforts to reduce GHG emissions through various transportation strategies. The second section explores land use, transit, and pricing policies aimed at reducing VMT. The third section discusses the integration of these strategies. We look at local readiness to use integrated strategies, drawing on our survey of California city and county planners, and analyze California's recent experiences with transit-oriented development (TOD)—a prime example of integrated land use and transportation planning. The final section summarizes our key findings and explores policy implications.

Transportation and California's Climate Change Policy

California's efforts to reduce air pollution have focused on transportation issues for decades. The state led the nation with the first emission regulations for vehicles in the early 1960s, and this leadership continues today in California's quest to reduce GHG emissions.

GHG Emission Trends

Greenhouse gas emissions in California have been increasing steadily over the past several decades, with the fastest growth occurring in the transportation sector. Statewide, GHG emissions increased almost 10 percent between 1990 and 2008, and emissions from transportation increased by over 16 percent. Without regulations to reduce emissions, this growth is expected to accelerate over the next several decades (California Air Resources Board 2008). The transportation sector is the largest single contributor to GHG emissions in the state, accounting for 37 percent of all emissions. Passenger cars and trucks account for almost three-quarters of this total.

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Policy Context

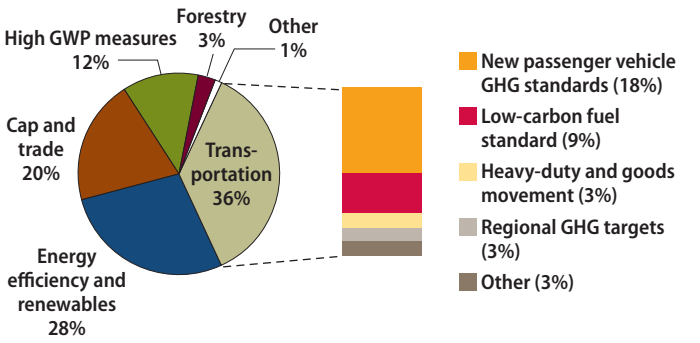
Recognizing the high risks associated with climate change, California has taken a leadership role in global efforts to reduce GHG emissions. Assembly Bill (AB) 32, the Global Warming Solutions Act of 2006, set a target for California to reduce statewide emissions to 1990 levels by 2020 (a roughly 30 percent reduction relative to business as usual), and the state is aiming to reduce emissions an additional 80 percent by 2050—the level considered globally necessary to stabilize the planet's climate.[4]

The California Air Resources Board (CARB) is responsible for implementing AB 32, and it has outlined a comprehensive "scoping plan" that includes all of the programs needed to achieve the state's 2020 emission reduction target (California Air Resources Board 2008). The largest share of these reductions (36%) is expected to come from programs that involve the transportation sector, including establishing GHG emission standards for new passenger vehicles, decreasing the carbon content of fuels, and lowering the number of miles driven. VMT reductions are included in the "regional GHG targets" established under SB 375 and depicted in Figure 1.

VMT reductions play a relatively modest role in the overall emission reduction plan—8 percent of all transportation sector reductions and only 3 percent of AB 32's overall target for 2020—anticipating the length of time needed to register cumulative effects from such measures as land use changes and new transit investments, which also require behavioral changes by the public.[5]

These estimates do not include other potential emission benefits of SB 375 associated with changes in land use. For example, higher-density housing units are smaller and therefore use less energy.[6] And, as noted above, SB 375 may

Figure 1. Transportation is a primary concern in near-term efforts to reduce emissions



SOURCE: California Air Resources Board (2008).

NOTES: The figure shows the share of emission reductions by target area, as presented in the AB 32 Scoping Plan. The statewide target is to cut 174 million metric tons of carbon dioxide–equivalent. The High GWP measures segment in the figure represents reductions in materials with global warming potential (refrigerants, some solvents, and other industrial gases). Within the transportation sector, "Other" includes measures to improve vehicle design and accessories (air conditioners, paint, and windows) and high-speed rail.

also lead to broader public health benefits, since reductions in driving improve air quality and tend to increase physical activity, such as walking and biking.

Reducing Vehicle Miles Traveled: The Challenge of Coordination

SB 375 directs the California Air Resources Board to establish GHG emission reduction targets for passenger vehicles in each of the state's 18 MPOs—regional agencies that cover roughly 98 percent of the state's population. MPOs are responsible for developing long-term (20-year or longer) regional transportation plans (RTPs). Although MPOs are responsible for compliance with SB 375 through the development of a Sustainable Communities Strategy (SCS) in the RTP, their success will require close coordination with two other key groups: local transportation and land use authorities. Most of the spending identified in a regional transportation plan is carried out by local entities—county transportation agencies, city public works departments, transit agencies and districts, and others—that control their own budgets.[7] Statewide, local governments and transit agencies are responsible for 72 percent of transportation expenditures (see Bedsworth, Hanak, and Stryjewski 2011 for details on expenditures). Cities and counties are also essential collaborators with the MPOs because of their authority over land use decisions.[8]

Successful implementation of SB 375 will require more interplay between the regional and local entities than there has been in the past. The new law provides some regulatory incentives to local governments to increase collaboration, and MPOs can create financial incentives by directing their resources toward projects that meet SB 375 goals.[9] But local willingness to participate will be a key ingredient to success.

Early Responses to Transportation and Land Use Goals

Even before the passage of SB 375, the state's largest regions had been collaborating with cities and counties to reduce driving and manage traffic congestion. Indeed, part of the impetus for SB 375 came from the "Regional Blueprint" planning process, which has encouraged MPOs and local governments to coordinate transportation and land use planning to meet a range of sustainability goals.[10]

Accordingly, several MPO planning directors we interviewed reported that SB 375 codifies what they were already doing and provides "wind at their backs." But the new law has also pushed regions to look for further improvements, as reflected in a comparison of carbon dioxide emission trends under current RTPs and the SB 375 targets set for 2035 (Table 1).[11]

And despite the recession and considerable local fiscal stress, an increasing number of cities and counties are undertaking two important climate change activities: GHG emission inventories and climate action plans (Table 2). Emission inventories develop a baseline of GHG emissions from different sources, enabling localities to identify areas for emission reductions and to monitor progress in meeting their goals. Climate action plans are general planning documents that define strategies for emission reductions and other sustainability measures. Roughly 70 percent of all local governments are actively engaged in these programs, covering over 85 percent of the state's population, and the vast majority report that their activities include goals, policies, or programs to reduce the number and shorten the length of car trips.[12]

Table 1. MPOs are stepping up GHG emission reductions since the passage of SB 375

	Current RTP adoption date	Per capita GHG emission reductions, 2005–2035 (%)	
		Current RTP projection	New target
Southern California (SCAG)	2008	–4	–13
San Francisco Bay Area (MTC)	2009	–3	–15
San Diego (SANDAG)	2007	–10	–13
Sacramento Area (SACOG)	2008	–13	–16

SOURCES: Heminger et al. (2010); California Air Resources Board (2010).

NOTES: For the SCAG region, the target set by the California Air Resources Board (CARB) is higher than the level established by the region in its "most ambitious scenario" (12%), provided to CARB as support for target-setting. The SCAG board voted in September to reject the new target (with a counterproposal of 8%) unless CARB accepted conditions including the restoration of state funding for transit and demonstration projects (Southern California Association of Governments 2010).

Table 2. Despite the recession, local climate action programs have increased

	Share of local governments with programs (%)	
	2008	2010
Emission inventory, municipal operations	55	70
Emission inventory, community at large	42	69
Climate action plan	52	69

SOURCES: For 2008, Hanak et al. (2008); for 2010, Bedsworth, Hanak, and Stryjewski (2011).

Thus, it appears that California's new climate policy goal to reduce driving is encouraging regions and localities to continue in the direction that many have already taken.

Policies and Programs to Reduce Driving

Three primary approaches can reduce VMT: changing land use patterns to reduce the need to drive; investing in mass transit and other alternatives to driving; and increasing the cost of driving and parking to encourage the use of alternatives. Although each of these strategies has received some attention in past planning efforts, SB 375 focuses specifically on ways to increase the effectiveness of these approaches. In this section, we discuss where California stands and what the research says about the usefulness of each approach on its own. We also describe some of the activities local governments are undertaking in each area.

Land Use Policies

Land use patterns—density, the proximity of jobs and housing, and design elements, such as shorter blocks and more street intersections—have a modest but often statistically significant effect on transportation behaviors, such as trip length, trip frequency, and the decision to drive or travel by other means (Ewing and Cervero 2010). Evidence also suggests that people who live in denser neighborhoods drive less (Ewing and Cervero 2001). But VMT reductions of more than a couple of percentage points would require increases in residential density that many researchers consider infeasible (Transportation Research Board 2009).[13]

High *employment* densities appear to boost transit ridership (and therefore reduce VMT) more than high residential densities, in part because it is relatively easy for workers to drive or bike from home (where their cars or bikes are) to a transit stop or station but not as easy to drive or bike from a transit station or stop to their workplace (Barnes 2005; Arrington and Cervero 2008; Transportation Research Board 2009). As we discuss below, greater focus on encouraging employment densities may create opportunities for California to boost the effectiveness of its VMT reduction efforts.

Land Use Trends

Despite the conventional wisdom that California (particularly Southern California) is the epitome of sprawl, residential density in California is well above the national average. Residential density in California in 2000 was 49 percent higher than the national average (Kolko 2011; see the text

box). Residential density increased from 1990 to 2008 in California but did not change at the national level.

Employment density is another story. Employment density in California is lower than in the nation overall (in 2006, 15% below the U.S. average) and, like the long-term national trend, is declining. In the six largest California metropolitan areas, employment densities within three miles of downtown fell nearly 25 percent between 1992 and 2006, whereas employment densities ten miles or more from downtown rose slightly over the same period. The movement of jobs away from dense downtowns is a decades-long trend with economic, political, and technological causes (Kolko 2011).

California's large metro areas display considerable variation in density. The Los Angeles metropolitan area ranks second nationally in residential density, and San Francisco–Oakland ranks third. In contrast, Los Angeles ranks only 22nd nationally in employment density. Of California's twelve largest metros, all but two—San Francisco–Oakland and Sacramento—have lower employment density than residential density.

Measuring density

Conventional density is measured as the number of people (or housing units or workers) per square mile (or other measure of area). But metropolitan areas and states often include undeveloped or sparsely developed land.

Weighted density takes this unevenness into account by measuring the number of people (or housing units or workers) in the areas where people actually live or work. It weights the average of conventional density measured at the Census-tract or other small geographic level by the number of people or workers in that tract. Weighted density better reflects the land use patterns experienced by a typical person or worker.

Consider two hypothetical cities, Sparseville and Densetown. Each has a population of 1,000 residents and consists of two square-mile Census tracts. In Sparseville, 500 people live in each tract, whereas in Densetown, all 1,000 residents live in one tract and the other is undeveloped. Both Sparseville and Densetown have a conventional density of 500 people per square mile (1,000 residents divided by two square miles). But the weighted density measure is 500 people per square mile in Sparseville, since the average person lives in a tract with 500 people per square mile, whereas the weighted density measure in Densetown is 1,000 people per square mile, since the average person (in fact, all people) lives in a tract with 1,000 people per square mile.

Throughout this report, we report weighted density measures for metropolitan areas and states.

The movement of jobs away from dense downtowns is a decades-long trend with economic, political, and technological causes.

Current land use patterns in most California metropolitan areas (high residential density, low employment density) do not offer much promise for reducing VMT. Furthermore, density patterns tend to have long life spans: They represent the cumulative result of decisions made over many years by governments, businesses, and households. Moreover, communities often resist higher-density development—local officials surveyed by PPIC ranked public opposition to density as the biggest barrier to reducing driving in their communities.[14]

Land Use Strategies in Action

Given the challenges of unfavorable long-term trends and public opposition, what land use strategies are cities and counties currently pursuing? Our survey inquired about a range of land use policies that constitute a "smart growth" approach to raising densities and increasing proximity to transit:[15]

Urban growth boundary or greenbelt: Restricts development outside designated areas; seeks to increase density within the core urbanized area and prevent leap-frog development;

Transit-oriented development: Designates priority sites or site-specific zoning and building standards around transit nodes and hubs; seeks to increase density in close proximity to transit;

Mixed use, higher-density, or infill development: Designates priority sites or site-specific standards to encourage these types of development; seeks to facilitate fewer and shorter car trips by providing more diverse land uses within close proximity;

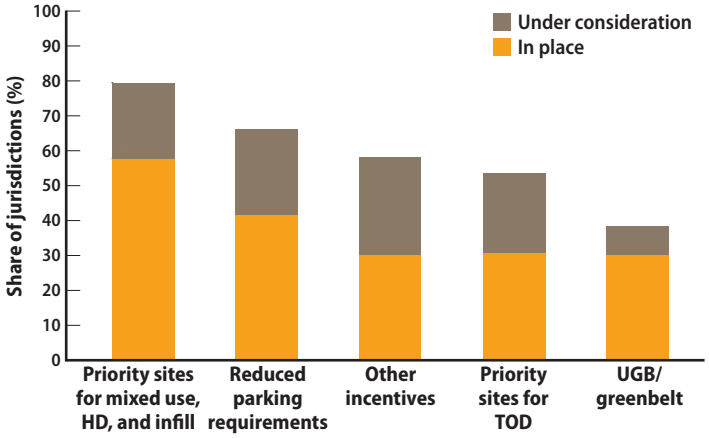
Reduced parking requirements: Reduces the number of spaces developers must provide per unit of residential or commercial space; seeks to facilitate infill and higher-density development by reducing costs to developers;[16]

Other incentives: Encourage density by reducing developer costs (e.g., preferential fees or permit streamlining for qualifying development).

Many localities are already employing a number of these strategies, and many others are considering them. Statewide, the designation of priority sites and site-specific standards to encourage mixed use, higher-density, or infill development is the most prevalent undertaking (used in 58% of all localities and under consideration in 22%), but all other approaches except urban growth boundaries are also already in use or under consideration in more than half of all localities (Figure 2).

In general, localities with larger populations have higher adoption rates for most individual policies and are most likely to rely on multiple approaches. Another important factor is experience with smart-growth strategies. Communities that have already adopted one land use policy are significantly more likely to have adopted or be considering others. Transit-oriented development is much more likely in communities that already have some form of rail transit (commuter rail, subway, light rail, and streetcar) or expect to have rail in the future.[17]

Figure 2. Local governments are using various land use tools to increase density and improve access to transit



SOURCE: Bedsworth, Hanak, and Stryjewski (2011).

NOTES: Answer to the question: Has your city/county used any of the following land use policies or tools? HD is high density, TOD is transit-oriented development, and UGB is urban growth boundary.

Investments in Transit and Other Alternatives

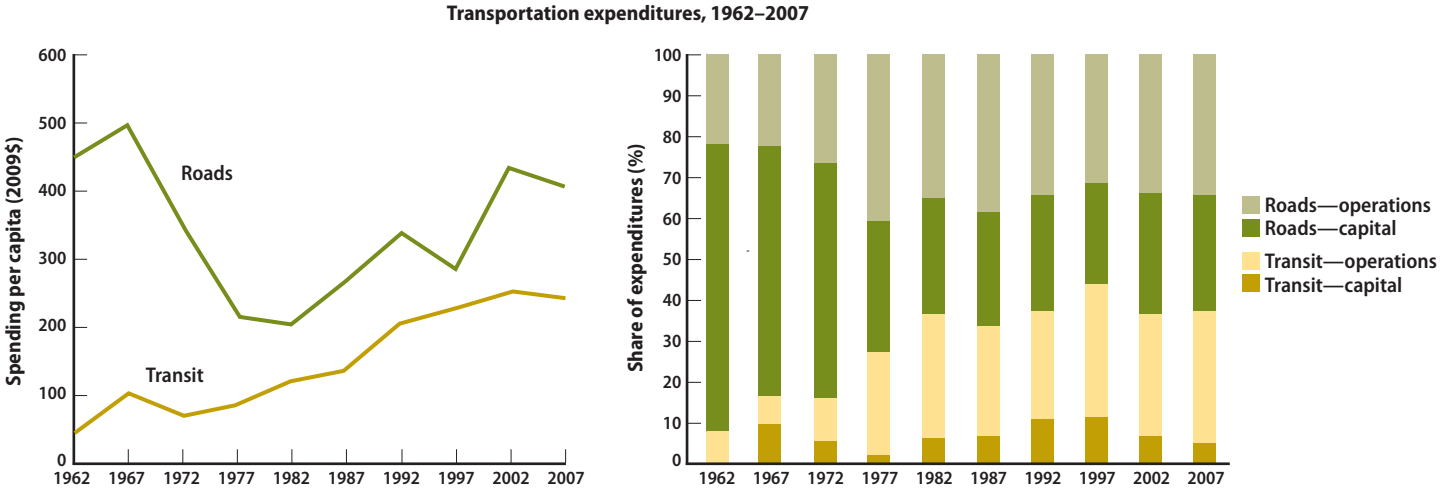
Transit serves multiple goals, including providing mobility for low-income, disabled, and elderly residents without cars. But one of transit's key goals, especially since the 1970s, has been to help reduce congestion (and air pollution) on roadways during peak periods (Fielding 1995; Hanak and Barbour 2005).[18] This goal relates most closely to SB 375's call to reduce GHG emissions from passenger vehicles.

Transit has been an important component of transportation spending in California since the end of the federal freeway expansion program in the 1960s (Figure 3). Since the early 1980s, transit has accounted for well over a third of all transportation spending in California and from 20 to 30 percent of capital investments, with even higher shares in the major metropolitan areas.[19]

Most transit capital spending is associated with rail projects (subways, commuter rail, light-rail, and streetcars). Between 1992 and 2006, 217 new rail stations (including several bus-rapid-transit stations) opened in the state, and dozens more are planned. These expansions appear consistent with the public's spending priorities: In surveys of California residents in 2004 and 2006, rail transit ranked as high or higher than highways (and nearly three times higher than buses) as a top priority for transportation spending.[20] Yet, bus service—generally a far less costly option—is much more widely available.[21]

To date, ridership trends for California's transit systems have been disappointing, relative to investments in this sector. For the state as a whole, the share of commuters taking transit increased from 5 percent to 5.5 percent between 1990 and 2008 (Table 3)—76.4 percent of all commuters still drive alone to work. Transit is most important

Figure 3. Transit has become an important component of California's transportation spending



SOURCE: Census of Governments.

NOTE: Data in the first panel are adjusted to a real per capita basis using the building cost index from *Engineering News Record* and population data from the California Department of Finance.

for commutes in the San Francisco–Oakland metropolitan area (15.3%)—second only to the New York City metro area nationally—and accounts for a much higher share of commutes along congested corridors, such as trips across the bay into downtown San Francisco. Transit ridership in Los Angeles (6.6%) is slightly higher than the state average, but it is much lower in other major metropolitan areas, such as Sacramento (3%) and Riverside–San Bernardino (1.9%).

Although rail represents only a small share of transit commutes (1.4% versus 4.1% for buses), it accounted for much of the increase in transit ridership between 1990 and 2008. In the San Francisco–Oakland and San Diego areas, increasing rail use actually displaced some bus use, which declined as a share of all commutes.[22] During this period, per capita VMT increased in California by 3.5 percent, suggesting that growing transit ridership did not displace road travel—or at least not enough to reduce overall driving.[23] This may be due to an increase in car use for noncommute trips: Work commutes account for just over a quarter of all car use, and noncommute trips are much less likely to involve transit.[24] Nonetheless, per capita VMT increased less in California than in the nation overall, where per capita VMT rose by 13.7 percent over the same period.

Cost is a major challenge for transit. Transit systems the world over rely heavily on operating subsidies. Statewide, transit fares cover only about a quarter of operating costs.[25] And a recent analysis of transit systems in the Bay Area found that operating costs have been increasing much more rapidly than inflation.[26] Many survey respondents expressed concerns about the ability to maintain adequate transit

MARK KARRASS/CORBIS

Light rail and buses in Long Beach. Just 6.6 percent of Los Angeles area commuters ride transit to work.

Table 3. Transit has increased slightly as a share of commutes since 1990

Metropolitan area/region	Transit share of commutes (%)			Change in share 1990–2008 (%)	
	1990	2000	2008	Rail	Bus
Los Angeles–Long Beach–Santa Ana	5.7	5.8	6.6	0.5	0.4
San Francisco–Oakland	14.3	14.4	15.3	1.8	–0.8
San Diego	3.4	3.5	3.6	0.4	–0.2
Riverside–San Bernardino	0.8	1.7	1.9	0.7	0.3
Sacramento	2.4	2.8	3.0	0.2	0.3
San Jose	3.0	3.5	3.8	0.8	0.0
California	5.0	5.2	5.5	0.6	–0.1
United States	5.3	4.7	5.2	0.2	–0.3

SOURCES: U.S. Census; American Community Survey.

NOTES: Transit includes rail and bus. Rail includes all rail transit (streetcar, subway, and rail). Bus includes ferries, which account for less than 1 percent of all bus use.

service in the face of recent state cuts to transit budgets, and in three of the largest regions, insufficient transit availability was ranked as one of the top three barriers to meeting goals for reducing driving.[27] Rail systems—which users often prefer to buses—are especially expensive to build and operate, leaving them open to criticism of cost-ineffectiveness and waste (O'Toole 2010; Poole and Moore 2010).

If transit is to contribute to achieving the SB 375 goals of reducing VMT, strategies will be needed to increase ridership and improve cost-effectiveness. Research has found that the likelihood of transit use increases with easy access (Ewing and Cervero 2010). Ridership falls significantly when workers live more than a quarter to a half mile from a transit station. In California, only 6 percent of residents live within a half-mile of a transit station, and only 12 percent of workers have jobs within a half-mile of a transit station.[28]

Transit use is more likely when there is greater street connectivity (e.g., grid-like plans) and a diversity of land uses, both of which can smooth transit operation and make using transit more appealing by reducing travel times and increasing convenience for riders (Ewing and Cervero 2010). Transit ridership by commuters is higher in metropolitan areas that have higher employment densities, especially in downtown areas, as well as higher residential densities in many neighborhoods throughout the metropolitan area.

In metropolitan areas with multiple transit systems, better connectivity of the overall system is also important. This is a particular challenge in the San Francisco Bay Area, which has more than two dozen distinct transit systems, many of which operate within the same service areas.[29] Maximizing transit ridership will require integrating services, timetables, and ticketing policies among systems in a region, so that transit becomes a more appealing option for long-distance commuters.

CAN BALCIOGLU/iStockphoto

More than 90 percent of Californians live in places with bicycle master plans completed or under way.

Walking and biking alternatives

Encouraged by state and federal financial support, many California localities are focusing on improving bicycle and pedestrian networks. Over 90 percent of California's residents live in a city or county that has completed or plans to complete a bicycle master plan (40% of all jurisdictions have already established a continuous network of bicycle routes). Just over half of the state's residents live in localities with similar planning under way for a pedestrian master plan or a "complete streets" plan that aims to improve safe access for all users, including pedestrians, bicyclists, drivers, and transit users (National Complete Streets Coalition 2010). Planners tend to be quite optimistic about the potential for bicycle networks to reduce VMT, although from a relatively low baseline: Bicycles accounted for only 1 percent of all commutes in 2008 (American Community Survey 2008). Walking (3% of commutes in 2008) accounts for a greater share of (typically shorter) noncommute trips (Hu and Reuscher 2004). Reducing car use for shorter trips can have disproportionately high benefits for GHG emission reductions, because gas mileage tends to be lower on such trips. Walking and biking also offer the benefit of improving public health (Ewing et al. 2003; Doyle et al. 2006).

Pricing Policies

Policies that increase the cost of solo driving have the most immediate and highest potential to reduce VMT (Rodier 2009). This strategy includes explicit pricing mechanisms, such as fuel and road-use charges and parking fees, as well as a strategy that practitioners often refer to as "demand management"—incentives such as carpool lanes, employee shuttles, and other employer inducements to use transit. Both strategies create financial or time-saving incentives to shift trip timing away from peak periods, making alternatives, such as transit, carpooling, and telecommuting, relatively more attractive (Deakin et al. 1996; Parry 2009).[30]

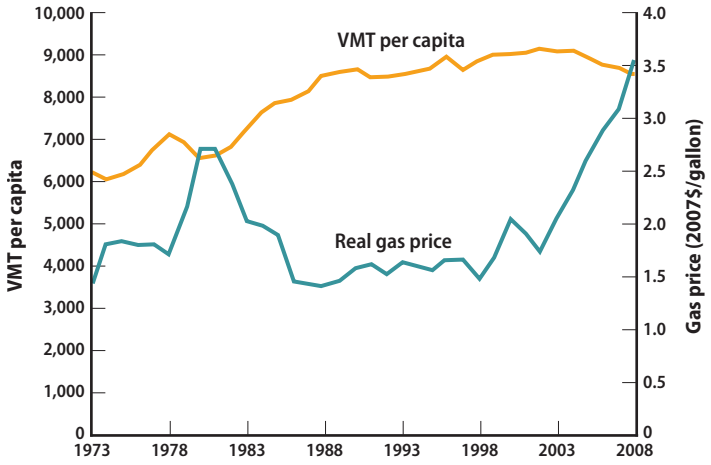
In addition, more explicit pricing strategies can generate revenues to support the transportation system, which is a growing concern.[31] Transportation analysts consider pricing policies to be a preferred way to fund transportation investments and maintenance, because they simultaneously raise revenues and send a signal to users to use the system more efficiently. The alternative—funding transportation through general tax revenues—pays for infrastructure but does not help to manage demand. Local sales tax revenues, which have become an important transportation funding source in recent years, are also highly regressive. However, public opposition can be a formidable challenge to implementing fee increases, as discussed below.

Federal, State, and Regional Pricing Policies

Federal and state gas taxes, introduced in the early 20th century, are the primary pricing incentive today. These taxes are a simple form of user fee, generally resulting in higher charges for those who drive more (i.e., consume more fuel). Recent experience shows that such price signals can have a discernible effect on VMT: Between 2004 and 2008, when average real gas prices jumped by 54 percent, per capita VMT in California declined by 5.8 percent (Figure 4). Although the onset of the recession likely played a role in declining road travel toward the end of this period, the reductions in VMT per capita began in 2005, when the economy was still booming.

Over time, however, rising fuel economy and public opposition to increasing the gas tax have reduced its usefulness as a source of revenue and as a price signal to drivers

Figure 4. VMT per capita in California declined when gas prices began rising in the mid-2000s



SOURCES: VMT data are from the Federal Highway Administration, *Annual Highway Statistics*, Table VM-2. Inflation-adjusted gas price data are from the California Energy Commission.

(Wachs 2010).[32] The federal gas tax has held steady at $0.184 per gallon since 1993, and California's gas tax has remained at $0.18 since 1994,[33] somewhat below the national average and far lower than fuel taxes in Europe and Japan.[34] Although raising these taxes and indexing them to inflation could help restore transportation revenues while sending a stronger price signal to drivers, transportation experts see far greater potential over the longer term in an alternative form of user fee: per mile, or VMT, charges.

Over time, rising fuel economy and public opposition to increasing the gas tax have reduced its usefulness as a source of revenue and as a price signal to drivers.

VMT-based fees, which rely on new electronic toll collecting and geographic positioning system technologies, have the potential to be more flexible than the gas tax: They can be varied according to time of day, type of road, and type of vehicle. Road metering has been gaining ground outside the United States, and a pilot program was recently completed in Oregon that functioned smoothly and reduced VMT (Sorenson and Taylor 2005a, 2005b; Spears, Boarnet, and Handy 2010; Rufolo and Kimpel 2009). These experiences led a national panel to recommend that the federal government actively promote pilot programs with VMT charges as part of the next federal transportation funding authorization, with a goal to fully convert from gas taxes to VMT charges by 2020 (National Surface Transportation Infrastructure Financing Commission 2009).

ATWATER VILLAGE NEWBIE/FLICKR/CREATIVE COMMONS

Toll lanes, carpool lanes, and other "demand management" and pricing policies have the greatest potential to reduce VMT.

In the absence of comprehensive federal and state legislation, California's largest MPOs have been adopting more targeted road pricing initiatives. Bridge tolling has long been a feature of transportation policy in the San Francisco Bay Area, and the MTC recently introduced variable pricing on the highly traveled San Francisco–Oakland Bay Bridge to help manage congestion during peak periods. Most expansions of highway lane miles since the early 1990s have focused on providing carpool or high-occupancy-vehicle (HOV) lanes in metropolitan areas (Hanak and Barbour 2005). Following the principle that "time is money," these lanes provide an incentive to reduce solo driving, and modeling has shown that they are more effective in areas where there are longer traffic delays on regular lanes (Dahlgren 1998).

Since the mid-1990s, some Southern California metro areas have also experimented with road tolling.[35] Most of these high-occupancy-toll (HOT) or express lanes combine free access for carpoolers with a toll option for solo drivers, sometimes with variable prices. Just as with general VMT-based pricing, HOT lanes rely on electronic toll-collection technology. Conversions and expansions of HOT lanes are a major component of planned roadway spending within the Bay Area, Southern California, and San Diego regions, and the Sacramento region plans to expand HOV lanes (Heminger et al. 2010).[36] Once these plans are realized, roughly 40 percent of the localities in our survey (constituting over 60% of the population) will be within 5 miles or less of at least one HOT lane. As with HOV lanes, the efficacy of HOT lanes depends on existing traffic conditions and delays (Dahlgren 2002).

Local Parking Policies

Placing a charge on public parking spaces within a given area can reduce the congestion resulting from drivers looking for free parking spaces, encourage the use of alternative means of transportation, and generate revenues (Giuliano and Agarwal 2010; Shoup 2005). In addition, limiting requirements on developers to provide parking can increase density and make car use relatively more costly (Shoup 1999). The effects on driving are particularly strong when workers must pay to park (Legislative Analyst's Office 2002; Taylor and Fink 2003).[37]

Yet parking pricing and management is still a seldom-used strategy in California.[38] Statewide, only 16 percent of the cities and counties in our survey (including the most populous localities) have initiated any type of charges for public parking in commercial areas.[39] And nearly nine-tenths of all localities (including the larger ones) continue to require that new commercial developments provide employee parking, with free parking for employees remaining the norm. However, as discussed above, a large and growing number of jurisdictions are relaxing minimum requirements for parking in some new developments to encourage density (Figure 2).

The Challenge of Public Acceptance

Although our survey of local officials indicated that public opposition posed an obstacle for all three types of VMT-reduction policies (increasing population density, transit use, and pricing), this problem may be especially important for pricing. Our survey showed that public opposition to higher charges for driving ranks a close second to public opposition to higher density. And as evidenced by the inability of both Congress and the state legislature to raise the gas tax since the early 1990s, the need to gain significant legislative or voter approval increases the difficulties of raising fees. Proposition 26, a new state constitutional amendment passed in November 2010, is likely to compound these difficulties for some types of fees.[40]

Experience may help overcome opposition to pricing options that involve some choice. For example, early concerns that toll lanes were inequitable have been allayed somewhat by use patterns: A broad cross-section of the population uses the toll facilities on the I-15 and Route 91 (Sullivan 1998; University of California Transportation Center 2003). According to the Southern California transportation officials we interviewed, government use of toll revenues to support parallel infrastructure and services can help garner public support for tolling.

Board members of SANDAG, the San Diego region MPO, recently rejected the introduction of a regional VMT fee because, in contrast to HOT lanes, it would have been applied uniformly across the board, without providing alternative travel options to drivers (San Diego Association of Governments 2010). Any large increases in federal or state road charges through a gas tax or VMT fee would surely raise public ire. In the short run, a large increase in gas prices or VMT fees could also raise equity concerns, because lower- and middle-income households would have less flexibility to respond by moving closer to transit or by purchasing more fuel-efficient vehicles.

Our survey showed that public opposition to higher charges for driving ranks a close second to public opposition to higher density.

Parking policies face the challenge of meeting the needs of commercial areas to attract customers while also managing congestion. They can also lead to objections in mixed use areas, where efforts to reduce parking near commercial enterprises can result in spillover to nearby residential streets.[41] One strategy that has helped to overcome opposition to parking restrictions and fees has been the reinvestment of parking revenues back into the downtown area in which they have been collected, a model used in Redwood City (Zack 2005) and Pasadena (Salzman 2010). Resistance to higher parking charges may also be offset once residents find that it is easier to find a parking space (since one of the goals of such fees is to hold vacancy rates to a low but acceptable level).

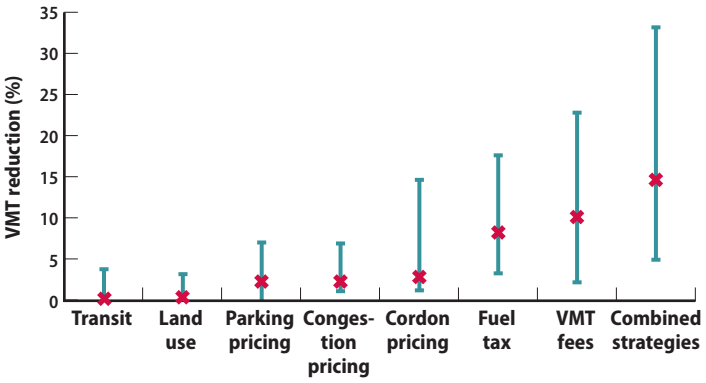
Building an Integrated Strategy

Research suggests that integrated strategies will be far more effective in reducing VMT than individual land use, transportation, or pricing strategies pursued on their own, making it possible for California to meet the goals of SB 375 (Figure 5). The Transportation Research Board (2009) predicts twice as large a reduction in VMT when higher-density strategies are paired with complementary policies, such as increased transit availability.[42] The extensive literature on transit-oriented development also stresses the need for complementary policies, demonstrating that transit investments in isolation are unlikely to lead to new development and increased densities (Giuliano and Agarwal 2010).

It is encouraging to note that, to some extent, California's largest MPOs are already pursuing combined strategies. Their most recent RTPs include increases in housing density, HOV/HOT lanes, and transit use.[43] In developing scenarios for SB 375 targets, the MPOs envisage increased efforts in several of these areas (Heminger et al. 2010).[44] At the same time, interviews with local officials revealed challenges in coordinating land use and transportation policies: For instance, transit may spur development, but without existing dense development it is more difficult to justify (and secure federal funding for) transit projects.

To shed light on the potential for success, we discuss the observations of local governments, the key players in this process. We then examine California's experience since the early 1990s with one of the primary integrated strategies—transit-oriented development.

Figure 5. Integrated policies have the highest potential to reduce VMT



SOURCE: Rodier's (2009) review of studies that model the effect of policies on VMT reduction.

NOTES: The figure shows the median (red X) and 95 percent confidence intervals (blue bars) from a range of studies over a ten-year time frame. The results for combined strategies are for approaches that combine land use change, transit, and pricing. Sample sizes: VMT fees (27), transit (20), parking pricing (20), land use (19), cordon pricing (17), fuel tax (17), combined strategies (15), and congestion pricing (9). Holding vehicle and fuel characteristics constant, VMT reductions and GHG emission reductions are equivalent. Cordonpricing involves charging an entry fee into an urban area—now done in London and Stockholm and under consideration in San Francisco.

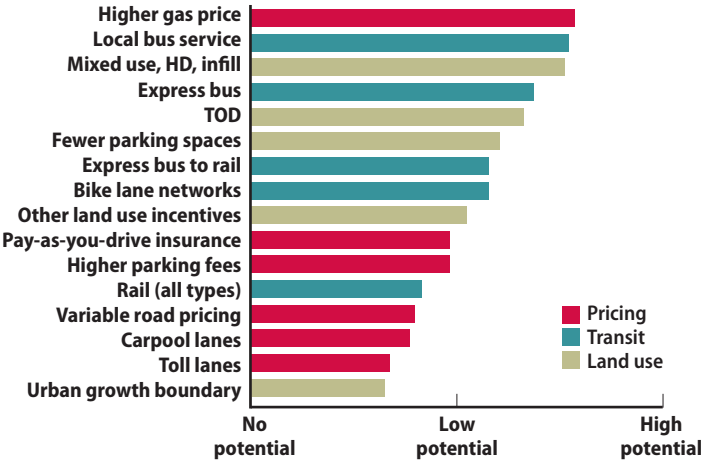
Local Perspectives on the Potential to Reduce Driving

Our statewide survey of local planning officials sheds light on the potential of local governments to meet the goals of SB 375 (Bedsworth, Hanak, and Stryjewski 2011). Respondents were asked to gauge their localities' potential to reduce driving relative to other localities within their region and to offer their opinions on the potential effectiveness of a range of land use, transit, and pricing strategies in their jurisdictions. The results reveal local planners' views of the feasibility of these strategies within their communities, taking into account both political acceptability and various community characteristics.[45]

In general, local officials appear cautiously optimistic about their overall ability to reduce driving in their localities. More than a third of all those surveyed reported that their community had below-average potential relative to others within their region. But after accounting for community size, we find that 45 percent of the population lives in localities that perceive above-average potential, compared to 27 percent in localities with below-average potential.

Local governments see the potential to reduce VMT through a range of approaches. Respondents were asked to gauge the potential effectiveness of a variety of land use, transit, and pricing strategies based on a three-point scale (high/low/no potential). Figure 6 presents the rankings of these strategies across the statewide sample, with each policy option color-coded by the type of strategy involved. The top five options—higher gas prices; local bus service; priority sites for mixed use, higher-density, and infill land uses; express bus service; and priority sites for transit-oriented development—come from all three strategies. And many respondents expressed the need for integrated approaches, in particular linking smart-growth land

Figure 6. Planners believe that a range of policies offers high potential for reducing VMT



SOURCE: Bedsworth, Hanak, and Stryjewski (2011).

NOTES: The policy potential score was calculated as the sample average of the potential ranking for each policy option. A score of 3 was given for "high potential," 2 for "low potential," and 1 for "no potential." For commuter rail and light rail, the score is combined into a single rail category. HD is high density.

uses with improved transit options and more accessible streetscapes.

Pricing policies stand out for their widely varied rankings. Higher gas prices rank first among all 16 policies examined, but all other pricing strategies rank in the bottom third.[46] Planners' views of the effectiveness of gas price increases are consistent with the research literature, but their low expectations regarding the potential of other pricing strategies are in conflict with the research.[47] This may reflect both recent gas price history and political realities. The state's recent experience with high gas prices demonstrated the potential of higher driving costs to reduce VMT (Figure 4). But this experience happened through market forces, not an explicit policy change. Most other pricing options would be implemented through local or regional policies, and planners are aware of the political difficulties of imposing higher costs on drivers.

The state's recent experience with high gas prices demonstrated the potential of higher driving costs to reduce VMT.

Several local characteristics appear important to planners' optimism about the potential of various strategies to reduce driving:[48]

Experience matters. A given strategy is nearly always ranked significantly higher in a locality that is already using it or planning to use it. Of course, localities are most likely to adopt policies that they expect will work, and officials might be inclined to favorably evaluate policies they have worked to implement. But optimism is as high or higher for policies already in use, rather than those under consideration, suggesting that experience has been at least somewhat encouraging, even in places where public opposition is cited as a serious concern.

Rail transit is a plus. Officials in jurisdictions served by rail tend to feel more optimistic about the overall potential to reduce driving, as well as about almost all of the individual policy options. This strong showing is consistent with the research finding that integrated strategies can have a greater effect on VMT. Rail is a relatively attractive alternative to driving, and it provides a focal point for denser land development—which makes other alternatives to driving, such as walking and bicycling, more feasible, especially for noncommute trips. As one official noted: "We have substantial vacant land . . . [and] existing light rail. This combination gives us the opportunity to 'get it right.'"

Local conditions shape expectations. Planners in more populous locales are more optimistic about their overall ability to reduce driving, the full range of pricing policies, and the potential for transit-oriented development. Consistent with the research literature, which finds that lower-income residents are more sensitive to changes in gas prices and more likely to use transit, officials in lower-income localities believe that higher gas prices and most transit options will prove more effective than in higher-income localities.[49] Perhaps as a result, these officials also perceive their localities' overall potential to reduce driving to

be higher than elsewhere. Consistent with the idea that proximity of jobs makes it easier to employ integrated strategies, officials in localities with a higher jobs-housing ratio are more optimistic about the potential of most pricing tools, access to rail, and the promotion of transit-oriented development.[50]

Party leanings are influential . . . The partisan split on climate policy in California, which has widened over the past two years, is also reflected in planners' perceived potential to respond to SB 375.[51] Local governments in more heavily Republican areas are less likely to adopt general climate change policies, and local officials in these areas are less optimistic about the overall local potential to reduce driving. Consistent with the stronger objection to taxes and fees commonly associated with this party's platforms, officials also rank the potential of most pricing strategies lower in these localities. They are also more skeptical of the potential for transit-oriented development and less likely to use this strategy, even when they have access to rail transit. Because many of the state's fastest growing counties are located in the more heavily Republican inland regions of the state, this partisan split may limit the effectiveness of SB 375 in places where there is the greatest potential to "build smart" from the ground up.

. . . but not determinative. Adoption of most smart-growth land use policies is not affected by residents' party affiliation, nor is the perceived potential of many of the individual options that can support SB 375 goals. And experience in the Republican-leaning San Diego region demonstrates that party affiliation is not a deal-breaker when it comes to developing aggressive regional strategies. Using a combination of increased housing densities, increased transit, and more HOV and HOT lanes, the SANDAG region's existing RTP is already one of the most ambitious in the state (Table 1).[52]

In sum, planners appear to have a good sense of local factors that are likely to affect the potential to respond effectively to SB 375. Much of the emerging message suggests grounds for optimism. Planners recognize the importance of using multiple strategies in combination, and they are optimistic about the policies they are already using or planning to use, highlighting the positive role of experience. They are also more hopeful about the potential of most other options when they have the availability of rail—the most popular (if most costly) form of transit. Planners in more populous communities generally perceive greater potential to reduce driving and are already more likely to be adopting the needed strategies.

Planners appear to have a good sense of local factors that are likely to affect the potential to respond effectively to SB 375.

But our findings also highlight some important constraints. Planners recognize the difficulties associated with higher-income households (which tend to support climate change policies but are less likely to respond to SB 375–related strategies), as well as those associated with political opposition—a potential barrier to implementing some of the supportive policy options in the fast-growing inland counties. They are also pessimistic about the prospects for most pricing strategies—an important component of effectively integrated strategies—underscoring the political challenges of making headway on this front. Finally, the optimism associated with the availability of rail appears largely unrealized in light of current transit ridership levels, suggesting that much progress is needed to capitalize on this potential. Improving the performance of transit-oriented development may play an important role in realizing this potential, as described below.

Transit-Oriented Development in California

Transit-oriented development is a prime example of the type of integrated land use and transportation planning that has the potential to reduce VMT. TOD's aim is to create higher densities around transit stations, making

transit ridership feasible for more residents and workers. Our survey revealed that planners are optimistic about the potential of TOD to help reduce VMT (Figure 6), particularly when they have or expect to have rail.

As we discussed above, density and proximity to transit influence ridership for employees even more than for residents. However, California has been experiencing a decline in employment density, making it harder for transit systems to achieve high ridership and making commercial development around new transit stations especially important (by "commercial" we mean any nonresidential development, such as office, retail, or industrial). Here, we evaluate how well TOD has worked over the past two decades of extensive rail transit expansion. We look at the location of new transit stations and analyze employment growth in the areas surrounding these stations.[53]

TOD is most suitable around fixed-line transit stations—rail or "bus rapid transit," which has fixed stations and dedicated bus lanes. In these areas—and in contrast to areas around ordinary bus lines—developers have some certainty that the transit service will not move; fixed-line transit also offers higher speeds and greater regional accessibility than the typical bus system.[54] Our analysis focused on the four largest MPO regions, where 217 new rail, subway, streetcar, and bus-rapid-transit stations opened between 1992 and 2006.[55]

We found that these new transit stations were located in areas with higher residential density and much higher employment density than other areas in the same counties.[56] Thus, California has successfully located transit stations in areas most able to deliver higher transit ridership. However, these new stations also reflect challenges faced by system expansions. Density around newer transit stations was lower than density around transit stations that opened before 1992. Many older transit stations, such as the San Francisco and Oakland portions of BART and the LA Metro Rail, are located in big-city downtowns: areas with the highest employment density. New transit stations in existing systems often extend lines into lower-density suburbs. And many new transit stations, such as portions of the LA Metro Rail green line and many BART stations

PAUL HOHMANN/FLICKR/CREATIVE COMMONS

The Fruitvale BART station. Transit ridership depends on jobs and housing being close to transit stations.

in the East Bay, are located in freeway medians. Although freeway medians offer a cost advantage (since they are an existing right-of-way), stations in medians may pose a challenge for land use development, given that the area immediately adjacent to the station is a freeway.[57]

Did localities take advantage of these new stations through new development efforts? This is the essential question for transit-oriented development, which should *increase* the concentration of residents, workers, or both near stations, thus raising overall transit ridership and lowering VMT. We examined both employment and residential growth.[58] Our analysis considered density changes within a quarter mile of new transit stations, comparing growth before and after the station opened with areas that lacked transit stations but were similar economically and geographically.

Averaging across all new transit stations, we found no increase in employment growth around new transit stations after they opened, either immediately or several years thereafter, relative to comparison areas. This suggests that localities were not effectively taking advantage of these new stations to encourage job-based TOD.[59] Nor were station openings associated with consistent employment growth

patterns in specific industries. Moreover, it does not appear that employment growth suffered from competition with residential growth: Residential densities *fell* over the period when new transit stations opened.

Despite the lack of employment growth on average, we did find considerable variation across stations. Employment growth was much higher around some new stations and much lower around others, even within the same locality, within the same transit system, and on the same route.

Although employment growth occurred around very different types of stations (see the text box), it followed regular patterns, tending to be higher around stations in areas that already had higher residential and employment densities and those located farther from an older transit station.[60] It may be that areas with higher density already had zoning in place that supported further development or lacked local opposition. At the same time, this finding implies that employment growth around transit stations does not hinge on having abundant vacant land.

The lack of additional job growth around many new transit stations represents a missed opportunity for raising employment densities, raising transit ridership, and lowering VMT. It is also consistent with the results of our survey of local officials about the focus of their TOD efforts: Among localities with existing or planned projects to increase density around transit stations, projects were much more likely to emphasize residential than commercial uses.[61] Regional transportation agencies appear to have been assuming that localities need more encouragement to build housing in the right places. In contrast, jobs—in the words of one transportation planner we interviewed—"take care of themselves."

These assumptions have probably taken root because land use policies in California have traditionally favored commercial over residential development, both because these uses generate more local sales tax revenues and because it is generally believed that businesses require less expensive local public services than residents (Boarnet and Crane 2001). Zoning practices reflect these assumptions.[62]

However, our evidence shows that employment growth around transit stations does *not* take care of itself, even if zoning around transit stations favors nonresidential uses.

Employment growth around transit stations does *not* take care of itself.

Different paths to employment growth: Hollywood/Highland and Sylmar/San Fernando

Stations associated with large, statistically significant increases in employment growth include the Hollywood/Highland and Hollywood/Vine stations on the LA Metro Rail Red Line in Hollywood and the Sylmar/San Fernando station on the Metrolink Antelope Valley Line in Los Angeles County's northern San Fernando Valley. These stations are located in very different neighborhoods with very different TOD strategies.

The Hollywood/Highland underground subway station opened in 2000 and was a high-profile transit-oriented development project focused on retail and entertainment along Hollywood Boulevard. The Los Angeles Community Redevelopment Agency was integral in assembling land for development, negotiating financing with the city, and securing approvals for the $600 million project that resulted in the Hollywood & Highland Retail Center, the Renaissance Hollywood Hotel, and the Kodak Theater (Cervero et al. 2004; California Department of Transportation 2002). Both the Hollywood/Highland and the neighboring Hollywood/Vine stations were dense, developed, mixed use areas even before their station openings.

The Sylmar Metrolink station in Santa Clarita opened in 1994. The nearby "Montage at Village Green" housing development opened in 2000. Whereas most TODs focusing on housing are "mixed use developments" incorporating some commercial space, the Montage was exclusively a housing development (Moses, Lewis, and Lastrape 2009). Kolko (2011) finds that employment growth that accompanied the station development included small businesses across numerous industries, including grocery wholesaling, light manufacturing, construction, and real estate brokerage. Many of these businesses were located between the station and the housing development. The Sylmar example shows that employment can grow around new stations even when the station TOD strategy emphasizes residential development.

Existing zoning that allows retail, office, or industrial development may not be sufficient to spur employment growth. A set of case studies of San Diego stations concluded that TODs were most successful when they coincided with local authorities' development plans for the area (Boarnet and Crane 2001). A study of the Washington DC Metro rail system found that dense development around new suburban stations hinged on the "determination and foresight" of local officials (Schrag 2006). The major Hollywood/Highland TOD (see the text box) illustrates the importance of regional transportation and local development authorities working together, well beyond a favorable zoning plan.

Numerous specific policies could encourage development around transit stations. Parking policies are one strategy: To encourage denser residential development, relax requirements that mandate the minimum number of parking spaces a developer must provide in residential TODs (Arrington and Cervero 2008); and to encourage transit ridership, restrict the availability or raise the cost of parking (Giuliano and Agarwal 2010; Shoup 2004). In addition, building a mix of TOD businesses, including retail and personal services that employees use during the day, encourages transit use by making it easier to run errands near the workplace (Center for Transit-Oriented Development 2008). And bolstering connectivity—including local bus feeder service to transit stations and surrounding streets that are friendly to walking and biking—helps increase transit ridership around TODs and, in making the location more accessible, is likely to raise demand for the location (Center for Transit-Oriented Development 2008).

A Hollywood & Highland Retail Center is not—and should not be—the model for employment growth at all transit stations. Appropriate levels of growth and industries differ across transit stations, depending on existing land uses, densities, and location in the transit network. Yet it is surprising that, on average, employment growth around new transit stations was no faster than in comparison areas. A shift in focus toward more job-based TOD may be in order for future development efforts around existing and planned transit stations. Expanding job growth around the increasing number of stations located outside downtown areas would improve employment exchanges with the broader metro area job market and increase the two-way use of costly rail systems. Employment growth near stations, even in residential areas, should be encouraged to exceed employment growth in similar nearby neighborhoods lacking transit access.

Policy Recommendations

With the adoption of SB 375, the state is once again taking a leadership role in national environmental policy.[63] The success of SB 375 will depend on how well all levels of government, working together, integrate land use planning, transit investments, and pricing policies and make them attractive to California's residents. For residents, the law implies a major behavioral shift, reversing a decades-long trend in which per capita VMT has been rising.

The success of SB 375 will depend on how well all levels of government integrate land use planning, transit investments, and pricing policies and make them attractive to California's residents.

The anticipated emission benefits of SB 375 are relatively modest—rather than a silver bullet, the new policy is one of many discrete actions that make up California's overall strategy for addressing climate change. But the same policies that can contribute to a reduction in GHG emissions from driving can generate other benefits. Higher-density development—essential for a viable transit system—consumes less energy and water per resident or worker, providing additional environmental and economic benefits. By making housing more affordable in milder coastal areas, policies encouraging higher density could also shift population and economic activity to places with

lower energy requirements and overall emissions, reducing statewide or national emissions per capita.[64] Reducing the need to drive and providing "walkable" streets would also provide public health benefits to California's residents.

Our analysis offers hope, as well as warning signs. The clearest grounds for optimism come from our survey of city and county officials—the local authorities who control land use decisions and oversee a majority of transportation dollars. Despite the recession, they have increased their climate-change–related activities and are adopting numerous land use strategies that can support the goals of SB 375. Furthermore, local officials tend to rate the policies and strategies they have already begun to implement as having strong potential to reduce VMT, despite various barriers to implementation, including public opposition to denser development.

Another reason for optimism is the extent to which both regional transportation authorities and local governments recognize the importance of integrated strategies that combine land use, transit, and pricing policies. Regional authorities in the state's major metropolitan areas are gaining support from local officials as they develop strategies to increase the use of toll lanes, focus more spending on transit, and move away from the typical model of suburban sprawl development. This pattern is evident even in regions where many residents do not support the state's climate policy goals.

Recent trends in residential and employment growth present a mixed picture. On the one hand, California's residential density is higher than the national average and rising—a plus for integrated strategies that encourage transit use. On the other hand, the state's employment density is lower than the national average—dramatically so in many metro areas—and falling. Low employment densities limit the potential for VMT reduction because employment density is even more strongly related to transit ridership than residential density.

The failure of rail transit to realize its potential—despite receiving a large share of transportation investments for several decades—is another warning sign. Rail ridership as a share of commutes has increased slightly in California—rising to 1.4 percent of all commutes in 2008 from 0.9 percent in 1990, before major investments in rail took place. But this growth is much slower than the pace of transit cost increases and service expansion.

However, voters and commuters think favorably of rail, often supporting local sales tax increases to fund rail investments, and they tend to switch from bus to rail when rail becomes available. Our local government survey respondents were also more hopeful about the success of VMT-reduction policies—land use and pricing as well as transit—if their localities already had rail service in place, suggesting that they perceive rail as an important platform for building an integrated strategy.

One contributing factor in the limited success of rail investments is the failure of transit-oriented development to live up to its potential. Jobs near fixed-line transit stations (including rail and bus rapid transit) are especially important for increasing transit ridership, because once workers arrive at a station, they do not have many options for commuting to more distant locations. Unfortunately, new transit stations, on average, have not been greeted by faster job growth in the surrounding area, even though local fiscal incentives and zoning have traditionally favored commercial development near transit stations. Paradoxically, SB 375 could make employment growth around transit stations even more difficult, because the law explicitly favors residential development in TODs: To receive the benefit of exemption from CEQA requirements, development projects near transit stations (called Transit Priority Projects) must be at least 50 percent residential, as measured by building square footage.

If California is to reap the benefits that greater employment density around transit brings, the state must consider encouraging commercial development over residential development near stations—the opposite of the current incentives in SB 375. In addition, local and regional authorities could adopt numerous specific policies to encourage commercial development around transit stations, including relaxing minimum parking requirements, providing development incentives, and ensuring good

connectivity between the transit station and surrounding areas through development of local bus feeder service and neighboring streets favorable to walking and biking. Failing to take advantage of rail through more intense land development around stations represents a significant missed opportunity to increase ridership and to make the most of costly transit investments.

Pricing represents another area of missed opportunity. Although regional authorities in the major coastal metro areas are moving forward with toll roads, few local authorities are raising the cost or limiting the availability of parking to encourage the use of alternatives to solo driving. Indeed, nearly 90 percent of all localities still require that new commercial developments provide employee parking. But the greatest shortcoming lies in state and federal policies: For nearly two decades, both the federal and state governments have failed to raise charges for road use through a higher gas tax or new VMT-based fees. These price increases are urgently needed to bolster the transportation finance system, and they are the most effective way to send the signal to businesses and residents to change their transportation behaviors and location decisions. Such fees are not politically popular, but in this case, responsible fiscal policy aligns with the efficient use of the transportation network.

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To make the most of all of the available policies—land use, transportation, pricing, and their integration—a regional perspective is essential, and a regional perspective must acknowledge the diversity of localities without losing sight of their interconnectedness. SB 375 encourages coordination, but it will be up to regional and local leaders to put the vision to work, recognizing local differences while overriding the temptation to yield to fragmented local interests. ●

Notes

[1] Washington state has adopted ambitious per capita VMT reduction targets as part of its climate change legislation, and several East Coast states have also adopted explicit VMT reduction goals as part of their climate change policies.

[2] Technically, SB 375 calls for a reduction in emissions from passenger vehicles beyond the reductions expected from improvements in vehicle fuel efficiency and the use of low-carbon fuels, as required by other regulations (described below). In the "most ambitious scenarios" for meeting the regional 2035 targets under SB 375, transportation system improvements (which include measures to improve traffic flow as well as some demand management measures we consider under "pricing," such as carpool programs) are expected to achieve 8–17 percent of regional GHG emission reductions in the Bay Area, Southern California, and Sacramento regions. San Diego examined one scenario in which these measures could achieve over half of the total GHG emissions goal (Heminger et al. 2010).

[3] The state's Strategic Growth Council, created in a companion bill to SB 375, is funding planning grants for SB 375, in recognition of the potential benefit to public health, conservation, and livability (Planning Grants and Incentives Management Team 2010).

[4] This goal was established under Executive Order S-3-05, signed in 2005.

[5] Some have argued that greater reductions in VMT than those in CARB's scoping plan are possible (Ewing and Nelson 2008; Winkelman, Bishins, and Kooshian 2010), whereas others argue that VMT reductions constitute a costly, inefficient, uncertain GHG emission reduction strategy (Moore, Staley, and Poole 2010). Boarnet (2010) provides a critical overview of this debate.

[6] High-density housing units also use less water for landscaping, providing additional energy savings and helping California to cope with increasing water scarcity (Hanak and Davis 2006; Hanak et al. 2011). In addition, land use policies that encourage growth in mild climate areas, such as coastal California, could reduce emissions generated by heating and cooling (Kahn 2010; Glaeser and Kahn 2010).

[7] In one extreme case—the vast region encompassing the Southern California Association of Governments (Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura Counties)—the MPO is responsible only for planning; all investments and maintenance are carried out by subregional and local authorities.

[8] Counties have authority over land use in unincorporated areas. City and county government representatives also constitute the majority of MPO boards.

[9] SB 375 offers three paths to ease requirements for environmental review of projects under CEQA: (1) programmatic streamlining for certain residential projects that are consistent with a region's SCS or Alternative Planning Strategy (APS), (2) streamlining or exemption for transit priority projects that are consistent with a region's SCS or APS and are at least 50 percent residential (as opposed to commercial), and (3) adoption of a uniform set of traffic mitigation measures for higher-density residential developments, which exempts these projects from further traffic mitigation requirements.

[10] For information on the program, see http://calblueprint.dot.ca.gov/

[11] Although the analyses are at an earlier stage, efforts are also under way in the smaller regions, including the San Joaquin Valley councils of governments (Bedsworth, Hanak, and Stryjewski 2011).

[12] These local programs also include activities addressing many areas outside transportation and land use, including energy and water use efficiency, green buildings, renewable energy, and waste reduction (Hanak et al. 2008).

[13] Changes in residential densities result from new construction or redevelopment. Because housing has a long life and new developments are a small share of the housing stock in all but recently built cities, even large increases in the density of new developments have only a modest effect on the overall average residential density of a city or metropolitan area.

[14] See Bedsworth, Hanak, and Stryjewski (2011), Appendix Table B.24(j). Out of nine barriers, public opposition to density ranked among the top three in every region but the San Joaquin Valley. But achieving higher commercial densities is often more politically feasible than achieving higher residential densities (Barnes 2005).

[15] Other smart-growth approaches available to local governments include improving the interconnectivity of roads and other elements of street design, which influence the attractiveness of driving versus alternative modes of travel (Ewing and Cervero 2010).

[16] Another parking strategy is "unbundling," in which developers sell the parking spaces separately from the residential or commercial units. This allows those who value parking most to buy it and facilitates providing less parking overall.

[17] In localities without rail, transit-oriented development tends to focus on higher-density and mixed use development along major bus corridors or on ensuring good bus connections for retail establishments. Several Central Valley cities also mentioned the possibility of capitalizing on high-speed rail as a focal point for TOD in the future.

[18] As a recent example, over half of the $4.9 billion dollars committed to projects designed to reduce congestion under the state's Traffic Congestion and Relief Act of 2000 was allocated to rail and other transit (Legislative Analyst's Office 2007).

[19] In the most recent RTPs of the four largest MPOs, the projected shares expenditures for transit over the next few decades range from 40 percent of the total in the San Diego region to 65 percent in the Bay Area (Bedsworth, Hanak, and Stryjewski 2011).

[20] Residents were asked, "What type of surface transportation project do you think should have the top priority for public funding as California gets ready for the growth that is expected by 2025?" In 2004, the ranking was freeways and highways (32%), light rail (31%), public bus systems (13%), local streets and roads (10%), and carpool lanes (7%). In 2006, the ranking was light rail (36%), freeways and highways (25%), public bus systems (14%), local streets and roads (9%), and carpool lanes (6%) (Baldassare 2004, 2006).

[21] Survey respondents reported the availability of local bus service in all but the least populous jurisdictions, and nearly half of all localities also have express bus services. Just over a quarter reported the availability of some forms of rail transit, and rail is planned in another 11 percent. Rail tends to be concentrated in more populous jurisdictions.

[22] In a national study, Baum-Snow and Kahn (2005) find that rail investments often fail to increase overall transit ridership, because many new rail transit commuters are former bus commuters, not former drivers.

[23] Data on VMT are from Federal Highway Administration, *Annual Highway Statistics*, Table VM-2.

[24] In a 2001 national survey of travel behavior, commutes accounted for 27 percent of VMT, though a much higher share of VMT at peak times and on the most congested routes. Transit was used for 3.7 percent of commute trips, 1.1 percent of trips was for family or personal business, and 1.0 percent of trips was for social or recreational purposes (Hu and Reuscher 2004, Tables 6 and 9). In California, 39 percent of trips originating from home are to work (California Department of Transportation 2003). Transit investments may also fail to reduce VMT because the reduction in road congestion encourages additional driving—for example, trucks moving goods (Duranton and Turner 2009).

[25] This finding is based on the authors' calculations using data from the Census of Governments, 1992–2007. Recovery rates vary across systems. For instance, at 64.5 percent, the Bay Area's BART system rate of operating cost recovery is far higher than the statewide average for transit in California. It is also one of the highest rates of recovery of any rail transit system in the country (O'Toole 2010).

[26] For the seven largest transit systems in the San Francisco Bay Area, operating costs increased 83 percent between 1997 and 2008, whereas the consumer price index increased by 39 percent. Over this same period, transit service (measured as hours in service) increased only 15 percent and ridership increased only 7 percent (Metropolitan Transportation Commission Transit Sustainability Project, 2010, available at www.mtc.ca.gov /planning/tsp/ABAG_Focus_presentation.pdf).

[27] See Bedsworth, Hanak, and Stryjewski (2011), Appendix Table B.24(j). For the Bay Area, insufficient transit availability ranked highest among nine barriers; this constraint ranked second highest (after public opposition to raising charges for driving) in the Southern California region, and third (after public opposition to density and the jobs-housing balance) in the San Diego region.

[28] See Kolko (2011). In California, fewer than 10 percent of people who live or work within a half mile of a transit station commute using rail transit; including bus riders, transit share rises to only 20 percent. Farther than a half-mile from transit stations, transit ridership drops off sharply. Here and elsewhere in the report, "transit stations" refer to stops on fixed-line transit systems—primarily rail (commuter rail, subways, light-rail, and streetcars). We do not include stops along a regular bus route as "transit stations" because, unlike stations in fixed-line systems, these stops do not require capital investment and tend not to be focal points for new residential or commercial development.

[29] The Bay Area's traffic and transit information portal, www.511 .org, lists 22 bus operators in the region as well as several rail and ferry operators. With the adoption of Resolution 3866 in early

2010, MTC will consider an operator's compliance with the region's Transit Connectivity Plan when allocating funding. The Transit Connectivity Plan requirements include consistent signage, dissemination of real-time transit information, provision of information on schedules and connections from other transit agencies, and guidelines for the use of a single, cross-system fare payment card (www.mtc.ca.gov/planning/tcip/RES-3866_approved.pdf).

[30] To the extent that these strategies improve gas mileage—a benefit of reduced congestion—they can also reduce GHG emissions for a given level of VMT.

[31] Numerous studies indicate a large and growing gap between revenues and funding needs (National Surface Transportation Infrastructure Financing Commission 2009).

[32] Americans' sensitivity to gas prices also appears to have declined over the past several decades—a phenomenon analysts have attributed to the fact that more sprawling land use patterns have made people more reliant on cars (Hughes, Knittel, and Sperling 2008) and to a declining share of transportation in household budgets (Small and Van Dender 2007).

[33] In early 2010, California's gas tax was increased, with a corresponding decrease in the sales tax on gasoline. This revenue-neutral "fuel tax swap"—adopted to provide more budget flexibility—will be invalidated under Proposition 26 (described below) unless the legislature approves it again with a two-thirds majority by November 2011 (Legislative Analyst's Office 2011).

[34] Gas taxes within the European Union range from about $1.90/gallon in Bulgaria to $3.70/gallon in the Netherlands and are usually augmented by general value-added taxes. Japan's gas tax is roughly $2.25/gallon (October 2010 exchange rates).

[35] Hanak and Rueben (2006) describe the early projects in Southern California.

[36] Conversion without expansion of lane capacity is likely to be more effective at reducing VMT, but it is also more politically difficult, particularly if it reduces open-access lanes. One challenge with conversion of HOV to HOT lanes is the desirability of having more than one HOT lane, so that traffic can flow smoothly in the event of an accident. Since most HOV lanes are single lanes, this means either building an additional lane or converting an existing open-access lane to HOT status. In the Bay Area, planners are working to create single-lane HOT lanes from existing HOV lanes in ways that avoid these problems. The new HOT lane on I-680 has double lanes at entry and exit points, but a single lane elsewhere.

[37] One study found that 77 percent of San Francisco Bay Area commuters provided with free parking drove alone, compared to only 39 percent of those required to pay for parking. The corresponding figures for how much these same people use transit were 4.8 percent and 42 percent, respectively (RIDES for Bay Area Commuters 2000).

[38] California adopted a parking cash-out law in 1992 requiring that employers with more than 50 employees in areas out of attainment with any state air quality standard, and who offer employees subsidized parking, give employees the option of "cashing out" that parking option. Employees can then use this money to pay for alternative means of commuting to work, such as transit or carpools. The federal tax code and the complexity of employer parking situations have made the program difficult to implement, though emission reduction benefits have been observed when it has been implemented. See www.arb.ca.gov/planning/tsaq/cashout/cashout.htm.

[39] San Francisco is conducting a pilot program that will vary on-street and garage parking rates to manage demand (http://sfpark.org/).

[40] This amendment, passed by 53 percent of voters, raises the vote threshold for new state regulatory fees from one-half to two-thirds of each house of the legislature, and it requires a two-thirds supermajority of the voting public to approve local regulatory fees that formerly could be approved by a simple majority of governing boards. Although this change does not affect strict user fees—i.e., charges that cover the costs of providing a service to the person being charged—it does affect fees that are used to benefit others. Litigation will likely be required to sort out the boundaries of the new rules. Thus, although parking fees, toll lane charges, the gas tax, and VMT charges could easily be considered user fees (i.e., used to help cover the cost of providing transportation services), some may interpret the new rules as a restriction on the types of programs that the fees can fund.

[41] In Bakersfield, for example, efforts to limit parking availability met with resistance from retailers who felt that they needed additional parking to accommodate peak shopping days such as "Black Friday." Residents in the cities of Los Angeles and Cypress objected to the spillover problems often experienced in mixed use areas.

[42] The Transportation Research Board (2009) summarized the research literature with the conclusion that doubling residential density would be associated with a 5–12 percent reduction in VMT, and possibly up to a 25 percent reduction with complementary changes in transit availability, the jobs-housing bal-

ance, and other factors. However, as mentioned above, doubling the density for even a large share of new housing would have only a modest effect on average residential density across a city or metropolitan area.

[43] Notably, none of the RTPs includes metrics of employment density, though some discuss the concept of a jobs-housing balance.

[44] Modeling scenarios done by SANDAG, which examined the potential gains from individual policy strategies relative to an integrated approach, highlight the benefits of combined strategies (Heminger et al. 2010). The San Joaquin Valley Blueprint (2009) also envisages an integrated approach. To some extent, planning for VMT reductions will be a learning-by-doing process, given the challenges of developing a comprehensive picture of how various policies might interact to affect driving behaviors in particular regions (Rose 2010).

[45] We did not explicitly refer to SB 375, so that we could avoid concerns that the responses might be used to gauge compliance with the law. Also, the survey was completed before CARB released draft regional emission targets in June 2010, so respondents did not know the level of the regional targets.

[46] Note, moreover, that our survey asked about gas prices, not gas taxes. We chose this wording to avoid conflating concerns over the perceived political feasibility of raising the gas tax with the perceived effectiveness of a resulting rise in gas prices.

[47] It is worth noting that the high marks for local bus service also conflict with the research, which finds that the potential for traditional local bus service to reduce VMT is fairly low. It is possible that planners were thinking about enhanced service lines, although they generally ranked express bus service lower than local bus service, except in localities with rail access, where express bus to rail service ranked highest among transit options.

[48] Results reported here are from multiple regression analyses, which control for the effects of population, household income, population growth rate, political party affiliation of voters, and other community characteristics.

[49] On gas price sensitivity, see Hughes, Knittel, and Sperling (2008). On transit use and income, see Barbour (2006).

[50] The jobs-housing ratio is calculated as the number of jobs relative to the number of households within a jurisdiction in 2006. Interestingly, a jobs-housing imbalance ranked as one of the top two perceived barriers to implementing policies to reduce driving in several regions: San Diego, the San Joaquin Valley, the "Other MPO" group (including Central Coast counties and several northern Sacramento Valley counties), and the "non-MPO" group (including rural counties not currently required to comply with SB 375) (Bedsworth, Hanak, and Stryjewski 2011, Table B.24).

[51] Statewide surveys find that Republican voters are less supportive of AB 32 goals than are Democrats or independent voters, and this gap has widened since 2008 (Baldassare et al. 2008, 2010).

[52] See Heminger et al. (2010).

[53] This section summarizes the "Transit and Development in California" section of Kolko's (2011) paper, "Making the Most of Transit."

[54] Bus rapid transit does not necessarily involve construction of a fixed or dedicated lane but typically, at a minimum, includes investments in advanced technologies and infrastructure that can speed the movement of buses and improve service. This larger investment makes it more of a "fixed" investment than typical bus service.

[55] These stations include extensions to BART in the San Francisco Bay Area, the Sacramento light rail system, the San Jose light rail system, San Francisco MUNI, LA Metro Rail (including the LA Metro bus-rapid-transit Orange Line through the San Fernando Valley), and new or mostly new systems such as the Altamont Commuter Express, Coaster San Diego, Harbor Transitway, and Metrolink Southern California.

[56] Employment density is the most important factor. Residential density does not positively affect the location of new transit stations holding other factors, including employment density, constant.

[57] In fact, CARB recommends against development immediately adjacent to freeways for public health reasons (California Air Resources Board 2005). Still, proximity to a freeway could boost ridership by facilitating park-and-ride use.

[58] Data limitations restricted our analysis of residential growth to a shorter time period and different method. For employment growth, we have detailed data for all years from 1992 to 2006 from the National Establishment Time-Series (NETS) database, whereas for residential growth, we have detailed data for only 1990 and 2000 from the U.S. Census.

[59] This result is somewhat surprising, given that the new transit stations were generally located in areas where employment growth was *already* faster than in comparison areas. One might therefore expect a boost in employment growth after the station

opened, if builders were to respond to the increased demand for land that typically occurs around new stations.

[60] The residential density measure is for 1990, and the employment density measure is for 1992.

[61] Over half (56%) of the communities with these projects reported that they were all or mostly residential, versus only about a third (31%) evenly split between residential and commercial and 13 percent mostly commercial (Bedsworth, Hanak, and Stryjewski 2011).

[62] Land surrounding transit stations in Southern California in the mid-1990s was much more likely to be zoned for commercial (including industrial) use than for residential use, relative to other portions of the cities containing those transit stations (Boarnet and Crane 2001). More recently, a 2007 review of San Francisco Bay Area TOD policies reports that development goals for TODs include minimum density requirements for residential development but not for employment, in part because "cities already have considerable incentives to zone for nonresidential uses, such as sales tax revenue and reduced fiscal impacts" (Nelson\Nygaard 2007, pp. 5–7).

[63] Recent federal climate change legislative proposals contain provisions that would extend requirements nearly identical to SB 375 to all MPOs in the nation.

[64] Recognizing this potential, Bay Area leaders have called for a reassessment of the region's growth barriers (King 2008).

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