The Four Circles:
An Integrated Approach to Behavior-Based Greenhouse Gas Reduction

Lauren Hilliard

URBAN LAND USE AND TRANSPORTATION CENTER (ULTRANS)
INSTITUTE OF TRANSPORTATION STUDIES, UNIVERSITY OF CALIFORNIA AT DAVIS

2609 E Street
Sacramento, CA 95816
Ph: (530) 848-4342
lhilliard@gmail.com

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ABSTRACT

“Even if vehicle fuel efficiency were to reach 55 mpg by 2030, we would still see only modest decreases in transportation carbon dioxide emissions without a decrease in vehicle miles traveled.” This quote from US Department of Transportation Secretary Ray La Hood in his July 14, 2009 testimony to Congress illustrates the growing role that the transportation sector has in meeting climate change objectives through not just vehicle and fuel technologies, but also through addressing travel behavior. This paper introduces how a “Four Circle Approach” to greenhouse gas (GHG) reduction can be used to support climate change stability, economic relief, and communities that encourage healthier lifestyles. This approach groups GHG reduction strategies into four categories: 1) Characteristics of the Built Environment: “6 Ds”, 2) Pricing Policies, 3) Vehicle Capacity Constraint, and 4) Transport System Efficiency. The Four Circle Approach lays out an integrated framework for reducing GHG emissions through changes in travel behavior – specifically a reduction in vehicle miles travelled and a more efficiently used transportation system. Based on a critique of California’s Senate Bill 375 and developing federal legislation, the proposed framework in this paper seeks to ensure implementation and accountability by directly tying funding to GHG reduction strategies and changes to institutional structures that currently create barriers to meeting national climate change and economic objectives. The Four Circle Approach would send strong signals to the public that climate change is an important issue through pricing mechanisms and funding priorities; furthermore, the integrated framework would engage the public as part of the climate change solution by providing them tools to make travel behavior choices for healthier lifestyles and communities.

Key Words: greenhouse gas (GHG) reduction; travel behavior; vehicle-miles-traveled (VMT); climate change; transportation funding; metropolitan planning
BACKGROUND

By February 16, 2005, over 140 countries had “entered into force” the Kyoto Protocol in a global effort to curb climate change impacts (1). To achieve climate stabilization, these countries agreed that a reduction of global anthropogenic greenhouse gas emissions (GHG) by 60 to 80 percent below 1990 levels was necessary (2). Despite the United States’ significant contributions to GHG emissions, this country has yet to join other developed and developing countries in making a commitment to reduce climate change impacts. However, 22 individual states have adopted their own climate change legislation or created climate change action plans, including GHG reduction targets. In 2007, the transportation sector accounted for 29 percent of the total GHG emissions in the United States – with nearly 60 percent of these emissions resulting from gasoline consumption from personal vehicle use (3).

One of those states, California faces even greater challenges in reducing GHG emissions, since its transportation sector accounts for approximately 38 percent of the total GHG inventory in the state. Of the transportation sector’s GHG contribution, 65 percent of emissions come from light duty trucks/cars and on-road freight (4). In response to the impacts of climate change, and the growing GHG contribution from transportation-related emissions, California issued a series of legislative actions to promote a lower carbon economy. Shortly after the Kyoto Protocol went into effect, California Governor Arnold Schwarzenegger issued Executive Order S-3-05, establishing a goal of reducing GHG emissions by 80 percent below 1990 levels by 2050. The following year, the legislature passed the Global Warming Solutions Act, Assembly Bill 32 (AB 32), calling for a reduction in GHG emissions to 1990 levels by 2020.

With nearly half the states in the country working toward GHG reduction goals, and with increasing pressure from the global community to achieve climate stabilization, the US House of Representatives passed the nation’s first climate change bill in June 2009, American Clean Energy and Security Act of 2009 (H.R. 2454). Introduced by Representative Waxman and Representative Markey, this bill established goals to reduce GHG emissions to 1990 levels by 2020 – the same goal California put forth under AB 32. The federal legislation would be equivalent to a 16.6 percent reduction below 2005 GHG levels by 2020 (3). California’s AB 32 goal would be equivalent to a 10.2 percent reduction below 2005 GHG levels by 2020 (5a, 5b).

Between 1990 and 2005, the transportation sector’s GHG contribution grew at a rate 1.4 times that of overall GHG emissions in the United States, and 1.9 times that of the overall GHG emissions in California (5a, 5b).

Three-Pronged Approach to GHG Reduction

The California Air Resources Board (CARB) has recommended a three-pronged approach (i.e. “three-legged-stool”) for reducing GHG emissions from personal vehicles. This three-pronged approach is characterized in Figure 1 and identifies vehicle technology, fuel GHG intensity, and travel behavior as key components contributing to overall passenger vehicle GHG emissions.

To address vehicle technology, the California Assembly passed AB 1493 (Pavley, Chapter 200, Statutes of 2002) in 2002, requiring a 30 percent reduction in GHG emissions by 2016 and becoming the first vehicle GHG legislation in the United States. The California Air Resources Board announced its “Low Carbon Fuel Standard” (LCFS) regulation in 2006, requiring oil companies to reduce the life-cycle GHG emissions from transportation fuels 10 percent by 2020. Largely based on the efforts California put forth by enacting new requirements for vehicle technology and fuel carbon intensity, the United States Congress recognized the important role of transportation in the Energy Independence and Security Act of 2007 (EISA...
2007), which mandated 35 mile-per-gallon Corporate Average Fuel Economy (CAFE) standards by 2035 and a roughly 10 percent reduction in the GHG intensity of motor fuels by 2020. While both California and the federal government have taken steps to address GHG reduction through vehicle efficiency and low-carbon fuel, strong measures to reduce GHG reduction through VMT and transportation system efficiency through travel behavior are still in early development.

FIGURE 1 Three-pronged approach to GHG reduction.

The Need for GHG Reduction from Travel Behavior

With the exception of 2008 VMT levels declining by 3.6 percent from 2007 levels due to sudden increases in petroleum prices (6), overall VMT per capita has been steadily increasing for decades. While fuel price volatility makes it difficult to predict actual growth in travel, the Energy Information Administration estimates that VMT per capita will increase 15 percent by 2030 (7). Assuming a 1.4 percent growth rate in VMT per year, and even more aggressive requirements than California and federal standards have so far adopted, the Center for Clean Air Policy (CCAP) calculates that by 2030, GHG emissions from passenger vehicles would only be 14 percent below 1990 levels – far less than the 47 percent below 1990 levels by 2030 required for climate stability (80 percent reduction below 1990 levels by 2050) (8). Figure 2 illustrates that based on these assumptions, we will not be able to achieve GHG reduction goals, even with a vehicle fleet averaging 55 mpg in 2030 and a reduction of 15 percent in the carbon content of vehicle fuels by 2030 (8). While these target levels assume equal reductions from all sectors, the study conducted by CCAP recognizes that other sectors with cheaper reduction costs would achieve greater relative reductions. Furthermore, the study notes that given the deep reductions required, major efforts will be needed from all economic sectors – including transportation (8).

A clear vision for the role travel behavior plays in a low-carbon economy is still under debate and evolution. This paper focuses on the role that individuals have on GHG emissions from both “how much they drive” (VMT) and “how they drive” (transport system efficiency).
If the United States does not significantly reduce GHG emissions from the transportation sector, other sectors such as electricity generation and energy use in buildings will need to compensate for the difference. Reductions from non-transportation sectors, however, are far from guaranteed. Since 1978, California has attempted to garner all cost-effective energy savings from newly constructed buildings (9), but has achieved no more than stabilization in per capita electricity consumption (10). While advanced vehicle technologies and the increasing availability of alternative fuels will significantly decrease GHG emissions both at national and state levels, these measures alone cannot meet the transportation-related targets necessary for climate stabilization (7,8). Without a clear understanding of what it will take to achieve these mid-term and long-term objectives, we will likely find that ambitious GHG reduction targets cannot be met under current funding and land use/transportation planning frameworks.

FOUR CIRCLE APPROACH

The Foundation under the “Third Leg of the Stool”

This paper illustrates how a “Four Circle Approach” to GHG reduction can support climate change stability, economic relief, and communities that encourage healthier lifestyles. The approach groups GHG reduction strategies into four categories: 1) Characteristics of the Built Environment: “6 Ds”, 2) Pricing Policies, 3) Vehicle Capacity Constraint, and 4) Transport System Efficiency. The overlapping of the four circles in the center demonstrates that strategies to address travel behavior are inter-related, and greater reductions occur when they are co-implemented. For example, if infill development within the “Characteristics of the Built Environment” circle were implemented without an incremental price signal or vehicle capacity constraint, then the GHG emission reductions would be minimal because there would be less incentive toward shorter trips.

Analysis from the Center for Clean Air Policy indicates that “greenhouse gas reductions can be achieved with significant net positive economic benefits when factoring in avoided infrastructure costs, consumer fuel and insurance cost savings, and projected tax revenue growth from high value economic development”(8). Travel behavior changes that reduce GHG
emissions can be a result of a shift in funding priorities away from transportation and land use projects that decentralize local economies and require additional capital and maintenance costs – instead driving the market toward compact, transit-oriented developments that in turn revitalize urban cores and district centers.

**GHG-Reducing Strategies for Travel Behavior: Current Research**

Current research on using travel behavior strategies to reduce GHG emissions indicate that combining measures has a much higher effect on emissions reduction than implementing single policy strategies. This is due to the interactive effects between strategies such as compact development and fee-based parking. *Growing Cooler: The evidence on urban development and climate change* provides an analysis of the combined effect of compact development and transportation strategies based on elasticities from the Texas Transportation Institute. They show a “Low Carbon Scenario” for 2030 that includes slowing highway capacity growth by a third while doubling transit capacity, development density, and fuel prices. This combination yields a 38 percent combined reduction in VMT from the trend scenario (2). In Ewing’s *CO2 Reductions Attributable to Smart Growth in California*, the GHG reductions for 2020 from compact development alone range from 3.4 to 4.7 percent (11). In *Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions*, the analysis finds that under maximum deployment of the “long-term/maximum results bundle,” which combines most of the 50 measures evaluated, GHG emissions can drop 24 percent without strong economy-wide pricing measures (12). With a nationwide price signal, such as fuel taxes equivalent to those in Europe, a 52 percent reduction would be possible (12). Required under the Energy Policy Act of 2005, the US Department of Energy analyzed the relationship between land use development patterns and vehicle travel in *Special Report 298: Driving and the Built Environment: The Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions*. This August 2009 study finds that reliable estimates for doubling residential density across a region may lower household VMT by 5 to 12 percent; further, it finds that this figure may increase to 25 percent when coupled with higher employment concentrations, public transit, diverse land uses, and other transportation demand management measures (13). In response to these recent findings, the University of Utah’s Metropolitan Research Center conducted a study in which they found a range of 20 to 40 percent VMT reduction from compact development based on existing literature ranges (14).

Table 1 provides a comparison between the GHG reduction estimates from single and combined policy scenarios.
### TABLE 1 GHG Reductions from Single and Combined Policy Scenarios in Context of Four Circle Approach

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Median GHG Percent Reduction from Trend: 10 yr horizon</th>
<th>Median GHG Percent Reduction from Trend: 40 yr horizon</th>
<th>GHG Percent Reduction: 2050 Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Policy Scenarios</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Characteristics of the Built Environment</td>
<td>Transit</td>
<td>0.3%</td>
<td>1.0%</td>
</tr>
<tr>
<td></td>
<td>Land Use</td>
<td>0.5%</td>
<td>1.7%</td>
</tr>
<tr>
<td></td>
<td>Bike/Ped</td>
<td>--</td>
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</tr>
<tr>
<td>Pricing Policies</td>
<td>Cordon Pricing</td>
<td>2.8%</td>
<td>1.7%</td>
</tr>
<tr>
<td></td>
<td>Parking Pricing</td>
<td>2.2%</td>
<td>2.0%</td>
</tr>
<tr>
<td></td>
<td>Congestion Pricing</td>
<td>2.3%</td>
<td>3.8%</td>
</tr>
<tr>
<td></td>
<td>VMT Pricing/PAYD+</td>
<td>9.86%</td>
<td>11.1%</td>
</tr>
<tr>
<td></td>
<td>Fuel Tax</td>
<td>8.4%</td>
<td>12.9%</td>
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<tr>
<td>Transport System Efficiency</td>
<td>Speed Limit Reduction</td>
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</tr>
<tr>
<td></td>
<td>Eco-driving</td>
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<td></td>
<td>Intelligent Transportation Systems</td>
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<tr>
<td>Vehicle Capacity Constraint</td>
<td>Highway Capacity Expansion &amp; Bottleneck Relief</td>
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</tr>
<tr>
<td>Combined Policy Scenarios</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Characteristics of the Built Environment</td>
<td>Land Use &amp; Transit</td>
<td>3.9%</td>
<td>15.8%</td>
</tr>
<tr>
<td>Pricing Policies</td>
<td>Pricing: Parking, VMT, Congestion</td>
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<td>16.6%</td>
</tr>
<tr>
<td>Characteristics of the Built Environment &amp; Pricing Policies</td>
<td>Transit &amp; Pricing</td>
<td>10.3%</td>
<td>17.1%</td>
</tr>
<tr>
<td></td>
<td>Land Use, Transit &amp; Pricing</td>
<td>14.5%</td>
<td>24.1%</td>
</tr>
<tr>
<td>Characteristics of the Built Environment, Pricing Policies &amp; Transport System Efficiency</td>
<td>Land Use, Transit, Pricing and Operational Improvements</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

*Pay as You Drive Insurance
++While highway capacity expansion and bottleneck relief had some short-term GHG reduction, the study concluded that this strategy was the only one out of fifty to increase GHGs in the long-term
*These results indicate maximum deployment under the “long-term/maximum results bundle” with and without an economy-wide pricing mechanisms

### Implementing GHG Reductions through the Four Circles Approach

While research studies show that combined strategies to alter travel behavior have a significant role in reducing GHG emissions, there is an array of implementation challenges within each of the “Four Circles.” Characteristics of the built environment (6 Ds), pricing policies, and vehicle capacity constraint deal with performance metrics that ultimately affect VMT. The implementation challenges in reducing VMT are greater than that for transportation system efficiency, due to the volume of policies, processes, and politics involved at multiple levels of government. Understanding the degree to which these challenges can be overcome will help local and national policy-makers prioritize incentives in transportation, metropolitan and local planning processes. It is important to note that with the cumulative GHG reductions that result
from combining multiple strategies, incentives in each circle are necessary to successfully address travel behavior.

**First Circle: Characteristics of the Built Environment**

The first circle focuses on how characteristics of the built environment influence VMT reduction. These characteristics can apply to existing or planned neighborhood development projects, and include the “6 D’s”: density of the project, design of the project (accessibility within site), regional accessibility to the project destination, diversity in project’s land uses (mixed uses shorten trips/change mode), distance to transit (within ½ mile), and demographics of the project area (age, income effects). Shifting funding priorities toward land use and transportation infrastructure can promote compact community design and a lifestyle that allows people to more easily incorporate non-vehicular choices into their daily trip making. Characteristics of the built environment that reduce VMT include increased transit frequency, access to goods and services through mixed-use and transit-oriented development, and complete networks of bike lanes and sidewalks.

Combining GHG reductions from the “6 D’s” with additional measures could have the greatest potential to influence travel behavior. However, successful implementation would need to address the role and impact of local general plan policies, transportation impact procedures, street design standards, and local politics. While Regional Blueprint plans create strong visions for a sustainable and integrated land use/transportation system, the unfortunate reality is that there are many existing barriers and disincentives for jurisdictions and developers in creating the developments outlined in these plans. Because local jurisdictions maintain land use regulatory authority, they can also stall implementation. Regional and local barriers that need to be addressed in the transportation and land use planning process include:

- Regional agencies lack regulatory authority and VMT targets that require compliance from local projects.
- Regional funding allocations are not tied to transportation and development projects that meet VMT consistency with regional plans.
- Environmental impact studies require project-level analysis of traffic impacts, and ignore the benefits of reduced VMT from higher density development at the regional scale.
- The current methodology used when analyzing traffic impacts from local development projects is the Level of Service (LOS) policy from the Highway Capacity Manual – which ignores impacts to other transportation modes, cumulative GHG emissions, infill development, and higher roadway infrastructure costs.
- There is no standardized methodology for mixed-use trip generation from projects, which results in reported inconsistencies among VMT generated from projects.
- Developing in existing neighborhoods often meets opposition from local residents, who commonly use documented LOS findings to resist new projects.
- There is a market-tendency for developers to build on the urban fringe where land is cheaper and mitigation fees are lower.
- Local governments in places that rely heavily on development impact fee revenues (i.e. California’s Proposition 13) are influenced by developer preferences and large, sales-tax generating projects that tend to generate increases in regional VMT.
Second Circle: Pricing Policies

The second circle examines why pricing policies are important for both maximizing GHG reductions and generating revenue for local and regional governments. Federal price signals have widespread effects on individual behavior and development markets, and state price signals can complement federal policies. Regional and local programs can deal directly with congestion and traffic flow efficiency effects on GHG emissions. A national and statewide price signal could also be implemented through an increase in fuel taxes. To address equity issues, the increase in fuel taxes could be an incremental increase spanning several years rather than an immediate and one-time increase. The United States could implement a “Fuel Price Escalator” similar to the United Kingdom’s so that a gradual increase in the fuel price would not dramatically affect consumers in the near term. With the insolvency of the Highway Trust Fund, a Fuel Price Escalator could become a significant revenue source for a new “Low Carbon Transportation Fund” where dedicated revenue serves GHG-reducing transportation and land use projects.

Pricing mechanisms at regional and local levels can also influence travel behavior. Transport for London estimates that since the central London congestion charge took affect in 2003, the city has achieved a 6.5 percent reduction in carbon dioxide (16). The United States Environmental Protection Agency estimates that a VMT fee of $0.02 per mile would reduce overall VMT by up to 5.6 percent (17). According to the Brookings Institute, changing all car insurance policies to Pay-as-You-Drive Insurance can save consumers and insurance companies up to $50-60 billion annually, while reducing VMT by 8 percent and reducing crash rates (18). Employers in Southern California saw a 12 percent reduction in commute VMT when they offered a parking cash option to their employees (19). A GHG strategy could combine pricing policies and the “6 D’s”. This could take the form of a “Carbon Impact Fee” for developers who choose to build on the urban fringe, with the funding generated used to incentivize development near transit within urban cores (2). In California, the 35 Air Quality Management Districts already have legal authority to implement such a carbon fee through their “Indirect Source Rule.”

While pricing mechanisms at any level of government can be difficult to implement due to the political nature of constituents, evidence suggests that the public may actually favor taxes that directly fund transportation. Over the last 25 years, voters in 20 California counties passed local transportation sales tax measures that generated approximately $2.5 billion annually for roadway and/or transit projects (20). With the web of institutional changes needed to support implementation of a Regional Blueprint, pricing mechanisms may be quicker and easier to implement in the near-term for GHG reduction. Additionally, pricing strategies could help struggling local and state governments fund needed GHG reducing projects. Because combined GHG reduction strategies complement each other, implementing the “6 D’s” strategies would be greatly strengthened once federal, state, regional, and/or local pricing mechanisms are in place to support them.

Third Circle: Vehicle Capacity Constraint

The third circle shifts funding priorities away from VMT growth (added vehicle infrastructure capacity) toward prioritizing a “Fix it First” policy at multiple levels of government (2). The added capacity from additional Single-Occupancy Vehicle (SOV) or High-Occupancy-Vehicle (HOV) lanes reduces travel times and costs, resulting in attracting trips from other routes and modes, and encouraging longer and more frequent travel (21). A ten percent increase in lane-
miles under short-term conditions can cause up to a four percent increase in VMT, and a ten percent increase in lane miles under long-term conditions can cause up to a ten percent increase in VMT (22). This information is important when crafting policies such as the provision of added capacity from additional HOV lanes – a more prudent policy may be to convert existing SOV lanes to HOV lanes, contingent on a comprehensive VMT/speed bin or GHG analysis of the tradeoff between emissions associated with suppressed demand and congestion. Furthermore, the increase in accessibility can induce growth, particularly in areas on the fringe of urban centers. Without roadway capacity expansion, development typically occurs in a more compact design reliant on existing infrastructure.

With existing transportation infrastructure falling into disrepair all across the county, a “Fix it First” policy at the federal, state and local levels could create significant GHG reduction from resurfacing and maintaining existing roadway infrastructure. Economically, a “Fix it First” policy is significantly less expensive than creating new lane. While studies show there can be short-term GHG reduction from added roadway capacity and bottleneck relief, the cumulative nature of GHG impacts require analyzing additional capacity beyond a 40-year horizon in which the GHG reduction benefit is limited (12). Further, converting existing lanes to HOV or High-Occupancy-Toll lanes can reduce VMT up to 1.4 percent while simultaneously funding a “Low Carbon Transportation Fund” to further support innovative strategies in any of the circles.

The common argument for roadway capacity expansion is rooted in the notion that the people do not like congestion. While this is somewhat true, and a mindset in the barriers to implementing Regional Blueprints and good project design, it is unfair and expensive to limit people’s options to one mode, particularly one that decentralizes goods and services that communities’ need. Slowing the rate of VMT growth through roadway capacity is critical to support good characteristics of the built environment and pricing mechanisms.

**Fourth Circle: Transport System Efficiency**

The fourth circle is unique because it is the only one that addresses how people actually drive, rather than how to reduce the amount of vehicle miles travelled. Because the institutional barriers and political limitations that exist in the VMT-reducing circles are not prevalent, transport system efficiency can be significantly easier to implement. Such measures include lowering speed limits to minimize GHG emissions, educating the public on how vehicle maintenance and handling of their automobile affects fuel economy, and creating intelligent transportation systems (ITS) such as coordinating traffic lights and metering on-ramps. The *Moving Cooler* study found that in total, these three transport system efficiency measures can reduce GHG emissions 3.7 percent to 6.9 percent from a 2050 baseline trend (12). The study also found that “eco-driving” alone could reduce GHG emissions up to 2.7 percent (12). Additional reductions accrue with more efficient intersection types, such as changing signalized intersections to roundabouts. A study by Tony Redington on opportunities for modern roundabouts to address climate change concluded that 25 roundabouts replacing existing traffic signals in the City of Burlington, Vermont would provide over 20 percent of the city’s overall 10 percent reduction in GHGs below 1990 levels (23). Converting existing highway/freeway lanes to HOV or HOT lanes would optimize existing infrastructure by either encouraging people to carpool or by allowing single occupancy vehicles to pay a price to use the facility - a combination of pricing and vehicle capacity constraint.
INTEGRATED FRAMEWORK FOR TRAVEL BEHAVIOR

Despite a genuine desire to address climate change, changing travel behavior is a fundamental challenge in reducing GHG emissions. Aligning our transportation and climate change objectives will require a cultural shift in thinking and action, and local government will require support to empower people to change their travel behavior by engaging them as part of the climate stability solution.

An integrated framework is necessary to support the Four Circle Approach, and this paper discusses the factors that lead to a successful framework, based on a critique of California’s Senate Bill 375 and developing federal legislation. The framework seeks to ensure implementation and accountability by tying funding directly to supporting GHG reduction strategies and addressing institutional barriers to national climate change and economic objectives. The Four Circle Approach and supporting framework would send strong signals to the public about the importance of climate change through pricing mechanisms and funding priorities. Simultaneously, this approach invites the public to be part of the solution by providing them travel behavior choices supporting healthier lifestyles and communities. Incentivizing the general public, as well as state, regional, and local governments, can support coordinated efforts to promote travel behavior that reduces GHG emissions. Further, using funding to align transportation and metropolitan planning processes will better enable people to reduce VMT and improve transport system efficiency.

Policy Objectives Outgrow Policy Frameworks

Congress included multi-modal planning and flexible funding provisions nearly twenty years ago in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). Since then federal transportation policy objectives have outgrown existing funding mechanisms and frameworks. We need increased fiscal flexibility and support to ensure accountability and implementation of new state, regional, and local objectives. ISTEA, TEA-21, and SAFETEA-LU are all examples of federal transportation reauthorization bills which include modest funding for multi-modal transport, but this supply-side-only approach has resulted in only minimal change to bicycle, pedestrian, and transit mode share nationwide, and these modes still represent less than ten percent of total transportation trips (24).

In 1991, when multi-modal planning was first incorporated into federal transportation funding legislation, it was probably fair to say the policy framework was consistent with the policy objectives. The supply-side framework included infrastructure funding for bicycle, pedestrian, and transit capacity in addition to roadway capacity. However, ensuing transportation policy objectives go beyond providing for non-automobile infrastructure and are now focused on the how these modes can reduce VMT as a strategy to meet federal climate change objectives.

In his July 14, 2009 testimony to the United States Senate Committee on Environment and Public Works, Secretary Ray LaHood of the United States Department of Transportation (Department) stated, “Even if vehicle fuel efficiency were to reach 55 mpg by 2030, we would still see only modest decreases in transportation carbon dioxide emissions without a decrease in vehicle miles traveled. Addressing VMT growth plays a key role in decreasing transportation related greenhouse emissions and should be included in overall efforts to prevent climate change. One way to achieve significant reductions in VMT is to develop more livable communities.”
Secretary LaHood went on to explain that in the next surface transportation reauthorization, the Department will prioritize reducing VMT and GHG emissions through smart community planning, and by enacting measures that provide added economic benefit to all Americans. Two days later, the United States Housing and Urban Development, Environmental Protection Agency, and Department of Transportation announced the forming of a joint “Partnership for Sustainable Communities.”

Current Frameworks to Address Travel Behavior

California’s Senate Bill 375

In keeping with its tradition of introducing environmental policy preceding federal action, on September 2, 2008, the State of California enrolled Senate Bill 375 (SB 375), Sustainable Communities and Climate Protection Act of 2008. The California Building Industry Association, League of California Cities, California State Association of Counties, and many environmental groups, affordable housing advocates, and urban planners supported this bill, which lays out a framework for metropolitan land use and transportation planning that requires GHG reduction one of the priorities in development and transportation projects. SB 375 requires the California Air Resources Board to establish regional GHG targets for each Metropolitan Planning Organization (MPO) in California. These targets must be set no later than September 30, 2010, and must set GHG limits for the automobile and light truck sector for 2020 and 2035. The law also mandates MPOs to create a “Sustainable Communities Strategy” (SCS) for how they will achieve their given GHG target. However, if an MPO cannot meet their GHG target through the development of an SCS, they can create an “Alternative Planning Strategy” (APS) to detail additional measures that the MPO could take to achieve their GHG targets (i.e. market trends or general plan consistency with SCS). While the bill makes no changes to how transportation and development projects are approved or funded, it is a cultural recognition that linking land use and transportation planning is an important aspect of reducing GHG emissions.

The Federal CLEAN-TEA Proposal

While federal legislation addressing travel behavior has not yet been proposed, there is promise that a new federal framework is forthcoming, one that links travel behavior and GHG reduction through funding allocations. Sponsored by Senators Carper, Specter, Merkley, Lautenberg, and Cardin from the Senate Committee on Environment and Public Works, the Clean, Low-Emission, Affordable, New Transportation Efficiency Act (CLEAN-TEA) would establish revenue sources for metropolitan planning through a “Low Greenhouse Gas Transportation Fund” and dedicate 10 percent of carbon cap-and-trade revenue for transportation GHG-reducing projects. Unlike SB 375, which mandates that regional plans consider GHG emissions but provides no funding link between the plans and land use and transportation projects, CLEAN-TEA sets up a voluntary “do more, get more” (8) framework to support MPOs which choose to develop a GHG reduction plan and related projects. The bill allocates funding to MPOs for VMT reduction and transport system efficiency strategies, including measures such as complete streets: marking crosswalks: traffic calming techniques; transportation demand management; congestion pricing; infill and transit-oriented development; public transit projects; improvements to travel and land use data collection; updates to travel models; intelligent transportation systems; and updates to zoning and land use regulations for coordinating local and regional plans. Contrary to other proposed federal legislation linking climate change and
transportation, such as H.R. 2454 and Congressman Oberstar’s proposed transportation reauthorization bill, CLEAN-TEA is unique because it goes beyond a supply-side approach to reducing GHG emissions from transportation (i.e. increasing transit capacity) and recognizes demand management as an essential way of influencing travel behavior. In addition to supporting pricing mechanisms, the proposed bill would prohibit transportation GHG reduction plans and priority projects from adding single-occupancy vehicle capacity to the transportation network.

Senate Bill 375: Critique of Existing Framework for Travel Behavior

While California’s Senate Bill 375 seeks to address travel behavior’s contribution to GHG reduction, implementation uncertainty, lack of funding provisions, and the voluntary nature of the project approval process hinders real change. Some implications of SB 375’s land use and transportation project provision cannot be determined until the framework is fully implemented.

Implementation of Development Projects

One such provision is California Environmental Quality Act (CEQA) relief for developers. If “transit priority projects” are consistent with either the SCS or the APS and meet the five-page project design and restriction criteria outlined in SB 375, a developer qualifies to submit an initial study of the project followed by a “sustainable communities environmental assessment” outlining mitigation for any potential development impacts. SB 375 also adds Section 21159.28 to the Public Resources Code, which allows any residential or 75 percent residential mixed-use project that is consistent with either the SCS or APS to be exempt from: “1) growth inducing impacts; or 2) any project specific or cumulative impacts from cars and light-duty truck trips generated by the project on global warming or the regional transportation network.” All other aspects of GHG emissions from the project must still be analyzed in an environmental impact study. Even in the acclaimed Regional Blueprint Plan for the Sacramento Area Council of Governments (SACOG), which largely inspired the premise of SB 375, single family large lot development is still the largest percentage (45 percent) of the overall housing type (25). Thus, it is not clear if stringent criteria for “transit priority projects” mixed with the CEQA relief actually incentivizes development patterns in greenfield locations.

Implications of Funding Priorities in California

The implications of SB 375’s funding provision are also yet to be tested. Here, funding for transportation and land use projects are prioritized within MPOs and allocated regionally and locally. Success here relies on how much SB 375 actually empowers MPOs to tie funding to VMT/GHG-reducing projects. One of the central tensions is a competing desire to reduce GHG while maintaining or increasing vehicular mobility largely through roadway capacity. SB 375 does not apply to transportation projects programmed for funding on or before December 31, 2011 that are contained in either the 2009 State Transportation Improvement Program or were specifically listed in a ballot measure prior to December 31, 2008. This includes the $11.25 billion Proposition 1B funding specifically designated for congestion reduction, highway and local road improvements (26). Additionally, climate change objectives may be a lower priority than job creation for large highway infrastructure projects under the American Recovery and Reinvestment Act of 2009’s allocation of $2.57 billion to California for highways; local streets and roads; freight and passenger rail; and port infrastructure projects (27). One potential resolution may come from the SB 375 implementation process, where MPOs must have “internal
"consistency" within Regional Transportation Plans. If the law truly is successful in establishing climate change as a priority, funding development and transportation projects that meet GHG reduction criteria (e.g. VMT reduction) would take precedence over roadway capacity projects that induce VMT.

Creating a National Framework for Travel Behavior: Lessons from and for California

With the United States Department of Housing and Urban Development, Environmental Protection Agency, and Department of Transportation joining together to address climate change and support sustainable communities, we need a new federal funding framework for transportation, metropolitan and local planning, and GHG reduction to shift toward VMT reduction. In an unusual role reversal, the US Department of Transportation has taken the lead in integrating housing and transportation needs that align with climate change objectives. Meanwhile California has passed an intricate land use and transportation framework for regional planning (SB 375), but success depends on the degree to which Caltrans, the Governor’s Office of Planning and Research, the Department of Housing and Community Development, and the California Air Resources Board can coordinate their priorities for GHG reduction through travel behavior.

It is important to remember that GHG reduction through travel behavior has unique challenges and opportunities in terms of successful implementation. Attempts to decrease VMT through the addition of transit services, bikeway infrastructure, and mixed-use development will likely not create results without price signals, changes in funding priorities, and public engagement. The historical supply-side focus of addressing travel behavior fails to take into account three necessities for successfully achieving the GHG reductions needed to meet California or federal climate change goals:

- The lack of price signals to consumers combined with a status quo or higher investment in roadway capacity sends a message to the public that climate change is not a serious threat.
- Ignoring an individual’s role and civic responsibility to be part of the climate stability solution is a missed opportunity in achieving GHG-reductions through travel behavior. The creation of tools such as an integrated economic, land use, and transportation model has the ability to communicate to the public how various policy choices can have positive effects on their communities.
- It is valid to assume that people value the convenience of driving over the equitable provision of access to goods and services; thus, extra measures need to be incorporated into the land use and transportation planning process to ensure the implementation of Regional Blueprints.

Using the Four Circle Approach in an integrated framework allows for flexibility in achieving hard GHG targets set at various levels of government in accordance with national goals. Incentivizing both GHG reduction strategies and institutional changes at the state, regional and local levels will be necessary and could be done through a funding program where the federal or state government matches, for instance, the cost of updating General or Comprehensive Plan policies, design standards, and codes (i.e. public outreach and staff development). Another program could be the federal government matching some portion of a fuel tax that states implemented. To achieve climate change goals, we need a fundamental shift away from our current framework linking federal transportation funding with VMT growth (2).
| TABLE 2 Framework to Incentivize GHG Reduction from Travel Behavior: Bottom-Up Approach Rewards Innovation, Top-Down Approach Incentivizes and Regulates Changes: |
|----------------------------------|----------------|----------------|----------------|
| **Federal**                     | **States**    | **MPOs**       | **Locals**     |
| **Federal Climate Change/Transportation Laws:** |                       |                       |                       |
| 1) Create a "Low Carbon Transportation Fund" funded by an incremental increase in fuel sales tax over decades 2) Establish GHG-reduction project criteria for allocating funding 3) Change transportation infrastructure funding priorities to slow the rate of VMT-inducing projects | Reward innovation in GHG reduction strategies | Reward innovation in GHG reduction strategies | Reward innovation in GHG reduction strategies |
| **States**                       |                       |                       |                       |
| 1) Eliminate Level of Service concurrency requirements 2) Require GHG conformity for transportation funding 3) Change general plan/growth management laws to reflect GHG objectives over VMT-inducing objectives 4) Initiative "Fix it First" for project prioritization 5) Establish GHG-reduction criteria for allocating funding 6) Change STIP funding priorities to slow the rate of VMT-inducing projects 7) Set statewide goals for GHG reduction from VMT 8) Coordinate State Housing and Transportation Agencies 9) Adopt a complete streets policy, supported by design guidelines and funding 10) Invest in public engagement and education regarding climate change | Reward innovation in GHG reduction strategies | Reward innovation in GHG reduction strategies |                       |
| **MPOs**                         |                       |                       |                       |
| 1) Re-structure MPO Boards to be elected directly (based on Portland Metro) 2) Change MPO funding allocation requirements to reward GHG-reducing projects 3) Initiative "Fix it First" for project prioritization 4) Invest in planning/engineering development through academia and public agencies 5) Match local transportation sales tax measures 6) Adopt a complete streets policy, supported by design guidelines and funding 7) Invest in public engagement and education of climate change | 1) Change MPO funding allocation requirements to reward GHG-reducing projects 2) Require GHG conformity for transportation funding 3) Create a "Carbon Impact Fee" or "Indirect Source Rule" for development to fund a regional "Carbon Trust Fund" to incentivize GHG-reducing projects | Reward innovation in GHG reduction strategies |                       |
| **Locals**                       |                       |                       |                       |
| 1) Initiative "Fix it First" for project prioritization 2) Match local transportation sales tax measures 3) Adopt a complete streets policy, supported by design guidelines and funding 4) Require GHG analysis in project review process 5) Update zoning codes, parking and level of service policies, and design standards to reflect GHG reduction goals 6) Invest in public engagement and education of climate change | 1) Eliminate Level of Service concurrency requirements 2) Create a "Carbon Impact Fee" or "Indirect Source Rule" for development to fund a local "Carbon Trust Fund" to incentivize GHG-reducing projects 3) To ensure that regional Blueprinting is accountable, require VMT thresholds in local general and comprehensive plans | 1) Replace community’s General or Comprehensive Plan Level of Service policy by an alternative policy that supports GHG reduction goals, incentivizes development toward urban centers, and accounts for transit, bicycle and pedestrian infrastructure 2) create street design guidelines that include narrow travel lanes, reduced speed limits, landscaping, and public space 3) create an ongoing maintenance funding stream for sidewalks, bike lanes, bike paths, and operational revenue for transit 4) change zoning codes and parking requirements that promote transit-oriented, bicycle-oriented, and pedestrian-oriented development 5) project approval dependent on the degree to which a new land use or transportation infrastructure project is consistent with proven GHG-reduction strategies 6) update a community’s General or Comprehensive Plan to include a VMT threshold with minimum density requirements 7) provide access to high-quality goods and services, including schools, parks, and public spaces (e.g. rooftop gardens) |                       |
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