Increasing vehicle occupancy in the United States

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Introduction

Automobile and roadway use is inefficient in the United States from the perspective of capital utilization and energy consumption. The single occupant automobile is the dominant form of transportation for the morning and evening commute periods, when congestion is the greatest. During the 1980's, the United States (USDOT, 1997) experienced significant increases in vehicle registration (21%), number of males and females in the workforce (8% and 22%), and vehicle miles of travel (41%). Continued urbanization, reductions in household size, increased numbers of primary workers per household, an increase in the single parent population, and general changes in lifestyle that accompany an aging driver population all contribute to transportation demand complexity. Motor vehicles ownership and operation grows annually, and state agencies continue to respond to congestion growth by building more capacity and increasing the efficiency of existing capacity. States build roadways to accommodate peak period travel, leaving facilities that operate below capacity for the majority of the day. Automobiles typically operate for less than one hour per day and when these vehicles are driven, they carry few passengers. Vehicle occupancy ranges from 1.05 during the morning commute to roughly 1.3 in the afternoon commute.

Consumers have universally adopted the personal automobile into their lifestyles, vigorously protecting the freedom to use these vehicles. Americans have come to expect rapid access to goods and services in their personal vehicles. Travelers usually choose the automobile over alternative modes, unless they cannot afford (or are not allowed) to own and operate an automobile. The personal utility of the automobile usually outweighs the utility of the alternative mode. Only in cases where transit is available, origin and
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A variety of definitions for the term Transportation Control Measures (TCMs) can be found in the literature, dating back to the 1950's (Meyer, 1998). For the purposes of this discussion, TCMs are actions designed to change travel demand or vehicle operating characteristics to reduce motor vehicle emissions, energy consumption, and congestion. TCMs include transportation supply improvement strategies and transportation demand management strategies. Transportation supply improvement strategies change the physical infrastructure to improve traffic flow, decreasing stop and go movements. Supply improvement strategies often require intensive capital investment and can take the form of bottleneck relief, construction improvements, signal timing, ramp metering, applications of intelligent transportation system technology, and alterations to land use patterns. Demand management measures attempt to change driver behavior to reduce the frequency and length of automobile trips. Strategies encourage drivers to share rides or use alternative transit. Demand management measures include, but are not limited to: no drive days, employer-based trip reduction programs, parking management, park and ride programs, work schedule changes, transit fare subsidies, and public awareness programs. Demand management measures may or may not require intensive capital investment, but are usually characterized by ongoing operating costs. Although the most successful TCMs to date are technology-related supply improvement measures, the focus of this paper is demand management strategies.

Throughout the 1980's, transportation demand management programs in the United States proved little more than a series of failed efforts to encourage people to reduce motor vehicle use. These demand management programs proved very unpopular with the public. In the early 1990's, legislators and regulators continued to strongly support initiatives designed to encourage ridesharing and reduce vehicle usage. However, by 1994, the federal government had rolled back the requirements that pushed state and local agencies toward the implementation of trip reduction measures. State and local agencies quickly moved away from such mandatory programs. In the 1990's, air quality management plans required by the Clean Air Act relied much less significantly on emission reductions from transportation demand management measures (Thompson, 1998; BAAQMD, 1997; CARB and
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1. Regulatory mandates

Regulatory mandates require, either directly or indirectly, that specific segments of the population change their trip-making behavior. Examples of direct regulatory mandates, most of which have been proposed but not implemented in the U.S., include: automobile bans in downtown areas, restrictions on motor vehicle idling time (i.e., heavy-duty vehicles), restricted access to airport terminals for certain types of vehicles, odd/even day gasoline rationing at retail filling stations (based on license plate numbers), restricted hours for goods delivery in urban areas, and peak hour restrictions on truck usage in downtown areas. Direct mandates are extremely unpopular, and none implemented on a sustained and widespread basis in the United States. Direct regulatory restrictions deprive travelers of personal mobility, without providing highly visible personal benefits in exchange.

Implementation of indirect regulatory mandates has been more common than direct mandates, primarily in the form of trip reduction ordinances implemented by local governments. These ordinances require employers to increase the average vehicle occupancy of employee vehicles reporting to work during commute periods, but usually allow the employers a great degree of flexibility and self-determination in developing their unique approach. In this case, regulatory agencies impose mandates on an intermediary, which in turn must devise methods to alter the behavior of those individuals and organizations under their control or influence. Because the employer can implement either prescriptive or incentive-based strategies, trip-reduction ordinances often manifest themselves as a hybrid between a regulatory mandate and a more flexible incentive-based approach.

1.1 Employer-based trip reduction ordinances in Los Angeles

During the late 1980s and early 1990s, employer-based trip reduction measures were implemented in many urban areas, and strongly supported by many air pollution control agencies (CARB, 1991; Lopez-Aquino, et al., 1991). Regulatory agencies developed commute vehicle occupancy goals (average vehicle ridership) that would result in fewer vehicle trips to the facility during the morning peak. Employers could offer their employees incentives (e.g., cash rebates for car-poolers) or impose disincentives (e.g., parking fees for employees who drive alone to work) to achieve these ridership goals.

The largest and most prominent experience with trip reduction ordinances was Regulation XV, adopted December 11, 1987 in the South Coast (Los Angeles area) air basin. More than 685,000 Los Angeles area commuters currently report to work at large facilities (250+ employees) during the peak period (1,577 worksites). Medium sized employers (100-250 employees) constitute 2,710 worksites and more than 315,000 employees. Regulation XV was designed to reduce the number of vehicle miles traveled and trips taken

Transportation demand management strategies

The objective of demand management strategies is to encourage or require drivers to reduce the frequency and length of automobile trips, to share rides, or to use alternative modes of transit (e.g., transit, bicycling, walking, etc.). Demand reduction can result from specific regulatory mandates such as trip reduction ordinances, economic (market-based) incentives, and education campaigns. This section examines each general strategy in turn:
between the home and worksite by requiring employers of 100 or more
individuals to prepare and implement trip reduction plans. Regulation XV plans
outlined how the facility would increase average commute vehicle occupancy
from the 1987 areawide level of 1.13 persons per vehicle entering the facility to
1.25-1.75 persons per vehicle, depending upon the location of the facility.
Employers developed their own incentive programs to encourage workers to
rideshare or use alternative transit modes. Progress was reported annually,
an plan was updated and revised until the ridership goal was achieved

The tripmaking impacts of specific measures implemented by employers
under Regulation XV were highly variable. Reductions depended upon such
local factors as employer size and location, employment size and site
characteristics, location of labor pool, and socioeconomic composition
facilities in the Regulation XV program found no apparent correlation between
the number of incentives offered and the improvement in ridership levels
(Giuliano et al., 1991). Hence, the quality or appropriateness of the incentives
offered, rather than the number of incentives offered, are the driving forces
behind behavioral change. Two factors in particular had a significant effect on
ridesharing: 1) use of parking incentives and disincentives coupled with transit
pass or commute subsidies; and 2) management commitment coupled with the
presence of an on-site transportation coordinator (LoPez-Aqueres, et al., 1991;
Schreffler and Kumyak, 1991). A necessary but not sufficient condition to
encourage ridesharing was found to be the establishment of a program to
guarantee rides home for emergencies and last minute work/personal schedule

Typical employer-based trip reduction programs use carpool incentives to
increase vehicle occupancy. The Ventura County government center, in the Los
Angeles basin, employed approximately 2700 people in 1990 and developed
employer-based trip reduction plan in response to Regulation XV (COMSIS,
1993). Employees accumulated a point for each day that they do not drive
alone to work. After collecting 96 points, employees received a cash award of
$200.00. As support measures, the government center provided a guaranteed
ride home, preferential carpool parking, and biking/walking facilities. The
facility vehicle trip rate decreased from 90 trips per 100 employees to 76 per 100
(69% single occupancy vehicle, 23% carpool, 2% transit, and 6% other).

Programs that include parking fees, such as the Bellevue, Washington City
Hall complex, can be very successful (COMSIS, 1993). City Hall charged $30
per month to park single occupant vehicles, provided transit users with free
transit fares, provided priority parking to carpools, and provided alternative
mode subsidies (carpools, $15/month; vanpools, $25/month; bike, walk, or
motorcycle, $15/month). Revenue neutral fees and subsidies were self-
sustaining. The mode split for this facility program was 52% SOV, 6.8% transit,
28.5% carpool, 3.7% vanpool, and 8.5% other. The vehicle trip generation rate

was 64.1 trips per 100 employees, compared with a region-wide average of 86.4
per 100.

Over the entire Los Angeles region, employer-based demand management
strategies were slow to evolve. Employers were required only to develop
"approvable" plans to achieve specified ridership goals with no penalty for
failure to achieve the goals. A detailed study of 1110 work sites (see Table 1),
found that the implementation of Regulation XV reduced vehicle commute trips
to participating facilities by about 5% during the first year of the program
(Giuliano et al., 1991). The most instructive finding of this study is that the
primary improvements in ridership came from increased use of carpools. All
other changes were trivial on an absolute scale: a slight increase in vanpools
and compressed workweeks, a slight decrease in bicycling/walking and
telecommuting, and no change in transit use. This finding suggested that
reduced vehicle usage can be accomplished with little or no institutional
change, as carpools do not require the same level of organizational effort and
financial support as many other options (Giuliano et al., 1991).

The change in travel behavior was based upon an initial survey (prior to
developing first year Regulation XV plans) and a survey at the end of the first
year. The local district provided industry with a great deal of flexibility in
implementing their own creative solutions during the first year plan submission,
even if some of the proposed plan strategies were questionable in terms of
theoretical effectiveness. That is, the district sought to create a cooperative
sense of self-determination, avoiding a pure command-and-control style of rule
implementation. Because incentive plans must be updated annually, and
because the district requires the elimination of failed strategies in favor of
strategies proven effective at other facilities, the effectiveness of Regulation XV
was expected to increase over time. The documented initial response of
companies to Regulation XV probably understates the effect of trip reduction
efforts; over time, as companies refine the strategies they choose to implement.
The District never performed follow-up studies past the second year.

Even if successfully implemented, the overall travel implications of programs
similar to Regulation XV should be modest. Commute trips represent roughly
25% of daily trips, and commute trips to facilities with 100 or more employees
represents approximately 40% of commute trips in the South Coast area
(SCAQMD, 1988). Even if commute trips to affected facilities are reduced by
between 5 and 20%, employer-based trip-reduction strategies may yield total
daily trip reductions of somewhere between 0.5% and 2% (although primarily
achieved during the peak periods). The costs of such initiatives are substantial.
Employers often hire rideshare coordinators and provide incentives, and
regulators must monitor and enforce the program. In a survey of more than 400
Los Angeles area facilities (Ferguson, 1989), the typical cost of placing
employees in carpools or transit through personalized ridesharing assistance
ranged from $7.72 per employee in large firms (~10,000+ employees) to $33.91
per employee in small firms (~100 employees).
Table 1: Changes in Mode Share at 1110 Facilities Reporting Under Regulation XV in the South Coast Air Basin (Giuliano, et al., 1992)

<table>
<thead>
<tr>
<th>Transportation Mode</th>
<th>Pre-Regulation XV Baseline Survey Mode Share</th>
<th>Post-Regulation XV Year-End Survey Mode Share</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive Alone</td>
<td>0.757</td>
<td>0.709</td>
<td>-6.3*</td>
</tr>
<tr>
<td>Carpool</td>
<td>0.138</td>
<td>0.184</td>
<td>33.3*</td>
</tr>
<tr>
<td>Vanpool</td>
<td>0.021</td>
<td>0.024</td>
<td>14.2</td>
</tr>
<tr>
<td>Bus</td>
<td>0.032</td>
<td>0.032</td>
<td>0.0</td>
</tr>
<tr>
<td>Walk/Bike</td>
<td>0.029</td>
<td>0.028</td>
<td>-3.4</td>
</tr>
<tr>
<td>Telecommuting</td>
<td>0.006</td>
<td>0.005</td>
<td>-16.7</td>
</tr>
<tr>
<td>Compressed Hours</td>
<td>0.016</td>
<td>0.019</td>
<td>18.8</td>
</tr>
</tbody>
</table>

* Statistically significant at p=0.01

1.2 Business opposition and increased flexibility

A few years after Regulation XV was implemented, when medium-sized businesses (100-250 employees) came under the regulatory requirements, the business community began exerting significantly increased political pressure on the South Coast Air Quality Management District (SCAQMD) to repeal the regulation. The District responded on December 8, 1995 by repealing Regulation XV and adopting Regulation XXII (Rule 2202) in its stead (http://www.scqmd.gov/trans/). The rule change was more superficial than substantial, in that the new rule did not significantly relieve businesses from implementing measures to increase commute vehicle occupancy (Siwek, 1998). Employers submit triennial Commute Reduction Plans and annually report progress in increasing vehicle occupancy. The District staff review Employee Commute Reduction Programs ensures that the employer continues to demonstrate a good faith effort towards achieving target commute vehicle occupancy. Staff also review programs to ensure that they will not disproportionately impact minorities, women, and low-income or disabled employees.

Rule 2202 shifted focus from increasing commute occupancy to providing emissions reductions. The District provided calculation methods to estimate emission reductions as a function of increased ridership. However, in its final form, the rule allowed businesses to develop alternative compliance strategies. Businesses may implement alternative emissions controls that achieve the same emission reductions as would have been achieved by the prescribed increase in commute vehicle occupancy. The rule's new air quality investment program (AQIP) also allowed businesses to buy their way out of regulation compliance, with the AQIP revenues (dollars/commuter) used to fund alternative regional control strategies.

1.3 Loss of national and state support for trip reduction measures

The 1990 Amendments to the Clean Air Act required the implementation of employer-based trip reduction measures in areas that suffered from severe or extreme ozone levels. The SCAQMD played a significant role in drafting the actual EBTR language in the Act (Siwek, 1998). After the CAA Amendments passed, corporations in severely polluted areas began to communicate with their sister companies in the Los Angeles region (45% of the large employers had sites in multiple nonattainment areas). The implications of the employer-based requirements of the CAA language began to crystallize for Corporate America as the costs of implementing these programs in other areas became apparent (Siwek, 1998). The USEPA moved forward with new inspection and maintenance and reformulated fuels programs at the same time they attempted to move forward with employer-based programs. The agency was clearly in trouble as the combined agenda began receiving serious opposition from state Governors on all fronts. Business interests objected so strenuously to the CAA language that would impose employer-based programs that they took their case directly to Congress.

On December 23, 1995, Congress amended Section 182(d)(1)(b) of the Clean Air Act. The new language allowed air quality planning agencies to opt out of the required employer-based programs, provided they submitted a demonstration in writing that identified alternative strategies that would achieve the equivalent emission reductions. States could simply signal their intent in writing to achieve equivalent reductions and the employer-based trip reduction programs could be removed from air quality management plans.
without a new plan being approved. Overnight, employee commute programs became voluntary, disappearing from air quality management plans across the nation.

The South Coast AQMD, however, did not eliminate their new On-Road Motor Vehicle Mitigation Options Program (Rule 2202) after the change in the CAR, partly because the region requires emissions reductions from every source they can tap. Rule 2202 already applied to the businesses that were used to complying with Regulation XV, and these businesses had achieved desired changes when Regulation XV was scrapped in favor of Rule 2202. However, on September 27, 1996, California Senate Bill 836 (Lewis) directly changed the South Coast program's requirements. The California Senate required the South Coast AQMD to exempt employers of 100-250 employees from the Rule 2202 program.

The Senate Bill instructed the District to undertake an 18-month trial period in which the agency would encourage voluntary rideshare efforts for these facilities. The Senate even required that $1.5 million dollars per year be allocated by the District to support voluntary ridesharing services. At the end of the trial period, the Senate would require an independent analysis of voluntary program benefits to determine if businesses achieved equivalent emissions reductions. Success would permanently exempt the facilities with 100 to 250 employees from the rule. Failure of the voluntary programs to achieve the emissions reductions would result in reimplementation of the rule to the facilities.

The SB836 Oversight Report (Haug International and LDA Consulting, 1998), completed in March 1998, determined that the voluntary measures failed to achieve the targeted emissions reductions of Rule 2202. While it is easy to argue over any of the individual assumptions used in estimating the effectiveness of the voluntary programs, the emissions reduction shortfall was so large that the voluntary programs were clearly unsuccessful. The emission reduction targets for the exempted facilities were 0.32 tons/day for reactive hydrocarbons, 0.37 tons/day for oxides of nitrogen, and 3.27 tons/day for carbon monoxide. However, the exemption of facilities from Rule 2202 and ineffective implementation of voluntary programs actually yielded an increase in pollutant emissions: 1.20 tons/day for reactive hydrocarbons, 1.40 tons/day for oxides of nitrogen, and 15.65 tons/day for carbon monoxide. Whether Rule 2202 would have achieved the prescribed target reductions is unknown, but the alternative voluntary measures did not. According to the terms of Senate Bill 836, on June 1, 1998, the regulation reverted to its original state and the medium-sized employer exemptions disappeared. The California Senate quickly took to the floor again, passing Senate Bill 432 (Lewis) on June 19, 1998. This emergency measure made the exemption for medium-sized companies permanent, despite the findings of the SB836 oversight report. The new Senate Bill also eliminated the $1.5 million allocation for voluntary rideshare programs. The largest air pollution control agency with the worst air quality in

the nation could not retain their commute program for medium-sized employers over public objection.

1.4 Effectiveness of individual measures

A large body of research on the effectiveness of individual transportation control measures is now in the literature (Meyer, 1997; COMSIS, 1994; COMSIS, 1993; Cambridge Systematics, et al., 1990; Higgins, 1989). By reviewing the programs implemented to date, researchers have been able to identify strategies (and specific the incentives and disincentives) that can change travel behavior at individual facilities. The literature clearly indicates that individual facilities can implement effective demand management strategies. However, agencies rarely perform cost-effectiveness analyses for these strategies.

Given the change in the political climate surrounding TCMs, the California Air Resources Board shifted from the development of transportation control measure guidance in the late 1980s to the evaluation of TCM cost effectiveness by the mid 1990s. The California Air Resources Board (1995) recently studied the cost effectiveness of 20 emissions reduction strategies funded by California vehicle registration fees. The assumptions on both the cost and benefit sides of the equations are uncertain, and the analyses did not employ consistent project life cycle assumptions, but the results are still useful. The CARB analyses (1995), after correctly annualizing the costs and benefits, indicate that signal timing, purchases of new alternative fuel vehicles, and construction of bicycle facilities can be cost effective compared to many new stationary source control measures. One measure, a videophone probation interview system, actually resulted in net cost savings and a negative cost-effectiveness ratio, indicating that there are still technology projects that can simultaneously attain emissions reductions and save public dollars. Of the twenty measures, eleven aimed to change travel demand, and nine aimed to improve traffic flow or to shift drivers to new vehicles or alternative fuels. Only six of the eleven demand management measures proved cost-effective. The technology-oriented supply improvement strategies (such as signal timing) and fuel shifts fared better, with eight of the nine measures proving cost-effective.

Regions can achieve behavioral change with regulatory mandates, but the reductions in vehicle usage and energy consumption have been rather modest to date and have come at considerable economic and political cost. Although the effectiveness of employer-based trip reduction ordinances would likely improve over time, the political support for regional requirements is lacking. Regional employer-based strategies did not prove highly effective before political opposition squelched them.
2. Economic incentives

Economic incentives in transportation include the provision of monetary incentives or disincentives to the transportation consumer (i.e., vehicle operator or passengers) as encouragement to change travel behavior. For example, cash incentives to carpoolers yield monetary advantages to the individual willing to make a “socially desirable” behavioral change. Economists have long argued that monetary signals serve as the most economically efficient method to achieve changes in transportation demand. Economic theorists assert that consumers will efficiently consume goods and services when they are required to pay the full cost of the goods and services. Provided costs are not set too high, economic incentives should achieve behavioral change more efficiently than prescriptive rules. Economic incentives including congestion pricing and gasoline tax increases have received strong support from businesses, environmental communities, and local press editorials in San Francisco, CA (Bay Area Economic Forum, 1980; Sierra Club, 1990; Cameron, 1991). Using the results of detailed household tripmaking surveys, economic and trip characteristic data from these same households, and standard statistical techniques, analysts have attempted to develop predictive models that can be used to analyze the effects of economic incentives. Impacts are determined for such factors as auto ownership, trip generation, employment location, spatial and temporal distribution of trips, trip chaining, mode choice, and route choice. The true cause-effect relationships between economic incentives and behavioral change are poorly understood, and specific models are generally applicable only to the area and time that data were collected. However, best practice models can be used as long as the worst potential inaccuracies are acknowledged and assessed (Harvey, 1994). Recent modeling work indicates that economic incentives at the upper range of what is politically plausible in the U.S. have the potential to yield reductions of nearly 15% in both number of trips and vehicle miles traveled (Harvey, 1994).

2.1 Transportation pricing

Transportation economics literature argues persuasively for the implementation of congestion pricing to improve the efficiency of the current transportation system. Some of the best explanations of congestion pricing benefits are in works by Mohring and Anderson (1998), and Winston, et al. (1998), and Kuhn (1994). Area licensing schemes are also an option, where vehicle owners purchase stickers allowing the car to enter the most congested areas of the city during peak hours. Examples of area license schemes can be found in Singapore, Hong Kong, and Oslo and Bergen Norway (COMSIS, 1993).

The Environmental Defense Fund and Regional Institute of Southern California sponsored the most comprehensive modeling studies of pricing on transportation behavior to date for the Los Angeles and San Francisco Bay Areas (Cameron, 1991; Harvey, 1994). These studies employed household level analysis using logistic and regression equations, and incorporated numerous feedback loops so that factors such as changes in price and travel time could iteratively change other factors such as trip generation and trip distribution. The findings for the South Coast area are as follows (Cameron, 1991):

- regional congestion pricing of $0.15 per mile (a market clearing price designed to yield a level of service D/E) may yield a VMT reduction of about 5.0% and trip reduction of 3.8%,
- regional $3.00 per day parking charges may yield a VMT reduction of about 1.5% and a trip reduction of 1.8%,
- regional $0.60 per hour non-employee parking charges may yield a VMT reduction of about 3.5% and trip reduction of 4.3%,
- mileage and smog-based registration fees (see Gordon and Levenson, 1988) averaging $110 per vehicle per year may yield a VMT reduction of about 0.4% and trip reduction of 0.7%.

the Bay Area study employed congestion pricing at $0.10 per mile, identical parking charges, and average smog-based registration fees of $125/vehicle per year. Theoretical results for the San Francisco Bay Area were similar, with travelers being slightly less responsive to economic incentives (Harvey, 1994).

Given the academic interest in congestion pricing, Congress established the Congestion Pricing Pilot Program in the Intermodal Surface Transportation Efficiency Act of 1991. The program was to fund congestion pricing studies and demonstration programs (Spock, 1998). Demonstration projects slated for test implementation included variable prices on: the Coronado Bridge in San Diego, California, the San Francisco Bay Bridge, two bridges in Lee County, Florida, the Tappan Zee Bridge on the New York State Thruway, and a toll road in Houston, Texas. Although ISTEA allocated $55 million in 1997 for congestion pricing pilot programs, Congress redirected these funds to other uses under the National Highway System Act of 1997. TEA-21 now allocates more than $50 million toward "value pricing" (congestion pricing) programs between 1999 and 2003. The DOT will provide 80% matching toward 15 new state/local programs. To date, no significant congestion pricing programs have been implemented in the United States for automobiles. Political support for variable congestion pricing on bridges in California crumbled in the California Legislature, leaving California's demonstration projects unimplemented. A variety of scoping studies has concluded that there is little interest in congestion pricing on public roads (Winston and Shirley, 1998). Focus groups indicate that the public will oppose conversion of public roads to toll facilities. A Citizen's Jury panel in Minnesota listened to expert testimony on congestion pricing and proposed on their own that increasing gasoline taxes would be a better option than imposing congestion pricing (Robinson, 1996). Given the low level of national
support for increased gasoline taxes, the results do not bode well for congestion pricing programs.

High occupancy toll lanes (HOT lanes) are proving to be a potentially viable alternative to congestion pricing. HOT lanes allow single occupant vehicles to gain access to new high occupancy vehicle lanes or facilities by paying a toll. HOT lane facilities are now operating in San Diego, California; Riverside, California; and Houston, Texas (Winston and Shirley, 1988). Because the public perceives HOT lanes as providing new capacity and appears more accepting of tolls on these facilities, additional investigation into the consumer acceptance and economic benefits of HOT lanes should continue.

2.2 Gasoline taxes

Harvey’s studies (1994) indicated that a $2.00 increase per gallon in gasoline tax could yield a VMT reduction of about 8.1% and trip reduction of 7.6%. Yet, determining the long-term effects of higher gasoline prices can be difficult. Research indicates that the gasoline price impact on gasoline demand is relatively inelastic over the short-term and somewhat more elastic over the long-term (Dahl and Sterner, 1991). The fuel is a small component of the cost of owning and operating an automobile. While significantly increased fuel costs can affect automobile use, the demand for new fuel-efficient vehicles also changes in response to fuel price. When gasoline prices rise, individuals who purchase more fuel efficient vehicles can retain many of the trips and VMT without experiencing significant increases in total operating cost. Long-term and short-term automobile purchase elasticities (which affect the fuel economy of the new vehicle fleet) are complex. Fuel price, VMT demand, and fuel intensity are inter-related, and the cumulative effect (perhaps in combination with a number of unknown socioeconomic variables) yields the change in net travel demand and net fuel consumption.

Not only are United States gasoline prices and federal gasoline taxes lower than other major industrialized countries, the US was the only one of these countries to actually reduce the federal gasoline tax between 1985 and 1985 (USDOE, 1997). Repeated attempts to raise the gasoline taxes to fund anything but construction of new facilities has not fared well in Congress (by the mid-1990’s, Congress even removed the $0.05 per gallon deficit reduction component from the federal gasoline tax). However, the public may be more accepting of increased fuel taxes than has been previously acknowledged. In 1998, citizens in Broward County, Florida voted to invoke a one-cent per gallon gasoline tax to replace moneys currently transferred from general funds to transportation projects (Suessentrop, 1998). The transfer freed up the general fund moneys to construct and operate three new homeless shelters. Despite objections from some political leaders, the citizens in Broward County recognized and corrected a transportation efficiency problem by removing (or at least reducing) the general fund transportation subsidy and replacing it with a user fee (gasoline tax). The motivation for change arose when the government targeted a popular project for funding and when the public received assurances that the increased funding would go toward that worthy goal. The American public may be quite willing to eliminate general fund subsidies (that come from property, sales, and income taxes) in favor of slightly increased gasoline taxes. The small improvements in price signals certainly wouldn’t hurt tripmaking efficiency. However, the public must be convinced that the government will return these funds through tax reductions or that the new funds will go toward popular programs. It may be critical to simultaneously quantify the existing subsidies, identify and implement the new spending priorities, and increase the gasoline taxes to compensate.

2.3 Parking pricing

In the United States, paying for parking is the exception rather than the rule: 90 to 95% of auto commuters pay nothing for parking (Shoup, 1997; Wilson and Shoup, 1990; Ullberg, 1991). Nationwide, employers provide 85 million free parking spaces to commuters, with a fair market value of nearly 36 billion dollars a year (Shoup and Breinholt, 1997). Even in the central business district of Los Angeles, where parking fees are more common than in most areas, of the 172,000 office workers, more than 54,000 drivers parked at their employer’s expense (Wilson and Shoup, 1990).

Despite the fact that most employees pay nothing for parking, it is important to remember that there is no such thing as free parking. Even if employers do not pay an outside vendor and instead provide their own lots for employee parking, these lots must be constructed, gated, monitored, and maintained. Furthermore, companies providing parking to employees at no charge pay an opportunity cost for not putting their property to more productive uses. The land could be developed and used in producing more company income or could be sold for development by others. Employers simply pass on the real and opportunity costs of parking to the consumers of the goods and services provided by the company. Parking costs transfer from employees (who benefit directly from the parking) to the consuming public (that benefits little if at all from the parking). Failure to charge employees for parking constitutes an inefficient pricing structure.

Travelers are highly sensitive to parking charges because the charges represent a large change in their “out-of-pocket” costs. Studies of carpool behavior have shown that commuters weigh the “out-of-pocket” cost savings from carpooling heavily in their carpool decision. Parking costs is one of the three most frequently cited factors (along with convenience and time saved) in the carpool decision (Wachs, 1990). This responsiveness to parking prices is economically rational since motorists treat the vehicle purchase and annual insurance payments as sunk costs with respect to daily travel decisions, leaving parking costs as a large percentage of out-of-pocket costs (Wachs, 1990). For
instance, typical commute trips to the Los Angeles core business district cost less than $2.00 per day in out-of-pocket gasoline costs. Adding the fair market value of parking to gasoline costs can increase out-of-pocket costs to roughly $6.00 per day (Wilson and Shoup, 1990). Free parking is a greater incentive to drive alone than would be the provision of free gasoline (Wilson and Shoup, 1990). As real prices of gasoline drop and urban parking costs rise, this trend will worsen.

Harvey's pricing studies and various Regulation XV studies suggested that parking pricing is likely to achieve a greater effect on travel demand than would a gasoline price increase. Using the same economic arguments made by Wachs (1990) and Wilson and Shoup (1990), the price of gasoline in Los Angeles would have to double or triple before out-of-pocket fuel costs would equal the fair market value of free parking. Similarly, the provision of free transit passes would be insufficient to overcome the out-of-pocket advantages provided by free parking. It is not surprising that a mode shift from parking fees appears to be greater than would occur from any new rail construction project in the Los Angeles Region or any large increase in gasoline prices (Wachs, 1990).

Various case studies lend support to the finding that parking prices are significant in affecting trip-generation and mode choice. An early study of employer-paid parking effects on mode choice, conducted in the late 1960s in the central business district of Los Angeles, examined County workers receiving employer-paid parking and federal employees paying for their own parking. The study found that only 40% of the employees subject to parking fees drove alone to work, while 72% of similar employees that were not subject to parking fees drove alone (CARB, 1987; Wilson and Shoup, 1990). The availability of transit and alternative modes, and the amount of available free parking, influence the effectiveness of parking pricing. Similarly, an analysis of 13 employers that instituited paid parking programs revealed that the number of trips was reduced by 20% at the worksite (Ullberg, 1991). Other studies in the Los Angeles area indicate that between 19% and 81% fewer employees drive to work alone when they are required to pay for their own parking (Wilson and Shoup, 1990). This translates to a 15% to 38% decrease in the number of auto trips made to the worksite. Providing an income supplement to employees before implementing parking pricing does little to diminish the effects (Harvey, 1994).

The provision of employer-paid parking is changing in California, through the passage of a law requiring employers to 'cash out' free parking. The 1992 California law, and subsequent regulations, require employers who provide free or subsidized parking to their employees to also provide a cash equivalent to those employees who do not consume the subsidized parking (California Health and Safety Code 43845). The regulation defines a subsidy as a payment by the company to a third party for the parking, so it does not affect the provision of free parking when the employer owns the parking spaces (or when the parking spaces are bundled into current leases). Nevertheless, the program is a good start toward eliminating the transfer of parking costs from the consumers of a company's goods and services back to the company's employees. The program applies to employers of more than 50 persons in areas that do not meet the state ambient air quality standards. In Los Angeles, the policy is implemented through South Coast Air Quality Management District Rule 1504 (Cash-Out Program for Non-Owned Employer Parking). Two recent surveys indicate that somewhere between 3% and 13% of the medium and large employers in the Los Angeles are affected by the parking cash out law (Weir, 1998).

The California Air Resources board sponsored research to evaluate eight case studies of firms that complied with California's parking cash-out. The number of drive-alone trips to these facilities dropped 17% after cashing out (Shoup, 1997). The number of carpools increased by 54%, the number of transit riders increased by 50%, the number of workers arriving on foot or bicycle increased by 39%, and total commute trip vehicle miles of travel dropped by 12% (Shoup, 1997). These findings are a revelation in that this significant shift in travel behavior resulted from a regional policy. In addition, the policy did not significantly reduce the total number of commute trips. Hence, the policy did not price travelers out of the market, overcoming a potential objection often raised with roadway or congestion pricing.

The eight employers did pay an additional $24 per year per employee in total commute subsidies (Shoup, 1997), because cash-out payments increased faster than subsidized parking payments declined. However, the net result was a true employee benefit program, where all employees received the same commuting benefit. Economists would expect employers to incorporate the final commute subsidy outlays into their wage structure the following year. The decision of individuals to opt out of tax-exempt employer-paid parking to taxable cash equivalents raised federal and state tax receipts by $65.00 per employee per year (Shoup, 1997). It is also interesting to note that when Southern California phased out employer-based trip reduction requirements for medium sized employers, five of the eight firms studied discontinued ridesharing and other EBTR incentives programs. The shift to parking cash-out strategies yielded significant changes in the commute behavior, while the previous four years of EBTR participation did not.

Results in California indicate that parking cash-out programs can be effective and efficient. These programs are likely to be politically palatable in areas outside of California, and could expand to employers with fewer than 50 employees. Given the overwhelming positive response of employers and employees in the case study interviews (Shoup, 1997), it is clear that such programs are easy to understand, add little administrative burden, and are readily accepted by the public as fair. Expanded cash-out programs could target employers that are currently exempt from the California program, such as those that provide parking on their own property. Program implementation
would simply require the assessment of the fair market value of the in-house parking benefit received. As parking demand at the regulated facilities declines, companies can recoup the opportunity cost of the land by putting the property to more productive use.

The implementation of regulatory mandates and parking pricing programs do not have to be mutually exclusive. Under trip reduction rules, employers may implement any workplace strategy to reduce drive-alone trips, including parking pricing. These two regional strategies may be more effective when implemented together. Employer programs and incentive policies can help improve the viability of the carpools and alternative transit modes, further supporting the parking incentive. On their other hand, regional parking pricing, applied to a large percentage of employers, may be sufficient without the regulatory overhead of regional employer-based programs.

To date, most businesses in Los Angeles have hesitated to implement employee parking pricing, despite the fact that increased parking fees can increase vehicle occupancy much more efficiently than other strategies. Most employees who receive free parking view this subsidy as a right, or fringe benefit of employment. Expanding the programs beyond the small percentage of employees already affected in California remains a challenge.

A final note on parking pricing. Planners and policymakers in Washington DC should have known for many years that proper pricing of parking could serve to significantly improve the efficiency of automobile use. In 1976, Cambridge Systematics modeled the potential impacts of potential carpooling policies for Washington DC and summarized these results at the Transportation Research Board’s annual meeting (Hirst, 1976). Twenty years ago, the Cambridge Systematics studies predicted changes in drive-alone rates and carpooling that parallel Shoup’s (1997) current findings.

3. Public information and education

Ongoing education campaigns can influence human behavior. Recent behavioral shifts, such as the overall decrease in the number of smokers and the increase in residential recycling activity, suggest that ongoing media campaigns coupled with formal educational programs can be effective. Many of California’s local air pollution control districts have implemented educational programs as a means to increase public awareness of how travel behavior affects air quality. For example, the air quality agencies in the Los Angeles and San Francisco regions prepared circulars that describe the benefits of employer-provided carpool incentives. The California Air Resources Board prepared a variety of information packets for government decision-makers as well as the public. Numerous states and local air pollution control agencies have followed suit across the United States.

Increasing vehicle occupancy in the United States

Education campaigns implemented in conjunction with regulatory mandates can make employer based trip reduction strategies more efficient at both the facility and regional levels. Facility-based education strategies to support programs include information dissemination, appointment of transportation coordinators, and use of special promotions (COMSIS, 1993). At the regional level, the South Coast AQMD implemented a compliance assistance education program to support Rule 2202. District staff members interact with corporate representatives and provide advice on the most cost-effective strategies implemented by other companies in the region. Various carpooling strategies are recommended by SCAQMD staff, such as: compressed work weeks, in-house rideshare matching, subsidized transit passes, carpool/vanpool subsidies, preferential carpool parking, flexible hours, telecommuting, bicycle lockers and showers, and company award/prize programs. Agency staff also recommend guaranteed rides home programs as a necessary supplement to facilitate successful carpooling strategies. Of the 55 employers that received advice and provided final cost information, about 88% (57) reported a significant decline in program implementation costs as a direct result of switching to the new options recommended by District staff (SCAQMD, 1997). The average annual cost per worksite declined from $35,618 to $16,043 for a net average cost savings of $19,573 per worksite, or $70 per employee (SCAQMD, 1997). Hence, education is an important component of regulatory and economic incentive approaches. Most employers (80%) also indicated that the new strategies greatly simplified program administrative procedures (SCAQMD, 1997). Only two respondents (3%) thought that the new options did not simplify administrative procedures.

Ozone alert programs have cropped up across the country, in which voluntary no-drive-day programs commence when predicted air quality is likely to violate air quality standards. On ozone alert days, the County Health Department in Tulsa, Oklahoma, receives substantial cooperation from the local television, radio, and print media. The media encourages the public to postpone unnecessary trips, share rides, use their cleanest vehicle, avoid vehicle refueling, and use alternative transportation modes (such as public transit or bicycling). In addition, free transit rides are provided and refineries supply less evaporative gasoline for sale in the area (Bishop, 1991).

Currently, the largest public education campaign is a combined effort of the USEPA and USDOT, 1998. The Transportation and Air Quality Public Information Initiative ("It All Adds Up to Cleaner Air") implemented demonstration programs in three US cities during the ozone season in summer of 1998: San Francisco, CA; Dover, DE; Milwaukee, WI. The agencies conducted baseline public opinion surveys prior to implementing the media campaigns, and will administer follow-up in November 1998. Agency staff will present the final survey results at the January 1999 annual meeting of the Transportation Research Board in Washington, DC. This year, the USEPA will
start maintaining a Smart Travel Resources Center that will serve as an
electronic repository for transportation and air quality public information
campaign materials (http://www.epa.gov/oms/traq/).

Programs aimed at the younger generation through grade school may
achieve positive results over time. Youth initiatives are also being conducted
Tampa, FL. Boston, MA and Kansas City, KC and MO through the cooperative
FHWA and USEPA venture. The Puget Sound Air Pollution Control Agency
(1996) in Seattle Washington developed resource materials for teachers
through their Clean Air Express program. Children's programs are likely to
yield a future generation that is educated about the costs and externalities
of transportation, perhaps to the point where these costs will play a role in travel
choices. It is difficult, however, to document these likely changes. To date,
public information campaign effectiveness figures do not exist. In their
evaluation of the cost-effectiveness of three public education campaigns, staff
of the California Air Resources Board (1995) note that "it is difficult to calculate
direct emissions benefits from these programs." Rather than attempting to make
benefit estimates, staff evaluates education programs using four criteria: 1) was
there a clear message consistent with stated air quality goals, 2) did the
message target specific behavioral changes and did the message reach the
audience, 3) did the project contain an evaluation component, and 4) based
upon the evaluation plan, did the attitudes and/or behavior change (CARB,
1995). For the three education projects reported, staff could not determine if the
two public measures yielded behavioral changes. However, the campaign
aimed at elementary school children did result in a demonstrable behavioral
change.

The CARE (Conserve, Avoid, Reduce, Encourage) project, conducted in the
Los Angeles area by the Southern California Environmental Education and
Leadership Foundation in 1993-94, involved elementary school children in a
transportation and air quality education campaign (CARB, 1995). The coalition
provided children with classroom materials describing the causes of air
pollution and methods to reduce automobile pollution. The children maintained
records of family travel activity for a one-week period before and after the
education program, and were encouraged to use alternative means for the
commute-to-school. The pilot program showed a demonstrable change in travel
behavior for the families of the students participating in the study. The agency
ever determined if permanent changes in travel behavior would have resulted
from widespread implementation of the pilot program. However, the fact that
children can significantly impact the activities of a family should not go
unnoticed. Some policy analysts argue that the success of recycling programs
resulted largely from the impact of children continually badgering their parents
to recycle.

The benefits of public information campaigns are uncertain because it is
difficult to disentangle the effect of the media campaigns from other measures
instituted at the same time (Hartgen and Casey, 1990), in part because the
emission effects are small. It is also difficult to define, in advance, how high the
costs of public awareness campaigns will need to be to achieve specific
behavioral changes. There also remains the question to what extent consumer
behavior will remain changed once successful media campaigns are
discontinued (i.e. is continual bombardment by media campaigns required to
sustain a behavioral change?). Nevertheless, given the historic failures of
regional travel demand programs, and the public resistance of pricing
strategies, public awareness campaigns are becoming a major focus of US
regulatory agencies desiring to influence regional travel behavior. It remains to
be seen if these investments will prove cost-effective.

Resistance to regional strategies

Because transportation demand management strategies directly affect
individuals, the public tends to scrutinize proposed initiatives. If a credible
analytical framework were available to analyze the costs and benefits of
demand management initiatives, perhaps the decision to adopt particular
actions would be less political. Unfortunately, such cost-benefit analyses are
not very accurate, given the tools currently available (Guensler and Sperling,
1994). Without reliable and widely accepted analyses of cost effectiveness,
politicians seem less willing to implement strategies that impose a monetary or
time cost on travelers. Numerous equity issues arise from questions of who pays
and who benefits from any transportation control measure. For example,
Wilson and Shoup (1990) indicate that the elimination of free parking in one
case study allowed employees access to a limited number of spaces that were
previously available to management and employees with seniority. Yet, even the
"equitable" redistribution of parking spaces depends upon who actually
holds the spaces under the current system, who will hold them under the priced
system, and what system of distributive justice is used to determine an
"equitable" distribution. Giuliano (1992) reported that a Honolulu program to
stagger work hours resulted in some public and private sector employees
shifting their working hours. While the project resulted in overall time savings,
workers who did not shift their schedule realized the greatest time savings
benefits. Participants who shifted their schedules did not save as much time
and workers that shifted their work schedules away from 7:30 a.m. or earlier
actually added 10 minutes to their daily commute. The Honolulu study further
inconvenienced active participants because the change in commute times often
disrupted their schedules outside of work (childcare, appointments, etc.). The
conflict between equity and efficiency is an age-old dilemma that arises in
every TCM implementation decision, especially at the regional level.

Public resistance to changes in status quo may also be influenced by the
public's perception of the magnitude of the likely effects. The fact that airline
industry deregulation occurred before the deregulation of freight industries
may have been linked to public perception. Consumers may have perceived that relatively large reductions in out-of-pocket airline ticket prices would occur, whereas freight deregulation would have an imperceptible impact on the costs of consumer items (Kingdon, 1984). In the Twin Cities panel study, the majority of participants refused to believe that congestion pricing would result in a significant decrease in congestion despite the expert testimony of economists (Robinson, 1996). In the case of transportation systems, the public is not generally aware of the sources and expenditures of transportation funds. For instance, citizens are surprised to learn local sales and property taxes (non-user-based fees) account for a significant portion of existing transportation revenues. Perhaps education campaigns in the area of transportation revenue are necessary to increase public acceptance of regional strategies.

The public sometimes views economic incentives as favoring the rich, because resources such as parking spaces, gasoline, and roadway capacity are sold to those who are willing to pay more. However, focus group studies do indicate that low-income groups see the potential for economic incentives to improve equity in the distribution of current transportation services. What constitutes fairness in the eyes of the American public is never easy to determine. Americans will routinely argue that subsidies are unfair (except, of course, they are receiving the subsidy). Americans quickly notice real (or proposed) increases in taxes or out-of-pocket costs or reductions in convenience. Yet, the public rarely notes when they are receiving a subsidy or are imposing costs on other individuals. Perhaps most Americans currently consider the status quo to be "fair"—else, there would be more public outcry for change. A major part of the problem is making Americans more aware of current subsidies and generating the necessary political will to correct those subsidies.

Conclusions

Throughout the late 1980's and early 1990's, air quality regulators adopted "reasonably available transportation control measures," trusting that the social benefits would outweigh the social costs (or at least that the costs would be lower than the costs of other alternative control strategies). The drive to attain ambient air quality standards led to the adoption of regional employer-based trip reduction strategies. Meanwhile, businesses and the public resisted changes designed to limit mobility. Businesses were not so optimistic that these measures were reasonable, and continued to oppose them, even while they began to implement trip reduction strategies. Business continually challenged agencies to demonstrate that the demand management strategies were cost-effective compared to technical solutions that could achieve emissions reductions or alleviate congestion. The poor quality of data and analysis on costs and benefits for regional measures is frustrating. Hopefully, the ability to estimate the benefits and costs of transportation demand management strategies will improve as additional data and improved models become available, although the scattered and sporadic nature of current studies is not encouraging.

Evidence suggests that demand management initiatives have had relatively small impacts on travel behavior and fuel consumption in the United States to date. Direct agency intervention has simply not worked as intended. Given the cautious approach of most trip-reduction ordinances, where companies submit revised incentive plans annually if they failed to achieve ridership goals, slow progress in these programs should not have been a surprise. Regional employer-based strategies were not able to prove themselves effective before political opposition eliminated the programs. Even the region with the worst air quality in the United States could not retain their regional employer-based program for medium-sized employers over public objection.

During the 1990's, economic incentives designed to internalize the personal and social costs of the automobile seemed to be the most logical and promising for achieving changes in travel behavior. As consumers internalize the true costs of owning and operating the personal automobile, individual tripmaking decisions become more rational, increasing system efficiency. Strategies such as congestion pricing, emission fees, and even pay-as-you drive automobile insurance received a great deal of attention in state legislatures and in the popular press. However, regions never implemented any of the major regional economic incentives. Even demonstration congestion pricing projects died in the political statehouses. The public clearly opposes pricing schemes. Even if the public did not object to the concept of pricing, regulators still need address a variety of equity dilemmas before pricing strategies are likely receive popular public support.

Despite the political climate that trends toward an increased dependence on user fees for public financing (The Public's Capital, 1992), regional economic incentives have not gained widespread acceptance. Economic incentives often require changes in existing law and finance policy that are difficult to obtain. Implementing economic incentives is still an uphill battle in the United States. Agencies were not even able to implement congestion pricing demonstration programs, despite the availability of federal funding, due to political opposition. Some economists argue that continued failure to implement regional congestion pricing leads to the conclusion that the transportation system must be privatized to obtain efficiency benefits (Winston and Shirley, 1998). However, a variety of successful, less intrusive, politically palatable economic incentives, such as parking pricing, should probably be attempted at the regional level before we hand the entire public transportation system over to private industry.

Probably the most successful transportation-related economic incentive to date has been the parking cash-out program in California, improving the price signals received by the consumer. Limited scale implementation has been very
successful. Regional parking pricing is likely to be a viable travel demand strategy, but will be difficult to adopt. Tax codes that allow employers to provide parking as a tax-exempt employee benefit need to change. Employers and employees need to feel that the costs of parking are real. Education initiatives or minor property taxes on parking spaces might help focus public and employer attention on parking as a commodity. Parking pricing is probably easiest to implement when integrated into plan approvals for new development (Weir, 1998). Developers can save money by reducing land space for parking and employers can integrate parking pricing into their salary structure from the outset, avoiding conflicts over taking of employee benefits.

Regions should continue to experiment with expanded parking pricing programs before implementing congestion pricing or privatizing roadways. Perhaps the slow, gentle push into economic incentives and correction of price signals will lead Americans toward more widespread acceptance of regional economic incentives such as congestion pricing. By implementing pricing strategies that the public will support and simultaneously continuing public education campaigns on the cost of owning and operating and automobile, gradual acceptance of more widespread incentives might be achieved. Because studies indicate that employees at smaller firms and in specific job descriptions will have more difficulty in identifying acceptable ride-sharing partners, regulatory agencies may still need to provide some form of regional support to promote carpool formation.

Some traditional centralized carpool support programs are cost-effective and could run concurrently with parking pricing. The transportation management agency might implement ride-share-matching programs, or contract the programs to outside vendors. However, once parking cash-out is phased-in, an alternative to traditional carpool programs might better harness the creativity of the private sector. Congestion Mitigation and Air Quality (CMAQ) funds ($300 million/year in California) and dedicated motor vehicle registration fees ($80 million/year in California) have helped some agencies implement programs to fund innovative demand management proposals (CARB, 1998). Vehicle registration fees, federal/state gasoline taxes, or other general taxes could fund a similar incentive program in private industry. Private and public entities could apply for funding of innovative demand management strategies. Such programs should require a formal cost-effectiveness demonstration before approval by the governing advisory board (which could consist of advisors from the regulated community). Agencies could implement these new incentive programs (funding drive-alone subsidies with alternative subsidies) when parking cash-out strategies fail to achieve ridership goals or simply when the cost-effectiveness analyses indicate the proposal would be beneficial. Because such programs would be voluntary, only those businesses that elect to submit applications for funding would participate, removing the mandate aspect of previous regional efforts.

Increasing vehicle occupancy in the United States

Automobile and roadway use remains inefficient in the United States from the perspective of capital utilization and energy consumption. However, the inefficient single occupant automobile brings great personal mobility and freedom. Meyer (1998) points out that automobile convenience is a significant factor in our travel decisions because there is little evidence of shifts in travel mode or to alternative travel times as a result of burdensome congestion delays. True, congestion does cause delay and significantly increased environmental costs. But employer mandates and other mandatory programs to increase vehicle occupancy have failed to pass muster with the public. The implementation of regional demand management strategies in the United States has become the exception rather than the rule. Americans have also rejected most pricing strategies, in part because they object to the increased costs that would result should they choose not to change their travel behavior. However, research in parking pricing does indicate that American consumers respond to price signals. Toll roads appear acceptable to the public when they provide new capacity, but not when imposed on existing “free” facilities. The public resists changes to the existing funding structure, perhaps to some extent because the public does not understand the complex subsidies and cross subsidies that thread through the transportation system. The future of demand management is likely to pivot upon perceptions of the significance of energy and environmental problems. It remains to be seen whether the perceived external costs are sufficient to motivate and justify changes in travel behavior. Meanwhile, transportation and air quality planners need to keep meandering through, educating the public, and demonstrating as many viable demand management strategies as the public will permit.

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