1.3 Promote a Reduction in Vehicle-Miles Traveled Through Pricing Measures

1.3.1 Background: Promote a Reduction in Vehicle-Miles Traveled Through Pricing Measures

Vehicle-Miles Traveled

Motor vehicles account for nearly all vehicle-miles traveled (VMT) in the U.S.—some 99 percent in 2007. The other three modes—railroads, transit, and domestic air carrier—accounted for 11.5 billion VMT combined; by contrast, motor vehicle VMT was more than 3 trillion. Between 1990 and 2009, the total VMT for passenger cars and light-duty trucks in the U.S. increased by 39 percent, as a result of population growth, economic growth, increasingly dispersed land use practices, and relatively low fuel prices.[91]

Potential Impact of Pricing Measures to Reduce Vehicle-Miles Traveled

VMT is responsive to various pricing measures, including mileage or other user fees (including fuel taxes), pay-as-you-go insurance, fees for access to road facilities through cordon pricing (tolls paid by motorists to drive in a particular area, such as a city center), and other congestion charges.[92] A third approach involves charging for access to street parking, depending on the time of day and demand, and pricing street spaces to create turnover. This approach reduces VMT two ways: by discouraging unnecessary vehicle trips and by eliminating the need or incentive to circle for an open space.[93]

Policies to Promote a Reduction in Vehicle-Miles Traveled Through Pricing Measures

We discuss three policies to promote a reduction in VMT through pricing measures.

Policy 1: Spur adjustments in the costs of operating a motor vehicle

Policy 2: Encourage variable tolls and congestion pricing

Policy 3: Spur adjustments in the prices for street parking

---

91 Research and Innovative Technology Administration Bureau of Transportation Statistics. 2009. *Transportation Statistics Annual Report. U.S. Vehicle-Miles: 1998-2007.* Available at: http://www.bts.gov/publications/transportation_statistics_annual_report/2009/html/chapter_01/table_01_02_10.html [accessed April 21, 2011].

92 Deakin, E., G. Harvey, R. Pozdena, G. Yarema. 1996. *Transportation Pricing Strategies for California: as assessment of congestion, emissions, energy, and equity impacts. Final Report. C*alifornia Air Resources Board. University of California Transportation Center. Available at: http://www.uctc.net/papers/434.pdf [accessed May 19, 2011].

93 Shoup, D. 2005. *The High Cost of Free Parking.* Chicago: American Planning Association Planners Press. Available at: http://www.uctc.net/papers/351.pdf [accessed June 19, 2011]

1.3.2 Impact of Policies: Promote a Reduction in Vehicle-Miles Traveled Through Pricing Measures

Policy 1—Spur adjustments in the costs of operating a motor vehicle

Definition

Measures aimed at increasing the costs of operating a motor vehicle include fuel taxes, pay-as-you-drive insurance, and mileage charges.[94] We discuss congestion pricing and tolls in Policy 2: Encourage variable tolls and congestion pricing.

History of Deployment

Fuel taxes: In 1956 the Highway Revenue Act and the Federal-Aid Highway Act established the Federal Highway Trust Fund, using dedicated revenues from a motor fuel tax, which was set at a fixed amount per gallon. It was last increased in 1993 to 18.4 cents per gallon.[95,96]

Pay-as-you-drive insurance: Starting in late 2010, a number of automobile insurance companies began to offer some version of pay-as-you-drive insurance. Most plans involve using odometer readings to give discounts on future premiums via yearly adjustments. A few use telemetric information to offer discounts more precisely correlated to distance driven.[97]

Mileage pricing: This method has been tested in a small pilot study, but the focus was on the feasibility of the technology and its potential for capturing revenue, more than its effect on VMT.[98]

Effectiveness and Impact on Reducing VMT

Fuel taxes: Gas price increases, which can be a proxy for higher fuel taxes, can reduce VMT by spurring work or residential relocations to shorten or eliminate trips, reducing car ownership, and increasing the use of transit, active transportation, and car-sharing.[99] However, gas price

---

94 Atkinson, R.D. 2009. *Paying Our Way: A New Framework for Transportation Finance*. Final Report of the National Surface Transportation Infrastructure Financing Commission. Available at: http://www.itif.org/publications/paying-our-way-new-framework-transportation-finance [accessed June 18, 2011].

95 Ibid.

96 Wachs, M. 2009. After the Motor Fuel Tax: Reshaping Transportation Financing. *Issues in Science and Technology Online*. Available at: http://www.issues.org/25.4/wachs.html [accessed May 19, 2011].

97 The Associated Press. 2011. *Low-Mileage Drivers Benefit from Insurers' Pay-as-You-Drive Plans.* April 11, 2011. Available at: http://wvgazette.com/ap/ApBusiness/201104110175 [accessed May 22, 2011].

98 Hanley, P.S. and J.G. Kuhl. 2011. *National Evaluation of a Mileage-Based Road User Charge: Initial Results.* Presentation at TRB 2011 Annual Meeting. National Academies of Science.

99 Lane, C. 2006. *Effect of Gas Prices on Mode Choice.* Parsons Brinckerhoff Quade & Douglas, Inc. Presentation to the Transportation Research Board Energy Committee. Available at: http://cta.ornl.gov/TRBenergy/trb_documents/LANE-Gas%20Price%20Effect%20on%20Mode%20Choice-1-25-06.pdf [accessed on June 18, 2011]

increases also spur drivers to purchase more fuel-efficient cars, with the result that nearly 60 percent of the reduction in gasoline use comes from more efficient engines, not fewer VMT.[100]

Pay-as-you-drive insurance: It could reduce VMT by a meaningful amount, though there are numerous uncertainties, given the size and heterogeneity of the driving population and driving conditions.[101]

Mileage pricing: More consideration has been given to its effectiveness in generating revenues, with other goals, such as reducing emissions and congestion given secondary consideration.[102] What data there is on VMT reduction is insufficient to conclude its impact, though preliminary study suggests it could encourage switching to alternative modes.[103]

Economic Factors

Fuel taxes: Given the complexity of transportation economics, it is difficult to predict the economic effects of raising fuel taxes. Any increase would have to be substantial to produce a significant reduction in VMT.[104]

Pay-as-you-drive insurance: Pay-as-you-drive insurance is expected to reduce the cost of driving for most drivers. Insurance companies could incur start-up costs outweighing any resulting revenue gains, if they were to install complex, real-time monitoring.[105]

Mileage pricing: Due to the lack of data, there has been no rigorous analysis of the economic effects.[106]

Conclusion

Increasing the cost of operating motor vehicles is likely to reduce VMT, although, given the complexities of economic behavior and tradeoffs involving personal transportation decisions, the scope of the reduction is not fully understood.

---

[100] Parry, I.W.H. and K.A. Small. 2005. Does Britain or the United States Have the Right Gasoline Tax? *American Economic Review*, 95 (4): 1276–1289.

[101] Bordoff, J.E. and J.N. Pascal. 2008. *Pay-As-You-Drive Auto Insurance: A Simple Way to Reduce Driving-Related Harms and Increase Equity*. Hamilton Project Discussion Paper. Washington, DC: Brookings Institution. Available at: http://www.brookings.edu/~/media/Files/rc/papers/2008/07_payd_bordoffnoel/07_payd_bordoffnoel.pdf [accessed May 19, 2011].

[102] Sorensen, P., L. Ecola, M. Wachs, M. Donath, L. Munnich, B. Serian. 2011. *Implementable Strategies for Shifting to Direct Usage-Based Charges for Transportation Funding.* NCHRP Web-Only Document 143. National Cooperative Highway Research Program. Transportation Research Board. Washington, D.C. Available at: http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_w143.pdf [accessed May 22, 2011].

[103] Whitty, J.M. 2007. *Oregon's Mileage Fee Concept and road User Fee Pilot Program: Final Report.* November 2007. Oregon Department of Transportation. Available at: http://www.oregon.gov/ODOT/HWY/RUFPP/docs/RUFPP_finalreport.pdf?ga=t [accessed May 19, 2011].

[104] Bordoff, J.E. and J.N. Pascal. 2008. *Pay-As-You-Drive Auto Insurance: A Simple Way to Reduce Driving-Related Harms and Increase Equity*, Hamilton Project Discussion Paper. Washington, DC: Brookings Institution. Available at: http://www.brookings.edu/~/media/Files/rc/papers/2008/07_payd_bordoffnoel/07_payd_bordoffnoel.pdf [accessed May 19, 2011].

[105] Ibid.

[106] Ibid.

Policy 2—Encourage variable tolls and congestion pricing

Definition

Variable tolls: Variable tolls can change either in response to actual demand, known as dynamic pricing, or at pre-determined times.[107]

Cordon/congestion pricing: Prices are set at entries, usually based on time of day and level of congestion.[108]

History of Deployment

Variable Tolls: With the advent of automated toll collection, states began converting their free carpool lanes to toll lanes.[109] As of October 2010, there were high occupancy toll lanes (HOT lanes) in the metropolitan areas of San Francisco, Seattle, Miami, Los Angeles, San Diego, Houston, Salt Lake City, Denver, and Minneapolis-St. Paul.

Cordon/congestion pricing: No cordon pricing has been implemented in the U.S. In 2007, New York City proposed the first cordon for a major city, but it was blocked by the state legislature.[110] In San Francisco, a cordon proposal was shelved after negative public reaction, with a final decision not likely until 2013 or 2014.[111] Singapore, London, and Stockholm are the only large cities with cordon pricing schemes.[112]

Effectiveness and Impact

Toll lanes have been found to improve roadway vehicle throughput, increasing the number of vehicles using the system by smoothing out peak demand; it remains unclear whether they can be used to reduce VMT rather than simply shift VMT to less expensive times of day.[113] Cordon

---

[107] U.S. Department of Transportation Federal Highway Administration. *Congestion Pricing: A Primer*. Available at: http://ops.fhwa.dot.gov/publications/congestionpricing/sec2.htm [accessed April 14, 2011].

[108] Ibid.

[109] U.S. Department of Transportation Federal Highway Administration. 2010. *Value pricing pilot program.* Available at: http://ops.fhwa.dot.gov/tolling_pricing/value_pricing [accessed November 5, 2010].

[110] Schaller, B. 2010. New York City's Congestion Pricing Experience and Implications for Road Pricing Acceptance in the United States. *Transport Policy*, 17 (2010) 266-273. Available at: http://www.nyc.gov/html/dot/downloads/pdf/schaller_paper_2010trb.pdf [accessed May 19, 2011].

[111] San Francisco County Transportation Authority. 2010. Mobility, Access, and Pricing Study. Available at: http://www.sfcta.org/content/view/302/148 [accessed May 19, 2011].

[112] Schaller, B. 2010. New York City's Congestion Pricing Experience and Implications for Road Pricing Acceptance in the United States. *Transport Policy*, 17 (2010) 266-273. Available at: http://www.nyc.gov/html/dot/downloads/pdf/schaller_paper_2010trb.pdf [accessed May 19, 2011].

[113] Lee, K., A.G. Hobeika, H.B. Zhang and H. Jung. 2010. Travelers' Response to Value Pricing: Application of Departure Time Choices to TRANSIMS. *Journal of Transportation Engineering.* 136, 811 (2010); doi:10.1061/(ASCE)TE.1943-5436.0000139 Available at: http://ascelibrary.org/teo/resource/1/jtpedi/v136/i9/p811_s1?isAuthorized=no [accessed May 22, 2011].

pricing in London reduced private automobile, van, and truck traffic by shifting trips to public transit, bicycles and taxis.[114]

Economic Factors

The economic effects of pricing measures that limit access to transportation facilities through tolls or cordons are not fully understood, given the complexities of transportation economics and the need to factor in social welfare gains and losses.[115]

Conclusion

Cordon pricing has been demonstrated to reduce VMT. Further study is needed to determine whether tolling merely shifts trips to other times of day. The economic effects of either approach are not fully understood.

Policy 3—Spur adjustments in the prices for street parking

Definition

Using programmable meters, and inputs from pavement sensors or other data sources, parking meter rates can be changed dynamically.[116]

History of Deployment

Only a few cities have implemented dynamic parking pricing, and most projects are in their early stages.[117,118,119,120,121]

---

[114] Leape, J. 2006. The London Congestion Charge. *Journal of Economic Perspectives*, 20 (4): 157-176. Available at: http://www.jstor.org/stable/30033688?seq=9, p.165 [accessed May 19, 2011].

[115] Viegas, J.M. 2001. Making Urban Road Pricing Acceptable and Effective: Searching for Quality and Equity in Urban Mobility. *Transport Policy*, 8 (4) 289-294.

[116] San Francisco County Transportation Authority. *Value Pricing in San Francisco*. Project Report for the U.S. Department of Transportation. Federal Highway Administration Tolling and Pricing Program. Available at: http://ops.fhwa.dot.gov/tolling_pricing/value_pricing/pubs_reports/projectreports/sfcta_arearoad.htm [accessed May 22, 2011].

[117] Kittelson & Associates. 2008. *Parking Management with Variable Pricing*. December 2008. Available at: http://www.mwcog.org/transportation/activities/tlc/pdf/DDOT-report.pdf [accessed November 15, 2010].

[118] Zack, D. 2005. *The Downtown Redwood City Parking Management Plan*. Available at: http://www.redwoodcity.org/bit/transportation/parking/pdf/DowntownRedwoodCityParkingPlan.pdf [accessed November 15, 2010].

[119] City of Seattle. 2008. *Seattle Urban Mobility Plan: Chapter 7*. January 2008. Available at: http://www.seattle.gov/transportation/docs/ump/07%20SEATTLE%20Best%20Practices%20in%20Transportation%20Demand%20Management.pdf [accessed November 15, 2010].

[120] FHWA. 2009. *Projects Not Involving Tolls: Parking Pricing*. Available at: http://ops.fhwa.dot.gov/tolling_pricing/value_pricing/projects/not_involving_tolls/parking_pricing/index.htm [accessed November 15, 2010].

[121] Performance-Based Parking Pilot Program. District Department of Transportation. Available at: http://ddot.dc.gov/DC/DDOT/On+Your+Street/Traffic+Management/Parking/Performance+Based+Parking+Pilots. [accessed November 15, 2010].

Effectiveness and Impact

Most metered or street parking is not efficiently priced. Availability-based pricing can set prices that insure that sufficient parking spaces are free at any time to eliminate prolonged searches for free spaces, reducing VMT.[122,123] Pricing on-street parking based on availability also reduces VMT by increasing the use of alternative transport modes, and discouraging low-priority vehicle trips.[124]

Economic Factors

The initial cost of installation of parking pricing systems varies depending on the scope of the program, though the operation is revenue-neutral. By reducing demand for new parking spaces, such systems can save money on construction, maintenance, and the like, as well as the opportunity costs associated with foregone land value. Those savings can support reductions in rents or sales prices of properties.[125]

Conclusion

Setting parking prices based on demand and availability, and changing them to maintain an optimum "vacancy rate" is a low-cost or revenue-neutral way to reduce VMT.

1.3.3 Conclusions: Promote a Reduction in Vehicle-Miles Traveled Through Pricing Measures

Pricing measures are a relatively low-cost mechanism for reducing VMT. They target three aspects of motor vehicle transportation: the cost of operating a motor vehicle (fuel prices, insurance prices, and mileage costs); the cost of access to transportation facilities (tolls and cordon charges); and the cost of housing the vehicle at the destination (parking costs).

While increasing the cost of operating motor vehicles is likely to reduce VMT, results are mixed for the individual measures. Fuel taxes would have to increase substantially for any significant reduction. Pay-as-you-drive-insurance and mileage charging schemes would provide incentives to drive fewer miles, but there has been no widespread deployment to test the hypothesis.

Cordon pricing has been demonstrated to reduce VMT, but more study is needed to determine whether tolling merely shifts trips to other times of day or results in absolute reductions. Finally,

---

122 Shoup, D. 2005. *The High Cost of Free Parking*. Chicago: American Planning Association Planners Press. Available at: http://www.uctc.net/papers/351.pdf [accessed June 19, 2011].

123 Litman, T. 2011. *Parking Management Strategies, Evaluation and Planning*. Victoria Transport Policy Institute. Available at: http://www.vtpi.org/park_man.pdf [accessed on June 11, 2011].

124 Shoup, D. 2006. Cruising for Parking. *Transport Policy*, 13 (2006) 479-486.

125 Shoup, D. 2005. *The High Cost of Free Parking*. Chicago: American Planning Association Planners Press. Available at: http://www.uctc.net/papers/351.pdf [accessed June 19, 2011].

parking pricing based on availability has resulted in VMT reductions, both in terms of fewer miles driven "cruising" for spaces and fewer discretionary trips.

1.4 Conclusions for Chapter 1

Reducing human exposure to transportation-related emissions that most directly affect human health—carbon monoxide, nitrogen oxide, ozone, (the primary ingredient in smog), particulate matter, sulfur dioxide, and toxics such as lead—can be accomplished through reducing emissions or reducing exposure or both.

Reductions in human exposure can be accomplished by expanding current monitoring systems by focusing on, for example, urban areas with persistently high ozone levels; siting long-term facilities and those that serve vulnerable populations in a way the provides an adequate buffer away from high-pollution sources, with special attention paid to $PM_{2.5}$ exposure; and continuing to build on the success of advanced motor vehicle emission control technologies and fuel efficiency efforts.

The transportation sector's level of greenhouse gas emissions and its contribution to climate change can be reduced by increasing the share of electric vehicles, though there are unknowns about driver behavior, infrastructure investments, and vehicle costs. Another approach is to reduce size disparities among vehicles by reducing their size overall, which can reduce consumer demand for large vehicles and thereby improve fuel economy and decrease transportation-related greenhouse gas emissions. The new CAFE standards that use a size-based indexing system create incentives for carmakers to reduce size disparities in their fleets.

Another method to reduce overall transportation-related emissions is to use pricing measures to reduce vehicle-miles traveled (VMT). These measures address three elements of transportation: the cost of operating a motor vehicle (fuel prices, insurance prices, and mileage costs); the cost of access to transportation facilities (tolls and cordon charges); and the cost of housing the vehicle at the destination (parking costs). Results are mixed for achieving VMT reductions through changing the price of operating costs. Fuel taxes would have to increase substantially for any significant reduction in VMT. Pay-as-you-drive-insurance and mileage charging schemes would provide incentives to drive fewer miles, but there has been no widespread deployment to test the hypothesis. Changing the way access to facilities is priced also shows varying results. Cordon pricing has reduced VMT in some settings. In the case of tolling, more study is needed to determine whether it causes absolute reductions or merely shifts trips to other times of day. Parking pricing has resulted in VMT reductions, both in terms of fewer miles driven "cruising" for spaces and fewer discretionary trips.