FUNDING FOR HIGHWAY ASSET CONSTRUCTION AND MAINTENANCE: SUSTAINABLE ALTERNATIVES TO THE TRADITIONAL GAS TAX

Author:
Matthew Volovski
Purdue University
mvolovsk@purdue.edu

INTRODUCTION

The funding needed for highway construction, rehabilitation, maintenance, and operations are obtained from various highway revenue sources. At the current time and in the foreseeable future, most highway agencies face a funding gap which occurs whenever the needed funding exceeds the revenue generated. The increasing levels of needed funding are derived from the depressed state of the United State's transportation infrastructure, as the roads and bridges have been assigned D and C+ grades respectively (American Society of Civil Engineers (ASCE), 2013).

Researchers and highway related organizations have stated that there is excessive unmet need for highway asset reconstruction, rehabilitation, and maintenance. The nation will need to invest $20.5 billion annually to eliminate the deficient bridge backlog by 2028, which is approximately 60% greater than current funding levels (ASCE 2013). In response to Transportation Equity Act for the 21st Century (TEA-21) and Moving Ahead for Progress in the 21st Century Act (MAP-21), federal, state, and local capital investments in highways have increased to $91 billion annually; however, that is still below the $170 billion annual capital investment that is needed to significantly improve road conditions and performance. These needs can be attributed to the aging highway infrastructure, the consequences of deferred reconstruction and rehabilitation, and increased demand and loading due to population growth that has far out-paced capacity expansion (Figure 1).

Figure 1 Demand and Capacity Growth Comparison (Centerline-mile and VMT data are from BTS (2012) Table 1-6 and 1-36, respectively)

The majority of revenue collected by highway agencies is generated from vehicle registrations, license fees, and excise tax (predominately fuel taxes). These revenues are not expected to grow significantly to match needs; a prognosis that arises from recent and ongoing developments in the highway transportation environment including lower fuel consumption (due to increasing vehicle fuel efficiency and increasing percentage of vehicles that use of alternative energy), stagnation of the fuel tax rate, and uncertainty in forecasted travel demand.

The imminent widening of the funding shortfall has precipitated calls for new strategies for highway financing or improvement of existing mechanisms. It is desired that these new strategies help agencies achieve their finance-related goals of revenue adequacy, equity across the various users of the highway system, and feasibility of application from a technological, cost, and public relations standpoint. In addressing the issue, this paper identifies, examines, and evaluates a number of alternatives for sustainable funding for highway asset construction and maintenance, particularly in a bid to supplement or replace the traditional gas tax, which, for several decades, has been the primary source of revenue.

TRENDS THREATENING THE ADEQUACY OF TRADITIONAL FUNDING MECHANISMS

The current and ongoing developments in the highway transportation environment pose serious obstacles to the long-term sustainability of the current funding sources. First is the loss of purchasing power because fuel taxes are not indexed to inflation or fuel price. Thus, while fuel prices have increased since

the late 1990s, fuel tax rates have not resulting in a decrease in the effective fuel tax rate (Federal Highway Administration (FHWA), 1997). Wachs (2003) suggested that raising fuel taxes would be more effective, efficient, and equitable than other revenue-generation mechanisms. However, most elected officials are unwilling to increase gas taxes, rather opting for borrowing, local sales tax, and other initiatives. Second is the influx of alternative energy sources. As alternative energy systems become more common, fuel taxes are not expected to generate the needed revenue for highway management (Whitty, 2003). Third is the increased fuel efficiency, driven by regulations and consumer demand, which is resulting in lower fuel tax receipts per mile traveled (Figure 2). The Transportation Research Board (TRB), 2006) estimated that with continued improvements in fuel economy, the average fuel consumption per vehicle mile can be expected to reduce by 20 percent by 2025.

Figure 2 Revenue and Travel Trends, Trust Fund and VMT data are from OHPI (2012) Table FE-210 and BTS (2012) Table 1-36, respectively

Fourth is the erosion of established finance practices. As pointed out by the TRB in its 2005 special report, some potential sources of stress in highway financing are evident, particularly in certain states where the local share of responsibility is high, for example, pressures to spend portions of highway revenue on non-highway purposes.

PAST RESEARCH ON ALTERNATIVE FINANCING MECHANISMS

Transportation administrators and researchers have long recognized the problem of inadequate highway revenue and have made efforts to address the issue from the needs side through better materials and design and from the revenue side by identifying and evaluating sources of additional revenue. Reno and Stowers (1995) identified and evaluated alternatives to motor fuel taxes for financing surface transportation improvements, TRB's Special Report 285 (2005) provided a comprehensive review of different sources of additional revenue including increases in the gas tax, debt financing, toll pricing, and mileage charging; and individual states have commissioned studies to identify evaluate alternatives to the gas tax (Oh et al., 2008; SCDOT, 2003; Oregon, 2003; Adams et al., 2001). Goldman et al. (2001) and Hamideh et al. (2007) examined the effectiveness of local option transportation taxes, and Verhoef and Rouwendal (2004) examined the pricing and financing in transportation networks. Wachs (2003) offered multiple reasons for increasing the gas tax, and the effectiveness of doing so was evaluated by VTPI (2005).

EVALUATION CRITERIA FOR FUNDING ALTERNATIVES

The criteria for evaluating the highway funding alternatives include sufficiency, economic efficiency, equity (spatial and across vehicle modes), and accommodation of jurisdictional and functional independence, practicality, and ease of implementation.

First, the pricing scheme should be sufficient in that it should generate adequate revenue to not only replace current funding sources but also to close the funding gap going forward. Second, economic efficiency considerations dictate that that the funding mechanism should contribute to the success of the highway program by helping ensure a positive return on the investment and therefore ensure that motorists are charged prices that closely matched the cost of their road use (TRB, 2005). Equity in a transportation system has three facets: cost, benefit, and ability to pay (Adams et al., 2001). Often, equity is measured on the basis of user costs due to difficulty in measuring user benefits or determining the appropriate level of regressiveness for implementation.

With regard to jurisdictional and functional independence, it is noteworthy that the highway system in any state is typically administered and maintained by several different levels of government (the most

visible of which are state and local). However, not every governmental unit is self-financed. Lower-level governments are often subsidized by their higher-level counterparts at levels that depend on their asset inventory. Further, it must be practical to develop estimates for any proposed financing mechanism using available data. Also, it must be feasible to implement the new financing mechanism considering the additional investment in hardware, software, manpower, and other resources for administration and enforcement.

REVENUE GENERATION ALTERNATIVES AND A PROMISING SOLUTION

The simplest alternative to the current funding mechanism is to increase the current gas tax rate. While easier to implement compared to other mechanisms, the primary obstacle is the political difficulty of raising the existing fuel taxes (Feigenbaum, 2012). Another alternative is to index the fuel tax rates to inflation or roadway costs. The Carbon Tax (VTPI, 2005b) is an alternative that could be imposed to reflect the amount of carbon emitted and could have a secondary benefit of controlling emissions. A third option is to implement a general sales tax to motor fuel; this could generate large amounts of revenue in a favorable economy but is extremely volatile and susceptible to economic fluctuations (Feigenbaum, 2012). Yet another option is to implement a value tax, which is a personal property tax based on the car's value. The value tax could be deducted from the federal income tax, thus transferring tax revenue from the general budget to the United States Department of Transportation, removing some equity issues that are associated with flat registration fees. The sixth option is tolling: a toll program is typically more appropriate for specific assets but is an efficient mechanism (because it is based on vehicle miles traveled (VMT) and vehicle class) and hence could raise sufficient revenue for reconstruction and rehabilitation of specific highway segments. It could also provide additional benefits such managing congestion and helping to gain public appreciation of direct user charging. However, tolling introduces problems of equity across the income classes. The fifth option is the VMT Tax, where user pays according to distance traveled (and in some cases, weight). Using information and communication technology, the fees are assessed according to VMT, the functional class of roads used, vehicle class and weight, and traffic conditions. Other options include bonds, grants, loans, and public-private partnerships (PPPs).

The VMT fee appears to be the most promising technique for directly assessing road users for the costs of individual trips within a comprehensive fee scheme that will generate revenue to cover the costs of highway programs. This mechanism could be used to offset external environmental and societal costs (reduced cost for lower emission vehicles or vehicles manufactured within the state or country). Data is currently available to establish the VMT pricing scheme: expenditure data is available from sources including FHWA's Highway Statistics, funding needs data from a needs assessment studies, and travel demand data from the states' Statewide Travel Demand Models (ISTDM).

VMT fees can be used to promote funding equity. A transportation policy may, by design or default, treat user groups differently according to residential or work locations. It is not uncommon for higher-level governments (federal or state) to subsidize highway construction in areas that have small populations. To address spatial equity, the VMT fee can be developed by decomposing the state highway network into rural and urban classes. Also, in developing a VMT fee, equity can be incorporated by decomposing the entire system into user groups (vehicle classes and weight groups) and facility classes (highway functional class) and establishing separate welfare functions for each of these clusters. Thus, the VMT fee can help achieve equity across vehicle modes. For example, the FHWA's Highway Cost Allocation Study (1997) established that single-unit trucks over 50,000 lb pay only 40% of the damage costs they inflict on the system while pickups yield more revenue than the costs they incur. VMT fees can help correct such imbalances by applying appropriate fee rates for the different vehicle classes. With regard to jurisdictional and functional independence, the VMT fee mechanism allows user fee rates to be established for each jurisdictional or functional highway class to cover expenses within that jurisdiction.

CONCLUSION

This paper examined the experience of federal and state agencies that have used or experimented with innovative funding mechanisms. This helped identify the design of the pricing scheme impacts on users, technology issues, legal and institutional issues and barriers to implementation including public acceptability. A VMT fee mechanism offers what may promise to be the most sustainable solution because it has the greatest potential in achieving revenue adequacy and equity among the different classes of highway users. However, the implementation of the VMT fee is expected to involve a large capital outlay at its inception due to technological hardware and software. Also, issues related to change inertia and privacy are expected to cause public opposition at least at the initial stages of its implementation. Governments must decide on the goals of the effort, authorities for setting fees and controlling revenue, the basis for determining fees, and how best to involve the private sector. Resolution of privacy and fairness concerns will be a prerequisite. As Oh and Sinha (2007) pointed out, the experience of several agencies has shown that the costs and barriers to implementation are expected to decline as the initial period wears off.

As cautioned by the TRB Special Report 285 (2005), a reformed finance system would remain subject to many of the external political and economic constraints that limit the revenue potential of the present system. However, reform would help transportation agencies manage capacity and target investment to projects with the greatest benefit to the public. Each dollar spent would be more effective and it is conceivable that the public would be willing to pay more for transportation programs that worked better.

REFERENCES

1. AASHTO (2002), Transportation – Invest in America: The Bottom Line. American Association of State and Highway Transportation Officials, Washington, D.C.
2. Adams, M., Hiatt, R., Hill, M.C., Russo, R., Wachs, M., Weinstein, A. (2001), Financing Transportation in California: Strategies for Change. Institute of Transportation Studies, University of California at Berkeley.
3. ASCE (2013), 2013 Report Card on America's Infrastructure. American Society of Civil Engineers. from http://www.infrastructurereportcard.org/grades/
4. BTS (2012), National Transportation Statistics. U.S. Department of Transportation, Bureau of Transportation Statistics. from http://www.bts.gov/publications/national_transportation_statistics/
5. Feigenbaum, B. (2012), Insights on Federal, State and Local Transportation Funding from 'The Voice of Transportation'. Reason Foundation. from http://reason.org/news/show/insights-on-federal-state-and-local
6. FHWA (1997), 1997 Federal Highway Cost Allocation Study. United States DOT, from www.fhwa.dot.gov/policy/hcas/summary/index.htm
7. Goldman, T., Corbett, S., Wachs, M. (2001), Local Option Transportation Taxes in the United States. Institute of Transportation Studies, University of California at Berkeley
8. Mannering, F. L. Oh, J., Labi, S., Hamideh, A. (2008), Public Acceptance of Local Government Transportation Sales Taxes: A Statistical Assessment, State and Local Government Review (40)3
9. Mayeres, I., Proost, S. (1997), Optimal Tax and Public Investment Rules for Congestion Type of Externalities. Scandinavian Journal of Economics 99
10. Oh, J., Labi, S., Sinha, K.C. (2007), Implementation and Evaluation of Self-Financing Highway Pricing Schemes - Numerical Analysis for the State of Indiana. Transportation Research Record 1966.
11. OHPI (2012), Highway Statistics 2012. U.S. Department of Transportation, Federal Highway Administration, Office of Highway Policy Information, from http://www.fhwa.dot.gov/policyinformation/statistics/2012/index.cfm

12. Reno, A.T., Stowers, J.R. (1995), NCHRP Report 377: Alternatives to Motor Fuel Taxes for Financing Surface Transportation Improvements. Transportation Research Board, National Research Council, Washington, D.C
13. SCDOT (2003), Transportation Funding Options for the State of South Carolina 2003-2022, Transportation Funding Series Special Report 3. South Carolina Department of Transportation
14. TRB (2005), Special Report 285: The Fuel Tax and Alternatives for Transportation Funding, Committee for the Study of the Long-Term Viability of Fuel Taxes for Transportation Finance. Transportation Research Board, Washington D.C.
15. Verhoef, E. T., and Rouwendal, J. (2002), Pricing, Capacity Choice, and Financing in Transportation Networks. Journal of Regional Science 44.
16. VTPI (2010), Evaluating Pricing Strategies – Factors to Consider When Evaluating TDM Strategies that Change Transportation Prices. Victoria Transport Policy Institute, TDM Encyclopedia, from http://www.vtpi.org/tdm/tdm70.htm (Updated May 9, 2012)
17. VTPI (2010), Fuel Taxes – Increasing Fuel Taxes and Fees. Victoria Transport Policy Institute, TDM Encyclopedia, http://www.vtpi.org/tdm/tdm17.htm (Updated May 9, 2012)
18. Wachs, M. (2003), A Dozen Reasons for Raising Gasoline Taxes, UCB-ITS-RR-2003-1, ISSN 0192-4095.
19. Whitty, J. (2003), Road User Fee Task Force: Report to the 72nd Oregon Legislative Assembly on the Possible Alternatives to the Current System of Taxing Highway Use Through Motor Vehicle Fuels Taxes, Oregon DOT.