Commission Briefing Paper 5B-01

Assessment of International Experience in Transitioning to New Transportation Revenue Sources

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Date: January 10, 2007

Introduction

This paper is part of a series of briefing papers to be prepared for the National Surface Transportation Policy and Revenue Study Commission authorized in Section 1909 of SAFETEA-LU. The papers are intended to synthesize the state-of-the-practice consensus on the issues that are relevant to the Commission's charge outlined in Section 1909, and will serve as background material in developing the analyses to be presented in the final report of the Commission.

This paper presents information on the international experience with implementation of new revenue sources associated with transportation user charges, typically collected via tolls or other fees for use of the transportation facility. There are more than 30 years of experience to draw on from locations across the globe, with some lessons learned about key factors to consider when implementing similar user charges in the U.S. This paper focuses on the introduction of new revenue sources for transportation investment through the implementation of user charges. Some of these user fee schemes are implemented through public-private partnerships (PPPs). While other benefits are afforded through the use of PPPs, such as expedited project delivery or project cost savings which may reduce project costs, this paper addresses the international experience with new revenues for transportation.

Background and Key Findings

Internationally, the experience in transitioning to new revenue sources for transportation has been far more extensive than in the United States in recent decades. In part, this is due to different governmental structures and public policies that are more supportive of these sources, to traditions that may be more accepting of tolling or pricing, and to different tax structures that in some cases may make private investment more competitive with traditional public investment. Equally important, most other countries fund transportation infrastructure from general revenues, as opposed to dedicated user fees as is the case in the U.S. While it is also true that other countries tend to have much higher fuel taxes, these taxes are deposited in the countries' general funds and are used to fund a whole host of needs, not just transportation. The ongoing competing demands for these general revenues arguably helped lay the groundwork for new approaches to funding needed transportation projects internationally.

The types of sources that this review covers include tolling, congestion pricing (including cordon pricing and value pricing) and distance based fees. In determining which transportation improvements might most effectively be developed through transitions to new revenue sources, key factors include:

- Development of a clear policy rationale for the proposed new revenue source;

This paper represents draft briefing material; any views expressed are those of the authors and do not represent the position of either the Section 1909 Commission or the U.S. Department of Transportation.

- Understanding and addressing the equity and privacy issues that may result from the new source;
- Building administrative, legal, and enforcement strategies that will facilitate the efficient and effective collection of the revenues;
- Building political and public support.

For those sources involving the private sector, the private sector involvement in transportation projects and financing is driven by a profit motive, and therefore will be most promising for those needs that are anticipated to result in high traffic volumes and profits delivered via tolls or other user fees.

This paper summarizes experience abroad, and suggests how lessons learned might be applied in the U.S. Key findings in this paper were developed through a literature review and interviews with select experts.

Types of User Charges

This paper is concerned with the new revenue sources, primarily user fees that can be implemented to raise new capital for transportation investments. Some of these user fee schemes are implemented through PPPs. While there are other efficiencies that can be afforded by PPPs, the focus here is on the new revenue sources brought to investment needs.

Most often, these new revenue sources are tolls or some other charge paid by the user of a transportation facility. Such user charges can be implemented in multiple forms, including:

- Tolling – refers to a traditional toll system, in which users pay a fee or toll based on a fixed schedule. Toll revenues are utilized to support operations and maintenance, and to pay debt service on bonds issued to finance the toll facility. With tolling, the main objective is revenue generation, without regard to traffic management issues or to the economic efficiency of the transportation system. Private concessions and PPPs have been extensively used in Europe to build, finance and operate new tolling facilities.
- Congestion pricing – refers to the use of tolls to manage demand and maximize economic efficiency, with revenue generation as a secondary objective. Fees may vary by time of day or with traffic conditions to manage demand. Cordon tolling and value pricing are types of congestion pricing. Note that of the examples presented in this paper, cordon tolling has been successful at both managing congestion and providing additional revenues, whereas the variable pricing applications in Japan and France have been successful at managing demand, but no excess revenue generation has been achieved.
    - Cordon Tolling – tolls that are charged to drivers entering and/or traveling within a particular area. In some instances, cordon tolls are only charged for trips during peak periods.
    - Value Pricing – tolls are variable, based on traffic demand. Typically, tolls are lower when demand is low, and increase as demand for the facility increases to manage traffic levels, and ensure that travel times are maintained at certain level.

- Distance-based pricing (vehicle miles of travel fees) – refers to a user fee based on the distance traveled on a particular facility or within a particular area (such as a country, state, or city).

International experience with these types of transportation user charges is summarized in the next section.

International Experience

The collection of tolls or other fees for use of transportation facilities is increasingly common in many countries, including European Community countries such as the United Kingdom, France, Italy, Germany, Switzerland, Poland, Hungary, and Portugal, as well as Australia, China, Argentina, Singapore, and Norway. This paper presents some examples of implementation of PPPs and private concessions, cordon tolls, value pricing and distance-based pricing in European and Asian countries.

PPPs and Private Concessions

Private concessions for road investments have been widely used in Europe, with Spain and France pioneering the use of PPPs to developed their toll network.[1] Other European countries, such as Portugal and Italy have also use road concessions to design-build-finance-operate highway facilities. China and India have large highway programs that are being financed through concessions.[2] China's highway program consists of the construction of 53,000 highway miles by 2020, with 90 percent of the cost being financed with tolls. India's program is second to China's, with 20 concessions already in place. Forty-eight concessions are in the process of being let for $12.5 billion of new expressways and divided highways, covering 6,000 miles. In recent years, PPPs for developing toll roads in the U.S. have emerged, with some of these international concessionaires also investing in the U.S.

France. In France[3], public motorway companies have been in existence since the late 1950s. In 1970, four private motorway concessionaires were set up. Of these four, only Cofiroute survived the difficult initial stage, i.e. the impact of the oil crisis of the mid-1970s and the massive increase in costs of both capital and construction of the early 1980s. There were two reasons behind Cofiroute's survival: one, its sound investment policy, with investment plans oriented towards cautious forecast and high enough traffic flow and two, strictly avoiding construction cost overruns. In 2005, Cofiroute's toll revenues were over €875 million (about $1,150 million USD)[4] and a net profit of almost €283 million (about $370 million USD). The other three private operators failed because the investment plans of their toll concessions turned out to be commercially unrealistic. The French government nationalized them, bringing the total of public

[1] Perez, Benjamin, James W. March. *Public-Private Partnerships and the Development of Transport Infrastructure: Trends on Both Sides of the Atlantic.* First International Conference on Funding Transportation Infrastructure, Institute of Public Economics at the University of Alberta. August 2006.
[2] The Regional Business Council, Mississippi River Bridge Study and Report: Report on Private-Public Partnerships. January 2006.
[3] Private Toll Road Concessions World-Wide, Wim Westerhuis, Director General, IRF Geneva Programme Center,; presented at Confederation of Indian Industries, Delhi, India; March 2000
[4] US dollar (USD) ≈ €0.76 as of December 18, 2006.

concessionaires to six today. Basically, they are also highly profitable. Net profits, however, are substantially reduced by a built-in inefficiency in the French publicly operated motorway system, based on cross subsidy. This system calls for high-profit routes to subsidize low-profit or unprofitable routes, which, in some cases, have more lanes than needed and were built for political or electoral reasons. This built-in inefficiency can result in a loss of financial discipline and the risk of misallocating resources.

Macquarie IPOs[5]. One concept that has not yet been widely considered in the U.S. involves public share offerings, like the initial public offerings (IPOs) offered by Macquarie. There appears to be a market for institutional investors in infrastructure IPOs, which can provide a portion of the equity needed by concessionaires. One notable example is a recent Greenfield toll project – an inherently risky undertaking – in the eastern suburbs of Melbourne, Australia which has been funded through an IPO; in fact the offering was oversubscribed (Macquarie is part of the concession for this project). Perhaps such IPOs will emerge as the concession market in the U.S. begins to mature. While no IPOs have been created using toll projects, U.S. firms have done IPOs for other types of infrastructure (e.g., energy), and some have participated in several toll road IPOs around the world (e.g., China, Israel, and Italy).[6]

Cordon Tolls[7]

Singapore. The first road pricing scheme was implemented in Singapore in 1975. The cordon toll is variable, ranging between $0.50 SGD to $3.50 SGD ($0.32 to $2.26 USD)[8]. Initially, the cordon toll was fixed and consisted of a fee on vehicles driving within a designated area during the morning hours, and required the purchase of a $3 SGD (about $1.94 USD) permit. At present, the cordon toll varies based on vehicle type, location, day of week and time of day. Traffic conditions within the cordon area are monitored and fees are adjusted every three months to ensure that travel speeds are maintained at specified levels [i.e., 45-60 km/hour (28-37 mph) on expressways and 20-30 km/hour (12-19 mph) on arterial roads]. The system operates using in-vehicle units, smart cards and enforcement through camera and license plate reading equipment.

The cordon toll in Singapore has been successful at reducing traffic congestion. When the cordon toll was introduced in 1975, a significant number of travelers shifted from single-occupancy vehicles (SOV) to carpooling and public transportation, with the latter experiencing an increase of 21 percent. Public and political opposition to the system has been limited; historically, Singapore's government has had significant control over auto ownership and use through vehicle quotas and high registration taxes. In addition, because the main purpose of the cordon toll is to reduce auto use and congestion, cordon toll revenues have been invested in transit, including the construction of rail systems over the last two decades. The cordon tolls generate approximately $80 million SGD (about $51.7 million USD), of which 20 percent goes to cover operating costs.

[5] Interview to Bob Poole (Reason Foundation), December 21, 2006.
[6] E-mail from Jim Taylor (Mercator Advisors, LLC), January 2, 2007.
[7] Most of the information provided in this section was summarized from FHWA's *International Urban Road Pricing (Final Report, June 2006*), unless noted.
[8] $1 US dollar (USD) ≈ $1.55 Singapore dollar (SGD) as of December 18, 2006.

Another major obstacle was developing a system that would be flexible enough to change as traffic conditions and technology evolves over time. The introduction of the electronic toll collection system (ETC) facilitates a flexible system, which has evolved significantly over time.

London, United Kingdom. Cordon tolls were implemented in London in 2003. Currently, the cordon toll is £8 (about $15.60 USD)[9] for vehicles entering Central London on weekdays between 7:00 am and 6:30 pm. The cordon toll zone will be expanded to the west in early 2007 to encompass other congested areas in London (Kensington, Chelsea, and Westminster). Cameras installed at entry points of the cordon area record the license plates of vehicles entering the cordon area. The fee can be pre-paid or paid on the day of travel. Failure to pay the cordon toll results in fines, with penalties ranging between £50 and £175 (about $97 to $341 USD).

The cordon toll in London has been successful in reducing congestion in central London, and consequently, revenues have fallen short of initial projections. By the end of 2005, average delay reductions within the cordon zone were estimated at 26 percent compared to pre-charge levels[10]. Car traffic into the cordon zone has dropped by 30 percent, compared to pre-charge levels. Gross revenues for the first year of operation had been projected at £120 million ($233.8 million USD), assuming the initial fee of £5, increasing to £130 million ($253.3 million USD) in subsequent years. Net revenue during the first year of operations were £68 million ($132.5 million USD). For the fiscal year 2005, net revenues are estimated at £122 million ($237.7 million USD), including additional revenues from the fee increase; most of the net revenues (over 80 percent) were used for bus service improvements and enhancements[11]. Operating costs of the system are approximately 42 percent of the gross revenues. Operating expenses has also exceeded projections due to higher costs of enforcement.

The successful implementation of the cordon toll scheme in London was due, in part, to the strong support of London's mayor, Ken Livingstone, and public acceptance. Mayor Livingstone included congestion pricing as one of the main issues in his political platform and remained committed to the proposal. Public acceptance was gained through the mayor's commitment to reduce congestion in Central London and to address equity issues by improving public transportation into the cordon zone. It also required the development of several exemptions and discounts, which in turn have resulted is lower revenues; 23 percent of the vehicle entering the cordon zone are exempt.[12]

The technology used to implement the cordon pricing in London consists of a video-based license plate recognition system, which was easy to implement. The main limitation of the system, however, is that this technology does not allow for the implementation of variable pricing. Transport London is currently exploring the use of technology for more flexible charging.[13]

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[9] $1 US dollar (USD) ≈ £0.51 as of December 18, 2006

[10] Transport for London, *Central London Congestion Charging – Impacts Monitoring*, Fourth Annual Report, June 2006.

[11] Ibid.

[12] University of Minnesota. *Pricing Experience in Northern Europe: Lessons Learned and Applicability to Minnesota and the U.S.* October 2006.

[13] Ibid

Value Pricing[14]

Autoroute A1, Northern France. Autoroute A1 is a toll facility in Northern France (between Paris and Lille) operated through concession by Sanef, which is one of the largest road concessionaires in Europe. A variable toll was implemented in 1992 to address congestion problems into Paris on Sunday afternoons and evenings. Tolls are increased by 25 to 56 percent between 4:30 pm and 8:30 pm; and reduced by the same rate two hours before and two hours after the peak period. The regular toll between Paris and Lille is estimated at €13 (about $17 USD)[15]. Variable pricing has also been implemented on Autoroute A5 (Paris to Troyes). In this facility, operated by the Societè des Autoroutes Paris-Rhine-Rhone (S.A.P.R.R.), tolls are increased by 25 percent during peak congestion periods, and reduced by 15 percent during periods of moderate congestion and by 35 percent without congestion.

The main purpose of the variable pricing was to shift traffic to non-peak periods to reduce congestion, **not revenue generation**. Variable pricing is supported by the French government, as long as they meet the following provisions:

- Users using the same facility should pay the same toll, unless travel conditions, such as congestion, are different;
- Variable tolls cannot be implemented as a source to increase revenue. For that reason, when tolls are increased during the peak period, they should be reduced during the off-peak;
- The system should be easy understand by travelers; and
- Variable tolls may be implemented to improve safety.

Public acceptance was favorable for two reasons: 1) extensive public involvement; and 2) assurance that toll increases were not designed to increase revenues, but to manage congestion.

Japan. Variable tolls were introduced in 2003. Tolls are reduced up to 50 percent for travel during the off-peak periods and on long distance trips. The purpose of the value pricing scheme is to shift traffic from congested non-tolled roads to parallel toll roads that are less congested.

The toll system in Japan is the largest in the world. Toll rates are set such that sufficient revenues are generated to cover capital, operating and maintenance expenses. The main concern raised through the implementation of variable tolls is that toll revenues could decline and will not be sufficient to cover existing costs. In that case, variable tolls are only justifiable if the public benefits (e.g., reduced congestion, improved air quality) are larger than the lost revenue. In the case of the city of Aganogawa, a 50 percent reduction in tolls resulted in significant traffic increases on the toll facility, offsetting any revenue losses with the reduced toll rate. On the other hand, in the city of Hitachi, a 50 percent discount resulted in revenue losses of ¥600,000

[14] Most of the information provided in this section was summarized from FHWA's *International Urban Road Pricing (Final Report, June 2006*), unless noted.
[15] $1 US dollar (USD) ≈ €0.76 as of December 18, 2006

(about $5,100 USD)[16] per day, but daily travel time savings were estimated at ¥15 million (about $127,100 USD).

Distance-based Pricing[17]

Switzerland. In 2001, Switzerland implemented a heavy vehicle fee based on distance traveled. The charge is applied to heavy vehicles (weighting more than 3.5 tons) traveling on all Swiss roads. The distance-based fee was initially set at 1.68 Swiss cents per ton-kilometer (2.22 US cents per ton-mile)[18], and increased to 2.44 Swiss cents per ton-kilometer (3.23 US cents per ton-mile). In 2008, the fee will be increased to 2.75 Swiss cents per ton-kilometer (3.63 US cents per ton-mile); the increase will become effective as the construction of a new rail link across the Alps is completed. The per-kilometer rate depends on the vehicle's weight limit (maximum allowable = 40 tons) and the vehicle emissions class. Two-thirds of the revenues collected through the heavy vehicle fee are used for rail infrastructure, whereas the remaining is dedicated to road construction and maintenance.

The heavy vehicle fee collection system consists of on-board units that record the distance traveled within Switzerland using a tachometer and a GPS component. The system is mandatory for all Swiss-based heavy vehicles. Foreign vehicle can pay the fee through a manual system, in which a chip card and inspection of the tachometer is conducted when entering the Swiss border, and the fee is calculated and paid as the vehicle leaves the country.

Public and trucking industry support were the biggest obstacles to the implementation of the heavy vehicle distance-based fee. The fee proposal gained public support after provisions were included that specified the uses of revenues for major rail projects and road improvements. The trucking industry support was obtained through the increase of heavy vehicle weight limits (from 28 tons to 34 tons in 2001, increasing to 40 tons in 2005).

Germany. The heavy vehicle distance fee in Germany was implemented in 2005, and is applied to heavy vehicle weighing 12 tons or more traveling on the autobahn. The fee is variable, based on distance traveled, emission category and number of axles of the vehicle. It ranges between €0.10 and €0.17 ($0.13 to $0.22 USD) per kilometer (i.e., approximately $0.21 to $0.35 per mile). The distance-based fee strategy was implemented to create competition between freight transportation modes, to finance transportation infrastructure needs, and to introduce innovative techniques of road pricing. Half of the net revenues are dedicated to rail and inland waterway infrastructure; revenues are also used to support road investments.

The fee collection system consists of an on-board unit that contains a GPS receiver, a digital map and a mobile phone that communicates with the payment center. Foreign vehicles and those without the on-board system can pay the fee through a manual system. The manual system requires registration prior to traveling on Germany's expressways.

[16] $1 US dollar (USD) ≈ ¥117.9 as of December 18, 2006
[17] Most of the information provided in this section was summarized from FHWA's *International Urban Road Pricing (Final Report, June 2006*), unless noted.
[18] $1 US dollar (USD) ≈ 1.22 Swiss francs (CHF) as of December 18, 2006

Technology problems were the main obstacles to the implementation of the heavy vehicle distance-based fees in Germany. The system was scheduled for opening in 2003, but technical problems associated with the electronic collection system delayed implementation until 2005. Some of this issues where related to additional testing time required (the German electronic collection system is incompatible with other existing electronic toll collection systems in Europe), and resistance from foreign carriers to install the new on-board system. Public concern regarding the heavy vehicle fee included potential diversions of freight traffic onto local roads, and a future of extension of the distance-based fee to all vehicles. There are future plans to implement the charge on some parallel routes to the autobahn system to reduce diversion.[19]

Key Factors in Transitioning to New Revenue Sources

There are several key factors in transitioning to new revenue sources that are underscored by the experience from abroad. These factors are discussed below.

Develop Clear Policy Rationale. A clearly stated, logical, and technically supported rationale is needed for whatever course of action is pursued, including clarity on the problem to be solved, how new funding sources will be established, and how the new revenues will be used. Some of the less successful examples abroad result from the lack of a clear statement of the rationale for the project and/or description of the consequences of inaction. Understanding and articulating the problem to be solved – e.g., congestion reduction versus generation of additional revenues – is of paramount importance at the outset, and must be clearly communicated to stakeholders. For example, congestion pricing initiatives in the Netherlands under consideration since the mid-1990s failed due to a distrust of government intent for the initiatives and a lack of understanding of how prices would be determined and how revenues would be used.

Address Equity and Privacy Issues. Equity and privacy are frequent concerns for the traveling public when confronted with new revenue concepts. In terms of equity, the benefits received for the price paid must be demonstrated. This involves both geographic equity – are the boundaries of a user charge established so as not to unfairly impact user groups within or outside the affected area – and social equity. For example, do those who can afford to pay a toll receive disproportionately more benefits than the poor, and in contrast, are the poor unfairly impacted by pricing policies over which they have no control, either as a result of less flexible work hours or because they must pay disproportionately higher costs to use the transportation facility? On the privacy side, technical schemes must be developed to prohibit the misuse of information about individual travel behavior. In the case of London, the cameras take pictures of license plates only, not the entire vehicle or the passenger, and pictures are deleted once a match between a license plate and a legal vehicle is made.[20] Failure to consider and address these issues can lead to resistance for proposed revenue sources, as was the case in Edinburgh, where concerns about the structure of a cordon pricing scheme outside of the city resulted in an overall failure of the scheme, which was perceived as unfair for certain stakeholders.

[19] University of Minnesota. *Pricing Experience in Northern Europe: Lessons Learned and Applicability to Minnesota and the U.S.* October 2006.
[20] Ibid.

Build Administrative, Legal, and Enforcement Strategies. Experience from abroad clearly indicates that overly complex user fee systems – in terms of establishing who pays, how much, how, when, and where – will undermine implementation efforts and may even cause those efforts to fail. Moreover, the legal and administrative structures need to be in place to permit such systems. For example, with the establishment of the European Union and the resulting relief from trade barriers between member nations, two countries – Switzerland and Germany – were able to successfully implement distance-based pricing programs to better control freight traffic on European highways and to collect fees from heavy vehicles operating on these highways, regardless of country of origin or destination of the shipment. The ability to leverage existing structures, rather than create entirely new ones, will also lead to more easily implemented and cost effective systems.

Build Political and Public Support. Some of the largest obstacles to user charges will be from the users themselves, and the elected officials who represent those users. Failure to consider the perspectives of the users and to build both public and political support will result in failure of the user change scheme. Ideally an elected official will become the champion of the scheme, as was the case for the London cordon toll. Yet consideration must also be given to election cycles and the possibility that new leadership will be elected before the user charge scheme is fully implemented.

The international examples presented here show the importance of public support to the successful implementation of new user fees. As mentioned above, equity and privacy issues should be addressed. In some instances, successful initiatives include specific plan and program of investments that will be implemented with the new revenues. The case studies presented above show that public support was increased when revenues are used to improve alternate modes of transportation (e.g., public transportation, freight rail). Goals of the road pricing initiative should be defined, and continuous monitoring of their performance is important to gain public confidence. A scan of European pricing projects conducted by the University of Minnesota (?) indicates that while public opposition was initially significant, the majority approved these systems after implemented, and the benefits of the pricing schemes became evident.[21]

In many instances, political champions are important for the implementation of new fee schemes. In the case of the cordon tolls in London, Mayor Livingstone's support of the initiative was key for moving forward with the implementation of the new use fee. In Singapore and Japan, the initiatives were authorized and implemented by the national government, which led to greater potential for implementation.

CONSOLIDATED COMMENTS FROM MEMBERS OF THE BLUE RIBBON PANEL OF TRANSPORTATION EXPERTS - PAPER 5B-01

One reviewer commented as follows:

[21] Ibid.

This paper provides a useful survey of international experience. On page 9 it notes the need to consider user and elected official perspectives, but does not expand upon it. Elaboration on international experience in developing user consensus and acceptance (in countries that care about such things) would be useful.