Title

Task A-2: Implementation and Management of Electronic Roadway Tolling: Lessons from Successful Cases

Authors

Kalauskas, Rebecca
Taylor, Brian D.
Iseki, Hiroyuki

Publication Date

2009

CALIFORNIA PATH PROGRAM
INSTITUTE OF TRANSPORTATION STUDIES
UNIVERSITY OF CALIFORNIA, BERKELEY

Task A-2: Implementation and Management of Electronic Roadway Tolling: Lessons from Successful Cases

Rebecca Kalauskas, Brian D. Taylor, Hiroyuki Iseki

California PATH Research Report
UCB-ITS-PRR-2009-11

This work was performed as part of the California PATH Program of the University of California, in cooperation with the State of California Business, Transportation, and Housing Agency, Department of Transportation, and the United States Department of Transportation, Federal Highway Administration.

Final Report for Task Order 6330 Task A-2

January 2009

ISSN 1055-1425

CALIFORNIA PARTNERS FOR ADVANCED TRANSIT AND HIGHWAYS

Task A-2: Implementation and Management of Electronic Roadway Tolling: Lessons from Successful Cases

California PATH Project—Task Order 6330

January 2009

Rebecca Kalauskas
Brian D. Taylor
UCLA Institute of Transportation Studies
3250 Public Affairs Building
Los Angeles, CA 90095-1656
http://www.its.ucla.edu

and

Hiroyuki Iseki
Department of Planning and Urban Studies
University of New Orleans
2000 Lakeshore Drive - 368 Milneburg Hall
New Orleans, LA 70148
http://planning.uno.edu/

Table of Contents

Abstract i

Executive Summary ii

Introduction 1

Methodology and Logistics 2

Overview of Organizational Structure for Electronic Roadway Tolling Projects 2

Government-Owned Corporations 6

Case Studies 7

Toronto's Highway 407: Financing and Constructing New Capacity 7

German Toll Collect: Maintaining Infrastructure 8

London Congestion Charging Scheme: Managing Congestion 10

San Diego I-15 Express Lanes: Enhancing Regional Transit Service 12

Common Barriers to Implementation 14

Technological and Practical Barriers 14

Legal and Institutional Barriers 16

Acceptability Barriers 18

Lessons from Successful Implementation of Road Pricing 20

Six-Step Framework 20

One Step at a Time… 21

Conclusion 23

Bibliography 25

Abstract

Over the past decade road pricing has moved from the drawing board to practice in projects large and small around the world. But while interest in and experience with electronic roadway tolling is on the rise, political acceptance is not yet widespread and standard models of implementation and management have yet to evolve. Accordingly, this report examines a variety of road pricing projects– some that were smoothly implemented, and others that encountered significant obstacles along the way. Based on these cases and a thorough review of the literature, we draw lessons to guide future implementation and management efforts. We find that the most common barriers to successful implementation concern political acceptability, incomplete or ambiguous public-private contracts, and the complex workings of highly bureaucratic government agencies. Collectively, these case studies show that there is no single best implementation and management structure; what works best depends significantly on the initiative's objectives, the availability of public and private resources, and political leadership.

Keywords

road pricing, congestion pricing, electronic toll and traffic management, electronic toll collection, dynamic congestion pricing, government policy, high occupancy toll lanes, policy, public private partnerships, toll roads, traffic congestion, management, implementation

Executive Summary

Introduction

While the preceding report in this series, Task A-1: *Motivations Behind Electronic Road Tolling*, considered *why* we are seeing a marked increase in the implementation of road pricing projects around the U.S. and around the world, this report focuses on *how* road pricing projects have been implemented. We concluded in that earlier report that the motivations behind road pricing were correlated with the type of tolling project, and we likewise find here that the most effective implementation paths and management structures are also related to the goals of the particular initiative. We conclude from this that the lead agency of any electronic roadway tolling project should carefully reflect on the goals and objectives of the initiative before developing a plan for implementation.

This report draws on road pricing and organization theory literatures, as well as on a number of examples of successful, and sometimes not so successful, implementation approaches to road pricing projects and concludes with a series of recommendations to help guide California and other states through the implementation and management design process. This executive summary briefly summarizes the principal findings of this work.

Overview of Organizational Structure for Electronic Roadway Tolling Projects

Once a road pricing project reaches implementation and planning stages, the three major organizational questions concern (1) who administers the program, (2) who manages and operates the program, and (3) who oversees the program. The administration of a road pricing program includes tasks such as determining toll rates, issuing bills, and collecting and distributing revenue. Management and operation responsibilities include managing the day-to-day operations of the initiative and the implementation of appropriate technologies. Finally, the overseeing organization makes many of the important policy decisions and manages relations between administrative and operating agencies or firms. Generally, the oversight of the program lies within the public sector while the management and operation responsibilities often rest within the public sector. On the other hand, the agency or firm that oversees administration tends to vary significantly from project to project. As mentioned earlier, the optimal organization structure depends heavily on the goals and objectives of the program.

Public-Private Partnerships

While public-private partnership arrangements have in many cases brought significant benefits to road pricing projects, they can entail significant risks and usual present implementation challenges as well. In most public-private partnerships, except complete privatization, the public sector retains some ongoing oversight over the projects. Thus, while the private sector can play a significant role in the design, implementation, administration, and operation of road pricing facilities, the public sector rarely releases the entire oversight to the private firms, and public agencies must be structured to work effectively with the private sector.

The institutional knowledge that lies within public sector agencies can sometimes qualify their employees as the experts in this area, in contrast to the employees of private sector firms who may lack this institutional knowledge. On the other hand, a great deal of technical expertise frequently lies within private sector firms, which make them especially strong candidates to develop the necessary technology for road pricing projects. Therefore, the public sector often proves best suited for the oversight and administration responsibilities, while the private sector is frequently better suited for operational and management duties. Finally, the design of the contracts with private sector can play a significant role in determining the success or failure of a project.

Government Owned Corporations

In order to collaborate efficiently with private firms, governments (especially those in the former British Empire) often develop government-owned or state-owned corporations to oversee large infrastructure projects, road networks, or tolling projects. A government-owned corporation is a legal entity created to perform commercial or business activity on behalf of the state and often plays a critical role as a monitoring arm of the government.

Case Studies

Toronto's Highway 407: Financing and Constructing New Capacity

The Toronto metropolitan area desperately needed to expand roadway infrastructure in the early 1990s but lacked sufficient funds to do so. Due to a combination of economic stimulus goals and a lack of public funds, Ontario officials decided to pursue a private financing strategy to fund the project because they did not want to wait for the traditional funding mechanisms. However, ultimately, the overseeing agency, the Ontario Transportation Capital Corporation (OTCC), financed the project because the government determined this would be a more cost-effective approach, while the operation and development were contracted to private firms. Although the project was ultimately funded directly through the public, the private sector still played a significant role in the timely construction of the roadway. Once construction of the Highway 407 was complete, the roadway was leased to the ETR Concession Company, a private consortium of firms, which now administers, manages, and operates the highway. Flexible legislation and an incremental implementation approach both proved to be critical in the successful development of Highway 407.

German Toll Collect: Maintaining Infrastructure

While contracting with the private sector successfully aided in the development of Toronto's Highway 407, the role of private firms involved with the implementation of Germany's Toll Collect provides a more cautionary tale. In developing a weight-distance tolling system for trucks using German roadways, the German government contracted with Toll Collect to run the operations of the initiative. However, due to unclear goals at the outset of the project, lack of communication, and a series of technical problems, the implementation of the Toll Collect Project was substantially delayed. Because of these delays, the German government found itself missing a significant amount of potential revenue as well as experiencing a loss of the faith among German people regarding the effectiveness of road tolling. This case highlights

the importance of establishing clear contracts with private firms and clear program objectives. If the uses of revenue are unclear, the project is more likely to encounter substantial public or political opposition, delaying the implementation process.

London Congestion Charging Scheme: Managing Congestion

In contrast to the Toronto and German cases, the private sector had very limited involvement in the implementation and management of London's Congestion Pricing Scheme. Prominent national political figure Ken Livingstone was elected Mayor of the Greater London Council on, among other things, a platform advocating for the introduction of congestion charging in central London. The Mayor acts as the key decision-maker of the Greater London Authority (GLA), which allowed Livingstone to move forward with his congestion charging agenda with minimal political opposition. The GLA also established the Transport for London (TfL), which provided the local authorities with direct control over the transit network and, as a result, the power make the necessary improvement needed to obtain public support of road pricing. Therefore, the successful implementation of the London pricing scheme can be largely attributed to the fact that a single agency (TfL) oversaw the project, rather than a collaboration of various agencies.

San Diego's I-15 Express Lanes: Enhancing Regional Transit Service

Like many other road pricing initiatives, San Diego's I-15 Express Lanes were originally conceived of primarily to reduce congestion along the I-15 corridor by converting an underutilized HOV lane into an HOT lane and redirecting the revenue to enhance transit service in the region. The financing and management of the I-15 Express lanes lay almost entirely in the public realm. A significant portion of the implementation funding came from the federal level, which reflected interest among federal officials in experimenting with various road pricing approaches to relieve congestion. While the federal agencies played a larger role in the original inception and funding stages, as the project moved toward implementation, the local stakeholders took on a greater role. During implementation process, the project management team met monthly to oversee the progress of the project, allowing all stakeholders to keep in constant communication. Many of the keys to successful implementation that played a role in the London case also apply to the San Diego case. Like London, San Diego benefited from the presence of a strong political champion – Jan Goldsmith – and a strong community outreach campaign. Likewise, at the organizational level, the transit system and the Express Lanes were managed by the same authority, SANDAG, which facilitated the improvements.

Common Barriers to Implementation

A significant body of literature focuses on identifying barriers frequently encountered in attempting to implement road pricing proposals, and many of the findings from this literature were consistent with the findings of our case studies (discussed above).

Technological and Practical Barriers

Frequently encountered technological challenges include interoperability issues and reliability of technology on large-scales. Some common practical barriers jurisdictions face include the complex structure of urban road networks and a lack of space for added capacity in urban areas. While these technological and practical barriers can certainly hinder the

implementation of road pricing projects, it is unlikely that with currently available technologies, these would be the sole, or even principal, reason a project failed to move forward. Even if technological barriers prevent implementation of a large-scale project, the proposal could always be implemented piece-meal. On the other hand, any impending practical barriers may play a larger role in guiding the implementation process and determining the optimal structure. In the long-run, both technological and practical impediments can easily be overcome.

Legal and Institutional Barriers

Legal restrictions from higher governing bodies, such as federal or state governments, can often impede the progress of road pricing proposals, even if the support is present at the local level. In addition to legislative barriers from higher authorities, contradictory legislation can often hinder implementation. Past experience demonstrates that securing the necessary legal approval is easier if road pricing projects are implemented only temporarily to address a specific problem or if the legislation is subject to periodic review. Additionally, disconnected decision-making structures, multi-level structure of government decision-making process or the number of administrative levels, and the role of the private sector can determine the efficiency with which a proposal moves towards implementation. The distribution of responsibilities and powers across different governmental administrative levels is often not ideal to manage and move road pricing forward.

Like technological and practical barriers, legal and institutional barriers rarely serve as a long-term impediment to implementation. Though in the near-term, inadequate legislative authority can delay a program. However, new legislation is frequently developed and passed to support popular projects. Likewise, institutional and organizational structures can be altered to reflect changing demands of road pricing projects. These impediments highlight the importance of incremental rather than wholesale implantation of pricing, but legal and institutional barriers, except as they have been wielded by opponents to kill pricing proposals (as in the case of New York[1]), are unlikely to sink a project when broad public and political support exists.

Acceptability Barriers

Strong public and political acceptance are perhaps the most important factors in determining whether a road pricing project moves forward. While technological, practical, legal, and institutional challenges can be overcome provided enough popular and political support exists, achieving such acceptance can be a daunting hurdle. The political and financial relationships among agencies at various levels of government – federal, state, and local – and between the various political parties can have a significant effect on the policy-decision making process. Rather than being grounded in economic principles, the decision often reflects parochial political interests. Certain justifications for introducing road pricing, such as expanded road capacity, environmental, and safety improvements, are more accepted than others. Another major hurdle in achieving public support is whether the road pricing program is perceived as

[1] In April 2008, New York State Assembly Speaker Sheldon Silver concluded that, due to a lack of support among New York State Assembly members, the New York City Congestion Pricing legislation would not be put to a vote, effectively killing the proposal, which required state legislative approval in addition to New York City Council approval. This case highlights that complex legislative hurdles can act as barriers to implementation when political support is mixed.

equitable and fair. The means in which toll revenues are used plays a large role in justifying the equity of road pricing initiatives. One of the most effective means for improving public support is to actively involve the community and key political leaders in the planning stages.

Lessons from Successful Implementation of Road Pricing

Six-Step Framework

Drawing on the research conducted for this report, we have identified six implementation steps common to many successful road pricing programs. While these steps are roughly ordered, they should not be construed to be a sequential step-by-step plan for implementation; rather these steps should be viewed as a checklist common to most successful road pricing. Implementation is, more often than not, an iterative process.

1. **Articulate system objectives**
2. **Affirm legal authority**
3. **Determine implementation framework**
4. **Design & evaluate road pricing plan**
5. **Adopt system plan, financing scheme**
6. **Procure management & technology services**

One Step at a Time…

A significant portion of the literature emphasizes the importance of adopting a gradual, incremental process to implementing road pricing. Because societies generally only accept drastic policy changes in emergencies, and not for chronic issues like heavy traffic, it is important to frame the introduction of road pricing as a gradual evolution and as the final element in comprehensive transportation planning process. Furthermore, toll rates do not necessarily need to be set at the optimal level upon initial implementation of the road pricing project. Rather than an optimal policy, the implementation path should follow a sequence of second-best alternatives moving towards the ultimate optimal policy. Finally, an incremental approach to implementation keeps the door open to alter or reverse actions at a reasonably low cost. This flexibility is particularly important in the later steps of the implementation path, so that plans can be altered if new information comes to light.

Conclusion

This report provides a review of the potential barriers to road pricing implementation, and the lessons from the successful implementation of pricing projects around the world. If a decision is made to move forward with road pricing, a special emphasis should be placed on addressing acceptability concerns as these are often the most challenging barriers to overcome. Additionally, while private firms often have a competitive and experiential edge over public agencies, the public sector still needs to be actively involved in the development, execution, and ongoing monitoring of such contracts. Finally, the organization of the public agencies tasked with implementation can also play a critical role in the success or failure of a project. Generally,

the more streamlined and less bureaucratic the government actors, the greater the likelihood of successful introduction of road pricing.

Such findings notwithstanding, there does not appear to be any one best practice for or approach to the introduction of road pricing. As jurisdictions in California move forward with road pricing projects, the best implementation and management scheme will depend greatly on the initiative's objectives, the availability of public and private resources, and most importantly, political leadership.

Introduction

The preceding report in this series, Task A-1: *Motivations Behind Electronic Road Pricing*, discusses the wide range of motivations that has driven the recent development of electronic road pricing projects across the globe. We conclude that the motivating factors behind the projects were as varied as the projects themselves. These motivations further played a key role in the ultimate project design – whether to toll a single facility, a cordoned area of the city, or to introduce a distance-based fee for an entire road network. While the preceding report considered *why* the world is seeing a marked increase in the implementation of road pricing schemes, this report focuses on *how* road pricing projects have been implemented. Just as the motivations behind road pricing were correlated with the type of tolling project, we find here that the most effective implementation paths and management structures are also related to the goals of the particular initiative. In other words, there is no universal "best practice." Rather, we conclude that the lead agency in any electronic roadway tolling project should carefully reflect on the goals and objectives of the initiative before developing a plan for implementation. A project that aims to construct new road capacity will most likely have a very different optimal implementation and management structures than a program that aims to enhance transit service in the region.

To provide concrete examples of our recommendations, we review several cases of successful implementation and the methods used to overcome barriers and challenges. We selected cases with a wide variety of objectives and geographic locations to best discern some effective tools and methods. The model cases discussed include London's Congestion Pricing Scheme, San Diego's I-15 HOT lanes, Toronto's 407 ETR, and Germany's Toll Collect program.

From these case studies, we find that transportation agencies and elected officials must carefully consider the barriers that stand in the way of enacting a proposal. While the implementation path and management structure might vary, the barriers that officials must overcome are fairly consistent across project types and geographic regions. These barriers can be divided into three categories: (1) technological and practical, (2) legal and institutional barriers, and (3) acceptability barriers (Niskanene, et al., 2003). Successfully overcoming these barriers is what separates the road pricing systems in use today from those that will forever remain on the drawing boards. While this report focuses primarily on the legal and institutional barriers to implementation, the report for Task A-3 will delve into technology issues, and the report for Task A-5 will examine barriers associated with political and public acceptance. While these other issues are important, a significant body of literature suggests that levels of acceptability among both the public and elected officials is perhaps the single most important factor in determining whether a project moves forward or stalls (Banister, 2004; Niskanene, et al., 2003; Ison & Rye, 2005).

Finally, we conclude with recommendations to help guide California and other states through the implementation and management design process. While much of the available literature focuses on case examples in Europe and Asia, the question remains how best to

translate these lessons to the context of the United States. Undoubtedly, many of the same hurdles stand between conception and implementation, particularly acceptance barriers. Given this, what lessons can California learn from the challenges and pitfalls others have encountered along the way?

Methodology and Logistics

The information in this report was gathered through a comprehensive literature review. This review considered primary and secondary data for specific case studies, as well as tertiary data from the scholarly literature on the successful implementation of road pricing projects. Much of this literature for this report overlaps with topics and issues discussed in other reports in this research series, such as public acceptability. The cases reviewed here were selected to provide a representative cross-section of various road pricing projects – both geographically and structurally. While some of the cases were implemented smoothly, others encountered significant obstacles along the path to implementation, which provide equally important insight.

Overview of Organizational Structure for Electronic Roadway Tolling Projects

Once a road pricing project reaches implementation and planning stages, the three major organizational questions concern (1) who administers the program, (2) who manages and operates the program, and (3) who oversees the program. The administration of a road pricing program includes tasks such as determining toll levels, issuing bills, and collecting and distributing revenue. Management and operation responsibilities include the day-to-day management of operations. Additionally, issues such as development of appropriate technology fall under the category of management and operation. Finally, the overseeing organization makes many of the important policy decisions and manages relations between administrative and operating agencies or firms.

As mentioned in the introduction, the assignment of these various responsibilities depends heavily on the objectives of the proposal, with both the public and private sectors playing integral roles. The private sector is likely to play a more significant role in administration and management and operation stages, while the public sector more often tends to provide the oversight for projects. Generally, road pricing projects that aim to raise public revenues or manage congestion are overseen by the public sector. In these cases, the road pricing programs are most commonly overseen by a single jurisdiction, but multi-jurisdiction arrangements are likely to become increasingly common as road pricing becomes more widespread and interoperable technology improves (Sorensen & Taylor, 2005). Multi-jurisdiction projects can cross city lines, state boundaries, or even international divides. However, by incorporating multiple jurisdictions, implementation and management issues become increasingly complex. Examples of multi-jurisdictional projects include Australia's Austroads, Bristol, England's Truck/Cordon Demonstration, and ARMAS Pan-European Road Tolling Project. In the cases where the project spans multiple jurisdictions, an independent agency generally administers the program, collecting the fees from the users and then distributing the revenue to the jurisdictions based on a pre-determined formula (Sorensen & Taylor, 2005).

Table 1 summarizes some of the overall trends in the provision of administration, management and operation, and oversight of road pricing projects. This table also highlights the division of services in the case studies that are discussed later in this report. However, the division between the public and private sector can be ambiguous, as responsibilities often bounce between the two sectors as a project evolves. Additionally, in many cases, a quasi-governmental organization is established to oversee the private sector's involvement in the administration, management, and operation of a project and to mediate between various public agencies and the private sector.

Table 1: Organizational Structure Trends

		Administration	**Management and Operation**	**Oversight**
Overall		Public/Private	Private	Public
Single jurisdiction application		Public/Private	Private	Public
Multi-jurisdiction application		Private	Private	Quasi-Public
Case Studies	**Type of Tolling**	**Administration**	**Management and Operation**	**Oversight**
(1) Toronto	Facility Congestion Toll – New Facility	Private *ETR Concession Company*	Private *Raytheon/ ETR Concession Company*	Quasi-Public *Ontario Transportation Capital Corporation (OTCC)*
(2) Germany	Weight-Distance Truck Toll	Quasi-Public *Infrastructure Funding Company*	Private *Toll Collect*	Quasi-Public *Infrastructure Funding Company*
(3) London	Cordon Toll	Public *TfL*	Private *Capita Group, IBM*	Public *TfL*
(4) San Diego	Facility Congestion Toll – Existing HOV Lanes	Public *SANDAG*	Public *SANDAG. Caltrans*	Public *SANDAG, FHWA*

While the public agency might also administer the program if it possesses adequate personnel and expertise, it is much more common for the actual administration and operation of the program to be contracted to the private sector. Private firms are in general better equipped with staff and resources to administer road pricing projects than the public sector (Sorensen & Taylor, 2005).

Likewise, public agencies often find it more efficient to turn to the private sector to develop and implement the needed technologies as part of the operations of the project. The two common approaches for securing technological assistance are: (1) contracting with a single or a consortium of firms or (2) put out a request for bids from multiple firms. In the first arrangement, the firm or firms are contractually obligated to deliver the technological services. However, as the German Toll Collect example illustrates, this contract can often lead to substantial delays in the implementation if the contracted firm encounters set-backs. In the alternative arrangement, firms are forced to compete with one another, and this competition in turn provides an incentive to lower the price and expedite the development (Sorensen & Taylor, 2005).

Public-Private Partnerships

The preceding section highlights the significant role the private sector can play in the implementation of road pricing projects. The accompanying deliverable (Task B-1) discusses public-private partnerships in great detail. Table 1 summarizes the various public-private structures as discussed in Task B-1: *Are Public-Private Partnerships a Good Choice for U.S. Highways?*. As that report notes, such arrangements demonstrate significant benefits to road pricing projects but also frequently demonstrate significant risks and added implementation challenges. While Task B-1 focused primarily on public-private partnerships as a financial mechanism, this paper concentrates more specifically the effectiveness of the private sector in a role of administrator and manager.

In most public-private partnerships, except full privatization, the public sector retains some ongoing oversight over the projects. Arrangements that involve the private sector in the administration, management, and operation and the public sector in the oversight of the project include the traditional procurement/service contracts, design-build/turnkey, and the build-operate-transfer/design-build operate/management contracts. The joint ventures, lease agreements, and design-build-finance-operate/concession arrangements also retain the public sector as the overseeing agency with the private sector playing a larger role in the administration and management and operation. Thus, while the private sector can play a significant role in the design, implementation, administration, and operation of road pricing facilities, the public sector rarely releases the entire oversight to the private firms, and public agencies must be structured to work effectively with the private sector.

Table 2: Structure of Public-Private Partnerships

Traditional Procurement/Service Contracts	Public agency issues separate contracts for the design, construction, and operation (if outsourced) to the lowest responsible bidders and remunerates them through direct payments
Design-Build / Turnkey	Similar to traditional procurement, except design and construction are combined into a single contract
Build-Operate-Transfer / Design-Build-Operate / Management Contracts	Entire project from design to operation is combined under a single contract, including project management, and the public agency pays through direct payments over the lifetime of the project
Joint Venture	The public agency forms a joint public/private company with local stakeholders to complete an improvement.
Lease Agreements	Existing or new facilities are leased to a private firm, which is allowed to charge tolls, for the purposes of operation
Design-Build-Finance-Operate / Concession	Similar to build-operate-transfer, except the private firm is allowed to collect tolls for a set period of time before transferring the facility to public control.
Full Private Provision	No reversion to public ownership takes place

Source: (Iseki, Uchida, & Taylor, 2008)

One of the frequently cited advantages of financing transportation projects through the private sector is the infusion of "up-front" capital to provide improvements or new services prior to the implementation of the project (Crawford & Catling, 2002). This benefit is particularly applicable in programs with the goal of improving infrastructure or transit options, but might not be as important for programs that aim just to manage congestion. Another commonly mentioned benefit of private involvement in the operation and maintenance of road pricing initiatives is that a private operator is not directly accountable to voters and therefore is free to raise prices to appropriate levels to efficiently manage congestion delays (Thornton, 2007).

The design of the contracts with the private sector can play a significant role in determining the success or failure of a project. Long-term contracts limit competition and thus the performance of the private firm might suffer without this incentive to improve efficiency within a competitive market (Sclar, 2000). Sclar also identifies several key factors that can play

a role in developing a model for a successful public-private contract. First, the expected service must be explicitly specified, so that a delivery of service is effectively overseen by the public agency without any dispute. Likewise, a careful delineation of service provision between the public and private sectors must be stated. As we will see later in this paper, the significant implementation delays experienced in the case of German Toll Collect highlights the critical need for full contracts to be developed at the time of the agreement. However, the ability of the government to enter into a complete contract is limited by unforeseen conditions. Another potential problem in the design of appropriate contracts is the "no-compete" clause, which can prevent the public sector from adding much-needed "competing" capacity in the case of corridor or facility pricing projects. In such a case, the private firm could conceivably continue to raise tolls to maintain a steady traffic flow for the corridor or facility in an environment of growing demand and static capacity. The case of Orange County's SR-91 Express Lanes[2], and their eventual transition from private to public ownership is perhaps one of the best known examples of the political conflict resulting from the limitations of a non-compete clause.

Finally, the institutional knowledge that lies within public sector agencies can sometimes qualify their employees as the experts, in contrast to the employees of private sector firms who may lack this institutional knowledge (Sclar, 2000). On the other hand, a great deal of technical expertise frequently lies within private sector firms, which make them especially strong candidates to develop the necessary technology for road pricing projects. Therefore, the public sector might often be best suited for the oversight and administrative responsibilities, while the private sector is frequently better suited for operational and management duties. The cases discussed in this paper primarily break responsibilities along these lines.

Government-Owned Corporations

Since the private firms often assume responsibility for operations and administration and the public sector often retains oversight, the relationship between the two sectors needs to be managed effectively. In order to collaborate efficiently with private firms, governments often develop government-owned or state-owned corporations (called "crown corporations" in commonwealth nations) to oversee large infrastructure projects, road networks, or tolling projects. A government-owned corporation is a legal entity created to perform commercial or business activity on behalf of the state. The state-owned holding company often plays a critical role as a monitoring arm of the government (Sam, 2008). By managing road networks through government-owned corporations, the state no longer holds a monopoly over road operations and opens up the provision of road networks to a competitive market. Examples of tolling projects that are overseen by government-owned corporations include the Ontario's Transportation

[2] In response to worsening congestion and lack of revenue for capacity expansion, the Orange County Transportation Authority (OCTA) partnered in the 1990s with the private investor California Private Transportation Company (CPTC) to fund the construction of four toll lanes in the median of State Route 91 in Santa Ana Canyon just west of the Riverside County border. Users of these lanes are charged a fee to save up to 30 minutes over traveling in the adjacent free, congested lanes. The fee varies by time and day from $1.25 to $9.50 to keep the toll lanes free-flowing. CPTC operated the SR-91 Express Lanes for several years, until a clash with Caltrans over capacity additions to the adjacent free lanes led to the sale of the facility back to OCTA in 2003. Today the lanes are publicly owned and regulated, but privately operated. The controversy left a negative impression of the role of the private sector in infrastructure development and management for many in Southern California

Capital Corporation, Italy's Autostrade, and Germany's Infrastructure Funding Company. Government-owned corporations are often eventually completely privatized, such as Autostrade in Italy.

Case Studies

Toronto's Highway 407: Financing and Constructing New Capacity

As discussed in the report for Task A-1, the Toronto metropolitan area desperately needed to expand roadway infrastructure in the early 1990s but lacked sufficient funds to do so. The Highway 407 was viewed as a critical step in reducing traffic congestion in northern area of the region. The province was still recovering from an economic recession, and a major infrastructure project would not only help alleviate congestion but also aid in stimulating the economy. Due to these economic stimulus goals and the lack of public funds, Ontario officials decided to pursue a private financing strategy because they did not want to wait for the traditional funding mechanisms coming through to fund the project.

With the hopes of attracting private investors, Ontario province created the Ontario Transportation Capital Corporation (OTCC) in 1993. OTCC is a crown corporation intended to manage investment in transportation infrastructure within the province of Ontario. Specifically, OTCC was mandated with the responsibility of securing private funding for the 407 Highway and managing the implementation of the proposed public-private partnership (Nix, 2001).

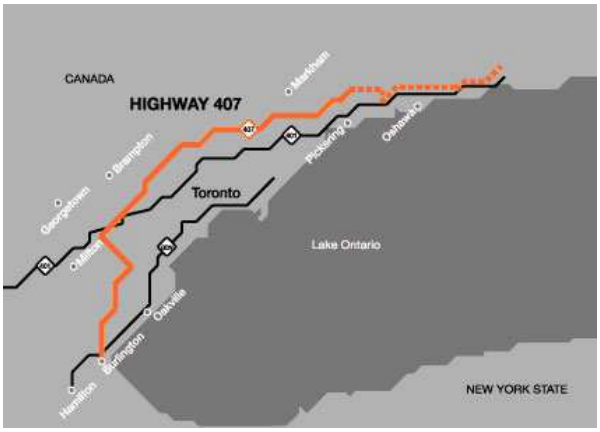

Figure 1: Location of the 407 (Commission for Integrated Transport, 2006)

However, once OTCC officials had reviewed the design-build-finance-maintain-operate-transfer (DBFMOT) proposals from two companies, they determined that the public sector could borrow money at a lower rate than the private sector, thus resulting in significant cost savings. Instead of the original DBFMOT scheme, OTCC divided the responsibilities between multiple firms. The province entered a design-build-operate agreement with one firm and a contract for the development of the electronic tolling technology with a second firm (Nix, 2001). The private company Raytheon constructed and operated the road from its opening in October 1997 through 1999. However, OTCC retained responsibility for the financing and maintenance of the roadway.

Due to these changes in the distribution of responsibilities, the provincial government assumed a significant portion of the risk associated with financing, owning, and operating the facility. As a result, in the opinion of the Ontario's Office of the Provincial Auditor, a public-private partnership was never established. Although officials still debate whether or not the government saved money through this financing mechanism, most agree that the construction of the roadway was greatly expedited as a result of partnering with private firms (Nix, 2001).

In April 1999, a consortium comprised of Spanish company Ferrovial, Cintra Concesiones de Infraestructuras de Transporte, SNC-Lavalin, and Capital d'Amérique CDPQ purchased the 407 ETR from Ontario for CA$3.107 billion (USD 2.09 billion) by (Nix, 2001). At this point, the consortium renamed itself the 407 ETR Concession Company. While the province of Ontario retains ownership of the land Highway 407, the consortium leases the land from the province and owns the road, buildings and other structures on the land. The province will regain ownership of these facilities at the end of the 99-year lease.

Although the original legislation mandated that the tolls were removed once the debt was paid off, the sale of the ETR Concession Company to the consortium changed this condition. In 1999, the Ontario government ruled that

> "The new owners will have the authority to set toll rates. However, they will be required to achieve pre-set traffic *congestion* relief targets established by MTO in order to increase rates above a specified toll level. The specified toll level is set at the current price of $0.11 per kilometer. This level can be increased by 2% per year plus CPI for the first 15 years, and thereafter, by CPI only. This means that the specified toll level can only increase by about three cents per kilometer over the first 15 years. The specified toll levels are connected to congestion relief targets. Toll rates above the specified toll level will only be permitted if the traffic volumes are at or above target levels. If the required traffic volumes are not met, any income from tolls charged above the specified toll level will be clawed back by the province along with an additional penalty of the same amount. Toll rates for trucks will continue to be two times the automobile rate for single unit trucks and three times the rate for multiple unit trucks." (Nix, 2001)

The implementation and management of Toronto's Highway 407 highlights the importance of flexible legislation and incremental implementation. Furthermore, this project demonstrates that sometimes it is more cost-efficient to finance through the public sector rather than depending on private investments. Finally, the private sector clearly played an instrumental role in expediting the project's implementation and construction even though it was not involved in the financing aspects.

Key Lessons:

- Financing through the public sector can save money
- Separate contracts for specific tasks
- Gradual implementation of tolling goals

German Toll Collect: Maintaining Infrastructure

While contracting with the private sector successfully aided in the development of Toronto's Highway 407, the role of private firms involved with the implementation of Germany's Toll Collect provides a more cautionary tale. The German government first developed the concept of Toll Collect in 1999 as a result of the desire of the German High Commission for Financing the Federal Infrastructure to switch from tax-based financing to

usage-based financing. In order to facilitate this transition, the Commission recommended the establishment of a Highway Funding Company (Fernstraßenfinanzierungsgesellschaft). This Company was conceived as a joint-stock company with the shares owned exclusively by the federal government. The company's infrastructure investments would be financed through a combination of distance-based toll revenue and debt on the capital markets. The Commission envisioned the revenue from the tolls to be used exclusively for the development of highway infrastructure while investments in other modes of transport were to be prohibited (Wieland, 2005).

However, once implemented in 2003, the company structure was very different from the original concept. Instead of the Highway Funding Company, the new firm was called the Infrastructure Funding Company (Verkehrsinfrastrukturfinanzierungsgesellschaft, VIFG). Rather than dedicating all investments to roadways, this firm was designed to cross-subsidize other forms of transport. According to the enabling national legislation, half of the toll revenues were to be dedicated to the development of rail and inland waterways. Additionally, the legislation stated that toll revenues were to go directly to the federal government, who would then disburse the funds to the Infrastructure Funding Company. This mandate contradicts the initial intention of the High Commission to separate the company's budget from the state's budget (Wieland, 2005).

While the finances would be managed through the Infrastructure Funding Company, the operation of the tolling system was to be managed by Toll Collect, a consortium of Deutsche Telekom, Daimler Chrysler, and Cofiroute. In 2002, Toll Collect was awarded the official license to run operations of the distance-based tolling system for 12 years with an agreement that the system would be operating by August 2003.

However, a series of technical problems significantly delayed the full implementation of the Toll Collect project until January 2005. Lack of communication between various Toll Collect teams led to the development of different software packages that did not have a common interface (Borgnolo, Stewart-Ladewig, & Neuenschwander, 2005). Additionally, the on-board units were not programmed with the European standard DRSC protocol, meaning Toll Collect on board units could not be interoperable with any other road pricing systems in Europe (Borgnolo, Stewart-Ladewig, & Neuenschwander, 2005).

Due to these delays, the German government became increasingly frustrated with Toll Collect's performance. Prior to developing the Toll Collect program, Germany had participated in the Eurovignette program, which provided some revenue from trucks. However, in anticipation of the implementation of Toll Collect, Germany pulled out of Eurovignette in August 2003. As a result, freight carriers were not paying any toll to Germany until January 2005, when Toll Collect was finally implemented. The revenue losses were estimated to be €163 million (USD 184 million) monthly in 2003 and €233 million (USD 290 million) monthly in 2004 (Borgnolo, Stewart-Ladewig, & Neuenschwander, 2005). Furthermore, Toll Collect was still unable to provide the government with a definitive start date.

As a result, Germany's Ministry of Transport cancelled its contract with Toll Collect February 2004. However, Toll Collect and the government were able to reach a compromise within 10 days of the initial cancellation, reinstating the contract on the terms that Toll Collect

would be restructured. During the negotiations to reinstate the contract, the German government stated that it felt that it should be compensated for the revenue loss due to the delay in implementation. As part of the compromise between the two parties, if the first stage of implementation of system did not occur by January 1, 2005, Toll Collect was subject to a fine of €40 million (USD 50 million) per month, which would increase in increments of €5 million (USD 6.2 million) for each additional month. The maximum allowed compensation was €80 million (USD 99.5 million) (Borgnolo, Stewart-Ladewig, & Neuenschwander, 2005). Additionally, the new contract stated that the second stage must be implemented by January 2006, and if it fails to be implemented, Toll Collect was to compensate the government equal to the expected revenues from road pricing. The German government retained the right to cancel the contract with Toll Collect if either stage of implementation fails (Borgnolo, Stewart-Ladewig, & Neuenschwander, 2005).

The Toll Collect system was finally implemented in two stages: a preliminary stage in January 2005 and a full version in January 2006, incorporating improvements to the onboard unit and software, which could make it feasible to incorporate secondary federal roads into the system (Wieland, 2005).

The delayed implementations of the Toll Collect system underscore the importance of developing stronger contracts with private firms so that the government does not lose on potential revenue. Wieland refers to the theory of incomplete contracts to explain the shortcomings of the German Toll Collect implementation (Wieland, 2005). The delays in the implementation led to nation-wide loss in faith of tolling systems (Borgnolo, Stewart-Ladewig, & Neuenschwander, 2005). Additionally, this case highlights the importance of balancing the best allocation of revenue with uses that are publicly acceptable. If the uses of revenue are unclear, the project is more likely to encounter substantial public or political opposition, delaying the implementation process. To avoid similar problems in the future, contracts should be written to include penalties for delays to compensate for potential revenue losses (Borgnolo, Stewart-Ladewig, & Neuenschwander, 2005).

Key Lessons:

- Financing structure can affect objectives and public acceptability
- Contracts should be designed to cover loss of revenue due to implementation delays

London Congestion Charging Scheme: Managing Congestion

In contrast to the Toronto and German cases, the private sector had very limited involvement in the implementation and management of London's Congestion Pricing Scheme. As discussed in the report for Task A-1, the congestion levels in central London in the 1990s had reached stifling levels, inhibiting economic growth and degrading environmental conditions. In addition, the extensive and aging London Underground subway was in desperate need of repair and upgrading, but with little available funding to do so. Prominent national political figure Ken Livingstone was elected Mayor of the Greater London Council on, among other things, a platform advocating for the introduction of congestion charging in central London. Immediately prior to Livingstone's election in 2000, a number of organizational and legislative changes paved

the way for the implementation of congestion pricing. In 1999, national legislation established the Greater London Authority (GLA), which proved to be critical in providing access to the necessary resources and revenue to implement the charging scheme. The GLA receives national funding, but the Mayor is also permitted to introduce local taxes, as well as fee programs like congestion pricing. More importantly, the Mayor acts as the key decision-maker of the GLA, which allowed Livingstone to move forward with his congestion charging agenda with minimal political opposition (Ison, 2004). The presence of such a strong political champion pushing for the implementation of the scheme played a critical role in the ultimate introduction of congestion charging, and the project likely would have stalled without Livingstone's advocacy.

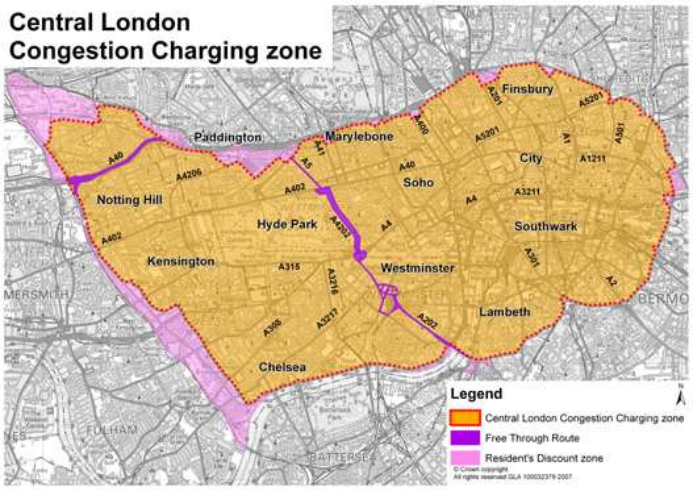

Figure 2: Map of London Congestion Charging (Transport for London, 2007)

Another essential component of the GLA was the establishment of the Transport for London (TfL). TfL is responsible for the major roads, buses, light rail, local transport capital funding for all local transport schemes, and the Underground (Ison & Rye, 2005). The members of the TfL board are appointed by the Mayor of London. The authority of TfL is unique in Britain, where local authorities often have no direct control over the transit network and, as a result, cannot make the necessary improvement needed to obtain public support of road pricing. Instead, the transportation agencies must depend on private operators to make the needed improvements (Ison, 2004).

The successful implementation of the London pricing scheme can be largely attributed to the fact that a single agency oversaw the project, rather than a collaboration of various agencies (Ison, 2004). TfL was charged with the responsibility of both the implementation of the road charging scheme and the accompanying improvements to both the Underground and surface bus systems. To manage the day-to-day operation of the pricing scheme, TfL contracted with the Capita Group, which in turn has employed sub-contractors, such as Mastek, which is responsible for developing and maintaining the information technology infrastructure. The current contract with Capita lasts through 2009, at which point IBM will take over the operations of the congestion charging scheme with a five-year contract (Capita to lose congestion charge, 2007).

Leape (2006) has categorized the costs associated with the implementation of the pricing scheme into five categories: (1) the initial set-up costs associated with the installation of infrastructure and services, (2) the operation costs, (3) the supervisory costs, (4) the traffic management costs, and (5) enforcement costs (Leape, 2006). The cost of initial implementation is estimated at approximately £200 million (USD$394 million). The continuous operating costs are considered to be the single largest cost associated with the pricing scheme and are estimated at £80 million (USD$158 million) per year. The operating costs are incurred in the form of payments from TfL to Capita, which manages operations. Furthermore, since TfL was

responsible for both the development of the congestion charging scheme and the alternative transportation options, the agency dedicated £100 million (USD$197 million) for traffic-management programs.

Since implementation, London officials have discussed various means of changing the program – both ways to increase its scope and, most recently, contracting it. Following initial implementation, the cordoned area was expanded to include a greater portion of central London. Additionally, recent proposals evaluated incorporating levels of vehicle emissions into the charge. Both of these proposed expansions illustrate the importance of utilizing an incremental approach to introducing road pricing projects.

While the position of Mayor involves considerably more than overseeing the central London congestion pricing program, and while Livingstone had generally proved to be a popular Mayor, Livingstone was recently ousted as Mayor in an election surprise by Boris Johnson. Johnson, an iconoclastic conservative has signaled his intent to halt the proposed western expansions of the congestion pricing program, though the existing central area pricing cordon will remain (Milmo, 2008).

Many agree that congestion pricing in London most likely would not have been implemented without Mayor Livingstone's work championing for the project. The infusion of revenues for transit and the gradual, albeit in some cases grudging, support from businesses and other key interests also played a substantial role in the successful development of the project (Banister, 2004). Finally, the unique organizational structure of the GLA and TfL facilitated streamlined the implementation process (Ison & Rye, 2005).

Key Lessons:

- Strong project management and political commitment critical in successful implementation
- Integrated team and partnership essential
- Importance of a clear procurement strategy
- Importance of public information campaign and presenting congestion charging as a component of an comprehensive transportation strategy

San Diego I-15 Express Lanes: Enhancing Regional Transit Service

Like many other road pricing initiatives, San Diego's I-15 Express Lanes were originally conceived of primarily to reduce congestion along the I-15 corridor by converting an underutilized HOV lane into an HOT lane and redirecting the revenue to enhance transit service in the region. In contrast to some of the other cases reviewed here, the financing and management of the I-15 Express lanes lay almost entirely in the public realm. A significant portion of the implementation funding came from the federal level, which reflected interest among federal officials in experimenting with various road pricing approaches to relieve congestion. The project was initially funded through the Federal Highway Administration's (FHWA) Congestion Pricing Pilot Program (Value Pricing Program). The FHWA grant provided $7.96 million in funding. In addition, the project received $1.99 million in local

matching funds and $230,000 from the Federal Transit Administration (FTA) (Schreffler, Golob, & Supernak, 1998).

The federal agencies played a larger role in the original inception and funding stages, but as the project moved toward implementation, the local stakeholders took on a greater role (Schreffler, Golob, & Supernak, 1998). In order to move forward with the implementation, the various stakeholders established several agreements distributing authorities and responsibilities. Caltrans and the FHWA entered into a contract to manage the distribution of the federal funds to the state. Additionally, the California Department of Transportation (Caltrans) and the San Diego Association of Governments (SANDAG) developed a Program Supplement Agreement for the purpose of transferring funds and project responsibilities to SANDAG. The FHWA environmental justice requirements attached to the funding caused some confusion and concern about adequately meeting the requirements. But the stakeholders felt that the funding was adequate for implementation. The implementation of the project was delayed less than a year and that was due mainly delays in finalizing essential agreements between FHWA, Caltrans, and SANDAG (Schreffler, Golob, & Supernak, 1998).

Figure 3: Location of 1-15 HOT Lanes (Federal Highway Administration, 2003)

SANDAG and Caltrans served as the primary partners in managing and implementing the I-15 Express Lanes project. The lanes are enforced by the California Highway Patrol (CHP), and transit improvements are provided by the Metropolitan Transit Development Board (MTDB). The original project management team consisted of SANDAG, FHWA, FTA, CHP, MTDB, the Cities of San Diego and Poway, the Automobile Club of Southern California, and Assemblyman Jan Goldsmith's office (Schreffler, Golob, & Supernak, 1998). Assemblyman Goldsmith acted as the primary political champion for the implementation of the Express Lanes. Like the London case, it is likely that the project would have stalled without Goldsmith's advocacy work. During implementation, the project management team met monthly to oversee the progress of the project, allowing all stakeholders to keep in constant communication.

In addition to funding duties, Caltrans was responsible for the operations and safety/liability issues related to the I-15 Express Lanes. At the local level, SANDAG established a Policy Advisory Committee and a Citizen's Advisory Committee, which were very active in the planning phase. Various consultants played an important role in the planning phases with the provision of analytical reports to support decision-making in regards to setting prices, public relations, and operational issues (Schreffler, Golob, & Supernak, 1998).

Many of the keys to successful implementation that played a role in the London case also apply to the San Diego case. Like London, San Diego benefited from the presence of a strong political champion – Jan Goldsmith – and a strong community outreach campaign. At the organizational level, the transit system and the Express Lanes were managed by the same authority, SANDAG, which facilitated the improvements.

Key Lessons:

- Integrating revenue and improvements in public transit to present comprehensive strategy
- A single agency oversaw both the HOT lanes and the transit improvements
- Public relations campaign essential in building supportive coalition
- Gradual implementation

Common Barriers to Implementation

A significant body of literature focuses on identifying barriers frequently encountered in attempting to implement road pricing proposals and many of the case studies discussed had to overcome these impediments. As mentioned in the introduction, the common barriers can be categorized into three groups: (1) technological and practical barriers, (2) legal and institutional barriers, and (3) acceptability barriers. Table 3 on the next page provides a summary of the three categories of barriers and frequent issues associated with each group. While much of the academic literature is drawn from experiences in European road pricing, many of the lessons can be carried over to the context of the United States as any successful initiative needs to address this full-range of challenges. Additionally, it is important to keep in mind that many of the impediments to road pricing are interdependent on one another. For example, achieving adequate public support is dependent on the existence of adequate technology (Niskanene, et al., 2003). Additionally, the relevant significance of specific barriers can vary greatly depending on a number of factors, such as the political context. This paper focuses primarily on the identified legal and institutional barriers to implementation.

Technological and Practical Barriers

As technology rapidly advances, technological impediments to the implementation of road pricing are fading. One common technological challenge that remains, however, is that some existing technology may be too expensive to justify implementation on a broad scale. Additionally, some of the technology that permits fully differentiated pricing based on congestion levels has not been widely tested in the field in a full variety of situations. Furthermore, interoperability problems continue to be a concern in the development of pricing initiatives that cross jurisdictional boundaries. While interoperability issues may not be a major problem at the outset of a project, as initiatives expand to incorporate a broader geographical area, interoperability of charging mechanisms could prove to be a major issue (Niskanene, et al., 2003). Furthermore, interoperability allows for economies of scale with respect to fixed costs of electronic tolling systems. Interoperable smartcards make it cheaper and more convenient for users if they can use one system for all transactions. As the case of the German Toll Collect

project illustrates, technology problems can play a role in significantly stalling a project, but these technological issues can usually be overcome.

Table 3: Common Barriers to Implementation based on Implementation of Marginal Cost Pricing in Transport - Integrated Conceptual and Applied Model Analysis (MC-ICAM)

Type of barrier	
Technological and practical barriers	• While technology for road pricing exists, it is not widely tested and is often considered too risky to justify full-scale implementation in the short term • Interoperability problems among systems • Complex structure of urban road networks and lack of space for added capacity in urban areas • Availability of reliable cost estimates and other data
Legal and institutional barriers	• Predominance of policy goals that are contradictory with economic efficiency and the principle of marginal cost pricing • Lack of federal laws to permit or facilitate road pricing as a general policy approach • Lack of coordination between adjacent cities and states • Disconnected nature of the decision-making structures and processes • Bureaucratic nature of implementation process – dealing with multiple administrative levels • Public-Private-Partnership (PPP) for funding, producing, and operating infrastructure • Legislation to prevent direct charges for road use on the basis of freedom of access and movement and certain civil liberties and privacy needs • Opposition by non-governmental stakeholder groups and opposition parties
Acceptability barriers	• Low public acceptability • Low business acceptability • Low political acceptability

Source: (Niskanene, et al., 2003)

More relevant to the focus of this paper are the practical barriers to implementation. A common practical impediment is access to quality and sufficient data on costs as well as of the welfare benefits and other potential effects of road pricing. Without accurate estimates of the implications and costs, it is much more challenging to garner the necessary support. This form of uncertainty is gradually declining as pricing programs become more commonplace. Additionally, the complexity of transportation networks and the geography of the jurisdiction play a major role in the feasibility of road pricing initiatives. For example, mono-centric and poly-centric cities might have very different optimal pricing strategies. Many feel that the urban form in Europe might be better suited for area-based congestion charging than the urban form of many American cities, which tend to be more sprawling without a strong central business district (Lindsey, 2003). Therefore, these differences in urban form imply that the road pricing programs should be designed differently. For example, facility-based tolling is perhaps more applicable in the U.S. context while cordon tolling may be more relevant to the European context.

Additionally, studies have shown that road pricing is both more urgent and more accepted in larger cities (Lindsey, 2003). This is likely due to higher levels of congestion in larger cities, which is critical in demonstrating the need for road pricing. For example, in response to attempts to introduce congestion pricing to Hong Kong, the Automobile Association there suggested the congestion problem had been exaggerated. Additionally, feasibility studies in both Hong Kong and Cambridge, England suggested that road pricing was not justified based on current congestion levels. On the other hand, London congestion levels had reached unacceptable levels – many Londoners felt drastic measures were justified. Therefore, proposals can fail if traffic congestion has not yet reached what are locally perceived to be unbearable levels (Ison & Rye, 2005).

The timing of the introduction of road pricing proposals can also play a critical role in its success or failure. The timing of the implementation can affect the public's perception of existing congestion and thus the need for road pricing programs. For example, the Hong Kong proposal failed in part because the proposal coincided with the merger of the Mass Transit Railway and Kowloon Canton Railway. This merger resulted in the creation of an urban rail transit network in excess of 200 kilometers and 150 stops/stations, which, in combination with an economic downturn in Hong Kong, significantly decreased congestion and thus the perceived need for road pricing. Political stability is another factor that varies based on the timing of the proposal. For example, the London congestion charging scheme was introduced early in Mayor Livingstone's term, which provided a certain level of political stability, allowing the measure to move forward (Banister, 2004; Ison & Rye, 2005).

While technological and practical barriers can certainly hinder the implementation of road pricing projects, it is unlikely that with current technology, this would be the sole reason a project failed to move forward. Even if technological barriers prevent implementation of a large-scale project, the proposal could always be implemented piece-meal. On the other hand, the practical barriers can play a larger role in guiding the implementation process and ultimately determining the optimal structure. For example, in dense urban environments, it might simply not be feasible to construct a new facility and instead cordon charging might be a better structure. In the long-run, both technological and practical impediments can easily be overcome (Niskanene, et al., 2003).

Legal and Institutional Barriers

Legal restrictions from higher governing bodies, such as federal or state governments, can often impede the progress of road pricing proposals, even if the support is present at the local level. In Europe, many countries limit the legal ability of local governments to introduce road pricing projects by creating stipulations that projects must meet. For example, France limits road pricing to new infrastructure, and in Sweden road tolls are considered taxes and therefore must be approved by the Parliament (Niskanene, et al., 2003). In other countries, civil liberty protections prohibit the tracking of the location of vehicles. Additionally, European Union legislation restricts the level of permissible tolling prices. Within the United States, tolling was prohibited on Interstate highways until the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) loosened the restrictions (Lindsey, 2003).

In addition to legislative barriers from higher authorities, contradictory legislation can often hinder implementation. For example, civil liberty, taxation, and environmental legislation can often pose a challenge to the legal standing of road pricing projects (Niskanene, et al., 2003). Laws pertaining to civil liberties can limit the ability of agencies to track the locations of individual vehicles, which is necessary in distance-based fee programs. Taxation legislation often prohibits jurisdictions from implementing new charges on road networks. Furthermore, some countries have legislation that prohibits tolls from varying over time, which greatly limits the ability to manage traffic flows. Past experience demonstrates that securing the necessary legal approval is easier if road pricing projects are implemented only temporarily to address a specific problem or if the legislation is subject to periodic review (Lindsey, 2003). For example, U.S. federal legislation is subject to re-examination automatically through the Reauthorization process. In Norway, the tolling schemes must be renewed every fifteen years. These legislative challenges closely coincide with building a strong political coalition across all levels of administration to prevent politicians from wielding legislation to block road pricing projects.

Organizational structure issues can also inhibit the implementation of road pricing plans. Disconnected decision-making structures, multi-level structure of government decision-making process or the number of administrative levels, and the role of the private sector can all determine the efficiency with which a proposal moves towards implementation. For example, in Europe, the management of urban roads is typically the responsibility of local cities, whereas interurban roads fall under the national jurisdiction (Niskanene, et al., 2003). Similarly, in the United States, urban surface streets are the responsibility of cities, and counties in unincorporated areas, while the Interstate and other state and federal highways fall under combined federal/state jurisdiction. These mixed, and sometimes competing, jurisdictions can make it challenging to coordinate a comprehensive road pricing approach as they may often have conflicting interests and goals.

Furthermore, the multi-level structure of bureaucratic decision-making can inhibit implementation. The distribution of responsibilities and powers across different governmental administrative levels is often not ideal to manage and move road pricing forward. In particular, the democratic political system with opposing parties and reelection concerns limits the ability of government to take political risks for the sake of operating efficiency (Niskanene, et al., 2003). While many jurisdictions face these barriers of distributed authority under democracy, a growing number of jurisdictions, like London, have overcome them. It's perhaps not surprising the first successful experiment in congestion pricing was in Singapore, a city-state that has a sole administrative level for implementing and deciding on transportation policies. The failure of the New York City Congestion Pricing proposal, due to an unwillingness of the state legislature to grant the necessary legislative authority, is a recent example of the challenges in multi-level approval processes to move projects forward.

Ison and Rye (2005) identify the existence of a single implementing body as a key characteristic of the success of the London Congestion Pricing Scheme. In London, the Mayor possessed the ability to make key decisions pertaining to congestion charging, as the head of the Greater London Authority. Furthermore, Transport for London was responsible for the implementation of the project, which expedited the process as the agency controls the major roads, buses, light rail, and local transport capital funding for all local transport schemes and the Underground. Transport for London is both well-funded and well-staffed, making it easier for

the agency to retain control of the implementation process. Since Transport for London is also responsible for managing the alternative transportation modes, it was possible to make the public transit improvements that proved to be so critical in building acceptance for the congestion pricing. In contrast, implementation attempts in Cambridge, England and Hong Kong were mired in conflicting political interests at various levels of government. Additionally, political stability is also critical in successful implementation. For example, London was politically stable throughout the implementation since it was introduced early in Mayor Ken Livingstone's term (Ison & Rye, 2005).

When the private sector is involved in the administration or oversight of a road pricing project, the government often loses the ability to set the optimal prices to manage congestion. Rather, the goal of the private sector is to maximize profits, and prices are set with this objective in mind (Niskanene, et al., 2003). While in practice the two are related, they are not identical. As private investors continue to play a large role in the development of road pricing projects, two regulatory models to curb monopoly power of private road developers have emerged: rate-of-return regulation and toll regulation. Rate-of-return regulation allows operators to implement time-of-day pricing freely in response to congestion levels in order to maintain steady vehicle flow – as on SR-91 and I-15 HOT lanes. With a toll regulation, the maximum toll is pre-determined by the government based on traffic levels and inflation index – as with Highway 407 in Toronto (Lindsey, 2003). On the other hand, since private operators have greater incentive to control costs, these tolls charged on private roads serve as benchmark for evaluating efficiency of competing public roads.

Like technological and practical barriers, legal and institutional barriers rarely serve as a long-term impediment to implementation. Perhaps in the near-term, inadequate legislative authority can delay a program. However, new legislation is frequently developed and passed – as is the case with the authorization that enabled London's Congestion Charging Scheme or California state legislation that permitted the conversion of HOV lanes to HOT lanes – with sufficient political support. Likewise, institutional and organizational structures can be altered to reflect changing demands of road pricing projects. Furthermore, an advantage of having numerous jurisdictions experimenting simultaneously with road pricing is that new projects can take lessons from various programs – both the successes and failures – to determine the ideal project design for the particular project (Lindsey, 2003). These impediments highlight the importance of incremental rather than wholesale implantation of pricing, but legal and institutional barriers, except as they have been wielded by opponents to kill pricing proposals (as in the case of New York), are unlikely to sink a project when broad public and political support exists.

Acceptability Barriers

Strong public and political acceptance are perhaps the most important factors in determining whether a road pricing project moves forward. While technological, practical, legal and institutional challenges can be overcome provided enough popular and political support exists, achieving such acceptance can be a daunting hurdle. Although we will elaborate on this topic in the report for Task A-5, this section will discuss some of the key political barriers and some of the steps that can be taken in the implementation phase to minimize acceptability problems.

One important aspect of the development of political will is the interaction between political support and the existing legal and institutional structures. The political and financial relationships among agencies at various levels of government – federal, state, and local – and between the various political parties can have a significant effect on the policy-decision making process. Rather than being grounded in economic principles, the decision often reflect parochial political interests. For example, often one level of government is fearful that it might lose out on a new source of revenue. Also, the institutional nature of government is often biased against change, and government employees are often fearful of new policies or organization arrangements that could potentially threaten their job security (Niskanene, et al., 2003).

Certain justifications for introducing road pricing are more accepted than others. Among the more acceptable justifications are (1) expanded road capacity, (2) environmental improvements, and (3) safety improvements. Tolling that is introduced for the purpose of travel demand management tends to meet stronger opposition (Niskanene, et al., 2003). It might be difficult for the public to grasp the benefits of road pricing in terms of demand management, but funding road expansion is an easier concept to explain.

Another major hurdle in achieving public support is portraying the road pricing program as equitable and fair. Equity issues are often defined in two ways: vertical equity and horizontal equity. Vertical equity pertains to how people or firms of different types fair relative to one another, while horizontal equity pertains to how similar people or firms fair relative to one another. With respect to road pricing, these similarities or differences are most often expressed in terms of income, but can also refer to race/ethnicity, geographic location, mode, or (in the case of firms) industry type (May & Sumalee, 2003). Equity concerns also vary greatly based on the type of tolling project, with cordon tolls and HOT lanes generally receiving far more criticism than weight-distance fees, which are not based on locations traveled. Logically, those residents who are likely to absorb a significant portion of the costs but enjoy few of the benefits are more likely to consider a road pricing program inequitable, compared with those who experience many of the benefits, even if they also pay a substantial portion of the costs.

Equity issues are treated in detail in Task A-5 in this research series. In a nutshell, a variety of approaches have proven effective in easing equity concerns among both the public and elected officials. For example, the means by which toll revenues are used plays a large role in justifying the equity of road pricing initiatives. Experience suggests that projects that are seen as enhancing the mobility of all or most of a region's residents raise fewer equity concerns and can help to overcome the equity concerns that do arise. One effective method of improving mobility across the region has been to dedicate funds to transit improvements. Many other proposals to address equity issues in road pricing have been proposed (Kind, Manville, and Shoup, 2007), including rather complex and elegant proposals such as "FAIR" lanes, but many have yet to be put into practice. One of the most effective means for improving public support has proven to be to actively involve the community in the planning stages (Banister, 2004; Niskanene, et al., 2003). The importance of community engagement has been highlighted in a number of case studies, including London and San Diego. Finally, gradual, incremental implementation has been shown to be effective in easing concerns over fairness among both public officials and the voting public.

Lessons from Successful Implementation of Road Pricing

Six-Step Framework

Replogle (2006) has developed a six-step framework to guide the successful implementation of road pricing. This framework incorporates many of the lessons learned from the case studies and the identified barriers that must be overcome to introduce road pricing. While these steps are roughly ordered, they should not be construed to be a sequential step-by-step plan for implementation; rather these steps should be viewed as a checklist common to most successful road pricing. Implementation is, more often than not, an iterative process.

1. Articulate system objectives

As the literature review and case studies have demonstrated, the ability to clearly identify and communicate the goals of the road pricing project is not only critical in designing the project, but also in securing public and political acceptance. First, a consensus must agree that transportation problems, such as congestion, warrant the introduction of a new policy approach. A road pricing project must be seen as a solution to an accepted problem for the scheme to be successful from the user's perspective (Ieromonachou, Warren, & Potter, 2006). For example, the London proposal clearly stated the program's objectives as to reduce total traffic in zone, increase traffic speeds and reduce levels of congestion in terms of vehicle delays (Ison & Rye, 2005).

2. Affirm legal authority

Likewise, considering potential legal barriers is critically important in determining who has the legal authority to implement a road pricing projects. Furthermore, it is critical to determine whether any restrictions exist as to conditions of facilities where tolling is limited. It is also important to keep in mind that legal approval is often easier to obtain either if road pricing projects are implemented only temporarily to address a specific problem or if the legislation is subject to periodic review (Lindsey, 2003). For example, the cases of Oslo and Stockholm illustrate that by continuously re-evaluating the progress of the road pricing projects, initial acceptance is higher.

3. Determine implementation framework

The optimal implementation framework is closely related to the system objectives, as discussed in the report for Task A-1. For example, a cordon charging scheme would be more appropriate for a project that aims to manage congestion levels, while a facility toll might be more appropriate for a project that aims to fund new infrastructure. The potential for diversion of traffic from tolled facilities should be considered as this may have an impact on the type of scheme implemented (Bowerman, 2007). Furthermore, at this point, any applicable barriers to implementation should be identified so that the project can be developed efficiently. The timing of the implementation path should also be a major consideration – at what point is the project likely to be met with the least amount of resistance?

4. Design & evaluate road pricing plan

The five major factors that should be considered here are: (1) the coverage or scope of the pricing system, (2) the composition of pricing measures and their levels, (3) degree of differentiation, (4) use of revenues, and (5) need of supplementary measures, such as transit development (Niskanene, et al., 2003). As officials evaluate various road pricing designs, they should keep in mind that project viability heavily affected by the level of the fee, the potential for evasion or diversion, and the security of information about people's travel (Small & Gomez-Ibanez, 1998). Simple, tested, and easy to understand technologies increase the likelihood of successful implementation. Furthermore, flexibility in the scheme's design and technology are critical in dealing with unanticipated changes in the future of the project and can help ensure the long-range success of the program.

5. Adopt system plan, financing scheme

The implementing agency must determine the most effective method of funding the project and the level of financial risk that public sector is willing to assume. The various funding mechanisms and lessons learned from the report from Task B-1 should be considered at this step of the implementation process. While private investment in road infrastructure has the potential to deliver transportation improvements at a lower cost and a shorter timeline than traditional procurement methods, partnering with the private sector can also, when poorly structured, prove to be costly in the long-run (Iseki, Uchida, & Taylor, 2008). Public-private partnerships are not just "free money," but rather a redistribution of costs and risks between the public and private sectors (Iseki, Uchida, & Taylor, 2008).

6. **Procure management & technology services**

More often than not, public agencies turn to the private sector to develop technology and manage the day-to-day operations of road pricing projects because the applicable technical expertise often resides in the private sector. However, as the German Toll Collect case illustrates, the importance of developing so-called "complete contracts" with these firms cannot be understated. In the German case, the failure to develop adequate technology in a timely fashion nearly sunk the entire project.

One Step at a Time…

A gradual, incremental process has proven to be one of the most effective approaches to implementing road pricing. The identification of relevant barriers to the specific situation are critical in determining the constraints a government faces in implementing a road pricing initiative, and in determining what is possible and feasible in the short, medium, and long-term runs (Niskanene, et al., 2003). In addition to the barriers that prohibit immediate implementation, costs associated with introduction, such as transition, transaction, and adjustment costs, justify a gradual implementation process (Niskanen, et al., 2003).

Generally, societies only accept drastic policy changes in emergencies. Although increasing traffic congestion certainly imposes extensive negative externalities, its gradual evolution makes it less likely to be perceived as a crisis or emergency, at least not overnight (Ison, 2004). The most fundamental reason gaining public acceptance is so challenging that members of the public perceive that they stand to lose by raising the cost of travel, but the benefits of the toll revenue are ambiguous and not direct. In other words, the added costs are certain, while the promised benefits are not. People are generally suspicious of plans to change arrangements with which they have grown comfortable (Small & Gomez-Ibanez, 1998). Gradual, incremental approaches, on the other hand, permit learning and enhance understanding and acceptance among the public (Ieromonachou, Warren, & Potter, 2006). The gradual growth in popularity among those who live and work around the SR-91 Express Lanes in Orange County is an example of this idea that familiarity breeds acceptance.

In order to maximize acceptability, road pricing proposals are often best presented as the final element in comprehensive transportation planning process, only introduced once all other alternatives have been exhausted (Ison, 2004; Harsman, 2003). Furthermore, people are more likely to be accepting when the relationship between tolling and revenue is clear, such as financing a new facility, which is funded directly by the revenue (Small & Gomez-Ibanez, 1998; King, Manville, and Shoup, 2007). In fact, introducing tolling to a region by applying it to a new facility might be an effective means of gaining public support (Niskanene, et al., 2003; King, Manville, and Shoup, 2007). Examples of cases that have utilized this approach include the Toronto 407 ETR and the SR-91 in Orange County. Road pricing cases that incorporate transit improvements, such as London, Stockholm, and San Diego, also emphasize the fact that road pricing is just one policy in a comprehensive approach to relieving traffic congestion.

Extensive literature has focused on the fact that toll rates do not necessarily need to be set at the optimal level upon initial implementation of the road pricing project. Rather than an optimal policy, the implementation path should follow a sequence of what economists would term "second-best" alternatives in moving towards the ultimate optimal policy. Although these second-best prices are not ideal in all respects, they can still be effective in achieving most of a program's goals, such as congestion relief or time savings. These second-best policies are inferred from the specific barriers to implementation. As a project moves towards optimal implementation, the relevant impediments will decrease over time. These barriers fall away due to a combination of society's growing acceptance and/or government's deliberate actions (Niskanene, et al., 2003). In Europe, policy-makers have found that lower toll levels help build public support and that the tolls can then be raised later to the optimal levels to control congestion (Harsman, 2003). The European PRIMA[3] case studies support findings that this stepwise implementation process is most effective (Harsman, 2003). In the United States, experiences with the SR-91 in Orange County suggest that the reasonable level of pricing, although not optimal, still generate sufficient revenues to cover all the operating cost while increasing the public's awareness of the efficacy of road pricing.

[3] The goal of the PRIMA project is to produce policy recommendations and guidance for implementation of urban road pricing systems in Europe through a series of case studies. The eight cities studied were Oslo, Barcelona, Marseille, Lyon, Stockholm, Rotterdam, Bern, and Zurich.

In order to optimize efficiency of implementation, both top-down and bottom-up approaches are helpful. For example, the federal and state legislation often needs to be changed, which requires the top-down authority (Harsman, 2003). However, in order to build adequate public support, it is also important to harness bottom-up support. The political challenges play a critical role in the successful implementation of road pricing proposals. In a democratically accountable governmental organization, the often conflicting presidential, national, federal, state, and local electoral cycles result in very few neutral periods where road pricing can be planned and implemented. Therefore, it is much more effective when the proposal is promoted by a single layer of government, if possible on the basis of an electoral mandate, as with Ken Livingstone or Jan Goldsmith. However, this concept failed in the attempted implementation of the New York City Plan. When a decision needs to be ratified by multiple authorities or multiple levels of government, and where government officials are subject to varying electoral timelines, it would be difficult to discuss sensitive issues such as revenue-raising measures (Baker, 2002).

Yet another advantage of taking an incremental approach to implementation is that this method keeps the door open to alter or reverse actions at a reasonably low cost (Niskanen, et al., 2003). This flexibility is particularly important in the later steps of the implementation path, so that plans can be altered if new information comes to light. On the other hand, in terms of reliability, sometimes it is best to design the implementation path in such a way that the government or implementing agency cannot deviate from the plan once it has been put into motion (Niskanen, et al., 2003).

Small and Gomez-Ibanez (1998) point to the important role incremental implementation played in the development of road pricing in Scandinavia. Road pricing in this region started in Norway with toll rings implemented to help finance transportation infrastructure, but gradually incorporated traffic management goals as a secondary objective. The experiences in Norway allowed Stockholm to adopt a much more extensive traffic management strategy through an area congestion fee. By the time the congestion fee was proposed in Stockholm, residents were familiar with the existence of tolls in Norway and their success. The Stockholm program was also implemented as a fixed-term experiment that, at its conclusion, was put before the voters, the majority of whom elected to make the program ongoing. Such gradual spillover effects are currently taking place within the United States as more HOT lanes are successfully implemented across the country from Houston to San Diego and Denver to Minneapolis.

Conclusion

This report provides a review of the potential barriers to road pricing implementation, and the lessons from the successful implementation of pricing projects around the world. While much of the information presented is drawn from case studies of congestion pricing from around the world, we believe that many of the lessons are applicable to California. While the technological and acceptance issues will be expanded on in later deliverables, special emphasis should be placed on addressing acceptability concerns as these are often the most challenging barriers to overcome. The six-step framework presented here provides guidance for important issues to consider at each step of the implementation process. Lessons from success cases also

highlight the importance of adopting an incremental implementation approach, particularly to build adequate political and public support.

While the role the private sector can play in road pricing projects was discussed at length in the report for Task B-1, this report paper focused more narrowly on the potential for private sector involvement in technical and management aspects. Private firms often have a competitive and experiential edge over public agencies in providing these services as their staff are often more experienced and have access to a greater array of resources. However, the public sector still needs to be cautious in developing such contracts to avoid situations such as those described in the case of the German Toll Collect.

The organization of the public agencies tasked with implementation can also play a critical role in the success or failure of a project. Generally, the more streamlined and less bureaucratic the government actors, the greater the likelihood of successful introduction of road pricing. The London Charging program highlights the advantages of a single agency managing both transit improvements and the road pricing initiative.

As was noted at the outset, there does not appear to be any one best practice for the introduction of road pricing. The U.S. is certainly different from the Europe, so many of the lessons from European examples should be carefully contextualized. As jurisdictions in California move forward with road pricing projects, the best implementation and management scheme will depend greatly on the initiative's objectives and the availability of public and private resources.

Bibliography

Baker, J. 2002. *Implementing Urban Road Pricing - Achievement and Barriers.* Transport & Travel Research Ltd.

Banister, D. 2004. Barriers to transport pricing. In P. Rietveld, & R. Stough, *Barriers to Sustainable Transport: Institutions, Regulation and Sustainability* (pp. 54-68). New York: Taylor & Francis.

Borgnolo, C., Stewart-Ladewig, L., & Neuenschwander, R. 2005. Position and Recent Trends in European Countries. In J. M. Viegas, *Interurban Road Charging for Trucks in Europe* (pp. 109-132). Elsevier.

Bowerman, A. 2007. *The Costs and Benefits of Road Pricing: Comparing Nationwide Charging with Project-Based Schemes.* London: Institute of Economic Affairs.

Capita to lose congestion charge. 2007. October 25, 2007. Retrieved May 2008, 16, from BBC News: http://news.bbc.co.uk/2/hi/business/7062030.stm

Commission for Integrated Transport. 2006. *World review of road pricing: Phase 1 - lessons for the UK*, June 21, 2006. Retrieved January 5, 2008, from http://www.cfit.gov.uk/docs/2006/wrrp/wrrp1/index.htm

Crawford, I., & Catling, D. 2002. *Developing implementation plans for urban transport road pricing schemes.* Ian Catling Consultancy, CUPID.

Milmo, Dan. 2008. "Transport: London mayor unveils congestion charge rethink," *The Guardian*, London, July 2, 2008. Retrieved 6 July 2008 from http://www.guardian.co.uk/uk/2008/jul/02/london.congestioncharging?gusrc=rss&feed=environment

Harsman, B. 2003. Success and Failure: Experiences from Cities. In J. Schade, & B. Schlag, *Acceptability of Transport Pricing Strategies*, pp. 137-151. Oxford: Elsevier.

Ieromonachou, P., Warren, J., & Potter, S. 2006. A Strategic Niche Analysis of Urban Road Pricing in the UK and Norway. *European Journal of Transport and Infrastructure Research* , pp. 15-32.

Iseki, H., Uchida, K., & Taylor, B. 2008. *Are Public-Private Partnerships a Good Choice for U.S. Highways?* Los Angeles: California PATH Project. ** pages.

Ison, S. 2004. *Road User Charging: Issues and Policies.* Ashgate Publishing, Ltd.

Ison, S., & Rye, T. 2005. Implementing Road User Charging: The Lessons Learnt from Hong Kong, Cambridge and Central London. *Transport Review, 24:4* , pp. 451-465.

King, David, Michael Manville, and Donald Shoup. 2007. "For Whom the Road Tolls: The Politics of Congestion Pricing," Access, 31: pp. 2-7.

Leape, J. 2006. The London Congestion Charge. *Journal of Economic Perspectives* , 157–176.

Lindsey, R. 2003. *Road Pricing Issues and Experiences in the US and Canada.* IMPRINT - EUROPE.

LKW-MAUT Electronic Toll Collection System for Heavy Goods Vehicles, Germany. 2007. Retrieved January 2, 2008, from roadtraffic-technology.com: The website for the road traffic industry: http://www.roadtraffic-technology.com/projects/lkw-maut/

May, A. D., & Sumalee, A. 2003. One Step Forward, Two Steps Back?: An Overview of Road Pricing Applications and Research Outside the United States. *International Persepectives on Road Pricing*, pp. 73-88. Key Biscayne, Florida: Transportation Research Board.

Milne, D., Niskanen, E., & Verhoef, E. 2001. *Legal and Institutional Framework for Marginal Cost Pricing in Urban Transport in Europe.* Helsinki: Government Institute for Economic Research.

Nash, C., & Sansom, T. 2001. Pricing European Transport Systems: Recent Development and Evidence from Case Studies. *Journal of Transport Economics Policy, Volume 35, Part 3*, pp. 363-380.

Niskanen, E., & Nash, C. 2008. Road Pricing in Europe - A Review of Research and Practice. In C. Jensen-Butler, *Road Pricing, the Economy and the Environment*, pp. 5-29. Springer.

Niskanen, E., de Borger, B., de Palma, A., Lindsey, R., Nash, C., Rouwendal, J., et al. 2003. *Phased Approach.* Leeds: Implementation of Marginal Cost Pricing in Transport - Integrated Conceptual and Applied Model Analysis (IM-ICAM).

Niskanene, E., de Palma, A., Lindsey, R., Marler, N., May, T., Nash, C., et al. 2003. *Pricing of Urban and Interurban Road Transport: Barriers, Constraints and Implementation Paths.* Leeds: Implementation of Marginal Cost Pricing in Transport - Integrated Conceptual and Applied Model Analysis (MC-ICAM).

Nix, F. 2001. *Alternative Road Financing Arrangements.* Canada Transportation Act Review.

Replogle, M. 2006. Road Pricing and Congestion Charging: Implementation Challenges. Environmental Defense and the Institute for Transportation and Development Policy. http://www.edf.org/documents/5842_Replogle_Implementation.pdf

Roth, G. 1998. Road Pricing in a Free Society. *Institute of Economic Affairs* , 9-14.

Sam, C.-Y. 2008. *Partial privitization, corporate governance, and the role of state-owned holding companies.* 63-88: Journal of the Asia Pacific Economy, 13:1.

SANDAG. 2008. *I-15 Managed Lanes*. Retrieved January 5, 2008, from SANDAG: http://www.sandag.org/index.asp?projectid=34&fuseaction=projects.detail

Schreffler, E. 2003. HOW POLITICS AFFECTS EVEN GOOD PROJECTS. *Internations Perspectives on Road Pricing*, p. 21. Key Biscayne, Florida: Transportation Research Board.

Schreffler, E. N., Golob, J., & Supernak, J. 1998. *I-15 Congestion Pricing Project Monitoring and Evaluation Services: Task 3.3.1 Phase I Implementation Procedures, Policies, Agreement and Barriers.* San Diego State University Foundation.

Sclar, E. D. 2000. *You Don't Always Get What You Pay For.* Ithaca: Cornell University Press.

Small, K. A., & Gomez-Ibanez, J. A. 1998. *Road Pricing for Congestion Management: The Transition from Theory to Policy.* University of California, Berkeley.

Sorensen, P. A. 2006. *Review and Synthesis of Innovative Electronic Tolling Applications Worldwide.* Los Angeles: UCLA Institute of Transportation Studies.

Sorensen, P. A., & Taylor, B. D. 2005. *Review and Synthesis of Road-Use Metering and Charging Systems.* Transportation Research Board.

Toll Collect - Legal Basis. 2007. Retrieved January 2, 2008, from Toll Collect: http://www.toll-collect.de/mautsystem/tcrdifr002-5_rechtl_grundlg.jsp;jsessionid=645D3D91EFA2C60A00DE3EFC4A88ED2C

Ubbels, B., & Verhoef, E. 2004. Barriers to transport pricing. In P. Rietveld, & R. Stough, *Barriers to Sustainable Transport: Institutions, Regulation and Sustainability*, pp. 69-93. New York: Taylor & Francis.

United States Government Accountability Office. 2006. *Highway Finance: States' Expanding Use of Tolling Illustrates Diverse Challenges and Strategies*, June, 2006

Wachs, M. 2003. Then and Now: The Evaluation of Congestion Pricing in Transportation and Where We Stand Today. *International Perspectives on Road Pricing*, pp. 63-72. Key Biscayne, Florida: Transportation Research Board.

Wieland, B. 2005. The German HGV-Toll. *European Transport* .