

**With What Concessions? The Influence of Metropolitan
Highway Public-Private Partnerships on Sustainable System
Management**

Christopher Grillo

Candidate, Master of Science in Transportation, Master in City Planning
Massachusetts Institute of Technology
cgrillo@mit.edu

P. Christopher Zegras

Assistant Professor, Urban Studies and Planning
Massachusetts Institute of Technology
czegras@mit.edu

1 Introduction

Transportation plays a critical role in metropolitan “sustainability,” influencing economic efficiency, environmental stewardship, and social equity. Theory suggests metropolitan transportation sustainability may require a strong public-sector role in ensuring inter-modal coordination, proper regulation and pricing, and inter-sectoral policy integration (e.g., land use and development policy). Theory also supports an important possible private sector role in financing, building, and managing transportation infrastructures, which governments have adapted for centuries (e.g., via PPPs). Today, shrinking public budgets, expanding costs, and changing political values enhance the PPP allure. The PPP promise also responds to a history of poor social returns and performance in the metropolitan transportation sector and seeks to leverage private sector motivations to fulfill objectives consistent in many respects with the sustainability agenda.

In this paper we examine which institutional strategies may best align the private sector’s profit-maximizing and presumed efficiency objectives with government’s ostensible social welfare objectives, including the financing of more sustainable metropolitan transportation systems. We ask: does the cooperative system management framework required under the “sustainability” paradigm fundamentally contradict the competitive realities of the market, particularly when private finance and commercial risk are involved? Since PPPs in metropolitan highway infrastructure appear to be on the rise, as do global concerns about the transport sector’s impacts on “sustainability,” the answer is important.

Our review of four metropolitan highway PPPs suggests that coordinating private finance with sustainable metropolitan mobility will be challenged without a public authority of appropriate geographic scope and powers to integrate metropolitan transport (and preferably land use) policy. We show that arrangement of finance of highway PPPs by the private partner can support some elements of our ideal sustainable metropolitan mobility system, but that rational business decision-making in the face of the private sector assuming large commercial risk can counteract other critical elements. In the meantime, the private sector can and should play a prominent role in metropolitan highway provision, maintenance, management, and operation, but with a public authority primarily responsible for arranging finance. In essence, it is important to get institutions right before considering passing substantial social responsibilities onto private finance.

This paper is organized into five sections, including this introduction. A background section reviews literature from which we derive our “ideal” sustainable metropolitan mobility model. A methodology section details our case study approach, including an overview of the case study universe from which we select our cases. The following section presents PPP case studies in four metropolitan areas: Santiago, Chile; Los Angeles, United States of America; Toronto, Canada; and Porto, Portugal, and analyzes pros and cons of private finance of PPPs in these different institutional contexts. A conclusion section summarizes the empirical evidence, suggests possible policy interventions, and considers extensions for future research.

2 Background

We first introduce concepts and theories from which we construct our “ideal” model for sustainable metropolitan mobility, and elaborate the criteria by which we can identify the appropriate role of PPP finance. We begin with a brief summary of the historical development of the concept of “sustainability” as related to metropolitan transportation. We follow with a discussion of the foundational theoretical and empirical bases upon which our model “objectives” are derived. We then link these objectives to criteria defining the optimal roles for finance and PPPs in metropolitan mobility as related to highway finance, provision, management, and operation.

2.1 Sustainability

Contemporary concepts of “sustainability” typically trace basic principles back to a 1987 United Nations (UN) World Commission on Environment and Development (WCED) publication colloquially referred to as the “Brundtland Report.” Named for the Commission Chairman, the Report describes the concept of sustainability as “the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987).

Since the Brundtland Report publication, various researchers and organizations have attempted to operationalize the concept of sustainability with respect to the transportation sector. In the “2001 European Union White Paper on Transport,” the European Commission (EC) outlines strategies for Members with regard to transportation and sustainable development. These include, but are not limited to, social marginal cost pricing (SMCP) of roads; inter-modal and inter-sectoral integration; mode shift away from road use for passenger and freight; targeted investments aimed at system efficiency; and other institutional reforms. The White Paper also acknowledges a critical role for the private sector in implementing many of these objectives (EC, 2001).

The EC has since supported numerous in-depth research programs examining in detail the transportation sustainability concept and providing implementation strategies to Members. For example, the PROSPECTS research program outlines sustainability objectives for implementing integrated transportation and land use strategies, including decision-making tools (May et al., 2005a) and methodological guidelines (Minken et al., 2003). The DISTILLATE research program includes, among a number of research initiatives, a useful and comprehensive effort at defining and standardizing various outcome performance indicators for transportation sustainability (Marsden et al., 2005). The ENACT research program introduces a decision-support framework for selecting the appropriate highway PPP contracting design to integrate SMCP principles given a number of institutional characteristics (ENACT, 2009), while the PATS research program suggests strategies for “fair and efficient pricing in transport,” with the objective of gaining public acceptability (PATS, 2010).

Academia, business, and non-governmental organizations have also contributed in recent years to operationalizing the concept of sustainability. Goldman and Gorham (2006) review various definitions of sustainable metropolitan transportation suggesting that they tend to provide either a “pathway” of general directional guides towards sustainability or

an “end state” view to indicators of success. The authors suggest that most definitions fail to fully take into account the larger systemic framework of transportation and cross-system interactions, while offering that a number of emergent approaches at the practical level provide much insight on implementation. Zegras (2010) also suggests a need to move towards a more systemic view of urban mobility, proposing a normative framework which conceptualizes sustainable urban mobility as requiring cities to provide more welfare (accessibility) per unit of throughput (mobility).

While recognizing the wealth of innovative work on conceptualizing and measuring metropolitan transportation sustainability, we adopt a pathway approach composed of simple “elements” to define our “ideal” model. We do this for a couple of reasons. First, the nature of our case study approach is largely exploratory, as we seek to understand directional relationships between PPP finance and key objectives defined for sustainable metropolitan mobility. We are interested less in precisely measuring sustainability as to identifying key institutional variables linking private finance to sustainable metropolitan mobility. Second, we propose relatively straightforward links between the impact of finance and generally-accepted objectives for sustainable metropolitan transportation.

Banister (2008) provides a useful framework for defining the objectives of sustainable metropolitan mobility for the purposes of our analysis. Building on many of the goals and objectives developed in recent decades, the Author suggests four key elements in formulating policy measures to promote the “the sustainable mobility paradigm.” Paraphrasing, these elements include: using road pricing and regulation to internalize social costs and support demand management; integrating land use development and transportation planning and regulation; using targeted information and various social marketing measures to gain public acceptability; and effectively deploying technology in transport modes and infrastructure systems to promote efficiency (Banister, 2008).

We borrow from Banister, the EC, and other transportation research to define our “sustainable metropolitan mobility” model, through which we analyze the successes and failures of our representative PPP cases. This model includes four overarching objectives for metropolitan transportation sustainability (i.e., our “ideal” model), for which we then derive five specific criteria representing the role played by highway infrastructure finance in meeting these objectives. Figure 1 represents the logic of this analytical framework, while the following sections outline the rationale for each of these objectives.

2.1.1 Optimal Pricing and Regulation

The theoretical underpinnings of optimal pricing and regulation are found in economics and equilibrium theory. Pricing at marginal social cost maximizes net social benefits by matching a consumer’s willingness to pay with the cost of production. If demand for road space grows, prices will increase, thus creating a market signal reducing demand or encouraging firms to produce more of that output (Gómez-Ibáñez, 1999). SMCP includes not only costs of infrastructure provision but also social costs of externalities. It can be used, for example, as a tool for optimizing the allocation of road space, particularly during peak traffic periods, by charging tolls so as to maximize the difference between consumer benefit and cost (Small and Verhoef, 2007).

Figure 1: Concept of Sustainable Metropolitan Mobility and the Role of Finance



Academic literature on efficient transportation pricing has long historical antecedents. Arthur Pigou (1920) is responsible for advancing the theory that socially-optimal consumption can be achieved by taxing a given good or service in a manner that fully internalizes all costs. Vickrey (1969) extended the concept of the Pigouvian Tax to transportation use, specifically advancing the idea that charging higher tolls on roadway users during peak hours will decrease congestion by spreading road volume more evenly over the course of the day. Contemporary literature considers strategies for overcoming practical impediments to implementing SMCP. For example, de Palma et al. (2007) suggest three practical constraints: inefficient pricing of substitute modes (e.g., transit, other system road segments, etc.), distortions in revenue sources for transport (e.g., from labor taxes rather than user fees), and political preferences. They suggest the combination of road pricing and hypothecation of such revenues to specific capacity enhancing improvements which, while controversial from the standpoint of public finance theory, offers a practical way to overcoming constraints (de Palma et al., 2007). Gómez-Ibáñez (1999) suggests that while implementation of SMCP is less difficult than commonly perceived, some minor upward adjustments to theoretically-efficient pricing can be tolerated due to practical constraints of economies of scale and scope, with profit-motivated price discrimination roughly approximating an optimal pricing solution.

While SMCP can be understood as a tool for cost recovery and internalization of externalities such as congestion, the role of this concept as a signal for optimal investment can be best understood through public finance theories by way of concepts of allocative and productive efficiency. The Organization for Economic Co-operation and Development (OECD) provides a helpful description of how these concepts relate

directly to efficient procurement of infrastructure, as detailed in Table 1. These concepts of efficiency in project evaluation and management complete the theoretical link between SMCP and the optimal pricing and regulation element of the “ideal” sustainable metropolitan mobility model, which aims to maximize social welfare with regard to both transportation use and investment.

Table 1: OECD Criteria for Efficient Infrastructure Provision

Principle	Description
Allocative Efficiency (Dynamic)	<ul style="list-style-type: none"> • Social benefits during a project’s life should exceed costs of construction and maintenance
Allocative Efficiency (Use)	<ul style="list-style-type: none"> • Pricing should reflect the marginal social cost
Productive Efficiency	<ul style="list-style-type: none"> • Investment and maintenance should minimize social costs and maximize benefits

Source: OECD, 2008.

These principals are crucial for sustainable metropolitan mobility, as even in the rare instances where highway users are charged directly for use, toll rates typically do not internalize all costs of production (e.g., provision of roadway). Even less rarely do prices reflect negative externalities, representing costs to society that are not directly borne by the user, including congestion and pollution. This may lead drivers to consume more “roadway” than they otherwise might if they had to pay the full cost to society.

2.1.2 Integration

While classical welfare economics provides a firm foundation for optimal pricing and regulation, the theoretical justification for system integration in the sustainable metropolitan mobility framework lies largely with transaction cost economics theory. In his 1937 essay, “Theory of the Firm,” Ronald Coase (1937) addresses the question of why firms exist at all. He remarks that activities within a firm serve as alternative forms of transaction to the marketplace, which is likely to occur when costs of using the pricing mechanism for procurement, in the form of the cost of knowledge and the cost of negotiating contracts, exceed the benefits (Coase, 1937). Williamson (2002) describes that the decision by firms to merge or otherwise coordinate is a function of the desire to reduce transaction costs. He further elaborates that Coasian transaction cost economics formed the foundation for other new areas of research inquiry regarding spillover costs and benefits that are germane to contemporary frameworks for justifying public interventions in infrastructure management, including information asymmetries, uncertainty, incomplete contracting, etc. (Williamson, 1991).

Much of the theory supporting government intervention to promote inter-modal and inter-sectoral integration represents extensions of transaction cost economics. Essentially, cooperation or integration may arise when the costs (in this case to public welfare) can be reduced by coordination. For example, Viegas (2005) explains that integration is the pursuit of lowering transaction costs between components of a system, and that coordination of transportation and land use can reduce the separation between activities, thus reducing the transaction cost associated with mobility. May et al. (2005a) suggest that strategic integration can achieve efficiencies in implementing policy objectives by

creating synergies and reducing barriers to implementation. Stead (2008) suggests that inter-sectoral transportation policy integration enhances welfare by reducing duplication of services or tasks; ensuring consistency between policies; improving achievement of cross-cutting goals; focusing policy on the overall goals of government; promoting innovation in policy development and implementation; and taking into account the larger systemic impacts of policies in any given metropolitan sector.

2.1.3 Public Acceptability and the Effective Use of Technology

A substantial amount of contemporary research in sustainable metropolitan mobility focuses on strategies for gaining public acceptance for sustainable policies. As Banister (2008) suggests, policy measures will have a greater likelihood of successful implementation when public support is present, particularly where changes to behavior are concerned. De Palma et al. (2007) defend the hypothecation of user fees into a dedicated account for transportation improvements in part because such programs help engender public support, as users perceive the direct benefits of their expenditure. Viera et al. (2007) propose multi-instrumentality approaches to create packages of policies engendering stronger support than singular policies. In fact, May et al. (2005b) suggest that linking congestion charging in Central London to transit improvements was the key to implementing this “sustainable” policy.

The academic literature on sustainable metropolitan mobility generally suggests a positive role for technology, though this assumption appears to derive mostly from empirical evidence and the belief that technological solutions are generally efficiency enhancing. For example, technology can play an important role in supporting efficient electronic pricing, relaying information to highway users for demand management purposes, improving automobile technologies, etc. Discussions of the role of technology on sustainability merit debate, but for the purposes of this research we adopt a positive view of technology towards sustainable metropolitan mobility.

2.2 Analytical Framework

Having provided theoretical and empirical support for the objectives of sustainable metropolitan mobility, we offer a framework for analyzing the role of finance, with an emphasis on private-sector finance, in supporting these ends. Figure 2 illustrates the links between PPP finance and each objective of our “ideal” model.

The role of finance in optimal pricing and regulation can be separated into two criteria: the extent to which finance supports SMCP for optimal use and the extent to which SMCP supports optimal investment. The latter is more straightforward. If a highway PPP finance program derives revenues from a (preferably) system-optimal pricing scheme and bases capacity expansion on demand and life-cycle costs, sustainable metropolitan mobility is enhanced. The criterion for SMCP and use is driven by whether the social cost of externalities is included in pricing, which should minimize social costs of congestion, pollution, etc. This is more complicated as traditional private finance will adopt a pricing strategy that accounts for externalities of use only when the profit-seeking enterprise sees either a financial benefit or when it decides to pass onto users costs for which it is made financially liable.

Figure 2: Metrics for Evaluating the Role of PPP Finance and Sustainability

Objective	Criteria: Role of Finance	Supporting Theory	Potential for PPPs
Optimal Pricing & Regulation	MSCP as a Signal for Use	<ul style="list-style-type: none"> • Public Finance Theory (Allocative Efficiency/Productive Efficiency) • Network Economics (MSCP, etc.) 	<ul style="list-style-type: none"> • Pricing Congestion • Pricing Other Externalities
	MSCP as a Signal for Investment		<ul style="list-style-type: none"> • Cost Recovery • Life Cycle Cost Approach • Value for Money • Disciplined Investment • Speed of Implementation
Integration	Inter-modal/Inter-sectoral Investment Strategy	<ul style="list-style-type: none"> • Public Finance Theory • Network Economics • Institutional and Organizational Theory (Transaction Costs, etc.) 	<u>Integration</u> <ul style="list-style-type: none"> • Inter-jurisdictional • Inter-modal • Inter-sectoral
Public Acceptability	Investment Criteria Supports Social Policies	<ul style="list-style-type: none"> • Normative Economics • Political Economy Theory 	<ul style="list-style-type: none"> • Compensating Losers • Adoption of Road Pricing
Adoption of Technology	Technology for Optimal Pricing and Management	<ul style="list-style-type: none"> • Network Economics 	<ul style="list-style-type: none"> • Cultural Acclimation • Scalability

The effect of PPP finance on integration is also nuanced. The most direct role relates to the consistency of pricing and investment programs of PPP highway segments compared to those of other metropolitan transportation system components, and how the PPP structure supports or fails to support sustainable use at the system-wide level. Also, private finance will dictate to some extent how revenues associated with increasing demand and the proceeds of externality pricing are expended. PPP contracts typically limit the scope of uses for revenues to only those systems for which the concessionaire acquires temporary ownership, though contracts might often specify other public sector rights to control pricing or enact other corridor mobility policies. Ideally, revenues would support enhancements to capacity or mitigation measures representing the largest social return on investment compared to all reasonable transportation and land use alternatives, as well as optimize decisions on alignment and transfers between system components.

The role of finance in public acceptability relates more generally to how users perceive the benefits and costs of private-sector pricing, investment, and management of the particular PPP. Finance plays a role in that it dictates, to some extent, the real or perceived “fairness” in gaining mobility or, for example, perceptions on the overall benefits of a public investment. Low public acceptability can lead to costly delays, excessive mitigation measures, lawsuits, and political interventions that may ultimately counter sustainability objectives.

The influence of finance on technology is relatively limited. The most critical metric is whether or not the mechanisms of finance, such as revenue collection policy, leads to the implementation of (and hopefully systemic adaptation of) electronic pricing technology.

2.3 Public-Private Partnerships and Finance

It is important to understand the theoretical benefits of PPPs to public welfare, and to link the role of private finance in PPPs to our “ideal” model of sustainable metropolitan mobility. First, however, we must define the term PPP for the purposes of our study. NHCRP (2009) reviews a wide range of literature, settling on a definition characterized by a contractual agreement between a government and a private entity whereby the government retains ownership but the private entity gains decision rights to carry out terms of the contract. Other research implies the sharing of responsibilities and risks as a key dimension (ENACT, 2009). For the purposes of this study, we define the critical elements defining a highway PPP by the existence of a contract and the sharing of risks and responsibilities between the public and private sector participants.

A number of authors have hypothesized as to what role PPPs can play in promoting social welfare generally. The overarching objective is “value for money,” which seeks to leverage private sector participation and expertise in such a way that provides greater overall social return on investment (e.g., allocative and productive efficiency) than public-sector implementation alone. OECD (2008) explains how private-sector participation can lead to an “optimum combination of whole-life-costs and quality” by assigning responsibilities to the entity most able to implement them. Engel et al. (2008) suggest that PPPs lower long-term life-cycle costs by bundling construction with operations and management, and further suggest PPP structures can better distinguish “White Elephants” (e.g., projects with a negative social return on investment) through the transparency and discipline of private financial markets. Inherent in this argument is the proposition that projects are financed and evaluated on the basis of projected revenues from the assessment of user fees (not to mention that private financial markets function properly). The ENACT (2009) research program considers the incorporation of SMCP into PPP frameworks, focusing on contract incentives and risks. Like Engel et al. (2008), the authors hypothesize that different PPP structures are needed depending upon the objectives of the program (ENACT, 2009).

The theoretical research provides insight as to how PPP finance can support sustainable metropolitan mobility; specifically that MSCP can be adopted to manage road use and underwrite capacity expansion. Many highway PPPs involve the implementation of user fee pricing to finance construction, maintenance, management, and operation. Additionally, the life-cycle cost considerations inherent in a long-term PPP relationship ensure that investments consider long-term value as opposed to only short-term construction costs. Furthermore, since most public-private road pricing schemes involve electronic tolling, PPPs could further enhance the cause of sustainable metropolitan mobility by installing the technological backbone necessary to effectively assess “optimal” prices on users of the particular road segment and increasing the potential to scale road pricing in an optimal manner throughout the metropolitan road network.

Preliminary empirical evidence suggests, however, that the advantages of PPPs involving private finance encounter many challenges in practice. Abdul-Aziz (2007) reviews numerous infrastructure PPPs, concluding that PPP project structures with service-oriented objectives (e.g., improving performance measures of efficiency and quality) generally deliver greater value for money than those PPPs whose primary focus is finance. He asserts that due to higher costs of finance for the private sector, higher value for money is delivered when the public partner accepts most of the commercial risk in financing a PPP project (Abdul Aziz, 2007). The Asian Development Bank (ADB, 2000) reviews metropolitan highway PPPs throughout the World, asserting that corridor management is the optimal solution, allowing for greater transfer of risk to the private sector (including greater commercial risks), but requiring sufficient development of public-sector institutional capacity. The ADB (2000) suggests that governments should slowly build-up capacity with shorter-term, less complex PPPs (e.g., management and operations only) before pursuing metropolitan highway PPPs with greater scope and transfer of commercial risks (and, hence, finance responsibilities) to the private sector.

The theoretical benefits of PPPs towards sustainable metropolitan mobility are also countered by theoretical detractors, particularly with regard to the element of integration. The World Bank, for example, generally supports the involvement of the private sector in transportation infrastructure provision, but recognizes that direct competition in such a market may reduce social welfare under certain conditions. The Bank suggests that even with private participation in metropolitan road infrastructure provision and management, the public sector must play an active role as a strategic inter-modal planner, regulator of market structure, and arbiter of conflicts with public objectives. The Bank suggests that a “corporatized” public sector entity, if left off-budget, might be preferable in terms of metropolitan road finance and administration due to lower public borrowing costs and the lack of many key elements in the transportation sector supporting true private market structures (World Bank, 1996). In terms of basic institutional reforms, the Bank recommends actions at the city or metropolitan level, including but not limited to the creation of a centralized financing program; a strategic authority for transportation and land use planning; and mechanisms for inter-modal, inter-sectoral, and inter-jurisdictional integration (World Bank, 2002).

The institutional prerequisites outlined by the ADB and World Bank for the role of government in enabling greater integration of PPP-financed highway segments within metropolitan transportation systems are generally non-existent or insufficient. Few multi-jurisdictional metropolitan areas have government institutions of metropolitan scope with broad control over transportation planning, regulation, funding, finance, and management to effectively “corporatize” transportation investment and management at the system-wide level. Furthermore since a “corridor management” strategy is the most theoretically efficient manner to transfer commercial risk to a private partner for any metropolitan highway PPPs arrangement, asset-based PPPs may fall short of or actually counteract some of the system-oriented elements of our “ideal” model for sustainable metropolitan mobility.

3 Methodology

We define the case universe using a combination of sources from the World Bank, the ADB, and knowledge of other projects, including primarily projects that have been proposed, planned, and/or implemented since the early 1990s (ADB, 2000; World Bank, 2010). With a more thorough scan of the international evidence we would expect to find additional highway PPPs throughout the World, but we limit ourselves to those cases of large scope for which at least some preliminary data and analysis are easily accessible through international infrastructure finance organizations and other academic and professional journals. Table 2 provides an overview of locations of metropolitan highway PPPs by country, metropolitan region, and typology. Some metropolitan areas are traversed by multiple PPPs. Furthermore, the case universe includes projects which have since failed or which never materialized as proposed or planned.

Table 2: Sample of Relevant Metropolitan Highway PPPs

Radial/ Circumferential	Network	Access Roads
<ul style="list-style-type: none"> • Australia (Sydney) • Canada (Toronto) • Chile (Santiago) • Malaysia (Kuala Lumpur) • Philippines (Manila) • Thailand (Bangkok) • United Kingdom (Birmingham) • USA (Los Angeles, Chicago, Washington) 	<ul style="list-style-type: none"> • Argentina (Buenos Aires and Cordoba approach roads) • Australia (Melbourne) • Portugal (Lisbon and Porto) • Thailand (Bangkok) • United Kingdom (London) 	<ul style="list-style-type: none"> • Argentina (Ezeiza Airport Access) • China (Hong Kong Tunnels) • China (Beijing Airport Access) • Indonesia (Jakarta Port Access) • Malaysia (KL Airport Access) • Philippines (Seaport Access) • Thailand (Bangkok Airport Access)

Table 2 is organized into three categories based on informed qualitative judgment. Some highway PPPs do not fit comfortably into one single category, and we make a best effort to classify different projects into the most appropriate grouping based on physical alignment and dominant functional characteristics. The definition of “metropolitan” is again somewhat qualitative. Generally speaking, if segments of a highway PPP are known to primarily serve intra-urban traffic, we classify those projects as metropolitan.

Classifying metropolitan highways into these typologies is important for applying a multiple case study analysis. The intent is to hold physical and functional attributes constant, to the extent possible, in order to focus the analysis on the effects of different institutional contexts (including political and socio-economic structures as well as governance structures of PPP contracts) on the role of PPP finance on sustainable metropolitan mobility. Since we are primarily interested in highway PPPs that are

physically and functionally integrated within dense intra-metropolitan networks, we select cases from the “Radial/Circumferential” and “Network” PPP categories. We do not consider “Access Roads,” which often link high density origin/destination areas (e.g., airports), and whose primary objectives are often justified by economic development concerns (e.g., port access to the central city). We do not consider highway PPP segments primarily intended for inter-urban traffic, as the physical and functional contexts are different from those of a dense metropolitan road network.

Of these cases, we select three from the “Radial/Circumferential” category for which information is generally widely available: Costanera Norte in Santiago, Chile; SR 91 in Los Angeles, USA; and ETR in Toronto, Canada. While these cases are well studied for various reasons in the literature, we believe that the linkage between private finance and metropolitan sustainability deserves greater attention. We also introduce the Douro Litoral Concession in Porto, Portugal, which represents a systems approach to leveraging private finance through a PPP structure to make improvements to highway infrastructure and operations on a network scale.

4 Case Studies

4.1 Costanera Norte, Santiago, Chile

The Costanera Norte Concession in the Santiago Metropolitan Area (SMA), Chile, is a pioneering approach to incorporating private finance and a PPP structure to improve metropolitan highway accessibility. While Chile’s national government (Government of Chile) began tendering highway PPPs in the early 1990s, the Costanera Norte Concession represents its first attempt at a primarily metropolitan highway PPP. The Costanera Norte case offers insight on the interactions between metropolitan planning and development and PPP highway finance, particularly given that it is a greenfield project. Overall, the project illustrates many of the opportunities and risks of leveraging private-sector finance towards the implementation of a project intended for both private profit and, ostensibly, social welfare objectives.

4.1.1 Analysis of Institutional Context for the Costanera Norte Concession

Chile is a unitary democracy, where the Government of Chile plays a dominant role in political administration. As such, metropolitan transportation policies and programs are heavily centralized at the national level. Those functions devolved to sub-national bodies are typically assigned to regional appendages of the Government of Chile. With the exception of local roads, the Government of Chile generally controls the planning, financing, construction, management, operation, and regulation of transportation infrastructure throughout the Country.

Approximately 95% of all revenues collected in Chile accrues to the national treasury, which directly or indirectly (through transfers to municipal governments) supports much of the transportation infrastructure investment throughout the Country. Excise and value added taxes on gasoline accrue to the Government of Chile, ostensibly to support transportation investment, though there is cross-subsidization (Zegras, 2003). In fact, most infrastructure funding is distributed by the Government of Chile through its various

ministries out of out of general flexible funding accounts (Aporte Fiscal Libre), whose levels are determined annually by the National Congress (CCC, 2008). The primary agency responsible for executing metropolitan highway investments in the SMA, including the tendering and regulation of all concessions, is the Ministerio de Obras Públicas [Ministry of Public Works, MOP] (Government of Chile, MOP, 2009). MOP makes investments in all modes of transportation to improve inter-urban and international connectivity; promote social and economic development; improve the quality of life in urban areas; and generally conserve infrastructure investments (Government of Chile, MIDEPLAN, 2009).

Transportation planning is still largely centralized. The Ministerio de Planificación y Cooperación [Ministry of Planning and Cooperation, MIDEPLAN] is responsible for analyzing and approving proposed government investments. Within MIDEPLAN, the Secretaría Interministerial de Planificación de Transporte [Inter-ministerial Secretariat for Planning and Transport, SECTRA] creates regional transportation forecasting models and other analytical tools and develops transport plans for each major urban area in Chile. SECTRA analyses support the Ministerio de Hacienda [Ministry of State] and individual agencies throughout the budget development processes (Government of Chile, SECTRA, 2009).

The Government of Chile has made efforts in recent years to support greater inter-modal and inter-sectoral integration within the SMA and has signaled a willingness to consider devolving some powers for transportation planning to regions and municipalities. For example, the Government of Chile approved in October, 2000 the Política y Plan de Transporte Urbano Santiago 2010 [2010 Santiago Urban Transportation Policy and Plan]. The Plan makes a primary recommendation to create metropolitan transportation authorities, which could coordinate the modernization and improvement of all systems of metropolitan transportation using both supply and demand mechanisms (ECLAC, 2003). This recommendation has yet to be realized. Additionally, the Government of Chile created a Committee of Transport Ministers in 2003, which launched Transantiago, a program for integrating and modernizing public transportation in the SMA. Transantiago's scope generally includes integrating and in some cases privatizing transit in the SMA. Its powers over road development are limited (Transantiago, 2003).

While Chile has made efforts at transportation policy integration and regionalization, PPP programs have progressed along a seemingly separate track. In 1991, the Government of Chile created the Ley de Concesiones [Concessions Law], which delegates to MOP broad authority to enter into PPP arrangements for almost any public infrastructure improvement, including transportation systems (Engel et al., 2000). By 2007, MOP had concessions on 50 separate road, airport, seaport, and transit infrastructure projects representing about \$11.3 billion in investment (Engel et al., 2008). Most of these projects are planned outside the rigorous evaluation process administered through MIDEPLAN and SECTRA, which has complicated parallel efforts to improve coordination of metropolitan transportation policy and administration in the SMA (Zegras, 2006).

The existence of formal and informal coordination of transportation policy in the Government of Chile should not be discounted, but it is inevitable that conflicts arise in implementing policies among many different agencies. Santiago 2010 and Transantiago have provided a helpful forum for coordinating policy, particularly as pertaining to metropolitan transit systems in the SMA. SECTRA provides objective forecasting and social benefit-cost tools, and regional planning bodies help coordinate different types of national-level infrastructure investment in urban areas. However, while reforms have attempted to bring more stakeholders into the process, the changing institutional structure of transportation policy in the Chile has created new types of conflict. In particular, MOP's program of urban highway concessions exists outside the traditional planning and investment programming process in Chile, complicating efforts at system coordination.

4.1.2 Analysis of the Costanera Norte Concession

The 40-kilometer Costanera Highway is an urban greenfield project connecting wealthy eastern suburbs of the SMA through downtown Santiago and to the western edge of the Metropolis. Development is underwritten by revenues from variable, electronic distance-based tolls. With the help of a \$75 million credit guarantee from the Inter-American Development Bank (IDB) and other support from the Government of Chile, the Concession initially achieved an AAA bond rating for project finance (Zegras, 2006).

The initial tender of the Costanera Norte Concession engendered lukewarm response, as most parties lacked interest in submitting proposals without some sort of government guarantee of commercial risk. Only one firm responded to the first solicitation in 1998, which was nevertheless disqualified on technical grounds. In 1999, the Chilean government re-issued the solicitation for Costanera Norte offering an \$80 million subsidy, exchange rate insurance, and a minimum traffic guarantee in return for a revenue sharing agreement should profits exceed an agreed-upon ceiling. The second round produced multiple applicants, with Impregilio, an Italian multinational, producing the winning bid by promising a \$12 million payment to the Government of Chile for the rights to a 30-year concession (Engel et al., 2000). The Costanera Norte opened along certain segments in 2005. Since then, the Concession has been sold to another Italian partnership organized under a single-purpose entity called, "Sociedad Concessionaria Costanera Norte" (SCCN), which purchased the rights to the Costanera Norte Concession in 2006 (SCCN, 2009).

Though only recently opened for operation, it is possible to make some judgments about the extent to which the Costanera Norte Concession matches up to our "ideal" model in terms of the role of PPP finance in sustainable metropolitan mobility. From the standpoint of private sector objectives, the Concession appears to have achieved some level of success. Demand grew rapidly in the first few years of operation, before stabilizing in 2008 (176.76 million users), about 2.6% above 2007 levels (172.33 million users) (SCCN, 2008b). Volume actually declined slightly in 2009 by 0.1% (176.52 million users), though profits increased due largely to toll increases. Despite the initial requirement for public subsidies, the Highway also appears to be currently operating exclusively on user fees (SCCN, 2009). As illustrated in Table 3, however, the results of the Costanera Norte Concession from the standpoint of the sustainable metropolitan mobility framework are mixed.

Table 3: Analysis of Costanera Norte Concession Versus “Ideal” Model

Criteria	Meets	Fails
MSCP as a Signal for Use	<ul style="list-style-type: none"> • Electronic, variable user-fee pricing • Congestion charging 	<ul style="list-style-type: none"> • No externality pricing except congestion
MSCP as a Signal for Investment	<ul style="list-style-type: none"> • User fees cover most development and operation costs • Flexible contractual process allows corridor improvements 	<ul style="list-style-type: none"> • Environmental mitigation costs required a subsidy • Transparency of renegotiations
Investment Decisions Seek Best Inter-modal Option and Follow Inter-sectoral Objectives	<ul style="list-style-type: none"> • Shared demand risk • Flexibility for policy changes 	<ul style="list-style-type: none"> • Congestion fees limited to highway program • Metro transit coordination separate
Investment Criteria Supports Social Policies	<ul style="list-style-type: none"> • Up-front public funds, but none during operation 	<ul style="list-style-type: none"> • Subverts normal evaluation process • Environmental mitigation costly
Tolling and Demand Management Technology Supports Sustainable Objectives	<ul style="list-style-type: none"> • Technology compatible with other highway concessions 	<ul style="list-style-type: none"> • No adoption outside of highway programs

With regard to pricing for optimal use, the implementation of variable electronic tolling is a positive step towards financing sustainable metropolitan mobility, but the Concession has not fully achieved the potential benefits of MSCP as a signal for use and investment. For example, the Concessionaire may charge a *tarifa de saturación* [saturation tariff] to help manage peak-hour traffic. However, the *tarifa* is not based on optimal MSCP, nor is it directly linked to investments to mitigate the effects of congestion (Zegras, 2006). Furthermore, there are no direct user charges for other externalities such as noise or emissions, so externalities remain “external” to the user’s decision-making.

The variable electronic user-fee based system aligns the financing of improvements to the Costanera Norte Concession closer with the “ideal” model in that pricing is ostensibly linked to investment, and the Contract allows flexibility to integrate publicly-proposed corridor improvements. Flexibility for renegotiations and capital subsidies has, however, also eroded links between demand and investment. By 2009, MOP had negotiated six changes to the Costanera Concession (SCCN, 2009). Engel et al. (2008) find fault with the excessive number of renegotiations, as they are planned outside the normal project evaluation process. The Authors also suggest that the initial project feasibility process, where environmental and community concerns led to large government subsidies, may actually have succeeded in detecting a “White Elephant”. On purely financial grounds, the Concession would not have been feasible without subsidy, and it is difficult to justify such an investment or any renegotiated improvement without a more transparent and independent analysis of benefits and costs (Engel et al. 2000).

From the standpoint of integration, the financing mechanisms of the Costanera Norte Concession allow MOP to retain policy flexibility through renegotiations and the sharing of some commercial risks with the Concessionaire in exchange for 50-50 sharing of revenues above forecast with the Government of Chile (Zegras, 2006). Despite a

reasonable sharing of risks and benefits, however, the Concessionaire is not obligated to expend any of the proceeds of congestion charges on appropriate mitigation methods (including potentially inter-modal alternatives). Therefore, in this instance the role of finance seems to counter the objectives of the sustainable metropolitan mobility model that future investments of congestion charges consider all modal (and inter-sectoral) and policy (e.g., land use) alternatives.

The failure to effectively engage the communities in the SMA with regard to the benefits and costs of the Costanera Norte investment has consequences for elements of public acceptability within the “ideal” model. Given the fact that development of the Costanera Norte through the heart of the SMA would have profound consequences for the environment and communities, and given the fact that the investment is subsidized by public funds, it is not surprising that local groups demanded participation in the PPP process. Though much of the financing is private, the context of the Costanera Norte PPP is well within both the public and private realms. The fact that MOP pursued a controversial investment such as a metropolitan greenfield project outside the normal project evaluation process likely contributed to the substantial costs of mitigation that made this PPP financially infeasible without government subsidy.

With regard to technology, the financing of the Costanera Norte Concession did succeed in implementing and seemingly gaining public acceptance for electronic distance-based pricing on a metropolitan highway stretch. Though unfulfilled to date, it is possible that this technological backbone could lead to a wider congestion pricing strategy for the various metropolitan highway PPPs traversing the SMA (Zegras, 2006). However, electronic distance-based tolling is still currently limited to highway segments only.

4.1.3 Conclusions from the Costanera Norte Concession

The Costanera Norte highway has in many ways enhanced the institutional capabilities for implementing integrated transportation policies in the SMA, but the Concession has also presented new challenges. The benefits include implementation of a user-based system of finance that explicitly ties demand with supply and the implementation of new technologies for revenue collection and demand management.

A number of issues prevent the financing structure of Costanera Norte from delivering on the optimal role of finance within the “ideal” sustainable metropolitan mobility model. First, road pricing and congestion charging generally serve profit maximizing rather than system optimizing goals. Costanera Norte might have better coordinated pricing and congestion mitigation within a larger planning framework, but the PPP was planned and tendered outside the normal project evaluation process. Santiago 2010 and Transantiago demonstrate a clear trend within the Chilean policy framework for both empowering metropolitan-level technical bodies to coordinate transportation planning and policy and enhancing private-sector participation in the sector, but highway concessions are generally operating independent of these efforts. Second, the case of Costanera Norte furthermore demonstrates that public acceptability will be a major impediment to efficient implementation when normal processes for project evaluation (even if flawed) are subverted. Finally, while MOP succeeds in maintaining policy flexibility by sharing

commercial risk with the Concessionaire, the lack of transparency in renegotiations may lead to less-than-optimal decisions on capacity enhancement that should otherwise be determined by rigorous cost-benefit analyses.

4.2 SR 91 Express Lanes, Los Angeles, USA

The privatization of high-occupancy toll lanes along State Road 91 (SR 91) in Metropolitan Los Angeles in the United States represents a case where regionalization of planning and investment programming functions does occur at the metropolitan level, but where a privately-financed highway PPP project was administered outside this process. Tendered by the State of California with a largely finance-oriented objective, the SR 91 Express Lanes Franchise provided immediate benefits to both the private and public partners, but high profits (and the perception of high tolls) coupled with inflexibility to implement changing public policy priorities led to its purchase by a government entity, the Orange County Transportation Authority (OCTA). The SR 91 Express Lanes Franchise demonstrates the potential dangers of transferring all commercial risk for a metropolitan highway project to the private sector, particularly with regard to requirements of private capital for policy guarantees over the life of the PPP.

4.2.1 Analysis of Institutional Context for the SR 91 Express Lanes Franchise

Transportation policy in Metropolitan Los Angeles exists within a federalist democracy system, characterized by three vertical levels of government and several regional-level authorities deriving power primarily from federal, state, and municipal authorities. For the purposes of this study, Metropolitan Los Angeles is defined consistent with the jurisdiction of the Southern California Association of Governments (SCAG) as six adjacent counties: Imperial, Los Angeles, Orange, Riverside, San Bernardino and Ventura (SCAG, 2008). As a Federally-recognized Metropolitan Planning Organization (MPO) for regional transportation coordination, SCAG is tasked with planning and programming United States Federal Government funding across all surface transportation modes within Metropolitan Los Angeles. Most State funds for local and urban regional projects are also planned and programmed through SCAG (Caltrans, 2008).

In Metropolitan Los Angeles, highways are typically financed by Federal and State Government motor fuel excise taxes, State sales taxes, and a variety of smaller cross-subsidies. The United States Federal Government determines national fuel excise tax rates and distributes these funds to States mostly to finance highway programs, though portions of federal funds derived from automobile motor fuel taxes are also apportioned to transit operators (FHWA and FTA, 2007). State motor fuel excise taxes fund many State-level programs as well as apportionments to municipalities. California also dedicates sales taxes levied on motor fuels to a variety of transportation programs, and State bond initiatives fund other major transportation improvements (Caltrans, 2007).

The Intermodal Surface Transportation Efficiency Act (ISTEA), enacted by the United States Federal Government in 1991, initiated a shift in emphasis to regional planning for federally-funded transportation improvements. MPOs such as SCAG must now develop and approve – in coordination with states, local governments, and operators – 20-year Regional Transportation Plans (RTP) that serve as the primary long-range transportation planning document for metropolitan regions and decision-making tool for developing

federal investment programs. MPOs must also develop and, jointly with state governors, approve four-year Transportation Improvement Plans (TIP) used for near-term programming of federal funding (FHWA and FTA, 2007). Therefore, while SCAG holds little power over the policy apparatus that raises revenues and structures expenditure guidelines, the MPO plays a primary role in setting the priorities of federal and state authorities in the programming of available funds for highway and transit investment.

Despite efforts to regionalize transportation and increasingly land use planning, however, funding and financing decisions are often made outside this context. Revenue sources for metropolitan highways are derived from higher-level authorities with rigid programmatic structures for making investment. Furthermore, revenues are based primarily on fuel consumption rather than distance traveled and externalities, so the links between demand and supply are far from optimal. Within this context, the State of California has attempted to leverage private finance and expertise on proposed investments by entering into PPP arrangements, which has introduced distance-based and, to an extent, congestion charging to highway projects. One such project is the SR 91 Express Lanes Franchise.

4.2.2 Analysis of the SR 91 Express Lanes PPP

In 1995, the State of California entered into a 35-year lease with the California Private Transportation Company (CPTC) for the franchising rights to construct, operate, make improvements to, and collect tolls on high-occupancy toll lanes through Orange County (OCTA, 2009b). The franchised portion of SR 91 stretches ten miles from the northwestern boundary of Riverside County westward (in the direction of Los Angeles County) to the downtown Anaheim employment areas in Orange County. Four tolled lanes, two in each direction, are located in the median of SR 91. These express lanes, for which ingress or egress is not permitted at intermediate points, are divided from non-tolled lanes by a “soft barrier.” Drivers have the option of driving in general lanes with no toll, or paying a toll to enter one of the express lanes. Express lanes are priced commensurate with volume in order to ensure a free flow of traffic (Sullivan, 2000).

The SR 91 Franchise initially appeared to be an unequivocal success. SR 91 became the first fully-automated variable toll highway in the United States, with tolls set to optimize the flow of traffic on toll lanes. The Franchisee financed improvements entirely from road tolls, reaching a break-even point on operations and debt service by August, 2008 – just 32 months after opening. Peak hour trips across the entire 18-mile stretch of SR-91, including the un-tolled 8-mile stretch in Riverside County, initially fell from 70 minutes on average to 30 minutes (Boarnet and Dimento, 2004). Applying a retrospective benefit-cost model comparing actual outcomes of the SR 91 toll project versus a base case scenario of public construction of identical general use lanes, Sullivan and Burris (2006) estimated a positive \$57.7 million net present value social return on investment over the first ten years of operation.

Shortly after implementation, however, the SR 91 Franchise began to burden public policy goals aimed at relieving corridor congestion in this high-growth area. The primary mechanism inhibiting coordination was the inclusion of a “no compete clause” in the CPTC lease. As a condition of taking on nearly all commercial risks associated with the SR 91 Express Lanes Franchise, CPTC succeeded in securing from the State of California

a contractual “no compete clause,” whereby no road improvements could be developed within a 1.5-mile buffer of SR 91 that might adversely affect the finances of the PPP. The inability to make improvements along the corridor severely constrained mobility improvement options for officials in Orange and Riverside Counties (Engel, 2008). In the end, OCTA purchased the rights to the SR 91 Express Lane Franchise from CPTC at a price set at 150% of construction costs (OCTA, 2009b).

Thus, the financial arrangements supporting the development of the SR 91 Express Lanes Franchise did succeed in some respects towards moving highway development and management policies in Metropolitan Los Angeles closer to our “ideal” model. However, several institutional weaknesses in government and contract structures prevented a potentially greater realization of these objectives. Table 4 summarizes how the SR 91 agreement matches up with the “ideal” role for finance within a sustainable metropolitan mobility framework.

Table 4: Analysis of the SR 91 Express Lanes Franchise Versus “Ideal” Model

Criteria	Meets	Fails
MSCP as a Signal for Use	•Electronic, variable user-fee pricing of 10 miles of express lanes	•No externality pricing except peak-hour congestion
MSCP as a Signal for Investment	•User fees cover all development and operation costs	•No compete clause
Investment Decisions Seek Best Inter-modal Option and Follow Inter-sectoral Objectives	•Likely positive net social benefit	•All demand risk to private sector •No policy flexibility for public sector
Investment Criteria Supports Social Policies	•No use of public funds	•Government buys at 150% of construction cost
Tolling and Demand Management Technology Supports Sustainable Objectives	•Technology now compatible with tolled public highways	•Lack of coordination with tolled public highways during PPP

Though not entirely consistent with MSCP, the variable toll pricing that finances the Franchise is a step in that direction. The fact that pricing varies with time of day (reflecting peak hours of traffic) promotes a high level of efficiency in the use of the toll lanes, although this does not necessarily lead to system optimality in the pricing and management of other corridor highways and transportation systems. Additionally, while tolls vary by time of day, price policies are static rather than dynamic. Furthermore, pricing for other externalities such as carbon emissions is not included in user fees.

With regard to the role of finance in promoting an optimal signal for investment, revenues began covering all operating and debt service costs within three years (Boarnet and Dimento, 2004), and continue to do so (OCTA, 2009a). However, the revenues accrued to the CPTC solely for improvements along four lanes of highway. As high levels of congestion later ensued in the SR 91 corridor and the “no compete” clause

prevented additional competition in the highway sector, CPTC essentially retained the revenues above costs for reinvestment in the Express Lanes only or as profit.

The role of SR 91 Express Lanes finance on inter-modal options and inter-sectoral objectives is difficult to gauge. Following the Sullivan and Burris estimates, the project resulted in a net social benefit. At the same time, it is less clear whether the structure of the SR 91 Express Lanes Franchise represented the optimal program of investment over the long-term. By shifting all of the commercial risk to the CPTC, the Franchisee felt little obligation to coordinate with local and state government agencies on policies outside the scope of the Contract, particularly those that could negatively impact demand, resulting in OCTA purchasing the Franchise at a premium in order to regain policy control (Boarnet and Dimento, 2004). Since having gained control of the Franchise, OCTA has expanded the scope of the franchise strategy to better accommodate other modes of transportation operating in the corridor. For example Express Bus, a local bus service, uses express lanes on SR 91 to facilitate local transit (OCTA, 2008). OCTA has also used approximately \$6.6 million in revenues for complimentary corridor projects, including facilitating links between other corridor toll roads (OCTA, 2009a). Given OCTA's mission to improve transportation generally in Orange County, the Authority is able to coordinate management and operations with inter-modal regional plans.

As far as promoting broader social policies and public acceptance, the Franchise initially delivered socially-beneficial improvements for which public funds were scarce. It is not likely that public development would have occurred for many years due to constrained budgets (Sullivan and Burris, 2006). Nevertheless, the fact that OCTA had to purchase the Franchise at a premium demonstrates that overall the public may have lost in the end.

The user-fee based financing mechanism did succeed in increasing public acceptability of electronic user fee road pricing (and, to a lesser extent, variable tolls). However public perception of PPP arrangements decreased substantially in the long-term in response to the resurfacing of corridor congestion to near previous levels within several years. Furthermore, a protracted conflict over coordination of SR 91 Express Lane tolling with a connecting State-owned toll highway (SR 241) demonstrated not only poor coordination of technology at the system-wide level, but negative effects on public perception of private finance and tolling of highways generally (Sullivan, 2000).

4.2.3 Conclusions from the SR 91 Express Lanes Franchise

Like the Costanera Norte Concession, the SR 91 Express Lanes Franchise has led to an electronic, variable user-based system of payment that approximates a role for finance more consistent with sustainable metropolitan mobility. At the same time, a number of institutional weaknesses prevent the SR 91 Express Lanes Franchise from potentially delivering greater benefits to metropolitan sustainability. These include, for example, a process driven by the objective to increase roadway throughput without using public funding rather than pursuing a broader metropolitan-wide (or at least corridor-wide) strategy for improving overall mobility. Furthermore, the allocation of risk between the public and private partners prevented opportunities for positive collaboration between public bodies and CTPC towards system-wide congestion improvement.

Though SCAG has broad powers to plan and program funding in Metropolitan Los Angeles, authorities at other levels of government ultimately approve the development, funding, and financing of highway infrastructure, as is the case with the SR 91 Franchise. Kanafani (2008) notes that no single organization in California has the authority to both plan and make investments across modes, suggesting that the ideal scenario cannot be achieved until there exists an organization capable of enforcing “incentives and revenue consequences” for individual actors to behave in an optimal manner from a system-wide perspective. He also suggests, however, that under the existing institutional structure, inter-modal approaches to transportation finance would encounter obstacles under either a public-private operation (sub-optimal competitive behavior) or public provision (politically unpopular trade-offs lead to sub-optimal decisions) (Kanafani, 2008). Therefore, it is unclear whether public implementation of the SR 91 Express Lanes concept would have produced better results with regard to integration.

The allocation of all commercial risk to the private sector also proved an institutional impediment to better integration and more optimal uses of revenues for reinvestment. In order to offload the commercial risks associated with demand for this greenfield (hence, risky) project, the State of California included a now infamous “no compete” clause. It would have been difficult to find a private-sector partner to accept this risk without such a guarantee, nor a lending institution willing to provide financing. Had the relationship between the State and CPTC included more shared risks and responsibilities, it might have been possible to coordinate greater public assumption of commercial risk in return for greater public policy flexibility regarding management and future investment.

4.3 ETR, Toronto, Canada

Like the previous cases, ETR introduced variable, electronic tolling to the development of a metropolitan highway. Unlike the previous cases, the project was financed and delivered by a public-sector authority, which later entered into a long-term ground lease with 407 International ETR Concession Company, Ltd. (407 ETR) to finance and develop future expansions and to manage, maintain, and operate the entire Highway segment. It is not clear that the involvement of the private-sector partner led to any improvements from the standpoint of finance and sustainable metropolitan mobility. In fact evidence suggests the opposite may have occurred. It would be unfair to cast blame for these deficiencies on 407 ETR, as a number of the same institutional deficiencies identified in the Costanera Norte and SR 91 Express Lane cases have explanatory value.

4.3.1 Analysis of Institutional Context for the ETR Ground Lease

Transportation policy in Canada adheres to a federalist approach to political jurisdiction. Federal authority for transportation is carried out by Transport Canada, which is responsible for international, national, and inter-provincial transportation policy; provision and/or regulation of airport, seaport, and inter-city rail transportation; and vehicle standards. Provinces are responsible for intra-provincial transportation, including major highway construction and maintenance. Municipalities are responsible for local roads, transit, parking, and, generally, planning (Hatzopoulou and Miller, 2008).

Highways in and around Toronto are typically financed by higher levels of government. The Canadian Federal Government collects fuel excise taxes, but does not formally dedicate all funding to transportation. Its transport ministry, Transport Canada, spends less on transportation investment than it receives in federal fuel taxes (Transport Canada, 2008). The Province of Ontario collects fuel taxes and vehicle registration fees ostensibly to support transportation investment. While revenues and expenditures are not formally linked, the Province anticipates raising approximately C\$3.1 billion in fuel taxes and C\$1.1 billion in vehicle registration fees in Fiscal Year 2009-2010 to cover approximately C\$4.2 billion in transportation infrastructure expenditures (Duncan, 2009).

Soberman (2008) describes how the City of Toronto represented an institutional model for federalism and metropolitan transportation policy from roughly the Post-World War II Era until the early 1990's. The Province of Ontario enacted the Metropolitan Toronto Act of 1953 creating the Regional Municipality of Metropolitan Toronto (now the City of Toronto) and the Toronto Transit Commission (TTC), a single integrated transit authority serving the same geographical area. The result was that all land use and transportation planning were centralized at the metropolitan regional level, albeit under different authorities. The benefits of such an institutional structure were illustrated by the case of the City of Toronto and the TTC, which effectively integrated metropolitan roads and transit throughout much of the latter half of the Twentieth Century. The TTC self-financed the construction (1948) and initial operation of the Toronto subway system without subsidy. The Toronto subway today registers the highest revenue capture as a percentage of operating costs (79%) in North America. Between 1971 and 1998, the Province apportioned all provincial funding ostensibly intended for highway development in the City of Toronto to a flexible Municipal Transit Program, which the City used to supplement local transit revenue sources. While local roads and transit fell under the jurisdiction of the City of Toronto and TTC, the Province took responsibility for operating commuter rail services to points outside of Metropolitan Toronto and, generally, suburban highway improvements (Soberman, 2008).

While the City of Toronto has long stood as an example of regional metropolitan government, continued peripheral growth has strained the line between municipal and provincial authority to shape regional transportation and land use policies. In recognition of this fact, the Province of Ontario passed The Places to Grow Act which requires the development of an urban growth plan for any area designated as an urban growth area by the provincial leadership. The Province established one such growth area, the Greater Golden Horseshoe, which includes Greater Toronto, the City of Hamilton (GTAH), and surrounding suburbs (Ontario, 2006). The Province of Ontario then created the Greater Toronto Transportation Authority (GTTA), now Metrolinx, under the Greater Toronto Transportation Authority Act and tasked the organization with creating an integrated, inter-modal, regional plan for the GTAH. The "Big Move," completed by Metrolinx in 2008, constitutes the long-term transportation planning segment of GTAH growth plan, including a financing and investment plan (Metrolinx 2008).

The provincial decision to develop and later to seek a private partner for the ETR project occurred at precisely at a time when the Province of Ontario and City of Toronto were beginning to restructure their relationship with respect to one another on regional transportation policy. Though ETR was planned as an inter-city connector, a substantial portion would traverse the City of Toronto. Implications of alignment, tolling policies, and other development issues would have a profound effect on transportation policy in the City of Toronto.

4.3.2 Analysis of the ETR Ground Lease

Shortly after the opening of the first 68 km stretch of Highway 407 in 1997, the Province passed the 407 Act, which authorized the tendering of a ground lease to a private-sector entity for the rights to operate, maintain, and collect tolls on Highway 407. The ground lease would carry the additional obligation to finance, construct, maintain, manage, and operate 40 kilometers of planned western and eastern extensions. The Province had initially created the Ontario Transportation Capital Corporation (OTCC), an independent public authority, to construct, operate, maintain, and manage the ETR, while collateralizing variable electronic toll revenues to finance the investment. In 1999, and after a competitive procurement process, the Province of Ontario awarded a 99-year ground lease to 407 ETR, a consortium including Spanish Sintra, Australian Macquarie International Group, and Quebec-based SNC Lavalin. 407 ETR paid approximately C\$3.1 billion up front for the rights to the Ground Lease (407 ETR, 2009).

The financing of the ETR project has undoubtedly helped promote objectives of the “ideal” sustainable metropolitan mobility model but also exhibits many of the same deficiencies observed in the Santiago and Los Angeles cases. Though the private sector did not play a role in project finance until after completion of initial construction and commencement of operation, ground leasing of the rights to ETR seems to have coincided with adverse impacts. Table 5 summarizes the role of PPP finance in the ETR Ground Lease in the context of sustainable metropolitan mobility.

Table 5: Analysis of the ETR Ground Lease Versus “Ideal” Model

Criteria	Meets	Fails
MSCP as a Signal for Use	•Electronic, variable user-fee pricing	•No externality pricing except congestion •Traffic diverted to parallel Route 401
MSCP as a Signal for Investment	•User fees cover all development and operation costs •Demand triggers capacity expansion	•No private interest: public-sector developed
Investment Decisions Seek Best Inter-modal Option and Follow Inter-sectoral Objectives	•No “no compete” clauses	•Private sector: all demand and policy risk •Truck freight traffic reduction objective disappointing
Investment Criteria Supports Social Policies	•Public “lost” in concession negotiation •Public disputes over toll hikes	•No use of public funds
Tolling and Demand Management Technology Supports Sustainable Objectives	•Innovative technology can bill with or without transponder	•No adoption outside of ETR

From the standpoint of the objective to implement MSCP pricing to support optimal highway use, Lindsay (2008) suggests that there are a number of problems with the ETR tolling scheme. He explains that existing tolls are inconsistent with ideal Pigouvian concession taxes since there is such a small difference between peak and off-peak prices (about 5%); that the tolls are variable but not dynamic; and that discounts offered to users distort the charging of user fees based on MSCP. Lindsey also notes that congestion relief for freight transport on the parallel Highway 401 has not materialized as hoped, at least from the standpoint of trucking organizations. Given that reducing congestion along international industrial shipping routes was a stated priority for building Highway 407, this result is concerning (Lindsey, 2008). So it appears that pricing schemes may currently support financing requirements for ETR, but that attempts to use user fee pricing as a corridor demand management tool have been less successful.

The link between finance, pricing, and corridor investment is less straightforward. Since the public sector actually financed initial construction, the role of private finance is limited at least in the initial segments. In terms of the operations phase, however, all user fee revenues cover all project costs without subsidy. Furthermore, the Ground Lease ties the level of permitted toll increases to certain minimum traffic volume absorption on the ETR, requiring that 407 ETR undertake capacity expansion if high levels of congestion are reached (407 ETR, 2009). These provisions allow the Province to maintain some policy control over future investments should traffic levels increase substantially, but any investments of project revenues are essentially limited to highway improvements.

The role of finance in supporting investment decisions across modes and policy domains has complicated any attempt at public-private coordination on corridor congestion management. The lack of a “no compete” clause does allow the public sector the flexibility to implement metropolitan transportation policies within the corridor. The Province has, for example, the right to build transit-ways on portions of the land ground leased to 407 ETR and maintains the right to develop transportation infrastructure that might compete with ETR (407 ETR, 2009). In reality, however, the requirements for effective public-private coordination require a sharing of commercial risk and the assumption by the public sector of most policy risk. It is unreasonable to expect the private partner to set user fees in a manner that might be socially beneficial but would lower profits, while at the same time government has little incentive to consider the financial requirements of the ETR Ground Lease as it implements policies elsewhere in the ETR corridor. Considering the initial government objective to relieve traffic on the parallel Highway 401, and given the initial disappointing results, it appears that the combination of private finance with a public-private incentive structure poorly designed for collaboration has prohibited greater integration in corridor congestion management.

Some of the most substantial problems with the ETR Ground Lease involve public disputes that have created an antagonistic relationship between 407 ETR, users, and political leadership. Though private finance secured through the ETR Ground Lease helped deliver highway expansion projects faster than likely under public control, there is a perception that the Province fared badly in contract negotiations. Mylvaganam and Borins (2004) summarize various estimates which show the value of the ETR Ground Lease at anywhere from C\$6-13 billion, versus the C\$3.1 paid by 407 ETR. The authors

attribute this to the fact that the Province moved too quickly to privatize before demand had fully ramped up and stabilized, resulting in a lower valuation during the transaction phase. They also suggest that the failure of the Provincial Government to insist on regulating tolls has contributed to highly-negative public opinion of 407 ETR. Within the first four years of the concession term, and despite previous assurances by government officials that tolls would decline under private management, 407 ETR raised peak-hour prices by 29.5% and off-peak prices by 79%. While the price increases can be seemingly justified by project economics in that they have succeeded in mitigating congestion on the ETR (though not parallel routes), public outcry has helped motivate subsequent provincial governments to pursue renegotiations and litigation against 407 ETR (Mylvaganam and Borins, 2004).

Financing is supported by an electronic revenue collection system capable of variable pricing, therefore, ETR provides a technological backbone that could feasibly support broader system-optimal user charging. Since ETR was initially implemented by OTCC, however, the private partners are not responsible for implementing this technology. Furthermore, since ETR is the only tolled highway in this region, opportunities to scale up electronic user-based road charging in Greater Toronto have not been realized.

4.3.3 Conclusions from the ETR Ground Lease

ETR represents in some respects the culmination of the consequences of poor inter-jurisdictional coordination when policy objectives clash between two scales of government. Despite a historically efficient approach to inter-jurisdictional regional transportation policy in the Toronto Metropolitan Area, it is clear that highway investment, management, and operation blurred the lines between metropolitan and provincial authority and responsibility. Although the City of Toronto largely controlled all transportation and land use policy at the metropolitan level, provincial highways in peripheral areas helped contribute to the sprawl that has in recent decades enlarged the effective scale of Metropolitan Toronto beyond traditional boundaries.

The ETR Ground Lease presents another example of a metropolitan highway PPP whose investment is financed entirely by variable, electronic user fees. However, the initial financing, construction, management, and operation occurred under a quasi-independent public authority. Therefore many of the elements of ETR consistent with sustainable metropolitan mobility such as road pricing and electronic tolling technology did not require private finance. It is important to note, however, that pricing policies never attained MSCP under either public or private control.

It is unclear whether issues of coordinating pricing with social objectives across policy domains would have been better under OTCC control. The development of ETR under OTCC served the purpose of implementing inter-sectoral regional policy, which expedited the development of a parallel route to Highway 401 for the ostensible economic development purpose of facilitating truck freight movement. Since OTCC's investment in ETR was secured based on projected user-fee revenues, however, there may still have been inter-agency conflict. Nevertheless, the infusion of private finance did not appear to help. Since 407 ETR has accepted substantial commercial and policy risk, the Lessee has little obligation to consider any other objective besides profit

maximization in its pricing policies. Thus, the governance structure of the Ground Lease, and specifically the allocation of commercial and policy risks, fails to establish the conditions necessary for inter-modal and inter-sectoral approaches to corridor congestion management. Furthermore, the Lessee has been in some ways disadvantaged by the lack of cooperation as it has been the recipient of putative government action.

Mylvaganam and Borins, former high-level provincial appointees involved with ETR whose terms more or less coincide with project implementation, offer a comprehensive analysis of Highway 407 planning, development, privatization, and consequences. First, Mylvaganam and Borins criticize the decision to move hastily on privatization from the standpoint of maximizing the concession price. After only two years of operation, highway utilization had not fully matured, so lease prices were determined based on overly-pessimistic forecasts. Second, the selection of a proposal with the highest up-front payment to the Province overlooked a proposal submitted by another bidder to deliver a project with a smaller up-front payment but a higher long-term return on investment for the public. Third, the failure to regulate toll rates and the decision to proceed with a 99-year concession term were critical errors. The Authors believe that political philosophy may have played a critical role in these outcomes, suggesting that a more careful treatment of how to successfully engage the private sector could have yielded better results (Mylvaganam and Borins, 2004).

4.4 Douro Litoral, Porto, Portugal

The Douro Litoral Concession in Porto, Portugal represents a recent innovation in metropolitan highway finance, whereby the private sector is engaged to help finance a network of highways in a metropolitan area. The Concession includes construction of and improvements to circumferential and radial highway routes connecting Porto, the second largest city in Portugal, to the larger Portuguese inter-urban highway network. The Concession involves the dual use of build-operate-transfer (BOT) and management and operation (M&O) contract types within the same agreement, with revenues from radial BOT segments cross-subsidizing circumferential and close-in radial segments of the larger network (which remain un-tolled). The case represents a practical innovation to finance metropolitan highway improvements in Metropolitan Porto, but falls short of the optimal role for finance in the “ideal” model of sustainable metropolitan mobility.

4.4.1 Analysis of Institutional Context for the Douro Litoral Concession

The Portuguese system of government is best classified as a unitary democracy, as the national government (Government of Portugal) dominates Portuguese political life, including the transportation sector. The Government of Portugal plans, executes, and regulates all aspects of transportation policy, regardless of whether they are inter-urban or metropolitan in nature, save for local roads and some transit. New highway development in Portugal, whether public or PPP in nature, generally follows a 2000 national road plan, the *Plano Rodoviário Nacional* [National Roadway Plan, PRN]. While transportation-related revenue sources (such as motor fuel taxes) do accrue to the Government of Portugal, investments are not explicitly linked to revenue sources. Furthermore, and with the exception of tolled inter-urban highways, the connection between road usage and payments for road use is largely not perceived by road users (Nelson, 2008).

The Portuguese Government has attempted to create sub-national institutional structures with the intent of shifting greater responsibility for metropolitan transportation planning and administration to regional levels of government. The impetus for decentralization to regional governments comes from two sources: (1) the Portuguese Constitution requires the establishment of regional administrative bodies and (2) the need to integrate Portuguese institutions with European Union (EU) norms and classifications in order to facilitate funding and administration. Prior attempts at regionalizing transportation and land use planning have produced organizations that generally lack sufficient power to effectively implement their respective mandates. In the meantime, mainland regional planning powers are vested in five *Comissões de Coordenação e Desenvolvimento Regional* (Regional Commissions for Coordination and Development, CCDR), which depend on the Government of Portugal for formal powers (Nunes Silva, 2009).

Most recently, the Portuguese Government created *Autoridades Metropolitanas de Transportes* [Metropolitan Transport Authorities, AMT] in Lisbon and Porto. The AMT's are to have responsibilities for strategic planning, coordination, and supervision; can receive revenues apportioned from the Government of Portugal; and are granted some abilities to generate own revenues (Fernandes Maciel, 2009). The final structure and powers of the AMT's are still pending.

The Government of Portugal tendered the Douro Litoral Concession in 2004 under a joint order of two ministries: the *Ministério das Finanças e da Administração Pública* [Ministry of Finance and Public Administration, MFAP] and the *Ministério das Obras Públicas Transportes e Comunicações* [Ministry of Public Works, Transportation, and Communications, MOPTC] (Government of Portugal, 2007). The Concession is currently regulated and administered by *Estradas Portugal* [Portuguese Roadways, EP], a state-owned enterprise formerly under the umbrella of MOPTC, and which is responsible for national highway development, operation, and maintenance. The Government of Portugal has created a new road concession administrator and regulator, but existing concessions such as Douro Litoral still fall under the authority of EP (Nelson, 2008).

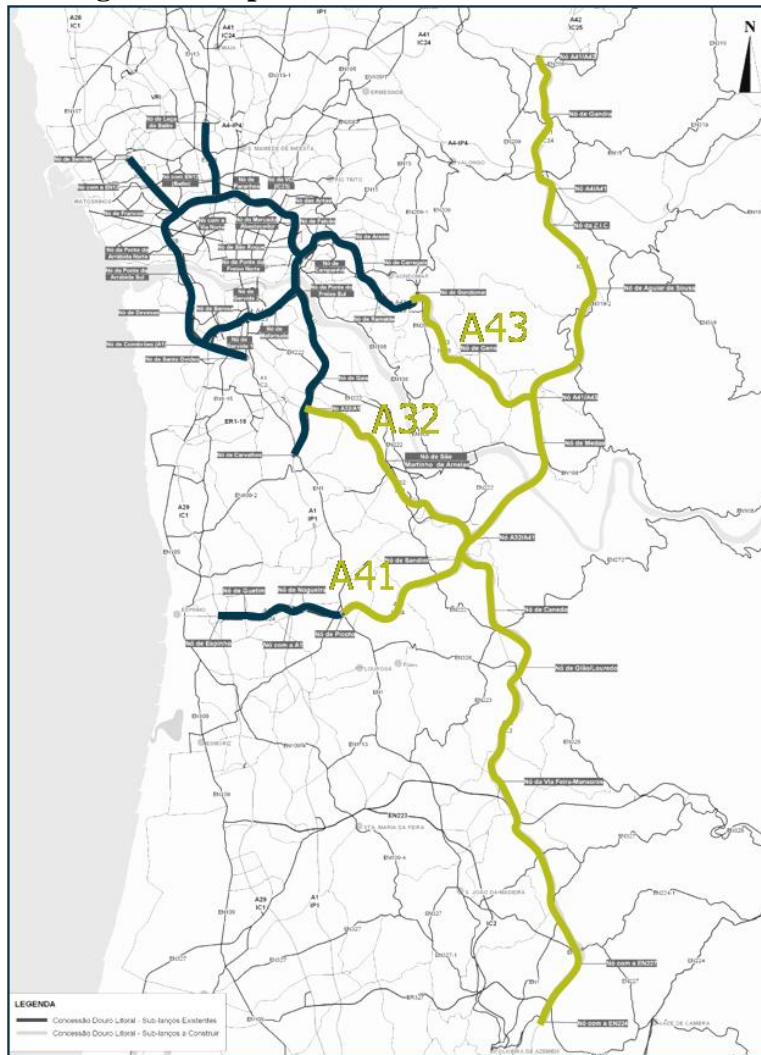
While policymakers in Portugal are attempting to reorient transportation institutions to better accommodate the sustainable transport framework advocated by the EU and an emerging consensus in EC and academic research, there are many remaining weaknesses. With regard to institutional structure, lower levels of government do not have sufficient powers of taxation and fiscal autonomy to manage metropolitan transportation policy. Additionally, the transportation sector is in major debt, with the Government of Portugal seemingly over-involved with developing highways “off-the-books” under the quasi-independent EP (Zegras et al., 2010). Furthermore, while the current highway concession program includes more network-oriented approaches in metropolitan areas, the case of Douro Litoral demonstrates that many shortcomings remain.

4.4.2 *Analysis of the Douro Litoral Concession*

The Douro Litoral Concession includes the bundling of two separate but related projects. First, the Concession includes a 30-year BOT agreement to construct, maintain, manage,

and operate three access roads (Routes A32, A41, and A43) from Metropolitan Porto to the main north-south axis of the Portuguese inter-urban highway corridor. Second, the concession contract includes a five-year rehabilitation, maintenance, management, and operation contract for the main circumferential highway surrounding the inner core of Metropolitan Porto. Figure 3 illustrates the alignment of the Douro Litoral Concession. Blue segments include portions falling under the M&O contract, while the yellow sections representing east-west radial segments from the inner metropolitan core are the BOT portions. The north-south segment illustrated in yellow represents part of the primary inter-urban highway connecting Porto northward to the Spanish border and southward to Metropolitan Lisbon.

Figure 3: Map of the Douro Litoral Concession



Source: Brisa

The Concession was awarded in late 2007 to Auto-estradas do Douro Litoral (AEDL), a single-purpose entity that is 55% owned by Brisa, a Portuguese holding company (Brisa, 2009). AEDL covers all costs associated with both projects with user fees collected electronically on tolled segments of the three inter-urban BOTs. In its winning bid,

AEDL agreed to pay the Portuguese Government €207 million for the rights associated with the Concession. A bid was awarded in December 2007, with the expectation that all construction (estimated at €1 billion) would be complete and fully operational by 2011 (Brisa, 2009).

Some elements of the Douro Litoral Concession are still under construction, though most are in operation. We analyzed the Concession contract and interviewed representatives of Brisa to gain a better understanding of the concession structure. Table 6 provides a summary of how the financing of the Douro Litoral Concession matches up to the “ideal” model from the sustainable metropolitan mobility framework.

Table 6: Analysis of Douro Litoral Concession Versus “Ideal” Model

Criteria	Meets	Fails
MSCP as a Signal for Use	<ul style="list-style-type: none"> •Electronic user-fee pricing for 76.2 km of BOT portions 	<ul style="list-style-type: none"> •Cross-subsidy of non-tolled 53 km circumferential •No externality pricing
MSCP as a Signal for Investment	<ul style="list-style-type: none"> •Positive IRR Base Case •Demand triggers BOT capacity expansion 	<ul style="list-style-type: none"> •Tolls linked to contract and CPI, not demand
Investment Decisions Seek Best Inter-modal Option and Follow Inter-sectoral Objectives	<ul style="list-style-type: none"> •National road strategy •Public shares in upside •Private risk mitigated by “financial balance” 	<ul style="list-style-type: none"> •Pure highway program •Private sector: most policy and demand risk •Metro Porto expansion
Investment Criteria Supports Social Policies	<ul style="list-style-type: none"> •No use of public funds •Little public opposition 	<ul style="list-style-type: none"> •Long term return on \$207 million cross-subsidy?
Tolling and Demand Management Technology Supports Sustainable Objectives	<ul style="list-style-type: none"> •Informal coordination of private firms on revenue collection 	<ul style="list-style-type: none"> •No adoption outside highways, bridges, and tunnels

While the Douro Litoral Concession does include electronic user-fee pricing for use of some segments of the highway, tolling falls short of supporting sustainable metropolitan mobility insofar as optimizing use and investment. First, a maximum toll is established for those portions of the network subject to direct user fees, with annual adjustments for inflation, so user fees do not represent MSCP for any concession road segments, let alone the larger metropolitan network. Additionally, no congestion charges are yet permitted (though variable tolling is allowed up to the maximum toll rate), and no direct externality pricing is included. Therefore, the cost of using the highways is distorted to the user, with travelers in often-congested inner-urban portions paying no direct fees, while being subsidized by drivers connecting from the metropolitan core to the inter-urban network. From an investment standpoint, the Concessionaire’s Base Case anticipates a positive internal return on investment, suggesting recovery of all construction, operation, and maintenance costs for construction and rehabilitation projects. Additionally, the contract does require capacity expansion should certain demand thresholds be reached (Government of Portugal and AEDL, 2007). However, since pricing is set by contract and not by MSCP and since many portions are in fact un-tolled, projected revenues do not provide a clear economic signal for optimal levels of capacity improvement.

With regard to inter-modal and inter-sectoral integration, the Douro Litoral PPP concept is a step in right the direction of financing sustainable metropolitan highways. Though decentralization would be ideal, the advantages of national-level policymaking is that highways are at least planned in a coordinated fashion through the PRN, so investments should in theory reflect public welfare objectives defined by a public-sector entity. Furthermore, the Concession contract does allow the Government of Portugal to share in the upside of future renegotiations and other changes to the contract which would lead to financial benefits for AEDL. Finally, the public sector does share some of the policy risk of the Douro Litoral Concession, as AEDL can request a “restoration of financial balance” to offset any subsequent Government of Portugal highway investments not anticipated in the PRN that affect profitability of the Concession (Government of Portugal and AEDL, 2007).

Though the governance structure of the Douro Litoral Concession does represent a step in the right direction with regard to integration and embracing a network concept, coordination of private finance and sustainable metropolitan mobility faces challenges on several levels. First, the offloading of nearly all commercial risk to AEDL coincides with all revenues being collected and owned by the Concessionaire. AEDL has no incentive (nor authority) to invest those resources in any alternative to the highways specified in the concession contract, which ties the hands of policymakers in terms of directing revenues from user fees to future alternatives potentially offering a higher social return on investment. Furthermore, other risks that would be best handled by the public sector are allocated to AEDL, including responsibility for administering expropriations (Government of Portugal and AEDL, 2007). Finally, Brisa suggests that the protections against government investments in competing highways included in the concession agreement may not necessarily cover all policy risks outside the AEDL’s control. For example, the proposed expansion of the Porto metropolitan light rail system could have an impact on highway PPP revenues (Lobato Melo, Personal Communication, 2010).

From the standpoint of public acceptability, there appears to have been little controversy for implementing this particular concession, although expropriations are approximately half complete to date (Lobato Melo, Personal Communication, 2010). The relative lack of controversy might have much to do with the fact that most existing portions of the metropolitan highway system remain un-tolled, yet will receive substantial reinvestment. It remains to be seen, however, whether the investments and direct payments made by ADEL represent a reasonable social return.

Finally, the impact of finance on the adoption of system-wide tolling has been largely successful with regard to integration of ADEL and concessionaires holding adjacent inter-urban PPPs. Not only is the technology integrated, but concessionaires coordinate informally to ensure that payments are fairly allocated when users traverse road segments under separate concession contracts (Lobato Melo, Personal Communication, 2010). Despite the existence of the requisite technology, however, road pricing has not been adopted on highway segments closer to the center of Porto, or on local roads.

4.4.3 *Conclusions from the Douro Litoral Concession*

Representatives of Brisa expressed a willingness to consider theoretical innovations proposed in academic literature that would ostensibly lead to more sustainable metropolitan approaches, provided that certain institutional structures are effectively implemented. Company representatives did not dismiss, for example concepts such as SMCP and inter-modal approaches to pricing and revenue allocation (though they were less enthusiastic about inter-modal area concessions on the basis of technical feasibility). However, they cautioned that several institutional pre-requisites for private-sector participation and finance would include a government authority with sufficient power to implement and enforce comprehensive inter-modal policy (and preferably at the metropolitan level); the adaptation of satellite-based distance charging; the differentiated pricing of externalities and the linking of those toll portions to direct mitigation measures (to engender public acceptance of additional fees); and greater private-sector input in the planning and alignment of highways prior to tender (or at least a chance to propose alternatives providing better value) (Lobato Melo, Personal Communication, 2010).

Brisa representatives also suggested that the Douro Litoral Concession does not represent a model that should necessarily be replicated. The Company accepted the un-tolled network portion of the Douro Litoral Concession largely because the tolled segments helped unify its inter-urban network in northern Portugal. Local economies of scale in management and operation made the Concession financially attractive, however, Brisa is less likely to have pursued the Douro Litoral Concession otherwise. For metropolitan networks, Company representatives suggest that longer-term contracts with availability payments (if distance-based tolling is unavailable) would allow for a more sustainable model to attract private sector interest as well as a greater opportunity for governments to realize greater value for money through longer-term life-cycle-cost management (Lobato Melo, Personal Communication, 2010). It appears that the Government of Portugal agrees to some extent, as a recent concession of a metropolitan highway networks just south of Lisbon incorporates similar provisions.

It is possible that the new AMT in Porto might offer the appropriate institutional vehicle for integrating planning, funding, finance, provision, regulation, and administration of metropolitan transportation, allowing future highway concessions to incorporate private-sector finance in a manner more consistent with the ideal sustainable metropolitan mobility model. The existence of inter-operable road pricing technology provides a platform through which a comprehensive user-fee based system of road use can be implemented on a system-wide SMCP basis if the proper institutional structure can be put into place.

5 Conclusion

5.1 Summary of Case Findings

After analyzing each of the four cases, the results are not surprising. Private involvement in arranging for PPP finance has helped support some criteria of sustainable metropolitan mobility at the asset level, but many of these benefits disappear when the larger system is considered. Furthermore, many crucial institutional elements promoted by the ADB,

World Bank, and other researchers for efficient public-private transportation investment are not present or sufficient in each case. These deficiencies suggest possible explanations for the gap between the role finance must play in the “ideal” model of sustainable metropolitan mobility and the empirical results. Table 7 illustrates key elements impacting the degree to which PPP finance interacts with sustainable metropolitan mobility objectives and how each case fares against these criteria.

Table 7: Summary of Key Sustainability Elements by Case

	Costanera	SR 91	ETR	Douro Litoral
Metro-level transport authority	✓	✓	✓	
Integrated metro transport planning, funding, finance, and management				
PPP tendered by metro authority				
MSCP				
Distance-based, user-fee pricing	✓	✓	✓	*
Peak Hour Charging	✓	✓	✓	
Pricing other externalities				
Life-cycle costs	✓	✓	✓	**
Investment tied to revenues	✓	✓	✓	**
Financially feasible (less subsidy)		✓	✓	✓
Corridor/area management				✓
Scalable electronic pricing	✓	✓	✓	✓
Shared demand risk	✓			✓
Government assumes policy risk	✓	✓		***

*For BOT portions only

**Investments made on the bases of BOT revenues include cross-subsidization of free M&O segments for the first five years

***Restoration of financial balance possible in some cases

Based on the case evidence, elements of metropolitan highway PPPs consistent with the role of finance in sustainable metropolitan mobility generally fall within the criteria of pricing for both use and investment as well as implementation of pricing technology. While falling short of MSCP, metropolitan highway PPPs with private finance components have in each of the four cases improved upon existing financing mechanisms, where such infrastructure was (and otherwise generally continues to be) financed with a mix of indirect fuel excise taxes and discretionary appropriations from government general revenue accounts. In each case the introduction of variable, distance-based pricing supports a rational process for determining investment levels and rationing use, albeit primarily from the perspective of optimizing financial value as opposed to social welfare. Pricing programs adopted in each of the four cases have thus far supported full cost recovery of debt service (minus some up-front subsidies in the case of Costanera Norte) and operation. Though not fully dynamic, PPP time-of-day pricing effectively introduced road congestion pricing schemes in three metropolitan areas:

Santiago, Los Angeles, and Toronto. Additionally, the inclusion of operations in long-term concession contracts has incentivized life-cycle-cost approaches to capital investment and management programs, which should provide long-term value.

Widespread acceptance and dissemination of electronic tolling technology has apparently acclimated users to user-fee pricing of metropolitan highways in each of the four cases. Only in Porto was electronic pricing of roadways widespread at the time of project inception, albeit on inter-urban routes. Implementation of road pricing technology has provided an efficient mechanism for recovering user fees. While the technology is currently only applied to PPP highways (and some public toll roads in Metropolitan Los Angeles), the technology is scalable so that policymakers could expand road pricing more generally to support metropolitan-wide system pricing and integration.

The case studies also demonstrate weaknesses of private-sector finance of highways from the perspective of sustainable metropolitan mobility. First, road pricing and congestion pricing is limited to the movement of vehicles on the specific assets under contract, often at the expense of system-wide optimization at the metropolitan (or at least corridor) level. In the cases of Toronto and Los Angeles, pricing policies have more or less helped ensure relatively free flows of vehicles on the ETR and SR 91 Express Lanes, respectively, but under private management have disappointed in improving overall corridor mobility. The Costanera Norte case does provide insight as to how flexibility can be built into a PPP contract so as to consider broader system-wide investment goals, but deficiencies in the transparency of renegotiations have led to questionable uses of this tool. The Douro Litoral Concession does somewhat consider system-wide mobility goals within the investment and management scheme, but does so without the benefit of establishing the crucial link between pricing and use on inner-metropolitan highway segments.

In many ways, the inclusion of private finance considerations in each case has merely illuminated pre-existing imbalances and inefficiencies in metropolitan transportation policy, particularly when considering the metropolitan sustainability mobility concept of integration. The literature suggests that sustainable metropolitan mobility requires some level of centralized metropolitan-wide control of transportation policy, including planning, funding, pricing, investment, and management decisions; and that such an agency should be empowered to consider modal and land-use and development alternatives. In fact, policymakers in each case have seemingly recognized this institutional deficiency by creating new metropolitan-wide transportation authorities (Metrolinx in Greater Toronto, Transantiago in SMA, SCAG in the Los Angeles Metropolitan Area, and the newly-enacted AMT law for Metropolitan Porto).

In each case, however, while policymakers have pursued measures aimed at devolving greater and broader powers to metropolitan-level transportation planning and administrative bodies, highway PPPs have been approved by non-metropolitan authorities concerned mostly with highway finance and capacity expansion. The outcomes reflect the objectives of the administering agencies, which are often (at least in retrospect) inconsistent with long-term sustainable metropolitan mobility objectives. Even in the case of Douro Litoral, which has faced relatively less formal opposition, the lack of a

mechanism for coordination between AEDL and Metro Porto could lead to conflict rather than integration of metropolitan road and rail policies. The seeming incongruence of PPP planning and execution with trends towards more integrated metropolitan mobility policy has consequences not only for effective system coordination, but also public acceptance. Major backlash from communities and representatives at the community level are present in all but the Porto case, with OCTA's purchasing of SR 91 Express Lanes representing the ultimate failure of the workability of a PPP franchise structure to meet broader public policy goals.

Some problems can be found in the governance structures of the PPP contracts, which may be rectified. For example, the allocation of commercial risk should weigh more heavily on the partner better able to manage that risk. In most cases, the public sector controls more of the variables that affect this risk. Assumption by the public sector of greater commercial risk might incentivize the private sector to participate in projects for which coordination is required and profits are small, but downside is low. Relieved of much of the difficult-to-manage commercial risks, the private sector partner can more effectively take on tasks which can support the institution of an approach to financing metropolitan highways more consistent with the sustainable metropolitan mobility model. Theory and the empirical evidence from the cases suggest these tasks include: investing and managing system components consistent with life-cycle-cost approaches (e.g., productive and allocative efficiency) and implementing innovative technology.

Though improved contracting methods are helpful, the core institutional deficiency in establishing the ideal role for financing of highways to support sustainable metropolitan mobility has little to do with private-sector participation. Rather metropolitan-wide transportation authorities are either non-existent or lack the powers to effectively integrate modal and inter-sectoral policies and to plan, manage, price, and provide metropolitan highways under a systems approach. With the exception of SCAG, none of the metropolitan-level transportation policy bodies has direct authority over metropolitan highways. Furthermore, distance-based road pricing is generally non-existent across cases on most metropolitan highways and all local roads. Energy, transit, and other metropolitan network infrastructures are often financed at least in part by direct user fees, which internalize some if not all of the costs to the user. So even where PPPs introduce road pricing or congestion pricing to metropolitan highways, the benefits do not accrue at the system level because the framework is narrowly tailored to financial performance at the asset level. Thus there is no incentive for the private partner to price and manage the system component in a manner consistent with the optimization of the larger network if such action would be inconsistent with the financial interest of the PPP contract.

5.2 The Future of Highway PPPs and Sustainable Metropolitan Mobility

The cases generally demonstrate the limitations of PPPs to support the criteria for finance within an "ideal" sustainable metropolitan mobility model in the absence of a public authority at a metropolitan scale to effectively integrate transportation policy (planning, pricing, regulation, externality mitigation, etc.) across all system components. Private-sector partners have neither the incentive nor the authority to coordinate with other components of the metropolitan transportation system unless financially beneficial.

Additionally, many of the social benefits of integrating transportation modes and metropolitan land use and mobility policies generally are difficult to quantify in financial terms, requiring a public authority to establish public value for such objectives, including the public's willingness to accept trade-offs (e.g., more restrictive land use, higher fares for transit, etc.). For this reason it is critical that an entity whose primary objective is enhancing social welfare for the entirety of the metropolitan system have the authority and the tools to establish the institutional framework for implementation. The public authority could construct a PPP contract structure that incentivizes private-sector partners to finance a segment (or corridor) of the metropolitan highway system in a manner consistent with the sustainable metropolitan mobility model, with the public accepting some risks and costs which might otherwise deem the project financially infeasible.

While the case studies suggest that the private sector can, and perhaps must, play a crucial role in metropolitan highway provision, maintenance, management, and operation, it is not clear that the private sector must play a prominent role in finance. Given that the public sector can often secure more favorable borrowing rates, and given the lack of private control over many systemic elements affecting highway commercial risk, it is unclear whether private participation was a pre-requisite for the finance of metropolitan highways in any of the four cases. OTCC financed ETR on the basis of variable, time-of-day, user-based electronic pricing, and OCTA has continued most of the successful elements of the SR 91 Express Lanes Franchise since taking over by maintaining the largely corporatized structure. Where the private sector has been successful in delivering value for money of highway investments is through life-cycle-cost approaches, innovative management practices, and speeding-up implementation. In essence, when provided with a set of tasks and appropriate incentives, the private sector can deliver real value to the public benefit.

In recent years, a number of governments, including the Government of Portugal, have changed philosophies on engaging the private sector for metropolitan highway provision, now favoring management and operation contracts supported by availability payments remunerated for successful performance of detailed objectives. While this seems appropriate for delivering value for money, such an arrangement does not solve the larger objective of creating greater efficiency in system investment and management decisions, which should, for example, tie user fees to road use. We believe that it is possible to satisfy all elements of our model and to eventually allow a greater role for the private sector to arrange for project finance, but this will not occur without a central metropolitan authority to rationalize finance and investment on a consistent, system-wide basis.

While our research suggests that the lack of a central metropolitan authority complicates the role of finance in promoting sustainable metropolitan mobility, additional case study research could identify specific characteristics of a successful metropolitan-wide authority capable of achieving these ends. We plan to undertake such research in the continuing evolution of this research topic.

6 Acknowledgments

This publication was made possible by the generous support of the Government of Portugal through the Portuguese Foundation for International Cooperation in Science, Technology and Higher Education and was undertaken in the MIT-Portugal Program.

7 Bibliography

- 407 International, Inc. (407 ETR). (2009). *Annual Information Form For the Year Ended December 31, 2008*.
- Abdel Aziz, A. (2007) Successful Delivery of Public-Private Partnerships for Infrastructure Development. *Journal of Construction Engineering and Management*. Vol. 133, No. 12. pp. 918-931.
- Asian Development Bank (ADB). (2000). *Developing Best Practices for Promoting Private Sector Investment in Infrastructure*. Asian Development Bank. Last accessed 25 February, 2010, from: http://www.adb.org/Documents/Books/Developing_Best_Practices/Roads/default.asp.
- Banister, D. (2008). The Sustainable Mobility Paradigm. *Transport Policy*. Vol. 15, No. 2, pp. 73-80.
- Boarnet, M. G. and Dimento, J. F. (2004). The Private Sector's Role in Highway Finance: Lessons from SR 91. *Access (University of California Transportation Center)*. No. 25, pp. 26-31.
- Brisa. (2009). *2008 Financial Report*.
- California Department of Transportation (Caltrans). (2007). *Transportation Funding in California*. Sacramento, California.
- (2008). Programming. Chapter 4 in *Project Development Procedures Manual*. Sacramento, California.
- Camara Chilena de la Construcción [Chilean Chamber of Construction] (CCC). (2008). Presupuesto Público 2008 [Public Budget 2008]. *Fundamenta*. Volume 36.
- Coase, R. H. (1991). The Nature of the Firm (1937). Chapter 2 in *The Nature of the firm*. (Williamson, O.E. and Winter, S. G., Eds.): Oxford, UK: Oxford University Press, Inc., pp. 18-33.
- Comisión Económica para América Latina y el Caribe [Economic Commission for Latin America and the Caribbean] (ECLAC). (2003). *Política y Plan de Transporte Urbano Santiago 2010 [2010 Santiago Urban Transport Policy and Plan]*. PowerPoint.
- de Palma, A., Lindsey, R., and Proost, S. (2007). Investment and the Use of Tax and Toll Revenues in the Transport Sector: The Research Agenda. Chapter 1 in *Investment and the Use of Tax and Toll Revenues in the Transport Sector*. (de Palma, A., Lindsey, R. and Proost, S., Eds.). Oxford, UK and Amsterdam, Netherlands: Elsevier, Research in Transport Economics. Volume 19, pp. 1-26.
- Duncan, the Honorable D. (2009). *2009 Ontario Budget: Confronting the Challenge, Building Our Economic Future*. Ontario, Canada: Ministry of Finance, Province of Ontario, Canada.
- DISTILLATE. (2009). Last Accessed 15 Dec, 2009, from <http://www.distillate.ac.uk/>
- ENACT. (2009). *Deliverable 5: Integrated Theoretical Framework: Final Guidelines for Case Studies and Simulation Model Applications*. Lisbon: Transportes, Inovação e Sistemas [Transport, Innovation and Systems].

- Engel, E. *Public Private Partnerships: When and How*. (2008). PowerPoint. Cambridge, MA: MIT CTL Lunch Time Lectures, December, 2008.
- Engel, E., Fischer, R. and Galetovic, A. (2000). *Franchising of Infrastructure Concessions in Chile: A Policy Report*.
<http://cowles.econ.yale.edu/~engel/research.htm>.
- (2008). *Public Private Partnerships: When and How*: First version.
<http://cowles.econ.yale.edu/~engel/research.htm>.
- European Commission. (2001). *White Paper – European transport policy for 2010: time to decide*. Luxembourg: Office of Publication of the European Commission.
- Federal Highway Administration and Federal Transit Administration (FHWA and FTA). (2007). *The Transportation Planning Process Key Issues: A Briefing Book for Transportation Decisionmakers, Officials, and Staff*. Washington, DC: U.S. Department of Transportation.
- Fernandes Maciel, V. (2009). *Establishment of Metropolitan Authorities (MTAs) for Lisboa and for Porto*. Boston, Massachusetts. Massachusetts Institute of Technology. Memorandum on 2009 Portuguese AMT Law.
- Goldman, T. and Gorham, R. Sustainable urban transport: Four innovative directions. *Technology in Society*. Vol. 28, No. 1, pp. 261-273.
- Gómez-Ibáñez, J. A. (1999). Pricing. Chapter 4 in *Essays in Transportation Economics and Policy: A Handbook in Honor of John R. Meyer*. (Gómez-Ibáñez, J. A., Tye, W. B., and Winston, C., Eds.). Washington: the Brookings Institution.
- Government of Chile. Website. Last accessed 3 July, 2009 at:
 -Ministerio de Obras Públicas [Ministry of Public Works, MOP]. (2009).
<http://www.mop.gov.cl/>.
 -Ministerio de Planificación y Cooperación [Ministry of Planning and Cooperation, MIDEPLAN]. (2009). <http://www.mideplan.cl/final/index.php>.
 -Secretaría Interministerial de Planificación de Transporte [Inter-ministerial Secretariat for Planning and Transport, SECTRA]. (2009). <http://www.sectra.cl>.
- Government of Portugal and Auto-estradas do Douro Litoral (AEDL). (2007). Douro Litoral Concession Agreement.
- Hatzopoulou, M. and Miller, E. J. (2008). Institutional integration for sustainable transportation policy in Canada. *Transport Policy*. Vol. 15, No. 3, pp. 149-162.
- Kanafani, A. (2008). Multimodal Transportation in California: Connecting Planes, Trains, and Automobiles. *Access* (University of California Transportation Center). Vol. 33, pp. 2-7.
- Lindsey, R. (2008). Prospects for Urban Road Pricing in Canada. *Brookings-Wharton Papers on Urban Affairs 2008*. Washington, DC: Brookings Institution Press.
- Lobado Melo, F. Brisa. (2010). Personal Communication. 3 March 2010.
- Marsden, G., Kelly, C., Snell, C., and Forrester, J. (2005). *DISTILLATE: Improved Indicators for Sustainable Transport and Planning, Deliverable C1, Sustainable Transport Indicators: Selection and Use*. Leeds, UK: University of Leeds. Last accessed 29 March 2009. <http://www.distillate.ac.uk/projects/project-c.php>.
- May, A.D., Karlstrom, A., Marler, N., Matthews, B., Minken, H., Monzon, A., Page, M., Pfaffenbichler, P., Shepherd, S. (2005a). *Developing Sustainable Land Use and*

- Transport Strategies: A Decision Makers' Guidebook*. Leeds, UK: Institute for Transportation Studies.
- May, A. D., Kelly, C. and Shepherd, S. (2005b). Integrated Transport Strategies. Chapter 14 in *Handbook of Transport Strategy, Policy and Institutions*. (Button, K. J. and Hensher, D. A., Eds.). Oxford, UK: Elsevier Ltd., pp. 237-254.
- Metrolinx. (2008). *The Big Move: Transforming Transportation in the Greater Toronto and Hamilton Area*. Ontario, Canada: Province of Ontario, Canada.
- Minken, H., Jonsson, D., Shepherd, S., Jarvi, T., May, T., Page, M., Pearman, A., Pfaffenbichler, P., Timms, P., Vold, A. (2003). *Developing Sustainable Urban Land Use and Transport Strategies: A Methodological Guidebook*. Oslo: Institute for Transport Economics.
- Mylvaganam, C. and Borins, S. (2004). *If you build it...: business, government and Ontario's electronic toll highway*. Toronto: University of Toronto Centre for Public Management by University of Toronto Press.
- National Cooperative Highway Research Program (NCHRP). (2009). *NCHRP Synthesis 391: Public Sector Decision Making for Public-Private Partnerships*. Washington: Transportation Research Board.
- Nelson, J. (2008). *Stuck with the bill, buy why? An analysis of the Portuguese public finance system with respect to surface transportation policy and investments*. Master of Science in Transportation/Master in City Planning Thesis, Cambridge, Massachusetts: Massachusetts Institute of Technology.
- Nunes Silva, C. (2009). The right to compete in transport infrastructures: Does centralist decision-making attenuate transport infrastructure conflicts? *IDEES*. no.32.
- Orange County Transportation Authority (OCTA). (2007). *91 Express Lanes 2007 Annual Report*. Orange County, California.
- (2008). SR 91 Implementation Plan. Orange County, California. Last accessed 1 January, 2009, from: <http://www.octa.net/sr-91.aspx>.
- (2009a) SR 91 Express Lanes 2009 Annual Report: Innovation that Works. Orange County, California.
- (2009b). 91 Express Lanes Fast Facts. Orange, California. Last accessed 28 January, 2009, from: <http://www.octa.net/pdf/91tollpolicy.pdf>.
- Organization for Economic Co-operation and Development (OECD). (2008). Efficiency in Different Models for Infrastructure Provision. Chapter 5 in *Transport Infrastructure Investment: Options for Efficiency*. Paris: OECD Publishing. pp. 105-124.
- PATS. (2010). Last accessed 11 May 2010 at: <http://www.tis.pt/proj/pats/>.
- Pigou, Arthur. (1920). *The Economics of Welfare*. London: Macmillan.
- Province of Ontario (Ontario). (2006). *Places to Grow: Better Choices. Brighter Future. Growth Plan for the Greater Golden Horseshoe*. Ontario, Canada: Ontario Ministry of Public Infrastructure Renewal.
- Small, K. A. and Verhoef, E. T. (2007). Pricing. Chapter 4 in *The Economics of Urban Transportation*. London and New York: Routledge.

- Soberman, R. (2008). Transportation in Toronto. *Managing and Financing Urban Public Transport Systems*. (Guess, G., Ed.). Budapest: Local Government and Public Service Reform Initiative, Open Society Institute-Budapest.
- Sociedad Concesionaria Costanera Norte, S.A. (2008a). *Estados Financieros 2008 [2008 Financial Report]*.
 ----- (2008b). Memoria Anual 2008. [2008 Annual Report].
 ----- (2009). Memoria Anual 2009. [2009 Annual Report].
- Southern California Association of Governments (SCAG). (2008). *2008 Regional Transportation Plan: Making the Connection*. Los Angeles.
- Stead, D. (2008). Institutional aspects of integrating transport, environment and health policies. *Transport Policy*. Vol. 15, No. 3, pp. 138-148.
- Sullivan, E. (2000). *Continuation Study to Evaluate the Impacts of the SR 91 Value-Priced Express Lanes*. Report submitted to: State of California, Department of Transportation, Traffic Operations Program, HOV Systems Branch.
- Sullivan, E. and Burris, M. (2006). Benefit-Cost Analysis of Variable Pricing Projects: SR-91 Express Lanes. *Journal of Transportation Engineering*. Vol. 132, No. 3, pp. 191-198.
- Transantiago. (2003). *Subete [Come Aboard]*. Santiago, Chile.
- Transport Canada. (2008). *2008 Transportation in Canada: An Overview, Addendum*. Ottawa, Canada: Minister of Public Works and Government Services, Canada.
- Viegas, J. M. (2005). Integrated Transport Systems: Public-Private Interfaces. Chapter 9 in *Handbook of Transport Strategy, Policy and Institutions*. (Button, K. J. and Hensher, D. A., Eds.): Oxford, UK: Elsevier Ltd., pp. 135-154.
- Viera, J., Moura, F., Viegas, J. (2007). Transport policy and environmental impacts: The importance of multi-instrumentality in policy integration. *Transport Policy*. Vol. 14, No. 6, pp. 421-432.
- Vickrey, W. S., (1969). Congestion Theory and Transport Investment. *The American Economic Review*. Vol. 59, No. 2, pp. 251-260.
- Williamson, O. E. (1991). Introduction. Chapter 1 in *The Nature of the firm*. (Williamson, O.E. and Winter, S. G., Eds.): Oxford, UK: Oxford University Press, Inc., pp. 3-17.
 ----- (2002). *The Theory of the Firm as Governance Structure: From Choice to Contract*. Haas School of Business, University of California, Berkeley. Website. Last accessed 3 March, 2010, at <http://groups.haas.berkeley.edu/bpp/oew/choicetocontract.pdf>.
- World Bank (WB). (1996). *Sustainable Transport: Priorities for Reform*. Washington: The World Bank.
 ----- (2002). *Cities on the Move*. Washington: The World Bank.
 ----- (2010). *Toolkit for Public-Private Partnerships in Roads & Highways*. Website. Last accessed 3 March 2010 at <http://www.ppiaf.org/documents/toolkits/highwaystoolkit/>.
- World Commission on Environment and Development (WCED). (1987). *Report of the World Commission on Environment and Development: Our Common Future*. (Chairman Brundtland, G. H.). Brussels, Belgium: United Nations.

- Zegras, C. (2003). Financing Transport Infrastructure in Developing Country Cities. *Transportation Research Record No.1839: Transportation Finance, Economics, and Economic Development*, pp. 81-88.
- (2006). Private Sector Participation in Urban Transport Infrastructure Provision. *Sustainable Transport: A Sourcebook for Policymakers in Developing Cities*. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Division 44, Environmental Management, Water, Energy, Transport, Federal Ministry for Economic Cooperation and Development.
- (2010). Mainstreaming Sustainable Urban Transport: Putting the Pieces Together. Chapter 19 in *Transport Policy-making and Planning for Cities of the Developing World* (Dimitriou, H. and Gakenheimer, R., Eds.), Routledge (forthcoming).
- Zegras, C., Nelson, J., and Macário, R. (2010). Hacia el Federalismo Fiscal: Dificultades y Desafíos en el Caso del Sector de Transporte Público Portugués [Difficulties and Challenges in the Case of the Portuguese Public Transport Sector]. Working paper.