Sustainable Metropolitan Mobility and Public-Private Partnerships: A Highway to Institutional Reform?

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Submitted to the Department of Urban Studies and Planning and the Department of Civil and Environmental Engineering in Partial Fulfillment of the Requirements for the Degrees of Master in City Planning and Master of Science in Transportation

The “sustainability” literature generally acknowledges a critical role for transportation infrastructure planning, finance, investment, design, construction, operation, and management for addressing the long-term viability of cities and metropolitan areas. At the same time, governments have increasingly employed public-private partnerships (PPPs) for metropolitan transportation infrastructure with the goal of improving project finance, delivery, and long-term management and operation. While proponents of “sustainability” often imply a more collectivist and public-sector-led paradigm and proponents of liberalization often argue for greater private sector intervention and market competition, theory suggests that both sectors offer unique institutional attributes critical to achieving sustainable metropolitan mobility (SMM). The question is how to optimally configure institutions to address the challenge of SMM for metropolitan transportation infrastructure delivery? Focusing on highways, this thesis adopts a broad definition of SMM that compasses efficient road pricing and regulation, integration of metropolitan transportation policy, public acceptability, and technology. It employs a qualitative case study analysis to test theories on optimal institutional configurations against seven cases across the world where PPPs were used to deliver highway infrastructure in metropolitan areas. The results suggest that the distribution of network, traffic, and demand risks; the spatial configuration of highways within metropolitan areas; and political factors play key roles in achieving SMM. Additionally, issues of vertical devolution and integration of government institutions and contract regulation likely play important roles but require more in-depth research.

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As I prepared to leave my job and life in Washington, DC, to begin graduate studies in the Department of Urban Studies and Planning, I found myself agonizing over how to make the most of this unique and exciting opportunity. A colleague, sensing my anxiety, asked me one simple question: If money and time weren’t an object, what would you choose to do? I told him without hesitation that I would study innovative ways to improve the interaction between transportation infrastructure planning and urban development. When I arrived at MIT, however, I was still uneasy about this path. I did not have an engineering background like most people I knew in the transportation sector. As I agonized again, my thesis advisor, Professor Chris Zegras, asked me basically the same question as my then-former colleague. Upon hearing my answer, Professor Zegras helped me design a curriculum, prepared me to apply for the Master of Science in Transportation, provided me with research work, and gave me flexibility to explore my interests. I owe Professor Zegras a debt of gratitude.

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Table of Contents

1 Introduction ............................................................................................................... 11

2 Sustainable Metropolitan Mobility ................................................................. 14
   2.1 Sustainability and Metropolitan Mobility .................................................... 14
   2.2 Pricing & Regulation: Signals for “Optimal” Use and “Optimal” Investment .. 16
   2.3 Integration: A Metropolitan Systems View of Investment .......................... 17
   2.4 Public Acceptability and Technology ...................................................... 19

3 Fiscal Federalism, Contracts, Property Rights, and PPPs ................................. 21
   3.1 Fiscal Federalism ............................................................................................. 21
   3.2 PPPs: Contract, Property Rights/Ownership and Transaction Cost Theories ... 24
      3.2.1 Contract, Property Rights/Ownership, and the Relationship to Metropolitan
            Highway PPPs ........................................................................................................... 26
      3.2.2 Risk Allocation ............................................................................................... 28
      3.2.3 Summary of Theoretical Literature on PPPs ............................................. 29
   3.3 Empirical Research and PPPs ......................................................................... 29

4 Methodology ............................................................................................................. 32
   4.1 Case Study Institutional Variables ................................................................. 38
   4.2 Measuring Outcomes ...................................................................................... 40

5 Case Studies .............................................................................................................. 45
   5.1 SR 91 Express Lanes, Los Angeles, USA ..................................................... 46
      5.1.1 Analysis of Institutional Context for the SR 91 Express Lanes PPP ............ 46
      5.1.2 Analysis of the SR 91 Express Lanes PPP .................................................. 48
      5.1.3 Conclusions from the SR 91 Express Lanes PPP ....................................... 52
   5.2 ETR, Toronto, Canada ...................................................................................... 56
      5.2.1 Analysis of Institutional Context for the ETR Ground Lease ..................... 56
      5.2.2 Analysis of the ETR Ground Lease .......................................................... 58
      5.2.3 Conclusions from the ETR Ground Lease .............................................. 63
   5.3 CityLink, Melbourne, Australia ...................................................................... 67
      5.3.1 Analysis of Institutional Context for the CityLink Concession ................. 67
      5.3.2 Analysis of CityLink ................................................................................... 70
      5.3.3 Conclusions from the CityLink Concession ............................................ 76
   5.4 Metropolitan Madrid Concessions, Madrid, Spain ........................................ 80
5.4.1 Analysis of Institutional Context for the Metropolitan Madrid Highway Concessions ............................................................................................................ 80
5.4.2 Analysis of the Metropolitan Madrid Highway Concessions .......... 82
5.4.3 Conclusions from the Metropolitan Madrid Highway Concessions ....... 86
5.5 Costanera Norte, Santiago, Chile ................................................................................................................. 90
5.5.1 Analysis of Institutional Context for the Costanera Norte Concession .... 90
5.5.2 Analysis of the Costanera Norte Concession ........................................... 93
5.5.3 Conclusions from the Costanera Norte Concession................................. 98
5.6 Douro Litoral, Porto, Portugal .......................................................................... 101
5.6.1 Analysis of Institutional Context for the Douro Litoral Concession ...... 101
5.6.2 Analysis of the Douro Litoral Concession ................................................ 104
5.6.3 Conclusions from the Douro Litoral Concession...................................... 110
5.7 M25 Orbital, London, UK................................................................................ 115
5.7.1 Analysis of Institutional Context for the M25 Private Finance Initiative. 115
5.7.2 Analysis of the M25 Orbital Private Finance Initiative ....................... 118
5.7.3 Conclusions from the M25 Private Finance Initiative ......................... 122
6 Case Study Comparative Analysis and Discussion ........................................ 126
6.1 Summary of Case Studies ................................................................................ 126
6.2 General Patterns in a Cross-case Study Analysis.......................................... 130
6.2.1 Temporal Patterns ..................................................................................... 130
6.2.2 Patterns in Formal Institutional Structures ............................................... 132
6.2.3 Patterns of Governance Institutions: Risk Allocation............................ 133
6.2.4 Spatial and Political Patterns ................................................................. 135
6.3 Revisiting the Hypotheses............................................................................... 138
7 Conclusions............................................................................................................ 141
7.1 Biases and Limitations of the Case Study Analysis.................................... 143
7.2 Applications of the Emerging Analytical Model ...................................... 144
7.3 Insights for Further Analysis........................................................................... 147
8 Bibliography ........................................................................................................... 150
List of Figures

Figure 1: PPP Value Creation Factors and Value for Money ....................................... 26
Figure 2: Monopoly-Contracts View of Regulation .................................................... 27
Figure 3: ADB Sequencing of Highway PPP Institutional Development .................... 31
Figure 4: Map of the SR 91 Express Lanes ............................................................... 48
Figure 5: Map of the ETR (Segments in Metropolitan Toronto)............................... 58
Figure 6: Map of the CityLink Concession ............................................................... 70
Figure 7: Alignment of Metropolitan Madrid Concessions ...................................... 83
Figure 8: Map of the Costanera Norte ................................................................... 93
Figure 9: Map of the Douro Litoral ...................................................................... 105
Figure 10: London M25 Orbital Concession: Map and Scope ............................. 119

List of Tables

Table 1: SMM Framework for Metropolitan PPPs .................................................. 15
Table 2: PPP Contract Types ................................................................................. 36
Table 3: Overview of Case Studies ..................................................................... 37
Table 4: Institutional and Contextual Variables for SMM .................................. 39
Table 5: Framework for Assessing Highway PPP Performance ......................... 41
Table 6: Institutional Profile: Highway PPPs in Los Angeles, USA (At the Time of Contract Award) ............................................................. 50
Table 7: SMM Performance Indicators: SR 91, Los Angeles .............................. 53
Table 8: Institutional Profile: Highway PPPs in Toronto, Canada (At the Time of Contract Award) ............................................................. 54
Table 9: SMM Performance Indicators: ETR, Toronto ........................................ 63
Table 10: Institutional Profile: Highway PPPs in Melbourne, Australia (At the Time of Contract Award) ............................................................. 72
Table 11: SMM Performance Indicators: CityLink, Melbourne ......................... 77
Table 12: Metropolitan Madrid Concessions ....................................................... 83
Table 13: Institutional Profile: Highway PPPs in Madrid, Spain (At the Time of Contract Award) ............................................................. 85
Table 14: SMM Performance Indicators: MMCs, Madrid ................................... 87
Table 15: Institutional Profile: Highway PPPs in Santiago, Chile (At the Time of Contract Award) ............................................................. 95
Table 16: SMM Performance Indicators: Costanera Norte, Santiago ................. 98
Table 17: Institutional Profile: Highway PPPs in Porto, Portugal (At the Time of Contract Award) ............................................................. 106
Table 18: SMM Performance Indicators: Douro Litoral, Porto ......................... 111
Table 19: Institutional Profile: Highway PPPs in London, UK (At the Time of Contract Award) ............................................................. 111
Table 20: SMM Performance Indicators: M25 Orbital, London ......................... 120
Table 21: Institutional Characteristics Across Cases (At the Time of Contract Award) 127
Table 22: SMM Performance Indicators Across Cases ..................................... 128
1 Introduction

The "sustainability" literature generally acknowledges a critical role for transportation infrastructure planning, finance, investment, and management for addressing long-term viability of societies. Academia, government agencies, business leaders, international development agencies, non-profits, and many others have, however, struggled to develop consistent and universally-valid tools to guide policy-makers towards sustainable transportation. Policy prescriptions are complicated, in part, by difficulties in operationalizing the concept, whose three-pronged meta-goals of increasing efficiency, promoting sound environmental stewardship, and promoting social equity suggest often different and sometimes conflicting remedies. While progress has been made in defining variables and understanding interactions and trade-offs, challenges remain to defining the appropriate set of interventions for a given context. While there may be general agreement on the basic sustainability objectives, specific details must vary by place. A wide body of literature analyzing the empirical evidence in different contexts, reveals a multitude of different approaches throughout the world, with theory ever-evolving in light of the evidence.

Even when a comprehensive set of sustainability objectives and desired outcomes can be articulated for a given locale and translated into a coherent transportation planning, finance, investment, management and operations strategy, citizens and governments must confront a complex set of institutional variables that will influence outcomes. These include, but are not limited to, designing formal institutional strategies to fulfill the objectives; implementing an efficient, effective, transparent, and broadly acceptable governance structure for delivering and managing infrastructure; and accounting for other context-specific socio-economic, spatial, and political factors.

Since at least the 1980s, governments have increasingly been exploring the use of public-private partnerships (PPPs) for metropolitan highway infrastructure finance, construction, operations, and management. This movement has lent both complexity and clarity to the sustainability debate around metropolitan transportation. On the one hand, application of PPPs in some metropolitan areas serves to focus the objectives for delivering certain segments of the metropolitan highway network under the framework of economic efficiency. Many of the initial projects involved private finance and private assumption of most, if not all, commercial risk, which many hoped would spur greater efficiency and innovation (though other political objectives were certainly involved). In some cases, PPPs offered some observable efficiency improvements versus public provision elsewhere on the network. However, many of these earlier attempts at metropolitan highway PPPs also resulted in consequences not only for environmental and social objectives of sustainability but also system-wide efficiency. Academia, government, and industry have absorbed these initial experiences and have since explored a range of different alternatives in search of the elusive "ideal" institutional structure for metropolitan highway infrastructure delivery, operations, and, especially, finance.

This thesis aims to add to the body of literature by investigating the concept of sustainability in light of the relatively recent trend towards delivering and managing highway infrastructure in congested corridors of metropolitan areas through PPPs. At
issue is the question of the optimal institutional structure for delivering highway infrastructure in metropolitan areas consistent with the objectives of sustainability. In attempting to answer this question, this research will test existing theories on the configuration of government institutions as well as mechanisms for delivering network infrastructure by examining seven relatively recent highway PPP cases.

The thesis adopts a framework of analysis loosely centered on the concept of sustainable metropolitan mobility (SMM) to evaluate different institutional approaches involving highway PPPs. Using the broad framework of SMM, I offer a set of objectives attempting to encompass the realm of sustainability and adapted to more specifically address outcomes of urban highway PPPs from a metropolitan system-wide perspective. Using theory as a guide, I develop performance indicators to help assess the extent to which different cases meet SMM objectives. The indicators aim to provide clear criteria, to be used to evaluate the strengths and weaknesses of different institutional pathways towards adoption of metropolitan highway PPPs. The goal will be to generalize, to the extent possible, the institutional elements indicative of movement towards SMM, while also identifying context-specific factors that may be less generalizable.

This case study research tests a basic theory from the public finance literature referred to as fiscal federalism. Fiscal federalism suggests that formal administrative and fiscal decision-making on all metropolitan transportation infrastructure investment and management should be devolved to a government body whose geographic scope of jurisdiction is consistent with the boundary of benefits and costs associated with said infrastructure (Tiebout, 1956; Oates, 1999; Nelson, 2008). This concept will be elaborated in later chapters of this research. For the purposes of this study, I propose that adherence to fiscal federalism is necessary to achieve the objectives of SMM.

Adherence to fiscal federalism alone will not, however, likely yield optimal results. A well-conceived and well-regulated project delivery and management strategy is also necessary, particularly given the fact that metropolitan highway infrastructure arguably demonstrates monopoly properties, network externalities, and other practical limitations for which incentives might be aligned with reduced social welfare. Thus, institutional governance structures for delivering and managing metropolitan highway infrastructure must allocate responsibilities to entities that can best control associated risks in order to minimize resource costs, while at the same time including regulatory and contract designs that reduce incentives for behavior that would lead to less-than-optimal social welfare outcomes. This study will test the extent to which institutional factors, including and in addition to fiscal federalism, may impact achievement of sustainability objectives defined in the SMM model. Furthermore, this thesis will address spatial and political factors which are often overlooked, but would seem to be relevant.

The remainder of this thesis is organized as follows. Chapter 2 summarizes the recent history of the development of the concept of sustainability, introduces the SMM framework, and reviews its theoretical underpinnings. Chapter 3 discusses relevant theories, including a review of fiscal federalism, theories of contracts and property rights, and, contemporary literature addressing the proposed benefits and costs of PPPs for transportation infrastructure. Chapter 4 develops both specific metrics for defining the
institutional structures associated with each case and develops the analytical model for evaluating outcomes with respect to the SMM framework. Chapter 5 includes detailed analysis of seven specific cases of highway PPPs in metropolitan areas (in order of ultimate delivery of the relevant infrastructure defined in the commercial management contract): the SR 91 Express Lanes in Los Angeles, United States of America (USA); the ETR in Toronto, Canada; CityLink in Melbourne, Australia; a series of metropolitan highway concessions in Madrid, Spain; the Costanera Norte in Santiago, Chile; the Douro Litoral in Porto, Portugal; and the M25 Orbital in London, United Kingdom (UK). Chapter 6 provides a cross-case analysis, general discussion of linkages between institutional metrics and SMM performance indicators, and an analysis of the hypotheses in light of the empirical evidence. Finally, Chapter 7 offers some concluding thoughts and suggestions for further research.
2 Sustainable Metropolitan Mobility

This chapter considers the concept of "sustainability" as related to metropolitan transportation and, specifically, planning, finance, investment, management and operations (hereafter referred to as "metropolitan transportation provision" or "metropolitan highway provision"). The first sub-section provides a brief overview of the contemporary development of the term sustainability and its application to issues of urban and metropolitan mobility. This includes a summary of the objectives of SMM as framed for this research and a more detailed analysis of the theories supporting the SMM objectives.

2.1 Sustainability and Metropolitan Mobility

Many of the principles related to sustainability are not new, but contemporary interpretations of the concept derive principally from a 1987 United Nations (UN) World Commission on Environment and Development (WCED) generally 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).

Numerous bodies in the public, private, and non-profit sectors have since attempted to operationalize the concept of sustainability for transportation and, in some cases, establishing quantifiable metrics. The European Commission (EC) has spearheaded a number of initiatives aimed at addressing sustainability generally and applying this concept to transportation. In adopting a framework of sustainability encapsulating economic, environmental, and social equity concerns, the EC’s “2001 European Union White Paper on Transport,” recommends 60 measures. Notable among these are: social marginal cost pricing (SMCP) of roads; inter-modal and inter-sectoral integration; mode shift away from road use for passenger and freight transport; targeted investments aimed at system efficiency; and other institutional reforms. The EC has also supported extensive research on land use and transportation interactions and sustainability, including efforts aimed at defining sustainability indicators and decision-making criteria (May et al, 2005a; May et al, 2005b; Marsden et al, 2005) and developing methodological guidelines for evaluating projects against these objectives (Minken et. al., 2003).

Others acknowledge the importance of a comprehensive view of transportation systems in addressing sustainability, but point out some of the weaknesses of current models in measuring multiple (and sometimes conflicting) criteria (Johnston, 2008) or the dangers of fixating on proxy indicators when evaluating the complex relationship between transportation and the environment across different institutional contexts (Boarnet, 2010). Goldman and Gorham (2006) suggest that most definitions fail to address the full system-wide view of transportation or consider the extent of cross-system interactions. Zegras (2010) points out some of the practical challenges of developing universally valid indicators of the concept of sustainability including a lack of data, differences in administrative approaches to measurement, and the need to take into account system feedbacks, relative societal values, and the inevitable trade-offs. He suggests a normative
framework which conceptualizes sustainable urban mobility as requiring cities to provide more welfare (accessibility) per unit of throughput (mobility).

Until such time that comprehensive, valid, and universal indicators for sustainability can be operationalized, we can at least be guided by qualitative objectives that encapsulate the main areas of consensus regarding transportation sustainability and which can be broadly applied across contexts. In reviewing the literature on the topic of sustainability and transportation, Banister (2008) suggests four elements critical to a sustainable mobility paradigm. These can be summarized as: 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.

Table 1 summarizes the framework for SMM as defined for this thesis, adapted from Banister’s “sustainable mobility paradigm.” For the purposes of this study, the SMM framework consists of four fundamental elements: pricing and regulation, integration, public acceptability, and technology. These elements distil into five objectives against which each PPP case study can be evaluated: pricing as a signal for optimal use, pricing as signal for optimal investment, integrated transportation system investment strategy, investment supports social policies, and employment of state-of-the-art technology for pricing and management. Each objective draws support from a range of economic and political science-related theories. The following sub-sections discuss the theories underlying the SMM framework.

Table 1: SMM Framework for Metropolitan PPPs

<table>
<thead>
<tr>
<th>SMM</th>
<th>SMM Objectives</th>
<th>Supporting Theory</th>
<th>Related Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pricing &amp; Regulation</td>
<td>Pricing as a Signal for “Optimal” Use</td>
<td>• Public Finance Theory (Allocative Efficiency/ Productive Efficiency)</td>
<td>• Marginal Costs</td>
</tr>
<tr>
<td></td>
<td>Pricing as a Signal for “Optimal” Investment (Productive Efficiency)</td>
<td>• Network Economics (MSCP, Second-best Pricing, etc.)</td>
<td>• Congestion Pricing, Other Externalities</td>
</tr>
<tr>
<td>Integration</td>
<td>Integrated Transportation System Investment Strategy</td>
<td>• Same as Above Plus, Institutional and Organizational Theory (Transaction Costs, etc.)</td>
<td>Integration, Intra-system, Inter-modal, Inter-sectoral, Inter-jurisdictional</td>
</tr>
<tr>
<td>Public Acceptability</td>
<td>Investment Supports Social Policies</td>
<td>• Same as Above Plus, Normative Economics, Political Economy-Derived Theories</td>
<td>Fairness and Equity, Compensating “Losers”</td>
</tr>
<tr>
<td>Technology</td>
<td>Employment of State-of-the-Art Technology for Pricing and Management</td>
<td>• Cross-cutting</td>
<td>Cultural Acclimation, Scalability</td>
</tr>
</tbody>
</table>
2.2 Pricing & Regulation: Signals for “Optimal” Use and “Optimal” Investment

One of the key elements of SMM is optimally pricing the use of transportation infrastructure, which helps move towards efficient levels of demand while also serving as both an indicator of user preferences and a revenue source for investment. Pricing can take many forms, including user-fee pricing, excise taxes, income taxes, and real estate taxes. Each can be justified based on different objectives. Optimal investment is generally defined by the presence of allocative efficiency (social benefits of investment during project length are greater than costs of construction and maintenance) and productive efficiency (minimizes costs and maximizes benefits in program execution) (OECD, 2008).

For the purposes of metropolitan highways, direct, variable user charges that are linked to demand offer the optimal solution. Pigou (1920) provided the seminal theoretical insight that directly charging users for costs consummate with externalities, or marginal social cost, optimizes social welfare. Mohring and Harwitz (1962) proved theoretically that under certain conditions, including the absence of economies of scale in construction, maintenance and use; prices reflecting marginal lost value of time due to congestion will achieve full cost infrastructure cost recovery. Vickery (1969) extended this concept by modeling transportation bottlenecks, demonstrating how tolls set to equal social marginal costs on a set of (homogenous) drivers entering a queue will eliminate congestion by spreading departure and arrival times over a longer and more evenly-distributed timeframe. Arnott et al (1993) extend Vickrey’s structural model by varying the elasticity of demand of drivers and allowing for different optimal supply under different tolling regimes, demonstrating mathematically that variable toll pricing would achieve the optimal level of social welfare.

While MSCP offers an elegant theory based on classical welfare economics, most of the research on road pricing and investment focuses on the absence of optimal conditions in practice. Verhoef (2008) defines some of the primary practical problems with MSCP include network spillovers, heterogeneity of travelers, uncertainty of traffic conditions, restrictions on the time-variability of road pricing technology, and imperfect markets elsewhere in the system. Rothengatter (2003) considers these limitations as well as the fact that the presence of scale economies complicates cost recovery under a MSCP regime, suggesting that optimal “second-best pricing” alternatives should be sought. Baumol and Bradford (1970) review the effects of different options for pricing roads infrastructure while satisfying cost recovery, demonstrating mathematically that the optimal second-best price would be proportional to the elasticity of demand (i.e., cost mark-ups, or “Ramsey Pricing”).

One of the challenges for MSCP is the presence of network externalities, or un-priced costs (or benefits) imposed by users on the larger transportation system. Verhoef (2007) models behavior in a transportation network with priced and un-priced links to demonstrate the impact of network externalities on imperfect markets, suggesting that a profit-maximizing road operator will tend to under-price and under-develop supply when faced with un-tolled substitutes but will over-price roads in the presence of un-priced compliments. A dense metropolitan transportation system will include a wide array of compliments and substitutes, thereby challenging the efficient pricing of any single link.
Though there are certainly practical difficulties in implementing MSCP in practice, it may be easier to roughly approximate than often believed. While acknowledging the practical role for second best pricing, Rouwendel and Verhoef (2006) suggest that some of the oft-cited challenges to road pricing, such as economies of scale and the indivisibility of capacity, are overstated. They also suggest that a variety of implementation paths can be designed with context-specific second-best pricing strategies that evolve through stages of institutional development towards more optimal pricing and investment regimes and, hence, MSCP (Rouwendel and Verhoef 2006).

The institutional element of pricing and investment also poses challenges that may require departures from some the theoretical ideal. De Palma et al. (2007) suggest that, while public finance theorem dictates that government revenues should be distributed based on investments yielding the highest social returns, it is often preferable to hypothecate (or earmark) road user fee revenues for specific system improvements that will benefit paying users. The authors suggest that this strategy can help assign costs to beneficiaries, ensure stable finance, reduce political abuse of funds, and promote public acceptability. Proost et al. (2007), however, suggest that hypothecation is not a panacea, as efficiency loss can sometimes be greater than the gains from reducing bad political judgment. The World Bank (2002) illustrates that overlapping political jurisdictions with different objectives present yet another challenge to effective provision of transportation networks, suggesting a need for, at minimum, a strong authority at the metropolitan level to coordinate pricing and investment.

PPPs could potentially lead to the SMM objective of optimal pricing and investment by introducing tolls and long-term investment and management strategies to highway infrastructure programs. Theory offers a strong argument for the movement towards variable, user-fee-based pricing, hypothecated revenues, and the creation of quasi-independent metropolitan authorities with control to judge optimal investments for the metropolitan transportation system. The commercial structure of PPPs could theoretically help achieve these objectives.

2.3 Integration: A Metropolitan Systems View of Investment

Another key element of the SMM framework is integration. In a metropolitan mobility system integration can include intra-modal (or network integration), inter-modal, inter-sectoral, and inter-jurisdictional. The two former terms generally imply integration of components of the transportation system under a unified program for metropolitan transportation provision. Inter-sectoral integration involves the consideration of not only mobility concerns in transportation infrastructure decision-making, but also other key metropolitan policies related to, for example, land development, environmental pollution, and economic development. Inter-jurisdictional integration involves interactions between government bodies that share relevant responsibilities in a given area. Financing an integrated network requires a more comprehensive strategy for assigning fees and evaluating investments not only in metropolitan highway infrastructure, but also in competing and complimentary infrastructures and modes and the consideration of goals and objectives in other policy domains.
The term integration should be distinguished from related terms. Geerlings and Stead (2003) describe a hierarchy of decision-making on three levels: co-operation, co-ordination, and integration. Co-operation requires the dialogue and exchange of information; co-ordination includes co-operation plus transparency and conflict mitigation; and integration requires co-ordination plus synergies, establishment of consistent policy goals, and joint working (Geerlings and Stead, 2003). Jones et al (2003) review attempts at integration in the UK, suggesting the importance of establishing valid outcome-oriented indicators that can be used as benchmarks. Thus, integration requires more than joint policy statements and consultations, but rather robust institutional structures that bind different government agents towards unified goals and objectives.

Coase’s (1991, 1937) proposal that institutional behavior of firms can be understood by analyzing transaction costs provides the theoretical foundation supporting the social benefits of integrating public sector decision-making on metropolitan transportation investment and management. Unlike neoclassical economic theories which assume firm decision-making is based entirely on input prices and demand, Williamson (1991, 2002) suggests that transaction cost economics’ concerns itself with more complex decisions within a firm and, specifically, when to purchase a given production input versus when to vertically-integrate production of that input within the firm. In this model, firms will vertically-integrate when the cost of using the market mechanism to procure an intermediate good to production (including costs of procurement, legal costs, etc.) exceeds the cost savings from outsourcing, which include savings from specialized production of that input and reduced internal bureaucratic costs (Williamson, 2002).

A growing body of research examines the practical benefits of integrated policy-making towards improving government policy generally, and transportation policies, specifically. Stead (2008) lists some of the benefits of integration, including: reducing policy duplication, ensuring consistency between policies, improving achievement of cross-cutting goals, directing focus on overall goals of government, promoting innovation in policy development/implementation, and promoting understanding of the larger systemic impacts of policies in a given sector. Some suggest that packaging multiple transportation policy instruments that taken together promote synergies (occurring when policies exhibit greater sum benefits under integrated decision-making than under un-coordinated strategies) can help overcome barriers to implementing social-welfare-enhancing transportation policies (May et al, 2005; Viera et al, 2007).

SMM’s integration and pricing elements go hand-in-hand. Consider, for example, the potential advantages of intra-modal (or vertical) integration, which could reduce costs associated with negotiating multiple and incomplete contracts (as well as accounting for network externalities). Marsden and May (2006) provide a case supporting the synergy benefits of inter-modal coordination and pricing, describing how the integration of transportation powers under Transport for London was the key to implementing congestion charging. The authors explain how the Mayor of London was able to link the costs of road charging directly to increased public transit services in order to win political support. Viegas (2005) justifies the inter-sectoral integration of transportation and land use on the basis of lowering transaction costs between components of a system, using the example that reducing the physical distances between two activity centers reduces the
“costs of travel” by reducing the need for travel (and therefore costs associated with time and construction). Vickerman (2008) reviews the case for inter-jurisdictional integration suggesting that about 55% of transportation benefits are indirect and that decentralized decision-making tends to produce less efficient outcomes, particularly when multiple modes are involved.

PPPs can clearly play a role in vertical integration in metropolitan highway provision. The opportunities for improving other scales of integration (e.g., intra-modal) appear complicated, but not impossible. Furthermore, we might envision area-wide mobility PPPs, which could include inter-modal (and perhaps inter-jurisdictional) alternatives.

2.4 Public Acceptability and Technology

Public acceptability and effective deployment of technology are almost certainly keys to the achievement of metropolitan transportation policies consistent with SMM. In representative democracies and, to an extent, non-democracies, a negative perception of benefits relative to costs may lead to organized efforts to derail project implementation. It is the duty of those entrusted with decision-making power to evaluate metropolitan transportation projects fairly and transparently, and to effectively convey and receive information to affected populations. Mobility “technology” itself spans a range of modes, devices, infrastructures, knowledge systems, etc., that can help support PPPs for SMM by enabling innovation, providing creative means to support complex pricing regimes within and across transportation modes, and collecting data to enhance financial and economic benefit-cost analyses.

Contributions from the literature on political economy, the social economy, and normative concerns of social equity help understanding the role of acceptability in transportation policy. The EU-supported PATS (2001) research project assessed the elements needed to secure public support for road pricing, recommending a number of strategies such as linking user fees to concrete capacity and quality improvements, compensating “losers” in an otherwise net-positive social investment (e.g., reducing other taxes, or providing direct subsidies, etc.), and effectively engaging stakeholders throughout the process. Rayle (2010) reviews theories on inter-organizational collaboration and communicative planning, suggesting that joint development of transportation scenario visioning and development with a broad array of stakeholders can lead to better projects and greater acceptability. Flyvbjerg et al. (2003) review the history of poor social returns on large infrastructure “mega-projects”, suggesting that failure can be attributed in part to inadequate deliberation, poor consideration of risks, and lack of accountability. Even worse, Flyvbjerg (2008) suggests that many of the problems with mega-projects are foreseeable, and the unfortunate result of “optimism bias” and “strategic misrepresentation.”

The role of information-related technologies is generally viewed as having a positive contribution to SMM by enhancing the technical feasibility of computing and administering complex pricing schemes, creating better data to support operations and investment, etc. However, institutional factors and constraints related to the effective deployment of technology remain inadequately understood (Stough and Rietveld, 1997). There are, of course, arguments against the role of technology in society – those remain
outside the scope of this thesis. With respect to finance and SMM, I adopt a generally favorable role of advances in technology vis-à-vis metropolitan highway infrastructure.

PPPs in metropolitan highway provision are often controversial, but they can help make the case for pricing. PPPs often require tolling for project finance, and more often than not employ advanced technologies to support these endeavors. The advent of electronic pricing technology can help accustom drivers to user fee pricing and, if scalable, could support network pricing on a larger scale.
3 Fiscal Federalism, Contracts, Property Rights, and PPPs

In much of the Americas, Europe, and Australasia, formal institutional concerns about sustainability have arisen at the same time that political philosophies have trended towards deregulation, privatization, and liberalization. These parallel trends may seem at odds; the former implying a more holistic and perhaps collectivist approach to resource management and the latter suggesting the need for greater private leeway in resource exploitation. The reality is more complex, with many supporting neo-liberal measures precisely to address real and/or perceived failures of public leadership in addressing complex resource allocation problems. This chapter provides a brief summary of the co-evolution of two relevant dimensions: decentralization of transportation policy and "privatization" of transportation infrastructure provision. A brief review of the literature will demonstrate how liberalization came to represent both a theoretical and practical solution to addressing infrastructure investment and management concerns in an era also dominated by concerns about sustainability.

This chapter also identifies the key theories supporting the hypotheses I will put forth in this thesis that greater adherence to fiscal federalist principles combined with an efficient and well-regulated project delivery and management strategy will lead to better outcomes with respect to the SMM model. Supporting this proposal are theories of fiscal federalism, contract theory, property rights theory, and other related research areas.

3.1 Fiscal Federalism

Fiscal federalism helps frame the challenges of inter-jurisdictional integration in transportation infrastructure provision, suggesting that modern “urban” transportation systems must be considered metropolitan in scale. Fiscal federalism suggests that maximizing social welfare requires that citizen preferences are tied to government allocation, which is best facilitated by setting government scale so as to best internalize benefits and costs and to assign administrative and fiscal powers for the related policy area to that authority (Oates, 1999, Nelson, 2008).

To better understand this concept, we need to define “federalism.” Inman (2007) reviews different definitions for federalism, which generally suggest the existence of multiple tiers of government that cede authority on some matters to a central state but retain other rights and powers that must be respected. He also reviews some of the contemporary arguments for and against federalism. Advocates of federalism point to supposed economic efficiency of decentralized decision-making (which will be addressed in the following paragraphs), the benefits from increased democratic participation, and the protection of personal rights and liberties that might otherwise be less rigorously guarded by government entities of larger geographic scopes. Arguments against federalism typically involve issues of social and territorial equity and, specifically weaknesses in decentralized structures for providing “norms of equal opportunity or economic fairness” (Inman, 2007; pg. 527). Essentially, for a system to survive, governments need to provide a minimum level of investment to allow its citizens equal opportunities to live and prosper. In decentralized systems, however, wealthier regions tend to receive better resources and opportunities than poorer ones (Inman, 2007).
Tiebout (1956) provides the foundation for the branch of public finance theory concerned with fiscal federalism. Tiebout’s well-known model basically describes a local public goods market, with individuals choosing local government jurisdictions that provide the desired tax rate and public goods provision levels. In this model, spatial mobility of consumers of local public goods is roughly equivalent to a shopping trip in the private market. Under a number of restrictive assumptions, including fully-mobile and knowledgeable consumers, the presence of numerous accessible local alternatives with no restrictions on employment, no economies of scale across jurisdictions in local good provision, and the presence of an optimal size and cost for bundles of goods offered by each local jurisdiction (which does not change with demand); an optimal solution can be reached. Essentially, consumer choice is represented by a “preference pattern for public goods” (pg. 418). The result is an equilibrium whereby the optimal aggregate level of goods produced in a local community equals the total actual demand for residents choosing to live in that locality, thus “revealing” consumer preferences. Tiebout also suggests that service integration should take place only in the presence of economies of scale across jurisdictions (Tiebout, 1956). Note the specific relevance of this last point to the metropolitan transportation condition, since many metropolitan mobility benefits and costs may spill over local (sub-metropolitan) jurisdictions.

Oates (1999) describes how fiscal federalism provides a model for increasing efficiency of state and local governments by aligning the responsibilities and fiscal instruments for the provision of a public good to an appropriate level of government. The author reviews Decentralization Theory, which dictates that if no cost savings can be achieved by integrating the provision of a public good, it is always possible to enhance welfare by decentralizing responsibility for the good and associated fiscal instruments to lower-level jurisdictions. Efficiencies come from reducing asymmetries of information between constituents and the government (through greater proximity of the government to the governed) and by reducing political pressures at higher-levels of government which often re-direct benefits of public goods to certain locations at the expense of others. Oates also summarizes the importance of taxation and intergovernmental transfers, which finance the system. In the ideal case, the national government will collect non-benefit taxes (i.e., taxes that are not directly linked to a specified level of benefit to the payer) and which will be used to fund macroeconomic stability programs, social redistribution to the poor, and national public goods such as defense. Local governments will collect benefit taxes as the basis for providing location-specific levels of public goods. National governments will also transfer funds to localities to incentivize investments that produce beneficial inter-jurisdictional spillovers, provide fiscal equalization (i.e., a minimum level of funding to provide public services) across the territory, and otherwise generally improve the efficiency of the tax system. While this model is not without its problems, it does offer general guidance for efficient taxing and production of public goods (Oates, 1999).

Nelson (2008) describes the how the concept of fiscal equivalence formally links both the administrative and fiscal concepts of fiscal federalism. Essentially, fiscal equivalence dictates that the beneficiaries of a public good should be responsible for paying for these benefits. Following a rigid interpretation of this logic, a government produces a level of goods and services for its constituents within a “benefit boundary”, and the economically
efficient manner for financing said benefits is by generating revenues exclusively within that boundary. Thus, in a decentralized system, sub-national levels of government should have fiscal powers consummate with generating sufficient revenues from within the “benefit boundary” to pay for public goods and services (Nelson, 2008).

Oates (1999) suggests, however, that fiscal federalist principles are challenged by spatial patterns of consumption which make it difficult to determine at which level of government a public good should necessarily be produce. Essentially, the boundary of benefits of different goods and services produced by governments may not be consistent with jurisdictional borders, nor will each individual good or service necessarily share the same benefit boundary. For example, it might be difficult to fund transit with taxes from only the central city, as beneficiaries typically include users from nearby cities and towns.

With respect to transportation infrastructure provision, theory suggests at least three levels of government involvement may be appropriate, depending on the infrastructure type and scope: “very” local, for neighborhood streets and local circulation routes; metropolitan (or, at least, inter-local jurisdictional), to account for the many transport demands that cross jurisdictional boundaries and the various forms of related spillovers; and higher level (e.g., provincial and/or national), as some infrastructures and services can be argued to be in, for example, the national interest. In practice, bounding infrastructures and services in such ways can be a challenge. In terms of metropolitan transportation, despite no agreement on the exact meaning of the term, metropolitan extends somewhere beyond the center “city” to include surrounding, contiguous built up areas, which combined exhibit some degree of regular economic and social interaction (e.g., Klove, 1952). A growing body of literature suggests that the key to economic growth rests at regional scales. Porter (2011), for example, reviews spatial trends in innovation and economic competition, suggesting that the city-region is slowly overtaking the nation-state as the critical unit of economic growth in a post-industrial world. He suggests that while the world economy is becoming more globalized, “[m]any of the most important levers for competitiveness arise at the regional level, and reside in clusters that are geographically concentrated (pg. 156). The author attributes this to a number of factors including the increasing importance of microeconomic capacity of areas, agglomerative benefits of clustering for innovation, and increasing integration between economic and social policies (Porter, 2011).

Lefèvre (1998) summarizes the arguments for metropolitan approaches to government in “Western” Countries. He reviews the arguments in favor of metropolitan government, which suggest that the forces of economic and social development play out at the metropolitan level, where scale economies enable better provision of services, the costs for which should be assessed across the metropolitan population, with planning and resource distribution coordinated at this level. Lefèvre also summarizes the argument against metropolitan regions. Advocates of Public Choice Theory, for example, following Tiebout, suggest that a metropolitan government violates citizens’ rights to choose localities which best match preferences, removes incentives for productive competition among localities, and reduces the accessibility and accountability of political representatives. Both the “pro-” and “anti-” metropolitan perspectives have practical
validity and the real challenge lies in striking the right balance between maintaining local
control for some public goods while ceding to higher-level authorities for others. Lefèvre
(1998) suggests that metropolitan governments have failed in the past because they have
been administered in a top-down and authoritarian manner reducing legitimacy, while
new trends favoring greater stakeholder participation and partnership and the increasing
focus of metropolitan regions in the world economy may lead to a renaissance.

Despite the practical difficulties associated with fiscal federalism, and the theoretical
debate surrounding the value of metropolitan government, it appears that metropolitan
transportation provision, in any case, would benefit from such a scale of governance.
Lefèvre (1998) suggests that strategic territorial planning and management of technical
infrastructure networks are generally considered a metropolitan competence. A
transportation system clearly plays a formative and functional role at the metropolitan
scale, with key infrastructures, services, and positive and negative impacts almost
inevitably crossing multiple jurisdictions, with varying levels of government (e.g.,
national, state, local) responsible for different (and sometimes overlapping) financing and
management responsibilities. Thus, applying fiscal federalist principles at a metropolitan
scale may help guide the development of institutional structures that efficiently and
effectively respond to the economic, social, and technical requirements of metropolitan
mobility.

In this thesis, I posit that metropolitan highway provision can help lead towards SMM
only in the presence of broad adherence to fiscal federalism for metropolitan-scale
transportation. Assuming that the boundaries of social benefits and costs of highways in
dense agglomerations primarily correspond to a metropolitan geographic scale, then
decision-making should roughly match that scale. Absent such a match, decisions may
more likely reflect a skewed perspective of the social values of the affected population in
establishing system objectives and lead to in-efficient and in-equitable distributions of
costs and benefits. A metropolitan-level authority, accountable to the population
experiencing the benefits and costs of a given metropolitan transportation system, should
then control administrative and fiscal aspects of the relevant inter-modal transportation
network (and, quite possibly, important aspects of the land use system). Such a body
would, in theory, be able to more adequately develop and manage the mobility system for
a given area.

3.2 PPPs: Contract, Property Rights/Ownership and Transaction Cost Theories
As PPPs for highways have become more commonplace since the early 1980’s, so has
research treating various elements of the topic. There is no universally-recognized
definition for PPP, though a broad consensus seems to be forming around the following
defining characteristics for transportation infrastructure: greater private participation than
under traditional procurement; transfer of greater decision-making to the private partner;
and government retention of ownership (NCHRP, 2009). Macário et al. (2009) suggest
two other key elements: private-sector financial investment and the transfer of substantial
risks traditionally born by the government under a regulatory contract to the private
partner. This research adopts this framework as a working definition.
The theoretical argument for PPP arrangements is to maximize social welfare under sub-optimal conditions, so it is important to first understand the theoretical optimum. According to Nicholson and Snyder (2007) classical welfare theory suggests that the market will provide an optimal production and distribution of resources, except in the presence of four types of “market failure”: imperfect competition, externalities, public goods, and imperfect information. Imperfect competition occurs when a party to a transaction exerts market power (i.e., influence over prices) by charging prices higher than marginal costs (e.g., monopolies). Externalities occur when the decisions of parties to a transaction affect another party outside that transaction, who is not involved in the price system. Externalities can be positive (e.g., industry agglomerations) or negative (e.g., pollution). Public good exist where the government may provide a particular good or service that carries substantial welfare but is not commercially viable because no user can be excluded from enjoying the benefits (non-excludable) nor will the benefits be diminished by the volume of users (non-rivaled). Imperfect information occurs when parties do not have access to all (or have asymmetrical access to) information relevant to a transaction. Normative questions of social equity are also problematic (Nicholson and Snyder, 2007). The market viability of highway infrastructure provision is plagued by all of these market failures, though it is questionable whether highways (like many goods and services provided by the government) truly meet the definition of a “public good.” In summary, the ostensible need for hybrid public-private arrangements arises due to weaknesses in the assumptions of classical welfare theory about the roles of the private and public sectors in maximizing net social benefits.

Macário et al. (2009) suggest that there are three main drivers of value in adopting PPPs to address the challenges of optimally delivering “value for money” for infrastructure in the face of market failures, social concerns, and institutional weaknesses. These include the integration of tasks, the allocation of risks, and supplying adequate incentives. Integration of tasks achieves efficiencies by reducing externalities that exist between traditionally discrete tasks (e.g., construction and operations) to optimize life-cycle costs in investment decision-making. Efficiencies through risk allocation occur by transferring risks endogenous to a project, which a private firm can more adequately bear and can better control if properly incentivized (e.g., schedules, cost management, etc.), while the public-sector retains exogenous risks over which a private firm has no control (exchange rate fluctuations, force majeure, etc.). Since the public and private partners each partially control factors related to demand, however, there is a trade-off between increasing incentives to the private firm by transferring these risks and increasing risk premiums on private finance. Supplying incentives basically involves injecting into the contract mechanisms that subject the private concessionaire to commercial competition in order to offset tendencies to take advantage of monopoly power, such as though incentives for payment, the length of the contract, and the possibility for early termination due to contract non-compliance (Macário et al., 2009).

Figure 1 illustrates the relationship between these three drivers of value and value for money. ENACT (2008) summarizes three theories that underpin this process of value creation. These include principal-agent or contract theory; property rights/ownership theory; and transaction cost theory. Contract theory is concerned with the most efficient
design of contracts so as to minimize adverse selection (e.g., the agent taking advantage of the private principal due to asymmetries of information) and moral hazard (the risk that an agent will act in its own self-interest as the expense of the principal). The property rights/ownership literature is concerned with how to optimally manage the (almost assuredly) incomplete contracts once they have commenced. Transaction cost theory deals with tying the optimal governance of a contract with attributes of a transaction, which under different conditions leads to either a more market-oriented, hierarchical, or hybrid governance structure (ENACT, 2008). Implementation of a project consistent with these three theories will help drive the three value creation factors towards the achievement of greater value for money.

**Figure 1: PPP Value Creation Factors and Value for Money**

![Figure 3 - Value creation process within a PPP](image)

Source: ENACT, 2008

The following subsections summarize contract theory, property rights/ownership theory and related research; cover in greater depth the issue of efficient risk allocation; and summarize the implications from theory for metropolitan highway PPPs. Since Chapter 2 discusses Transaction Cost Theory, the subject will not be revisited in a detailed manner in this chapter.

### 3.2.1 Contract, Property Rights/Ownership, and the Relationship to Metropolitan Highway PPPs

Much of the literature on PPPs and contract theory focuses on appropriate institutional designs for transportation infrastructure ownership and regulation in the face of market failure and social equity concerns. Gómez-Ibáñez (2003) describes how transportation infrastructure can exhibit characteristics of natural monopolies due to durable, immobile investments and economies of scale and traffic density, and suggests that the level of public involvement increases with the complexity of writing individual user contracts. As represented in Figure 2, the author presents a model for determining the optimal contract and regulatory regime for implementing an infrastructure project based on potential constraints to efficient markets. The ideal contract is a private contract with prices determined by the market. PPPs generally fall within the middle of the spectrum.
Others suggest the importance of distinguishing between market power and monopolistic pricing in evaluating privatization. In questioning the benefits of public ownership of utilities, Demsetz (1968) suggests that economies of scale do not necessarily lead to suboptimal pricing, and that liberalization can still be preferable, though the author allows that regulation might be justified to prevent excessive capacity and to monitor excess profits. Shleifer (1998) also suggests that increased market liberalization for natural monopolies can improve efficiency, while allowing that regulation might be necessary where contract quality and social concerns are high. Engel et al. (2002) model highway auctions under conditions of imperfect competition “in” a market versus competition “for” a market (e.g., exclusive rights to provide a good or service within a market area, or “Demsetz competition”) suggesting that the latter is superior in any case of decreasing marginal revenue (i.e., most cases). Small and Verhoef (2007) explain that network externalities lead to either excessive market power or insufficient revenues depending upon the network configuration, and suggest that private contractors should be responsible for “full length corridors” that are subject to competition of some sort.

Property rights and ownership theories also offer qualified support for highway infrastructure PPPs, typically focusing on the near impossibility of writing complete contracts for long-term, complex highway PPPs. Grossman and Hart (1986) state that much of the transportation economics literature focuses too much on costs and pricing without focusing on ownership, suggesting that it is important to assign residual ownership rights and control to the entity with the greatest incentives for efficient decision-making. In scenarios where construction and long-term management and operation are bundled, such rights should be transferred to the private partner during the concession period (Hart, 2003). Zhang and Levinson (2009) model centralized versus more decentralized (and privatized) ownership structures, suggesting that the latter could theoretically lead to near-optimal pricing and investment outcomes under proper regulation, although practical difficulties exist such as non-socially-optimal tolling, profit maximization, monopoly, complex interdependencies, and severe competition. Others emphasize the role of “quality of regulation” rather than “ownership” (Ragazzi, 2005).
Other theoretical literature on PPPs concerns strategies for striking the right balance of powers and incentives in different institutional contexts to realize greater social welfare. Some of the primary issues that have emerged include balancing the need for trusting and transparent relationships with the persistent threat of competition (Hensher and Stanley, 2008); maintaining a mix of private and state-owned infrastructure providers in a market to reduce information asymmetries (Fayard, 2005) and to more closely incentivize optimal pricing (de Palma and Lindsey, 2000); selecting context-appropriate second-best pricing regimes and risk allocations, backed by decoupling financial reward from the authority to set charging policies (Macário et al., 2009); and separating a government road PPP grantor from the government regulator to reduce potential conflicts of interest that might advantage the principle and agent at the expense of users and public welfare (Engel et al., 2008).

In summary, contract, property rights, transaction costs, and related theories suggest that there are important roles for both the public and private sectors in the efficient delivery of metropolitan transportation infrastructure. However, the literature also suggests that departures from idealized models (e.g., market failures and normative concerns) make it difficult to strictly separate the optimal assignment of rights and obligations. Two variables seem to be particularly critical in responding to the practical challenges of implementation within the value creation framework: risk allocation and the physical (the composition of links within a program) and spatial (existing network configuration) elements of the proposed metropolitan highway investment. The next sub-section addresses issues of risk allocation. Spatial elements will be addressed later in this chapter.

3.2.2 Risk Allocation

The concept of risk allocation is critical to understanding opportunities for greater efficiencies in transportation infrastructure provision through outsourcing to private firms. Engel et al. (2008) suggest that there are three major risks involved in highway PPPs for which private firms attempt to secure public insurance in some form: construction and maintenance risk, policy risk, and demand risk. The authors suggest that private firms have enough control over the factors impacting construction and maintenance risk that these responsibilities should remain with the private partner, while some elements of demand risk that are beyond the firm’s control should remain with the government. With regard to policy risk, Engel et al. suggest that the policy risks of government actions with unintentional consequences to private PPP operators (e.g., changes to environmental laws) should remain with the private firms, as these affect all firms in a market. However, policy risks resulting from intentional government actions that are expected to affect the finances of a PPP operator (building of competing links, decreasing toll rates due to political pressure, etc.) should be covered by the public party (Engel et al., 2008).

Other researchers have studied the difficult issue of allocating risks that neither the public nor private partners necessarily control in a highway PPP. As described in the previous section, roadway segments in a metropolitan area cannot be easily isolated from complement and substitute road links. While much of the literature suggests that
commercial risks such as demand risk and revenue risk should be shared between public and private partners, researchers have offered different suggestions for effective implementation. The ADB (2000) suggests not only the need to share demand risks, but also emphasizes the need for the public-sector body to maintain land acquisition risk for which government embodies unique sovereign powers. Engel et al. (2008) recommend least-present-value-of-revenue (LPVR) auctions, where bidders select a target return on investment, and concession lengths can vary until that target is achieved. Macário et al. (2009) suggest performance-based contracts as an alternative for incentivizing efficiencies from private-sector participation while limiting the assignment of demand risks.

Chung et al. (2008) provide a helpful review of the types of risk inherent in roadway PPPs and illustrate the appropriate distribution of those risks among actors. The authors suggest that, since the private firm cannot control much of the environment surrounding a metropolitan PPP highway link and the public sector has network planning power, the government should guarantee certain conditions of that environment and compensate the private partner if those conditions change (e.g., due to investments or infrastructure policies that the government implements). Given network assurances, the private partner should then be able to more accurately forecast demand and actively manage traffic risk on the PPP segment to ensure realization of such outcomes (Chung et al., 2008).

3.2.3 Summary of Theoretical Literature on PPPs

The literature on contracts, property rights and ownership, and risk leaves ambiguity in defining the spatial/structural and socio-political dimensions of project delivery that could, along with adherence to fiscal federalist principles, deliver better outcomes within the SMM framework. For example, the literature acknowledges both the benefits of decentralization as well as practical limitations, especially regarding network externalities (e.g., Small and Verhoef, 2007) and the natural monopoly properties (e.g., Gómez-Ibáñez, 2003). In response, theory (e.g., Engel, 2002) seems to imply that competition “for” the market (i.e., the granting of some regulated monopoly rights in a contract) for highway infrastructure may prove more effective than competition “in” the market (i.e., multiple PPPs competing on complementary or substitute links). This approach has spatial and physical-structural implications, which will be discussed in Section 1.3. Other literature recognizes the inevitability of deviating from pure theory due to the composition of providers in a market, the relationships between public and private actors, the distribution of contract risks, and the variability of types of efficient pricing and incentive structures based on circumstances and contexts. Thus, normative and political questions of fairness and equity also appear important. These elements will also be discussed in Section 1.3.

3.3 Empirical Research and PPPs

The empirical literature on roadway PPPs reports mixed results. The literature generally falls into three categories: econometric analysis of outcomes, context-specific case studies or multiple case studies, or meta-analyses. This sub-section focuses on the latter two. PPPs seem to have not lived up to expectations, but the literature has identified many positive outcomes, while also detailing initial failings and identifying recommendations.
Case studies on highway PPP performance in delivering value for money abound. For example, in his analysis of PPP critical success factors, Zhang (2005) reviews eight design-build-finance-operate (DBFO) PPPs implemented through the UK’s Private Finance Initiative (PFI), concluding that they delivered about 15% greater cost savings than conventional provision. Abdel Aziz (2007) reviews numerous infrastructure PPPs, concluding that PPPs 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).

Gómez-Ibáñez and Meyer (1993) review highway PPPs throughout the world, including some of the world’s first attempts at metropolitan highways in Bangkok, Kuala Lumpur, and Jakarta. The authors suggest that most of the urban PPP projects involved politically-connected local entrepreneurs and substantial government subsidy. The authors conclude that roadways carry only low to moderate prospects for privatization compared to other types of infrastructure due to demands for standardized pricing and performance throughout the road system, the difficulty of maintaining competition while balancing the financial need for cost recovery, unclear benefits from cost reductions, and environmental and social equity concerns Gómez-Ibáñez and Meyer (1993). The World Bank’s (1996) comprehensive reviews of highway PPPs examined many of the shortcomings identified in the theoretical and empirical literature, suggesting that increased privatization can improve performance, but that a strong public-sector role is required to mitigate monopoly exploitation, excessive/duplicative capacity, and incentives to de-emphasize quality, safety, and social equity. Miller (2000), drawing from the early Hong Kong use of PPPs for highway tunnels, attributes “success” to three basic conditions: “good” project sponsors, “good” project rationale, and “good” returns. Zegras (2006) attempts to place the use of PPPs into the broader metropolitan context, suggesting success requires an appropriate strategic approach to metropolitan mobility planning, the ex-ante establishment of the proper regulatory and legal framework, proper project and program evaluation techniques, adequate assignment of risk and guarantees, clear identification of distributional effects, and full assessment of impacts such as externalities, complete network performance and adaptability over time, private sector development opportunities, multi-modalism, and political patronage.

The Asian Development Bank (ADB, 2000) provides a global assessment of road PPP’s in the developing world, concluding that such project delivery mechanisms have largely disappointed; especially true for the handful of metropolitan PPPs in Asia, due deficiencies in institutional structure and lack of experience in implementation. The ADB recommends a sequencing of institutional co-evolution in the public and private sectors towards the “commercialization” of road infrastructure – beginning with simple maintenance and operation contracts and leading, ideally, to corridor management contract structures. Figure 3 illustrates the ADB’s proposed framework for the institutional development of highway PPP programs.
Thus, the empirical literature offers some insights into potential relationships with space and physical configuration. These factors include network externalities, involving interactions with other system components in a given space, and other market failures that may lend towards the suggestion (e.g., Engel et al., 2002) that competition “for” a market may be preferable to competition “in” a market. Furthermore, and consistent with the suggestions of some theorists (e.g., Small and Verhoef, 2007), the ADB provides a framework for designing transportation infrastructures that, in full maturity, essentially endogenizes many of the spatial externalities by bundling segments of a highway system into a single corridor management program.

These insights suggest that the legal, economic, spatial, and physical structures of metropolitan highway links more closely resemble a utility (or public transit) distribution network than inter-urban roads, whose development models have traditionally (for better or worse) more closely resembled real estate finance models. Thus, metropolitan highway PPP can take account of network principles, whether by bundling multiple segments with high degrees of complementarity or substitutability, efficiently allocating commercial (or at least network) risks, and/or some combination thereof.

Socio-political factors also appear important. The theoretical literature suggests the need for greater regulation when social costs are high, and the ADB model recommends a ramping-up of government capacity to address these regulatory concerns. Other authors (e.g., Abdel Aziz, 2007) suggest that the primary indicator of success in addressing value for money is the degree to which decisions are made for providing better service rather than for reducing government financing obligations.
4 Methodology

This research employs a multiple international case study approach to study the effects of institutional structures, including formal structures of government, the governance of project delivery regimes, and other spatial and political factors on observable outcomes with respect to the SMM framework. The case study methodology is most helpful in exploring questions of how a process works when the researcher has no control over the “experiment,” and when the number of potential variables is much greater than data points. A case study generally involves the development of a theory, the generalization of a theory, or the testing of a hypothesis. The theory or hypothesis is tested against actual cases, with the goal of formulating “analytic generalizations” (Yin, 2004). This approach is appropriate for the research question in this thesis given that the researcher has no “control” over the “experiment”, the relatively limited universe of highway PPPs that can reasonably be considered “metropolitan” in nature, and the wide variety of potential institutional elements and complex processes that contribute to outcomes.

Theory suggests that institutional structures for metropolitan transportation provision should adhere to fiscal federalism in order to achieve the objectives of SMM. This assertion is supported by the fact that fiscal federalism is a model for addressing the spatial element of institutional design towards optimizing the same social welfare outcomes targeted by the SMM model. For example, SMM objectives include pricing as a signal for both optimal use and investment, which is theoretically achieved by internalizing economic costs of mobility. Fiscal federalism aims to internalize the costs of providing a combination of public goods within the physical boundaries in which the primary beneficiaries reside. Achievement of SMM requires public acceptability, and some proponents of fiscal federalism suggest benefits in terms of citizen participation and democracy. Fiscal federalism also offers a framework for addressing system integration. If one assumes that the benefit boundary of most metropolitan transportation infrastructure is at the metropolitan level, as suggested in the literature, than a geographically-consistent authority for inter-modal (and perhaps inter-sectoral) administration and finance could internalize the costs and benefits of the wide variety of individual segments into a unified system.

These theories can be examined by focusing on a particular type of project delivery mechanism, the PPP. First, highway PPPs have co-evolved along with, and in some cases in response to, the policy objectives of SMM. Second, PPPs provide a window on how institutional structures influence the role of finance in moving towards SMM, due in part to the existence of a contract for a defined segment of an otherwise larger network. This allows the researcher to isolate and analyze a specific, observable component within a complex system. The contract exposes the institutional “inputs” of a highway infrastructure program also typically requires a combination of official public and private reporting mechanisms. Regulatory reports and company financial reports, for example, reveal outcomes relevant to SMM. By looking at highway PPP concessions, I hope to identify key institutional elements in designing metropolitan transportation systems consistent with the SMM framework. Some of these conclusions may be generalizable to transportation institutions at a metropolitan scale.

While theory suggests that fiscal federalism is a necessary condition for achieving SMM, it is not likely to be sufficient. First, as detailed in Chapter 3, different spatial patterns of consumption of public goods challenge achievement of the SMM model (Oates, 1999). Second, inefficiencies in production further complicate fiscal federalism. As Chapter 3 also suggests, increasing
productive efficiencies requires transfer of risks and responsibilities to the private sector when the private party is best able to efficiently control that particular element of an investment and management program. However, the literature also demonstrates the practical difficulty of efficiently assigning risks and responsibilities, suggesting that classical welfare theory may not hold for metropolitan transportation provision due to monopoly properties of metropolitan transportation infrastructure, network and other externalities exhibited both within the transportation system and via interactions with other urban systems (e.g., land use), and issues of quality and social equity. Thus, a third key issue is designing the components of a PPP concession so as to incentivize the optimal delivery of a particular set of objectives, encompassing broader social, economic, and legal (i.e., regulating monopoly pricing) concerns. The empirical literature points toward adoption of corridor, area, or perhaps metropolitan-wide infrastructure concessions under performance-based “regulated monopoly” project delivery and management mechanisms.

These theories lead to the following testable hypotheses:

- Optimal delivery and management of metropolitan transportation infrastructure requires an authority for metropolitan transportation provision whose formal institutional design is consistent with fiscal federalist principles.
- Optimal delivery and management of metropolitan transportation infrastructure PPPs requires the distribution of risks and responsibilities to the entities best able to efficiently control and implement such project elements.
- The optimal highway PPP project configuration should incorporate links and project components in a manner that facilitates contracting of broader area, corridor, and/or metropolitan mobility objectives.

This research is concerned primarily with formal and governance institutions. Stough and Rietveld (2005) summarize four institutional types. Formal institutions are more rigid, but slightly faster changing than informal institutions, which include “codified statutes, constitutional provisions, laws, regulations, and high level administrative orders.” Governance institutions are the slightly more flexible rules and guidelines by which governments conduct business externally and internally, and institutions of resource allocation and employment include multiple actors across sectors making fast and oft-changing decisions on time-sensitive issues of production and output (Stough and Rietveld, 2005). Thus the first hypothesis generally refers to the optimal structuring of formal institutions, while the latter two concern primarily issues of governance.

This thesis focuses on a particular type of metropolitan transportation infrastructure PPP: the highway. This may seem ironic, as many proponents of sustainability criticize highways vis-à-vis other modes of mobility. This study does not pre-suppose the inherent superiority of any modal alternative. Rather, it proposes that if highways tend to represent unsustainable approaches, it is because they are not planned, finance, priced, and managed in an efficient and equitable manner. Based on the literature review in Chapter 3, PPPs, under the right framework, could offer sustainable approaches to managing mobility in some contexts. Given the levels of current investment in roadways and the dominance of the automobile in most industrial and post-industrial societies, it is would be naïve to suggest that highways and automobile will disappear.
anytime in the foreseeable future. Nor would such a scenario necessarily represent optimality. Therefore, the focus of this study is how to sustainably integrate highway investments that use PPP project delivery structures into the larger metropolitan transportation infrastructure system.

To test the hypotheses and the overall validity of the theories upon which they are derived, this study explores seven metropolitan areas that have recently (within approximately the past 25 years) employed PPPs to deliver highway infrastructure. The designation of a highway as metropolitan is somewhat subjective. For the purposes of this study, a highway is metropolitan if it mostly traverses areas in and/or around a large city, appears to largely service commuter traffic during peak hours of travel, and competes with other modes of urban transportation. In each case, the observable outcome of interest is the PPP and, specifically, the attributes of the PPP vis-à-vis the SMM framework. The use of multiple cases makes it possible to detail different institutional variables that could possibly influence SMM outcomes, with the goal of identifying key patterns supporting or inhibiting realization of the “ideal.”

Each of the seven cases exists in a different formal institutional context, though the cases and groups of cases do share similarities. Ideally, case study research would be structured to hold constant those potentially influencing variables not directly of interest to the research, while allowing for some variation in the variables of direct interest (in this case, the degree of fiscal federalism, the governance approach to, and spatial elements of PPP delivery). Naturally, in examining the complex metropolitan settings of today, one cannot hold “everything else” constant – many other variables of relevance may be unobservable (or unobserved). Even among the observed variables, isolating the effect of any particular variable and its relative influence can be difficult. The approach to case selection partly alleviates this challenge as relevant institutional variables can often be held constant across two or more, but not necessarily all, cases. This enables the detection of possible patterns when comparing outcomes among different combinations of case groupings.

In terms of global similarities, several key institutional variables can be approximately held constant across all cases. For example, each PPP was tendered under a democratic form of government and procured via a competitive tender, although the form and level of competitiveness might vary. The political-economic contexts for each case can be classified as market-oriented economies. Each case is in among the one or two largest metropolitan areas within its respective country, and therefore also generally a major center of international commerce. Although the cases represent widely varying project costs, the total figures involved are at least US$100 million, with five cases registering at least US$1 billion in total project costs. Therefore, each project can rightfully be considered a “major” intervention. Additionally, while population densities vary in each locale, it is probably fair to say that each metropolitan area faces contemporary challenges of urban sprawl, downtown congestion, and lack of adequate funding for urban transportation infrastructure and services.

With respect to exploring issues of policy devolution and fiscal federalism, the cases can be grouped by geographical, political, and legal attributes. Geographically, three cases are from Europe, two from North America, and one each from South America and Australasia. Politically, the cases come from systems that can be classified as federal democracies (four) and unitary democracies (three). In terms of legal heritage, four derive from British common law philosophies (four) and three from Iberian/Napoleonic case law philosophies.
Other institutional and contextual attributes directly relevant to the projects include spatial and physical contexts, contract types, and procurement objectives. For example, three cases encompass, at least initially, a single axis to and through the metropolitan area, while four include networks (or at least multiple axes) of highway segments. Contractually, we have four BOT/BOOT, two BOTs mixed with other delivery mechanisms, and one DBFO (see Table 2 for a description of different PPP contract types). Qualitatively speaking, five projects seemed motivated primarily by financial and political considerations, whereas two projects appear to be motivated more by service improvement considerations. Therefore, the selected cases represent a broad spectrum of governance approaches in applying PPPs for metropolitan highway provision from the most market- and competition-oriented to the most service-based and collaborative. At the same time, enough commonalities exist among groups of cases that it will be possible to explore different patterns of formal institutional, governance, spatial, and political structures with respect to outcomes. Table 3 provides an overview of the seven cases.

The selected cases still represent just a modest glimpse at the broader universe of potential cases. First, while there are relatively few metropolitan highway PPP cases, there are many inter-urban highway PPPs throughout the world (see ADB, 2000; World Bank, 2010). In addition to analyzing transportation PPPs, generally, Gómez-Ibáñez and Meyer (1993) detail several of the few metropolitan highway PPPs that existed as of the early 1990s, primarily in East Asia, including: Bangkok, Thailand; Kuala Lumpur, Malaysia; and Jakarta, Indonesia. These rare (at the time) metropolitan highway PPPs took place under more authoritarian governments and in less-developed market structures (at least at the time). Furthermore, Gómez-Ibáñez and Meyer (1993) suggest that in each case, privatization was enabled by substantial government assumption of risk, with contract awardees typically well-connected to the issuing governments. The research on both inter-urban highway PPPs and PPPs in emerging democracies/market economies is well-established. In many ways, the PPPs considered in this thesis benefitted from drawing on these previous experiences. Nevertheless, the scope of this research is the more recent, and relatively uncommon, application of highway PPPs in metropolitan areas within democracies and under relatively more mature market environments.
<table>
<thead>
<tr>
<th>Type of PPP Contract</th>
<th>Brief Description</th>
<th>Application in Transport Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>B(O)OT - Build-(Own)-Operate-Transfer</td>
<td>In a B(O)OT-contract, the private party invests in an asset, builds it, and operates it for a certain period of time while retaining ownership. At the end of the contract period, the asset is transferred to the public party (&quot;transfer&quot;); the government then pays a sum for the residual value of the assets. Revenues to earn back the initial investment are generated through exploitation, and trough the transfer payment at the end of the contract period.</td>
<td>Infrastructure projects in all modes of transport (road, rail, ports, airports)</td>
</tr>
<tr>
<td>BTO - Build-Transfer-Operate</td>
<td>In a BTO-contract, the private party invests in an asset and builds it. Ownership of the asset is transferred to the government after construction is finished. The asset is however operated by the private party, who can earn back its investment this way. Revenues are generated through exploitation.</td>
<td>Infrastructure projects in all modes of transport (road, rail, ports, airports)</td>
</tr>
<tr>
<td>BOO - Build-Own-Operate</td>
<td>In a BOO-contract, the private party invests in an asset and builds it. It is then owned and operated by the private party, who can earn back its investment this way. Revenues are generated through exploitation.</td>
<td>Infrastructure projects in all modes of transport (road, rail, ports, airports)</td>
</tr>
<tr>
<td>DBFMO – Design-Build-Finance-Maintain-Operate</td>
<td>In a DBFMO-contract, the private party invests in an asset, which it designs and builds, and then maintains and operates. Revenues are generated through exploitation.</td>
<td>Infrastructure projects in road and rail</td>
</tr>
<tr>
<td>DBFM – Design-Build-Finance-Maintain</td>
<td>In a DBFM-contract, the private party invests in an asset, which it designs and builds, and then maintains. Revenues are generated through performance based funding from the government (e.g. shadow tolls, availability payments)</td>
<td>Infrastructure projects in road and rail</td>
</tr>
<tr>
<td>Concession</td>
<td>A more general term for contracts that award a private party for a certain period of time an exclusive right to carry out an investment and then maintain and operate it, under public responsibility. All types of PPP that generate revenues directly from exploitation can be considered concessions.</td>
<td>Infrastructure projects in all modes of transport (road, rail, ports, airports) Public transport services.</td>
</tr>
</tbody>
</table>

Source: Macário et al. (2009)
### Table 3: Overview of Case Studies

<table>
<thead>
<tr>
<th>Highway PPP</th>
<th>Los Angeles, USA</th>
<th>Toronto, Canada</th>
<th>Melbourne, Australia</th>
<th>Madrid, Spain</th>
<th>Santiago, Chile</th>
<th>Porto, Portugal</th>
<th>London, UK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continent</td>
<td>North America</td>
<td>North America</td>
<td>Australasia</td>
<td>Europe</td>
<td>South America</td>
<td>Europe</td>
<td>Europe</td>
</tr>
<tr>
<td>Country GDP per Capita (2008 US$)</td>
<td>45,230</td>
<td>45,166</td>
<td>48,253</td>
<td>36,061</td>
<td>10,091</td>
<td>22,805</td>
<td>43,544</td>
</tr>
<tr>
<td>Federalism</td>
<td>Federal</td>
<td>Federal</td>
<td>Federal</td>
<td>Federal</td>
<td>Unitary</td>
<td>Unitary</td>
<td>Unitary</td>
</tr>
<tr>
<td>Legal Traditions</td>
<td>Common Law</td>
<td>Common Law</td>
<td>Common Law</td>
<td>Case Law</td>
<td>Case Law</td>
<td>Case Law</td>
<td>Common Law</td>
</tr>
<tr>
<td>Metro Area Pop. (2006)</td>
<td>12.2 million</td>
<td>5.2 million</td>
<td>3.7 million</td>
<td>5.2 million</td>
<td>5.7 million</td>
<td>1.3 million</td>
<td>7.6 million</td>
</tr>
<tr>
<td>Contract Type</td>
<td>BOT</td>
<td>BOT</td>
<td>BOT/BOOT</td>
<td>BOT + DBB</td>
<td>BOT</td>
<td>BOT/M&amp;O</td>
<td>DBFO</td>
</tr>
<tr>
<td>Road Typology</td>
<td>Radial Suburban HOT Lanes</td>
<td>Radial Suburban and Downtown Bypass</td>
<td>Inner-Urban Connector and Downtown Bypass</td>
<td>Three Radial Suburban and Circumferential Urban Ring</td>
<td>Radial Suburban with Downtown Tunnel</td>
<td>Three Radial Suburban and Circumferential Urban Ring</td>
<td>Circumferential Urban Ring with Complimentary Roadways</td>
</tr>
<tr>
<td>Size</td>
<td>~16 km</td>
<td>68 km (Initial) 40 km (New)</td>
<td>22 km</td>
<td>175.5 km (Radial) 85.4 km (Ring)</td>
<td>42.4 km</td>
<td>76.2 km (Radial) 53 km (Ring)</td>
<td>~100 km (Upgrades) ~400 km (O&amp;M)</td>
</tr>
<tr>
<td>Primary Motivation</td>
<td>Financial</td>
<td>Financial/Political</td>
<td>Value for Money</td>
<td>Financial</td>
<td>Financial</td>
<td>Financial</td>
<td>Value for Money</td>
</tr>
<tr>
<td>Development Cost (US$)</td>
<td>135 million</td>
<td>~1.2 billion (initial)</td>
<td>~1.5 billion</td>
<td>~1.9 billion</td>
<td>$384 million</td>
<td>~1.5 billion</td>
<td>~8.8 billion (est.)</td>
</tr>
</tbody>
</table>

---
1 Unless otherwise indicated, sources of data are found in individual case studies in Chapter 5
2 Source: UN (2011)
3 Source: Inman (2007)
4 Source: City Mayors (2011)
5 Source: City Mayors (2011)
6 All development costs converted into US$ based on exchange rates on January 1 of the year the contract was signed using the currency converter tool at http://www.oanda.com/.
4.1 Case Study Institutional Variables

The institutional and contextual variables represent observable indicators relevant to the hypotheses. These indicators fit roughly into six categories (see Table 4), corresponding to formal institutional structures, project governance, and spatial and political context:

1. “Structure of Transportation Institutions” – which describes the extent to which administrative and fiscal responsibilities have been devolved to sub-national levels of government, and the extent to which transportation and land use policies have been integrated at the metropolitan level;
2. “Structure of Highway PPP Institutions,” – which relates to the formal structure of the project delivery mechanism itself with respect to the process of evaluating and tendering the PPP contracts;
3. “Contract Risk Allocation” – covering elements related to the efficient distribution of rights and obligations;
4. “Project Revenues and Finance” – including elements identified in the literature as critical to the stable and efficient structuring of project revenue generation and finance, such as management structure and contract design (e.g., length and rates of return);
5. “Spatial Context” – since the complexities of transportation networks within which metropolitan highway PPPs are embedded may make these projects’ outcomes particularly sensitive to spatial and physical attributes;
6. “Political Context” – in this particular scope, aiming to capture more informal institutional structures related to nearer-term political realities (rather than long-term cultural attributes).

Generalizing from the first two categories, one can observe that these roughly represent the hypothesis relating to the role of the fiscal federalism in producing better outcomes and the role of a well-regulated project delivery structure. The second two categories indicate expectations regarding the influence of risk allocation and project finance dimensions on SMM. Variables in the final two categories are intended to address the hypothesis related to spatial configuration and also control for political factors identified in the empirical literature on PPPs that could influence SMM outcomes.

Many other unobserved attributes may also be relevant to the outcomes of interest. Nonetheless, while not necessarily exhaustive, the above categories appear to cover the breadth of relevant factors vis-à-vis the scope of this research. If, through analysis of these factors, clear patterns emerge, it should be possible to develop analytical generalizations in support of the overarching theories regarding fiscal federalism, risk allocation, and spatial/physical configurations and the role of highway PPPs in SMM.
<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>Expected Positive Effect on SMM</th>
</tr>
</thead>
<tbody>
<tr>
<td>National institutional structure - federalism</td>
<td>Federal democracy</td>
<td></td>
</tr>
<tr>
<td>Originator jurisdiction</td>
<td>Approximately equal to metropolitan scale</td>
<td></td>
</tr>
<tr>
<td>Originator administrative scope - transportation</td>
<td>All metropolitan transportation infrastructure</td>
<td></td>
</tr>
<tr>
<td>Originator administrative scope - land use</td>
<td>Primary control of land use</td>
<td></td>
</tr>
<tr>
<td>Originator fiscal scope</td>
<td>Originator controls fiscal instruments to finance project</td>
<td></td>
</tr>
<tr>
<td>Originator jurisdiction</td>
<td>Country has broad experience</td>
<td></td>
</tr>
<tr>
<td>Originator experience - highway PPPs</td>
<td>Grantor has experience with highway PPPs</td>
<td></td>
</tr>
<tr>
<td>Legal framework for PPPs - originator</td>
<td>Jurisdiction has general (not ad hoc) PPP legislation</td>
<td></td>
</tr>
<tr>
<td>Use of public-sector comparator (PSC)</td>
<td>Uses PSC for PPP decision-making</td>
<td></td>
</tr>
<tr>
<td>Project evaluation</td>
<td>Follows traditional approach for highway evaluation</td>
<td></td>
</tr>
<tr>
<td>Competition and procurement</td>
<td>Competitive international procurement</td>
<td></td>
</tr>
<tr>
<td>Policy risk (intentional)</td>
<td>Government policy risk (intentional)</td>
<td></td>
</tr>
<tr>
<td>Land acquisition risk</td>
<td>Government land acquisition risk</td>
<td></td>
</tr>
<tr>
<td>Network risk</td>
<td>Shared network risk</td>
<td></td>
</tr>
<tr>
<td>Demand/revenue risk (excluding network risk)</td>
<td>Shared or private with government network risk</td>
<td></td>
</tr>
<tr>
<td>Private sector has flexibility to raise and lower tolls</td>
<td>Private sector has flexibility to raise and lower tolls</td>
<td></td>
</tr>
<tr>
<td>Government has regulatory authority over toll rates</td>
<td>Government has regulatory authority over toll rates</td>
<td></td>
</tr>
<tr>
<td>Revenue sharing if projects exceed IRR</td>
<td>Revenue sharing if projects exceed IRR</td>
<td></td>
</tr>
<tr>
<td>Yes, if project scope is not self-financing</td>
<td>Yes, if project scope is not self-financing</td>
<td></td>
</tr>
<tr>
<td>Scope and process outlined in contract</td>
<td>Scope and process outlined in contract</td>
<td></td>
</tr>
<tr>
<td>Includes existing roadways (brownfield)</td>
<td>Includes existing roadways (brownfield)</td>
<td></td>
</tr>
<tr>
<td>Aligned through metropolitan center</td>
<td>Aligned through metropolitan center</td>
<td></td>
</tr>
<tr>
<td>Service-oriented (value-for-money)</td>
<td>Service-oriented (value-for-money)</td>
<td></td>
</tr>
<tr>
<td>Project follows established/evolving PPP framework</td>
<td>Project follows established/evolving PPP framework</td>
<td></td>
</tr>
</tbody>
</table>

Note: "Originator" refers to the entity with ultimate legal authority (e.g., Government of Chile) and “Grantor” refers to the body delegated such responsibilities (e.g., Ministry of Public Works).
4.2 Measuring Outcomes

Chapter 2 summarizes the literature on factors believed to be critical to achievement of SMM from a public finance perspective. Table 5 summarizes these factors under four over-arching objectives, links these objectives to underlying theory, and identifies variables, possibly observable, within a highway PPP that potentially enable performance assessment.

Table 5 is organized as follows. The “Objective” column highlights the critical, finance-related SMM goals defined in Chapter 2. The “Supporting Theory” column encapsulates theories underlying the SMM objectives as they relate to metropolitan transportation infrastructure provision and PPP deployment as elaborated in Chapters 2 and 3, respectively. The last column identifies “Performance Indicators” for measuring each SMM Objective. As one moves down the “Objective” column, the rows encompass the theoretical underpinnings of each preceding Objective. For example, “Efficiency of the investment for the transportation system” embodies its own objective as well as those related to “Pricing optimizes flow on the asset” and “Project-oriented productive efficiency.” Finally, the “Performance Indicators” column distills the information conveyed in the first three columns into metrics for qualitative analysis. These indicators are not organized in any particular order, though they often become broader and more difficult to evaluate as one moves down each respective column. For example, contracts should facilitate an evaluation of whether or not a PPP represents an “Asset planned as part of a broader highway/road network,” insofar as whether the project segment is designed to integrate (e.g., pricing, technology, demand management, etc.) with the larger metropolitan transportation system. However, determining whether or not a PPP demonstrates, for example, “Evidence that project represented best-known transport alternative” is more complicated because it is difficult to precisely specify the full realm of legitimate alternatives, those alternatives known by the decision-makers at the time, and how other alternatives would have fared in practice. For indicators such as the latter, this research endeavors to locate ex post evaluations and reach out to project stakeholders to lend clarity to this question.

The “Pricing & Regulation” goal reflects the fundamental role these elements play in resource allocation consistent with the SMM framework. The dotted line between the objectives “Pricing optimizes traffic flow on the asset” and “Project-oriented productive efficiency” accounts for the theory that pricing will induce consumers towards efficient asset “use”, which in theory corresponds to the generation of revenues equal to the financial cost of the corresponding ideal capacity “investment” (i.e., the insight of Mohring and Harwitz (1962)). Performance measures for pricing for optimal use include a criterion of introducing direct user-fee-based road pricing of any kind, which internalizes at least some of the debt service and maintenance costs to users. Time-variant pricing, be it peak hour price increases, peak hour congestion mark-ups, etc., helps account for addressing the costs associated with congestion. Variable pricing based on full marginal costs would represent the optimal achievement for this category. Although MSCP would be theoretically optimal, this study would accept any other second-best pricing option, as discussed in Chapter 2, that dynamically responds to changes in demand throughout the highway corridor. Metrics in this category are relatively straightforward to measure.
<table>
<thead>
<tr>
<th>SMM Goal</th>
<th>Objective</th>
<th>Supporting Theory</th>
<th>Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pricing &amp; Regulation</td>
<td>Pricing optimizes traffic flow on the asset</td>
<td>• Public Finance Theory (Allocative Efficiency/Productive Efficiency)</td>
<td>• Introduces road pricing</td>
</tr>
<tr>
<td></td>
<td>Project-oriented productive efficiency</td>
<td>• Network Economics (MSCP, Second-best Pricing, etc.)</td>
<td>• Time-variant pricing</td>
</tr>
<tr>
<td>Integration</td>
<td>Efficiency of investment for the transportation system</td>
<td>• Same as Above Plus</td>
<td>• Variable pricing based on marginal costs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Institutional and Organizational Theory (Transaction Costs, etc.)</td>
<td></td>
</tr>
<tr>
<td>Public Acceptability</td>
<td>Investment supports societal goals</td>
<td>• Same as Above Plus</td>
<td>• Bundles construction and operations &amp; management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Normative Economics</td>
<td>• Implements LCC management for entire project scope</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Political Economy-Derived Theories</td>
<td>• &quot;Revealed&quot; demand sufficient to justify capacity availability</td>
</tr>
<tr>
<td>Technology</td>
<td>Employs state-of-the-art technology for pricing and management</td>
<td></td>
<td>• User fee revenues meet expectation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Method for re-investing/re-distributing excess revenues</td>
</tr>
</tbody>
</table>

Cross-cutting criterion: Required to implement theoretical approach and efficiently achieve optimal model output

---

6 Objectives derived in part from Banister (2008)
Regarding “Project-oriented productive efficiency,” this objective attempts to separate commercial management from the larger question of whether the investment demonstrates the most efficient inter-modal transportation solution (as implied by the “Efficiency of investment for the transportation system” objective). The objective focuses on the productive efficiency element of Public Finance Theory, or the efficient management of project resources towards the desired social ends. The first two performance measures under this sub-objective reflect temporal considerations, relating to potentially productive long-term pricing and investment enabled by “bundling” (or integrating) construction with maintenance, management, and operation. The next two indicators aim to measure, respectively, the justification for capacity decisions relative to demand and whether or not user fee revenues met expectations. The latter indicator is distinguished from the former because it is possible for a project to generate expected demand without attaining revenue targets if pricing policies had to be adjusted downward and/or if the project grantor had to unexpectedly provide financial support. This might actually present a better solution for the overall system, but still implies that the initial planning and/or present management failed to efficiently employ resources towards the achievement of the desired level of capacity and service. The last indicator represents evidence of efficient re-distribution or re-investment of revenues in excess of expectation. This implies that if demand and revenues greatly exceed expectation, then excess revenues generated can be put to most productive use towards SMM rather than, for example, being retained entirely as profit. Like the first objective, the elements to be measured are generally straightforward, although as one moves down the column, metrics begin to require greater levels of judgment (e.g., “revenue expectations” for the short-term versus long-term).

The “Efficiency of investment for the transportation system” objective represents the desire for system integration across transportation modes, implying many of the same principles as when discussing previous objectives. Integration here, however, encompasses a broader scope of managing and facilitating the interactions between elements of the metropolitan transportation system. This objective deals primarily with allocative efficiency, or whether or not the social benefits of a given investment exceed the social costs, particularly in light of alternative transportation investments. It also pulls from institutional and organization theories to justify the cross-systems framework of analysis. The first two performance metrics require that the grantor plan the PPP project consistent with mobility policies within the larger road network and the larger inter-modal system, respectively. The next indicator evaluates evidence of mutually-beneficial contract renegotiations or other contract changes that satisfy public policy goals while providing fair compensation for the private highway provider. The next metric evaluates, to the extent possible, ex post evidence that the project has met corridor mobility objectives for the metropolitan transport system. For example, grantors and private providers might renegotiate contracts to ensure mutual benefit due to changes in the institutional environment. However, such flexibility does not imply anything about the quality of those decisions. Successful achievement of this objective implies renegotiations that are clearly consistent with corridor transportation investment objectives. The last indicator necessitates evidence that the project represented the best-known transportation alternative at the time of contract award. Overall, measurement
becomes much more qualitative and subject to judgment (e.g., defining “mutual benefit, etc.) as one moves down the column.

The “Investment supports societal goals” objective aims to represent public values, which are related to whether the investment criteria lead to greater and more equitable distribution of benefits throughout a metropolitan area while mitigating social costs. Although possibly overlapping with the “Efficiency of investment for the transportation system” objective (which ostensibly represents the transportation system-wide efficiency of a given investment), this objective aims to capture a higher-level view of transportation investment. Given the overall societal goals and corresponding mobility needs in a given corridor and/or metropolitan area, did the investment and project delivery mechanism result in an appropriate intervention? This objective considers not only mobility, or the ability to move through the transportation network, but also related sectors such as land use and development, environmental quality, and broader social concerns such as social equity. The first performance indicator reflects the assumption that the project should at least be consistent with a comprehensive metropolitan plan and/or was justified by a reasonably-credible social benefit-cost analysis. Fulfillment of the next indicator requires demonstrated public acceptance of road pricing as directly resulting from the initiative. The third indicator measures the presence of a long-term, sustainable relationship between public and private partners. PPPs and metropolitan highway projects, generally, can be controversial, so that an enduring contract relationship in the face of both public and private pressures is a sign of a robust structure for project delivery. The last indicator attempts to evaluate broad perceptions of fairness and equity of the project and PPPs among all stakeholders, including governments, private providers, highway users, and residents. Issues of social goals, public acceptability, and fairness are by far the most difficult to measure without surveys, detailed interviews with a range of stakeholders, and/or in-depth content analysis of press materials, etc. Absent those possibilities, judgment must be made on the basis of limited, incomplete, and inconsistent data across cases.

Finally, the “Employs state-of-the-art technology for pricing and management” objective reflects technology’s critical role in enabling all other SMM goals and objectives, rather than being an end in and of itself. This research limits the scope of technology to that which is directly related to pricing and dynamic management under the assumption that, towards these ends, technology can improve efficiency. For example, faster and higher-capacity computing can allow for more refined dynamic network pricing. Electronic identifiers can obviate the need for toll booths, which increases travel time. Technology allows for improved data gathering, which can inform integrated metropolitan mobility strategies. Essentially, advances in technology tend to improve efficiency in production; this may reflect a bias of the economics theories underpinning this analysis. A broader debate on the value of technology to society and sustainability more generally is largely outside the scope of this research.

In summary, the case studies will be analyzed according to four objectives, which derive from theories related to the goals of the SMM framework. As one moves down the column of the table, objectives progressively encompass all of those that come before. Measurement simultaneously becomes more qualitative, more open to judgment, and
includes ever-broader objectives for SMM. Fulfillment of each objective in each case is evaluated on the basis of several key performance measures, which provide proxy evidence.
5 Case Studies
In this chapter, I present seven case studies of highway PPP in seven different metropolitan areas throughout the Americas, Europe, and Australasia. The case studies are arranged in approximate order of completion of major construction and commencement of full operations. The cases include the following:

- SR 91 Express Lanes, Los Angeles, USA
- ETR, Toronto, Canada
- CityLink, Melbourne, Australia
- Metropolitan Madrid Concessions (MMCs), Madrid, Spain
- Costanera Norte, Santiago, Chile
- Douro Litoral, Porto, Portugal
- M25 Orbital, London, UK

For each case, I summarize the key institutional variables, governance institutional variables, and spatial and political contexts for each PPP (see Table 4). As elaborated in Chapter 4, these factors are believed to be relevant to the outcomes observed from the SMM framework. This will be followed by analyses of the extent to which each case meets the performance objectives outlined in Table 5 in the CAM. These indicators measure the fulfillment, partial fulfillment, or lack of fulfillment of key elements related to different objectives of the SMM framework. A cross-case analysis and discussion will follow in Chapter 6.
5.1 SR 91 Express Lanes, Los Angeles, USA

The State Road 91 (SR 91) Express Lanes PPP demonstrates how private-sector finance and management coupled with road pricing can rapidly deliver high-quality infrastructure, but also highlights the challenges of coordinating public and private objectives over the long term in a complex spatial environment. In Metropolitan Los Angeles, highway programs are supported by a complicated institutional structure where metropolitan regional bodies are responsible for integrated metropolitan-wide transportation planning and investment programming, while policy, revenue, and funding decisions are generally made by federal and state authorities. Due to funding constraints in the late 1980s, the State of California established a new institutional framework for supplementing traditional highway procurement with a pilot PPP program. Tendered under this legal authority, the SR 91 PPP provided immediate benefits to both the private and public partners. In the long-run, however, high profits (and the perception of high tolls) coupled with inflexibility to adapt to changing public policy priorities led to its purchase by a local government entity, the Orange County Transportation Authority (OCTA).

5.1.1 Analysis of Institutional Context for the SR 91 Express Lanes PPP

Transportation policy in Metropolitan Los Angeles exists within a federal democracy (Inman, 2007), 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 refers to the six counties within the jurisdiction of the Southern California Association of Governments (SCAG): Imperial, Los Angeles, Orange, Riverside, San Bernardino and Ventura (SCAG, 2008). As a federally-recognized Metropolitan Planning Organization (MPO) for regional transportation coordination, the 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 the SCAG (Caltrans, 2008).

In Metropolitan Los Angeles, highways are primarily financed by United States (US) Federal and California State motor fuel excise taxes and dedicated portions of state sales taxes, respectively. The US Federal Government primarily supports highway development by levying national fuel excise taxes and dedicating these revenues to transportation investments. The majority of the proceeds of national fuel and vehicle excise taxes are distributed to states to help finance highway programs, while about 15% of these funds are apportioned to transit operators (FHWA and FTA, 2007). California motor fuel excise taxes fund many state-level transportation programs, including required state co-financing commitments required for receipt of federal funding and apportionments to municipalities to supplement local transit funds. California also dedicates sales taxes levied on motor fuels to a variety of transportation programs, while periodic state bond initiatives fund other major transportation improvements on a more ad hoc basis. California counties collect fare box revenues from various transportation services and have the option of levying an additional 1% city/county use and sales tax to be dedicated to local transportation programs (Caltrans, 2007). This option has been adopted throughout the Los Angeles Metropolitan Area, with rates ranging from 0.25% in parts of San Bernardino County to 1% in some cities within Los Angeles and Riverside counties. Most areas of Metropolitan Los Angeles, including all of Orange County, levy a 0.5% sales and use tax (CBOE, 2009).
The SCAG holds little power over the policy apparatus that raises revenues and structures expenditure guidelines, however, 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. The Intermodal Surface Transportation Efficiency Act (ISTEA), enacted by the US Federal Government in 1991, facilitated a shift in emphasis to metropolitan regional planning for federally-funded transportation improvements. Designated MPOs such as the SCAG must develop and approve – in coordination with state governments, local governments, and operators – 20-year Regional Transportation Plans (RTP) that serve as a primary long-range transportation planning document for metropolitan regions and a tool for developing federal investment programs. MPOs must also develop and, jointly with state governors, approve a minimum four-year Transportation Improvement Plans (TIP), which is used for near-term programming of federal funding. Departments of transportation in each state must then approve a State Transportation Improvement Plan (STIP), which must incorporate (and be consistent with) TIPs prepared in each metropolitan area, plus planned investments in non-metropolitan areas of the respective state. The STIP and all TIPs must be “fiscally constrained,” whereby sources of funding must be identified for inclusion in the plan (FHWA and FTA, 2007). The California Transportation Commission (CTC) is the state agency responsible for approving the California STIP, which it does biennially for investments covering a scope of five-years (CTC, 2011).

In addition to traditional procurement (i.e., design-bid-build), the State of California has on rare occasion procured highway infrastructure through PPP structures. In 1989, the State Assembly passed AB 680, a bill authorizing the State of California to enter into four BOT arrangements with private firms as demonstration projects for the potential use of private finance and management to deliver roadway infrastructure (Caltrans, 2011). Miller (2002a) summarizes the procurement of highway PPP demonstration projects enabled by AB 680. The California Department of Transportation (Caltrans) initially issued a request for qualifications (RFQ) to select a pool of firms that would be invited to submit highway PPP proposals. After selecting 10 firms, Caltrans issued a request for proposal (RFP), whereby qualified firms could submit “conceptual proposals” for BOT highway projects, with the State of California abstaining from issuing parameters regarding the location and scope of said projects. The State would then approve four projects, with a requirement that there be at least one project in each of Northern and Southern California. In total, eight submissions were received from the ten pre-qualified firms. Among the four selected was a proposal for the development of tolled express lanes in the median section of an existing highway, SR 91, through Orange County (Miller, 2002a).

In summary, highway programs in Metropolitan Los Angeles depend upon a mix of federal, state, and local authorities, with the SCAG serving a key institutional role for integrating transportation planning and programming within a regional framework. Despite efforts to regionalize transportation and increasingly land use policy, however, funding and financing decisions are generally made outside this context. Revenue sources for metropolitan highways are derived from higher-level authorities with rigid programmatic structures for investments. Moreover, revenues are based primarily on fuel consumption, ignoring the spatial and temporal nature of the relevant costs. Finally, ad hoc state legislative actions, such as bond issues and AB 680, present additional challenges to integrated regional highway and transportation policy in Metropolitan Los Angeles. The following section explores the SR 91 Express Lanes PPP and its implications for SMM.
5.1.2 Analysis of the SR 91 Express Lanes PPP

Opened in 1995, the SR 91 Express Lanes were initially financed, developed, and operated by the California Private Transportation Company (CPTC). Through a 35-year lease with the State of California, CPTC gained franchising rights to construct, operate, make improvements to, and collect tolls on high-occupancy toll lanes (HOT) through a ten-mile stretch of Orange County (OCTA, 2009b). As illustrated in Figure 4, the franchised portion of SR 91 stretches from the northwestern boundary of Riverside County westward (in the direction of Los Angeles County) to downtown Anaheim employment areas in Orange County. Sullivan (2000) describes the SR 91 PPP programmatic structure under the CPTC PPP. The PPP included four tolled lanes, two in each direction, are located in the median of SR 91. Users had the option of driving in general lanes with no toll or, if they have acquired requisite transponders, paying a toll to enter the express lanes at either end of the facility (no intermediate points). Express lanes were priced commensurate with volume at different discrete intervals of the day will the goal of providing a free flow of traffic (Sullivan, 2000). OCTA has largely retained the same operating structure, though it has implemented several programs aimed at wider corridor demand management, such as free High Occupancy Vehicle (HOV)-3 lanes, where automobiles carrying three or more passengers pay no toll (OCTA, 2009b).

Figure 4: Map of the SR 91 Express Lanes

![Figure 4: Map of the SR 91 Express Lanes](Source: FHWA (2011))

Miller (2002a) reviews the procurement and transaction process for implementing the SR 91 Express Lanes proposal. Having been selected during the RFQ process, CPTC submitted a proposal for the widening of congested SR 91 by four lanes total (two in each direction). The project sponsor included a developer to handle project finance and construction management (Peter Kiewit and Sons’, Inc.); a French subsidiary familiar with toll road operations (ConfiRoute Corporation); a contractor with experience in transportation construction (Granite Construction, Inc.); and a provider of electronic transponder equipment (MFS Communications Company). CPTC designed its program consistent with a proposal that had already been approved (but not yet planned) by the CTC to add four high-occupancy vehicle (HOV) lanes to median sections of SR 91 through Orange County. Traffic had doubled on this section of SR 91 between 1980 and
1990 from 91,000 to 180,000 vehicles per day, and CPTC anticipated that volumes would approximately double again by 2010 (Miller, 2008a). Today, approximately 280,000 vehicles travel tolled and un-tolled stretches (OCTA, 2009b). Miller (2002a) explains that the State accepted CPTC’s proposal to implement the SR 91 Express Lanes under a tolled HOT lanes scheme, entering into a Developer Franchise Agreement that specified all relevant rights and responsibilities of both parties. CPTC would have the right to set toll levels, but would have to share revenues with the State should they result in an internal rate of return (IRR) exceeding 17%. CPTC accepted all demand, revenue, environmental approval, and land acquisition risks, while the State agreed to not build any competing roads within an “Absolute Protection Zone” around the SR 91 corridor (Miller, 2002a).

The SR 91 PPP initially appeared to be an unequivocal success. SR 91 Express Lanes became the first fully-automated variable priced highway segment in the USA, with pre-set, time-varying tolls set to produce free flow of traffic on toll lanes. CPTC financed improvements entirely from tolls, reaching a break-even point on operating and debt service costs by August, 1998 — 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 PPP versus a base case scenario of public construction of identical (free) 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. Net benefits were derived from travel time savings, fuel cost savings, and lower emissions; versus higher costs for construction, management and operations, and enforcement (Sullivan and Burris, 2006).

Shortly after implementation, however, CPTC began to burden public policy goals aimed at relieving corridor congestion in this high-growth area. The primary point of contention was the inclusion of a “no compete clause” in the CPTC lease (i.e., the agreement not to develop competing roads in the Absolute Protection Zone). Under this clause, no road improvements that might adversely affect the finances of the PPP could be developed within a 1.5-mile buffer of SR 91. The inability to make road improvements along the corridor severely constrained mobility management options for officials in Orange and Riverside Counties (Engel, 2008). Left with no other alternative for broader mobility management within the corridor, OCTA purchased the rights to the SR 91 Express Lane franchise in 2003 from CPTC for $207 million, or about 50% more than the original $135 million cost of construction (OCTA, 2009b).

Table 6 summarizes the key factors for analyzing the SR 91 PPP, including formal institutional variables associated with transportation policy in the Los Angeles Metropolitan Area; the governance institutional variables specific to the concession; and other elements of the spatial and political contexts. The next subsection of this chapter will then analyze the observable performance metrics defined in the methodology chapter.
Table 6: Institutional Profile: Highway PPPs in Los Angeles, USA (At the Time of Contract Award)

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>Expected Positive Effect on SMM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>National institutional structure - federalism</td>
<td>Federal democracy</td>
</tr>
<tr>
<td>Structure of Transportation Institutions</td>
<td>Originator jurisdiction</td>
<td>Approximately equal to metropolitan scale</td>
</tr>
<tr>
<td></td>
<td>Originator administrative scope - transportation</td>
<td>All metropolitan transportation infrastructure</td>
</tr>
<tr>
<td></td>
<td>Originator administrative scope - land use</td>
<td>Primary control of land use</td>
</tr>
<tr>
<td></td>
<td>Originator fiscal scope</td>
<td>Originator controls fiscal instruments to finance project</td>
</tr>
<tr>
<td></td>
<td>Country experience - highway PPPs</td>
<td>Country has broad experience</td>
</tr>
<tr>
<td>Structure of Highway PPP Institutions</td>
<td>Project grantor experience - highway PPPs</td>
<td>Grantor has experience with highway PPPs</td>
</tr>
<tr>
<td></td>
<td>Legal framework for PPPs - originator</td>
<td>Jurisdiction has general (not ad hoc) PPP legislation</td>
</tr>
<tr>
<td></td>
<td>Use of public-sector comparator (PSC)</td>
<td>Uses PSC for PPP decision-making</td>
</tr>
<tr>
<td></td>
<td>Project evaluation</td>
<td>Follows traditional approach for highway evaluation</td>
</tr>
<tr>
<td></td>
<td>Competition and procurement</td>
<td>Competitive international procurement</td>
</tr>
<tr>
<td>Contract Risk Allocation</td>
<td>Policy risk (intentional)</td>
<td>Government policy risk (intentional)</td>
</tr>
<tr>
<td></td>
<td>Environmental &amp; land acquisition risk</td>
<td>Government environment &amp; land acquisition risk</td>
</tr>
<tr>
<td></td>
<td>Network risk</td>
<td>Shared network risk</td>
</tr>
<tr>
<td></td>
<td>Demand/revenue risk (excluding network risk)</td>
<td>Shared or private with government network risk</td>
</tr>
<tr>
<td>Project Revenues and Finance</td>
<td>Authority for pricing</td>
<td>Private sector has flexibility to raise and lower tolls</td>
</tr>
<tr>
<td></td>
<td>Regulating Tolls</td>
<td>Government has regulatory authority over toll rates</td>
</tr>
<tr>
<td></td>
<td>Mechanism for sharing in upside of roadway improvements</td>
<td>Revenue sharing if projects exceed IRR</td>
</tr>
<tr>
<td></td>
<td>Contractual guarantees/support of revenues or profitability</td>
<td>Yes, if project scope is not self-financing</td>
</tr>
<tr>
<td></td>
<td>Renegotiations</td>
<td>Scope and process outlined in contract</td>
</tr>
<tr>
<td>Spatial Context</td>
<td>Maturity of asset</td>
<td>Includes existing roadways (brownfield)</td>
</tr>
<tr>
<td></td>
<td>Project alignment - central city</td>
<td>Aligned through metropolitan center</td>
</tr>
<tr>
<td>Political Context</td>
<td>Primary motivation of PPP</td>
<td>Service-oriented (value-for-money)</td>
</tr>
<tr>
<td></td>
<td>Degree of political/philosophical motivation</td>
<td>Project follows established/evolving PPP framework</td>
</tr>
</tbody>
</table>

Notes: Y = Fulfilled; "P"=Partial Fulfillment; Otherwise Non-Fulfillment; "Originator" refers to the entity with ultimate legal authority (i.e., the State of California) and "Grantor" refers to the body delegated such responsibilities (i.e., Caltrans)
Overall, the legal and financial arrangements supporting the development of the SR 91 Express Lanes did succeed in some respects in moving highway development and management policies in Metropolitan Los Angeles closer to SMM. However, several institutional weaknesses in government and contract structures prevented a potentially greater realization of these objectives. The introduction of pricing and the bundling of investment with long-term operations, management, and maintenance represent the more beneficial outcomes with respect to theory. Generally speaking, however, the SR 91 PPP did not fare as well with regard to issues of broader system integration and public acceptability. The remained of this sub-section discusses these results (specifically during the period under CPTC management).

Adoption of variable toll pricing to finance the franchise is a step in that direction. The fact that pricing varied with time of day (reflecting peak hour traffic) promotes a high level of efficiency in the use of the toll lanes. This does not, however, necessarily lead to system optimality in the pricing and management and the rest of the transportation system, including movements on free lanes of SR 91. Furthermore, while tolls vary by time of day, prices are set for discrete time intervals over the course of the day rather than dynamically based on actual demand.

With regard to the role of pricing and regulation in promoting an optimal signal for investment, revenues began covering all operating and debt service costs within three years (Boarnet and Dimento, 2004). 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, the “no compete” clause effectively restricted other highway development in the corridor. Faced with a clear public need to improve mobility in the SR 91 corridor, public agencies lacked both the authority to pursue a wide range of investment options as well as access to most of the revenues generated by high corridor demand with which they might be able to finance such interventions. This appeared to be a sub-optimal condition from the standpoint of allocative efficiency.

The role of SR 91 Express Lanes PPP in supporting integrated mobility management is difficult to gauge. CPTC’s proposal included a highway alignment that had already been proposed through normal project evaluation channels, albeit as an HOV rather than a HOT lane strategy. In this sense, CPTC adopted a proposal within the scope of integrated metropolitan needs and, it could be argued, further improved upon this proposal by adopting road pricing and expediting project delivery. It is less clear, however, whether the SR 91 PPP proposal represented the optimal program of investment over the long-term. By shifting all 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 essentially being forced to purchase the franchise at a premium in order to regain policy control (Boarnet and Dimento, 2004). Since having gained control of the Express Lanes, OCTA has initiated HOV-3 lanes and expanded the scope of the corridor strategy to better accommodate other modes of transportation operating in the corridor. For example Express Bus, a local bus service, uses SR 91 Express Lanes 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, which was more difficult under the CPTC franchise.

As far as promoting broader social policies and public acceptance, the SR 91 PPP initially delivered socially-beneficial improvements for which public funds were scarce. According to estimates by Sullivan and Burris (2006), the project resulted in a net social benefit, and it is not likely that the public sector would have developed the project for many years due to constrained budgets. The evidence from this case suggests that the public acceptance of road tolling remained high through the early years of SR 91 Express Lanes operation, as surveys conducted in 1999 estimated that 55-75% of users generally supported road pricing. At the same time, however, the surveys suggested approval ratings of between only 30-50% for variable road pricing and 30-45% approval for the private operator (Sullivan, 2000).

The user-fee based financing mechanism did succeed in increasing public acceptability of electronic road pricing (and, to a lesser extent, variable tolls and the concept of HOT lanes). However, 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). OCTA (2009a) claims that it now coordinates with nearby counties, and Riverside in particular, on corridor tolling policies.

5.1.3 Conclusions from the SR 91 Express Lanes PPP

Table 7 summarizes the performance of the SR 91 PPP relative to the SMM framework. SR 91 delivered strong results with regard to introducing time-variant pricing to help optimize traffic flows (at least on HOT lanes) and for delivering an efficiently managed commercial product. An inability to foster collaboration between public and private partners towards an integrated corridor investment and management strategy, and the resulting public backlash, adversely impacted objectives for system-wide efficiency of investment and delivering on societal goals.

The SR 91 Express Lanes PPP introduced electronic, variable user-based system of payment as a concept in Los Angeles to not only support investment but also to help improve management of traffic flows on a major metropolitan highway. While not system optimal, the pricing regime did initially deliver on expectations, decreasing travel times through the corridor (at least on the tolled lanes). Pricing based on marginal costs would necessitate pricing all lanes on the tolled stretch of SR 91, which could actually result in lowering tolls on the express lanes to more optimally balance traffic. Nonetheless, for a pilot project, CPTC did a relatively good job of introducing pricing as a strategy to manage corridor traffic demand.

CPTC’s commercial management of the SR 91 Express Lanes franchise attained a high degree of project productive efficiency on the express lanes within the scope of the contract. By taking responsibility for initial investment as well as long-term operations and management, the sponsor helped deliver productive efficiencies with regard to
minimizing life-cycle-costs. CPTC's commercial management skills are illustrated by the project's successfully meeting demand and revenue forecasts. Though the contract included a clause that would have likely led to profit sharing at some point during the PPP term, the State would have been unable to distribute proceeds for reinvestment to optimize corridor mobility due to the no compete clause.

Table 7: SMM Performance Indicators: SR 91, Los Angeles

<table>
<thead>
<tr>
<th>Objective</th>
<th>Performance Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pricing Optimizes Traffic Flow on Asset</td>
<td>Introduces road pricing</td>
</tr>
<tr>
<td></td>
<td>Time-variant pricing</td>
</tr>
<tr>
<td></td>
<td>Variable pricing based on marginal costs</td>
</tr>
<tr>
<td>Project-Oriented Project-Oriented Productive Efficiency</td>
<td>Bundles construction and operations &amp; management</td>
</tr>
<tr>
<td></td>
<td>Implements LCC management for entire project scope</td>
</tr>
<tr>
<td></td>
<td>&quot;Revealed&quot; demand sufficient to justify capacity availability</td>
</tr>
<tr>
<td></td>
<td>User fee revenues meet expectation</td>
</tr>
<tr>
<td></td>
<td>Evidence of efficient re-investing/re-distributing excess revenues</td>
</tr>
<tr>
<td>Efficieny of Investment for Transportation System</td>
<td>Asset planned as part of broader highway/road network</td>
</tr>
<tr>
<td></td>
<td>Ability to manage corridor as an inter-modal transportation system</td>
</tr>
<tr>
<td></td>
<td>Evidence of mutually-beneficial renegotiations/contract changes</td>
</tr>
<tr>
<td></td>
<td>Evidence of project meeting corridor mobility objectives</td>
</tr>
<tr>
<td></td>
<td>Evidence that project represented best-known transport alternative</td>
</tr>
<tr>
<td>Investment Supports Societal Goals</td>
<td>Consistent with plan and/or ex ante economic evaluation</td>
</tr>
<tr>
<td></td>
<td>Public acceptability of electronic tolling</td>
</tr>
<tr>
<td></td>
<td>Long-term, stable relationship between public and private partners</td>
</tr>
<tr>
<td></td>
<td>Broad stakeholder perception of fairness and equity of project &amp; contract</td>
</tr>
</tbody>
</table>

Notes: "Y" = Fulfilled "P" = Partial Fulfillment; Otherwise Non-Fulfillment

Overall, the SR 91 PPP failed to clearly demonstrate efficiency as an investment in the larger metropolitan transportation system. In fairness, the project did follow an existing proposal (albeit for HOV lanes), did not appear to prevent corridor investments in rail-based public transportation infrastructure, and initially met time-savings objectives of the PPP program. It is difficult, however, to isolate and treat by different rules a single highway segment in dense and complex roadway network - such as that which serves Metropolitan Los Angeles - without impacting the larger system. The arms-length relationship between CPTC and local public agencies coupled with the no compete clause hampered greater integration of SR 91 into the management of Orange County highway corridors. The adverse impacts revealed themselves in different ways including, for example, conflicts over integrating pricing technology with a nearby State-owned toll road and incongruities between the rate of corridor land development and the provision of highway infrastructure. Essentially, the allocation of risk between the public and private partners failed to incentivize, and through the "no compete clause" dis-incentivized,
collaboration between public bodies and CTPC towards investment for system-wide management. And while the contract preserved government rights to invest in alternative modes of transportation in the same corridor, it is also true that under OCTA management inter-modal integration has been more apparent, as evidenced by coordination of Express Bus service use of the express lanes.

It is also not clear that the SR 91 PPP represented the socially-optimal investment given corridor mobility needs. While there existed a proposal for construction of median HOV lanes through the Orange County sections of the SR 91 corridor, the project was not formally planned and prioritized among other metropolitan mobility investment alternatives. The process for delivering the SR 91 PPP appeared to prioritize securing private finance rather than first identifying the best metropolitan-wide (or at least corridor-wide) plan for improving overall mobility and then tailoring finance to meet this need. Thus, the ability to secure private finance helped drive the decision to proceed with this particular project versus other projects under planning review by CTC (and SCAG) that could potentially have delivered equal or better corridor mobility results.

The SR 91 PPP did not represent a complete failure to meet societal goals. Though adapted for private finance and participation, the SR 91 Express Lanes PPP followed for a proposal under consideration to add additional highway capacity along the SR 91. Furthermore, ex post economic evaluations revealed the achievement of substantial benefits to society. Beyond technical analysis, however, the general perception is that the SR 91 PPP did not promote a broad array of societal goals. This is illustrated by public polemics over coordinating tolling technology with public roads, decreasing measures of public acceptability of variable-tolled highways and the eventual need for a government buyout of CPTC to overcome impasse. While public acceptability of road pricing as a means of financing road investment remained relatively high during CPTC’s management, opinions of the private sector’s role in pricing eroded with time. The dissonance between public and private objectives led to the premature ending of the PPP, with OCTA purchasing the rights from CPTC for the SR 91 Express Lane franchise.

Other spatial and political factors may have contributed to the outcomes observed regarding SMM. From a spatial and economic standpoint, the SR 91 Express Lanes PPP was developed at a time of rapid urbanization in Orange and Riverside counties. Given the unstable and highly unpredictable economic forces acting upon this particular area, the allocation of all commercial risk to the private sector may have proven unwise. In order to offload the commercial risks associated with uncertain demand, 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. Furthermore, the California Legislature essentially created a separate process for evaluating highway PPP schemes under a different framework for evaluation – ability to cover private financing costs. Though CPTC closely followed in its SR 91 RFP response an existing proposal for managed
lanes, the franchising agreement left little flexibility for dealing with broader public priorities for integrated metropolitan mobility.

Given that the SR 91 express lanes are now managed by OCTA in much the same manner as under CPTC, and given the improvements in integrating corridor mobility management (at least with bus transit), it is fair to question whether private involvement was necessary to deliver the benefits associated with this investment. Kanafani (2008) notes, however, that no single organization in California has the authority to both plan and make investments across modes, suggesting the need for an organization capable of enforcing “incentives and revenue consequences” so that individual actors behave in an optimal manner from a system-wide perspective (page 5). He also suggests 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 under public finance and development. Hindsight has allowed OCTA to absorb lessons learned and make subsequent policy adjustments.
5.2  ETR, Toronto, Canada
ETR was the world’s first fully electronic toll road, and its development offers insight on both the opportunities and challenges of public-private finance for metropolitan highways. Initially tendered as public-private initiative, the project was ultimately financed and initially operated by a public-sector authority. Shortly after opening, however, the Ontario government re-tendered the highway, eventually 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 substantial improvements from the standpoint of SMM. In fact there is some evidence to the contrary. Blame for these deficiencies cannot fall entirely on 407 ETR, however, as many inadequacies, real or perceived, resulted in large part from institutional factors. The project also shows some clear successes.

5.2.1  Analysis of Institutional Context for the ETR Ground Lease
Hatzopoulou and Miller (2008) summarize transportation policy in Canada, which follows a mostly federalist approach to political jurisdiction. Federal authority rests with 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).

Most of the revenues collected from road users accrue to federal and provincial governments, which subsidize municipal transportation investments. According to Transport Canada, the Canadian Federal Government collected CAN$ 5 billion in federal fuel excise taxes, while expending CAN$ 4.4 billion on all transportation programs (Transport Canada, 2010a, 2010b). The national Gas Tax Fund dedicates CAN$ 2 billion per year of federal fuel excise taxes to be transferred to municipalities for transportation infrastructure investment (Transport Canada, 2011). Beyond the Gas Tax Fund, federal highway investments are not directly linked to user charges. The Province of Ontario collects fuel taxes and vehicle registration fees. Though not revenues and expenditures are not formally linked, the Province anticipated collecting approximately CAN$ 3.1 billion in fuel taxes and CAN$ 1.1 billion in vehicle registration fees in Fiscal Year 2009-2010, which equals the CAN$ 4.2 billion in estimated transportation infrastructure expenditures (Duncan, 2009). The City of Toronto funds transportation programs through a mixture of property taxes and farebox receipts.

Soberman (2008) summarizes how the City of Toronto and the Province of Ontario coordinated on metropolitan transportation policy from roughly the Post-World War II Era until the early 1990s in a manner largely consistent with the principles of fiscal federalism. The Province of Ontario enacted the Metropolitan Toronto Act of 1953 creating the Regional Municipality of Metropolitan Toronto (now the City of Toronto). The Province delegated to the City authority for regional arterial roads, land use, and public transit, with the six constituent municipalities continuing to control local roads. All regional land use and transportation planning were centralized under the Chair of Metro Toronto, appointed by the Premier of Ontario. The result was that all land use and transportation planning were centralized at the metropolitan regional level, albeit under different authorities (Soberman, 2008).
As Soberman (2008) illustrates, the City of Toronto effectively integrated metropolitan transportation investment and management throughout much of the latter half of the Twentieth Century. The Toronto Transportation Commission (later renamed the Toronto Transit Commission under the 1953 Act) self-financed the construction (1948) and initial operation of the Toronto subway system entirely from farebox revenues, and supplemented funds for future expansion with property taxes. The author explains that, although the system no longer operates without subsidy, the Toronto subway still registers the highest revenue capture as a percentage of operating costs (79%) in North America. Soberman further explains that between 1971 and 1998, the Province of Ontario apportioned all provincial funding that would have been earmarked for local highway development in 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, the Province took responsibility for operating GO Transit commuter rail services to points outside of Metropolitan Toronto and, generally, suburban highway improvements (Soberman, 2008). Thus, jurisdictional boundaries for metropolitan versus provincial transportation infrastructure and services were, for several decades, relatively well defined. While the Province collected some revenues generated within the metropolitan area (e.g., motor fuel taxes), it transferred substantial amounts of funds to the City of Toronto, and permitted flexibility in local expenditure until 1998, when the provincial government devolved transit and secondary roads to municipalities.

While the City of Toronto had long stood as a good example of regional metropolitan government, continued peripheral growth has strained the line between municipal and provincial authority for shaping regional transportation and land use policies. In recognition of this fact, the Province of Ontario passed in 2005 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, and surrounding suburbs (GTAH) (Ontario, 2006). The Province of Ontario then created the Greater Toronto Transportation Authority (GTAA), 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).

7 George Davies, Deputy Minister of Transportation of Ontario during the time of the Highway 407 planning and development and Chair of the public enterprise that built the initial stretch of ETR (the Ontario Transportation Capital Company), was kind enough to grant me an interview and review this case study. He commented that it is important to understand that municipalities in Ontario are still “creatures of the Province,” which is the “dominant funder of municipal transit and highway capital.” Mr. Davies indicates that the Province has in the past removed itself from funding metropolitan transportation infrastructure, which has been followed by underinvestment and, later, reassertion of provincial authority. He suggests that the Places to Grow Act and the creation of the Metrolinx regional transportation authority represent reassertions of provincial authority for metropolitan transport.
The provincial decision to develop and later to seek a private partner for the ETR project occurred during the 1990s at precisely the 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 traverses the dense Toronto road network (see Figure 5). The alignment, tolling policies, and other development issues would have a profound effect on transportation policy in the City of Toronto.

Figure 5: Map of the ETR (Segments in Metropolitan Toronto)

5.2.2 Analysis of the ETR Ground Lease

The ETR project has a history of some relative back-and-forth regarding public versus private roles. As Miller (2002b, 2002c) summarizes, the Province of Ontario had initially intended to procure the 68-kilometer highway segment under a 30-year BOT structure, with the private partner responsible for financing, building, maintaining, and operating the asset in return for the right to collect tolls. The Province created the Ontario Transportation Capital Corporation (OTCC) to deliver the new highway segment in partnership with the private sector. The Province issued an RFQ in 1993, selecting two teams to submit tenders, but later decided to unbundle the contract, awarding a Design-Build contract to a team from one bidding group and a Design-Build-Operate contract for the tolling technology development and operation to a team from the second bidding group. The Province retained ownership of the asset and financed the CAN$ 1.5 billion in costs with government funds. However, in 1998, shortly after completion of an initial operation, the Province elected a more free-market oriented government, which decided to re-tender the existing Highway 407 and future extensions to the private sector under a long-term ground lease (Miller, 2002b, 2002c).
Shortly after the new government took office, 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. In 1999, after a competitive procurement process, the Province of Ontario awarded a 99-year ground lease to 407 ETR, a consortium led by Spanish Ferrovial/Sintra and Quebec-based SNC-Lavalin and Capital d’Amérique CDPQ. 407 ETR paid about CAN$ 1.5 billion up front for the rights to the Ground Lease (407 ETR, 2010).

The financing of the ETR project has helped promote some SMM objectives, road pricing in particular, but also exhibits several deficiencies. Since the private sector did not play a role in project finance until after the completion of initial construction and commencement of operations, the extent to which the ground lease has actually contributed to achieving SMM pricing and investment goals remains questionable. Moreover, the ground leasing of the rights to ETR seems to have coincided with several adverse impacts, calling into question whether or not private management and finance has delivered on expected social benefits.

Table 8 summarizes the key factors for analyzing the ETR PPP, including formal institutional variables associated with transportation policy in Metropolitan Toronto; the governance institutional variables specific to the concession; and other elements of the spatial and political contexts. The next subsection of this chapter then analyzes the observable performance metrics defined in the methodology chapter.

To the extent that MSCP represents the optimal tariff structure for highway use, Lindsey (2008) suggests that there are a number of problems with the ETR tolling scheme. He explains that tolls are inconsistent with ideal Pigouvian congestion fees citing the small difference between peak and off-peak prices (about 5% at the time); 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 (Lindsey, 2008), this result is concerning.

At the same time, 407 ETR claims that it provides free flow conditions on 407 ETR at all times of day, a stated objective of the tender, and since 2008 the company has differentiated pricing not only by time-of-day but by roadway segment. Effective February 2011, light vehicle charges can range from CAN$ 0.1935/km to CAN$ 0.2295/km depending upon the zone travelled and time of day (407 ETR, 2010). Additionally, the 407 ETR points out that average daily traffic has increased every year, except the recession-dampened 2009; that electronic transponder penetration has increased steadily; that 75% of users save 15 minutes or more in travel time by using ETR, and that that a number of other social and environmental benefits accrue due to reductions in travel times and fuel use (407 ETR, 2011a). Therefore, it appears that pricing schemes may currently support financing requirements for ETR and managing congestion levels on the highway itself at all times of day. However, it is questionable whether pricing consistent with objectives of maximizing revenue and minimizing congestion on the ETR represents a system-optimal approach to demand management for corridor highways.
<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>Expected Positive Effect on SMM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure of Transportation Institutions</td>
<td>National institutional structure - federalism</td>
<td>Federal democracy</td>
</tr>
<tr>
<td></td>
<td>Originator jurisdiction</td>
<td>Approximately equal to metropolitan scale</td>
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<tr>
<td></td>
<td>Originator administrative scope - transportation</td>
<td>All metropolitan transportation infrastructure</td>
</tr>
<tr>
<td></td>
<td>Originator administrative scope - land use</td>
<td>Primary control of land use</td>
</tr>
<tr>
<td></td>
<td>Originator fiscal scope</td>
<td>Originator controls fiscal instruments to finance project</td>
</tr>
<tr>
<td>Structure of Highway PPP Institutions</td>
<td>Country experience - highway PPPs</td>
<td>Country has broad experience</td>
</tr>
<tr>
<td></td>
<td>Project grantor experience - highway PPPs</td>
<td>Grantor has experience with highway PPPs</td>
</tr>
<tr>
<td></td>
<td>Legal framework for PPPs - originator</td>
<td>Jurisdiction has general (not ad hoc) PPP legislation</td>
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<tr>
<td></td>
<td>Use of public-sector comparator (PSC)</td>
<td>Uses PSC for PPP decision-making</td>
</tr>
<tr>
<td></td>
<td>Project evaluation</td>
<td>Follows traditional approach for highway evaluation</td>
</tr>
<tr>
<td></td>
<td>Competition and procurement</td>
<td>Competitive international procurement</td>
</tr>
<tr>
<td>Contract Risk Allocation</td>
<td>Policy risk (intentional)</td>
<td>Government policy risk (intentional)</td>
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<tr>
<td></td>
<td>Land acquisition risk</td>
<td>Government land acquisition risk</td>
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<tr>
<td></td>
<td>Network risk</td>
<td>Shared network risk</td>
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<tr>
<td></td>
<td>Demand/revenue risk (excluding network risk)</td>
<td>Shared or private with government network risk</td>
</tr>
<tr>
<td>Project Revenues and Finance</td>
<td>Authority for pricing</td>
<td>Private sector has flexibility to raise and lower tolls</td>
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<tr>
<td></td>
<td>Regulating Tolls</td>
<td>Government has regulatory authority over toll rates</td>
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<tr>
<td></td>
<td>Mechanism for sharing in upside of roadway improvements</td>
<td>Revenue sharing if projects exceed IRR</td>
</tr>
<tr>
<td></td>
<td>Contractual guarantees/support of revenues or profitability</td>
<td>Yes, if project scope is not self-financing</td>
</tr>
<tr>
<td></td>
<td>Renegotiations</td>
<td>Scope and process outlined in contract</td>
</tr>
<tr>
<td>Spatial Context</td>
<td>Maturity of asset</td>
<td>Includes existing roadways (brownfield)</td>
</tr>
<tr>
<td></td>
<td>Project alignment - central city</td>
<td>Aligned through metropolitan center</td>
</tr>
<tr>
<td>Political Context</td>
<td>Primary motivation of PPP</td>
<td>Service-oriented (value-for-money)</td>
</tr>
<tr>
<td></td>
<td>Degree of political/philosophical motivation</td>
<td>Project follows established/evolving PPP framework</td>
</tr>
</tbody>
</table>

Notes: Y = Fulfilled “P” = Partial Fulfillment; Otherwise Non-Fulfillment; “Originator” refers to the entity with ultimate legal authority (i.e., the Province of Ontario) and “Grantor” refers to the body delegated such responsibilities (i.e., MTO)
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. Since entering the ground lease, however, user fees have been sufficient to cover, without subsidy, all financing and operations costs. Furthermore, the ground lease ties the level of permitted toll increases to certain minimum traffic volumes on the ETR, and requires that 407 ETR undertake capacity expansion if high levels of congestion are reached (407 ETR, 2010). These provisions allow the Province to ensure that there will be a connection between traffic levels, tolls, and investment. However, any investments of project revenues are essentially limited to highway improvements.

Collier (2011, Healthy Transport Consulting, Personal Communication) suggests that the Province should concentrate on pricing existing roads rather than using road pricing only when investing in new capacity. According to Collier, at the time of ETR planning, the Ministry of Transportation Ontario (MTO) had discussed internally the possibility of tolling many roads in Metropolitan Toronto and dedicating some of that funding to transit, but that such plans never materialized. Collier further suggests that recent efforts at regional integration of transportation and planning policy under Metrolinx are not novel, but rather represent the re-discovery of policies that had existed in the early 1990s.

Despite the fact that the Province of Ontario retains policy flexibility to manage mobility in the ETR corridor, many complications remain for inter-modal transportation and broader inter-sectoral policies. Regarding metropolitan policy implementation in within the corridor, the lack of a “no compete” clause does, in theory, allow the public sector flexibility. 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, 2010). Davies (MTO, 2011, Personal Communication) suggests, however that the contract includes provisions that allow the lessee to file claims against the Province for any policies deem discriminatory to the ETR. He explains that when the TTC tried to build a new subway station near the highway, 407 ETR claimed that project construction would lead to the temporary closing down of some lanes, which would be discriminatory. An arbitrator ruled in favor of the 407 ETR, and the TTC could not continue with the project as planned (Davies, MTO, 2011, Personal Communication).

In theory, the lessee did nominally take-on all demand and revenue risks for the ETR and therefore should be entitled to all revenue proceeds collected from users. The context of this transfer of commercial risk, however, breaks down upon further scrutiny. Davies (MTO, 2011, Personal Communication) explains that the Province ended up financing and developing the initial ETR segments because, essentially, no private bidder was willing to accept most commercial risk without government guarantees of bonds. He continues that, by the time the ETR was again tendered and awarded as a ground lease, it was already apparent to the market that the project was going to be able to pay for itself. Therefore, Davies suggests there was little actual market risk left for the private sector, except traffic on required extensions (Davies, MTO, 2011, Personal Communication).
In reality, and as detailed in Chapter 3, effective public-private integration for corridor mobility management likely requires a sharing of commercial risk, or at least government assumption of network risk and most intentional policy risk. It is unreasonable to expect a private firm to set user fees in a manner that might be socially beneficial to overall corridor mobility 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. The lessee’s actual commercial risks were substantially mitigated by initial project delivery and operation by OTCC, however, 407 ETR retains the risk that future public policies could adversely impact project finances, especially if future arbitration procedures prove less favorable to the private partner. In fact, the concessionaire identifies widening of Highway 401 and transit investment as potential corporate risks (407 ETR, 2010). Considering the initial government objective of relieving traffic on the parallel Highway 401 to support economic growth, and given the disappointing results in doing so, it appears that the combination of private finance with a less-than-optimal allocation of risk impairs greater integration in corridor mobility 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. Although private finance secured through the ETR ground lease helped deliver highway expansion projects faster than would have been likely under public control, there is a perception that the Province fared badly in contract negotiations. Mylvaganam and Borins (2004) summarize various analyses in the years immediately following the ground lease that estimated project financial valuation at between CAN$ 6-13 billion, compared to the CAN$ 3.1 billion paid by 407 ETR. The authors attribute this sharp increase in value 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 express the belief that an alternate proposal submitted by another bidder would have delivered better long-term benefits, but that the government selected ETR 407’s less favorable long-term plan due to a slightly higher up-front payment. The authors furthermore 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, they claim that 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% (Mylvaganam and Borins, 2004). While the price increases could in theory be justified by project-level economics in that they have succeeded in mitigating congestion on the ETR (though not necessarily free parallel routes and not necessarily aimed at economically efficient congestion levels on the asset itself), public outcry has helped motivate subsequent provincial governments to pursue renegotiations and litigation against 407 ETR.

Public disenchantment with the ETR ground lease has reverberations beyond the project itself. Collier (2011, Healthy Transport Consulting, Personal Communication) suggests that disappointment with the ETR PPP has adversely impacted the public’s acceptability of road pricing in general and that the public has lost faith, at least temporarily, in the viability of private-sector involvement in infrastructure (Collier, 2011, Healthy Transport Consulting, Personal Communication).
Consulting, Personal Communication). This is concerning from the SMM standpoint as related to both road pricing and efficient distribution of risk and responsibility for infrastructure development among the public and private sectors.

Lastly, while ETR provides a technological backbone that could feasibly support broader system-optimal user-based pricing, such a system has yet to be deployed at a metropolitan scale. In fact, ETR is the only tolled highway in the area. Since ETR was initially implemented by OTCC, however, 407 ETR as an entity is not directly responsible for implementing this technology.

5.2.3 Conclusions from the ETR Ground Lease

Table 9 summarizes the performance of the ETR ground lease relative to the SMM framework. As described in the methodology chapter, the indicators measure the fulfillment, partial fulfillment, or lack of fulfillment of key elements related to different SMM objectives. Overall, the ETR ground lease makes progress in optimizing traffic flows on the asset itself and lends to a relatively high degree of productive efficiency in managing the investment. It is not clear, however, that the ETR ground lease, as tendered and constructed, represented the best investment option for the transportation system and the wider societal goals within the Greater Toronto Area.

Table 9: SMM Performance Indicators: ETR, Toronto

<table>
<thead>
<tr>
<th>Objective</th>
<th>Performance Indicator</th>
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<tbody>
<tr>
<td>Pricing Optimizes</td>
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<tr>
<td>Traffic Flow on Asset</td>
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<td></td>
<td>Introduces road pricing</td>
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<td></td>
<td>Time-variant pricing</td>
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<td>Variable pricing based on marginal costs</td>
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<tr>
<td>Project-Oriented</td>
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<tr>
<td>Productive Efficiency</td>
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<tr>
<td></td>
<td>Bundles construction and operations &amp; management</td>
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<tr>
<td></td>
<td>Implements LCC management for entire project scope</td>
</tr>
<tr>
<td></td>
<td>&quot;Revealed&quot; demand sufficient to justify capacity availability</td>
</tr>
<tr>
<td></td>
<td>User fee revenues meet expectation</td>
</tr>
<tr>
<td></td>
<td>Evidence of efficient re-investing/re-distributing excess revenues</td>
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<tr>
<td>Efficiency of Investment for</td>
<td></td>
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<tr>
<td>Transportation System</td>
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<td></td>
<td>Asset planned as part of broader highway/road network</td>
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<td></td>
<td>Ability to manage corridor as an inter-modal transportation system</td>
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<tr>
<td></td>
<td>Evidence of mutually-beneficial renegotiations/contract changes</td>
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<td></td>
<td>Evidence of project meeting corridor mobility objectives</td>
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<td></td>
<td>Evidence that project represented best-known transport alternative</td>
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<tr>
<td>Investment Supports Societal Goals</td>
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<tr>
<td></td>
<td>Consistent with plan and/or ex ante economic evaluation</td>
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<tr>
<td></td>
<td>Public acceptability of electronic tolling</td>
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<td></td>
<td>Long-term, stable relationship between public and private partners</td>
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<tr>
<td></td>
<td>Broad stakeholder perception of fairness and equity of project &amp; contract</td>
</tr>
</tbody>
</table>

Notes: "Y" = Fulfilled "P"=Partial Fulfillment; Otherwise Non-Fulfillment
It is difficult to determine the extent to which formal institutional structures contributed to the failings of the ETR project, both real and perceived. All persons connected with knowledge of the ETR ground lease with whom I spoke\(^8\) expressed the opinion that there was generally broad consensus across political jurisdiction on the need for the ETR. However, it is interesting that the ETR tender and award coincides with the blurring of traditional lines of authority between metropolitan and provincial governments. Although the City of Toronto largely controlled all transportation and land use policy at the city level, sprawl into neighboring suburbs – largely along highways – has blurred traditional geographic lines of what today constitutes “Metropolitan Toronto.” Davies (2011, MTO, Personal Communication) points out that the ETR program also coincided with parallel efforts at the provincial level in the mid 1990s to devolve greater responsibility and funding for local transportation to municipalities. Therefore, any perceived failings of the development of ETR, and the subsequent ground lease, occurred in the context of a sincere effort to restructure transportation policy towards fiscal federalist principles. Furthermore, and interestingly, Metrolinx was recently created to fill a perceived vacuum of leadership at what today constitutes Toronto at the “regional scale,” yet many of the policies now under consideration mirror MTO proposals from the early 1990s (Collier, 2011, Healthy Transport Consulting, Personal Communication).

The ETR ground lease presents an example of a metropolitan highway PPP whose investment is financed entirely by variable, electronic user fees, which moves in the right direction with respect to optimizing flows on the highway. Nevertheless, it appears that the pricing design employed by OTCC, before the concession, may have been more consistent with optimizing flows and managing mobility throughout the corridor and larger metropolitan network, although the limited period of public ownership during the ramp-up period provides only little empirical evidence. However, under neither public nor private control were tolls set to dynamically reflect marginal costs. Furthermore, weak regulation of toll rates and the decision to proceed with a 99-year concession term were critical errors, as this may lead to inefficient pricing of the system as well as excessive profits (Mylvaganam and Borins, 2004).

From the standpoint of productive employment of resources in pursuit of project objectives, 407 ETR’s long-term, life-cycle-management approach has supported a highly efficient commercial operation. Demand and revenue seem to have justified the level of capacity development, at least for the initial 68 km section. While the contract does require reinvestment in new capacity should certain demand thresholds be reached, profit levels probably exceed what could be considered a risk-appropriate return on investment and could therefore be classified as economic rent.

The evidence suggests that while ETR might have represented an efficient and effective investment for the larger transportation system, the decision to enter into a long-term ground lease with 407 ETR may have hampered the opportunity to fully realize the

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\(^8\) The author spoke with George Davies, former Deputy Minister of Transportation for the Province of Ontario and Martin Collier, a transportation consultant promoting road pricing and other mobility measures in Ontario. The author also received helpful feedback and resources form Brendon Hemily, a transportation consultant in Toronto.
system-wide benefits. The ETR had been planned for years and the need to relieve truck access on Highway 401 was well established, although the evidence suggests that results have fallen short of expectations, at least with respect to freight mobility (see Lindsey, 2008). Furthermore, the Province retained its policy authority to implement inter-modal corridor mobility policies, but legal questions as to what constitutes “discriminatory” have held up at least one important public transportation project. While it is questionable to what extent the ETR ground lease has helped deliver on expected results, it is clear ETR ground lease left virtually no flexibility for the public and private partners to reasonably negotiate mutually-beneficial changes to project scope to deal with uncertainties and unforeseen future conditions. Furthermore, the selection of a proposal with the highest up-front payment to the Province may not have represented the best long-term investment for the public. Mylvaganam and Borins (2004) suggest that political philosophy may have played a critical role in these outcomes, suggesting that more carefully engaging the private sector could have yielded better results.

With regard to achievement of overall societal goals, the ETR project itself is consistent with decades of planning, and broad agreement among local and provincial government authorities on the need for a tolled highway. The evidence suggests, however, that OTCC might have been able to deliver greater social return on investment by retaining control of Highway 407. The development of ETR under public ownership and finance served the purpose of implementing inter-sectoral regional policy by expediting construction of a parallel route to Highway 401 for the ostensible economic development purpose of facilitating truck freight movement. Some, like Lindsey (2008) argues that this objective has not been realized under private management to the extent envisioned in early plans. Furthermore, the negative perception among the public for the ground lease itself appears to have adversely affected public acceptability of other policies consistent with SMM such as road pricing and leveraging private-sector expertise in designing investment programs consistent with state-of-the-art practices and life-cycle-cost management. The result is that when inevitable conflicts have arisen, both parties have resorted to legal action against one another. While the Province of Ontario has lost most of these legal battles, 407 ETR has been in many ways disadvantaged by the lack of cooperation as it has been the recipient of punctative government action, so its seemingly strong current financial position is not without long-term risk. Finally, the process of tendering the ground lease to ETR failed to adequately address impacts on stakeholders (e.g., users) leading to negative perceptions of fairness and equity. Mylvaganam and Borins (2004) 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.

While the decision to seek a private partner for Highway 407 may not have represented the best long-term policy for metropolitan mobility in Greater Toronto, a more flexible contract structure could have at least established an effective framework for collaboration between the Province of Ontario and 407 ETR. This could have made it possible to better align both public and private objectives to adapt to the uncertain and off-changing metropolitan policy environment. Since 407 ETR has accepted all commercial and policy risk (however much mitigated by the initial assumption of development and commercial
risk by the OTCC), the company has little obligation to consider any other objective besides profit maximization and maintaining free flow traffic 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 long-term, integrated approaches to corridor congestion management.

The lack of effective public-private collaboration during the ETR ground lease term hints at a poorly aligned allocation of risk. While 407 ETR has reaped high rewards, it has been lucky in that many of the risks for which it does not exert complete control (e.g., demand risk and many policy risks) have not substantially affected its financial position, at least so far. If a truly integrated metropolitan transportation infrastructure program is to exist with private and public partnership, then, a more cooperative approach to managing network and, perhaps, traffic demand risks is needed.

Lastly, the ETR ground lease tender represented a hasty, politically charged process outside of normal procurement policies. A legal and institutional framework incorporating a more comprehensive, consistent, and rigorous evaluation of project benefits and costs, investment alternatives, finance, and long-term management might have established a more socially beneficial (or at least acceptable) project structure (e.g., tolling, etc.) and a better governance structure for incorporating private finance.
5.3 CityLink, Melbourne, Australia

The CityLink concession is similar in project delivery structure to earlier highway BOT schemes in much of the world with the private-sector partner financing construction, maintenance, management, and operations from user-based tolls. It differs from other projects in that it is partially a brownfield project configured entirely within the center of the metropolitan region, rather than a radial or circumferential route to and through outlying areas. CityLink also helped complete gaps in the metropolitan highway network by connecting three major radial highways running into and out of central Melbourne, thereby facilitating movement through the central city transportation network, while diverting some vehicles off congested local arterials. In this sense, the project is conceived as being a component of a larger network rather than an isolated asset. Moreover, CityLink provides critical access to and from industries considered central to the economic vitality of the entire metropolitan region. Given its importance to overall public welfare and given its ostensible function as the center artery of a dense network, the choice to partner with the private sector warrants study, as do the institutions supporting this strategy.

5.3.1 Analysis of Institutional Context for the CityLink Concession

Australia is a federalist democracy under a parliamentary system derived from the United Kingdom’s Westminster Tradition (Hodge and Greve, 2005). Government responsibilities are carried out primarily at three progressively smaller geographic levels: national, state/territory (sub-national jurisdiction), and local. The Australian Commonwealth Government administers federal transportation policies and programs through the Department of Infrastructure and Transport. The National Land Transport Act of 2009 (Nation Building Program) provides the primary framework for federal investment in national and interregional land transport projects. The Act authorizes $AUS 37 billion in investment in Australia’s National Land Transportation Network, comprised of national and inter-regional road and rail infrastructure, from Fiscal Year 2008-2009 to Fiscal Year 2013-2014 (Department of Infrastructure and Transport, 2011b).

Sayeg (2009) explains the limitations of the Commonwealth Government with respect to metropolitan and regional transportation policy. Under the Australian Constitution, the Commonwealth retains limited powers for local or regional transportation. The Commonwealth does retain substantial taxing and revenue powers, which it uses to collect fuel excise taxes, however, these revenues are deposited in the Consolidated Revenue Fund rather than dedicated transportation expenditure funds. While the states retain residual powers for local and regional transportation policy and administration, they may refer some powers to the Commonwealth. For the most part, States do not cede transportation (and land use) policy and administrative powers to the Commonwealth Government, but do receive transfers from federal programs that specify investment criteria. Historically, the Commonwealth Government has established economic criteria for transportation and land development funding (benefit-cost analysis, etc.). For example, the Commonwealth Government enacted the Infrastructure Australia Act 2008, which identified infrastructure gaps throughout the country and paved the way for the creation of the AUS$20 billion Building Australia Fund, which will award competitive co-funding grants to states and municipalities on such projects (Sayeg, 2009). The program awarded AUS$3.2 billion for construction of 40 kilometers of dual-track rail lines in Melbourne and surrounding communities (Department of Infrastructure and Transport, 2011a).
Sayeg (2009) also describes how the State of Victoria dominates transportation planning, policy, and administration in the Melbourne Metropolitan Area. The Victoria Department of Transport is responsible for strategic planning across all modes and coordinates with the Victoria Department of Planning and Community Development for consistency with regional land use plans. Transportation and land use planning and investment are coordinated through two primary documents. Published by the Victoria Department of Sustainability and Environment in 2002, Melbourne 2030 is a government-wide strategy for land use development in and around Melbourne, while the 2008 Victoria Transport Plan (VTP) serves as the primary inter-modal strategic guidance for coordinating transportation policy and investment within the land development framework. The Victorian Department of Transport also works with municipalities, of which there are 31 in the Melbourne Metropolitan Area, to develop Integrated Local Transport Plans, which aim to address sub-regional inter-modal transportation and land use issues (Sayeg, 2009).

The State of Victoria recently adopted, at least officially, a new legally-binding institutional strategy for transportation policy based on the concept of “sustainability.” The Transportation Integration Act 2010 reauthorized all state transportation agency and state-owned enterprises under a new strategic paradigm centered on integrated decision-making that considers the entire transportation network in evaluating investments. In essence, the Act aims to integrate transportation and land use planning across agencies through a corporate planning approach and codifies the VTP at the strategic long-term plan for transportation policy in the State of Victoria. The Act requires that all investments be evaluated for economic, environmental, and social impacts and that all public bodies responsible for transportation submit three-year corporate plans demonstrating adherence to the objectives and strategies codified in the law (Department of Transport, 2011). Hence, rather than consolidating agencies or devolving powers, the State has instead attempted to use legislation to co-ordinate various state-owned agencies behind a more integrated and sustainable policy strategy.

The VTP proposes AUS$38 billion in investment, stressing the prioritization of transit as well as investment that better integrates land use and transportation. The plan envisions a poly-centric Melbourne Metropolitan Area with various transportation alternatives linking activity centers and residential areas. Substantial investments (AUS$7 billion) are directed at urban rail infrastructure, aimed at integrating the commuter-rail system into a “modern metro network” and doubling urban rail capacity. Bus and tram acquisitions ($AUS 1.5 billion) will help modernize fleets and expand transit services. The plan also provides investments in roads linking to CityLink, aiming to relieve congestion in inner Melbourne (Department of Transport, 2010).

State-owned enterprises develop and manage much of Australia’s transportation infrastructure, including much of the assets under the charge of the State of Victoria. Hodge and Greve (2005) explain that these public bodies were created under conservative governments as a means for bringing commercial approaches to public service, with an overriding objective of economic development. The authors suggest that state-owned enterprises by and large improved productivity while being viewed generally positively by citizens (Hodge and Greve, 2005). In the State of Victoria, VicRoads is the state-owned enterprise responsible for highway infrastructure while VicRail is responsible for all State rail infrastructure assets (Sayeg, 2009).
Authorized under the Victorian Transport Act 1983, VicRoads is responsible for managing and improving 52,537 lane km of State arterial roads and 3,060 bridges. Established as a Victorian statutory authority (e.g., state-owned enterprise), the Authority consists of an appointed Chief Executive, a Corporate Management Group, and Advisory Board (including stakeholder membership), other specialized oversight groups, and nine divisions (VicRoads, 2009).

While collaboration with the private sector for transportation infrastructure delivery has long historical antecedents in Australia, the use of BOT-style versions of PPPs is a more recent phenomenon. Hodge and Greve (2005) suggest that in the 1980s and 1990s neo-liberal government philosophies of privatization, competition, outsourcing, and service purchasing resulted in a movement towards more private provision of government services, including transportation infrastructure. They continue that Australian government bodies eventually turned towards relatively new PPP strategies characterized by long-term, integrated contracts and sharing of risks, which they claim has resulted in a “joint decision-making” structure rather than a principal-agent environment. The authors conclude that Australian state governments became more fervent adopters of PPP strategies in large part due to the possibility of developing projects off public balance sheets to circumvent federal debt restrictions (Hodge and Greve, 2005).

The Australian experience with highway PPPs has been mixed. In a report commissioned by Infrastructure Partnerships Australia, the Commonwealth Government’s lead PPP authority, the Allen Group Consulting (2007) estimated key development metrics across a number of PPP projects in Australia. The report suggests cost savings compared to traditional procurement of 30.8% from project inception to completion (and 11.8% from contract award to completion), and that PPP projects deliver 3.4% earlier than forecast while traditional government-developed transportation projects have typically been delayed by a factor of 23.5%. Hodge (2004) suggests that the benefits of PPPs are achieved primarily by transferring risks that the private sector is better equipped to handle, but cautions that empirical evidence is inconclusive as to whether or not these benefits exceed the additional costs of administration in the Australian experience, with the choice of discount rate weighing heavily on the outcome (Hodge, 2004)9. Sayeg (2009) explains how the State of Victoria has aggressively embraced private-sector provision in the procurement for most public transportation services, while simultaneously implementing integrated public transport plans. The State provides regional bus, light rail, and tram services through contracts with private providers, but designs contracts to require ticket and fare integration among different service providers across all modes of public transport (Sayeg, 2009).

Though VicRoads has used PPP structures sparingly for the procurement and management of roadway infrastructure, the projects undertaken have involved important highway projects in Melbourne. Two projects, CityLink and EastLink, have involved substantial investments along critical metropolitan highway corridors. EastLink is fairly recent and involves largely peripheral urban highway elements (FHWA, 2009). CityLink, however, has been under contract for over a decade and covers a network of highways serving the movement of people and goods into and out of critical port and commercial districts in inner Melbourne.

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9 Professor John Stanley with the University of Sydney Business School was kind enough to review this case study and notes that much of the current debate on Australian road PPPs centers on deferring tenders until after initial development and traffic ramp-up. He suggests that this might provide better information on which to negotiate contracts, particularly in light of the demonstrated uncertainty associated with past road concession traffic forecasts.
5.3.2 Analysis of CityLink

In 1995, the State of Victoria passed the Melbourne City Link Authority Act 1995, which created the state-owned Melbourne City Link Authority (MCLA) to assist in project development for CityLink, solicit and recommend a concessionaire, and coordinate implementation. The MCLA oversaw the concession of the rights to build, operate, manage, and collect tolls on the 34-year (now 37-year), AUS$ 2 billion, 22-kilometer CityLink project to Transurban, an Austrian road investment and management firm. Completed in December, 2000, CityLink connects three highways; the Tullamarine to the north, the West Gate to the West, and the Monash to the East. As detailed in Figure 6, CityLink connects each of these three major metropolitan highways, linking the airport, seaport, and industrial centers to the south and east of Melbourne to and around the central business district. MCLA has since been dissolved, and concession management activities are now housed within the State Highway Authority, VicRoads (VicRoads, 2010).

Figure 6: Map of the CityLink Concession

Source: CityLink (2011)
Ardnt (1998) summarizes the CityLink PPP financing and risk allocation. Transurban raised AUS$1.8 billion to finance the widening of existing roads, construction of new elevated roads and tunnels, and installation and operation of an automated electronic tolling system (the State covered some other corridor investments). While Australian highway PPPs had traditionally transferred mostly design and construction, operating, and finance risks to the private sector, the State of Victoria was able to transfer market demand risks to Transurban as well. The State would accept all risks traditionally borne by the public sector, primarily environmental and land acquisition, as well as risks that neither party could completely control. These included network, sovereign, and external risks. With respect to network and sovereign risks, the State agreed to make certain investments and implement specific traffic policies. If the State failed to meet its obligation, Transurban can make a claim pursuant to a Material Adverse Effect (MAE) clause in the agreement. If deemed valid, an MAE claim provides the concessionaire financial redress, taking the form of an extended concession period (up to 54 total years), changes to toll rates, direct government contributions, and other mechanisms. MAE can also be claimed for actions on the part of any government entity that adversely affects project finances (Ardnt, 1998).

While the assumption by the State of Victoria of network and sovereign risks helped provide a more stable environment for the transfer of market risks to the private sector, the contract provided other means of mitigating private market risks. Ardnt (1998) describes how Transurban retained the option to issue interest-free promissory notes in lieu of annual concession payment. Transurban is scheduled to make annual payments of AUS$ 95.4 million payments for the first 25 years, followed by AUS$45.2 over the next 18 years (depending upon the ultimate contract length), then AUS$1 million per year thereafter (if necessary). The government can only redeem the promissory notes before the end of the concession if the project return on investment at the time of issue is 10% (after tax) or greater and if the payment constitutes less than 30% of the previous year’s distributable cash flow. Therefore, the State is in fact exposed to some elements of market risk, as its payments are linked to the financial success of the project (Ardnt, 1998). The State also retains the right to terminate the concession at various intervals beginning in year 25 if private sector ROI reaches 17.5%, thus retaining some ability for the public to benefit from the upside of higher-than-expected returns on investment (PricewaterhouseCoopers, 2008).

Table 10 summarizes the key factors for analyzing the CityLink PPP, including formal institutional variables associated with transportation policy in Metropolitan Melbourne; the governance institutional variables specific to the concession; and other elements of the spatial and political contexts. The next subsection of this chapter will then analyze the observable performance metrics defined in the methodology chapter.
Table 10: Institutional Profile: Highway PPPs in Melbourne, Australia (At the Time of Contract Award)

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>Expected Positive Effect on SMM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure of Transportation Institutions</td>
<td>National institutional structure – federalism</td>
<td>Federal democracy</td>
</tr>
<tr>
<td></td>
<td>Originator jurisdiction</td>
<td>Approximately equal to metropolitan scale</td>
</tr>
<tr>
<td></td>
<td>Originator administrative scope – transportation</td>
<td>All metropolitan transportation infrastructure</td>
</tr>
<tr>
<td></td>
<td>Originator administrative scope - land use</td>
<td>Primary control of land use</td>
</tr>
<tr>
<td></td>
<td>Originator fiscal scope</td>
<td>Originator controls fiscal instruments to finance project</td>
</tr>
<tr>
<td>Structure of Highway PPP Institutions</td>
<td>Country experience - highway PPPs</td>
<td>Country has broad experience</td>
</tr>
<tr>
<td></td>
<td>Project grantor experience - highway PPPs</td>
<td>Grantor has experience with highway PPPs</td>
</tr>
<tr>
<td></td>
<td>Legal framework for PPPs – originator</td>
<td>Jurisdiction has general (not ad hoc) PPP legislation</td>
</tr>
<tr>
<td></td>
<td>Use of public-sector comparator (PSC)</td>
<td>Uses PSC for PPP decision-making</td>
</tr>
<tr>
<td></td>
<td>Project evaluation</td>
<td>Follows traditional approach for highway evaluation</td>
</tr>
<tr>
<td></td>
<td>Competition and procurement</td>
<td>Competitive international procurement</td>
</tr>
<tr>
<td>Contract Risk Allocation</td>
<td>Policy risk (intentional)</td>
<td>Government policy risk (intentional)</td>
</tr>
<tr>
<td></td>
<td>Land acquisition risk</td>
<td>Government land acquisition risk</td>
</tr>
<tr>
<td></td>
<td>Network risk</td>
<td>Shared network risk</td>
</tr>
<tr>
<td></td>
<td>Demand/revenue risk (excluding network risk)</td>
<td>Shared or private with government network risk</td>
</tr>
<tr>
<td>Project Revenues and Finance</td>
<td>Authority for pricing</td>
<td>Private sector has flexibility to raise and lower tolls</td>
</tr>
<tr>
<td></td>
<td>Regulating Tolls</td>
<td>Government has regulatory authority over toll rates</td>
</tr>
<tr>
<td></td>
<td>Mechanism for sharing in upside of roadway improvements</td>
<td>Revenue sharing if projects exceed IRR</td>
</tr>
<tr>
<td></td>
<td>Contractual guarantees/support of revenues or profitability</td>
<td>Yes, if project scope is not self-financing</td>
</tr>
<tr>
<td></td>
<td>Renegotiations</td>
<td>Scope and process outlined in contract</td>
</tr>
<tr>
<td>Spatial Context</td>
<td>Maturity of asset</td>
<td>Includes existing roadways (brownfield)</td>
</tr>
<tr>
<td></td>
<td>Project alignment - central city</td>
<td>Aligned through metropolitan center</td>
</tr>
<tr>
<td>Political Context</td>
<td>Primary motivation of PPP</td>
<td>Service-oriented (value-for-money)</td>
</tr>
<tr>
<td></td>
<td>Degree of political/philosophical motivation</td>
<td>Project follows established/evolving PPP framework</td>
</tr>
</tbody>
</table>

Note: "Y" = Fulfilled "P"=Partial Fulfillment; Otherwise Non-Fulfillment; "Originator" refers to the entity with ultimate legal authority (i.e., the State of Victoria) and “Grantor” refers to the body delegated such responsibilities (i.e., MCLA)
The CityLink pricing and toll regulation strategy promotes more efficient use of the metropolitan road system, though not necessarily optimality from a system demand management standpoint. Pricing is section-based and calculated on the basis of how many of the 11 metered zones a vehicle crosses in traversing the CityLink (VicRoads, 2011). Nonetheless, the objective of the tolling regime is revenue maximization within contractual constrains (Lay and Daley, 2002), not system optimality. While Transurban has some discretion to raise and lower tolls – the contract allows Transurban to charge higher rates during peak periods to commercial vehicles – rates do not vary according to demand (Allen Consulting Group, 1996). Daley (Transurban, Personal Communication, 2011) explains that, essentially, there is a cap on the amount that can charge per trip, but there is a lower cap rate for trucks during the hours of 8:00 pm to 6:00 am to encourage travel during less congested hours. With respect to toll increases, Daley explains that the contract allows Transurban to increase tolls by either 4% or the rate of inflation, whichever is higher, until 2015. Thereafter, rates can increase only by the rate of inflation.

The relative efficiency of CityLink tolling has been hotly debated. As previously discussed, the lack of variability in tolling deprives regulators of the use of congestion pricing as a demand management tool (with the notable exception of peak period commercial vehicle tolling). Some question whether tolls have been set too high to derive maximum social benefit, claiming that price levels have diverted more vehicles onto local arterial roads than initially forecasted (Allen Consulting Group, 2003; Hodge and Greve, 2005). Hodge (2004) reviews various traffic impact studies, suggesting that CityLink pricing may have diverted between 15-37% of traffic onto adjacent streets. It was recently reported in the Melbourne Herald Sun newspaper that toll rates have increased from a maximum trip cap charge for a car of AUS$3.77 when CityLink opened in 2000 to AUS$6.93 today. According to the article, tolls have been increased 44 times and by 83-88%, while inflation has increased by only 34% and gasoline costs have increased by 72% (McArthur and Mickelburough, 2011). Daley (Transurban, Personal Communication, 2011) counters that this is misleading, as tolls are raised quarterly by contract.

Officials with CityLink argue that pricing is appropriate for the levels of demand generated on CityLink and that increasing traffic on nearby roadways is a product of robust economic and population growth in Melbourne rather than excess toll rates. Lay and Daley (2002) argued that (in early years of the concession) peak hour automobile volumes and commercial vehicle volumes at all times of day were consistent with forecasts; average time savings at prevailing toll rates roughly reflected prevailing average local wages (as expected); and reducing non-peak hour prices would reduce revenues but not necessarily attract more users. Daley (Transurban, 2011, Personal Communication), acknowledges that the concession has been a profitable venture for Transurban (Mr. Daley indicates that shares today are worth approximately AUS$5.25 versus AUS$1 upon initial issue, albeit at an estimated 3% annual inflation rate, AUS$1 in 1996 would be about AUS$1.60 in today’s money). He counters criticism of toll rates however, suggesting that traffic growth on CityLink outpaces the rates of growth on parallel roads; that urban infill

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10 Demi Chung, a PhD student and Lecturer at the Australia School of Business at the University of New South Wales who was kind enough to review this paper, comments that it important to recognize that tolls roads in Australia are priced according to the costs of infrastructure rather than congestion.

11 Mr. Daley is an executive with Transurban who at the time helped lead the concession negotiation and project team. Mr. Lay is an expert on transportation infrastructure with ties to business and academia, who helped author the referenced journal article while serving as president of the Royal Automobile Club of Victoria.
projects and Melbourne’s growth during the concession period from 3.2 million to 4 million are responsible for dramatic increases in demand on CityLink, and that Transurban has entered into approximately forty contract changes with the State of Victoria in order to help satisfy both facilitate public projects.

In terms of the impact of pricing and regulation on investment, CityLink exhibits both strengths and weaknesses with respect to SMM. Apart from some initial public funding supporting the CityLink project site, user fees have covered all debt service and operating costs. Furthermore, contractual flexibility allows for coordinated public and private action on unanticipated corridor improvement needs. The contract specifies that either the public or private partner can fund improvements that positively impact the finances of the CityLink concession. VicRoads and Transurban then share 50 percent each of the revenue gains, net of improvement costs. This clause has been exercised on multiple occasions, most recently to coordinate the implementation of an AUS$1.39 billion upgrade project to the Route M1 highway, which includes the east-west segment of CityLink (VicRoads, 2009).

While the private finance of CityLink does provide some measure of additional scrutiny in the form of capital market discipline, some elements of the concession suggest deficiencies with respect to maximizing public return on investment (i.e., allocative efficiency). Brown (2005) suggests that government policies for reducing market uncertainty (and hence risk) have helped encourage investment, but have consequently resulted in the transfer of real value from the government to Transurban. She estimates that Transurban’s right to issue promissory notes rather than make concession payments constitutes a valuable financial option for the private partner that could be worth up to 10% of total recoverable NPV of revenues (Brown, 2005). Alonso-Conde et al. (2007) compare the value of Transurban’s option to issue promissory notes against the State’s ability to cancel the concession early if the notional IRR of the project exceeds 17.5%. Using a Monte Carlo simulation of various potential outcomes, they demonstrate a substantial net financial benefit to the private partner.

CityLink provides some encouraging signs with respect to harmonizing private-sector finance with integrated metropolitan transportation investment and management strategies. The CityLink concession contract provides an incentive-based structure for coordinating new public and private improvements that support broader corridor policies. With respect to corridor-wide investment and management, revenue sharing provisions for corridor investment ensure that the public shares in the upside of future improvements in and around CityLink. The aforementioned AUS$1.39 billion Route M1 upgrade in particular demonstrates the benefit of this approach. Vong and Gaffney (2007) measure the impact of AUSS$100 million worth of project investment earmarked for intelligent transportation systems (ITS) in the form of a Freeway Management System (FMS) and a Coordinated Freeway Ramp Signal (CFRS) system. According to the authors, the first AUSS$1 million investment along the Monash Freeway paid for itself in 11 days. Daley (Transurban, 2011, Personal Communication) explains that Transurban supports efforts to relieve highway congestion with transit, which the company deems mutually-beneficial, and even proposed an expansion of contract scope to include the development of a light rail network.

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12 In my conversation with Mr. Daley, he suggests that the State was well aware of the value of this option, which was used to help facilitate financing for, at the time a relatively new investment asset class.
As of yet, however, the State of Victoria has not been willing to expand the scope of the
CityLink concession to multiple modes of transportation infrastructure. As described previously,
however, the VTP does envision substantial public investment in rail transit in the Melbourne
Metropolitan Area (Department of Transport, 2010).

The CityLink concession structure also provides the public sector flexibility to implement
transportation policy that would adversely affect concession finances, while also providing a
mechanism for compensating Transurban for financial losses. Hodge (2004) reviews the decision
by the State to build a new road, the Wurundjeri Way, to help spur redevelopment of the
Dockland area near the western CityLink extension, resulting in a AUS $ 35.8 million MAE
claim against Victoria by Transurban. CityLink claimed that the new road was responsible for
average daily volumes falling short of projections. Daley (Transurban, 2011, Personal
Communication) expressed disappointment that arbitrators ultimately failed to side with
Transurban in its MAE claim regarding Wurundjeri Way, suggesting that revenues were affected
for that link.

CityLink benefited from having been conceived of as a critical link in a larger network, but
challenges remain to implementing integrated metropolitan transportation policies. While the
MAE provides a mechanism for implementing public policy while honoring the concession,
current and future governments are tied to previous policy decisions codified into the contract.
For example, the current State of Victoria transportation policy and planning strategy prioritizes
integration of the transportation system and land use, but CityLink was implemented prior to the
current framework. Transurban might be able to claim MAE on policies that may benefit overall
public welfare but reduce the financial position of the CityLink Concession. This is not, in and of
itself, a problem, as the MAE is designed specifically to facilitate such policy flexibility. While
there is a financial cost to the government, the MAE forces public actors to confront often-
hidden costs of public actions (Hodge, 2004; PricewaterhouseCoopers, 2008). The problem
occurs, however, when potential policy interventions carrying substantial long-term benefits in
excess of short-term costs, including reasonable MAE settlements, may be deferred or
abandoned due to requirements for compensatory payments. This is partly speculative, however,
as I am not aware of any such occurrence during the CityLink concession period.

With respect to public acceptability, Transurban does appear to have made reasonable
concessions to satisfy environmental and community concerns, and the project itself appears to
have delivered on promised benefits. Lay and Daley (2002) describe how Transurban agreed to
design and construct a more expensive and longer tunnel through the eastern extension, which
carried substantial costs, but proved more environmentally friendly and engendered public
support. Daley (Transurban, 2011, Personal Communication) explains that Transurban sees its
business as long-term service delivery with a commitment to sustainability and innovation, rather
than simply infrastructure provision. He further suggests that, Transurban will thus sometimes
consider a more expensive alternative in some cases for the sake of being a good corporate
citizen and in the interests of maintaining good relations with the community and the State of
Victoria. The Allen Consulting Group (1996) conducted an economic impact study
commissioned by the Melbourne CityLink Authority and estimated a benefit-cost ratio of 2.04
for the project, including both one-time and long-term benefits. The report suggested that the
project would lead to both temporary as well as permanent increases in employment and output.
Furthermore, the report estimated substantial annually-recurring benefits from reduced travel
time; lowering of vehicle operating costs and accident rates; enabling freight carriers to deploy larger, more efficient vehicles; and other benefits to businesses and individual travelers. An ex post economic evaluation confirmed the benefit-cost ratio (Allen Consulting Group, 2003).

Deficiencies in State of Victoria transportation institutions hampered CityLink’s potential role in supporting broader social policies. While the State established a special entity for managing the concession and operation of CityLink, the MCLA has been criticized for its oversight role due to a number of legal controversies regarding cost-overruns, delays, faulty tunnel designs requiring substantial repairs, and delayed deployment of the electronic tolling system (Hodge, 2004; Hodge and Greve, 2005). Hodge (2004, pg. 45) further suggests that a “crash through” political style for effectuating the project led to a lack of “due process,” which caused a lack of transparency in evaluating the project and engendered initial public backlash.

Finally, CityLink has demonstrated positive strides in the use of tolling and demand management technology towards greater sustainability at the system level. Lay and Daley (2002) suggest that the electronic tolling system design is both efficient and has helped generate public acceptance. With respect to acceptability, the concessionaire installed a redundant system to track vehicles, including a video-based monitoring system to record license plates and an electronic transponder reading system. This helps prevent false prosecutions, by giving the user the benefit of the doubt if either individual system fails (Lay and Daley, 2002).

Beyond the implementation of a section-based and fully-electronic tolling technology system, the integration of ITS for congestion management points towards a more systemic approach to managing throughput. The most glaring weakness is the seeming unwillingness of political institutions to consider pricing of non-highway roads. None of the current planning and policy documents for a more “sustainable” Metropolitan Melbourne provides serious consideration of these policies. Daley (Transurban, 2011, Personal Communication) cautions, however, that any larger road pricing plan should emphasize maximizing use of existing infrastructure, and that while radial road pricing is possible, the State should consider the need for complimentary circumferential routes as well as transit enhancements as part of any such plan.

5.3.3 Conclusions from the CityLink Concession

Table 11 summarizes the performance of the CityLink concession relative the SMM framework. CityLink’s most glaring weakness is a static pricing regime. The concession registers strong results in across other objectives, demonstrating high productive efficiency and seemingly representing allocative efficiency as a transport system investment. Fair or not, at least a few commentators suggest that tolls are too high, and may result in a higher level of diverting traffic to some local roads. This perception hurts the case for fully meeting perceptions of fairness and equity, though the project registers strong results across other indicators of societal goals.

CityLink demonstrates that private-sector involvement and even finance of metropolitan roads can make substantial strides towards SMM, and specifically system integration, provided that institutions are aligned towards this objective. While metropolitan transportation strategies have not been devolved to a theoretically appropriate geographic scale, it appears that the State of Victoria has at least implemented a SMM policy framework that will coordinate the efforts of most government entities relevant to intra-metropolitan transportation and land use. Though not theoretically ideal, the solution seems to more-or-less work for the Melbourne context.
Table 11: SMM Performance Indicators: CityLink, Melbourne

<table>
<thead>
<tr>
<th>Objective</th>
<th>Performance Indicator</th>
<th>Y</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pricing Optimizes Traffic Flow on Asset</td>
<td>Introduces road pricing</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time-variant pricing</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Variable pricing based on marginal costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project-Oriented Productive Efficiency</td>
<td>Bundles construction and operations &amp; management</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Implements LCC management for entire project scope</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;Revealed&quot; demand sufficient to justify capacity availability</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>User fee revenues meet expectation</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evidence of efficient re-investing/re-distributing excess revenues</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Efficiency of Investment for Transportation System</td>
<td>Asset planned as part of broader highway/road network</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ability to manage corridor as an inter-modal transportation system</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evidence of mutually-beneficial renegotiations/contract changes</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evidence of project meeting corridor mobility objectives</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evidence that project represented best-known transport alternative</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Investment Supports Societal Goals</td>
<td>Consistent with plan and/or ex ante economic evaluation</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public acceptability of electronic tolling</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long-term, stable relationship between public and private partners</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Broad stakeholder perception of fairness and equity of project &amp; contract</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Y* = Fulfilled "P"=Partial Fulfillment; Otherwise Non-Fulfillment

The incorporation of road pricing and electronic charging technology does contribute towards optimizing traffic flows, but the structure and regulation of CityLink tolls has not resulted in system-optimal pricing. Transurban appears justified in raising prices, with demand validating willingness-to-pay; however, it is possible (though not entirely clear) that the economically-optimal policy would be to lower tolls and induce more users onto CityLink. This issue is exacerbated by the lack of variable road pricing regime for non-freight vehicles. Such a system could improve efficiency and fairness in allocating costs to users based on time of day of use.

Transurban’s approach to commercial management has achieved a high degree of productive efficiency in the investment, management, and operation of CityLink. The life-cycle-cost approach, combined with meeting demand and revenue expectations, demonstrates the benefits of applying commercial management towards meeting long-term investment and operations objectives. Though the State of Victoria has the right to terminate the contract early if (as it appears thus far likely) Transurban meets a certain IRR threshold, it is questionable whether the distribution of revenues until that time will represent the most productive employment of proceeds, or if excess revenues will be distributed entirely as higher-than-expected returns (hence, economic rent). Since Transurban has demonstrated repeated willingness to change contract terms and co-invest...
with the State, it is fair to say that some of the excess profits are being put to productive use. However, it is premature to make a judgment at this time.

Although the structure of the PPP bears many similarities with other radial BOT arrangements, the physical configuration of the project as a critical link within a larger system has helped frame the investment in terms of its efficiency as a mobility solution within the context of the larger metropolitan network. Collaboration on subsequent corridor investments, such as the new M1 upgrades and ITS implementation demonstrate the ability of the public and private partners to work together towards the mutually beneficial achievement of corridor mobility solutions. The MAE clause provides a mechanism for providing flexibility to implement public priorities, while ensuring fair compensation to Transurban should policies adversely impact project finances. This governance strategy offers some important insights for incentivizing coordination of public and private parties in supporting a more holistic and integrated approach to corridor/area transportation investment and management. Though it is difficult to tell whether or not the CityLink concession represented the best alternative under consideration for meeting Metropolitan Melbourne’s mobility needs, it does appear to have responded to one of the most pressing objectives for the transportation system in Metropolitan Melbourne – facilitating freight truck transport to and from seaport, airport, and inter-state nodes.

The CityLink concession has been successful in many instances in delivering on societal goals. Ex post evaluations of benefits and costs have confirmed that expected net benefits have been met. The public has accepted tolling not only of highways, but of metropolitan highways in principle, as evidenced by willingness of the State government to proceed with the EastLink project. Additionally, Transurban and the State of Victoria have developed a seemingly strong working relationship, which is important for dealing with the complexities of managing inter-modal metropolitan mobility in a large, growing city such as Melbourne.

Public acceptability will always be a concern, however, where a monopoly is granted for infrastructure providing a service that many consider a public good. This seems to have prevented buy-in from some segments of the Metropolitan Melbourne population, particularly some users who accuse Transurban, probably unfairly, of price gouging (McArthur and Mickelbourough, 2011). This will especially be the case when there is a perception of excess profits. The State of Victoria prioritized shifting demand and revenue risk to the private sector in its CityLink tender, and in many ways Transurban is now reaping the benefits of a good investment. Pricing road infrastructure concessions under a system-optimizing toll would likely require a different type of relationship with a private partner; one that might involve greater public investment and assumption of commercial risk. However, such a strategy might be detrimental to other objectives for CityLink, including providing reliable access for truck freight if system optimal tolls called for lower prices and higher levels of traffic (and, hence, longer travel times to cross inner Melbourne). Plus, the combination of high roadway congestion in the face of increasing costs is perhaps a signal of support for the State’s investment in alternative forms of transportation such as new buses and light rail. Thus, while CityLink does not
necessarily meet broad stakeholder perceptions of equity and fairness, evaluating this criterion is far from straightforward.

Furthermore, the decision to create a separate contract management authority and allow the concession to proceed without the normal process of public scrutiny may have contributed to poor oversight, both real and/or perceived, during the construction phase. The later merging of contract management into VicRoads appears to respond, at least in part, to this institutional weakness. However, the initial mistakes in structuring governance institutions also influence public acceptability of the project.

One of the key takeaways from the CityLink case is the difficulty of allocating risk in a manner that satisfies the complex objectives of a metropolitan transportation system. From a finance perspective, the CityLink concession represents a close-to-ideal allocation of risk, especially considering many earlier metropolitan PPP projects throughout the world. Ardnt (1998) suggests, however, that there needs to be more symmetry in sharing the upside of uncertainty with the government partner, not just mitigating the downside risk of the private partner. The author also concludes that the contract should not have allowed the concessionaire the option to defer concession payments, as this led to the de facto assumption of some market risks in the public’s expected concession payments (Ardnt, 1998). Estimates of the value of this option to the concessionaire dwarf the value of the State’s option to terminate the concession deal early.

Additionally, although the CityLink concession approaches the theoretical ideal distribution of policy, network, and demand risk; the complexity of metropolitan transportation system objectives can make matters less straightforward. In the case of CityLink, the distribution of risk mirrors the theoretically-optimal structure, with the government carrying policy and most network risk, and Transurban carrying demand and revenue risk. The Docklands redevelopment and Wurundjeri Way, however, illustrate the challenge of distributing risk in a world of many competing objectives, such as economic development. Although the MAE offers a mechanism for dealing with such conflicts, it is probably better if – like the West Link project – the public and private partners can find a way to work together on a mutually-agreeable solution. Just because the public-sector won the MAE case does not necessarily mean that the outcome optimizes social welfare.

From a broader institutional standpoint, the Victorian Government has set out a strategy aimed at “sustainability” and overall “integration” but has yet to implement many tools likely needed to support such ambitions goals. With regard to optimizing investment and use, more serious consideration road pricing, including congestion and externality pricing, might provide a more optimal use and financing of the metropolitan road network. The idea of dedicating revenues to specific corridor or area improvements also warrants study. In the meantime ITS investments in demand management are a necessary but not sufficient step.
5.4 Metropolitan Madrid Concessions, Madrid, Spain

The Spanish Government has a long history of financing inter-urban highways with toll road concessions, but a series of PPPs in Metropolitan Madrid represents new institutional challenges for integrating public and private objectives in a complex spatial context. Three concessions in the late 1990s aimed to finance four new radial toll roads and one new circumferential road in suburban Madrid exclusively with real tolls. The vision, as articulated by the Spanish Government, called for leveraging the market viability of radial toll road segments to cross-subsidize the development of the circumferential route. While thoughtful in its consideration of network spillovers and system behavior, the program’s technical and economic flaws have led to substantial financial difficulties with negative ramifications for SMM in Metropolitan Madrid.

5.4.1 Analysis of Institutional Context for the Metropolitan Madrid Highway Concessions

Spain is a federal democracy, with administrative and fiscal powers shared by multiple levels of government (Inman, 2007). There are three levels of government relevant to transportation institutions in Metropolitan Madrid. These include, from largest to smallest, the Government of Spain, the Comunidad Autonoma de Madrid (Autonomous Community of Madrid, CAM), and municipalities within the CAM, such as the historic Madrid City. Keating (2006) explains how the division of responsibilities between levels of Government in Spain is often unclear and asymmetrical. In an attempt to address nationalist sympathies in the Basque, Catalonia, and Galicia regions, Spain’s 1978 constitution extended the opportunity for relative autonomy to any region requesting such status. The result was the rapid division of the entire Spanish territory into 17 autonomous regions, including the CAM, but with asymmetrical devolution of powers across the territory. The CAM, for example, retains relatively close ties to the Government of Spain. Spain’s constitution reserves certain powers for the center, specifies powers to be transferred to Autonomous Regions through individual legislation, and details a list of powers that could be further devolved to the Regions. In essence, the Spanish Government retains residual powers over any authority not directly granted to the Autonomous Regions, but legal ambiguity allows national governments to both consolidate and decentralize powers with relative fluidity. Political parties, which are strong at both regional and national levels, typically provide the forums for negotiating the sharing of powers, which has produced a relatively stable system of co-operation. Municipalities are not dependent on regional governments for power, and enduring political connections with the national government helps preserve this independence (Keating, 2006).

The Spanish Government administers and regulates transportation programs through the Ministerio de Fomento (Ministry of Development, MF). MF has broad authority to propose and execute national transportation and infrastructure policies; regulate all transportation services; work with the Administration General de Estado (General Secretary of State) on issues of urban quality of life; plan and program transportation investment; and administer other programs such as postal and spatial mapping services (MF, 2011). MF policies and strategies are guided by the 2005 Plan Estratégico de Infraestructuras y Transportes (Strategic Infrastructure and Transport Plan, PEIT). PEIT aims to harmonize Spanish transportation policies within the EU framework. This includes an emphasis on inter-modal system planning and management, working with the Autonomous Regions to develop sustainable mobility plans, evaluating infrastructure investment in metropolitan areas around concepts of safety and mobility (as opposed to spatial...
development), and assigning larger percentages of costs directly to users. Although Autonomous Regions retain substantial powers over intra-regional transportation, the PEIT claims that several national legislative acts (Land Transport Act 16/1987 and the Organic Act 5/1987) and regional agreements have resulted in the de facto adoption of national legislation throughout the country (MF, 2005). MF hopes that it will be able to work with Autonomous Regions toward the implementation of metropolitan transportation policies and programs outlined in the PEIT.

The CAM is, in many ways, ahead of the national government in implementing integrated metropolitan plans, at least for public transportation. Within the CAM, metropolitan transportation policies and programs fall under the authority of the Consejería de Transportes e Infraestructuras (Department of Transport and Infrastructure), which also houses the Consorcio Regional de Transportes de Madrid (Madrid Regional Transport Consortium). Founded in 1986 a year after the CAM approved Spain’s first comprehensive regional transportation plan, the Consorcio is tasked with integrating all public transportation services, public and private, throughout the metropolitan region. This includes local and inter-urban buses, the Metro de Madrid urban rail system, and regional commuter rail services (Consorcio Regional, 2011).

The PEIT summarizes revenue sources and expenditure programs for national transportation investment. Financing for Spanish highways historically comes from two sources, general revenues from the national government and private finance. The Spanish Government levies motor fuel excise vehicle taxes, which are deposited into government general revenue accounts. An annual budget process determines the funds available for expenditures for various federal programs, including direct expenditures by ministries such as MF and transfers to Autonomous Regions and local transportation operators. General funds are also distributed to state-owned enterprises, which operate different transportation infrastructures and services (technically considered government investments rather than expenditures). Private finance through PPPs forms the other major source of funding for national transportation investment in Spain, especially highways. Overall, the MF aims to generate 20% of near- and medium-term infrastructure finance from private sources, and 25% for highway programs (MF, 2005).

Tolled PPPs have played a key role in the history of the development and finance of highway systems throughout Spain. Since the passage of the Spanish Concession Law in 1972, support for PPPs has experienced two periods of high emphasis, the 1970s and from roughly 1996 to current times, with approximately 5,000 km either under operation or under award and development (Baeza and Vassallo, 2008). Allard and Trabant (2007) explain that the Spanish Government and provinces aggressively deployed PPP arrangements for financing infrastructure due in part to fiscal restraints imposed by the Maastricht Treaty and in part to the format of EU structural and cohesion funds. Autonomous Regions are also legally authorized to apply PPPs to deliver infrastructure (Renda and Schrefler, 2006), though the Spanish Government has initiated 84% of all PPP projects and furthermore provides substantial construction and operating guarantees as well as repayable loans to concessionaries (Ministerio de Fomento, 2007).

The MF (2007) describes the Spanish model for tendering and administering highway PPPs. The 1972 Concessions Law established a Government Delegate in the Concessionary Companies of National Toll Motorways as the coordinating and executive authority for the Spanish Government interests in PPPs. The Government Delegate is today housed under the MF, and additionally performs a number of regulatory and oversight roles for roadway concessions on
behalf of the Spanish Government, including reporting on the performance of concession contracts. Key features of the Spanish toll road concession model include State initiation of projects, competitive tender, review of bids based on economic and technical feasibility, the inclusion of a "restoration of balance" clause in contracts that allows concessionaires to be compensated for government action resulting in material financial losses, and flexibility for renegotiations. In terms of pricing, the Spanish model regulates contract pricing through the use of a "reversion coefficient." Under this regime, prices may be increased each year up to the average national inflation rate, but may be limited below this figure if average daily traffic exceeds expectation (MF, 2007). Thus prices appear negatively affected by excess in demand, which seems to contradict the possibilities for congestion pricing.

Gómez-Ibáñez and Meyer (1993) suggest that highway PPPs in Spain have mostly proven financially viable because they have been concentrated in densely-travelled inter-urban corridors primarily between and among urban industrial centers and tourist destinations on the eastern Mediterranean coast; have charged relatively high tolls; and the fact that concessionaires have historically been conservative in bidding due to near complete transfer of demand risk. The downside, however, is that the Government of Spain has retained mostly financially unprofitable inter-urban tolled highways that require substantial subsidies. Furthermore, high prices charged by concessionaires on PPP highways leads to sub-optimal system allocation of traffic and congestion on un-tolled highways (Gómez-Ibáñez and Meyer, 1993).

To summarize, numerous institutional actors are involved in the development and management of transportation systems in Spain, with a seemingly heavier influence of national-level and private-sector bodies in highway finance and administration. The PEIT offers a blueprint for designing transportation planning, investment, and management programs more consistent with concepts such as fiscal federalism, sustainable finance, integrated metropolitan system management, and optimal assignment of costs. The CAM has already implemented many of the strategies recommended in the plan, especially for designing integrated approaches to public transportation. The challenge of providing mobility solutions in car-dependent, peripheral areas of the Madrid region as well as on congested roads near the center will require innovative infrastructure solutions. Based on historic and current trends, this will likely involve coordination among levels of government and with private firms. While Spain has broad experience with PPP finance and management of inter-urban toll roads, it is worth studying how the experience and institutional structure translates to delivering highway infrastructure in metropolitan areas.

5.4.2 Analysis of the Metropolitan Madrid Highway Concessions

Three concessions of suburban highway segments in Metropolitan Madrid illustrate a relatively new approach to the application of PPPs for highway infrastructure finance, provision, and management in Spain. The Metropolitan Madrid concessions (MMC) include four toll highway segments, which have been issued under three separate concessions to three different private entities: the R-2 (HENARSA); the R-4 (Madrid Sur); and the bundled R-3/R-5 (Accesos a Madrid). Figure 7 illustrates the alignment of the three MMCs with respect to the CAM and other major regional highways. Concessionaires of all three highways are also required to contribute revenues towards the construction of a free outer ring road (the M-50) that will connect each of these tolled segments, as well as un-tolled segments around the periphery of Metropolitan Madrid. This approach makes strides in incorporating road pricing to reduce
congestion and support network infrastructure development, however, the results have been disappointing as all segments have fallen far short of demand and revenue targets and have not addressed congestion closer to Madrid City.

**Figure 7: Alignment of Metropolitan Madrid Concessions**

![Alignment of Metropolitan Madrid Concessions](image)

Source: Vassallo et al., 2011

The concession contracts generally follow the MF's framework for highway concessions. The contract specifies the exact alignments of each toll road to be developed, the portions of the M-50 urban ring for which each individual concessionaire would be responsible, and maximum tolls (MF, 1999). Table 12 provides a summary of the key statistics of the MMCs.

**Table 12: Metropolitan Madrid Concessions**

<table>
<thead>
<tr>
<th>Concessionaire</th>
<th>Toll Highway</th>
<th>Length of the Toll Highway (km)</th>
<th>Length of the M-50 Beltway (km)</th>
<th>Construction Costs (€)</th>
<th>Concession Period</th>
<th>Average Toll (2008 € cents/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HENARSA</td>
<td>R-2</td>
<td>62.3 km</td>
<td>18.4 km</td>
<td>308</td>
<td>24 Years</td>
<td>10.19</td>
</tr>
<tr>
<td>Madrid Sur</td>
<td>R-4</td>
<td>52.5 km</td>
<td>44.7 km</td>
<td>642</td>
<td>65 Years</td>
<td>9.66</td>
</tr>
<tr>
<td>Accesos a Madrid</td>
<td>R-3, R-5</td>
<td>31.8 km, 28.9 km</td>
<td>22.3 km, 22.3 km</td>
<td>450, 450</td>
<td>50 Years, 50 Years</td>
<td>8.23, 9.39</td>
</tr>
</tbody>
</table>

Source: Vassallo et al, 2011
Vassallo et al. (2011) explain the motivations of the Spanish Government for entering into the MMCs. While the Government of Spain has extensive experience with relatively un-congested inter-urban highway PPPs, the MMCs differed from previous initiatives in that they were designed to carry mainly intra-metropolitan traffic. In tendering the MMC’s, the Spanish Governments aimed to develop four new toll routes to help relieve peak-hour traffic congestion on free highways connecting growing outer suburbs of Metropolitan Madrid to the center, while leveraging the presumed profitability of these routes to cross subsidize the M-50, which would provide connections between the new routes and alternative free radial highway routes. The Spanish Government also sought private-sector partnership to finance metropolitan transportation infrastructure due to a lack of budgetary resources due to commitments of national funds for inter-urban highway development and pressure to maintain fiscal austerity due to EU convergence. Additionally, the Spanish Government hoped that the MMCs could provide a first step towards congestion pricing. Finally, there was also hope that the new highways would promote real estate development in the periphery of the City of Madrid (Vassallo et al., 2011).

Vassallo et al. (2011) also detail the problems experienced by the MMCs. First, demand has not materialized as expected. The MMCs opened in 2003 and 2004, but average daily traffic is consistently measured at approximately 25-50% below expectation (and closer to the latter). The authors attribute this to several factors, including some macroeconomic factors outside the direct control of the concessionaries. However, the authors also identify both physical and institutional flaws that contributed to the lack of expected demand, including inconvenient means for transferring from often-congested free radial highways to the MMCs; the fact that the MMCs do not extend into near-in areas of Madrid where congestion is most severe; a rigid tolling policy that does not allow for rational pricing; and the fact that many commuters are simply willing to accept travel delays rather than paying tolls (especially evening commuters). Second, the MMCs delivered 16-26 months late and 16-33% over-budget. This can be attributed in large part to the fact that the Spanish Government allocated all land acquisition risk to the private partners. The Government assumed that compensation would reflect rural land values, however, land owners successfully appealed to the courts for compensation more closely reflective of urban land values (Vassallo et al., 2011).

Table 13 summarizes the key factors for analyzing the MMCs, including formal institutional variables associated with transportation policy in the Metropolitan Madrid; the governance institutional variables specific to the concession; and other elements of the spatial and political contexts. The next subsection of this chapter will then analyze the observable performance metrics defined in the methodology chapter.

With respect to pricing and regulation, the MMCs succeeded in adopting for the first time within the CAM a system of user fees for the right to use metropolitan highways. While this is a step in the right direction, however, it is clear that that pricing levels have not led to system-optimal use of the overall highway network. Whether the issue is rigid pricing, high elasticity of demand, lack of demand in general in the areas which the highways are aligned, competition from competing free routes, lack of access between free routes, or other reasons; pricing of the MMCs has at best had a minor impact on optimizing the use of roadways in the CAM.
### Table 13: Institutional Profile: Highway PPPs in Madrid, Spain (At the Time of Contract Award)

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>Expected Positive Effect on SMM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure of Transportation Institutions</td>
<td>National institutional structure - federalism</td>
<td>Federal democracy</td>
</tr>
<tr>
<td></td>
<td>Originator jurisdiction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Originator administrative scope - transportation</td>
<td>Approximately equal to metropolitan scale</td>
</tr>
<tr>
<td></td>
<td>Originator administrative scope - land use</td>
<td>All metropolitan transportation infrastructure</td>
</tr>
<tr>
<td></td>
<td>Originator fiscal scope</td>
<td>Primary control of land use</td>
</tr>
<tr>
<td></td>
<td>Structure of Originator jurisdiction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transportation Originator administrative scope</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>All metropolitan transportation infrastructure</td>
</tr>
<tr>
<td></td>
<td>Structure of Originator fiscal scope</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Originator controls fiscal instruments to finance project</td>
</tr>
<tr>
<td></td>
<td>Country experience - highway PPPs</td>
<td>Country has broad experience</td>
</tr>
<tr>
<td></td>
<td>Project grantor experience - highway PPPs</td>
<td>Grantor has experience with highway PPPs</td>
</tr>
<tr>
<td></td>
<td>Legal framework for PPPs - originator</td>
<td>Jurisdiction has general (not ad hoc) PPP legislation</td>
</tr>
<tr>
<td></td>
<td>Use of public-sector comparator (PSC)</td>
<td>Uses PSC for PPP decision-making</td>
</tr>
<tr>
<td></td>
<td>Project evaluation</td>
<td>Follows traditional approach for highway evaluation</td>
</tr>
<tr>
<td></td>
<td>Competition and procurement</td>
<td>Competitive international procurement</td>
</tr>
<tr>
<td>Contract Risk Allocation</td>
<td>Policy risk</td>
<td>Government policy risk</td>
</tr>
<tr>
<td></td>
<td>Environmental &amp; land acquisition risk</td>
<td>Government environment &amp; land acquisition risk</td>
</tr>
<tr>
<td></td>
<td>Network risk</td>
<td>Government network risk</td>
</tr>
<tr>
<td></td>
<td>Demand/revenue risk (excluding network risk)</td>
<td>Shared or private with government network risk</td>
</tr>
<tr>
<td>Project Revenues and Finance</td>
<td>Authority for pricing</td>
<td>Private sector has flexibility to raise and lower tolls</td>
</tr>
<tr>
<td></td>
<td>Regulating Tolls</td>
<td>Government has regulatory authority over toll rates</td>
</tr>
<tr>
<td></td>
<td>Mechanism for sharing in upside of roadway improvements</td>
<td>Revenue sharing if projects exceed IRR</td>
</tr>
<tr>
<td></td>
<td>Contractual guarantees/support of revenues or profitability</td>
<td>Yes, if project scope is not self-financing</td>
</tr>
<tr>
<td></td>
<td>Renegotiations</td>
<td>Scope and process outlined in contract</td>
</tr>
<tr>
<td>Spatial Context</td>
<td>Maturity of asset</td>
<td>Includes existing roadways (brownfield)</td>
</tr>
<tr>
<td>Political Context</td>
<td>Project alignment - central city</td>
<td>Aligned through metropolitan center</td>
</tr>
<tr>
<td></td>
<td>Primary motivation of PPP</td>
<td>Service-oriented (value-for-money)</td>
</tr>
<tr>
<td></td>
<td>Degree of political/philosophical motivation</td>
<td>Project follows established/evolving PPP framework</td>
</tr>
</tbody>
</table>

*Y = Fulfilled “P”=Partial Fulfillment; Otherwise Non-Fulfillment Note: “Originator” refers to the entity with ultimate legal authority (i.e., the Government of Spain) and “Grantor” refers to the body delegated such responsibilities (i.e., the Ministry of Fomento)*
Many of the same issues concerning pricing have implications for decision-making on corridor highway investments. In retrospect, demand does not appear to have justified the levels of highway investment, at least at current prices (high from a standpoint of system optimality). Furthermore, as Vassallo et al. (2011) point out, the areas experiencing the highest levels of congestion – typically highways within the M-40 ring road which forms the inner terminus of the MMCs – are free of charge. A more sustainable approach would include pricing of congested inner-CAM routes, which could support transportation investment in those same areas where it is most needed. Additionally, the cost of land acquisition proved to be a more serious risk than expected, adversely impacting the financial viability of the MMCs.

The Spanish Government can be commended for attempting to account for network spillovers by planning the MMCs as a whole and requiring the construction of complimentary network segments to ensure the delivery of a more complete system. While seemingly pragmatic, however, the plan simply has not worked. First, the network alignment does not permit convenient access between free and tolled highways. Many drivers may very well prefer to pay for faster travel times, but may more often than not take their chances with congestion levels on free routes. If congestion levels are high, users may have few reasonable options for transferring to tolled lanes. Vassallo et al (2011) suggest that perhaps the Spanish Government should have instead sought PPPs for tolled HOT lanes within existing corridors (similar to the SR91 case), which would have simultaneously introduced road pricing, maintained free alternatives for other users, and increased permeability between free and toll roads. Second, the CAM has for 25 years invested in transit and integrated planning to in an attempt to reduce peripheral growth and related externalities. Though they at least introduce an element of pricing, the MMCs reinforce the dominance automobile use and sprawl in the CAM.

With respect to supporting public acceptability, the MMCs seems reasonably uncontroversial, although this could be attributed to the fact that free alternatives exist for users unwilling to pay tolls. However, it appears that objectives for real estate development played a major role as well, which may have affected the alignment of the new toll routes. While the Government was likely able to gain the favor of different constituencies such as the infrastructure construction industry, real estate interests, and citizens of outer-metropolitan areas for pursuing the MMC programs and alignment, it is questionable whether the long-term metropolitan public interest has been served.

Finally, while technology has been deployed for toll collection, there seems to be little relevance from the standpoint of SMM. Tolling, at this time, is not an effective demand management tool. Pricing is static, not variable, so the full possibilities for technology are not being realized.

5.4.3 Conclusions from the Metropolitan Madrid Highway Concessions

Table 14 summarizes the performance of the MMCs relative to the SMM framework. Though the concessions have promoted some elements of SMM, a number of institutional weaknesses prevent achievement of many desired SMM outcomes.
Table 14: SMM Performance Indicators: MMCs, Madrid

<table>
<thead>
<tr>
<th>Objective</th>
<th>Performance Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pricing Optimizes Traffic Flow on Asset</td>
<td>Introduces road pricing</td>
</tr>
<tr>
<td></td>
<td>Time-variant pricing</td>
</tr>
<tr>
<td></td>
<td>Variable pricing based on marginal costs</td>
</tr>
<tr>
<td>Project-Oriented Productive Efficiency</td>
<td>Bundles construction and operations &amp; management</td>
</tr>
<tr>
<td></td>
<td>Implements LCC management for entire project scope</td>
</tr>
<tr>
<td></td>
<td>&quot;Revealed&quot; demand sufficient to justify capacity availability</td>
</tr>
<tr>
<td></td>
<td>User fee revenues meet expectation</td>
</tr>
<tr>
<td></td>
<td>Evidence of efficient re-investing/re-distributing excess revenues</td>
</tr>
<tr>
<td>Efficiency of Investment for Transportation System</td>
<td>Asset planned as part of broader highway/road network</td>
</tr>
<tr>
<td></td>
<td>Ability to manage corridor as an inter-modal transportation system</td>
</tr>
<tr>
<td></td>
<td>Evidence of mutually-beneficial renegotiations/contract changes</td>
</tr>
<tr>
<td></td>
<td>Evidence of project meeting corridor mobility objectives</td>
</tr>
<tr>
<td></td>
<td>Evidence that project represented best-known transport alternative</td>
</tr>
<tr>
<td>Investment Supports Societal Goals</td>
<td>Consistent with plan and/or ex ante economic evaluation</td>
</tr>
<tr>
<td></td>
<td>Public acceptability of electronic tolling</td>
</tr>
<tr>
<td></td>
<td>Long-term, stable relationship between public and private partners</td>
</tr>
<tr>
<td></td>
<td>Broad stakeholder perception of fairness and equity of project &amp; contract</td>
</tr>
</tbody>
</table>

"Y" = Fulfilled "P"=Partial Fulfillment; Otherwise Non-Fulfillment

While the pricing regime seeks to align benefits with costs of new development, the strategy employed fails to address larger issues of optimizing traffic flows and highway congestion in the Metropolitan Madrid transportation system. The efficiency of pricing comes from both the assignment of costs to users for wear and tear as well as the costs imposed on society such as congestion. Pricing in this case is based on cost recovery and on the principle of willingness to pay, not system-optimal traffic management, and probably should be lower.

Other than bundling investment with long-term management and operation for tolled segments, the MMCs failed to deliver substantially greater productive efficiencies than traditional procurement. While the overall project scope included construction of the M-50, long-term operations and management is limited only to the radial routes. It is thus fair to question whether investments in the M-50 would necessarily represent the most efficient long-term program, as long term management and maintenance is not the responsibility of the concessionaries. To the extent that the MMCs aimed to help mitigate congestion, an inefficient physical alignment and ineffective demand forecasting have proven to be unfortunate obstacles. Levels of demand and revenues simply do not support the level of capacity delivered, at least at current prices. And while there are no excess
revenues for potential re-investment, contract parameters do not appear to establish an efficient mechanism to facilitate such a program.

From the standpoint of promoting efficiency of investment for the entire Metropolitan Madrid transportation system, the Government of Spain succeeded in leveraging expected MMC revenues to cross-subsidize the construction of the M-50. It is unclear, however, the extent to which the MMCs have supported or failed to support inter-modal transportation system investment and management. Due to their peripheral locations, the MMC probably have not substantially impacted existing transit system operations. However, to the extent that the MMCs have supported low-density, peripheral development, future demands for public transit in those areas could put stress on the larger metropolitan public transportation system. Furthermore, overly optimistic forecasts and a sub-optimal physical alignment of new roadway segments failed to provide users with convenient alternatives to make more optimal use of the network system. Therefore, it is fair to question whether these investments represented the best alternatives to addressing corridor congestion and mobility concerns.

The MMCs offer mixed results with regard to delivering on overall societal goals. The segments were delivered to plan, and the MMCs have possibly helped spearhead a trend to extend widely-accepted inter-urban road charging policies into metropolitan highway systems in Metropolitan Madrid. It is uncertain, however, to what extent the current contractual relationship between the Government of Spain and the concessionaires can be sustained considering the significant financial difficulties that persist with each of these highway concessions. In the past, the Government of Spain has typically renegotiated with concessionaires, but the MMCs seem to offer a no-win situation for all parties involved. Furthermore, the price of appeasing key constituencies was the delivery of new infrastructure to support new land development in the periphery, but unfortunately these programs have had minimal impact on reducing congestion throughout the wider metropolitan network. The primary beneficiaries were probably developers and landowners on the periphery of the CAM. While there does not appear to be much public backlash against the MMC developments, this may have more to do with physical alignments through less populated areas than necessarily strong stakeholder engagement.

Inefficient risk allocation also appears to have contributed to the failure of the MMCs in delivering on expected social benefits. Private firms shouldered most of the demand risk for these concessions. It is now clear that many of the key factors in managing this risk were outside the control of concessionaires including, but not limited to, government macroeconomic policies and decision-making on overall metropolitan system management. The alignment of Spanish highway PPPs must be pre-specified in tender documents, leaving private bidders little flexibility to potentially propose alternative alignments that might better mitigate commercial risk (e.g., HOT lanes strategies suggested by Vassallo et al. (2011)). This risk was further complicated by the assignment of land acquisition risk to the private concessionaires. Given the fixed physical alignments, and given the unknowable position of the Spanish judiciary with respect to compensation for land takings for metropolitan highways, concessionaires did not effectively control key variables for maintaining timely schedules and holding-down construction costs.
Finally, while the CAM, through Consorcio Regional de Transportes de Madrid, has for 25 years aimed to reduce peripheral land development and improve mobility in congested areas, highway policies have rarely contributed to these objectives. In fact, these policies have often counteracted attempts at greater SMM. The MMCs nominally aimed to address some of these challenges by introducing road pricing in the CAM, but the program seems mostly ineffective in achieving these ends, particularly while simultaneously meeting public demands for free alternative routes and pressures for new peripheral land development.
5.5 Costanera Norte, Santiago, Chile

The Costanera Norte concession in Chile resulted in the development of an electronically-tolled PPP highway through the dense center of Santiago and offers insight on the interactions between metropolitan planning and development and PPP highway finance, particularly for primarily greenfield projects. While Chile’s national government began tendering highway PPPs in the early 1990s, the Costanera Norte concession represents its first attempt at a primarily metropolitan highway PPP. Overall, the project illustrates many of the opportunities and challenges of leveraging private-sector finance towards the implementation of a project intended for both private profit and satisfying social welfare objectives.

5.5.1 Analysis of Institutional Context for the Costanera Norte Concession

Chile is a unitary democracy (Inman, 2007), 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 central government. 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.

Consistent with this national institutional framework, revenue collection and transportation investment decision-making is largely centralized within the national government. Zegras (2003) estimates that 95% of all revenue 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. With respect to revenues derived from transportation, the Government of Chile collects fuel excise and value added taxes ostensibly to support transportation investment, with some cross-subsidization of other modes such as transit (Zegras, 2003). In fact, most infrastructure funding is distributed by the Government of Chile through its various ministries out of general flexible funding accounts (Aporte Fiscal Libre), whose levels are determined annually by the National Congress (CCC, 2008). The primary agency in charge of state transportation investment is the Ministerio de Obras Públicas (Ministry of Public Works, MOP). MOP is responsible for planning, constructing, and managing a wide range of public infrastructure projects, including highways in the Santiago Metropolitan Area (SMA); and for the tendering, administering, and regulating state public-private concessions (MOP, 2011). MOP shares its authority for roadway building in urban areas with the Ministerio de Vivienda y Urbanismo (Ministry of Housing and Urban Development, MINVU) and municipalities (Rufián, 2002).

The Secretaría de Planificación de Transporte (Secretariat for Transportation Planning, SECTRA) is the Government of Chile’s primary agency responsible for metropolitan and national transportation planning (though MOP also plays an important role). SECTRA’s competence is in technical support for project evaluation, and the agency is responsible for working collaboratively will all relevant agencies to create metropolitan transportation plans in Greater Santiago and other major Chilean cities (SECTRA, 2011). SECTRA has recently been folded into the Ministerio de Transportes y Telecomunicaciones (Ministry of Transportation and Telecommunications, MTT), which is tasked with proposing national transportation policies, supervising state-owned and private industries operating within these sectors, and enforcing laws
and regulations (MTT, 2011). MTT and MOP are jointly responsible for developing the transportation plans for the SMA (Bronfman, 2008).

The Government of Chile has made efforts in recent years to support greater inter-modal and inter-sectoral integration and devolve greater powers for transportation policy to government bodies in the SMA, but most of these plans have not been realized. For example, the Government approved in October, 2000 the Plan de Transporte Urbano de Santiago 2000-2010 (2000-2010 Santiago Urban Transportation Plan, PTUS). Responding to the need to control the explosive growth of car use and urban sprawl in the SMA, the PTUS was implemented in an effort to promote public transportation, rationalize car usage and housing development, and increase the participation of non-government entities and citizens towards a focus on greater quality of life (Fernández and Osses, 2004). The PTUS also made a primary recommendation to create a metropolitan transportation authority for the SMA, which would coordinate the modernization and improvement of all systems of metropolitan transportation using both supply and demand mechanisms (CEPAL, 2003). With the exception of the coordinated public transportation program, Transantiago, however, few of the major PTUS recommendations have been realized (Quijada, Personal Communication, 2011).

Transantiago constitutes a comprehensive initiative for integrating and increasing the efficiency of public transportation in the SMA. The name “Transantiago” actually corresponds to three different things:

- The Transantiago “agency,” Coordinación Transporte Público de Santiago (CTPS), provides technical and administrative support to MTT in developing an integrated mobility system for the SMA (CTPS, 2011).
- The Transantiago “system” includes buses, the Santiago Metro rail system, and other supporting infrastructure (Transantiago, 2011).
- The Transantiago “program” involves the integration of public transportation routing and pricing into a zone-based system of trunk routes down major corridors (rail and dedicated bus lanes) and local bus feeder routes (Transantiago, 2011).

The Transantiago program also includes the use of PPPs for three types of infrastructure and/or services: (1) bus route operations (previously under private, but uncoordinated operation); (2) financial administration, including the issuance of integrated fare cards, revenue collection and distribution, and accounting; and (3) the construction, maintenance, and operation of the infrastructure supporting one of the major dedicate bus trunk routes under a series of concessions for the construction, maintenance, and operation of 24 new – and maintenance and operation (M&O) of 11 existing – bus transfer stations (Zegras, 2006).

While Chile has made efforts at integrating transportation policy, regionalization, and, to an extent, privatization, its highway 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

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13 Dr. Eduardo Engel at the Yale University Department of Economics, and expert on highway PPPs, was kind enough to review this case study. Dr. Engel suggests that it is important not overemphasize the success of Transantiago, which has by no means a model for implementing an integrated public transportation system.
infrastructure improvement, including transportation systems. All PPP’s under the Concessions Law are BOT or DBOT in nature, and other government agencies wishing to pursue public-private infrastructure solutions can delegate MOP to lead such efforts (CCOP, 2011a). 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). Many of the initial highway PPP proposals were planned outside the rigorous evaluation process administered by SECTRA, however, which has complicated parallel efforts to better integrate metropolitan transportation policy and administration in the SMA (Zegras, 2006).

Rufián (2002) summarizes how the Chilean road concession program evolved as a response to circumstances within Chile in the late 1980s and early 1990s. She suggests that Chile faced a deficit in road infrastructure spending of approximately $6.25 billion, including $2 billion in metropolitan roadways, for which one estimate (albeit by a trade group representing the construction industry) pegged annual economic losses at $1.7 billion. The author explains that the objectives of the Chilean concession program were to leverage private funds to close funding gaps, improve the management and productivity of infrastructure investment, and decentralize production to a level whereby investment decisions could be better coordinated with user demand and direct payments for use; and the Coordinación General de Concesiones (Coordinator General of Concessions) was created within MOP to help implement this program.

In terms of project risks, Rufián (2002) explains that Government of Chile retains expropriation risk (if costs for land acquisition exceed contract estimates), some geological risk in construction, catastrophic risk, and environmental risks during pre-construction and construction. Commercial risks (revenue, demand, and network) are shared, as the Chilean Government guarantees a minimum level of revenues, while the concessionaire must evenly share revenues in the event that profits exceed a given threshold (Rufián, 2002).

Regarding the structuring of highway tolling and tendering, Gómez-Lobo and Hinojosa (2000) explain how MOP has basically taken much of the risk and responsibility related to rate setting out of the financial realm of concessionaires. According to the authors, MOP will set a range of toll pricing bands for highway concession contracts, with the bidders able to propose project tolls. MOP determines these bands on the basis of expected traffic flows such that tolls cannot be too low so as to reduce benefits to demand management, while rates cannot be too high so as to congest other corridor roadways. In general, the Government of Chile will guarantee incomes on each project up to 70% of official estimate costs. In return concessionaires must contribute 50% of all revenues once project IRR reaches 15%. Toll rates can increase by the rate of inflation and, in some cases, peak period toll increases are permitted. Up front concession “transaction” payments made by concessionaires to the Chilean Government, a criteria in some highway concession tenders, is deposited in the Fondo de Infraestructura (Infrastructure Fund) along with all revenue share payments. These funds are then used to support subsidies and income guarantees for other Chilean road concessions. Toll rates are often used as criteria for project selection, though the actual tender and evaluation process, as well as the level of subsidies and other government support, varies from project to project (Gómez-Lobo and Hinojosa, 2000).
In summary, Chilean transportation infrastructure policy is characterized by centralized decision-making, and informal coordination among various national agencies. SECTRA provides quantitative forecasting and social benefit-cost tools, and regional planning bodies help coordinate different types of national-level investment in metropolitan areas. Other than Transantiago, however, efforts at more formal coordination and devolution for transportation policy in the SMA have not materialized. It is inevitable that conflicts arise in implementing metropolitan transportation policies in the SMA due to oft-competing agency objectives and differences between national and local interests. Since the Government of Chile vests most institutional power for its concession program in MOP and outside of normal project procurement and evaluation processes, the risk for conflict is apparent. The next section explores this and other institutional factors in evaluating the Costanera Norte concession in the SMA.

5.5.2 Analysis of the Costanera Norte Concession

On February 24, 2000, The Chilean Government awarded a 30-year concession to the Sociedad Concessionaria Costanera Norte (SCCN) for the construction of 35 km, and upgrading of existing 7.4 km, of east-west highway through the heart of the SMA (See Figure 8). The Costanera Norte project would cost $384.4 million. Furthermore, the portions of the construction falling under SCCN’s responsibility would be financed with electronic tolling. The electronic toll system allows users to drive unimpeded through the highway system, with electronic equipment tracking usage in order to formulate charges. The system was also designed to be inter-operable with three additional planned, and now completed, SMA metropolitan concessions: the Norte-Sur (Autopista Central); Vespucio Sur (Ruta 78 – Av. Grecia); and Vespucio Norponiente (El Salto-Ruta 78) (CCOP, 2011b).

Figure 8: Map of the Costanera Norte

Source: CN, 2011
CEPAL (1999) explains that the Costanera Norte tender emerged after decades of planning and conflict. Proposals for an east-west highway through the SMA first surfaced as early as 1963. In 1995, the Chilean Government released the Plan de Desarrollo del Sistema de Transporte Urbano del Gran Santiago 1995-2010 (Greater Santiago Urban Transport System Development Plan 1995-2010) which included a proposal for the Costanera Norte as a concession that would be financed by user tolls. The highway also represents to some extent a compromise between MOP and SECTRA, the latter of which historically supported demand management solutions to urban mobility while the former supported capacity expansion to achieve these ends. In 1995, MOP initially forecast construction costs at $130 million for the Costanera Norte, which would serve 4,000 vehicles paying an average $0.05/km (CEPAL, 1999).

Initially tendered in 1996, Costanera Norte experienced multiple delays and escalating costs on account of various environmental and community impact conflicts before eventually being awarded at three times the cost of initial estimates. CEPAL (1999) summarizes these conflicts and the impacts on the initial project scope. First, community groups in the central parts of the city, especially Bellavista and Pedro de Valdivia Norte, though which the Costanera Norte was to be aligned, sued to stop the project. Though the lawsuit was unsuccessful, the community groups successfully petitioned COREMA, the regional environmental commission, to delay the project on the basis that the highway would adversely impact el Cerro San Cristóbal, a national park within the SMA and a symbol of pride among citizens. COREMA resolved the conflict by requiring the selection of an alternate route under initial consideration, which was actually less costly, and the inclusion of a number of environmental mitigation interventions. The second major conflict involved communities in the eastern suburban areas of Las Condes and Vitacura along the Eje Kennedy, a 7.4 km stretch of existing free highway included in the project. These communities objected to having to pay for use, resulting in the requirement for a payment to MINVU to cover the costs already invested, and an alignment of tolling portals so as to allow local residents to pass along certain segments for free (CEPAL, 1999).

According to CEPAL (1999), escalating project costs combined with substantial environmental mitigation (including the tunneling, trenching and covering several stretches of the new alignment), drove project costs to nearly three times the initial 1995 estimate of $130 million. To make the concession financially viable, MOP offered the option to purchase minimum income guarantees up to 80%, guarantees of up to 85% of lost tolls due to equipment failures, the opportunity to charge a peak hour premium, currency guarantees, and opportunities to earn revenues from ancillary activities (CEPAL, 1999). In 1999, the Chilean government re-issued the solicitation for Costanera Norte also offering $80 million in complimentary investment, producing multiple applicants, with Impregilo, 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 project was further enabled, with the help of a $75 million credit guarantee from the Inter-American Development Bank (IDB) (Zegras, 2006).

Table 15 summarizes the key factors for analyzing the Costanera Norte PPP, including formal institutional variables associated with transportation policy in the SMA; the governance institutional variables specific to the concession; and other elements of the spatial and political contexts. The next subsection of this chapter will then analyze the observable indicators for SMM defined in the methodology chapter.
<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>Expected Positive Effect on SMM</th>
</tr>
</thead>
<tbody>
<tr>
<td>National institutional structure - federalism</td>
<td>Federal democracy</td>
<td></td>
</tr>
<tr>
<td>Originator jurisdiction</td>
<td>Approximately equal to metropolitan scale</td>
<td></td>
</tr>
<tr>
<td>Originator administrative scope - transportation</td>
<td>All metropolitan transportation infrastructure</td>
<td>Y</td>
</tr>
<tr>
<td>Originator administrative scope - land use</td>
<td>Primary control of land use</td>
<td>P</td>
</tr>
<tr>
<td>Originator fiscal scope</td>
<td>Originator controls fiscal instruments to finance project</td>
<td>Y</td>
</tr>
<tr>
<td>Country experience - highway PPPs</td>
<td>Country has broad experience</td>
<td>Y</td>
</tr>
<tr>
<td>Project grantor experience - highway PPPs</td>
<td>Grantor has experience with highway PPPs</td>
<td>Y</td>
</tr>
<tr>
<td>Legal framework for PPPs - originator</td>
<td>Jurisdiction has general (not ad hoc) PPP legislation</td>
<td>Y</td>
</tr>
<tr>
<td>Use of public-sector comparator (PSC)</td>
<td>Uses PSC for PPP decision-making</td>
<td></td>
</tr>
<tr>
<td>Project evaluation</td>
<td>Follows traditional approach for highway evaluation</td>
<td></td>
</tr>
<tr>
<td>Competition and procurement</td>
<td>Competitive international procurement</td>
<td>Y</td>
</tr>
<tr>
<td>Policy risk (intentional)</td>
<td>Government policy risk (intentional)</td>
<td>Y</td>
</tr>
<tr>
<td>Land acquisition risk</td>
<td>Government land acquisition risk</td>
<td>Y</td>
</tr>
<tr>
<td>Network risk</td>
<td>Shared network risk</td>
<td></td>
</tr>
<tr>
<td>Demand/revenue risk (excluding network risk)</td>
<td>Shared or private with government network risk</td>
<td>Y</td>
</tr>
<tr>
<td>Authority for pricing</td>
<td>Private sector has flexibility to raise and lower tolls</td>
<td>P</td>
</tr>
<tr>
<td>Regulating Tolls</td>
<td>Government has regulatory authority over toll rates</td>
<td>Y</td>
</tr>
<tr>
<td>Mechanism for sharing in upside of roadway improvements</td>
<td>Revenue sharing if projects exceed IRR</td>
<td>Y</td>
</tr>
<tr>
<td>Contractual guarantees/support of revenues or profitability</td>
<td>Yes, if project scope is not self-financing</td>
<td>Y</td>
</tr>
<tr>
<td>Renegotiations</td>
<td>Scope and process outlined in contract</td>
<td>Y</td>
</tr>
<tr>
<td>Maturity of asset</td>
<td>Includes existing roadways (brownfield)</td>
<td>P</td>
</tr>
<tr>
<td>Project alignment - central city</td>
<td>Aligned through metropolitan center</td>
<td>Y</td>
</tr>
<tr>
<td>Primary motivation of PPP</td>
<td>Service-oriented (value-for-money)</td>
<td></td>
</tr>
<tr>
<td>Degree of political/philosophical motivation</td>
<td>Project follows established/evolving PPP framework</td>
<td>Y</td>
</tr>
</tbody>
</table>

Notes: “Y” = Fulfilled “P” = Partial Fulfillment; Otherwise Non-Fulfillment; “Originator” refers to the entity with ultimate legal authority (i.e., Government of Chile) and “Grantor” refers to the body delegated such responsibilities (i.e., MOP)
Overall, the concession has achieved commercial success. 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, SCCN, which purchased the rights to the Costanera Norte Concession in 2006 (SCCN, 2010b). Demand grew rapidly in the first few years of operation, held steady during the world financial crisis in 2008 and 2009, and registered 6.6% year-over-year growth in 2010 (188.16 million total users) as Chile emerged from recession (SCCN, 2010b). SCCN reports a net profit of $24.2 in 2010 after taking in $20.7 million in 2009, and the concession has accumulated about $69.7 million in earnings since commencing operations. Due to this performance, SCCN recently dropped its bond insurance guarantees in return of offering bondholders a slightly higher interest rate (SCCN, 2010a).

The implementation of variable electronic tolling is a positive step towards financing SMM, but the Concession has not fully-achieved optimal pricing as a signal for use. For example, SCCN may charge a tarifa de saturación (saturation tariff) to help manage peak-hour traffic. However, it is widely perceived that the tarifa has been applied to increase profits for the concessionaire rather than to contribute to corridor-wide congestion management and, necessarily, investments aimed at mitigating said congestion effects (Zegras, 2006). Furthermore, CEPAL (1999) suggests that the charging structure on the Eje Kennedy could lead to congested nearby roads, with users trying to avoid tolls, and thus reducing social benefits.

The variable electronic user-fee based system makes strides in rationalizing highway investment with revenues from pricing, however, the level of government subsidies calls into question the net social benefit of development. Engel et al. (2000) criticize the procurement process, suggesting that necessary changes in initial scope to mitigate environmental risks and satisfy community concerns increased project costs to the point where most private-sector bidders did not believe that the Costanera Norte would be financially viable. To enhance financial appeal to the private sector, the Government of Chile ended up agreeing to guarantee higher levels of revenue (in return for government benefit of potential financial upside) and invest $80 million in complimentary bridges, water, and park works. The authors suggest that the procurement process may actually have succeeded in detecting a “White Elephant,” or a project whose social costs exceeded the benefits of implementation. However, the government likely considered the increased cost a failure of the political process rather than a lack of value for the Costanera Norte project itself (Engel et al., 2000). Other estimates suggest that the government ended up covering much more than the initial $80 million in subsidies to make the project financially viable, including substantial unanticipated costs for land acquisition due to realignments and other changes to project scope (Quijada, Personal Communication, 2011).

From the standpoint of integration, the Government of Chile retains the flexibility to enact integrated corridor transportation policies, as the contract allows for renegotiations to enable new joint corridor investments. This flexibility is a double-edged sword, however, as investment decisions are based on government priorities, not necessarily improvements “informed” by the pricing regime. Normally, the government directly
reimburses the concessionaire for implementing complimentary investments. As of the end of 2010, MOP had negotiated six changes to the Costanera concession, and is currently working on proposing another set of corridor investments (SCCN, 2010b). Engel et al. (2008) and Zegras (2006) find fault with the excessive number of renegotiations, as they occur outside the normal project evaluation process leading to little transparency in ensuring the social value of investment decisions.

The initial 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 and, hence, the overall social value of this investment. Given the fact that development of the Costanera Norte through the heart of Santiago would have profound consequences for the environment and directly impact 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. MOP’s pursuit of this complex investment outside Chile’s normal project evaluation process led to an initial tender that overlooked substantial costs of environmental and community impact mitigation that, when revealed, challenged the market feasibility of this investment without government subsidy and guarantees. While MOP did ultimately change the alignment of the Costanera Norte and included environmental mitigation measures, it did so only after the relentless opposition by local communities and the intervention of the judiciary. Ultimately community groups would have a strong voice in the process, resulting in an investment program more acceptable to stakeholders. Had MOP followed the normal project evaluation process, or at least negotiated early and in good faith with stakeholders during project preparation, it might have been possible to deliver the project faster and, potentially, at a lower financial cost.

The question of whether or not the Costanera Norte concession actually represented a socially desirable investment is further clouded by a lack of transparency in evaluation. Before soliciting the second (1999) tender, MOP commissioned an economic evaluation of the Costanera Norte proposal, which concluded that the project would deliver a 21% social return on investment (Fernández & De Cea, 1999). However, since this analysis was commissioned by MOP, it did not receive the typical scrutiny through normal bureaucratic channels as other Chilean infrastructure investment, nor did this analysis include a number of the additional costs borne by the Government of Chile to consummate the deal (Quijada, 2011, Personal Communication).

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). In fact, there are now a number of different toll concessions in the SMA (CCOP, 2011a), and tolling technology is inter-operable. However, electronic distance-based tolling is still currently limited to PPP highway segments, whose pricing is determined by contract rather than by optimal system management.
5.5.3 Conclusions from the Costanera Norte Concession

Table 16 summarizes the institutional context of the Costanera Norte PPP. Overall, the Costanera Norte fulfills many of the key elements of the SMM framework, but is challenged to achieve optimal pricing and only partially fulfills many indicators once on considers the larger inter-modal transportation system and broader societal goals.

The Costanera Norte succeeds not only in introducing road pricing for metropolitan highway infrastructure, but also peak hour charging (i.e., the tarifa de saturación) to help optimize traffic flow on the asset. However, “optimization” in this case seeks to achieve a balance of faster travel times and profit maximization. Furthermore, while the tolling regime varies crudely with demand, it is not demand responsive in a dynamic sense.

Table 16: SMM Performance Indicators: Costanera Norte, Santiago

<table>
<thead>
<tr>
<th>Objective</th>
<th>Performance Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pricing Optimizes Traffic Flow on Asset</td>
<td>Introduces road pricing</td>
</tr>
<tr>
<td></td>
<td>Time-variant pricing</td>
</tr>
<tr>
<td></td>
<td>Variable pricing based on marginal costs</td>
</tr>
<tr>
<td>Project-Oriented Productive Efficiency</td>
<td>Bundles construction and operations &amp; management</td>
</tr>
<tr>
<td></td>
<td>Implements LCC management for entire project scope</td>
</tr>
<tr>
<td></td>
<td>“Revealed” demand sufficient to justify capacity availability</td>
</tr>
<tr>
<td></td>
<td>User fee revenues meet expectation</td>
</tr>
<tr>
<td></td>
<td>Evidence of efficient re-investing/re-distributing excess revenues</td>
</tr>
<tr>
<td>Efficiency of Investment for Transportation System</td>
<td>Asset planned as part of broader highway/road network</td>
</tr>
<tr>
<td></td>
<td>Ability to manage corridor as an inter-modal transportation system</td>
</tr>
<tr>
<td></td>
<td>Evidence of mutually-beneficial renegotiations/contract changes</td>
</tr>
<tr>
<td></td>
<td>Evidence of project meeting corridor mobility objectives</td>
</tr>
<tr>
<td></td>
<td>Evidence that project represented best-known transport alternative</td>
</tr>
<tr>
<td>Investment Supports Societal Goals</td>
<td>Consistent with plan and/or ex ante economic evaluation</td>
</tr>
<tr>
<td></td>
<td>Public acceptability of electronic tolling</td>
</tr>
<tr>
<td></td>
<td>Long-term, stable relationship between public and private partners</td>
</tr>
<tr>
<td></td>
<td>Broad stakeholder perception of fairness and equity of project &amp; contract</td>
</tr>
</tbody>
</table>

“Y” = Fulfilled “P” = Partial Fulfillment; Otherwise Non-Fulfillment

The Costanera Norte PPP structure also achieves a high level of project-oriented productive efficiency. By bundling investment with long-term maintenance, management, and operation, the highway should benefit from minimizing life-cycle costs. Furthermore, SCCN financial reports suggest achievement of demand and revenue expectations. Despite delays in securing stakeholder support and false starts with respect to procurement that threatened the viability of the project, the end product has meet commercial objectives. While the concession contract does require sharing of revenues in excess of a concessionaire IRR threshold, it is too early to tell if such a scenario will
occur and whether or not the government will employ those resources in the most efficient manner to manage corridor mobility.

Regarding the efficiency of investment and procurement from a metropolitan inter-modal transportation management perspective, the Costanera Norte in theory enables the Government of Chile to maintain flexibility for integrated corridor mobility policy. While the highway is mostly well integrated in the larger road system, however, it is less clear how the Costanera Norte fits into the larger scheme, led by Transantiago, for improving urban public transit. There is little question that the contract mechanisms enable collaboration between the grantor and concessionaire in delivering corridor mobility. This is evidenced by six different renegotiations, whereby the SCCN has made subsequent investments in the Costanera Norte network in exchange for negotiated compensation. Whether or not these renegotiations and reinvestments meet corridor mobility objectives, however, is less clear. Not only does MOP tender concessions outside the normal planning process, renegotiations are largely at the Ministry's discretion, which calls into question the degree to which integrated decision-making actually occurs within the Government of Chile for highway PPP programs. On the other hand, the political and spatial context of the Costanera Norte proposal drew many stakeholders into the process of project evaluation, including other government ministries and community groups, resulting in realignment of the highway through a less-environmentally sensitive area and, ironically, reducing costs for that particular segment.

While the Costanera Norte concession appears to have delivered on some degree of societal goals, negative perceptions of equity and fairness on the part of some stakeholders challenge greater realization of this objective. When one considers the final tender, the project has delivered according to plan and commercial expectations. Acquisitions of transponders continue to increase within the SMA, metropolitan highway pricing has become integrated and institutionalized, and SCCN and MOP seem to have a strong relationship, which should bode well for inevitable, unforeseeable, and changing policy needs. The Costanera Norte might have better coordinated pricing and congestion mitigation, however, within a larger planning framework. The backlash against the project among affected communities demonstrates that public acceptability of a PPP investment will be challenged when normal processes for project evaluation (even if flawed) are subverted. Furthermore, the lack of transparency in renegotiations may lead to less-than-optimal decisions on capacity enhancement that should otherwise be determined by cost-benefit analyses subject to the same scrutiny of other public infrastructure investment proposals. Due to this lack of transparency, it is difficult to judge whether or not renegotiations have supported societal goals.
It also bears mention that spatial factors, which initially seemed to serve as barriers to project implementation, may have ultimately worked to mitigate some of the political challenges to SMM. While MOP is technically one of several major players involved with transportation policy in the SMA, its administrative and fiscal powers in transportation infrastructure provision, and especially concession programs, dwarfs those of other entities responsible for various aspects of mobility and land use in the SMA. This could potentially lead to a situation where broader social goals for transportation investment, such as Transantiago’s vision of public transportation integration and the integrated transportation and land use plan suggested by PTUS, become secondary to MOP’s more narrow institutional objectives. However, the alignment of the Costanera Norte through the dense center of Santiago forced MOP and, ultimately, SCCN to confront many of the complex interactions between the highway, the wider transportation network, and broader metropolitan social, political, and environmental systems. The result was a project that more approximately matches the objectives a broader set of stakeholders, yet at the same time meets the financial and operational objectives of MOP and the concessionaire. The project price tag might have grown greatly, but at least the process helped reveal the real economic costs of the project.
5.6 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 Douro Litoral concession involves the dual use of BOT and M&O contract types within the same agreement, with revenues from tolled portions of 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 structure for SMM.

5.6.1 Analysis of Institutional Context for the Douro Litoral Concession

The Portuguese system of government is best classified as a unitary democracy (Inman, 2007), as the national government (Government of Portugal) dominates Portuguese political life, including the transportation sector. The national government plans, executes, and regulates all aspects of transportation policy, regardless of whether they are inter-urban or metropolitan in nature, except for local roads and some transit. The Government of Portugal has embarked upon an aggressive program for entering into various PPPs for the finance, provision, and operation of the national system of highways; including, increasingly, networks of metropolitan highways.

Nelson (2008) summarizes transportation institutions in the Portuguese Government. Overall transportation planning, administration, and regulation falls under the Ministério das Obras Públicas Transportes e Comunicações (Ministry of Public Works, Transportation, and Communications, MOPTC). Under MOPTC, Estradas de Portugal (Portuguese Roadways, EP) was historically responsible for highway development, operation, and maintenance, including oversight of concessions. EP, like most government agencies responsible for financing, developing, and managing infrastructure in Portugal; was historically organized as a state-owned enterprise. The Portuguese Government, however, passed legislation in 2005 to restructure Portugal’s 83 state-owned-enterprises (spanning many sectors including transportation) and the way national infrastructure is financed. Fully implemented in 2007, the reorganization led to both the quasi-privatization of EP14 and the creation of an independent roadway regulator under MOPTC, the Instituto Nacional de Infraestructuras Rodoviarias (National Institute for Roadway Infrastructure, INIR). INIR is now responsible for overseeing both EP as well as existing and future roadway concessions signed with private firms. EP’s roadway portfolio is now technically considered a single roadway concession between the company and the Portuguese Government. EP retains, however, the authority to tender roadways in its portfolio to private-sector bidders, though these future concessions will be considered “sub-concessions” of EP rather than direct PPPs with the Portuguese Government (Nelson, 2008).

Nunes Silva (2009) summarizes the Portuguese Government’s recent efforts to devolve greater authority to sub-national institutional structures with the intent of shifting greater responsibility

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14 A state-owned enterprise, 100% owned by the state, but with an independent board and reliant on own-source revenues.
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's requirement for 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).

Metropolitan transportation authorities, for Lisbon and Porto, were first empowered under a 2003 law which was never fully implemented. That law was superseded by new legislation, ratified in January 2009, creating Autoridades Metropolitanas de Transportes (AMT) for Lisbon and Porto. The AMTs are to be primarily responsible for coordinating public transit among municipalities within their respective districts. Among the AMTs' responsibilities will be facilitating and approving Urban Mobility Plans and Operational Transport Plans; projecting demand and finance needs of the public transport sector; working with municipalities to coordinate funding; making recommendations to appropriate Government of Portugal authorities on public transportation fares as well as investments in other modes of transportation; and, in some limited cases, to receiving revenues and/or generating revenues for programs (Assembleia da República, 2009). While legally “existing,” functionally the AMTs remain dormant. All individuals contributing to this case study report, spanning government officials, infrastructure concessionaries, and academics, seem to believe that, while well intentioned, the AMTs will have little power without funding, and little scope over roadways.

Regarding transportation finance, the link between roadway revenues and expenditures in Portugal is, at best, indirect. Dunn (2010) summarizes revenue flows and finance in the country. Transportation infrastructure has traditionally been financed through state-owned enterprises, which were funded by a mix of general revenues from a wide variety of indirect sources (value added taxes, income taxes, etc.) and direct receipts from concession, farebox, and other user-fee sources. When in 2007 the Portuguese Government privatized, at least in theory, much of the state-owned-enterprise sector, it also devolved greater administrative and fiscal responsibilities, including greater authority to raise revenue. The goal is for state-owned enterprises to become financially self-sustaining through user fees, issuing debt, and public-private concession payments. As part of the 2007 reorganization, however, the Portuguese Government agreed to dedicate about 15% of all fuel tax revenues to EP (Dunn, 2010). According to the 2010 national budget, of the €3 billion in petroleum product taxes the Government of Portugal expected to receive, €555 would be dedicated to EP. Referred to as the Contribuição de Serviço Rodoviário (Contribution to Roadway Services), this payment is not considered a subsidy but rather a

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15 Special thanks to Vladimir Fernandes Maciel of Universidad de São Paulo for help with translation.
16 For this report, I spoke with Federico Lobato Melo and George Lopes with Brisa, Rui Manteigas with EP, and Alberto Moreno and Rui Soares with InIR. I also received guidance on understanding Portuguese transportation institutions from Dr. José M. Viegas and Dr. Rosário Macário at Instituto Superior Técnico in Lisbon.
concession payment from the government. EP funds operations with a mix of this contribution and sub-concession payments (MFAP, 2010).

The first PPP for financing highways in Portugal occurred in the 1970s, but PPPs accelerated in the 1990s with the Portuguese Government looking to the private sector as a means of providing newer and higher-quality internal transportation for economic development while maintaining relative fiscal austerity, both policies prioritized for EU market convergence (Fernandes and Viegas, 1999). The Government of Portugal’s foray into roadway concessions began in 1972 with the development of 390 km of inter-urban toll highway under a DBFO contract with Brisa. Brisa, which had initially been established in 1972 as a private entity, was essentially nationalized in 1974 but privatized again in the 1990s (Fernandes and Viegas, 2005). The Brisa concession today includes 12 inter-urban highways spanning 1,100 km throughout Portugal, and the now-renegotiated contract is set to expire in 2035 (Brisa, 2010). In the 1990’s the Portuguese Government tendered a series of PPPs to complete a planned system of national highway and complimentary regional highways, the most financially viable of which would be governed by real tolls. Less profitable links that were deemed important for territorial cohesion, intended mostly for more rural areas, would be financed with shadow tolls. Unfortunately, the shadow toll schemes resulted in large liabilities for the Portuguese Government, prompting various attempts to restructure the shadow toll roads as real toll PPPs (Fernandes and Viegas, 2005). As of today, there are 15 highway concessions held between the Portuguese Government and private firms, plus the EP concession with the Portuguese Government, plus seven additional EP sub-concessions to private firms, and all shadow toll schemes have either been or are scheduled to be converted to real tolls by 2011 (Moreno, 2011).

Monteiro (2005) reviews Portuguese application of PPPs for infrastructure and services. The author finds that PPPs have generally delivered infrastructure faster and of higher quality than traditional procurement, but that these projects have not necessarily produced the most economically efficient solutions. Institutional weaknesses include lack of a long-term perspective on budget implications, lack of government experience managing long-term contracts, and other issues of inefficient project evaluation and contract design. Monteiro (2005) suggests that positive developments include the creation in 2003 of a general legal authority for PPPs and adoption of a more rigorous process for project evaluation (including public sector comparators17), and the creation of Parpública, a central government knowledge center for PPPs.

The Portuguese Government’s quasi-privatization of the state-owned-enterprise sector and aggressive efforts at leveraging private finance for roadway infrastructure development may complicate parallel efforts, such as the AMT Law, to structure more integrated regional approaches to transportation policy and to improve the stability of finances within the sector. Dunn (2010) suggests that the reorganization and semi-privatization of the state-owned-enterprise sector in Portugal could further entrench uni-modal decision-making, as infrastructure investment migrates off of the national budget and onto modally oriented individual accounts. He suggests that more efficient outcomes occur where there is competition between different modes for the use of scarce resources, but that the emerging framework could incentivize greater modal-

17 Dr. Macário suggests PSCs are still not generally used for road PPPs.
centric decision-making on investment (Dunn, 2010). Nelson (2008) and Zegras et al. (2010) express concern that Portugal failed to adequately evaluate benefits and liabilities in its aggressive pursuit of highway finance, causing higher-than-expected government costs. The authors suggest that high levels of off-the-books debt generated by the state-owned enterprise sector, coupled with historically soft budgets and implicit government guarantees, could complicate the sustainability of Portuguese transportation infrastructure finance.

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, many weaknesses remain. With regard to fiscal federalism and institutional structure, lower levels of government do not have sufficient administrative and fiscal autonomy to manage metropolitan transportation policy. The use of PPPs has supported the application of user-pay principles to finance infrastructure, however, the semi-privatization of SEEs has complicated any attempt to foster greater inter-modal investment decision-making. The Douro Litoral concession offers a recent case where both the objective for promoting user-based infrastructure finance and the objective for designing a more systems-oriented network management approach to infrastructure investment intersect. The Portuguese Government adopted a thoughtful and practical approach to reconciling these objectives, however, the initial results are not encouraging.

5.6.2 Analysis of the Douro Litoral Concession

The Douro Litoral concession represents a new approach to incorporating a metropolitan network perspective on a highway toll concession project by bundling a number of key highway links into an area-wide program scope. First, the concession includes a 27-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 and several near-in radial links (Government of Portugal and AEDL, 2007). Figure 9 illustrates the alignment of the Douro Litoral Concession.

The Douro Litoral concession was awarded in 2007 to Auto-estradas do Douro Litoral (AEDL), a single-purpose entity that is 45% owned by Brisa and will be operated and managed by Brisa O&M, a branch of Brisa specializing in operations and management of toll highways. AEDL covers all costs associated with both projects with user fees that will be collected electronically on tolled segments of the three inter-urban BOTs. The project includes 76 km of new BOT highway segments under the 27-year BOT arrangement, as well as 53 km of inner-Porto highway segments under the 5-year M&O contract. The expected level of total private investment is €1 billion, with most construction of BOT segments to be completed by the end of 2011 (Brisa, 2011). In its winning bid, AEDL agreed to pay the Portuguese Government €207 million for the rights associated with the concession (Brisa, 2009).
Table 17 summarizes the key factors for analyzing the Douro Litoral PPP, including formal institutional variables associated with transportation policy in Metropolitan Porto; the governance institutional variables specific to the concession; and other elements of the spatial and political contexts. The next subsection of this chapter will then analyze the observable “output” metrics defined in the methodology chapter.

While the Douro Litoral Concession includes electronic user-fee pricing for some segments of the highway, tolling policies do not support the SMM goal for efficient pricing to optimize use. First, the contract establishes a maximum toll for those portions of the network subject to direct user fees, with annual adjustments for inflation. No congestion charges are permitted, though variable tolling is allowed up to the maximum toll rate (Government of Portugal and AEDL, 2007). The maximum tolls are set by the Ministério das Finanças e da Administração Pública (Ministry of Finance and Public Administration, MFAP) and are uniform for all concession projects throughout the entire country (Manteigas, EP, Personal Communication, 2010). Therefore, prices do not reflect local conditions. Furthermore, the lack of congestion pricing eliminates a potential tool for demand management of inner-metropolitan highways in Porto. Instead, highways in inner-Porto will likely remain highly-congested during peak periods, while users of BOT segments could be over-charged.
<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>Expected Positive Effect on SMM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structure of Transportation Institutions</strong></td>
<td>National institutional structure - federalism</td>
<td>Federal democracy</td>
</tr>
<tr>
<td></td>
<td>Originator jurisdiction</td>
<td>Approximately equal to metropolitan scale</td>
</tr>
<tr>
<td></td>
<td>Originator administrative scope - transportation</td>
<td>All metropolitan transportation infrastructure</td>
</tr>
<tr>
<td></td>
<td>Originator administrative scope - land use</td>
<td>Primary control of land use</td>
</tr>
<tr>
<td></td>
<td>Originator fiscal scope</td>
<td>Originator controls fiscal instruments to finance project</td>
</tr>
<tr>
<td><strong>Country experience - highway PPPs</strong></td>
<td>Country has broad experience</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Project grantor experience - highway PPPs</strong></td>
<td>Grantor has experience with highway PPPs</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Legal framework for PPPs - originator</strong></td>
<td>Jurisdiction has general (not ad hoc) PPP legislation</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Use of public-sector comparator (PSC)</strong></td>
<td>Uses PSC for PPP decision-making</td>
<td>P</td>
</tr>
<tr>
<td><strong>Project evaluation</strong></td>
<td>Follows traditional approach for highway evaluation</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Competition and procurement</strong></td>
<td>Competitive international procurement</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Policy risk (intentional)</strong></td>
<td>Government policy risk (intentional)</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Land acquisition risk</strong></td>
<td>Government land acquisition risk</td>
<td>P</td>
</tr>
<tr>
<td><strong>Network risk</strong></td>
<td>Shared network risk</td>
<td>P</td>
</tr>
<tr>
<td><strong>Demand/revenue risk (excluding network risk)</strong></td>
<td>Shared or private with government network risk</td>
<td></td>
</tr>
<tr>
<td><strong>Authority for pricing</strong></td>
<td>Private sector has flexibility to raise and lower tolls</td>
<td>P</td>
</tr>
<tr>
<td><strong>Regulating Tolls</strong></td>
<td>Government has regulatory authority over toll rates</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Mechanism for sharing in upside of roadway improvements</strong></td>
<td>Revenue sharing if projects exceed IRR</td>
<td>P</td>
</tr>
<tr>
<td><strong>Contractual guarantees/support of revenues or profitability</strong></td>
<td>Yes, if project scope is not self-financing</td>
<td></td>
</tr>
<tr>
<td><strong>Renegotiations</strong></td>
<td>Scope and process outlined in contract</td>
<td></td>
</tr>
<tr>
<td><strong>Maturity of asset</strong></td>
<td>Includes existing roadways (brownfield)</td>
<td>P</td>
</tr>
<tr>
<td><strong>Project alignment - central city</strong></td>
<td>Aligned through metropolitan center</td>
<td>P</td>
</tr>
<tr>
<td><strong>Primary motivation of PPP</strong></td>
<td>Service-oriented (value-for-money)</td>
<td></td>
</tr>
<tr>
<td><strong>Degree of political/philosophical motivation</strong></td>
<td>Project follows established/evolving PPP framework</td>
<td>Y</td>
</tr>
</tbody>
</table>

"Y" = Fulfilled  "P"=Partial Fulfillment; Otherwise Non-Fulfillment; Note: "Originator" refers to the entity with ultimate legal authority (i.e., the Government of Portugal) and "Grantor" refers to the body delegated such responsibilities (i.e., EP)
From the perspective of linking pricing and regulation with investment, the Douro Litoral concession continues the Portuguese Government’s commitment to applying tolling as a means of financing highway expansion. Additionally, the contract does require capacity expansion should certain demand thresholds be reached (Government of Portugal and AEDL, 2007). Therefore, there is an attempt by the Government of Portugal to link revenues of potentially higher-than-expected usage of tolled segments directly to additional roadway investment.

Since pricing is set by contract and since many portions are in fact un-tolled, however, projected revenues do not provide a clear economic signal for optimal levels of capacity improvements, with potential consequences for both the public and AEDL. The concession contract includes a Base Case of expected financial performance, whereby AEDL and the Portuguese Government specify operational and financial expectations. The Base Case anticipates a positive internal return on investment, suggesting recovery of all construction, operation, and maintenance costs for construction and rehabilitation projects; including costs associated with upgrades of the M&O segments (Government of Portugal and AEDL, 2007). Therefore, rather than prices revealing socially-optimal investment, the entire program is pre-specified, with pricing policies established by uniform national standards. The connection between the actual cost of segments of the road network and actual prices is distorted, with travelers in often-congested inner-urban portions paying no direct user fees (only indirect fuel taxes), while being subsidized by drivers connecting from the metropolitan core to the inter-urban network.

One of the primary risks of potentially over-charging users of BOT segments to cross-subsidize inner-metropolitan highway users in Porto is that such an arrangement could threaten the financial stability of AEDL’s investment if overpriced radial segments do not generate sufficient demand and, hence, revenues. Alternatively, one could argue that if pricing is set too high, and demand does not materialize, then the current program includes more capacity expansion than required. Irrespective of pricing, AEDL has already adjusted downward its 2006 Base Case traffic forecasts upon which the concession contract was negotiated, though this is probably more attributable to the world financial crisis than the lack of performance or capacity of the concessionaire (Manteigas, Personal Communication, 2010). Brisa has booked approximately €140 million in liabilities over the past two tax reporting years to account for changes in expected losses for its investment in the AEDL concession (Brisa, 2011).

With regard to integrating the Douro Litoral within a larger metropolitan transportation and land use framework, the PPP is a step in the right direction in terms of accounting for some network externalities in highway investment and management. Notwithstanding the previously described economic inefficiencies of the pricing and investment plan, inclusion of a network of metropolitan highways under a single contract should, in theory, incentivize AEDL to consider long-term, whole-system impacts in optimizing investment while also internalizing economies of scale. However, the M&O portion of the contract will last only five years, which is probably insufficient to fully reap the economic benefits of this approach. The fact is AEDL reluctantly accepted the un-tolled network portion of the Douro Litoral Concession under the five-year M&O portion of the concession contract largely because local economies of scale in management and
operation from Brisa’s larger portfolio of urban and inter-urban concessions in the Porto Metropolitan Area made the concession financially attractive. Brisa considers the M&O segments to be a financial stress adding risk to the overall project scope, but feels that this was a necessary cost of business for the opportunity to benefit from operating the larger area network (Lobato Melo, Brisa, Personal Communication, 2010).

While Government of Portugal and AEDL both envisioned network benefits to bundling multiple segments, the Douro Litoral concession offers mixed results in terms of integrating system investment and management from a “metropolitan” perspective. First, according to Brisa, four different concessions cover different areas of the highway network that traverse parts of the Porto Metropolitan area. Brisa suggests that the opportunity to apply a region-wide perspective under a single contract has, thus, already been missed (Lobato Melo, Brisa, Personal Communication, 2010). The other three highway concessions in the Porto area are, however, generally inter-urban stretches that are geographically further from the center of Porto than those segments corresponding to the Douro Litoral (APCAP, 2011). Therefore, the concept of what constitutes efficient management of regional network may differ depending upon how one defines the scope of a region. AEDL has exclusive control over all toll motorways and much of the complimentary highway infrastructure that can be easily classified as “metropolitan.” However, Brisa suggests that efficient and integrated highway network investment and management have a much larger scope.

Second, the inclusion of a “restoration of financial balance” clause in the Douro Litoral concession contract provides a mechanism for the public sector to retain authority to implement integrated metropolitan transportation plans while compensating AEDL for adverse financial impacts. The contract explicitly excludes environmental and tax law changes, but does leave open the possibility for claims to be made for “[l]egal legislative modifications of a specific nature which impact directly on the revenues and costs concerning activities under concession.” (Government of Portugal and AEDL, 2007). This vague language subjects the Portuguese Government to potentially onerous financial risks so that potentially beneficial policies that might generate claims for restoration of financial balance might be deferred. Furthermore, the Portuguese Government retains this liability for risks that it does not completely control, as municipalities have flexibility to implement policies aimed at local mobility which could trigger claims on the national government (Moreno and Soares, InIR, Personal Communication, 2011).

A third complication with integration of public and private sector objectives is the changing nature of Portuguese transportation institutions, which affects the private-sector roadway concessionaires’ understandings and assumptions regarding relationships with the Portuguese Government. In the past, the Portuguese Government has taken an active role in renegotiating contracts with private-sector concessionaries, generally on an ad hoc basis, either when the need for public interventions adversely affected the contract or when financial troubles warranted help for a project (Manteigas, Personal Communication, 2010). Officials at InIR suggest that, in the future, it will only seek to renegotiate PPP contracts if it can be demonstrated that net benefits to the public will not be sacrificed (Moreno and Soares, InIR, Personal Communication, 2011). Therefore, it is unclear what will happen in the case where a highway concession is financially
distressed, but proposed renegotiations do not meet the standards established by InIR. Social welfare would likely be adversely affected in either case, whether by the potential degradation of service of a failing concession or via unfavorable financial renegotiations for the government.

Fourth, while the Douro Litoral concession attempts to treat all roadway segments therein as a network and apply private-sector expertise to support efficient system-wide life-cycle cost solutions, the length of the M&O portion is insufficient for these purposes. The grantor’s original intention was to include the M&O portion of the contract throughout the length of the BOT contract, but MFAP determined that this would make the project financially unsustainable. The M&O segment was thus reduced to only 5-years (Manteigas, Personal Communication, 2010; Moreno and Soares, Personal Communication, 2011). Thus, the potential for leveraging the private partner’s expertise towards long-term life-cycle-cost management of the M&O segments will not likely be fulfilled.

Lastly, the extent to which risk allocation approaches optimality remains unclear, with numerous problems emerging that complicate efforts at successful integration of public and private interests. On the positive side, the Government shares in potential “upside,” as AEDL must add capacity to BOT segments if demand thresholds are reached, and the concessionaire must share increased financial returns from future refinancing or if the government passes future legislation that allows the concessionaire new revenue-raising opportunities. Furthermore, the “restoration of financial balance,” however inconvenient for policy makers, protects AEDL from some policy risks and networks risks—although it is not entirely clear which types of claims would be valid under the broad framework established in the concession contract—while monetizing the “real” costs of government interventions. The allocation of all demand and revenue risk to the private sector coincides with all revenues being collected and owned by the concessionaire, however, and AEDL has no incentive (nor authority) to invest those resources in any alternative other than those required in the concession contract. This ties the hands of policymakers in terms of directing revenues from user fees to future alternatives potentially offering a higher social return on investment for metropolitan mobility, such as public transit infrastructure. Furthermore, AEDL is responsible for administering expropriations, although the Portuguese Government is responsible for the costs (Government of Portugal and AEDL, 2007). It is debatable whether administering expropriations is a task for which private-sector leadership is appropriate. Even though the direct financial risks are not held by AEDL, any resulting unanticipated project delays could affect the project.

From the standpoint of delivering on a broad range of social policies and engendering public acceptability, the Douro Litoral project has been a qualified success. There has been limited public backlash because there will be no tolls on existing roads, and there have been few environmental concerns raised, and only a “normal” level of complaints about maintenance (Moreno and Soares, Personal Communication, 2011). Also contributing to this outcome is the fact that the Portuguese Government spent years studying potential alignments of the new roadways proposed for the Douro Litoral concession, including environmental impact analyses, public outreach, and negotiation with municipalities (Manteigas, Personal Communication, 2010). Rigorous economic and
financial analyses (KPMG, 2009; Central Banco de Investimento, 2003) appear to have confirmed, at least *ex ante*, the overall social benefits of the project. The aforementioned 2009 KPMG benefit-cost study considered benefits such as reductions in travel time, emissions, roadway incidents, and petroleum consumption; induced new permanent employment; toll receipts (from induced traffic only); and indirect benefits to the economy from increasing roadway access to markets and increased economies of agglomeration. The study calculated a benefit-cost ratio of 1.69, and an expected IRR of 10.2% (KPMG, 2009).

While the Government of Portugal appears to have helped garner public support for the Douro Litoral project through its project evaluation and environmental review processes, the resulting project scope left little flexibility for potential improvements. A project manager at Brisa suggests that there are more efficient alternatives to the specified alignment of the Douro Litoral project, and that engagement of potential roadway concessionaires from the onset of planning could have led to solutions beneficial to both the private and the public (Lobato Melo, Personal Communication, 2010).

Finally, collection of tolls on the Douro Litoral is facilitated by technical integration. The Via Verde electronic toll system, which is 60% owned by Brisa, allows road users to drive non-stop through any stretch of tolled roadway (plus bridges, tunnels, and some parking), while radio-based transmitters tally user-fee charges, which are latter billed to owners. The system is interoperable on all tolled roadway concessions (Brisa, 2011), therefore the possibilities for extending Via Verde to wider metropolitan road charging appear feasible. However, road pricing has not been adopted on highway segments closer to the center of Porto, or on local roads.

5.6.3 *Conclusions from the Douro Litoral Concession*

Table 18 summarizes the performance of the Douro Litoral relative to the SMM framework. The Douro Litoral’s pricing policies and overall structure will not likely lend to optimal flow of traffic on the relevant assets, and a number of inefficiencies in the contract structure affect not only the productive long-term management of the asset but also potentially its commercial viability. The concession does demonstrate achievement of some indicators of allocative efficiency as a transportation system investment and at least partially meets broad societal goals for metropolitan area mobility.

The Douro Litoral concession provides a window for understanding the challenges of implementing both economically efficient and socially desirable metropolitan highway infrastructure at a metropolitan scale. The Portuguese Government sought to leverage what it expected to be high financial returns from increasing toll road capacity in outer areas of the Porto Metropolitan Area to make improvements to congested and politically-difficult-to-toll inner-urban highway segments. The result, however, is a program that will not likely impact the current trends in increased inner-urban roadway use and congestion, while adversely affecting the financial feasibility of commercially risky greenfield development.
The Douro Litoral concession helps reveal some of the weaknesses of Portuguese institutional structures for financing and administering transportation infrastructure investment and management programs with respect to SMM. First, highway investment programs reflect, generally, national priorities. While the Douro Litoral PPP did not necessarily provoke local backlash, it also failed to substantially improve a critical concern of metropolitan travelers: roadway congestion. The Douro Litoral concession offers residents of Metropolitan Porto free upgraded infrastructure at no cost as a benefit for supporting toll road development of radial links to the inter-urban network. However, this program fails to solve the problem of properly pricing (and, hence, regulating use of) congested metropolitan highways, thereby postponing (at least) the development of more economically efficient transport system use and a stable system of roadway and transport system finance. As an official at EP pointed out, something will need to be done eventually, as the policy of expanding roadways followed by still increasing traffic and congestion will reach a limit of practicality (Manteigas, Personal Communication, 2010).

Table 18: SMM Performance Indicators: Douro Litoral, Porto

| Objective | Performance Indicator                                      | Y | P |
|-----------|-----------------------------------------------------------|----|--
| Pricing Optimizes Traffic Flow on Asset                  | Introduces road pricing                                |   | Y |
|           | Time-variant pricing                                      |   |   |
|           | Variable pricing based on marginal costs                  |   |   |
| Project-Oriented Productive Efficiency                   | Bundles construction and operations & management       |   | Y |
|           | Implements LCC management for entire project scope       |   |   |
|           | “Revealed” demand sufficient to justify capacity availability |   |   |
|           | User fee revenues meet expectation                        |   |   |
|           | Evidence of efficient re-investing/re-distributing excess revenues |   | P |
| Efficiency of Investment for Transportation System       | Asset planned as part of broader highway/road network  | Y |   |
|           | Ability to manage corridor as an inter-modal transportation system |   | P |
|           | Evidence of mutually-beneficial renegotiations/contract changes |   | P |
|           | Evidence of project meeting corridor mobility objectives  |   | P |
|           | Evidence that project represented best-known transport alternative |   | P |
| Investment Supports Societal Goals                       | Consistent with plan and/or ex ante economic evaluation |   | P |
|           | Public acceptability of electronic tolling                | Y |   |
|           | Long-term, stable relationship between public and private partners |   | P |
|           | Broad stakeholder perception of fairness and equity of project & contract |   | P |

“Y” = Fulfilled “P”=Partial Fulfillment; Otherwise Non-Fulfillment

The Douro Litoral makes a noteworthy attempt to apply a systems approach to financing, investing, managing, and operating a network of critical highway segments in an integrated fashion. Practically speaking, the Portuguese Government succeeded in leveraging the expected high financial returns on new BOT segments to improve inner Porto highway segments to which the new radial roads would link. However, this
“success” must be tempered by several weaknesses. With respect to optimizing traffic flows on the asset, pricing is far from efficient. First, the cross-subsidization of M&O segments with BOT segment tolls distorts the economic cost of use. Given high levels of congestion on inner-metropolitan segments, users of these roadways should pay relatively high tolls to dis-incentivize peak-period travel, rather than no tolls whatsoever. Second, while pricing on BOT routes can vary, tolls cannot exceed a maximum limit. While the concessionaire could in theory lower tolls to stimulate greater use, it will only do so if such a policy would increase profits. It is not clear that is will be the case.

Regarding the productive efficiency of the investment, the Douro Litoral does successfully bundle investment and long term management and operation for the BOT segments, partially integrates investment of complimentary inner-metropolitan roads, and ensures that portions of excess revenues are reinvested in the highway system. The M&O contract will only last five years, however, not long enough to incentivize the concessionaire to take a long-term life-cycle-cost approach to investment and management decisions on all roadway segments covered in the contract. Furthermore, the M&O contract is really more of a pre-ordained maintenance wish-list provided as essentially an in-kind contribution for the right to develop the BOT program; a long-term view might suggest more productively efficient means of delivering the level and quality of infrastructure desired. In this case, there are probably few corridor efficiencies that will be gained from possible scale economies in maintenance and bundling activities (i.e., construction and maintenance). Furthermore, to the extent that tolls on BOT segments must be set higher than marginal costs to cover O&M on the un-tolled portions, these higher toll rates may reduce demand for this new capacity to lower than economically efficient levels. This could also disadvantage the finances of financially risky new BOT links with already highly uncertain forecasted levels of demand. While both the concessionaire and the Government believed that economies of scale in maintenance and operation could help overcome some of these inefficiencies, the initial financial outlook of AEDL is not good.18

Analyzing the Douro Litoral from the perspective of efficiency as an investment in the larger metropolitan transportation system, the concession is conceived as a component of a larger metropolitan network. The project was rigorously planned and evaluated. Nonetheless, it is difficult to analyze the remaining outcome variables for this objective, as much of the project is not yet complete. Thus any judgment is partially speculative. For example, the extent to which the concession will support inter-modal system management, particularly in light of Dunn’s (2010) analysis of the increased uni-modal orientation of the state-owned enterprise sector in Portugal, remains questionable. Manteigas (EP, 2011, Personal Communication) suggests, however, that the Portuguese Government considered expansion of the Porto light rail system and links to Porto’s airport during the lengthy environmental review process. The Portuguese Government should be given some benefit of the doubt regarding inter-modal considerations. With regard to other variables, the outlook is more pessimistic. The changing nature of

18 It bears mention that, while the AEDL concession appears in financial trouble, Brisa’s 2010 Annual Report demonstrates strong financial results elsewhere.
relationships between project grantors, regulators, and concessionaires makes it unclear how public and private actors involved in the Douro Litoral will be able to work together to address unforeseen future challenges. The current situation offers few mutually beneficial alternatives. It is also unclear the extent to which this PPP might reduce metropolitan congestion, particularly in light of the fact that un-tolled portions are the most heavily used. The public appears content to be gaining new investment on the M&O segments, but we cannot yet know whether these interventions are sufficient to materially improve inner-metropolitan congestion. The concessionaire and the Portuguese Government also apparently disagree on whether the BOT segments represent the most optimal alignment.

It is also difficult to determine the extent to which the Douro Litoral investment supports broader societal goals, except that the project continues the cultural acclimation of Portuguese roadway users to user fees. The Douro Litoral did follow a rigorously planned and carefully evaluated project scope and continues successful implementation of inter-urban electronic road pricing into the Porto Metropolitan Area. However, downgraded financial prospects and a changing institutional environment may test previously strong relationships between the concessionaire and the Portuguese Government. In terms of perceptions of fairness, the project will clearly disadvantage users of BOT segments in favor of those using inner-urban segments.

From a broader perspective, it is unclear to what extent the Douro Litoral concession will be flexible enough in the long-term social benefits to justify costs, particularly when one considers both the high degrees of uncertainties involved and the current distribution of risk. First, greenfield BOTs carry substantial and many unknown commercial risks, for which AEDL has little control. For example, the concessionaire does not control other network factors such as land use and development policy along the highway stretch. Second, it is also unclear the extent to which the “fiscal balance” clause is sufficient to handle network risks. It is highly debatable whether or not the concessionaire should be responsible for demand risks related to macro-economic performance (like most other consumer industries). In the case of Douro Litoral, although AEDL directly carries demand risk, a financial failure on the part of the concessionaire still produces risks for the public sector in terms of its policy mandate to provide mobility, and therefore a failure by Brisa is in many ways a failure for transportation consumers in Porto.

Policy risks appear to be assigned to the public sector, but uncertainty in what constitutes a valid claim of “restoration of financial balance” clause could prevent government agencies from undertaking important public interventions. The contract broadly specifies the types of government actions that would trigger a need for restoration of financial balance, with disputes to be handled in Arbitration Court (AEDL and Government of Portugal, 2007). When asked what specific types of government interventions would or should trigger a valid claim, interviewees agreed that outcomes would be uncertain and largely at the behest of the judiciary. This uncertainty could lead to timid government action such that important public interventions are deferred for fear of triggering a claim by AEDL. In cases where the proposed intervention offers benefits exceeding the costs of
restoring fiscal balance to the concessionaire, action is warranted despite the costs. A more detailed specification of valid claims in the contract might reduce uncertainty for both parties and facilitate greater public and private integration on implementing system-wide transportation policies and programs. At the same time, the impossibility of foreseeing every possible future conflict would still require that consistent and fair enforcement fall upon the Portuguese judiciary.

Lastly, private concessionaires and public grantors (such as EP for highways) will need to adapt to the new institutional reality of an independent regulator (InIR), which will provide a more consistent and transparent framework for future negotiations. InIR will also be challenged, however, to adopt a reasonable and consistent approach for dealing with inevitable unforeseen circumstances in long-term contracts, particularly those that were negotiated prior to the 2007 institutional reforms. Negotiators for AEDL and the Portuguese Government may have prioritized speed of implementation with the belief that details could be renegotiated later. The potential for renegotiations, however, has likely changed. If the current institutional structure (i.e., independent regulator) had existed before the bidding, then the bids would likely have been more conservative. At the same time, one cannot expect an accurate prediction of the timing and scope of a world financial crisis. The contract negotiated for the Douro Litoral, as currently constructed, does not ultimately appear to serve the interests of either the private or the public partners.
5.7 M25 Orbital, London, UK

The procurement of capital upgrade and long-term infrastructure management for the M25 Orbital, a heavily-congested circumferential route just outside the boundary of Greater London, offers a strategy for increasing the efficiency and performance of a metropolitan highway by engaging the private sector in a long-term, performance-based contract. The initiative includes the bundling of capital improvements, maintenance, and operation, where the private entity is remunerated on the basis of meeting outcome-oriented performance requirements. The application of a system of “availability payments”, fixed payments from the government contracting authority to the private contractor based on achievement of capacity “availability” and other performance objectives, is a governance strategy increasingly applied in highway PPPs throughout the world, particularly where goals for procurement more heavily favor complex social goals (as explained in Chapter 3). Since this procurement vehicle allows for the specification of outcomes as part of the concession contract, the M25 Orbital case offers insight on reconciling SMM with private-sector participation in a metropolitan highway provision.

5.7.1 Analysis of Institutional Context for the M25 Private Finance Initiative

Though the UK has in recent years increasingly devolved greater responsibilities to local and regional governments, the country is still mostly a unitary democracy (Inman, 2007). The central government controls much of the public policy and administrative functions throughout country. The Department for Transport (DfT) is responsible for national transportation policies and programs across all modes, while its executive arm, the Highways Agency (HA), is responsible for the stewardship, operation, and development of the UK’s strategic road network. The Highways Investment Board (HIB) at HA reviews and makes recommendations on highway investments, including public-private proposals (HA, 2009).

Traditionally highway finance and procurement in the UK is characterized by the separation of decision making on revenues and expenditures. Mackie and Smith (2005) explain that Her Majesty’s Treasury (HMT) is responsible for levying road taxes (fuel duty and vehicle excise taxes), income taxes, and other indirect taxes, while HA and local authorities are responsible for financing road infrastructure investments primarily through HMT transfers. The authors suggest that, while the connection between revenues and expenditures is not explicit, direct and indirect taxes more than cover the infrastructure costs of car use, though estimates vary on cost recovery on heavy goods vehicles. Except for some bridge crossings (and London congestion fees), however, road pricing is generally non-existent (Mackie and Smith, 2005).

A series of central government legislation has devolved many transportation administrative and policy powers to regional and local government entities. This trend largely began in the neoliberal era led by Margaret Thatcher in the 1980’s and John Major in the 1990s, but accelerated under the leadership of Tony Blair and Gordon Brown under Labour’s “Third Way” philosophy. Canning et al. (2010) actually trace this trend back to the creation of Passenger Transport Authorities in 1968, but emphasize more recent legislation (1991 Roads and Street Works Act) that empowered integrated regional transport planning through Local Transport Authorities (LTA); required LTAs to create five-year local transport plans (2000 Transport Act); and reoriented LTA objectives towards a “Network Management Duty”, including encouragement of pricing and demand management (2004 Traffic Management Act). The authors conclude, however, that not all powers granted to LTAs have been exercised, due in part to conflicting
objectives, lack of commensurate funding, and a belief that road pricing will eventually be implemented at the national level (Canning et al., 2010).

Marsden et al. (2009) review the development of local transport plans in the UK, for which funding varies based on evaluations against locally-determined performance targets and success in meeting those targets. The authors suggest that LTAs have generally set challenging but achievable targets, as the system has incentivized the setting of aggressive goals (for which funding can be requested) but not unrealistic ones (for which poor performance results in less funding).

The 1999 Greater London Authority Act further advanced the cause of devolution in London specifically by (re-)creating the position of a directly-elected city mayor and creating Transport for London (TfL), an agency responsible for implementing the Mayor’s Transport Strategy. TfL is responsible for the integrated planning and delivery of all modes of service in London, including local transit and roadways (TfL, 2010). The agency has also introduced congestion charges, for which a toll is required for any vehicle to enter a defined area in Central London. According to TfL, congestion charging, instituted in 2003, has reduced the number of vehicles entering the center by 25%, and has created a pool of revenues that is used for expanding local bus and other government services (TfL, 2009). As of January 4, 2011, the cost of entering Central London is £9-12 for a daily pass depending upon method of pay, though less expensive monthly and annual passes are available and substantial discounts apply if operating a “green” vehicle (TFL, 2011). Thus, TfL has advanced many of the key objectives of SMM, including road pricing and metropolitan transportation policy integration.

Devolution of decision-making responsibility to TfL has not, however, coincided with autonomy with respect to funding. On behalf of the UK Government, Sir Michael Lyons launched a three-year study on the future of local government (the Lyons Inquiry) in the UK. Completed in 2007, the Lyons Inquiry recommended the devolution of more responsibility and accountability to local governments. Many of the Inquiry’s recommendations concern funding. According to the report, local governments in the UK are limited in their abilities to generate own revenues to the county tax (a hybrid property and services tax). Otherwise, local governments are dependent on the UK Government for much of the funding needed to provide public services. The Lyons Inquiry recommends reorienting the relationship between UK Government funding to localities, suggesting greater flexibility in use of funds, incentive-based criteria for securing funding awards, and limited additional powers for local taxation such as perhaps an income-based tax supplement to the county tax. The Inquiry also reiterated support for local land use planning and flexibility in local road congestion charging (Lyons Inquiry, 2007).

In support of the Lyons Inquiry findings, TfL (2006) argues that the Mayor of London controls only about half of the funds required to implement his transportation investment agenda within the jurisdiction, with the rest of the funding derived from the UK Government Transport Grant

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19 President Margaret Thatcher had abolished the former Greater London Council in 1986 nominally to reduce bureaucracy and the cost of local government, but also largely out of political motives to dis-empower Ken Livingston, a the labor party’s leader in charge of the Council (BBC, 2011). Ken Livingston would re-emerge as Mayor after the passage of the Greater London Act, and is responsible for instituting congestion charging.
and other programs. The agency points out that the tendency of the UK Government to reduce proportionately Transport Grant allocations in response to increases in local revenues makes it politically difficult to implement fare increases and congestion charging; precisely the types of revenue-generating interventions favored by devolution of administrative powers.

In addition to pursuing institutional reforms regarding devolution of administrative and finance powers to local governments, the UK Government has embarked upon a nearly three-decade-long effort to leverage private sector expertise and efficiency in the delivery of government infrastructure and services. The most common type of PPP in the UK is the Private Finance Initiative (PFI), launched in 1992, whereby a private entity is selected to construct and operate a public infrastructure service for a period of 25-30 years, with compensation taking the form of unitary Government payments. As of September, 2009, PFI has been responsible for 500 projects with a cumulative capital value of £28 billion (NAO, 2009).

Corner (2005) explains how PFI represents a government-wide effort to shift the activities of public agencies from that of owner/operators to purchaser of services, with DfT being a primary participant. The author describes how, under PFI, the private sector takes on long-term responsibilities for capital improvements and services, while the public sector retains a role as procurer and project enabler. Unlike BOT schemes financed on the basis of user receipts, however, under the PFI’s DBFO approach the responsible government entity (DfT/HA in the case of transportation infrastructure) specifies outputs in a contract and commits defined revenues over the long-term for successful performance. The private firm finances all capital improvements and operations on the basis of these future defined payments (Corner, 2005).

Mackie and Smith (2005) describe the history of PFI and, specifically, the application of PFI to road infrastructure projects beginning in the early 1990s. The authors suggest that a confluence of economic and political factors reduced the budget for national roads by 33 percent and local roads by 50 percent. The UK Government responded by relaxing rules that facilitated private-sector finance of infrastructure, initiating the use of a public sector comparator (PSC) to analyze the benefits of PFI versus traditional procurement for a given roads project (i.e., “value for money”), and establishing a strategy of shadow toll pricing as the government remuneration method for private participants (since few roads were tolled). Shadow tolls were paid on behalf of users by the government to private contractors based on traffic volume. Initially, 14 highway segments were tendered to private firms under DBFO structures. Mackie and Smith (2005) suggest that since 2000, DBFOs have generally fallen out of favor with DfT and HA for several reasons, including the crowding out of other investment priorities due to PPP contract obligations and the high cost of private capital versus public financing. In the first case, there is evidence that agencies have a tendency to pursue PFI projects over other worthy proposals. In the latter case, evidence exists that private financing costs may be higher than public borrowing rates, and that margins have widened further since the dawn of the financial crisis in 2008 (NAO, 2009).

The initial PFI experience for highways in the UK produced mixed results. Pollitt describes how the UK’s independent National Audit Office (NAO) found that while some highway PFI projects delivered faster and at lower cost than traditional procurement benchmarks, some did not carry sufficient benefits to warrant DBFO rather than traditional procurement. In particular, NAO criticized the selection of discount rates that overstated DBFO benefits in the PSC analyses. NAO also found that too much demand risk had been allocated to private firms under the shadow
tolling scheme, leading to suboptimal cost management (Pollitt, 2005). NAO (2009) continues to be critical of methodologies employed for calculating value for money, suggesting that inputs and counterfactuals are often too subjective for meaningful comparison.

In summary, the UK has embarked upon an aggressive effort to devolve greater responsibilities for transportation policy and administration to metropolitan areas, especially for London, while at the same time securing greater private participation in infrastructure finance. These efforts are part of a larger movement towards reorganizing government and public infrastructure and services procurement, which has demonstrated some strengths and weaknesses. Devolution of transportation administration to TfL has supported elements of SMM, as evidenced by congestion charging, demand-management, and integrated investment programs. Local finance is challenged, however, by existing revenue-raising and investment policies that do not permit sufficient local control of investment programs. The UK Government still exerts substantial control over local transportation policies through the use of the purse strings; a level of control that extends also into the realm of PPPs for highways. While it is likely that private finance has delivered real benefits on some highway projects, questionable analytical methods, high costs of private capital, and inefficient risk allocation call into question whether PFI has been appropriate in all cases.

5.7.2 Analysis of the M25 Orbital Private Finance Initiative

The M25 DBFO involves 125 miles of high-capacity circumferential highway, which forms an “orbit” approximately 20 miles from Central London. The contract includes road widening in five distinct sections of the roadway and renovation of the Hatfield Tunnel on a northern highway access route. The contract also includes 30-year O&M contract for the entire M25 Orbital, 125 miles of connecting roads and junctions, the Hatfield Tunnel, and the Dartforth Crossing (bridging the Thames River to the west of Greater London) (NAO, 2010). Figure 10 provides geographic context for the M25 Orbital as well as the scope of the lane widening program.

While the DfT and HA initially applied PFI procurement strategies to implement inter-urban highway projects during an era of fiscal constraint, the concept for the concession of expansion, management, and operation of the M25 Orbital seemingly originated from a different set of circumstances. As part of a series of studies on multi-modal approaches to improving performance of transportation infrastructure in London, DfT commissioned a report on improving congestion on the M25 Orbital. The report recommended limited and strategic road construction paired with area-wide user charging, suggesting further that road pricing would be the key to sustained and meaningful demand management. The study also recommended the dedication of revenues from road pricing to transit enhancements as part of an overall vehicle use reduction strategy (KBR, 2001). While the Orbit Multi-modal Study envisioned area-wide pricing of travelers using the roadway, the UK Government opted for a phased program of limited road widening and the use of other demand management tools, such as various intelligent transportation system (ITS) solutions. HA ultimately determined that a single DBFO bundling initial investment with long-term maintenance and operation would result in the greatest overall benefit in implementing this integrated strategy (HA, 2010).
Unlike previous highway DBFO's in the UK, HA tendered the M25 Orbital on the basis of availability payments. In this sense, the contractor’s exposure to demand risk (heavily criticized by the NAO for previous shadow toll concessions) would be mitigated as payments would accrue on the basis of achieving acceptable levels of quality as specified in the contract rather than the volume of users. Ultimately, HA selected Connect Plus (a consortium of Balfour Beatty, Skanska, WS Atkins, Egis Projects) at a total cost of £6.2 billion over the 30-year life of the contract. The contract was signed in May 2009, and will terminate in 2039 (HA, 2010).

Table 6 summarizes the key factors for analyzing the M25 Orbital PPP, including formal institutional variables associated with transportation policy in Greater London; the governance institutional variables specific to the concession; and other elements of the spatial and political contexts. The next subsection of this chapter will then analyze the observable performance metrics defined in the methodology chapter.
<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>Expected Positive Effect on SMM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structure of Transportation Institutions</strong></td>
<td>National institutional structure - federalism</td>
<td>Federal democracy</td>
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<td></td>
<td>Originator jurisdiction</td>
<td>Approximately equal to metropolitan scale</td>
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<td>Originator administrative scope - transportation</td>
<td>All metropolitan transportation infrastructure</td>
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<td></td>
<td>Originator administrative scope - land use</td>
<td>Primary control of land use</td>
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<tr>
<td></td>
<td>Originator fiscal scope</td>
<td>Originator controls fiscal instruments to finance project</td>
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<tr>
<td><strong>Structure of Highway PPP Institutions</strong></td>
<td>Country experience - highway PPPs</td>
<td>Country has broad experience</td>
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<td></td>
<td>Project grantor experience - highway PPPs</td>
<td>Grantor has experience with highway PPPs</td>
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<td></td>
<td>Legal framework for PPPs - originator</td>
<td>Jurisdiction has general (not ad hoc) PPP legislation</td>
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<tr>
<td></td>
<td>Use of public-sector comparator (PSC)</td>
<td>Uses PSC for PPP decision-making</td>
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<tr>
<td></td>
<td>Project evaluation</td>
<td>Follows traditional approach for highway evaluation</td>
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<tr>
<td></td>
<td>Competition and procurement</td>
<td>Competitive international procurement</td>
</tr>
<tr>
<td><strong>Contract Risk Allocation</strong></td>
<td>Policy risk (intentional)</td>
<td>Government policy risk (intentional)</td>
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<tr>
<td></td>
<td>Land acquisition risk</td>
<td>Government land acquisition risk</td>
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<tr>
<td></td>
<td>Network risk</td>
<td>Shared network risk</td>
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<tr>
<td></td>
<td>Demand/revenue risk (excluding network risk)</td>
<td>Shared or private with government network risk</td>
</tr>
<tr>
<td><strong>Project Revenues and Finance</strong></td>
<td>Authority for pricing</td>
<td>Private sector has flexibility to raise and lower tolls</td>
</tr>
<tr>
<td></td>
<td>Regulating Tolls</td>
<td>Government has regulatory authority over toll rates</td>
</tr>
<tr>
<td></td>
<td>Mechanism for sharing in upside of roadway improvements</td>
<td>Revenue sharing if projects exceed IRR</td>
</tr>
<tr>
<td></td>
<td>Contractual guarantees/support of revenues or profitability</td>
<td>Yes, if project scope is not self-financing</td>
</tr>
<tr>
<td></td>
<td>Renegotiations</td>
<td>Scope and process outlined in contract</td>
</tr>
<tr>
<td><strong>Spatial Context</strong></td>
<td>Maturity of asset</td>
<td>Includes existing roadways (brownfield)</td>
</tr>
<tr>
<td></td>
<td>Project alignment - central city</td>
<td>Aligned through metropolitan center</td>
</tr>
<tr>
<td><strong>Political Context</strong></td>
<td>Primary motivation of PPP</td>
<td>Service-oriented (value-for-money)</td>
</tr>
<tr>
<td></td>
<td>Degree of political/philosophical motivation</td>
<td>Project follows established/evolving PPP framework</td>
</tr>
</tbody>
</table>

"Y" = Fulfilled "P"=Partial Fulfillment; "N/A" = Not Applicable; Otherwise Non-Fulfillment; Note: "Originator" refers to the entity with ultimate legal authority (i.e., the UK Government) and “Grantor” refers to the body delegated such responsibilities (i.e., HA)
As the M25 Concession has only recently commenced, there is little ex post data upon which to evaluate specific policy outcomes. It is still possible, however, to analyze the institutional model for delivering road infrastructure and management under a long-term contract in Metropolitan London; particularly in light of the Greater London Authority Act, the PFI, and the objectives of TfL and DfT/HA.

The M25 Orbital contract failed to directly deliver on pricing and regulatory goals of SMM. As NAO (2010) explains, the Orbit Multi-modal Study suggests that area pricing would be a critical component to integrated M25 corridor mobility management, but HA defers to a future date when it believes area-wide pricing would be technologically feasible (possibly by 2014). Within central London, the current congestion charge scheme helps promote more efficient use of roadways in the London Metropolitan Area and supports investment of congestion mitigation measures such as public transit services. Arguably travelers on the M25 Orbital benefit indirectly from these interventions in Central London. In the absence of direct pricing, however, short-term reductions in congestion due to M25 investments in capacity and technology may be counteracted by future induced travel, as suggested in the Orbit Multi-modal Study (KBR, 2001). The M25 Orbital PPP fails to directly impact the way drivers perceive the costs of using the system or to add clarity to the prioritization of future area investments, both of which are critical components of SMM.

With regard to integration, HA accounts for the network properties of the Orbital by bundling long-term operation and maintenance of the M25 with 125 miles of connecting roads and junctions, as well as bridge and tunnel crossings. Since Connect Plus is responsible for meeting quality performance metrics over 30 years, the contractor is incentivized to apply an integrated life-cycle cost approach towards managing corridor performance. Performance criteria include lane availability, road conditions, route performance (i.e., reduced travel time and improved travel time reliability), safety, and unplanned event management. The UK Government also retains the ability to renegotiate contracts should it become necessary to change the requirements. Connect Plus can also receive proactive management bonuses for working with HA to achieve other agency objectives (NAO, 2010). While HA initially envisioned a demand management program, including the use of ITS tools to integrate the M25 Orbital concession with local road management, this objective has yet to be realized and may not be until at least 2012. Integration with other modes of transportation and other sectors, such as land use planning, appears largely outside the scope of this project.

In terms of engendering public acceptability, the Orbit Multi-modal Study helped inform the investment and management program from an overall systems perspective, and the PSC should have offered a reasonable benchmark informing the decision to pursue a DBFO procurement. The NAO (2010) has, however, identified weaknesses in both project evaluation and procurement, which the Office believes resulted in a failure to consider potentially more efficient alignments, escalating financing and transaction costs, and questionable assumptions for the PSC. The NAO report suggests that there are potential public economic benefits (e.g., an estimated £2.3 billion NPV due to reduced travel time and accidents). With respect to the programmatic decision-making, however, the NAO argues that HA failed to consider a less-costly alternative to lane widening that
would have allowed traffic to use shoulder lanes during peak periods (estimated savings for this alone would have been £400 million – 1.1 billion NPV) and failed to implement integrated demand management programs with local authorities as expected, which could reduce the expected long-term travel time benefits. Regarding the use of PFI, NAO found that 18 months of delays in the preparation and execution of the procurement led to £660 million (PV) in higher private financing costs, as financial close occurred during the height of the world financial crisis. Furthermore, the report suggests that for the PSC, HA used cost figures from projects with substantial cost over-runs, and that the Agency did not investigate wide gaps between private operations and maintenance costs and public sector benchmarks. Considering the £80 million in consulting fees paid by HA for legal, financial, and technical assistance to support procurement and the public assumption of £68 million in finance risks to close the deal, the case for private finance is less clear (NAO, 2010).

In terms of actual performance, the M25 Orbital offers a new approach to utilizing PPPs for road infrastructure in the UK, applying availability payments rather than shadow toll scheme. It is too early to tell, however, whether private finance led to value for money – the initial NAO analysis leaves plenty of room for doubt.

Finally, technology has played a limited role to date with respect to supporting optimal road pricing and management in the M25 Orbital corridor. Proposed corridor demand management plans that envision application of ITS solutions and coordination with local authorities offers a necessary but insufficient strategy for using technology for congestion mitigation and system management. Such a program should be implemented in 2012. The future use of electronic road pricing, on the other hand, remains uncertain. SMM

5.7.3 Conclusions from the M25 Private Finance Initiative

Table 20 summarizes the performance of the M25 Orbital PPP relative to the SMM framework. The M25 Orbital's most glaring weakness is the lack of a pricing regime to support optimal use of the roadway system. With respect to other objectives, it is difficult to definitively analyze several elements due to the fact that the contract was only recently signed, and the full program of improvements will not be realized until 2015. Nevertheless, the M25 Orbital PPP appears to have delivered an innovative strategy for engaging the private sector in an effort to provide integrated corridor mobility access through London's metropolitan highway system consistent with broad social goals, but not without flaws in pricing, demand management, and financing.

The M25 Orbit Multi-modal Study seemed to provide a logical path for coupling investment with pricing and demand management to deliver the most efficient outcomes given the mobility objectives of the highway network. Despite the relative success of congestion pricing in Central London, however, it appears that further road pricing decisions will be deferred unless and until the UK Government takes broad action. Until that time, the lack of road pricing deprives the opportunity to more efficiently manage demand and mobility through the M25 Orbital corridor.
The M25 Orbital PPP case demonstrates the possibility for incentivizing private-sector entities to help deliver productive efficiencies by bundling investment with long-term maintenance and operations with the goal of managing life-cycle-cost. It does this by incentivizing Connect Plus to consider the most efficient investment for, essentially, the entire highway system surrounding Greater London. It is unclear as of yet whether or not demand levels will materialize as expected, but since the project is not dependent upon volume for financing, this is a less important from the standpoint of project finance. Without pricing, however, the M25 Orbital PPP cannot achieve more optimal levels of project-oriented productive efficiency.

Table 20: SMM Performance Indicators: M25 Orbital, London

<table>
<thead>
<tr>
<th>Objective</th>
<th>Performance Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pricing Optimizes Traffic Flow on Asset</td>
<td>Introduces road pricing</td>
</tr>
<tr>
<td>Project-Oriented Productive Efficiency</td>
<td>Bundles construction and operations &amp; management</td>
</tr>
<tr>
<td>Efficiency of Investment for Transportation System</td>
<td>Asset planned as part of broader highway/road network</td>
</tr>
<tr>
<td>Investment Supports Societal Goals</td>
<td>Consistent with plan and/or ex ante economic evaluation</td>
</tr>
</tbody>
</table>

*"Y" = Fulfilled "P"=Partial Fulfillment; Otherwise Non-Fulfillment*

The M25 Orbital project delivery structure has seemingly helped deliver a good investment for the metropolitan transportation system as a whole from the standpoint of allocative efficiency. First, the contract bundles a number of complimentary links, which helps reduce network spillovers within the highway and road systems and incentivizes Connect Plus to consider the most efficient investment program. Second, the use of performance-based contracting explicitly sets transportation system outcomes as the criteria by which the contractor will be rewarded. Third, contractual mechanisms allow for future renegotiations should network management priorities change. Thus, the M25 Orbit PPP should offer insights on leveraging a corporate model for delivering complex policy objectives through the use of performance-based availability payments. The
approach allows the HA to establish overall corridor mobility goals as criteria for payment, thus incentivizing the contractor to consider system-wide impacts in its investment and management programs. It is too early to tell if this scheme will meet corridor mobility objectives, but the potential seems to be high.

Despite mostly positive results in terms of designing a project and project delivery structure to support an efficient investment program, it is not clear that the overall program represents the best-know mobility alternative for the M25 Orbital corridor. First, the heretofore lack of national and local transportation agency co-ordination towards a unified demand management strategy for the M25 Orbital corridor reveals problems of inter-jurisdictional integration of highway investment with locally-controlled metropolitan mobility programs. The devolution of administrative responsibilities and accountability to the Mayor of London and TfL for Capital transportation systems management, albeit incomplete, demonstrates a willingness to allow local flexibility to enact context-specific, integrated mobility strategies. Furthermore, the Orbit Multi-modal Study emphasizes the creation of technology-supported demand management programs in order to best manage corridor mobility and derive greater value for investment. As of yet, however, neither pricing nor a system for corridor demand management exists for the M25 Orbital. Therefore integration of national and local roads investment and operations towards comprehensive mobility management in London is unfulfilled.

Second, the UK Government failed to maximize benefits from the M25 Orbital procurement in part because it failed to secure an efficient allocation of risks. NAO (2010) suggests that the perceived market risks were such that the net cost of private capital over the public cost of funds may have more than exceeded any potential social benefits of private sector finance. Given the precarious state of world financial markets at the time of contract closing, it is fair to question whether the private partners were in the best position to manage financing risks, particularly in light of the widening spreads between cost of private capital and costs of public capital during the time of contract closing (NAO, 2010). Even with government assumption of most demand risks (and some financing risks), the case for private finance is tenuous.

Third, the NAO (2010) report suggests that HA did not necessarily proceed with the best-known overall investment program know at the time of procurement. One of the M25 Orbital bidders proposed submitting the aforementioned alternative that would, rather than expand the scale of the existing highway, employ flexible peak-hour use of shoulder lanes. While HA questioned the technical feasibility, its own trials of a similar project on a different highway (the M42) seemed to demonstrate the benefits of this alternative NAO (2010).

Evaluating the extent to which the M25 Orbital PPP meets broader societal goals is complicated by the fact that the project is relatively new and does not include pricing. On the positive side, the investment program proceeded only after a rigorous project evaluation process, and the use of a PSC to support the decision to engage a private finance partner. This does not absolve HA from scrutiny, as NAO exposed some of the weaknesses of the project evaluation and negotiation processes, but demonstrates that he project was planned and tendered after a reasonably rigorous and transparent evaluation.
process. The effect on public acceptability of road pricing is, essentially, neutral. Additionally, while it is too early to evaluate how robust the partnership between the UK Government and Connect Plus will prove to be, the flexibility enabled in the contract allows room for hope.

Perceptions of fairness of a highway PPP program is contingent on gaining public confidence that the benefits of privately-financed and managed infrastructure projects are greater than that of conventional provision. The NAO (2010) report on the M25 Orbital PPP suggests the persistence of many of the same institutional weaknesses in decision-making that provoked public backlash in earlier inter-urban highways tendered via PFI. These include overly optimistic value-for-money estimates, high transaction costs, and high costs of private capital. Furthermore, NAO identified additional issues with respect to the M25 Orbit procurement including but not limited to a failure to give serious consideration to a potentially more efficient project scope, procurement delays, and failure to implement corridor demand management programs along with road widening. Governments must be rigorous in using transparent and comprehensive processes for evaluating the relative benefits of different public investment options. This process must lead decision-making on procurement and finance, not the opposite. Otherwise, citizens may rightly question the integrity of programs that cede greater private-sector control of critical metropolitan system components.

Lastly, this analysis of the M25 Orbital exposes other core institutional weaknesses of metropolitan transportation investment and management policy in London vis-à-vis fiscal federalism principles. First, the M25 Orbital project itself fails to utilize pricing as a demand management tool. TfL has taken the initiative to apply congestion pricing in central London roadways to control traffic and to reinvest in alternative strategies such as increased bus service. It is far from certain that complete devolution of authority of M25 would necessarily result in regional pricing (most of the highway is located just outside of Greater London’s formal jurisdiction, and the City recently reduced the geographic scope of congestion charging). However, to maximize the value of the M25 investment, there must at least be greater collaboration among municipalities (including Greater London and surrounding counties) and between the Central government and Greater London on integrated road demand management plans that considers both technology and pricing solutions.
6 Case Study Comparative Analysis and Discussion

The previous chapter reviewed in detail seven case studies. This chapter summarizes the findings and discusses potential implications of different institutional factors on SMM outcomes. First will be a brief composite summary of the seven cases. This will be followed by a summary and discussion of possible patterns emerging within and across the cases, including a more refined analysis of the institutional variables, SMM outcomes, and linkages between the two. Finally the initial hypotheses will be revisited to test validity in light of the cross-case analysis.

6.1 Summary of Case Studies

Visualizing the relative differences among the cases helps to identify patterns which may evidence linkages between institutional variables and SMM outcomes. In this section, two tables aim to facilitate this cross-case comparison. Table 21 summarizes institutional factors across each of the seven cases (at the time of contract award), while Table 22 details the observations of outcomes from the standpoint of SMM.

Regarding formal, governance, spatial, and political variables, Table 21 highlights the relative institutional context of each case. First, few cases appear to meet the majority of criteria under the Structure of Transportation Institutions category. CityLink comes the closest, with the State of Victoria effectively integrating transportation infrastructure at the metropolitan level. Though the State of Victoria is larger than the Melbourne metropolitan area, about two-thirds of the state population resides in the Melbourne Metropolitan Area. Plus the State has long played a dominant role in metropolitan transportation investment and management, as well as coordinating metropolitan transportation policy with municipal governments. Victoria’s greatest liability with respect to integrating metropolitan transportation policy appears to be having only partial control of local land use and roads planning and heavy dependence on discretionary Commonwealth funding.

More recent cases tend to exhibit more of the critical factors for an Efficient Structuring of Highway PPP Institutions. This is not surprising given the fact that key criteria include past experience with PPP procurement mechanisms and the adoption of legal and economic evaluation processes, which take time to evolve and perfect. It should be noted that the three metropolitan areas corresponding with Iberian legal origins (Santiago, Madrid, and Porto) seem to have overall greater experience with and more well-established traditions of application of PPPs for procuring highway infrastructure. Also, though the tradition of using a public-sector comparator derives principally from the UK PFI, similar legal systems elsewhere have not (or at least had not at the time) adopted similar protocols (e.g., Los Angeles and Toronto).

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20 As detailed in Table 3, 3.7 million people live in Metropolitan Melbourne, while the population of the State of Victoria is approximately 5.5 million. State population data available at the Australian Bureau of Statistics Website at: http://www.abs.gov.au/ausstats/abs@.nsf/mf/3101.0/
### Table 21: Institutional Characteristics Across Cases (At the Time of Contract Award)

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>SR 91</th>
<th>ETR</th>
<th>CityLink</th>
<th>MMCs</th>
<th>CN</th>
<th>Douro Litoral</th>
<th>M25</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structure of Transportation Institutions</strong></td>
<td>National institutional structure - federalism</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Originator jurisdiction</td>
<td></td>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Originator administrative scope - transportation</td>
<td></td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Originator administrative scope - land use</td>
<td></td>
<td>P</td>
<td></td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Originator fiscal scope</td>
<td>P</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td></td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td><strong>Structure of Highway PPP Institutions</strong></td>
<td>Country experience - highway PPPs</td>
<td></td>
<td>Y</td>
<td></td>
<td>Y</td>
<td></td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Project grantor experience - highway PPPs</td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
<td></td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Legal framework for PPPs - originator</td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Use of public-sector comparator (PSC)</td>
<td></td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P</td>
</tr>
<tr>
<td></td>
<td>Project evaluation</td>
<td></td>
<td></td>
<td></td>
<td>P</td>
<td></td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Competition and procurement</td>
<td></td>
<td>Y</td>
<td></td>
<td>Y</td>
<td></td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td><strong>Contract Risk Allocation</strong></td>
<td>Policy risk (intentional)</td>
<td></td>
<td>Y</td>
<td></td>
<td>P</td>
<td></td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Land acquisition risk</td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
<td>P</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Network risk</td>
<td>Y</td>
<td>P</td>
<td></td>
<td>Y</td>
<td></td>
<td></td>
<td>P</td>
</tr>
<tr>
<td></td>
<td>Demand/revenue risk (excluding network risk)</td>
<td></td>
<td>P</td>
<td></td>
<td>Y</td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Project Revenues and Finance</strong></td>
<td>Authority for pricing</td>
<td>Y</td>
<td></td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Regulating Tolls</td>
<td></td>
<td>Y</td>
<td></td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mechanism for sharing in upside of roadway improvements</td>
<td>Y</td>
<td></td>
<td>P</td>
<td>P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contractual guarantees/support of revenues or profitability</td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Renegotiations</td>
<td></td>
<td>Y</td>
<td></td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Spatial Context</strong></td>
<td>Maturity of asset</td>
<td>Y</td>
<td></td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project alignment - central city</td>
<td>Y</td>
<td></td>
<td></td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Political Context</strong></td>
<td>Primary motivation of PPP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Degree of political/philosophical motivation</td>
<td>Y</td>
<td></td>
<td></td>
<td>Y</td>
<td></td>
<td></td>
<td>Y</td>
</tr>
</tbody>
</table>

"Y" = Fulfilled “P” = Partial Fulfillment; “N/A” = Not Applicable; Otherwise Non-Fulfillment
Table 22: SMM Performance Indicators Across Cases

<table>
<thead>
<tr>
<th>Objective</th>
<th>Performance Indicator</th>
<th>SR 91</th>
<th>ETR</th>
<th>CityLink</th>
<th>MMCs</th>
<th>CN</th>
<th>Douro Litoral</th>
<th>M25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pricing Optimizes</td>
<td>Introduces road pricing</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Traffic Flow on</td>
<td>Time-variant pricing</td>
<td>Y</td>
<td>Y</td>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asset</td>
<td>Variable pricing based on marginal costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project-Oriented</td>
<td>Bundles construction and operations &amp; management</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Productive Efficiency</td>
<td>Implements LCC management for entire project scope</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td>Efficiency</td>
<td>&quot;Revealed&quot; demand sufficient to justify capacity availability</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td></td>
<td>User fee revenues meet expectation</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Evidence of efficient re-investing/re-distributing excess revenues</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td></td>
<td>P</td>
<td>P</td>
<td></td>
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<tr>
<td>Efficiency of</td>
<td>Asset planned as part of broader highway/road network</td>
<td>P</td>
<td>P</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Investment for</td>
<td>Ability to manage corridor as an inter-modal transportation system</td>
<td>P</td>
<td>P</td>
<td>Y</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td>Transportation System</td>
<td>Evidence of mutually-beneficial renegotiations/contract changes</td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Evidence of project meeting corridor mobility objectives</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>Y</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td></td>
<td>Evidence that project represented best-known transport alternative</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td></td>
<td>P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investment Supports Societal Goals</td>
<td>Consistent with plan and/or ex ante economic evaluation</td>
<td>P</td>
<td>P</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Public acceptability of electronic tolling</td>
<td>P</td>
<td></td>
<td>Y</td>
<td>Y</td>
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<tr>
<td></td>
<td>Long-term, stable relationship between public and private partners</td>
<td>Y</td>
<td>P</td>
<td>Y</td>
<td>P</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Broad stakeholder perception of fairness and equity of project &amp; contract</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
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*Y* = Fulfilled “P”=Partial Fulfillment; Otherwise Non-Fulfillment
In terms of contract risk allocation and project revenues and finance, private firms are increasingly absolved of intentional policy risks (SR 91 had a no compete clause but only for roads, and ETR relies on the legal system to determine what is “discriminatory”) and network risks through various contractual mechanisms, such as “MAE” and “fiscal balance” clauses. Sometimes demand risks are simply shared, as in the Costanera Norte case. In return, government principals retain flexibility to control finance elements such as regulating tolls, sharing in the upside of higher-than-expected revenues, and renegotiating contracts when other policy priorities intersect with project finances. The M25 represents a recent trend, which will be discussed in Chapter 7, where the public partner basically assumes all commercial risks.

The cases suggest an interesting trend regarding the spatial and physical composition of metropolitan highways. They are becoming increasingly complex, with project scopes now encompassing circumferential routes and complimentary roadway links. Earlier cases, such as the SR 91 and the ETR included basically single axes of radial highway, mostly aligned in less-dense suburban areas. More recent projects, such the Douro Litoral and the M25 Orbital, include either maintenance and/or M&O considerations for vast stretches of network links, many of which are not part of major project construction or expansion plans.

With regard to highway alignment, only CityLink and the Costanera Norte PPPs include segments approaching the dense centers of their respective metropolitan transportation networks. All other cases are mainly suburban, at least during initial stages. CityLink technically bypasses the Melbourne CBD, but it still provides basically direct access in and out of the center. One could argue that the ring road portion of the Douro Litoral M&O contract is fairly close to the inner-urban core of Porto, but does not pass through the center.

Finally, a few patterns emerge among factors grouped under the category “Political Context.” In particular, regarding the “purpose” for applying PPPs across each context, both CityLink and the M25 Orbital were seemingly tendered only after detailed analysis supported the purported relative efficiency of PPPs versus traditional project delivery approaches. All other projects seemed to be motivated, at least in large part, by the lack of public funding availability and/or political considerations.

Table 22 illustrates the relative performance across cases, revealing several insights. First, it appears that two of the earlier projects, the SR 91 and the ETR, succeed in advancing variable pricing and internal productive efficiency while sacrificing a more comprehensive view of metropolitan transportation system needs and broader societal needs. At the same time, the most recent project, the M25 Orbital in London, represents the opposite extreme, with inter-modal and broader social concerns taking precedence while sacrificing efficient pricing and, to a lesser extent, productive efficiency objectives of SMM. In the middle are four cases where attempts are made to satisfy the broad spectrum of indicators corresponding to the four SMM performance categories, though each succeeds to various degrees.
CityLink and the Costanera Norte offer the most balanced results in terms of attaining many of the performance criteria across all objectives. Both projects include implementation of distance-based electronic pricing, though the Costanera Norte has the advantage of allowing for peak-period pricing via the tarifa de saturación. Both demonstrate success in attaining high degrees of productive efficiency, seem to represent relatively efficient allocations of societal resources to meet area transportation objectives (especially CityLink), and have more-or-less met broader societal goals (albeit not necessarily satisfying all stakeholders).

Two projects which bundled tolled and un-tolled highway links, the MMCs and the Douro Litoral, succeeded to some extent on delivering on societal goals. The cases, however, generally fail to meet most of the criteria regarding pricing and optimal traffic flows, productive efficiencies, and investment efficiency for the larger transportation system. It is possible that the many trade-offs required to satisfy so many different constituencies may have eroded some of the economic and financial benefits of tendering these PPPs to private partners.

6.2 General Patterns in a Cross-case Study Analysis

Several general patterns emerge from the case comparison. The previous sub-section alluded to one of the clearest patterns: the evolution of institutional design of highway PPP procurement and implementation, accompanied by changes in patterns of performance relative to SMM. This trend and the associated outcomes illustrate several interesting patterns with respect to project complexity, finance, and regulatory structures. With respect to formal institutional structures, the patterns are less clear. The degree of devolution of authority to sub-national levels of government seems at best a minor factor in the outcomes revealed, however, this may have much to do with the complexity of issues involved. At the same time, sub-patterns within the overall governance frameworks of the PPP cases suggest important effects. This section will explore these effects, focusing on the process by which projects were evaluated and on different allocations of risk between the public and private partners. Finally, I explore the potential influences of oft-overlooked parameters such as spatial factors and political context.

6.2.1 Temporal Patterns

The type of governance structure for deploying metropolitan highway PPPs has evolved from a largely isolated, project-oriented, finance-oriented, and market-driven framework to a more integrated, network-oriented, service-oriented, and co-operative structure. The trend corresponds to the gradual shift in outcomes in favor of more integrated and socially-acceptable (or at least socially-beneficial) investment decisions, but a relaxation of emphasis on pricing and the related elements of optimal use of infrastructure and productive efficiency for individual projects. In the middle are projects whereby more complicated contractual arrangements attempted to balance the objectives of SMM, with varying degrees of success.

Among the earlier cases, SR 91 and ETR demonstrate the strengths and shortcomings of metropolitan highway PPP programs aimed at shifting substantial risk to the private sector for delivering on SMM. Both projects delivered innovative (for the time)
electronic-based, variable pricing mechanisms (albeit only crudely demand-sensitive) to help regulate highway use and finance debt service and long-term operation and maintenance. Both cases achieved high levels of productive efficiency with life-cycle-cost principles applied to initial and subsequent investment, demand justifying the capacity decisions, and revenues exceeding forecasts. The arms-length, market-transactional nature of the contracts, however, left little room for dealing with the impacts of uncertain future levels of demand and revenues. Among the implications for these PPPs, higher-than-expected revenues were retained for higher profit equating to economic rent. Furthermore, the lack of flexibility in contract designs, and the private assumption of all commercial risks, left little room for true “partnership” in terms of flexibility to adapt to changing political and economic environments. The SR 91 contract grew so incompatible with corridor mobility needs that OCTA bought the franchise at a premium. The 407 ETR team and the Province of Ontario have been through multiple rounds of litigation and have been unable to negotiate changes that would even seem in the best interest of both parties. 407 ETR seems content to meet its contractual obligations, pay its debts, reap the benefits associated with a risky but thus-far highly-profitable investment, and hope that it can rely on the court system to protect its financial interests. The Province of Ontario, meanwhile, will likely pursue every possible avenue at its disposal to improve corridor mobility, short of direct putative actions, with little concern for 407 ETR’s financial position.

The PPP approach employed for London’s M25 Orbital, the most recent transaction analyzed in this study, represents practically the opposite end of the project delivery spectrum. The HA awarded the contract on an availability payment basis, which encompasses rehabilitation, management and operation of as many kilometers of connector roads as the M25 itself. There is no tolling, and the private consortium is not responsible for demand risk (only improving overall travel time through investment and management). Rather, the objectives of the concessionaire are to apply innovation and management expertise to deliver life-cycle-cost-effective levels of capacity according to specification. Such specification has been rigorously reviewed for consistency with overall corridor mobility management plans, although there is some question as to whether an alternative proposal for peak hour use of shoulder lanes might have delivered a more socially-beneficial outcome. Nevertheless, for all intents and purposes, HA has retained full policy control over the M25, facilitated project implementation, and arguably demonstrated value for money in pursuing a PPP. It appears to have sacrificed, however, the opportunity to leverage private intervention to support pricing elements critical to optimizing traffic flows.

The three contracts signed between the consummation of the ETR ground lease and the M25 PPP (Costanera Norte, the MMCs, and Douro Litoral) demonstrate mixed levels of attainment of SMM objectives. CityLink, while delivered at approximately the same time as SR 91 and ETR, compares more consistently to the three “middle-term” projects. These projects aimed to balance the rights, obligations, risks, and rewards in such a manner that could, in theory, incentivize public and private partners to cooperate on pricing, employing investment and operational protocols consistent with network-wide system management, and meeting the broader societal concerns. No clear patterns of
performance emerge, however, suggesting that other elements, including specific governance, spatial, and political factors play more important roles.

6.2.2 Patterns in Formal Institutional Structures

The influence of formal institutional structures on performance requires a nuanced analysis, particularly with regard to attainment of fiscal federalist principles. Overall, none of the project originators represents the theoretically best jurisdiction for implementing metropolitan transportation policy. Four of the originators are national governments (Costanera Norte, the MMCs, Douro Litoral, and the M25 Orbital) and three of the originators have sub-national, but supra-metropolitan, jurisdictions (SR 91, ETR, and CityLink). The only detectable pattern among these cases relates, again, to time, with some indications of higher levels of government assuming more control. The cases do not suggest, however, a strong relationship between scope of political jurisdiction and outcomes.

While fiscal federalism seems to imply the need to devolve greater responsibilities for transportation administration and finance, this research demonstrates strong and weak performances under both national and sub-national governments. For example, the two projects that register relatively strong performance across all SMM objectives, CityLink and Costanera Norte, were tendered by sub-national and national originators, respectively. As suggested in the hypothesis, this research expected to find stronger correlation between SMM outcomes and devolution of authority for highway administration and finance from (mainly) national-level governments to metropolitan regions. This hypothesis is not categorically disproved, but probably requires more cases for broader examination.

One of the expected benefits of fiscal federalism is to integrate decision-making on investment and management of different but complimentary functional components of a system (e.g., road, rail, and land use systems to address metropolitan mobility). It appears that the Government of Chile and the State of Victoria retain relatively high degrees of control over most major metropolitan transportation infrastructure concerning metropolitan mobility, and the CityLink and Costanera Norte concessions achieve broad-based achievement of SMM objectives across categories. However, the Portuguese Government has complete control over metropolitan transportation infrastructure in Porto, including local and regional rail services, but the Douro Litoral project appears to be in financial trouble (albeit probably owing more to macroeconomic conditions than failures of integration). Thus, it is not clear from the cases that integrating under a single authority the many functional areas concerned with different aspects of metropolitan mobility will necessarily lead to better outcomes.

Regarding other elements of the Structure of Highway Institutions category, few clear patterns emerge. First, it appears that the level of originator experience with highway PPPs has little influence on outcomes. The SR 91 and ETR cases took place in contexts with little originator and/or national roadway PPP experience and both experienced difficulty delivering projects consistent with the longer-term needs of larger metropolitan mobility systems. Experience with highway PPPs, however, does not guarantee success. In Spain and Portugal, originator experience in inter-urban roadway concessions appears...
to have poorly translated into success with metropolitan-level concessions, particularly
with regard to efficient deployment of private-sector expertise and resources (e.g.,
project-related productive efficiency) as well as overall efficiency of the investments
from a transportation systems perspective. The State of Victoria seems to have made-up
for a lack of organizational experience with PPPs by studying lessons learned from other
contexts, for example, by incorporating a PSC for project evaluation. The Government of
Chile seems to have avoided the fate of others by proactively dealing with expected
network and demand/revenue risks. This will be discussed in the following sub-section.

6.2.3 Patterns of Governance Institutions: Risk Allocation
Governance elements, or institutional factors regarding the structuring of relationships
among relevant actors (i.e., the “Contract Risk Allocation” and “Project Revenues and
Finance” categories), appear to have strong effects on overall performance. This is
particularly the case with regard to risk allocation. Specifically, the sharing of demand
risk in return for government control of some project finance factors, in addition to a
proper allocation of all other major risks, seems to relate to performance. In fact, the
correlation of these governance factors with overall achievement of SMM outcomes is
probably among the strongest revealed by the cases. CityLink and the Costanera Norte
demonstrate the strongest overall results across all SMM categories, while the London
M25 Orbital achieves similar levels of success across all measures excluding those
variables related to pricing. In all three cases, the contract originators essentially retain
(intentional) policy risks and land acquisition risks, while sharing network risks. This is
consistent with theory, which suggests that the government principals are best able to
manage these risks. The private firms retain most demand and revenue risk, as theory
would suggest, but the Victorian and Chilean governments recognize the substantial
uncertainties involved and agreed to provide some contractual flexibility to deal with
large divergences in revenues from expectation, high or low, in a systematic fashion. The
Costanera Norte concession allows for renegotiations whenever the Government of Chile
needs to adjust transportation policies that might affect the PPP project. The CityLink
concession allows flexibility for both future investments that are deemed mutually
beneficial and includes the MAE clause, which allows Transurban to make claims for
monetary remedy when government policies affect project finances. Meanwhile, the
public sector has been able to retain greater control over policies within the project
corridors, allowing for collaboration to deal with unforeseeable and ever-changing
circumstances.

This last point merits further discussion. While the public sector originator may retain
policy flexibility, perhaps enabled by MAE, fiscal balance and renegotiations clauses,
often the discretionary decision-making power has been apportioned to the project
grantor (e.g., MOP in the Costanera Norte case). In theory, the originator (in this case, the
Government of Chile) can determine the best metropolitan mobility policies from a broad
integrated perspective, and then, through its executive appendages, renegotiate
with/compensate private partners with highway PPP contracts to facilitate
implementation. In practice, however, the grantor may act on different objectives than the
originator. This may lead to mutually-beneficial relationships between the grantor and
private partner that are not necessarily beneficial for the originator. This research focuses
mainly on the impact of the structure of relationships between the originator and private partner, however conflicting bureaucratic objectives within a level of government can impact outcomes and will be discussed briefly in Chapter 7.

The M25 Orbital PPP also scores high across all SMM objectives except for pricing-related criteria. In this particular case, the UK government retains all commercial risk, but in exchange also retains near complete policy control within the M25 corridor. The private contractor (Connect Plus) is responsible only for the availability, quality, reliability, and safety of the infrastructure it is required to deliver.

While project grantors in the SR 91, MMCs, and Douro Litoral cases retain some policy risks and network risks, CityLink and the Costanera Norte distinguish themselves by sharing broader commercial risks. In the case of CityLink, Transurban retains most demand and revenue risk, but the State of Victoria pledges by contract to implement specific corridor investments and policies; assumptions upon which demand forecasts are based. The concession contract also allows for the deferral of concession payments should IRR figures not materialize in early years, providing Transurban with a valuable option to support project cash flows. In the case of the Costanera Norte, the Government of Chile guarantees SCCN a minimal level of revenues in exchange for a share of revenues exceeding a given threshold. In the case of the M25, Connect Plus is not responsible for generating certain levels of threshold demand but, rather, managing and operating the highway in a manner that improves travel time and reliability. These functions seem generally within the realm of control of Connect Plus. It probably also encourages coordination with public authorities at all levels to improve mobility throughout the corridor.

Inefficient allocation of land acquisition risk also adversely affects the MMC and Douro Litoral cases. The unanticipated high cost of condemning land in the Madrid periphery increased costs substantially on private partners responsible for the MMCs, and they are all today in financial distress. In the Porto case, AEDL is not financially responsible for land acquisitions, but they are responsible for administering land takings. Though this is not a direct transfer of risk, it is questionable whether private-sector intervention is administratively efficient for such a task.

A clear pattern emerges. A flexible approach to commercial risk; the retention by government grantors of regulatory authority over project revenues, tolling, and processes for changing contract scope; and an efficient allocation of all other risks - these all correlate with broad achievement of SMM outcomes across all objectives except perhaps pricing-related indicators. CityLink, the Costanera Norte, and the M25 Orbital generally exhibit these traits. The other four cases demonstrate less flexible allocations of commercial risk and/or deficiencies with respect to effective government regulatory authority for tolling and finance. At the same time, these four cases generally involve the complete transfer of demand risk to private partners. While an argument can be made in theory for the complete transfer of demand risk to the private sector as long as the government grantor retains a share of network risk (see Chung et al. 2008), empirical (if not theoretical) evidence outlined in Chapter 3 suggests that this might be problematic given characteristics of natural monopolies, imperfect markets in land and other systems,
and the complexity of the transportation networks in which metropolitan highways are embedded. As might be expected, financial results reflect the high variability of the risks involved, as two PPPs generated much higher-than-anticipated profits (SR 91 and ETR), while two appear to be in financial trouble (MMCs and Douro Litoral).

6.2.4 Spatial and Political Patterns

Though perhaps lacking in detailed theoretical elaboration, the effects of spatial and political context on PPP outcomes seems apparent from empirical observations outlined in Chapter 3 and general logic. Given the uncertainty of how people will behave given changes to a complex metropolitan transportation network, changes to any element of the system could produce unanticipated outcomes. Logically, alignment of new infrastructure and/or new rules on infrastructure within a network might influence SMM outcomes. Likewise, political factors will have an impact on institutions and, therefore, outcomes as well.

For example, consider the physical alignment of highway PPPs through the dense center of a metropolitan area. The CityLink concession includes two primary axes running through the center of Melbourne, albeit bypassing the central business district, which connect with critical economic origins and destinations in the south (Port of Melbourne) and north (Melbourne Airport) and the interstate highway network running east and west. CityLink includes the expansion of existing roads, where levels of usage are already firmly established. Land uses are also generally well established throughout the route, except for perhaps the developing Dockland areas to the west. It is not surprising that this western extension is the only segment of the project that has resulted in lower-than-expected demand. Development of transportation infrastructure in the highly-settled center of Metropolitan Melbourne has not been without challenges. Transurban undertook extensive tunneling in some areas, in excess of original plans, in order to satisfy environmental and community concerns. While this increased the costs of the project, the concessionaire believes that this investment will pay-off in the long-run in terms of community goodwill. It does not appear to have disadvantaged profitability.

Somewhat similarly, the Costanera Norte runs from high income suburbs in the East of the city, straight through downtown Santiago to a newly developing business and industrial park, and the airport in the West (with connections to the nation’s main North-South highway in the city center and the highway to the highly populated Coast in the West). Construction of this alignment imposed at least five years of delays to account for community and environmental concerns, which eventually led to higher costs of construction. The end result, however, is a project more consistent with overall societal objectives, while generating stable demand and exhibiting robust financial performance. Though construction delays were problematic, the process of “internalizing” community and environmental concerns yielded a price more closely associated with actual societal costs. The Government of Chile ultimately had to provide at least US$80 million in complimentary investments and some revenue guarantees. The fact that the entire project scope is not entirely financeable with user-fee revenues is not necessarily an indicator of a socially undesirable project. Once the costs were allocated among public and private parties, the concessionaire became responsible for a specified level of investment and
performance. To date, the project has delivered levels of demand and revenues more-or-less consistent with those envisioned at the signing of the contract. The more complex concerns of inner-metropolitan residents were reasonably addressed. Finally, the contract includes mechanisms for renegotiation should broader policy concerns again require public and private cooperation in the Costanera Norte corridor.

The suggestion that CityLink and the Costanera Norte may have derived better overall outcomes with respect to SMM because of alignments through the respective metropolitan centers seems almost counter-intuitive. One might expect private participation in infrastructure delivery to be particularly challenged by the complexities of satisfying inner-metropolitan mobility and, really, quality-of-life objectives. However, delivery of projects in areas of mature mobility patterns and land uses also confers some level of stability and relative predictability of use and capacity needs. Furthermore, the fact that these projects considered, by design or otherwise, a wider range of objectives throughout the project evaluation (or at least the tendering) phases promoted processes that took into account broader societal concerns as part of planning, procurement, development, and long-term management. At the same time, nearly all of the suburban PPPs in current operation (e.g., SR 91, ETR, and the MMCs) have experienced wide variability in demand. Furthermore, conflicting policy objectives, often arising after contract completion and project opening, seem to have contributed to less optimal outcomes. For example, MMC revenues seem to have suffered from an alignment motivated as much by development of sparsely-populated land as by congestion relief. Furthermore, the policy objective that ETR would facilitate goods movement through Metropolitan Toronto has not materialized as desired, and the Province of Ontario has little leverage to renegotiate.

Another spatial factor worth exploring is the complexity of the roadways included in the PPPs themselves. Table 21 does not include this variable because no clear a priori assumption exists about its influence on SMM. Bundling many road links seems to actively internalize network spillovers, but at the same time exacerbates monopoly conditions. Perhaps in recognition of the complex interactions of road segments operating in a dense metropolitan environment, more recent PPPs have included not only radial segments financed through BOT mechanisms, but also requirements for the in-kind construction of complimentary links (the MMCs) or M&O agreements for other corridor links (Douro Litoral). The M25 Orbital essentially concessions the entire system of main highway access routes into Greater London. The remaining concessions include single links (SR 91 and ETR), single links with one complimentary link (the Costanera Norte), and two axes with no complimentary links (CityLink).

Two potentially informative patterns seemingly emerge. First, under certain conditions, BOT-style concessions may offer feasible solutions consistent with SMM where they include relatively simple links in otherwise complex metropolitan highway networks. These conditions might include alignments in areas with established land development where patterns of user behavior are more predictable, and where contracts relatively easily allow for the sharing of some commercial risks and the flexibility for both regulation and renegotiation. The CityLink and Costanera Norte concessions show that such an outcome is feasible and consistent with SMM. Second, where it proves too
difficult to sufficiently specify critical parameters for the concession of a simple metropolitan highway link, it might be more efficient to tender a cohesive network. The MMCs and the Douro Litoral seem to recognize the network effects of delivering new highway infrastructure, and both aim to satisfy broader network demands through cross-subsidies within the respective PPP programs. The outcomes, however, apparently sacrifice the financial and economic integrity of the BOT programs without necessarily optimizing the investment from transportation system or broader societal contexts. The M25 Orbital, on the other hand, delivers an integrated highway solution by, essentially, integrating almost all relevant metropolitan highway links under a single PPP with consistent performance objectives, albeit still isolated from the rest of the metropolis.

Lastly, the influence of political context cannot be discounted in terms of impacts on both overall institutional structure and the governance of PPP programs and projects. Political context can help determine not only the best technical solution, but also the project alternative more consistent with broader societal objectives. This includes issues such as perceptions of fairness and social equity which are critical to public acceptability and, hence, social welfare.

Numerous insights can likely be gleaned from analyzing political contexts, however, I attempt to discern the motivations for each project and project delivery mechanism. Two projects appear to have been rigorously planned and then tendered only after thorough evaluations of the benefits and costs of PPP versus traditional procurement. Though far from perfect, the evaluations carried out in support of the CityLink and the M25 Orbital PPP generally demonstrated both clear economic rationale for project development and value for money in seeking private-sector partnership and finance. While each project inevitably has its detractors, it is probably fair to say that each was largely motivated by a desire to improve levels of mobility in the most efficient manner possible. As illustrated previously, both projects register relatively high on a broad spectrum of SMM outcomes.

The remaining projects appear to have been motivated as much by financial pressures on public budgets and/or political philosophy. With the notable exception of the Costanera Norte, the outcomes appear to have been adversely impacted. Caltrans delivered SR 91 as a pilot to study the possibility of wider adoption of private finance of highway infrastructure delivery, which was motivated in large part by lack of public funds and State-level Legislation encouraging private sector involvement. The initial segments of the ETR were effectively delivered by the OTCC, but subsequently tendered for a long-term ground lease under political pressure by a newly-elected provincial government. Tendering the ETR might have been advisable, however, it appears that the government prioritized expediting privatization and securing the highest possible ground lease payment over necessarily negotiating the best possible long-term deal. Spain and Portugal have a relative long history of applying PPP project delivery mechanisms for inter-urban highways. However, the motivation for seeking private finance for metropolitan highway infrastructure stems, at least in part, from efforts to facilitate EU integration by maintaining lower deficits and liberalizing industries generally. While PPPs have been reasonably successful on some inter-urban routes in both countries, it does not appear that existing strategies appropriately accounted for complexities of metropolitan highway networks. The Costanera Norte concession certainly seems to have been motivated in
large part by finance-oriented objectives and/or political objectives. Unlike the Portuguese and Spanish cases, however, the Costanera Norte tender resulted in years of complex negotiations with numerous stakeholders which, as previously suggested, may account for outcomes that are overall more consistent with the SMM framework.

In summary, three cases appear to have achieved relatively broad positive outcomes across the spectrum of categories for evaluating SMM – CityLink, the Costanera Norte, and to a lesser extent, the M25 Orbital. Formal institutional factors apparently supporting SMM include the presence of a project originator with substantial control over most metropolitan transportation infrastructure systems and the ability of the originator to distill lessons learned from previous experiences in designing metropolitan highway PPP structures. With regard to governance structures of project delivery and contracts, balancing commercial risk with government flexibility for regulating project pricing and finance and theoretically efficient allocation of all other risks strongly correlates with broader realization of SMM objectives. Public assumption of (intentional) policy and land acquisition risks combined with shared network and possibly demand risks is critical to delivering both the stability and flexibility required by both parties to address uncertainty and adapt to unanticipated needs. Spatial factors also appear relevant and two options emerge. In the first case, corresponding to CityLink and Costanera Norte, a grantor will tender a relatively simple link or set of links closer to the center of a metropolitan area. The project will account for many of the competing objectives up front and allow substantial flexibility to adapt to change. A second option, roughly corresponding with the M25 Orbital, applies to a case where highway segment performance is linked strongly to a wide array of complimentary network links, whereby it may be advisable to tender the entire (or at least most relevant) parts of the network. Finally, projects tendered after rigorous public planning and economic evaluation fare better than those primarily motivated by finance or philosophy.

6.3 Revisiting the Hypotheses

Having distilled the key patterns from the cases, we can now return to test the initial hypotheses. The over-arching hypothesis is that three key elements must be present in order for a metropolitan highway program to achieve the full realm of objectives in the SMM framework. First, formal institutional structures must respect principles of fiscal federalism, implying that all administrative and fiscal responsibilities for metropolitan highway investment and management should be entrusted to a public body whose jurisdiction roughly corresponds with the same geographic scale. Second, projects should be delivered under public-private governance structures where risks and responsibilities are distributed to the entities best able to efficiently control and implement such project elements. Third, the configuration of metropolitan highway PPPs should attempt to endogenize network and other spatial externalities by contracting broad area, corridor or, perhaps, entire metropolitan mobility PPPs.

While none of the cases represents a perfect scenario for fiscal federalism, neither do they offer much evidence that devolution of transportation administrative responsibilities alone makes a substantial difference. First, the optimal alignment of policy jurisdiction may be context specific. CityLink offers one of the closest approximations of fiscal
federalism, with the State of Victoria historically retaining substantial control over most major transportation infrastructure in Metropolitan Melbourne. Daley (2011) suggests, however, the CityLink concession has many unique attributes contributing to its success, which have not always been replicated in metropolitan highway PPPs elsewhere in Australia that have been tendered by state authorities. In the case of the Costanera Norte, the Government of Chile is responsible for most metropolitan-scale transportation infrastructure in the SMA, and retains much of the technical and institutional knowledge for project evaluation and PPP delivery. Plus, Santiago is the seat of the national government, and the SMA is by far the most important political and commercial center in the country. Moreover, the Costanera Norte case demonstrates that local groups have substantial power to slow-down and influence project delivery, and it appears that such voices may have helped shape a better outcome. In a sense, this outcome helps support arguments for greater adherence to fiscal federalism by reducing asymmetries of information between constituents and representatives and reducing political pressures from outside the relevant jurisdiction. The M25 Orbital is also tendered by a national-level authority, but benefits from the institutional knowledge and experience of the UK Government's PFI initiative as well its situation in the population, commercial, and political center of the country.

The second hypothesis regarding the efficiency of PPP structures under the condition of optimal allocation of risks is supported by the cases. The three cases demonstrating the best overall results with regard to SMM objectives — CityLink, the Costanera Norte, and the M25 Orbital — most clearly demonstrate public assumption of (intended) policy risk and land acquisition risk, and shared network risk, whereas each of the other cases is deficient (partially or wholly) in at least one of these criteria. It is less clear what the "theoretically" optimal allocation of demand risk should be, though the literature seems to support the sharing of these risks in return for some level of public policy control over project pricing and management. CityLink (indirectly) and the Costanera Norte (explicitly) provide some level of shared demand risk, while also permitting some level of government flexibility to regulate the concession (e.g., toll rates). The M25 Orbital transfers all demand risk to the public sector, and the use of availability contracts seems to offer a viable alternative for securing efficiencies of private commercial management while mitigating the risk premiums for transferring demand risk. None of the other cases demonstrate sharing of demand risk, and the outcomes reflect either excessive profits or financial distress. Neither of these outcomes appears particularly beneficial for social welfare.

While the third hypothesis does not hold across all cases, important spatial patterns emerge. The question at hand is how can public- and private-sector objectives be reconciled to deliver metropolitan highway infrastructure in a manner consistent with the SMM framework? The cases suggest, albeit preliminarily, that the alignment of the highways themselves might be relevant to outcomes. Two spatial patterns, in combination with adequate flexibility and risk allocation in contracts, suggest the potential for better outcomes. One, corresponding to the CityLink and Costanera Norte PPPs, includes relatively simple alignments of one or two road axes that run through the center of the metropolitan area. The second feasible option is more consistent with the
initial hypothesis. Following the M25 Orbital example, a metropolitan highway PPP might include many highway links, but tendered as a cohesive area, corridor or, perhaps, metropolitan network.

A fourth pattern also bears mention. The cases suggest that metropolitan highway PPPs might produce better outcomes if they result from a service-oriented evaluative framework rather than where finance and political philosophy dominate. This is not entirely surprising, particularly in light of the empirical literature on PPPs in Chapter 3. This element is not explored as an explicit hypothesis in this research, mainly because this insight has been thoroughly researched. Nonetheless, it is important to note that this research provides consistent results with earlier studies on this topic.

In revisiting the theories supporting my hypotheses, a few judgments can be rendered. First, the case studies appear to validate the theory that PPPs can enhance productive efficiency when risks are assigned to the partner best able to bear and control them, while allowing for sharing of risks that are not controlled by any one entity or where multiple project objectives (e.g., social concerns) require greater flexibility. Furthermore, the empirical evidence shows that area or corridor performance contracts do support efficient project delivery in certain contexts, but that BOT structures can work on relatively simple links in a network if those links are embedded in highly-developed areas with established land use and mobility patterns. Previous empirical work demonstrating the value of service-oriented decision-making versus finance-oriented decision-making is validated. Finally, the assertion that rigid adherence to fiscal federalism is not disproved. Rather the cases demonstrate little evidence to empirically support devolution for its own sake, while illustrating the practical difficulties of attributing benefits and costs to highway systems.
7 Conclusions

This thesis sought to answer the question: What is the optimal institutional structure for delivering urban highway infrastructure consistent with the concept of sustainability? Parallel trends towards integration of metropolitan regional transportation policy and private participation in the finance, provision, and management of infrastructure suggested a need to better understand how public- and private-sector actors could effectively work together towards advancing SMM and, to a larger extent, urban economic vitality and quality of life. After reviewing public finance, network economics, transaction costs, political economy, contract, and property rights theories, I proposed three hypotheses:

- Optimal delivery and management of metropolitan transportation infrastructure requires an authority for metropolitan transportation provision whose formal institutional design is consistent with fiscal federalist principles.
- Optimal delivery and management of metropolitan transportation infrastructure PPPs requires the distribution of risks and responsibilities to the entities best able to efficiently control and implement such project elements.
- The optimal highway PPP project configuration should incorporate links and project components in a manner that facilitates contracting of broader area, corridor, and/or metropolitan mobility objectives.

Focusing on the PPP project delivery mechanism, I applied an international comparative case study methodology to test these hypotheses. The cases support some theories, while providing richer context for the consideration of others. I offer four conclusions.

First, no clear pattern emerges regarding adherence to fiscal federalist principles, alone, and outcomes more consistent with SMM. Still, regardless of geographic scope, the originator’s relative level of authority over all modes of transportation seemed to be somewhat beneficial. Perhaps it is simpler to integrate policy within the same “level” of jurisdiction than vertically or horizontally across jurisdictions. In short, the “transaction costs” for integrating across defined jurisdictions may be high, or the appropriate geographic scope too difficult to define. At the same time, causality may run in the opposite direction. It appears that metropolitan PPPs (for example, the Costanera Norte in Santiago) might actually help catalyze movement towards fiscal federalism by assigning costs directly to users and stimulating involvement of groups of stakeholders with diverse perspectives.

Second, projects performed better when contracts allocate risks based on which party is better able to bear and control them. In the case of some commercial risks where neither party has complete control, government assumption of most network risks is helpful. In some cases, sharing of demand risks in return for some level of government regulatory control might help stabilize finance and ensure both reasonable private and social returns on investment.
Third, there seem to be two spatial configurations that promote successful outcomes. Where market failures—such as difficult-to-quantify network externalities—exist, a viable approach (consistent with my hypothesis) is an area-wide, corridor, or metropolitan-wide concessions where compensation is based on meeting performance objectives. However, for relatively simple links that traverse the denser core of a metropolitan area (i.e., where land development and mobility patterns are relatively mature), private firms might be better positioned to take on more demand risks, as long as institutional structures are in place to prevent abuse of market power. This is probably because there may be lower levels of uncertainty in forecasting demand and mobility patterns or, perhaps because there is a greater value for reducing travel time near the urban center where congestion is typically the highest.

Lastly, the case study outcomes are consistent with other empirical work suggesting that highway PPPs work best when tendered and evaluated on the basis of providing lower costs for equal or greater levels of social benefit (i.e., value for money). PPPs tendered principally on the basis of political philosophy or to relieve cash-strapped public budgets do not perform as well. This is perhaps because in the former case, the government might fail to thoroughly analyze the best policy and, in the latter case, because private finance will not fix underlying institutional weaknesses.

These insights will hopefully have value in aiding policy-makers in designing viable institutional structures for delivering metropolitan highways. Furthermore, the approach itself should be useful to researchers and policy-makers in framing future consideration and discussion on the strengths, weaknesses, opportunities, and limitations of PPPs for addressing different aspects of SMM. In characterizing SMM, I have linked this framework to leading theories arguing for both government action as well as private finance and management of infrastructure. I also elaborate a set of indicators to measure achievement of SMM objectives in light of formal institutional, governance, spatial, and political factors that the literature suggests are related to elements of the SMM framework. This framework is, however, also adaptable to different contexts. It is possible, for that one could adopt this same basic framework and analytical approach but vary the weights of categories to better reflect a given value system. The directional relationships and internal conflicts might still hold, but produce other important insights. The framework is also scalable to consider a larger and wider sample of cases.

Finally, while the case studies point towards the aforementioned conclusions, it is important to take a step back and consider the wider implications of this analysis from a broader perspective. In the remainder of this chapter, I first discuss the biases and limitations of the research approach and methodology. Then, since a “good” model should help predict outcomes under future scenarios, I consider the broader applicability of my approach to other contexts and infrastructures. Finally, as the cases revealed a number of issues that merit further research, I conclude with a brief discussion of some of these.
7.1 Biases and Limitations of the Case Study Analysis

While I made every effort to find a set of cases representative of the “universe” of metropolitan highway PPP projects and to pursue both breadth and depth of data to accurately represent the cases chosen, a number of biases and limitations could well remain. To limit the influence of such biases, I did my best to pursue alternative perspectives on each case, view any emergent pattern with skepticism, and caveat findings appropriately. This subsection discusses some of the biases and limitations, the steps taken to mitigate these challenges, and remaining concerns.

First, my own biases and limitations as a researcher include perceptions from personal experience, language barriers, and availability of communications channels to acquire data. Having previously worked in both the public and private sectors on issues of economic development and, more recently public-private finance for land development, I have developed my own unique perspective. While trying to be conscious of my biases, I recognize my predisposition to support the idea of highway PPPs, while also being experienced enough to view many political and commercial arguments with caution. Overall, I may over-emphasize the benefits of technical/technocratic analysis, although I have done my best to consider wider societal goals and practical commercial arguments (e.g., cost recovery). Culturally, language barriers forced me to select cases primarily from English-, Spanish-, and Portuguese-speaking contexts, given my ability to read and communicate (at various levels of competence) in these languages. Fortunately, this constraint is not overwhelmingly limiting, as many prominent metropolitan highway PPPs have occurred in locales where one or more of these languages is widely spoken.

Finally, I relied on a combination of existing networks through faculty at MIT and IST in Portugal as well as relationships developed at conferences to secure written data and personal interviews for the case studies. Therefore, my sources may be biased towards those sources most easily available to me.

Another limitation and potential source of bias in this research is inconsistency in the types of data available for each of the seven case studies. Ideally, the cases would be based on exactly the same types of data to consistently analyze the institutional factors and relative SMM performance indicators. In actuality, the type, form, and quality of data available vary substantially for each case. For example, the level of detail regarding the performance of private-sector contractors on economic, financial, social and other expectations of different PPPs depends on the level of government and/or contractor transparency in making project evaluation documents available. In some cases, such as the Douro Litoral case, project evaluation documents, otherwise not readily accessible, were available for this analysis due to my meetings with officials in Lisbon and their willingness to share public documents.

Despite my efforts to speak with a range of government officials, industry representatives, and academics familiar with each PPP project, personal sources for each case were often skewed towards responsive entities willing and able to provide direct assistance. I investigated and attempted to corroborate all noteworthy claims made by interviewees, but the analysis may still inadvertently give weighted voice to the identified and successfully engaged sources. Overall, I believe that Douro Litoral probably represents the most “balanced” case, largely due to my participation in the MIT-Portugal
Program and the contacts and on-the-ground presence thereby facilitated. I also believe ETR and CityLink represent well-balanced cases, with the former represented by a mix of government officials, academics, and consultants and the latter represented by industry and academics. The MMCs and the Costanera Norte case representations depended heavily on communication with academics and, in the latter case, advocates. I spoke briefly with government officials in the SR 91 and M25 Orbital cases, but was not able to secure timely enough direct assistance.

Consistent inclusion of data in this analysis also posed a challenge. For example, each SMM objective contains varying numbers of representative performance indicators, each evaluated based on the fulfillment, partial fulfillment, or lack of fulfillment. The analysis could yield the impression of assigning equal weight to each objective, and equal weight to each performance indicator under each objective. However, the intention was not to assign "scores" for each case, but rather to identify patterns of institutional structures and patterns of outcomes, while applying a more qualitative and holistic view of performance in making judgments on overall outcomes. Another researcher might weigh the relative value of some objectives and/or performance indicators in a different manner and I encourage any researcher with particular insights on relative values to do so. For the purposes of this thesis, however, my goal was to represent directionality of impacts and consider the overall outcome.

Another limitation worth discussing concerns the comparability of outcomes across different contexts. I looked at theory to develop hypotheses on expected impacts of different meta-institutional variables on PPP performance and I attempted to both identify valid indicators and control for other known factors expected to impact outcomes. Some patterns seem to emerge that are consistent in many respects with theory, while other results – such as the relative merits of two seemingly successful spatial models – offer interesting possible nuances. We cannot reach definitive conclusions about the generalizability of these results across different contexts. Instead, the results suggest the value of more in-depth and wider analyses.

Finally, it is important to recognize that two of the PPPs, the Douro Litoral and the M25 Orbital are not yet fully operational according to the terms of the respective contracts. Therefore, the judgments on these cases are preliminary and, to an extent, speculative.

7.2 Applications of the Emerging Analytical Model

For a model to be valid, it must consistently predict outcomes given a specified set of inputs. Pulling from public finance, network, political economy, contract, property rights, transaction costs theories, I defined a number of institutional variables hypothetically influencing various elements of SMM. Reviewing the literature on sustainability, and its underlying theoretical concepts, I defined performance indicators as rough proxies for achievement of SMM. If the model and underlying data are correct, then this approach should enable us to predict SMM outcomes for other metropolitan highway PPPs in institutional contexts similar to those studied in this thesis.
For example, many of the project originators (and grantors) introduced in the case studies have subsequently entered into additional PPPs for different metropolitan highway projects. In the wake of the Costanera Norte, for instance, MOP concessioned four additional highways in Santiago which are all now in operation. To some extent, institutions have adapted based on lessons learned, in part, from the cases described in this thesis. However, many other institutional variables remain the same. The following paragraphs review some of these projects briefly and assess, initially and basically, the validity of the analytical model for predicting general SMM performance.

The State of Victoria recently issued another PPP for EastLink, a highway extending north-south along the eastern boundary of the Melbourne Metropolitan Area. The project was delivered in 2008 at a cost of US$2.4 billion under a PPP contract. The PPP shares many of the same institutional characteristics as the CityLink concession. However, bid evaluations prioritized the lowest proposed toll rates, and the State limited the potential growth of tolls to inflation. Furthermore, excess revenues must be shared with the public sector. These tolling and finance criteria responded, in part, to some of the perceived weaknesses of the earlier CityLink concession. The 39 kilometer EastLink project delivered five months ahead of schedule and, after a contractually agreed-upon four-month toll-free period, began collecting tolls to finance debt service and operations (FHWA, 2009).

Due to EastLink’s location along the metropolitan periphery, the analytical model predicts that productive efficiency objectives of the SMM framework will suffer relative to CityLink. The case study analysis suggests that physical alignment of CityLink through the center of the Melbourne Metropolitan Area contributed to the highway’s strong performance against many SMM objectives, especially for meeting revenue and demand targets. The case analysis also suggests that PPPs for simple links can perform well under BOT-type contracts when aligned through mature (in terms of land development) areas of metropolitan area, where land use and mobility patterns might be more predictable and, hence, less risky for a private venture to finance.

At the same time one of the primary weaknesses of CityLink relates to meeting societal goals and, specifically, perceptions of fairness as challenged by perceptions of high tolls. Perhaps greater government control of toll rates could be exchanged for public-sector assumption of more commercial risk, though the theoretical argument for shared demand risk is weak given the public ownership of network risks and intentional policy risks. In the case of EastLink, however, the private firm seems to take on more risk with little additional government support. Therefore, there is some risk that, even if societal goals are more closely approximated, productive efficiencies may be adversely affected.

Based on preliminary and somewhat superficial information, the analytical model would predict poor demand and revenue performance and, hence, failure to broadly achieve project-specific productive efficiencies. This seems to match current reality. Daley (2011) explained that EastLink’s share prices have fallen by nearly half from AUS$1 to AUS$0.43 since opening. Although Mr. Daley is a competitor of the EastLink project team, his characterization is consistent with informal conversations I have had with other persons in Australia familiar with both projects. Granted, the concession term is still early
and EastLink opened during the height of a world financial crisis. Nonetheless, CityLink continues to prosper, at least financially, and has been more resilient to commercial risks.

Consider now the Portuguese case. In tendering a system of highways on the south bank of the Tagus River, across from Lisbon City, the Government of Portugal has sharply deviated from its governance (hence, tendering and contracting) approach to the Douro Litoral concession. Awarded in 2009, the Baixo Tejo concession includes a mix of tolled (17 km) and un-tolled (51 km) metropolitan highway links. Unlike the Douro Litoral concession, however, toll proceeds will revert to EP and the concession team will be remunerated entirely via availability payments based on performance. Otherwise, many of the actors are the same (Brisa has a 30% stake in the concession), the formal institutional structure is the same, and the project is configured in a metropolitan area network (in this case covering just the portion of the Lisbon Metropolitan Area along the south banks, although Brisa is actually involved in highway concessions on both banks of the River) (Brisa, 2009).

The analytical model suggests that the availability payment structure should, relative to the outcomes observed in the Douro Litoral case, offer improved project-specific productive efficiencies and greater opportunities for mutually-agreeable renegotiations. In the case of productive efficiencies, the concessionaire is incentivized to apply all of its commercial expertise to efficiently deliver on mobility and other objectives defined in the contract, without concerns for the economic distortions and financial risks that have plagued efficient delivery and operation of the Douro Litoral. The Portuguese Government’s assumption of commercial risks should also make it easier to engage the concessionaire in renegotiating elements of the contract to conform with changing policies. Regarding renegotiations, however, the flexibility of easily renegotiated contracts comes with risks, such as renegotiations serving the interests of those directly involved at the expense of users and the public at large. Nevertheless, the analytical model suggests that the results should resemble the London M25 outcomes, with the added benefit of road pricing to help support demand management and financing of at least some of the newer links. As the Douro Litoral transitions from construction to full operations phase, it will be interesting to learn if these predictions hold.

The case studies alluded to other metropolitan highways, either in the same or related metropolitan contexts. Although time and resource limitations prevent further analysis of these, I briefly summarize them for future research considerations. The Costanera Norte case suggests that the highway was tendered as the first of at least four additional metropolitan highway concessions, which were designed for interoperable electronic pricing and, in theory, conceived as a cohesive network. These include a mix of brownfields and greenfields as well as a mix of alignments towards the center and periphery of city. Plus, one could assume that all of these highways interact with one another. There are many opportunities then to test various facets of this emerging model. The MMCs case alludes to the MF’s plan to aggressively seek private finance for future highway development. PPPs have fallen out of favor in Metropolitan Los Angeles. As alluded to in the SR 91 case, however, the State of Virginia is re-deploying the HOT lanes concept along stretches of the Washington, DC beltway. It will be interesting to see, over time, how well the MF and the State of Virginia absorb lessons learned from past
experience with metropolitan highway PPPs in Spain and the USA, respectively, particularly with regard to balancing the assignment of demand risk to the private party, retaining policy flexibility, and coordinating land use development on greenfield projects.

Finally, given the ongoing proposals for and development of PPP highways in metropolitan areas around the world – Mexico City, Mumbai – other institutional contexts could be similarly examined under this model to modify it and/or extend its validity.

7.3 Insights for Further Analysis

Application of PPPs for metropolitan highways is a relatively new policy strategy and requires greater theoretical and empirical study in order to help meet the demands for more sustainable approaches to planning, financing, developing, and managing urban mobility infrastructures and services. While the case study analysis focused on the institutional, spatial, and political dimensions of metropolitan highway PPPs and performance relative to SMM objectives, other interesting themes emerged that might warrant further analysis in future empirical work. The most straightforward extension of this research would be to deepen the analysis of the existing cases and add additional cases, from similar and different institutional contexts. For example, in the USA since SR91, metropolitan highways have been developed in Chicago, Denver, Texas, and elsewhere.

In addition, possibilities for applying quantitative statistical methods to measure the magnitude and relative importance of different institutional and related factors identified in this thesis on SMM outcomes could lend further support to the analysis. Unfortunately, the lack of a large sample (or population) might complicate the application of statistical methods in this case. The case study method seems appropriate to the somewhat exploratory scope of this thesis. While the case study design aimed to control for some variables while allowing others to vary and thereby “isolating” potential effects, the truth remains that metropolitan mobility systems are highly complex. It is difficult to capture the degree of correlation between all the known and unknown factors, as well as to accurately and consistently represent outcomes. As the number of metropolitan highway PPP cases grows, it might become more feasible to apply statistical methods to help lend an additional quantitative layer of rigor to analyzing this topic.

The cases also reveal some preliminary leads for investigating other potential linkages between institutional, spatial, and political factors and sustainable outcomes. The following paragraphs briefly review these topics.

First, I have identified two different spatial strategies for metropolitan highway PPPs: relatively simple, BOT concessions in dense inner-metropolitan areas (potentially brownfields) with established land use and mobility patterns and area-wide performance-based PPPs for wider networks with high potential for various market failures and high social concerns. Engel et al. (2008) argue that one of the benefits of a highway PPP program is applying market scrutiny to test whether or not a project is financially viable or a “white elephant.” However, the downside might be that only “financially-viable” projects will be funded, regardless of “economic viability.” The two-pronged spatial
approach might work because it seeks to extract as much benefit from private participation as possible given a set of constraints. In the financially-viable PPP case, more demand risk can be transferred to the private firm, which in that particular case might very well be able to more efficiently control relevant factors leading, theoretically, to greater net social welfare. For less financially-viable but socially beneficial metropolitan highways, the area-based performance contract could be helpful in extracting the efficiencies of private expertise in long-term, life-cycle management. A number of factors might reduce the financial feasibility of a given link, such as network externalities with substitute and/or serial links, lack of control of other factors (e.g., land use development). However, private participation and finance can still improve efficiencies from integrating tasks (see ENACT, 2008) given public assumption of some demand or all demand risk and setting the right incentives for performance such as availability payments. More research is necessary to further test this insight.

The cross-case study analysis suggests that PPPs for relatively simple, and usually greenfield, highway links on the peripheries of a larger metropolitan network do not perform as well relative to the SMM framework. In these cases, project finance outcomes vary substantially in both directions (excessive profits and financial distress). Possible connections between the variability of finance risk and the spatial configuration and location of a network link merit further analysis. Related to this topic, one could further explore how brownfield PPPs fare relative to seemingly riskier greenfield projects.

Furthermore, and as suggested by Collier (2011, Healthy Transport Consulting, Personal Communication), it would be interesting to study in greater depth the relative value of applying PPPs to price, manage, and maintain existing highways rather than to expand highway networks into less developed areas. This is also related to the high occupancy toll (HOT) lane movement in the USA and its PPP potential (evidenced by the original SR91 and the more recent projects in metropolitan Washington, DC). The lessons of the MMCs suggest that such an alignment could improve performance of suburban PPPs.

Another possible area of future inquiry concerns the economic, regulatory, and legal consequences of the trend towards performance based/availability payment contracts. My analysis presents the SR 91 and ETR cases as residing at the opposite end of a spectrum relative to the M25 Orbital, with the former cases prioritizing competition and the latter prioritizing integration and regulated monopoly. Essentially, contracts seem to be converging around the utility distribution model in countries such as the USA, at least prior to deregulation in the 1980s, except that the government can negotiate “payments” on behalf of users. In the case of the aforementioned, Baixo Tejo contract in Lisbon, Portugal, users will be required to pay user fees that in theory help fund concession payments to a monopoly provider of highway access. This trend may make sense at first glance given the economic and physical properties of highway networks that become increasingly dense as they approach the central node(s) of metropolitan areas. But is this really an efficient development? What about the promised efficiencies from deregulating utilities, rail, and other network infrastructures? Contract theory and property rights theory suggest that there is no a priori reason to suggest that regulation is necessarily efficient in response to economies of scale arguments for integration, but they allow that regulation may be necessary in practice due to the limitations of writing good contracts,
market failures, and social concerns (Gómez-Ibáñez, 2003; Demsetz, 1968, Shleifer, 1998, etc.). It appears that setting the right incentives is critical to the efficient and equitable functioning of any metropolitan highway PPP, and more research is needed on this topic.

Future research might focus on political aspects of highway PPPs. For example, what is the impact of political expediency on highway PPPs? In Toronto, the zeal to concession the ETR ground lease as quickly as possible before demand had fully matured and for the highest up-front price may have led to social welfare loss. Furthermore, how many political objectives can be lumped into a metropolitan highway PPP without eroding the potential benefits of private-sector infrastructure provision and management? The Government of Spain tendered the MMCs, at least in part, to satisfy real estate development interests. The results, thus far, are not encouraging, at least from a transportation and demand management standpoint. Engel et al. (2008) recommend separating the project grantor from project regulator in PPP programs. Given that renegotiations and flexibility are important to meeting long-term, and presumably unforeseen needs, ensuring transparency and sound investment evaluation may be critical to preventing conflicts of interest. The creation of an independent road regulator in Portugal should, in theory, lead to more favorable renegotiations for the Portuguese Government, but what happens when a project such as the Douro Litoral leaves few favorable options for either party? To take this argument one step further, what is the best regulatory structure for metropolitan highway PPPs, and where should that authority be housed? One can see where fiscal federalism might fit into this discussion.

Finally, why is it necessary for private participation to help promote pricing and productive efficiency elements of SMM? In theory, a state-owned enterprise can finance projects based entirely on revenue bonds (hence, subjecting the investment to the discipline of the marketplace), can make investment decisions considering long-run life-cycle-costs (hence, they are not necessarily wedded to cash accounting practices that traditional government agencies often must adhere to), and has less incentive to extract monopoly prices (excess revenues can increase the power of the enterprise to finance other projects, but the “profit” motive is not as strong as in the private sector). Are governments simply taking the easy route to implementing pricing by shifting responsibility (and hence public dissatisfaction) onto private firms? As Sullivan (2000) pointed out, citizens of Metropolitan Los Angeles reported much higher overall favorability for road pricing as a concept than for the firm managing the SR 91 Express Lane PPP. Or do users perceive pricing by the private sector as a legitimate payment for a service but road pricing by the government as just another tax? Perhaps pricing by a private firm can help accustom users to road pricing for transportation infrastructure, which might otherwise be politically infeasible.

These and other topics merit attention in future research. Given the likely growth in PPP arrangements for delivering metropolitan highway infrastructure, and need to address the sustainability of human living patterns, these questions are both timely and important.
8 Bibliography


150


161


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