Appendix I:
***Assessing Highway Tolling and Pricing Options and Impacts* –**
National Cooperative Highway Research Program

NCHRP
REPORT 722

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Assessing Highway Tolling and Pricing Options and Impacts

Volume 1: Decision-Making Framework

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP REPORT 722

Assessing Highway Tolling and Pricing Options and Impacts

Volume 1: Decision-Making Framework

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

In recognition of these needs, the highway administrators of the American Association of State Highway and Transportation Officials initiated in 1962 an objective national highway research program employing modern scientific techniques. This program is supported on a continuing basis by funds from participating member states of the Association and it receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board of the National Academies was requested by the Association to administer the research program because of the Board's recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communications and cooperation with federal, state and local governmental agencies, universities, and industry; its relationship to the National Research Council is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

The program is developed on the basis of research needs identified by chief administrators of the highway and transportation departments and by committees of AASHTO. Each year, specific areas of research needs to be included in the program are proposed to the National Research Council and the Board by the American Association of State Highway and Transportation Officials. Research projects to fulfill these needs are defined by the Board, and qualified research agencies are selected from those that have submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Research Council and the Transportation Research Board.

The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

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FOREWORD

By Lori L. Sundstrom
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NCHRP Report 722: Assessing Highway Tolling and Pricing Options and Impacts provides state departments of transportation (DOTs) and other transportation agencies that are considering instituting or modifying user-based fees or tolling on segments of their system with a decision-making framework and analytical tools that better describe likely impacts on revenue generation and system performance. This report is presented in two volumes. *Volume 1: Decision-Making Framework* should be of immediate use to staff responsible for structuring the policy-level evaluation of potential tolling and pricing solutions to examine their policy implications, performance expectations, and financial impacts. *Volume 2: Travel Demand Forecasting Tools* will provide staff who develop the forecasts of potential revenue, transportation demand, and congestion and system performance with an in-depth examination of the various analytical tools available for direct or adapted use.

The continued growth in travel demand, worsening congestion, and the significant reduction in transportation funding available from traditional sources has prompted a number of DOTs and other transportation agencies, including toll authorities and metropolitan planning organizations, to turn to tolling and pricing as a method to fund new capacity and to more effectively manage congestion and improve the performance of their systems. A number of agencies have initiated projects that rely on tolling (the assessment of a fixed fee for the use of a roadway) and/or pricing (varying toll rates by time of day or volume of traffic) as an alternative to traditional funding sources. Several states have enacted legislation that requires new capacity to be funded by revenues derived from tolling and/or pricing. Traditional methods and analytical tools used in transportation decision making such as transportation demand forecasting, risk analysis, benefit-cost analysis, financial analysis, market research, and others fall short, however, in addressing the complexities associated with tolling and pricing decision making.

Under NCHRP Project 08-57, Parsons Brinckerhoff, Inc., was asked to develop a decision-making approach for DOTs and other transportation agencies to use to conduct comprehensive, transparent, and technically defensible analyses of a range of likely impacts of potential tolling and pricing solutions. The resulting decision-making framework in Volume 1 can be applied to a variety of scenarios in order to understand the potential impacts of tolling and pricing on the performance of the transportation system, and on the potential to generate revenue to pay for system improvements. Parsons Brinckerhoff conducted a literature review, collected state-of-the-practice information from numerous agencies, and provided five detailed case studies (viewed through the lens of the decision-making framework) that present lessons learned and illustrate a variety of best practices. Volume 2 provides a set of practical recommendations for developing travel models for different pricing studies. The

research team also evaluated travel models and network simulation tools used to forecast travel demand and revenue, and identified short-term and long-term improvements and strategic directions to improve the quality of their results and relevance to decision making.

Public and private sector decision makers and practitioners should find *NCHRP Report 722* a valuable resource as they review issues associated with tolling and pricing decisions.

CONTENTS

Note: Many of the photographs, figures, and tables in this report have been converted from color to grayscale for printing. The electronic version of the report (posted on the Web at www.trb.org) retains the color versions.

Introduction

With continuing growth in travel demand, worsening congestion, and funding shortages, state departments of transportation (DOTs), metropolitan planning organizations (MPOs), and other transportation agencies are considering tolling and pricing options to generate revenue for new projects and manage the performance of their local transportation systems. As the use of tolling and pricing becomes more prevalent, and as the options for considering variable pricing become more flexible with the use of electronic toll collection (ETC), policy makers and planners need a better understanding of the issues that distinguish tolling and pricing projects from traditional highway improvements and a framework for making better and fully informed decisions on how, when, and what to price.

Transportation professionals also need an understanding of the potential effects of tolling and pricing projects on the performance of the entire transportation system. While tolling and pricing strategies can provide new sources of revenue to fund expanded transportation capacity and also improve the performance of the transportation system, they introduce important questions, such as how the projects will be financed, how they will be operated, and who will be able to use them. Decisions regarding tolling and pricing projects must be based on accurate, reliable, and credible forecasts of their effects on travel behavior, the revenues they will generate, as well as their important policy implications and overall performance expectations.

The public's knowledge and awareness of pricing issues are often limited, and this places a greater burden on policy makers and planners to provide reliable and accessible information on what can be perceived as a complex concept. Traditional methods and analytical tools for making transportation planning decisions (including risk analysis, benefit-cost and other economic analysis, financial analysis, market research, and travel-demand forecasting) may fall short in addressing the behavioral changes that tolling pricing can induce. These methods often need to be enhanced and applied consistently for tolling and pricing projects to be evaluated fully and accurately.

Objectives

The purpose of this research effort is to develop a decision-making framework that includes descriptions, evaluation of methods, and analytical tools to assess pricing options and forecast their impacts on travel behavior and congestion. The research identifies improved methods and analytical tools to fill gaps in existing capabilities, focusing in particular on enhanced travel-demand forecasting methods employed to support decisions on how tolling and pricing can be used to fund new roadway capacity and manage congestion.

Organization

The findings of the research are provided in two volumes: the first addresses decision-making frameworks, while the second focuses on improvements to travel-demand forecasting methods and analytical tools.

Volume I is organized in three sections:

- **Decision-Making Processes and Framework.** This section covers pricing basics for transportation planners. It presents the most common steps that together form an overall decision-making framework for tolling and pricing projects. Each step is associated with a set of critical assessments, where accumulated experience and wisdom is summarized in the form of practical recommendations.
- **Pricing Project Case Studies.** This section provides five case study examples of the process actual transportation agencies have followed to make decisions on the feasibility and implementation of tolling and pricing

projects. These case studies describe the decision-making process from project initiation through financing and implementation. These practical examples illustrate a variety of approaches to decision-making and demonstrate how critical issues have been resolved under actual circumstances.

- **Synthesis and Best Practices.** This section distills the information presented in the case studies on decision frameworks for tolling and pricing, together with the technical aspects that comprise them, and synthesizes the ways in which these frameworks and aspects have been employed by the case study agencies.

PART 1

Decision-Making Processes and Framework

CHAPTER 1

Framework for Tolling and Pricing Applications

While the specifics involved in every project are contextual and unique, decision makers in both the public and private sectors of the transportation industry would benefit from a better understanding of the issues associated with pricing and approaches for assessing potential pricing projects. This chapter provides detailed information on issues germane to pricing, together with the various assessments that form a framework for decision-making for potential tolling and pricing applications.

1.1 Tolling and Pricing

Facing budget shortfalls and growing congestion levels, public officials in states across the country are considering the use of tolling and pricing strategies to address growing demands on the U.S. transportation network. Generally, tolling and pricing projects can be expected to emerge from the following sources:

- The state or metropolitan transportation planning process;
- The National Environment Protection Act (NEPA) review process;
- A state legislature or local county government;
- An existing state or local transportation department or toll authority; or
- A private developer.

Before embarking upon an exploration of the issues associated with tolling and pricing, it is helpful to establish definitions for these terms.

Tolling strategies involve the imposition of fees for the use of a roadway facility. Classic examples include fixed fees that motorists pay—usually based on the number of axles or vehicle weight—to cross a bridge or tunnel or drive on a tolled highway facility. Tolling strategies are used primarily as a revenue source to finance and expedite the implementation of needed transportation improvements.

Pricing specifically refers to strategies that vary toll rates by time of day or traffic volume level to manage congestion or use of that facility. Pricing is used as a tool to influence travel behavior, reduce congestion, maximize vehicle throughput and provide new transportation options.

The distinction between the two concepts underlies their primary goals:

- Creating a new income stream that can be used to pay for transportation improvements; and
- Using roadway pricing as a means to manage congestion.

Tolling provides decision makers the advantage of a new source of revenue that can be leveraged up front to implement costly improvement projects. At the same time, advances in toll collection technology provide the opportunity to use pricing to encourage drivers to consider travel options that can reduce congestion.

Other goals often associated with tolling and pricing include expediting the delivery of new transportation improvement and, in certain cases, engaging the private sector as an investment partner. The goals underlying tolling and pricing projects drive the evaluation and decision-making processes, which must be tailored to assess and compare the ability of different pricing options in meeting regional needs.

1.2 Evaluation Framework

The evaluation framework for tolling and pricing processes largely mimics the transportation planning process followed by MPOs and the analyses associated with obtaining NEPA approvals. However, it differs from these well known processes in that it introduces new technical, legal, and public outreach challenges, all of which must be addressed effectively and

incorporated into the decision-making process to move projects forward. These issues are discussed in further detail in Chapter 4 of this report.

Despite a great variety of approaches and significant influence from regional conditions, four major phases of analysis can be distinguished when assessing tolling and pricing projects:

- **Exploratory.** The purpose of this initial phase is to determine if further study of tolling and pricing based on a certain initiative is warranted. This phase effectively might be omitted if state legislation requires a pricing feasibility study for each highway project (as in Texas). However, some components that relate to the analysis of travel conditions are still useful for the subsequent Preliminary (Feasibility) Study. This type of conceptual analysis may be used to investigate and compare a range of toll facility configurations, though selection of a specific pricing alternative is premature at this stage.
- **Preliminary.** The purpose of this phase is to identify promising projects and create a shortlist of candidates, including each candidate's most promising alternatives. These studies evaluate the feasibility of tolling and pricing projects in an individual travel corridor, a metropolitan region, or an entire state. This stage may also be bypassed if pricing is considered as an additional component of a project already undergoing environmental review.
- **Feasibility.** The purpose of this phase is to identify a preferred physical layout and tolling/pricing scheme for each project. Additionally, project documentation required for environmental approvals is prepared together with a financial feasibility study incorporating refined traffic and revenue estimates. This phase is essential before advancing individual projects into implementation.
- **Investment Grade.** The purpose of this phase is to prepare project rating documentation that assesses the potential financial investment using private sector bonds and serves as a basis for subsequent contract negotiations with the private-sector partners. It is an integral part of project implementation if toll-backed financing is involved. Investment Grade Study provides the necessary data to finalize funding arrangements in the Financial Plan, the formal document that details a project's cost estimate and revenue structure and identifies financial resources to be utilized in meeting those costs. This phase is not required for tolling and pricing projects that are not financed by debt backed by future toll proceeds.

These phases are shown in Figure 1-1, together with eight key methodological aspects considered within each phase of the decision-making framework.

The first three phases identified earlier largely coincide with those used in the traditional transportation planning process, which assess improvement alternatives in increasing detail. However, the investment grade phase is unique to tolling and pricing projects and is only required when the toll revenues generated by the improvement are used to raise financing for its construction.

As shown in Figure 1-1, each phase of the evaluation process involves technical analyses and assessments across a wide range of disciplines. While the disciplines involved remain essentially unchanged from one evaluation phase to the next, they become increasingly detailed and require that the pricing alternatives being assessed be defined with greater precision as assessments progress through the four-phase process. Each analysis phase culminates in a shortlist of candidate tolling and pricing projects that demonstrate the strongest ability to meet regional goals. A recommendation is made on which concepts merit further analysis.

While there is a logical flow from one phase of analysis to another, the assessment of pricing projects does not necessarily require all four phases of analysis. Rather, tolling and pricing can be considered at nearly any phase of the overall transportation planning process. The Exploratory and Preliminary phases can be bypassed if tolling or pricing is considered on a project that is already well-defined. This may be the case, if the idea of pricing a highway improvement emerges from an ongoing NEPA study, as a result of legislative action, or an unsolicited offer from a private sector developer.

Accordingly, two broad approaches may be used to initiate and assess tolling and pricing projects: the comprehensive approach, which features a systematic progression through the four assessment phases identified in Figure 1-1; and the project-specific approach, which begins at the Feasibility phase and focuses on pricing for a specific corridor or improvement. Both approaches, described in greater detail below, are valid, and can result in productive tolling and pricing projects that meet local goals. Importantly, both approaches may be used in a given region.

Comprehensive approach. Comprehensive processes are those where pricing projects result from a regional, state-wide, or corridor study undertaken by a public planning authority. Recent examples of this approach include:

- *Metropolitan Transportation Commission Bay Area HOT Lane Feasibility and Implementation Study* (Parsons Brinckerhoff 2008);
- *Washington State Comprehensive Tolling Study* (Cambridge Systematics 2006);
- *Colorado Preliminary Traffic and Revenue Study* (Wilbur Smith Associates 2005);

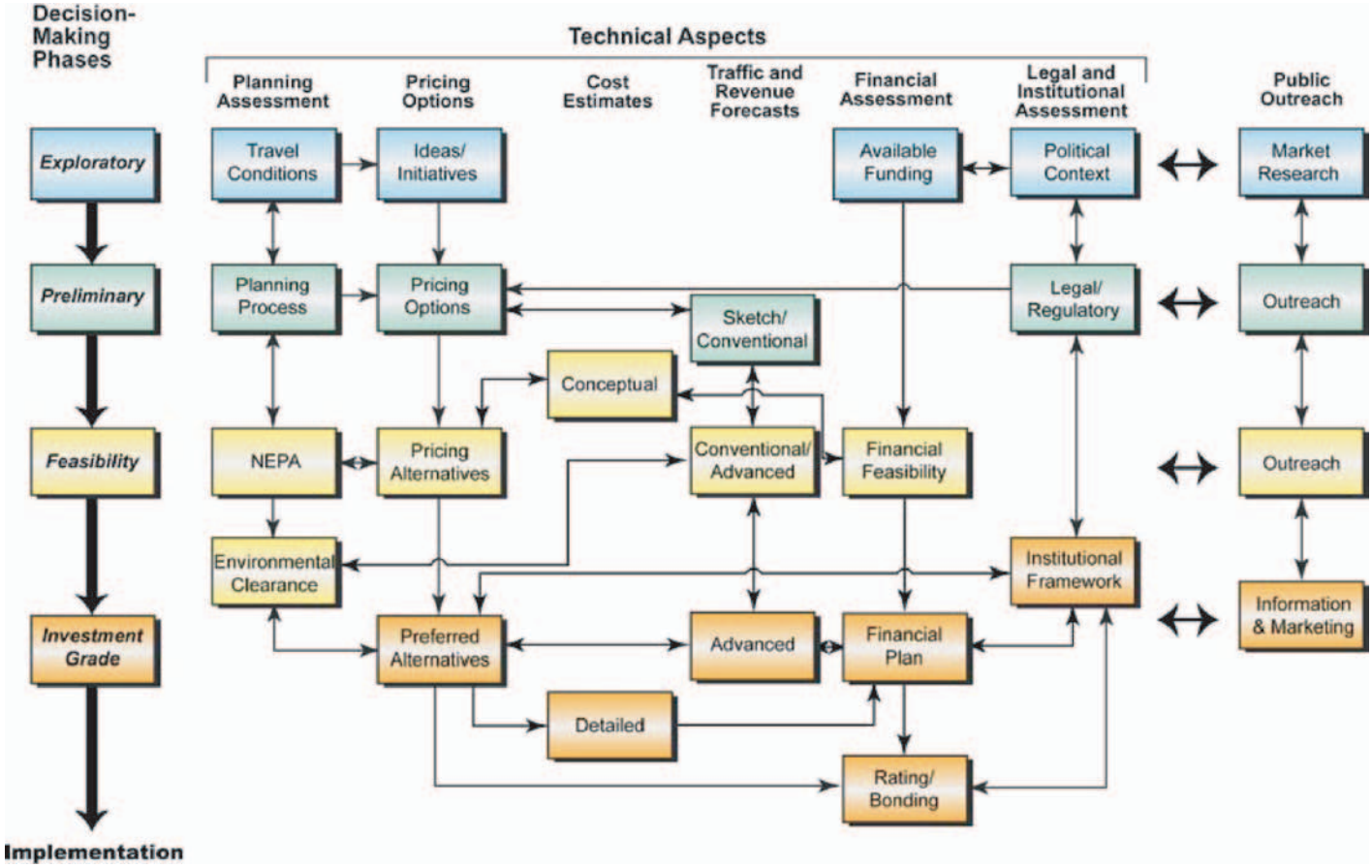

Figure 1-1. Decision-making framework for tolling and pricing projects.

- *Texas' Guidelines for Conducting Traffic and Revenue Studies* (TTA 2005b); and,
- *Atlanta's HOT and TOT Feasibility Studies* (Parsons Brinckerhoff 2005).

This approach is attractive from a theoretical perspective, since potential projects and their alternatives are systematically derived based on regional needs rather than from a financial feasibility perspective. Potential pricing projects are studied using a systems-level perspective, focusing on regional network performance, as well as local and regional social welfare.

Project-specific approach. Tolling and pricing projects that result from individual corridor or project studies follow the project-specific approach. Despite certain limitations, this approach to network planning has proven itself the fastest and most practical way for advancing pricing projects to the implementation stage. Whether implemented by public or private sector sponsors, this approach excels at determining a project's financial feasibility early on and often expedites project implementation. However, it does not guarantee an "optimal" investment from a public benefit perspective—either socially or financially (Enright 2006). In addition, no tolling or pricing projects implemented in the United States using the project-specific approach have benefited from the application of advanced travel demand modeling tools. Without these tools, the often crude and unreliable forecasts used for these projects exacerbate revenue risks associated with toll financings.

As illuminated by the case studies provided in Part II of this report, more often than not, transportation agencies use both approaches to identify individual tolling and pricing projects suitable for implementation, and assess the possible use of pricing on a larger regional basis. Many regions begin their experience with pricing as a result of low hanging fruit situations where there is a clear logic behind the use of tolls on a new or existing facility. It should be noted that the availability of federal money provided by dedicated programs supporting tolling and pricing including the Value Pricing Pilot Program and the UPA Program have encouraged state DOTs and local planning agencies to undertake pricing studies or move ahead with implementing actual pricing projects. If pricing is

implemented successfully by following the project-specific model, a region may consider embarking on a comprehensive assessment of pricing in other settings, with subsequent projects moving forward for further assessment as a result. This progression can occur within single agencies, or it can see different agencies—for example a state DOT and the MPO—leading different types of evaluations. The use of both the comprehensive and project-specific approaches are prime features of the case studies that follow in Part II of this report.

Significantly, this research effort demonstrates that a flexible decision-making framework is likely to incorporate both approaches, capitalizing on their respective strengths to arrive at a tailored decision-making framework reflecting regional transportation needs, institutional arrangements, and politics. However, whatever decision-making framework is ultimately used, it must be underpinned by a rigorous technical assessments utilizing good data and robust analytical tools.

1.3 Goals for Tolling and Pricing

Any pricing study identifies certain goals that are reflected in the subsequent evaluation of alternatives. Normally, the over-arching goals underpinning pricing studies are already set in any associated legislative documents. They frequently include congestion relief/travel time savings, additional revenue, and expedited project delivery.

A more systematic classification of goals can be helpful in the decision-making process. Clear formulation of a tolled project's primary goals together with recognition of more specific, derivative goals is beneficial as potential tolling concepts are considered by different communities, including transportation professionals, elected officials, bankers and investors, and the general public. Figure 1-2 depicts the primary goals often associated with tolling and pricing projects, together with an array of derivative goals which they also support. While the primary goals of revenue generation and congestion relief are a common denominator for almost all pricing studies, their concrete formulation varies significantly from study to study, reflecting the specific project context, as well as the priorities of different stakeholder groups.

Tolling and pricing can assist policy makers in achieving many desirable effects:

Provides New and Sustainable Source of Revenue to Fund Transportation Improvements. Tolling and pricing offer the potential to provide a new source of revenue to fund transportation improvements. Implementing pricing on existing or expanded facilities may generate new revenues to support other transportation needs, such as improved transit services. The decision to develop costly new highway projects as toll roads may also allow DOTs to reserve their traditional funding sources for other uses.

Often the natural instinct of decision makers is to direct whatever funding is available to those needs that are most pressing. However, to maximize the benefits that toll revenues can provide, policy makers should consider tolling on costly projects with the highest demand levels. This strategy will maximize new toll revenues, and reserve other traditional, often scarce funding sources for other projects that cannot be supported by tolls.

Tolling provides an important opportunity for state and local governments to create new revenue streams and raise money to fill the growing gap in transportation funding.

Leverages Upfront Capital. Tolling and pricing also have important leveraging effects. Even before a toll road becomes operational, the anticipated revenue stream from the facility creates significant borrowing power in the capital markets. Toll projects also allow local transportation agencies to tap into important financial tools provided by the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) of 2005, including Transportation Infrastructure Finance and Innovation Act (TIFIA) credit enhancements, Section 129 and state infrastructure bank (SIB) loans, and private activity bonds. The decision to implement a highway project as a toll road not only allows DOTs to leverage future toll receipts to raise capital funds, it may also provide them with access to new financing sources that would otherwise be unavailable. Tolling also provides the flexibility to blend these different monies with traditional capital funding sources.

Expedites Project Implementation. Tolling allows DOTs to accelerate the implementation of transportation projects and improvements that enhance mobility. Tolling also enables DOTs to construct projects using single procurements rather than breaking them up into smaller and more affordable construction packages often required on a pay-as-you go basis from limited tax sources. Avoiding these types of delays limits the effects of inflation and reduces costs. It also makes the benefits of the new transportation improvements available to the public more quickly.

Provides a Tool to Manage Congestion. Variably priced toll projects also provide important new tools to help manage congestion, improve the performance of congested travel corridors, and improve travel reliability. When toll rates are adjusted to reflect congestion levels, motorists are encouraged to travel during less congested periods, use other routes, or take advantage of transit alternatives, thus limiting demand to levels that can be accommodated at reliably high levels of service.

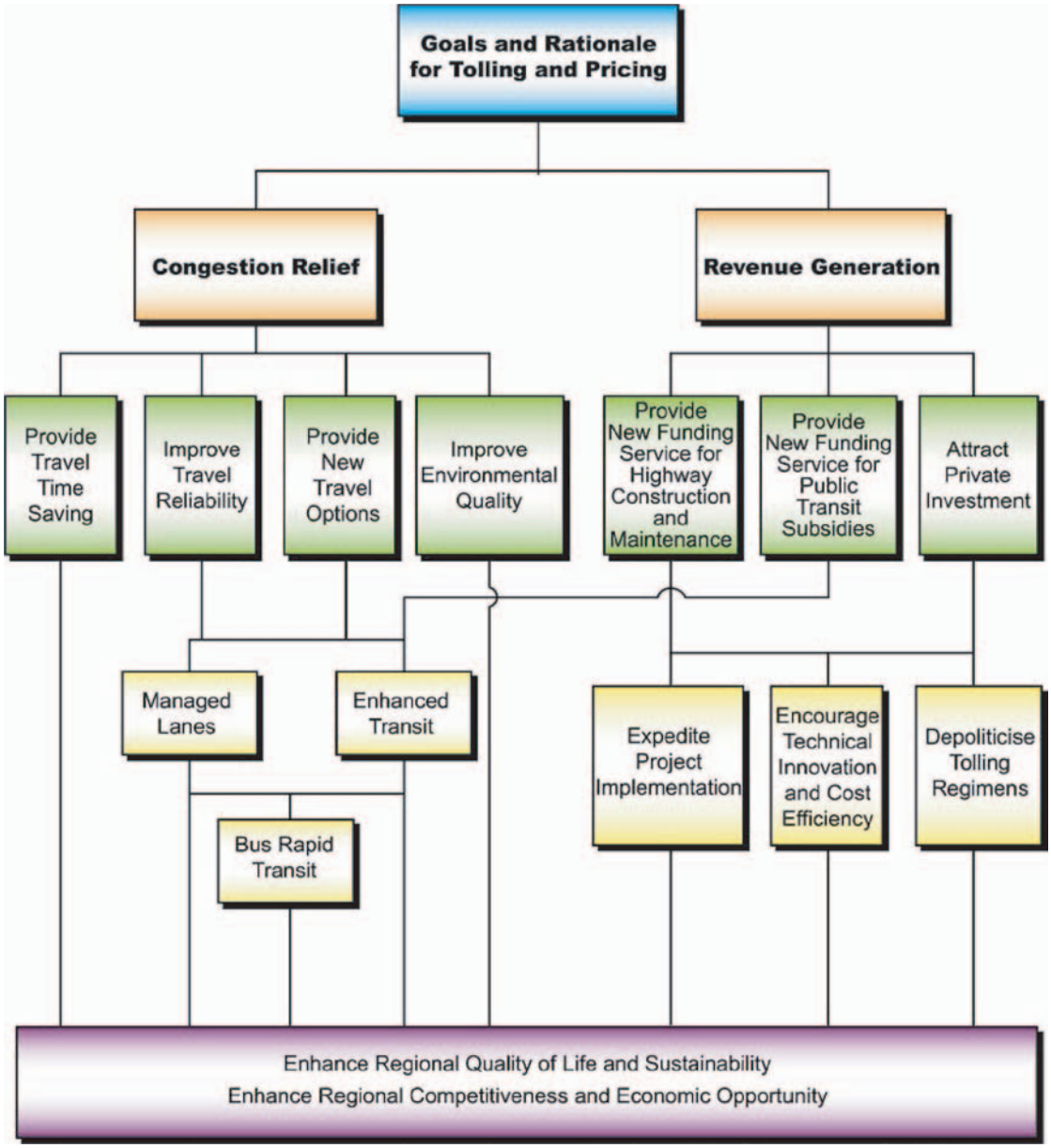

Figure 1-2. Goals and objectives for tolling and pricing.

Provides New and Reliable Travel Options. On managed lanes, variable pricing can be used to ensure that free flow conditions are maintained at all times, including congested peak hours. High-occupancy toll (HOT) lanes encourage ride sharing and can facilitate the implementation of bus rapid transit (BRT) and other transit services.

Saves Time and Money. Congestion results in 3.7 billion hours of delay per year for motorists in the United States, keeping people from their jobs, appointments, and families. These delays waste 2.3 billion gallons of fuel and result in an annual cost of $63 billion to the nation's economy. Pricing our highway system to operate more efficiently and reliably provides the opportunity to reduce the burden of congestion on the economy and society.

When pricing or managed lane concepts are concerned, an implicit set of conditions should exist for these applications to be considered a viable option. These conditions include the following:

- A recurring congestion problem to level of service (LOS) D or worse within a corridor or region for a significant period of time each weekday.
- A significant backlog of unmet travel demand, and/or lack of available resources (right-of-way, funding, regional

consensus or environmental issues) to address capacity deficiencies in a more conventional means through adding roadway or transit capacity.
- An interest and ability to minimally increase roadway capacity by managing its use to specific dedicated purposes to ensure that a high level of service can be provided as an alternative to recurring congestion.

Ultimately, the goals and objectives that are set for a corridor improvement or managed lanes project should dictate the operational strategies employed.

1.4 Deciding Whether to Consider Tolling or Pricing

The decision to consider the use of tolling or pricing may be made by any number of interested organizations, including state legislatures, departments of transportation, toll authorities, transit agencies, or metropolitan planning organizations. It could also be made by interested individuals, including elected officials, such as legislators, mayors, governors, MPO directors, state DOT directors, toll authority leaders, or the boards of such organizations.

While MPOs are tasked with identifying transportation goals in most regions, other stakeholders and decision makers may have their own agenda that may make the case for tolling and pricing compelling. Any entity pursuing tolling and pricing strategies should be able to describe at a conceptual level what congestion management goals are being sought, as well as the process for implementing and operating potential tolling and pricing projects. Once the goals are identified, other important issues must be considered prior to advancing tolling and pricing strategies.

The following initial assessments will help decision makers to determine whether formal study of tolling and pricing would be beneficial:

- **Document existing travel and demographic conditions.** Completing an assessment of existing regional travel conditions and demographic trends is extremely important. This enables transportation professionals to identify congested corridors and quantify the effects of congestion in terms of hours of delay, lost productivity, and wasted fuel. Projected growth patterns should also be considered to determine to what extent congestion is likely to increase and to prioritize where and when future improvements will be needed.
- **Determine state and local funding options.** Once a program of desired improvements is identified, it is necessary to review the region's ability to pay for the program. All known funding sources should be identified and assessed for their ability to allow the region to keep pace with the demand for transportation. A clear financial need provides a compelling rationale for further study of tolling and pricing strategies.
- **Political champions.** It is also helpful to identify what agencies and organizations would be likely to support tolling and pricing strategies and if there are respected local business leaders or public officials who would be willing to champion the cause.
- **Public opinion.** Public opinion is critical in the ability to move tolling and pricing projects forward. Targeted market research can help decision makers gauge the public's reaction to the topic. Market research is helpful in distinguishing the types of tolling and pricing applications that the public would be likely to support from those that they would not. It can also help decision makers identify messages that resonate with the public. Quiet outreach involving dialogue with key stakeholders, as well as focus groups with ordinary citizens, can prove extremely helpful to pubic officials as they consider whether or not to move forward with further assessments of tolling and pricing options.

With all these pieces in place, decision makers will need to assess the upside and downside of moving forward, together with their ability to lend momentum to the interest in tolling and pricing strategies. They should also reflect on the amount of political capital they are prepared to invest and keep in mind that a decision to study the feasibility of pricing is far from one to move into implementation.

Toll Setting Primer

Using pricing to manage utilization and using tolls to raise adequate revenues are not necessarily competing objectives. On the contrary, it has been shown that an optimally designed and optimally priced road would generate user toll revenues just sufficient to cover its capital costs. The term "optimal design" in this context means the road generates benefits to users in excess of its capital costs. The term "optimal pricing" means that tolls should represent, at all times, the short-run marginal costs imposed by the user.

The reason that this combination yields roads that are self-financing is because efficient pricing and cost-beneficial investment practices are linked by a common objective: to spare economic resources (most notably travel time, in the highway case). The self-sufficiency of optimal toll finance was first demonstrated by Mohring and Harwitz in 1962.[1]

In practice, however, it is difficult to levy road prices that are efficient at all times. Doing so involves a tolling scheme with highly-variable toll levels. Tolls need to vary intimately with a vehicle's contribution to congestion levels and wear-and-tear costs, which, in turn, may

vary by vehicle and facility type. Until recently, tolling technology did not have the flexibility to levy efficient tolls. It also has been difficult, in practice, to confine road building to "optimal designs" that generate user benefits in excess of capital costs.

In the practical context, therefore, the pricing and revenue objectives are often at odds with each other. For example, an agency may wish to build a road that is not cost-beneficial, in which case revenues from optimal tolls will be insufficient to finance the road. Or, it may be that the road is cost-beneficial, but the agency cannot implement the tolling technology needed to levy optimal tolls. In addition, the "lumpiness" of typical highway improvements makes the application of optimal pricing/optimal design paradigms complicated. For these reasons, the toll setting procedure must accommodate practical constraints.

There are two types of accommodations. If the adequacy of toll revenue is not a constraint (e.g., some highway trust fund monies have already been dedicated to the road), then the tolls can be set to emphasize the efficient use of the road. Although not typically implemented very precisely, the tolls are set to minimize the value of travel time spent by the users, generate maximum throughput of the road, or some other quasi-efficiency objective.

Alternatively, if generating sufficient revenue is the primary concern, the toll setting procedure will establish structure and level of tolls that maximizes revenue. This will not be an "efficient" toll scheme either. Rather, it will tend to levy higher-than-efficient tolls, especially on those classes of users or in those times of day where travelers are relatively insensitive to toll levels.

Going forward, tolling technology will advance to the point that levying efficient tolls is no longer a major constraint. Once this occurs, it may be easier to link specific tolls to specific, new facilities and to implement refined tolling schemes. This, in turn, will make it easier to embrace the self-sufficient road finance model, or at least something more akin to it.

[1]Mohring, H. and M. Harwitz, Highway Benefits: An Analytical Framework, Northwestern University Press: Evanston, Illinois, 1962.

The Metropolitan Planning Process

While the impetus for studying tolling and pricing could come from any of the regional figures mentioned above, responsibility for planning for transportation improvements is vested in MPOs. Federal law requires MPOs be designated in all urbanized areas in the United States with populations over 50,000. They are required to maintain two basic documents:

- A Fiscally Constrained Long-Range Transportation Plan (CLRP), usually with a 25-year horizon; and
- A Transportation Improvement Program (TIP) identifying projects to be funded within the next six years.

In order to receive federal funding, transportation projects must be included in both the CLRP and the TIP.

MPOs are also required to maintain data and technical tools needed to make informed decisions on transportation investments. These include traffic statistics, information on travel patterns and conditions, and surveys to determine travel behavior characterized by trip purpose, length, and mode of travel. In addition, MPOs are required to maintain computerized travel demand models, which are used to test the performance of potential transportation improvements and provide decision makers with quantitative information about the consequences of their decisions.

In addition, many MPOs establish long range regional planning strategies that set goals to guide regional transportation investments to achieve economic development, environmental quality, and quality of life standards. These plans are often particularly useful as they reflect the needs and priorities of various entities involved in regional decision making.

While projects will ultimately need to be incorporated into the MPO planning process to qualify for federal funding, local needs and solutions may be promoted by a number of different players.

CHAPTER 2

Defining the Attributes of Pricing

In addition to the physical aspects of tolling and pricing projects, their definition also includes the development of tolling policies. It is common for multiple toll policies to be tested for individual physical improvements. This examination provides decision makers with an appreciation for the effects of different toll rates and policies on the feasibility of funding the projects using toll proceeds, as well as their ability to reduce traffic congestion. Potential pricing regimens should be developed in consultation with transportation planners responsible for maintaining regional travel demand models to ensure that existing models have the capability or can be readily modified to assess the pricing options being considered. The idea is to pair a physical solution with the optimal package of operational policies to derive the greatest benefit from the improvement.

Pricing regimens are invariably comprised of a combination of attributes. As they move through the different phases of the evaluation process, pricing concepts are normally defined at greater and greater levels of resolution. During the early Exploratory Phase, the pricing concepts are likely to be described by a few basic characteristics, but at the more advanced states, they involve consideration of multiple permutations and careful review of their effects on traffic services, projects revenues, implementation cost, and financial feasibility [see *Technical Memorandum 2005-1. TTA Toll Feasibility Analysis Process* (TTA 2005a) for an example of added level of detail from phase to phase].

2.1 Pricing Forms

With the flexibility in utilizing variably priced toll rates afforded by ETC technology and the expanding number of managed lane concepts currently being considered across the United States—from HOT lanes to express toll lanes, and even truck-only toll lanes—an increasingly large number of pricing forms exist. These pricing forms stem from different combinations of six major characteristics [see also *Active Transportation Management Strategies Using Managed Lanes: Introduction to Strategies and Techniques* (WSA 2007) for systematic approaches and discussion of typology of pricing and managed lanes]:

- Physical configuration of the facility (*what/where to price?*)
- Unit of pricing (*per what to price?*)
- Toll collection technology and enforcement (*how to implement pricing?*)
- Base toll level (*what to charge?*)
- Pricing differentiation *(whom and when to price more or less?)*
- Vehicle eligibility *(whom to price/whom to allow on a managed lane facility?)*

Not all characteristics of pricing projects are considered immediately in the early phases of decision-making, since that would create an inordinately large number of individual alternatives for single facilities, let alone for an entire regional network. During the earlier phases in the decision-making framework, screening efforts should focus on the most promising pricing concepts using a limited subset of the most important aggregate characteristics. The consideration of other details can be deferred to subsequent analysis phases, which normally focus on a reduced number of alternatives.

Table 2-1 provides a systematic template for classifying major pricing dimensions. Each pricing form can be identified here, including express toll lanes (ETL), high-occupancy vehicle (HOV) lanes, HOT lanes, truck-only toll (TOT) lanes, variably priced HOV/HOT lanes, and any combination of these. It is helpful to keep this template in mind when specifying pricing alternatives in response to specific goals.

As implied in the structure of the template, the formulation of pricing alternatives involves two levels of decision-making. The first-order decision relates to the choice of basic unit of pricing (per trip, per mile, or per day) and consideration of congestion (flat or variable). Variably priced tolls can be fixed, with different tolls determined by hour and direction

Table 2-1. Classification of pricing forms.

Differentiation eligibility/exemption/discounts	
By time-of-day/congestion level	Flat/fixed
	Variable/preset by TOD and direction
	Variable/real-time dynamic
By vehicle characteristics/type	Auto
	Low emission auto
	Motorcycle
	Single-unit truck
	Combination truck
	Transit bus
By vehicle occupancy	SOV
	HOV-2
	Registered HOV 2
	HOV-3
	HOV-4+
By place of residence	Resident of a certain area
	Visitor
By method of payment	Cash
	Transponder/ETC
By day of week	Weekday
	Weekend
By season	Summer/spring
	Winter/fall

of travel and day of the week, or dynamic, with toll rates changing in real time—as often as every three minutes—based on congestion conditions in the parallel general purpose lanes. Pricing level and structure are frequently the first set of considerations associated with any pricing initiative at early stages of decision-making. These considerations closely relate to the physical project alternatives. Second-order considerations involve further refinements such as pricing differentiation, eligibility by vehicle type and occupancy. These normally come into play at later stages of decision-making, when different pricing policies are examined for each physical design.

In certain cases—such as the conversion of HOV lanes to HOT operation—second-order pricing considerations are considered immediately. Pricing level and lane eligibility by vehicle type generally remains an open issue. Different vehicle classification schemes may require evaluation—from a two-class car-and-truck system, to a four-class system including motorbikes and light commercial vehicles. Even the method of classification might vary—based on height and length criteria, number of axles, tire width, or a combination of all these. The identification of the most appropriate classification will depend on local conditions and the expected mix of traffic. While simplicity in classification offers several advantages, automatic vehicle identification (AVI) technologies coupled with adequate enforcement (e.g., vehicle inspection programs) tend to permit a wide variety of classification schemes. Vehicle occupancy-based pricing remains the most troublesome aspect to enforce and cannot yet be handled by AVI systems.

With HOT lane concepts, vehicle occupancy is one of the primary parameters used to differentiate pricing forms. Seven of the eight operating HOT lane facilities in the United States in mid-2008 have involved the conversion of an existing HOV facility that had unutilized excess capacity. In these cases, occupancy requirements for HOV vehicles were not changed. Rather, the conversion involved providing non-complying vehicles the right to use the facility in exchange for a variably priced toll. However, there are also other instances where HOV facilities performing at or near capacity are being considered for possible HOT conversion. In this case, occupancy requirements for vehicles using the managed lanes for free or at a discounted rate need to be increased so that free capacity on the lanes can be sold to non-complying vehicles. This dynamic may involve an increase in HOV occupancy requirements from two to three passengers. However, it can also involve requiring all HOV 2 vehicles to register as official carpool vehicles in exchange for the right to use the facility. This management technique is designed to free capacity by preventing discretionary HOV 2 vehicles—motorists that happen to have multiple occupants in their vehicle but do not normally—from using the lanes.

Many managed lane programs also afford low emission vehicles the same privileges as HOVs. This policy was popular with many DOTs when hybrid vehicles were first introduced. However, with an increasing popularity of hybrid vehicles and rising fuel prices, several HOV and HOT lanes are now operating at capacity due to the prevalence of single occupant hybrid vehicles, prompting decision makers to rethink this policy.

Other dimensions can also be introduced to pricing regimens. They include an exemption or discount for residents of a certain area, "bulk" discounts for ETC users, differential toll rates for weekdays and weekends, as well as seasonal variations. This last dimension should be considered in areas and along corridors with a significant variation in traffic by season, such as areas with a significant seasonal number of tourists/visitors.

Finally, these pricing forms can be combined further with different credit-based or bulk discounts, and other programs. These programs are designed to achieve the same pricing goals, but in a more flexible and presumably more equitable fashion.

The myriad of pricing forms used today creates particular challenges when developing travel demand forecasts for tolling and pricing projects. These issues are discussed further in Chapter 4 and are explored in detail in Volume II.

2.2 Where Pricing Is Used

It is important to recognize that pricing forms can be deployed on a wide variety of facilities and contexts. It is the combination of the pricing form and the facilities on which they are considered that together comprise a "pricing alternative."

The different types of facilities on which pricing is used can be arrayed as follows:

- A new "greenfield" toll facility.
- A widening or extension of an existing toll facility.
- The addition of new priced lanes to an existing non-toll facility.
- Conversion of an existing non-priced facility to priced facility. The most frequent example is the conversion of an HOV lane to HOT operation. However, it can be any newly introduced pricing.
- Change in pricing form on an existing toll facility. The most frequent example is conversion of fixed tolls to variable/real-time tolls.

2.2.1 Managed Lanes

The most common application of roadway pricing in the United States is used on managed lanes. Managed lanes use variably priced tolls and other strategies (including vehicle occupancy requirements, access control, and toll collection procedures technology) to manage traffic service on designated highway lanes to ensure superior travel conditions, particularly during peak travel periods. The direction of traffic on managed lanes may be fixed in each direction when there is adequate right-of-way, or reversible if right-of-way width is constrained and there is a distinct trend in the direction of peak period traffic flows.

There are three types of managed toll lanes employing pricing, including:

- HOT lanes—Limited-access, normally barrier-separated highway lanes that provide free or reduced-cost access to qualifying HOVs, as well as access to other paying vehicles not meeting passenger occupancy requirements. Variably priced tolls are normally charged, and all tolls are collected electronically.
- ETL—Limited-access, normally barrier-separated highway lanes requiring drivers of all vehicles to pay a variably priced toll to use the facility. All tolls are collected electronically.
- TOT lanes—Limited-access, normally barrier-separated highway toll lanes available only to trucks for a variably priced toll. Feasible in congested metropolitan corridors with high truck volumes; all tolls are collected electronically.

Managing a priced toll facility requires an understanding of the facility's vehicle carrying capacity under varying conditions together with real-time monitoring capabilities and access to tools to regulate vehicle flows and optimize utilization. While a great deal of attention is focused on the role pricing plays in regulating demand, pricing is only one of four tools used to regulate traffic flows on managed toll lanes:

- Pricing—imposing a user fee on the lanes that helps regulate demand by time of day, day of the week, and direction of travel. The fee increases during periods of highest demand.
- Occupancy—limiting lane use to vehicles carrying a minimum number of passengers. Two (HOV 2) and three (HOV 3) minimums are typical occupancy constraints.
- Eligibility—limiting lane use to specific types of users, such as HOVs, motorcycles, low emission vehicles, or trucks.
- Access—limiting or metering ingress to the lane or spacing access so that demand cannot overwhelm the capacity of the managed lanes.

These tools are applied in different combinations depending on the type of facility to be priced. For example, pricing is the only management tool available for ETL lanes, whereas all four can be used with HOT lanes. Management tools give operating agencies a wide range of opportunities to maintain reliable traffic service on managed lane facilities. As described above, pricing can be introduced on specific highway lanes within a larger highway right-of-way.

It is important to note that there are also powerful synergies between BRT and managed lanes. By providing new free-flow passage through congested corridors, managed toll lanes present opportunities to launch new BRT services. BRT is an increasingly attractive alternative to rail transit due to competitive cost and greater flexibility in serving more dispersed populations in suburban environments.

BRT service benefits from the fast, reliable, and identifiable service on free-flowing lanes. Both BRT and HOT lanes represent new travel options for the public and in certain cases they may allow officials to combine highway and transit in an innovative way. A number of proposed managed toll lane facilities include such transit amenities as park-and-ride lots and direct access ramps for buses.

2.3 Classifying Pricing Concepts

Using the different characteristics described, Figure 2-1 classifies pricing concepts by pricing form and facility type and arrays the expected difficulty in gaining public acceptance. The most publicly palatable projects tend to be those where the pricing form or level changes on an existing tolled or priced facility. The most challenging projects tend to be those where pricing is added to existing, previously non-tolled facilities. Sometimes the latter is perceived as added taxation instead of user fees. Such tolling policies generally require thoughtful and regular presentation of project benefits to the general public.

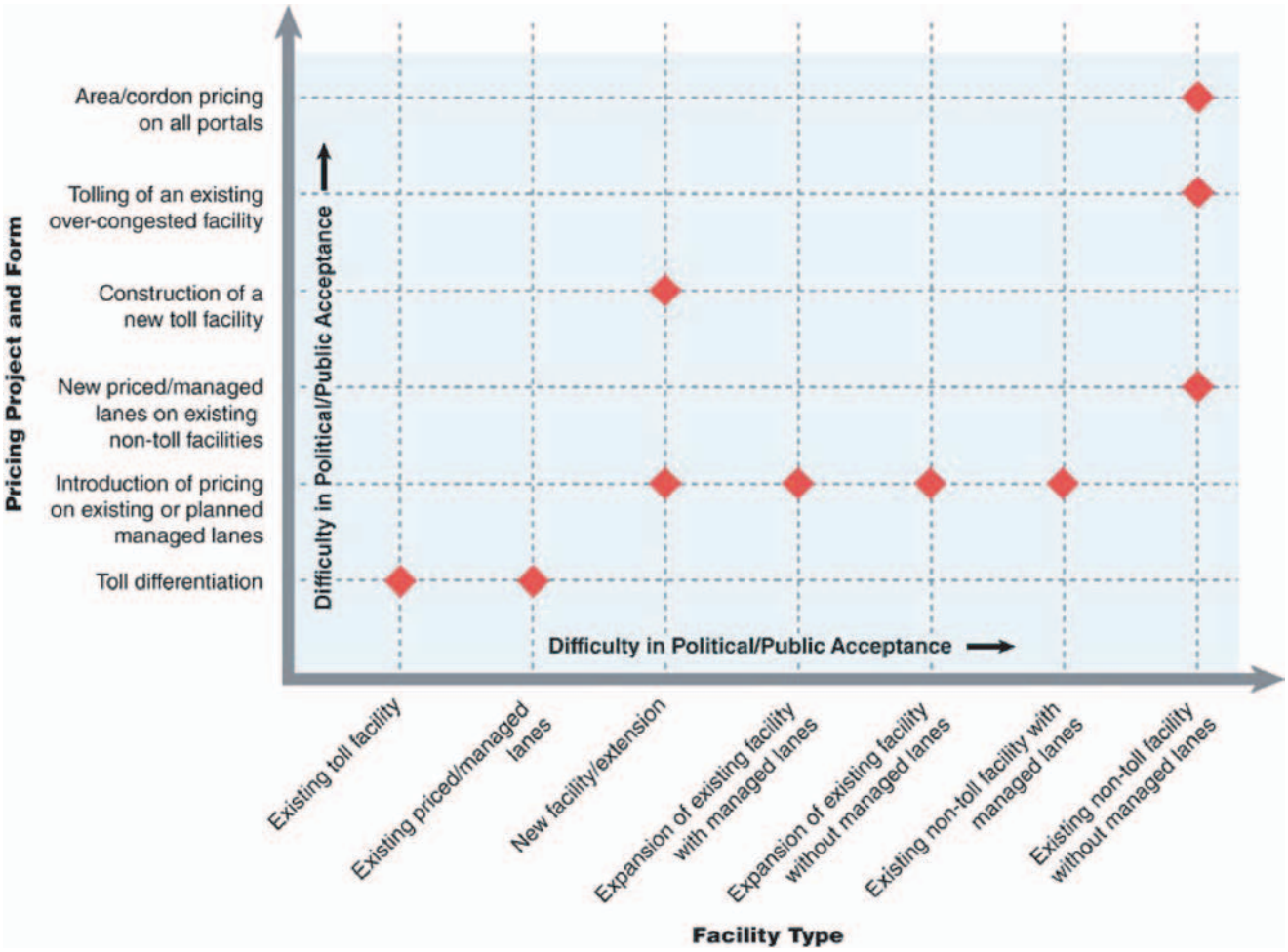

Figure 2-1. Classification of pricing forms.

CHAPTER 3

What Is Different in Highway Planning with Pricing?

While the general contours of the decision-making framework for highway projects are similar for tolled and non-tolled facilities, several unique issues arise with tolled projects. These issues include added travel demand modeling challenges, additional design and technology considerations, opportunities for public opposition, funding related matters, and emphasis on environmental justice. For these reasons, the decision-making process for tolled facilities is rich with challenges and tends to require great care. This section of Volume I outlines the particular challenges associated with the assessment of tolling and pricing projects. The following section describes best practices for executing the different technical assessments required throughout the multi-phase evaluation framework for tolling and pricing studies. These discussions are followed by detailed case studies of the evaluation frameworks used by five United States transportation agencies to assess and implement a wide variety of tolling and pricing projects. These case studies are structured to align with the evaluation framework presented earlier, giving readers a more concrete sense of distinctions between tolled and non-tolled project planning and implementation, as well as an appreciation of the actual work completed by specific discipline at each phase of the analysis.

Readers interested in further information on the challenges associated with developing travel demand forecasts for tolling and pricing studies should note that Volume 2 of this final report is organized around the same evaluation framework, thereby illuminating modeling details and best practices at each phase of the evaluation framework.

3.1 Differences in Decision Making with Tolling and Pricing Projects

While decision-making frameworks for pricing largely mimic the typical transportation planning process, additional steps are layered on almost every issue. To date, highway pricing in the United States has been imposed largely on an ad hoc basis, at almost any stage in the planning and development process. Of course, context also is important for understanding the unique aspects of pricing applications. Decisions depend on the type of project (new, expanded, or converted facility) as well as the underlying need for pricing (e.g., improving mobility by managing demand, full or partial project funding, and revenue generation for other purposes). In general, roadway pricing causes meaningful distinctions to emerge in the context of various project features. Even in the context of general project tasks, for most any highway project, the decision to toll a roadway plays an important role:

- Formulation of project alternatives, in terms of physical infrastructure (facility design and ease of access) and vehicle eligibility.
- Demand analysis and regional impact, for coordination with the regional planning process.
- Environmental impact analysis and approval through the NEPA process.
- Estimate of capital, operations, and maintenance costs.
- Identification of sources and levels of public funding (federal, state, and local).

The decision to toll begets a variety of other considerations as well:

- Heightened importance of public involvement and acceptance, especially in regions unfamiliar with pricing.
- More thoughtful evaluation of social equity and environmental justice issues (especially when converting existing, non-tolled facilities to tolled status).
- Pricing's impact on travel behavior and facility performance (vis-à-vis objectives of maximizing throughput, managing demand, and/or generating revenues).
- Availability of alternative modes (public transit) and non-tolled, substitute routes.
- Use of revenues for full or partial project funding, investment in other facilities, other modes, and/or other purposes.

- Choice of toll collection and enforcement technologies, and associated costs.
- Details of pricing policies (e.g., HOT lanes, fully variable versus pre-defined versus flat rate tolls).
- Enabling authority/legislation for such pricing policies.

The following discussions expand upon some of the important challenges that distinguish the evaluation process for tolling and pricing projects from other transportation improvements.

3.1.1 Public Outreach

Gathering support (both public and political) for any tolled project is a key challenge. While there are strong funding and operations arguments for flat-rate and variable pricing, the public often perceives tolls as a new tax on something that has always been free, or at least paid for at the pump. Therefore, building public support is a crucial step in the project process. Public agencies must pay close attention to revenue use and equity impacts of road pricing, while rallying the support for the project from citizens, elected officials, and institutional leaders (Hattum and Zimmerman 1996). As a project nears completion, project marketing can take center stage (United States GAO 2006). Such efforts have been used successfully by state and local officials to garner support for California's I-15 and SR91 projects (Perez and Sciara 2003).

In the case of converting existing roadways to tolled status (such as the case of congestion pricing on existing, heavily trafficked roadways), building support can be extremely challenging. Podgorski and Kockelman (2006), Kockelman et al. (2006), and King et al. (2007) recommend using the toll revenues to support local transportation improvements and generate support for the use of pricing.

Early involvement by a project champion is often essential to successful outreach efforts for tolling and pricing projects. A particular group or individual may step forward to express initial interest in and support of the proposal, or project sponsors may proactively seek to identify potential project champions early in the public involvement process. In some cases, champions may come from organizations and interest groups that are non-traditional supporters of roadway projects.

Table 3-1 highlights some groups whose leaders may play the role of champion, depending on the circumstances of the project. When anticipating responses from different

Table 3-1. Identifying potential tolling and pricing champions.

Group	Why They May Support Tolling and Pricing
Chambers of Commerce	Chambers of commerce may support tolling and pricing projects when they improve regional competitiveness, when they expedite the implementation of needed projects that would otherwise be delayed, when they provide new transportation options, and when they help improve the efficiency of the regional transportation system.
Elected Officials	Elected officials may support tolling and pricing projects if they favor a market-oriented approach, if they want to provide new transportation options, if they want an innovative project in their district, or if their constituents support the proposal.
Newspaper Editorial Boards and Local Media	Media support may come where the rationale for tolling and pricing projects is well understood and where editorial boards believe the project benefits and deserves support of their readers.
Environmental Advocates	If a pricing project introduces tolls on an existing general-purpose lane or an entire roadway, it could make single-occupancy auto travel less attractive.
Taxi Associations	Taxis that use tolling and pricing facilities may be able to generate more fares in less time during peak periods.
Transit Agencies; Transit Advocates	In corridors without preferential lane treatment for HOVs or transit, transit operators may support tolling and pricing projects due to transit time savings. They may also support HOV to HOT conversions if a portion of the toll revenues is used to support transit.
Emergency Medical Service/Police and Fire Departments	Tolling and pricing facilities may enable emergency services to respond more quickly to incidents.
Rideshare Agencies, Transportation Management Associations	Rideshare and other transportation associations may support tolling and pricing options that provide new transit services and discounts to HOV vehicles.
Employers; Business Groups	Employers and business may support tolling and pricing facilities with the potential to make transportation operations more efficient and to reduce delay time.
Developers	Developers may support tolling and pricing facilities that enhance access to office buildings, shopping centers, residences or other locations they own.
Neighborhood Associations	Area residents may support tolling and pricing facilities if they enhance their mobility and travel options.

stakeholder groups, it is important to recognize that support for or opposition to a tolling or pricing project may depend on project circumstances.

3.1.2 Equity Issues

Environmental justice and other equity considerations are among the primary concerns of the environmental review for any tolling or pricing project. While the general public and many policy makers associate road pricing with benefits for wealthier individuals and sometimes truckers (since these groups may be more willing to pay for and better able to afford tolled routes), others often benefit as well. For example, a survey for San Diego's I-15 express lane project revealed that a majority of motorists from all income groups support the priced lanes (Perez and Sciara 2003). Moreover, DeCorla-Souza and Skaer (2003) and Kockelman and Kalmanje (2005) suggest several ways in which equity concerns can be mitigated: a portion of toll revenues can go toward funding projects that benefit lower income travelers; toll revenues can be used to provide credits to low income travelers; travelers in free lanes may receive credits for tolled lane use based on the amount they travel; and/or congestion-based revenues may be returned uniformly to all residents of a corridor or region for use anywhere in the system. Such policy decisions can be critical to gathering adequate support for tolled projects, as well as maximizing social welfare.

3.1.3 Environmental Approvals

With the important exception of public acceptance and equity issues, it can be expected that the different assessments comprising an environmental review of tolling and pricing projects would be identical to that for non-tolled highway improvements. It should be noted that even in cases where tolling and pricing projects are approved using a Finding of No Significant Impact (FONSI), a project sponsor is likely to be asked to demonstrate that it has conducted a comprehensive public outreach effort through which it has ascertained that the project will garner public support and will not impact low income users or populations unfairly.

The focus of environmental reviews for tolling and pricing projects depends to a great extent on local policy decisions made during earlier planning phases regarding the use of tolling. These goals should be incorporated into the purpose and need statement for the project. As with other transportation improvements, environmental approvals must be coordinated with other decision-making milestones, including the MPO planning process.

In certain cases, the consideration of tolling and pricing may be introduced while the environmental process is underway or even after it has been completed. At a minimum, this change would require a reevaluation of the analyses completed. The level of detail of the reevaluation depends on the circumstances surrounding the particular project. In situations where the introduction of tolling and pricing is determined to be significant, a supplemental environmental impact statement must be prepared.

3.1.4 Travel Demand Forecasting

In addition to addressing issues of public opposition, travel demand forecasting is a more intense endeavor, since behavioral models must consider both tolled and non-tolled alternatives, as well as multiple tolling scenarios. Standards can be particularly high when private sector investment is involved (to meet bonding requirements). In general, there is more risk and uncertainty associated with tolled highway projects than with non-tolled projects (Standard and Poor's 2004). Further, there is more risk and uncertainty associated with managed lane toll projects than traditional toll projects. Essentially, few regions have any experience with travelers' response to the presence of tolls and even less so to congestion pricing, so it often is unclear how long it will take drivers to adapt and adopt the new technologies and tolled routes. Moreover, regular involvement of private sector investment means close scrutiny of revenue forecasts. Standard and Poor's (2002, 2003, 2004) suggests that actual traffic volumes on new priced roadways average roughly 25% less than forecasted. For example, Flyvbjerg (2005) found that actual traffic volumes on non-tolled routes tend to be slightly greater (about 9%), when averaged, than forecast. These findings imply substantial risk for public agencies, a gamble that they presently are ill-equipped to handle. Poole (2007) suggests that private financial markets are much better able to account for such risk, and suggests that such considerations are making PPPs a popular alternative to the turnpike authorities and toll road commissions of the past.

3.1.5 Tolling Design and Technology

Tolling design is one obvious difference between tolled and non-tolled projects. Questions such as whether the technology has been proven and whether it has been successfully implemented elsewhere must be answered before decisions are made. Technology now allows facilities to be priced to make more effective use of their capacity. Some federal tolling programs also require toll collection solely through electronic means for all users, thereby making access to ETC technology one of the tools used to manage such facilities.

A number of technology related issues must be addressed before implementation can take place, including privacy,

cost, and reliability (Hattum and Zimmerman 1996). Once the tolling technology has been established, it is crucial to develop a pricing schedule. Pricing can be fixed, vary by time-of-day, and/or vary as a function of demand, in order to keep traffic flowing. In addition, it is important to develop procedures for making adjustments to the pricing schedule. Clarity on this point also enhances the chances for greater accuracy in revenue forecasts for future years.

A small number of toll facilities around the world are equipped with standard transponder-based ETC systems as well as character recognition systems that identify the license plate number of vehicles without transponders. In this manner, these ETC systems are able to reference motor vehicle registration databases and issue bills to the owners in noncompliance. Known as open road tolling, these dual technologies allow operators to remove toll booths completely. In general, toll collection systems should be simple, unified, and inter-operable. Given the operational advantages of ETC and the flexibility in terms of toll policy it affords, manual toll collection should be avoided or kept to a minimum whenever possible.

3.1.6 Toll-Backed Financing

Most toll roads are financed by borrowing debt backed by future toll revenues. Toll-based finance is straightforward and very much akin to the municipal finance model. First, a public authority needs to be vested with the responsibility of developing toll roads within its given jurisdiction. After completing the appropriate feasibility studies, the authority issues bonds against anticipated toll revenues and uses the proceeds to fund the construction of the toll road. Once the toll road is open to traffic, the authority pays back its debt and interest costs using toll revenues collected on the facility. This model is attractive to investors as the interest they make on their holdings is exempt from federal and state income taxes. The toll-based finance model may also be used in conjunction with PPPs. In this case, the private sector partner would arrange financing for the project and then repay the debt from toll revenues. In the past, private activity debt for toll projects could not be issued on a tax exempt basis. However, as described in Section 3.1.8, those limitations were modified with the passage of the SAFETEA-LU in August 2005.

Reliance on toll-backed financing necessitates detailed financial feasibility assessments along with financial planning (for the role of equity versus debt, and repayment structuring). It also demands rigorous traffic and revenue forecasts, subject to multiple sensitivity tests and some form of risk analysis. Such financing requires a variety of additional institutional arrangements, including debt issuing authority and a bond rating process. State DOTs and MPOs often are unaccustomed to such arrangements, and changes in business practices will be needed.

More detailed information on the analysis requirements for the Investment Grade Phase of the evaluation framework for tolling and pricing projects is provided later in Section 4.4.1 of Volume 1.

3.1.7 Tolling as a Means to Engage the Private Sector

Tolling also provides opportunities for governments to engage the private sector in developing new highway facilities or maintaining and improving existing roads. Conventionally in the United States, public agencies—usually DOTs or other special authorities—assume all financial responsibility for both the design and construction of highway projects and then operate and maintain the completed facilities themselves. However, given that toll roads are financed—either entirely or in part—by leveraging future toll receipts, it is possible for public agencies to engage the private sector to design, build, finance, and operate new toll roads on a concession basis. In addition, some agencies have entered into long-term lease agreements with private partners to operate, maintain, and make improvements to existing toll roads.

Public-private partnerships provide a number of advantages by allocating responsibilities to the party—either public or private—that is best positioned to control the activity and produce the desired results. This allocation is accomplished by specifying the roles, risks, and rewards contractually, to provide incentives for maximum performance and flexibility.

The primary benefits of using PPPs to deliver transportation projects include:

- Expedited completion compared to conventional project delivery methods;
- Project cost savings;
- Improved quality and system performance from the use of innovative materials and management techniques;
- Substitution of private resources and personnel for constrained public resources; and,
- Access to new sources of private capital.

In addition, as DeCorla-Souza and Barker (2005) and Poole (2007) note, private partners are often better equipped and incentivized to handle risks inherent in building and operating toll facilities. In particular, for public toll operators, there are particular challenges associated with increasing toll rates, as the public and elected officials are generally leery of tax increases. While many concessions and PPPs involve some sort of toll rate cap (e.g., no more than a 2% increase per year) toll adjustments are treated as a contractual issue rather than a political one. By providing the public sector with access

to new sources of capital and financing, PPPs also allow governments to use their own financial resources for other transportation needs. As of mid-2008, 23 states and one U.S. territory had enacted statutes enabling the use of various PPP approaches for the development of transportation infrastructure (FHWA P3 website: http://www.fhwa.dot.gov/ipd/p3/index.htm). However, in locations where there is no legislative framework allowing for PPPs, it can be difficult (and time consuming) to establish such a framework.

If private financing is used to any extent, there tends to be heightened public and political scrutiny and interest, and the procurement process may take center stage. Of course, enabling legislation must exist for private sector involvement in this form, and concession agreements must be drawn up, defining details of risk allocation, revenue sharing, pricing plans (including toll escalation), identification of additional revenue sources, length of term, buy-back provisions and termination clauses. It should be noted, however, that while private partnerships are often an attractive implementation model, they do not necessarily guarantee financial success.

3.1.8 Legislative Authorities

Finally, there are a number of overlapping legal frameworks that affect the implementation of tolling and pricing projects. State and local jurisdictions have the greatest flexibility to implement tolling and pricing on local roads and highways that have been, or will be built without federal funding. Greater restrictions apply when tolling and pricing are used on the Federal Aid Highway System, or on HOV lanes or busways funded with transit monies. As a result of these restrictions, the vast majority of tolling and pricing projects implemented over the past 50 years have involved either new state or county toll roads or the expansion of pre-existing toll facilities that have been incorporated into the Interstate Highway System.

Federal Requirements. The SAFETEA-LU authorization legislation of 2005 softens these distinctions by easing constraints on the use of tolling and pricing on the Interstate Highway System. Under current federal law, new toll roads can be created using tax funds, tolls or a mix of tolls, federal aid and other sources, and existing non-Interstate federal aid highways can be converted to toll roads in the context of reconstruction, rehabilitation, or capacity expansion. The authority to convert eligible HOV facilities to HOT use has been extended to all Interstate facilities in all states, provided that HOVs are able to use the lanes at no cost. The constraints on the conversion of Interstate highway facilities to toll facilities have been modified slightly via the Interstate System Reconstruction and Rehabilitation Program (which allows for tolls to be implemented to support major maintenance and improvements on three existing Interstate facilities to be tolled) and the new Interstate System Construction Pilot Program, which has been added in SAFETEA-LU, and is designed to permit tolling to finance construction of three new Interstate highways.

Toll agreements are required when Federal-aid funds are used for construction or improvement of a toll facility. These agreements are executed between FHWA and the state DOT and the toll authority. Toll agreements require that all toll revenues are first used for any of the following: debt service, reasonable return on private investment, and operation and maintenance, including reconstructing, resurfacing, restoring, rehabilitating work, or modifying access points to the Interstate Highway System. Toll agreements may also include a provision regarding use of any toll proceeds in excess of those needed for the required uses outlined above.

If a toll facility is operated by a bi-state organization, approvals would be required from the U.S. Congress, as well as both state legislatures. Similarly, parallel legislation is required to establish an authority operating toll facilities connecting two countries.

State and Local Requirements. Various state and local authorities are also needed to implement tolling and pricing projects. Local legal requirements are dictated by state and local statutes and regulations, as well as pricing and toll collection policies and mechanisms used to raise financing. Policy makers interested in pursuing tolling and pricing projects should consult with legal experts to identify the specific requirements that would apply in their regions. The discussions below describe the range of legal authorities that may pertain.

- Tolling Authority—State and local laws usually provide explicit authority to toll highways and crossings. In many states this authority does not exist, and when it does exist, it may be limited to roads operated by a designated turnpike or toll road authority. If a proposed toll project is not located along a facility operated by one of these agencies, legislative provisions may be required to enable the collection of tolls on the new facility.
  - Such enabling legislation may designate the operating agency or agencies—including potential private investment partners—and outline their specific responsibilities in such areas as construction, maintenance, toll collection accounting, and enforcement. The legislation may also establish how toll revenues may be spent. In many cases states may require that toll revenues are used solely for transportation purposes, rather than general government uses.
  - Pricing projects involving variably priced tolls may require special enabling legislation. This legislation may

also establish how the variable rates will be set, identify minimum acceptable traffic service standards on priced facilities, and prescribe how and when toll rates could be changed.
  - Where possible, enabling legislation should provide maximum flexibility for state DOTs and other project sponsors to adopt innovative tolling, pricing, and procurement policies so that they can take advantage of new innovations in these areas.
- Public-Private Partnership Authority—Use of private financing mechanisms for transportation facilities can occur only when the necessary legal authority exists and governing legal principles and restrictions are observed. As of August 2008, 23 states and one U.S. territory have passed legislation providing the legal authority for private sector participation in transportation projects to varying degrees.
- Design-Build Authority—Design-build procurement is used for the construction of most toll facilities that are financed on a limited recourse basis. This is especially true for PPP concession projects. As of August 2006, 38 states have laws allowing the use of design-build procurement, which combines the design and construction into a single contract, transferring greater risk and potential reward to the private sector. Title 23 of the U.S. Code has also been amended to allow the use of federal funds on any highway project using design-build procurement.
- Debt-Financing Authority—State governments must also provide legislative authority to enable debt financing and the issuing of bonds. Such legislation may also establish caps on the amount of debt that can be outstanding at any given time. It may also establish parameters for using a combination of different funding sources to develop tolling and pricing projects.
- Electronic Toll Collection Authority—State legislation may also be needed to establish the terms and conditions governing the use of ETC systems and requirements for account holders. For example, state legislation may be required to provide ETC operators with access to data maintained by state registries of motor vehicles and to allow toll operators to use video technology to identify toll violators and issue summonses. This authority is essential to toll enforcement and protects the value of the revenue stream generated by the project.
- Variable Pricing Authority—Many regulations governing the operation of toll roads only allow flat point-to-point or per-mile toll rates. If such an agreement exists, a pricing project involving variably priced tolls may require special enabling legislation. Enabling legislation may also be required to permit use of pricing, performance standards, or other innovative procurement methods on tolling and pricing projects.

3.2 Screening and Evaluation Procedures

Tolling and pricing concepts are normally evaluated using a series of screening measures that assess the effectiveness of different alternatives in meeting overall regional mobility goals and any specific goals identified for the possible use of tolling and pricing concepts. This process is accomplished by compiling technical information on proposed alternatives and comparing the ability of different alternatives to meet a series of screening criteria. Probable screening criteria would include:

- Congestion relief potential;
- Consistency with state and regional plan goals;
- Ability to improve the efficiency of the regional transportation network;
- Public acceptance;
- Institutional feasibility;
- Safety impacts;
- Order-of-magnitude construction cost;
- Revenue generation potential; and
- Financial viability.

The culmination of the screening process is the identification of a shortlist of candidate tolling and pricing projects that demonstrate the strongest ability to meet regional goals and a recommendation on whether or not those concepts merit further analysis.

The overall decision-making framework for tolling and pricing projects is essentially a series of screening exercises at an increasingly detailed level of resolution that ultimately results in the identification of a project to move into implementation. Given the many different needs and circumstances that lead different regions to consider the use of tolling and pricing, several different approaches to initial screening and evaluation have been adopted.

Summaries of two notable examples are provided on the following pages.

Given the great variety of local goals, geographic and demographic conditions, and institutional relationships, it is not prudent to recommend a single methodology for screening candidate tolling and pricing projects. Flexibility is needed to address regional conditions, legislation, the current state of the toll road development, and political and public acceptance in different locations. While local circumstances will dictate whether the systematic or project-specific decision framework is used, a number of effective features for screening exercises can be identified:

- Multi-stage successive screening is needed and it should be based on the widest possible definition of conceptual network alternatives.

- Initial evaluation of candidate pricing project should be based on a broad set of criteria similar to one adopted in the Colorado study.
- At more advanced stages, financial feasibility becomes the most important criterion as emphasized in the Texas and Colorado studies.

If there is a decent and well-calibrated regional transportation model in place, it can be effectively used from the early stages of analysis. Alternatively, simplified sketch-planning tools can be applied at earlier stages, while a more advanced transportation model is developed or improved for each project feasibility study (implied in the Texas study).

Successive Financial Feasibility Analysis. This approach was adopted in the *North Texas Turnpike Authority Toll Feasibility Analysis Process* (2005). According to this approach, the pricing project feasibility analysis is essentially the same at all four stages. The ultimate goal of the feasibility analysis is to provide an estimate of total project cost compared with the economic value of a candidate pricing project typically expressed as the potential for the project to be funded through bonds. However, at each successive stage, traffic and revenue forecasts become more reliable as well as project cost estimates, and schedules are also refined to a greater degree of certainty. In particular, the following objectives were specified for each stage:

- Conceptual level of analysis (Stage 1) is used to investigate and compare a range of toll facility configurations. Criteria for project advancement includes full coverage by forecasted toll revenues of toll collection operating costs and the capital cost of installing after the initial ramp-up period (within 3-5 years of opening), coverage of at least of 10% of the total project cost by toll revenue, and demonstrated political and/or funding support.
- Sketch level of analysis (Stage 2) is used to refine and evaluate the most promising strategies for a candidate project or corridor. It considers production, financial, and revenue constraints, and, occasionally, a phased implementation plan including "staged" scenarios. Criteria for project advancement includes a provision that potential toll revenues can provide an acceptable portion of the funding required for implementation of a candidate project. If anticipated revenues for the project are very high, it is possible to move directly into an Investment Grade (Stage 2) study, and skip the Intermediate Grade (Stage 3) study.
- Intermediate level of analysis (Stage 3) supports the final design process for pricing project development, and refines traffic and revenue estimates to strengthen the financial plan. When traditional funding sources cannot pay for construction, but bond funding could cover a significant portion of funding shortfall, the project may be advanced to an Investment Grade (Stage 4) study. Otherwise this stage may be the last study level if the project will be fully funded by public funds (i.e., TxDOT funds, state bonds, etc.) and/or other local sources without private sector bonds.
- Investment Grade level of analysis (Stage 4) refines traffic and revenue forecasts such that their accuracy is suitable for use in evaluating the project as a potential financial investment using private sector bonds. This is the final stage in the project development and finance process that certifies the revenue generation potential of a candidate toll project. At this stage, the amount of bond funds available from toll revenue used to finance a candidate toll project is based on the assessment of a bond rating agency. The available bond funds may lead to successful certification of a viable Financial Plan.

The North Texas Turnpike authority is using this general approach as it advances plans for more than 10 major tolling and pricing expansions that are in various phases of development.

Preliminary "Broad-Brush" Screening with a Subsequent More Rigorous Financial Feasibility Analysis. This approach was adopted in the *Colorado Toll Enterprise Preliminary Traffic and Revenue Study* (2005). The following evaluation criteria were applied at four successive stages:

- Initial screening process (Stage 1) is based on "broad-brush" criteria such as volume/capacity ratio, average daily traffic volumes in excess of 30,000 vehicles per day, average daily truck volumes, roadway classification, projected population growth, inclusion in the statewide transportation plan, projects identified through the Strategic Investment Plan process, projects sponsored by private entities, and roadway improvement segments with recently completed or ongoing corridor level studies.

- The first-tier screening (Stage 2) is still a generally subjective analytical approach, but more detailed and rigorous than the initial screening process. The following 12 criteria are used: potential safety impacts, toll operations viability assessment, economic growth considerations, consistency with statewide and regional plan goals, community impact assessment, congestion relief potential, network continuity considerations, order-of-magnitude construction cost estimates, general constructability assessment, 20th year traffic and revenue potential, relative financial feasibility index, and others.
- The second-tier screening (Stage 3) is conducted on a reduced number of project corridors and project scenarios, but makes use of travel demand models in developing traffic and revenue estimates. The optimum toll rate, which maximizes toll revenue, is selected for each of the projects for each time period by direction. A more detailed analytical approach is also used to develop preliminary estimates of capital, operating, and maintenance cost for each candidate toll project. The second-tier analysis also brings together these estimates of revenue and cost to evaluate the financial feasibility of each project. The potential projects are ranked based on the percentage of each project's cost paid from a maximum issuance of senior lien bonds and equity contributions from federal, state, and/or local sources. Projects able to fund at least 70% of total project cost through these sources are deemed more financially feasible.
- Investment Grade studies (Stage 4) includes a comprehensive evaluation of the selected individual projects including multiple construction/design alternatives for certain projects.

As a result of its initial findings, CDOT has continued work on environmental studies that include toll lanes or toll roads as alternatives to be considered on the following six projects:

- US 36
- I-70 East
- C-470
- Northwest Corridor
- I-70 West
- I-25 North

Other corridors under consideration, but without formal environmental studies underway, include the Colorado Springs Toll Road, a project proposed by a private investor, and I-270.

CHAPTER 4

Major Decision-Making Stages and Technical Aspects

This section of Volume I provides detailed descriptions of the technical analyses that are needed in the different stages of consideration for tolling and pricing projects.

The areas of analysis identified in Table 4-1 constitute a useful methodological core for the assessment and evaluation of tolling and pricing options. They are also instrumental for classification and synthesis of best practices and can be defined as follows:

- **Transportation Planning (P).** This aspect considers the pricing project within its regional transportation system and established goals. This aspect requires a comprehensive analysis of the transportation and environmental impacts of candidate pricing projects. Established planning procedures, NEPA, and the MPO process regulate the planning process.
- **Project Definition (R).** This aspect relates to the physical layout, access, and cross-section design of the facility as well as analysis of various possible pricing forms, toll rates, and associated toll-collection technologies. In the decision-making process, this aspect manifests itself when considering various project alternatives, and choosing a preferred alternative and optimal toll rate.
- **Cost Estimates (C).** This aspect relates to the comprehensive estimation of all project cost components, including construction, operations and maintenance, and toll-collection equipment. Estimates of capital and operating costs are prepared for most tolling and pricing alternatives. During the initial stages of the decision-making framework, cost estimates are likely to be more conceptual and defined with greater resolution and detail in subsequent stages.
- **Traffic and Revenue Forecasts (T).** This aspect involves preparing traffic and revenue forecasts. Similar to project costs, at the earlier stages of analysis, traffic and revenue forecasts are prepared at the preliminary sketch level. Later, as the physical parameters and pricing forms become more detailed, traffic and revenue forecasts can be more rigorously refined using advanced modeling tools. Traffic and revenue forecasts play a crucial role in the final choice of the preferred pricing alternative and the optimal toll rate that meet the established regional goals, such as congestion relief, revenue maximization, or social welfare maximization.

  Traffic estimates for the Exploratory and Preliminary Phases normally utilize an entire regional traffic network or broad corridors that include multiple improvement projects in addition to the tolling and pricing options being assessed. However, during the latter two stages, modeling efforts are more likely to focus on the individual tolling and pricing alternatives. As described in greater detail in Volume 2, different levels of forecasting accuracy and technical sophistication are required in the four phases of the decision-making process.
- **Financial Feasibility (F).** This aspect brings together cost and revenue estimates and results in evaluation of the project's financial feasibility. The goal of this assessment is to create a viable financial plan that substantiates full coverage of the project cost from a combination of the expected revenues and additional available funds. This aspect is closely intertwined with traffic and revenue forecasts and also includes the development of important assumptions on the use of generated revenues and availability of other funding sources to support the project.
- **Institutional Assessment (I).** This aspect relates to the institutional and organizational framework used to implement and operate tolling and pricing projects. It comprises such issues as the type and structure of the public authority sponsoring the project, the entity responsible for collecting tolls, the entity responsible for enforcement, the entity responsible for the maintenance of the physical infrastructure (both roadways and electronic toll collection equipment) and the possible involvement of a private-sector partner. The institutional assessment identifies an appropriate ownership structure for the project and the

Table 4-1. Matrix of decision-making steps.

Phase		Technical Aspect							
		Planning (P)	Project (R)	Cost (C)	Traffic and Revenue (T)	Financial (F)	Institutional (I)	Legal (L)	Public Outreach (O)
Exploratory	1	P1	R1	C1	T1	F1	I1	L1	O1
Preliminary	2	P2	R2	C2	T2	F2	I2	L2	O2
Feasibility	3	P3	R3	C3	T3	F3	I3	L3	O3
Investment Grade	4	P4	R4	C4	T4	F4	I4	L4	O4

distribution of rolls, responsibilities, and contractual agreements between the various entities involved. This aspect is closely intertwined with financial issues, as well as legal issues that establish the rights and responsibilities of the various entities involved in developing and maintaining the project.

- **Legal Review (L).** This aspect involves the assessment of the legislative issues associated with pricing and the possible need to enact enabling legislation to provide the sponsoring agency with the authority to collect tolls. Even if general tolling authorities are in place, the use of advanced pricing forms (such as fixed or dynamic variable pricing, pricing differentiation, and associated discounts/exemptions) and issues associated with the use of project revenues may require specific approvals.
- **Public Outreach (O).** This critical aspect includes numerous issues associated with the acceptance of pricing by the general public. The public outreach process involves two aspects: 1) testing different pricing concepts with key stakeholders and the public at large to understand what aspects and policies are generally acceptable and which are not; and 2) educating the public on the need for pricing and the mobility benefits it affords. Feedback from the outreach process is essential to the formulation of alternative pricing concepts. The findings of the outreach process also have a significant impact on decision-making for tolling and pricing projects, as they identify real-world constraint on possible pricing projects, forms, and toll rates. In particular, this aspect emphasizes the importance of a comprehensive traffic and environmental impact study, including social justice analysis with respect to geographical markets and population income groups, as well as the provision for new transit options in corridors where pricing is being considered.

4.1 Exploratory Phase (1)

Exploratory studies typically are done to test the overall feasibility of tolling and pricing concepts within a metropolitan region or potentially an entire state (see Figure 1-1). They generally rely on limited existing data and involve simple analysis with basic assumptions about the potential market for a new facility, toll levels, and levels of capture. The purpose of these studies is to gain a sense of the market and potential for congestion relief with the application of tolling and pricing in different corridors.

Exploratory tolling and pricing feasibility studies generally require coordination with existing MPO and regional planning processes, and involve baseline assessments of local travel, economic, financial, and political conditions, as well as public opinion. This information is used to define a variety of tolling or pricing options (see Section 4.2 for further discussion). Ultimately, if the decision to move forward with further study is made, plans for doing so would need to be incorporated in the MPO process.

It is important to note that the consideration of tolling and pricing does not need to begin at the Exploratory Phase. In many locations individual pricing opportunities—such as the conversion of an underperforming HOV facility in a congested corridor to HOT operation, or the construction of a badly needed toll facility—have been implemented directly without exploratory studies. However, the implementation of these initial tolling and pricing projects may lead to the assessment of other tolling opportunities in the region. This type of approach has emerged in San Diego, Houston, Virginia, and Minneapolis, and is discussed in further detail in the case studies included in Chapter 5.

Alternatively, a more comprehensive approach may be pursued where tolling and pricing are assessed at the regional or state level in locations that do not have existing toll facilities. This approach may result from a state or local legislative mandate. This model has been pursued in Colorado, Washington State, and Oregon. The Washington and Oregon efforts are summarized later in this chapter, while a case study of the Oregon experience is included in Chapter 5.

The following sections describe the assessments and analyses normally conducted during the Exploratory Phase for the eight technical aspects of the decision-making framework.

4.1.1 Transportation Planning Aspects (P1)

Planning aspects involved at the Exploratory Phase are closely intertwined with the pricing initiative and early project outline (R1) as well as regional mobility goals and conditions. The following issues are critical for planning at the Exploratory Phase:

- **Congestion Growth Trends.** Over-congested facilities are always good candidates for pricing. While congestion growth trends in the past should be analyzed based on traffic counts, future tendencies should be modeled within the framework of a regional transportation model. It is helpful to compare model-based forecasts to observed trends to determine whether the model results are consistent, or if further calibration is needed. A set of specific and consistent evaluation criteria for potential tolling and pricing applications (e.g., congestion levels by facility type) is provided in Volume 2.
- **Demographic and Land-Use Development Trends in the Region/Corridor.** Some of the most important basic factors in travel demand forecasting are the population and employment inputs and assumptions. All else being equal, travel demand is proportional to population and employment growth. The evaluation of pricing alternatives is heavily dependent on socioeconomic forecasts and assumptions. However, these same forecasts are frequently cited as the main reason for overly optimistic traffic and revenue forecasts. In general, pricing projects have a better chance of financial success in corridors with high population and employment growth rates, accompanied by plans for intensive future development. In addition to total population and employment growth rates, it is important to account for socioeconomic, employment, and land-use profiles. Pricing projects fare especially well in more densely developed and congested corridors with retail uses, which attract more traffic than any other employment type. It is also important to remember that policy-driven population and employment forecasts prepared by MPOs are not necessarily accepted by rating agencies or private lenders and investors. Therefore, the substantiation of these forecasts against the observed trends is crucial.
- **Provision of Public Transit Enhancements in the Congested Corridors and Regions.** The use of transit enhancements—particularly BRT—together with pricing creates important synergies and provides new mobility options and benefits in corridors where pricing is being considered. Transit enhancements extend mobility benefits to lower income populations that may not have access to automobiles or the disposable income needed to pay for tolls. While most intercity highways have limited transit use, transit enhancements are appropriate with urban and suburban managed lane applications.
  - Transit evaluation should examine opportunities such as park-and-ride facilities to accommodate additional ridership generated by travelers diverted from the tolled facilities. When transit enhancements are incorporated with pricing alternatives, such as HOT lanes and BRT service, they can be evaluated together in an integrated framework.
- **Early Screening and Evaluation Criteria.** For a consistent regional policy, it is recommended that agencies establish a clear list of evaluation criteria to identify candidate projects. An example of such a list is given in the *Colorado Tolling Enterprise Preliminary Traffic and Revenue Study* (2005), which used the following criteria to identify highway facilities across the state as candidates on which to assess pricing:
  - Volume-over-capacity ratio (congestion level)
  - Daily traffic volume of 30,000 or greater
  - Average daily truck volumes
  - Roadway classification
  - Projected population growth in adjacent areas
  - Inclusion in the State Transportation Improvement Program (STIP)
  - Project identified through the Strategic Investment Plan process
  - Projects sponsored by private entities
  - Completed or ongoing corridor studies (NEPA)
  - Some other early-stage criteria mentioned in other studies
  - General constructability assessment and construction cost range
  - Community impact
  - Toll operations viability
- **Network Continuity Considerations.** Also at the Exploratory Phase, it is essential that analysts anticipate the regional network impacts of the pricing concepts assessed. If congestion relief is a prominent goal, it is important to ensure that the proposed pricing scheme really improves travel conditions in the entire corridor rather than shifting congestion to other facilities. Conceptual regional network policies that are formulated for the entire network (rather than for a single facility) have a better chance of finding an optimal solution to reduce congestion [see, for example, Atlanta's *High Occupancy Toll Lanes* (2005) report].

4.1.2 Definition of Exploratory Tolling and Pricing Alternatives (R1)

In a comprehensive approach, the definition of tolling and pricing alternatives is embedded in the early screening and

evaluation procedures (P1). The following issues are critical for project definition at the early (exploratory) phase:

- Project features and objectives should be consistent with the agency's established pricing goals, as described in Section 1.3.
- State legislation (where it exists) creates a legal framework and may also identify goals and conditions for the use of tolling and pricing. The following examples of state tolling legislation also identify overarching goals for the use of pricing:
  - Texas House Bill 3588 (2003)—Requires that TxDOT examine the use of tolls and private funds as the primary source of financing on all major highway construction projects (new and upgraded facilities), and that the feasibility of PPPs be assessed for all new highway projects.
  - Colorado (2003)—Colorado's Tolling Enterprise was commissioned to complete a financial feasibility study of tolling on all major highway projects planned anywhere in the state to determine if potential toll projects could be financed independently.
  - Washington State (2006)—The State Transportation Commission recommended adoption of a statewide tolling and pricing policy, and identified a shortlist of projects for near-term evaluation, along with avenues for mid-range to longer term projects; it stated that decision-making should depend on objective criteria applied consistently across the state.
  - Oregon Senate Bill 772 (2003)—Oregon's Innovative Partnership Program was initiated to develop toll projects as public-private partnerships.
- Under a comprehensive approach, each pricing project is evaluated as part of the associated region's long-term Regional Transportation Plan. This type of study normally establishes guidelines for early project selection and outlines possible initiatives. For example, Washington State's proposed tolling policies were broken into three successive stages (Cambridge Systematics 2006):
  - Short-term (high-cost projects during implementation, variably priced managed lanes, HOV lane conversion to HOT lanes)
  - Mid-term (addition of managed lanes, broader use of tolling for system performance optimization)
  - Long-term (all forms of tolling, for funding new highway construction)

Other important considerations are project inclusion in the state's Constrained Long-Range Transportation Plan/Transportation Improvement Plan (otherwise federal monies are not available) and project consistency with federal air quality standards. In light of environmental approvals, different situations lead to different decision-making and modeling steps. In particular, the following situations should be distinguished:

- Project is proposed prior to Environmental Approval.
- Project is proposed as a result of an Environmental Impact Statement (EIS).
- Project is proposed after gaining Environmental Approval (likely would require supplemental analysis).
- Project involves conversion of an existing facility.

High-cost and highly needed projects (e.g., tunnels, bridges, and alleviation of bottlenecks along congested corridors) that cannot be funded solely with existing sources are natural choices for a comprehensive approach. A survey completed in August 2006 by Parsons Brinckerhoff for FHWA identified 168 new tolling projects advanced in 27 states and one U.S. territory since the passage of ISTEA in 1991. These include priced facilities that opened for services, and others in various stages of planning, design, finance, and construction. Together these projects represent more than 3,770 centerline miles of highway and would provide more than 14,565 lane miles of capacity (http://www.fhwa.dot.gov/ppp/toll_survey.htm).

It should be noted that with a project-specific approach, the decision-making process essentially bypasses Stages 1 and 2 of the evaluation framework and instead focuses on a specific pricing project in a designated corridor. This is the case, for example, of the I-495 Capital Beltway HOT lane project in Northern Virginia, which is being implemented as the result of an unsolicited offer from a private entity. This project is discussed in further detail in Section 5.5 of Volume 1.

4.1.3 Cost Estimates (C1 and C2)

When dealing with multiple projects and alternatives at the Exploratory Phase, cost estimates are prepared at a conceptual level. Cost estimates are further refined as the scope of a specific project is developed. For the early project screening process, "off-the-shelf" estimates based on cross-section types are often adapted from recent environmental and design studies or bid tabulations using mileage-based cost factors for similar highway construction. Separate considerations should be made for major structures such as bridges, tunnels, or interchanges, given their expense and one-of-a-kind nature. The addition of a 20% contingency is also standard practice with conceptual cost estimates.

In addition to capital construction costs, preliminary estimates should also account for the following related activities (*Washington State Comprehensive Tolling Study* 2006):

- Design and professional fees, or "soft" costs (design and professional fees)

- Right-of-way acquisition (including property damage)
- Operating and maintenance costs
- Capital renewal
- Technology, Intelligent Transportation Systems (ITS), payment systems, customer service, and "back office" costs
- System administration

4.1.4 Sketch-Level Traffic and Revenue Forecasts (T1/T2)

Similar to the conceptual cost estimates, the traffic and revenue estimates at the Exploratory Phase are preliminary in nature and intended only to identify the potential viability of pricing alternatives. The level of sophistication of existing modeling tools varies, but most models can be refined to complete forecasts for a regional pricing study, as well as for full-blown feasibility and investment grade studies. However, these upgrades have minimal effect unless the decision to invest in the regional travel demand model has been made with future stages in mind.

In regions where advanced activity-based models have been developed and used by MPOs (e.g., San Francisco and New York), the models can be used in all stages of evaluation for ongoing pricing studies. In other cases, simpler 4-step models with certain added features have been used for regional pricing studies (e.g., Atlanta). This type of modeling work is frequently outsourced to the private partner or a third-party consultant.

With both simplified and advanced modeling tools, model input is subject to the following sketch-level specifics:

- Since screening exercises involve the identification of the most promising pricing alternatives, the focus is on orders of magnitudes and tendencies; exact numbers are not analyzed. It is recommended that analysts round traffic volumes to hundreds or thousands in any comparison or ranking of competing projects.
- For pricing alternatives on existing facilities (e.g., conversion, adding managed lanes, and/or changing toll rates and/or pricing forms) and where a regional travel model is not available, a simplified model structure can be applied based on the direct use of available data and assumptions regarding traffic growth and diversions. However, this approach is more problematic for new facilities, as well as projects involving significant capacity additions and/or re-configuration, and is not recommended.
- Corridor-level and sample enumeration models can be applied based on an origin-destination survey of existing users. These surveys are also useful for calibration of regional models.
- It is important to ensure consistency of modeling assumptions when screening potential pricing projects at the early stage (*Guidelines for Conducting TTA Traffic and Revenue Studies* 2005). This includes making consistent assumptions on toll rates, toll escalation, revenue annualization, and other factors influencing revenue calculations are consistent from alternative to alternative, unless there is compelling reason for differentiate specific factors. This would be the case if sensitivity analyses were being completed.
- Sketch-level tools are designed to distinguish between basic pricing alternatives, including physical layout of the facility, vehicle eligibility, principal pricing unit, and toll rates. Many details relating to price differentiation, toll collection technology, and bulk discounts (among others) cannot be analyzed, and should not be used as a decision-making factor at this early stage.
- Sketch-level modeling tools must provide reasonable estimates for the screening and evaluation criteria adopted in step P1 of the decision-making process for such parameters as congestion relief impacts, level-of-service improvements, and travel time savings. These sketch tools, in general, are not suitable for applications beyond this purpose.
- The travel demand model should be applied for two or three time horizons, such as the opening year and one or two maturity years that may be 20 to 30 years apart. The yearly traffic and revenue streams are subsequently interpolated and extrapolated as needed for a preliminary financial feasibility analysis.

A comprehensive discussion on model features required for pricing studies is discussed in Volume 2 of this report.

4.1.5 Assessment of Financial Context and Preliminary Financial Feasibility (F1/F2)

At the Exploratory Phase, it is important to complete realistic assessments of available public funding sources and identify gaps that could be filled by toll revenues. The following sources should be considered:

- Traditional Federal funding;
- State highway funds;
- Other state participation such as bond referenda or sales tax mileages;
- Local participation in the form of bond referenda or local sales tax mileages;
- Innovative finance facilities including: TIFIA credits, GARVEE bonds, private activity bonds (PABs), State Infrastructure Banks (SIBs), and Section 129 loans; and
- Funding raised by private investment partners.

It should also be noted that certain locations—most notably San Diego County—have not used toll proceeds to help finance major HOT lane expansions. In this case, the

goals established for pricing projects focus on congestion relief rather than revenue generation. This approach has been facilitated by San Diego passing two aggressive bond referenda that have provided large amounts of local financing for transportation enhancements. Additional information on San Diego's pricing program is provided in Section 5.4.

In practical terms, when toll revenues are considered as a means to fund high priority projects, the following issues should be considered when developing a financing approach:

- Costly projects with high demand are leading candidates for pricing; traditional funding should be reserved for other highly valued projects that cannot be supported by tolls. This approach can be seen in Houston, for example, where voters approved the creation of a local toll authority with a specific mandate to develop two highly needed greenfield highways for which funding was not otherwise available. Additional information on Houston's tolling program is provided in Section 5.1.
- If practical from a public and political acceptance perspective, no geographic constraints should be imposed on the use of toll proceeds. Instead, decisions should be made on a systematic basis. From a financial perspective, those projects with the highest financial feasibility or the ability to be self-supporting should be built first. As excess revenues are generated by these early projects, they can help fund less financially viable projects. This concept is counter to conventional wisdom in the United States, where there is a strong bias toward using toll revenues within the same corridor or general location where they were generated.

Several federal innovative finance programs provide financial assistance for tolling and pricing projects, and allow state and local project sponsors to leverage their available resources. As part of the exploratory financial assessment, local sponsors should engage in a dialogue with FHWA officials to determine whether any of the following innovative finance programs could be used to enhance the feasibility of local pricing options:

- The TIFIA was established by TEA-21 in 1998, and in 2005 SAFETEA-LU lowered its minimum capital cost threshold to $50 million (and $15 million for ITS). The TIFIA program provides federal credit assistance to nationally or regionally significant highway, transit, and rail projects that have their own dedicated sources of revenue. The program is intended to leverage substantial co-investment by providing supplemental or subordinate debt.
- SAFETEA-LU expanded bonding authority for private activity bonds (PABs) by adding highway facilities and surface freight transfer facilities to a list of other activities eligible for tax exempt facility bonds. PABs are not subject to the general annual volume cap for PABs for state agencies and other issuers, but are subject to a separate national cap.
- SAFETEA-LU established a new SIB program under which all states and territories are authorized to enter into cooperative agreements with the Secretary of Transportation to establish infrastructure revolving funds eligible to be capitalized with federal transportation funds authorized for fiscal years 2005–2009. A SIB, much like a private bank, can offer a range of loans and credit assistance enhancement products to public and private sponsors of Title 23 highway construction projects or Title 49 transit capital projects.
- Similar to SIBs, Section 129 loans allow states to leverage additional transportation resources and direct assistance to other eligible projects. States have the flexibility to negotiate interest rates and other terms of Section 129 loans. When a loan is repaid, the state is required to use the funds for a Title 23-eligible project or credit enhancement activities, such as the purchase of insurance or a capital reserve to improve credit market access or lower interest rate costs for a Title 23 eligible project.

Although estimates for revenue generation potential and construction costs remain crude during the Exploratory Phase, a preliminary financial feasibility analysis should be conducted to test the viability of different tolling and pricing alternatives, as well as different financing approaches. Financial feasibility assessments are usually an integral part of the early screening and ranking of potential pricing projects, and also help to identify viable financial models for implementing them.

In addition to the public finance approach, certain tolling and pricing projects may have the potential to be developed as a PPP. Under this model, a private investor/developer is given the right to implement a new toll facility or operate an existing asset for a specified period in exchange for certain obligations. To develop a toll project on a PPP basis, the project must be found to generate adequate toll revenues to cover the cost of financing, constructing, and operating the facility. If this is not the case, public sponsors must provide any additional funding to make the project financially feasible. Project sponsors may wish to explore the possibility of developing toll projects as PPPs as part of their exploratory financial feasibility assessments.

4.1.6 Possible Institutional Frameworks (I1/I2)

Initial investigation of possible institutional frameworks (I1) for a tolling or pricing project may begin in the Exploratory Phase and can be coupled with the Preliminary Phase (I2). Identifying the entity to sponsor a tolling or pricing project is one of the most fundamental issues of this stage. A wide

variety of options exist, and an ultimate recommendation will be based on whether there is an existing toll operator in the region, the various relationships among existing transportation agencies, and the capabilities of those entities. Existing local agencies are generally the best choice to serve as operators of potential tolling and pricing projects. These may include municipal or county toll authorities, transit agencies, or even MPOs vested with the authority to levy tolls. In cases where no established local agency exists, the possibility of creating such an agency should be explored. An alternative approach is creating a unit within the state DOT to sponsor the project; many state toll enterprises or turnpike authorities use this approach as a model.

The nation's recent experience with tolling and pricing demonstrates that there are multiple models for implementing and operating these projects. Decisions regarding sponsorship will ultimately reflect agency capabilities, local conditions, and existing institutional relationships. Existing state and local laws and constitutional provisions may favor the selection of certain organizational options over others.

Other institutional arrangements to consider include identifying the entities responsible for enforcing toll collection, as well as the entity responsible for roadway maintenance, and relations with other toll operators using the same electronic toll collection clearinghouse.

As these various institutional relationships are being considered, thought should be given on how the toll proceeds from potential tolling and pricing projects would be used. In certain cases, they may be used in their entirety to pay back underlying project debt. However, in other cases a portion of the proceeds from the project may be used to support new transit improvements or other transportation investments in the pricing corridor. This use of project proceeds works well in gaining support for tolling and pricing from a wide constituency, including the general public.

4.1.7 Legislative Requirements (L1)

State or local tolling enabling legislation (if not yet in place) is the first implementation step of any pricing project (see discussion for R1). In addition, various state and local authorities are needed to implement tolling and pricing projects. Local legal requirements are dictated by state and local statutes and regulations, as well as pricing and toll collection policies and mechanisms used to raise financing. Policy makers interested in pursing tolling and pricing projects should consult with legal experts to identify the specific requirements that would be needed in their regions. The discussion below describes the range of legal issues that may pertain.

State and local laws usually must provide explicit authority to toll highways and crossings. In many states, this authority does not exist, and when it does exist, it may be limited to roads operated by a designated turnpike or toll road authority. If a proposed toll project is not located along a facility operated by one of these agencies, legislative provisions may be required to enable the collection of tolls on the new facility. Where possible, enabling legislation should provide maximum flexibility for state DOTs and other project sponsors to adopt innovative tolling, pricing, and procurement policies, to take advantage of new innovations in these areas.

Further details on the different types of legislative authority commonly needed for tolling and pricing projects is provided in Section 3.1.8 of Volume 1.

4.1.8 Assessment of Public Opinion (O1/O2)

Public outreach is an essential element throughout the planning and implementation of any toll project. Carefully planned and executed public outreach plays a critical role in helping develop tolling and pricing projects to appeal to the widest spectrum of the public. Outreach allows the public to consider the advantages new tolling and pricing facilities can provide and ultimately accept them as a new travel option. An effective public involvement strategy requires the sensitive guidance of stakeholders through each step of the project, inviting maximum public participation in the process, and documenting all feedback received.

In the early stages of public involvement, information gathering allows officials to gain insight into public attitudes, opinions, knowledge, and "acceptabilities and deal-breakers" associated with tolling and pricing. Early outreach efforts should include local chambers of commerce and business associations, as well as public interest organizations concerned with transportation issues. Focus groups can help identify key issues and stakeholder interviews provide the opportunity to explore how these might be addressed.

The following critical aspects must be considered:

- Compared to traditional highway projects, pricing introduces new concerns with respect to public acceptance and environmental justice. Specifically, equity across income groups is a primary issue—it should be demonstrated that low-income groups are not discriminated against and have reasonable free roads or transit alternatives.
- It is preferable when interest in tolling is initiated at the local level rather than imposed by the state.
- The following public education communication points have proven effective in practice:
  - Quicker construction
  - Travel time reliability (e.g., elimination of "buffer time" allowances in trip scheduling)
  - Use of revenues to support regional transportation needs
  - Tolling and pricing projects as a means to facilitate transit improvements

Outreach efforts for exploratory studies of tolling and pricing should identify differences in the likelihood of the public's accepting different types of toll alternatives. They should also assess how opinions vary within the region and among people of different income groups. With pricing, particularly on managed lanes, equity is an important issue. Given that priced lanes provide paying drivers the opportunity to bypass congestion, some critics assert that they favor higher income individuals. However, usage data show that drivers in all income brackets use and support the facilities.

As the great variety of approaches pursued by different states and metropolitan regions has shown, political acceptance of pricing is largely a function of the history of toll roads in the region as well as socioeconomic makeup and road-pricing experience of the local population. The role and activities involved in public outreach evolve throughout the four stages of the decision-making framework. Further public outreach activities in the feasibility and investment grade phases are discussed in Sections 4.3 and 4.4.

4.1.9 Outcomes of Exploratory Feasibility Assessments

Given the different contexts—both in terms of demographics and geographic characteristics, as well as relationships between planning agencies—a number of different outcomes can be expected at the end of an Exploratory Phase of tolling and pricing. One outcome could be the identification of a shortlist of corridors where the use of tolling and pricing may be effective in achieving regional goals and the recommendation that more detailed investigations take place. Similarly a recommendation could be made against further consideration of the topic. Alternatively, the use of tolling and pricing could be adopted as part of regional transportation policy, or a decision could be made to test the use of tolling and pricing on a pilot basis.

4.2 Preliminary Phase (2)

Preliminary studies are typically done to test the feasibility of tolling and pricing projects in an individual travel corridor or a metropolitan region (see Figure 1-1). This evaluation phase may also be bypassed if pricing is being considered as an additional component of a project already undergoing environmental review. As described in further detail below, the information flowing from preliminary feasibility studies is often used as inputs to the regional planning or MPO process.

4.2.1 Coordination with the Regional Planning Process (P2)

Promising pricing projects identified at the Exploratory Phase will ultimately need to be incorporated into the regional transportation planning process. Decision makers should be aware of the following procedures and issues as they consider the addition of tolling and pricing projects to regional transportation plans:

- Consistency with **state and regional plan** goals and priorities. This principle is essential from the very early stages of any pricing initiative (P1/R1). All tolling and pricing projects eventually should be incorporated into state and regional plans. SAFETEA-LU includes numerous provisions to strengthen the integrity of highway planning that directly relate to pricing projects:
  - The statewide planning process must be coordinated with metropolitan planning. The State Transportation Improvement Program (STIP) must be updated every four years. State DOTs must reimburse MPOs for performing the planning process.
  - MPOs are responsible for the documents needed for federal funding:
    - Financially Constrained Long-Range Transportation Plan (CLRP), usually for 25 years.
    - Transportation Improvement Program (TIP) identifying projects to be funded within the next four years (and updated every four years).
  - MPOs are responsible for the transportation conformity process (every four years) and State Implementation Plan (SIP) for air quality that is based on the TIP.
  - Special requirements for pricing plans:
    - Discussion of environmental mitigation activities (statewide and metropolitan).
    - Operational and management strategies to improve the performance of the existing transportation facilities and relieve congestion (metropolitan).
    - Congestion management processes in Transportation Management Areas.
- From a **transportation system performance** perspective, the following issues should be considered:
  - Long-range transportation plans (statewide and regional) should be consulted to determine whether improvement projects are planned for routes that could compete with, or complement, the candidate project.
  - Viable alternative (competing) free routes and/or transit services for each pricing project. (It is important to ensure network stability in case of accidents as well as social equity for low-income populations).
  - Transit integration with pricing projects (BRT, HOV lanes with buses).
  - Priced network continuity to major destinations like the metropolitan core (avoiding shifting bottlenecks to a different place).
  - No significant adverse impacts through diversion of traffic to other routes.
  - No undue safety problems.

- A **consistent decision-making principle on pricing** (or system of evaluation criteria) should be developed. Pricing should be fairly and equitably applied in the context of the statewide transportation system with no adverse economic or social impacts to particular segments of the population. In particular, the following special markets should be assessed at a very early stage to evaluate the pricing project's viability, as well as the most appropriate range of pricing forms. (For the base year, this evaluation can be done by combining the observed data on traffic counts with special surveys.):
  - Percentage of low-income drivers.
  - Percentage of non-residents (external traffic).
  - Percentage of trucks and commercial vehicles.
  - Percentage of HOVs by occupancy levels.
- As a rule, the **same traffic forecasting and impact analysis tools** that support long-range regional transportation plans and major investment studies in individual corridors should be used for pricing studies. The regional/metropolitan model normally constitutes the best basis for the initial feasibility study and subsequent stages. Using ad-hoc pricing models unrelated to the regional model is an unusual case that can create inconsistencies in the regional planning process. It should be adopted only if there is a compelling reason against using the regional model. Private investors often tend to develop their own independent model tools and enhancements to test the results for public agency models and assumptions.
- A system of highway toll facilities should be planned, operated, and financed as a **system**, with toll rates set for the system rather than facility by facility. This strategy utilizes leveraging revenues among system-wide facilities including transit cross-subsidies. However, this principle may clash with the notion of individual-project financial feasibility. Reconciliation of system-wide and individual-project approaches is not a trivial task and may require compromises on both sides. It is, however, important to ensure that a system perspective has been considered in the MPO and decision-making processes.

4.2.2 Defining Preliminary Tolling and Pricing Options (R2)

The following important aspects of tolling and pricing concepts should be considered as alternatives are assessed within R2. These aspects also must be incorporated into the travel demand modeling process and subsequent analyses that depend upon traffic and revenue forecasts.

- **Physical layout of the facility.** For a new toll road or conversion of an existing facility, a set of parameters should be defined relating to its cross-section design (the number of managed/priced lanes and general-purpose lanes), access control, and links to transit facilities and service. Pricing projects should be accurately coded in the model network with precise locations for access points and ramps. Managed lanes and general purpose lanes should be coded as separate network links.
- **Vehicle eligibility for managed lanes.** Once the physical aspects of the pricing alternatives have been defined, parallel operating requirements need to be identified. As described in Section 2.1 there is a wide variety of possible pricing forms, including ETL lanes with no occupancy requirements, HOV lanes with occupancy requirements of 2+ or 3+, HOT lanes with occupancy requirements of 2+ or 3+, TOT lanes, variably priced HOV/HOT lanes, and combinations thereof. Vehicle eligibility rules can be applied by vehicle type, as with TOT lanes, or vehicle occupancy, as with HOV and HOT lanes. Multiple vehicle eligibility alternatives can be considered for the same physical facility. Modeling efforts should account for vehicle eligibility by including multi-class assignments and occupancy sub-choice assumptions in the mode choice model.
- **Unit of pricing.** It is crucial to determine whether a trip-based pricing form should be used or a daily pricing form, as used in cordon or area pricing concepts. Trip-based pricing forms are simpler and can be handled by 4-step models. Daily pricing forms are more complicated and can be better handled by activity-based models (as applied by the New York and San Francisco region MPOs). At more advanced stages of project development, various bulk discounts and credit-based forms may be considered with a trip-based or daily pricing form.
- **Setting basic toll rates.** The simplest forms of tolling considered at early stages of evaluation include fixed (entry) tolls, distance-based tolls, and entry-exit tolls. Fixed tolls in many cases can be set in one direction (e.g., the one most congested in the peak period), since most trips are symmetrical. Thus, a flat toll would still act as a congestion pricing measure. A more complex pricing form for consideration at an early stage is variable (congestion) pricing pre-set by time-of-day periods. Multiple pricing forms can be considered for the same physical facility.
  - To handle time-of-day-specific tolls properly, the travel model should have at a minimum the corresponding differentiation among level-of-service variables in both the mode choice and trip distribution procedures. Additionally, inclusion of a time-of-day choice (peak-spreading) sub-model is recommended. While setting specific toll rates for each hour of the day is reserved for more advanced stages (and normally requires multiple sensitivity tests), there are some preliminary ways to practically set standardized toll rates to rank

different projects in a consistent and comparable manner. For example, in *Guidelines for Conducting TTA Traffic and Revenue Studies* (2005b), the following assumptions are recommended:

- A base toll rate of 12.0 cents per mile (in 2003 dollars)
- Three percent inflation per year until the opening year
- After the opening year, 3% inflation per year applied every 5 years
- Toll rates for trucks established based on number of axles and assuming a distribution across truck categories

Cost, traffic and revenue, financial, and institutional aspects in the Exploratory Phase also pertain at the Preliminary Phase and therefore are not repeated here.

4.2.3 Federal and State Legislation and Regulations (L2/L3/L4)

As pricing initiatives progress to more advanced stages and as the nature of pricing applications under consideration becomes more clear, it is essential to identify any legal authorities needed to implement them. Legal authorities may be required at the federal, state, or local level. Important distinctions exist between tolling state and local roads and the Interstate Highway System. Tolling on the Interstate must comply with Title 23 of the U.S. Code, which is updated every seven years through the transportation authorization process. In 2005, SAFETEA-LU mainstreamed certain types of tolling applications on the Interstate including the conversion of HOV lanes to HOT operation. In addition, it established or continued several demonstration programs to test the use of tolling and pricing under certain conditions. These programs are limited to a specified number of states or actual projects administered by the United States Department of Transportation (U.S.DOT). State and local transportation authorities should coordinate with their local FHWA division office to determine which federal tolling and pricing programs may be applicable.

Federal legislation and regulations formulated in SAFETEA-LU and related documents include the following:

- Existing non-Interstate federal-aid highways can be converted to toll roads in the context of reconstruction, rehabilitation, or capacity extension.
- Conversion of HOV lanes to HOT or ETL operation has been extended to all Interstate facilities.
- Three existing Interstate facilities may be tolled for the purpose of reconstruction or rehabilitation if they cannot be adequately maintained or improved without tolls (Interstate System Reconstruction and Rehabilitation Program).
- Tolling is allowed to finance construction of three new Interstate highways (Interstate System Construction Pilot Program).
- Adding managed lanes to existing facilities in congested metropolitan areas (including Interstate Highways) is encouraged—15 demonstration projects (Express Lanes Demonstration Program).
- Innovative value pricing forms (real-time dynamic variable pricing, area pricing) are encouraged—15 pilot projects (Value Pricing Pilot Program).
- Flexibility is provided to select a private partner in order to accelerate the implementation (Special Experimental Program 15 [SEP-15]). Approvals for PPP tolling and pricing projects are coordinated by the FHWA Office of PPPs.
- SAFETEA-LU eliminates the $50 million floor on the size of design-build procurements eligible for federal funding.

In conjunction with federal legislation, it is essential to consider **state legislation**, corresponding local regulations, and authorizations. The following aspects must be taken into account:

- State and local jurisdictions have the greatest flexibility in implementing tolling and pricing on local roads and highways built without federal funding.
- New toll roads can be built using tax funds, tolls, or a mix of different sources.
- Legislative action may be taken to establish a broad policy framework for the use of tolling statewide, as in Texas, Colorado, and Washington State. This approach allows advancing projects that meet the policy criteria by approval of a statewide tolling authority, without further legislative action.
- State enabling legislation is required for the use of PPPs in the development of transportation enhancements.
- A tolling authority (if it does not exist yet) should be designated with the ability to perform the following functions:
  - Enable collection of tolls on the new facility.
  - Set toll rate policy.
  - Designate the operating agency for construction, maintenance, toll collection/accounting, and enforcement.
  - Use toll revenues including public transit and other transportation projects.
  - Establish minimum acceptable level-of-service standards.
  - Variably priced tolls may require special enabling legislation.
  - Establish the duration of toll collection (tolls should remain in place to fund additional capacity, capital rehabilitation, maintenance, operation, and system performance optimization).

- Legal authorities should be provided for:
  - Private sector participation (varying degrees).
  - Design-build (DB) procurement.
  - Debt financing (may include a cap on debt and parameters for using a combination of different funding sources).
  - Interagency agreements for ETC access to state registries of motor vehicles and use of video technology toll enforcement.
  - ETC interoperability agreements.
  - Formal agreements for other areas for which the public sponsor may be responsible, such as utility agreements and the purchase of right-of-way.

4.2.4 Public Outreach (O2)

As pricing concepts are defined with greater resolution in the Preliminary Phase, outreach with the public, key stakeholders, and elected official must continue. Input gathered through this process must be used to develop alternatives that can garner the support of the widest possible constituency. Section 4.1.8 provides a more detailed discussion of public outreach in early stages of the decision-making framework.

4.3 Feasibility Phase (3)

The Feasibility Phase of the decision-making framework normally aligns with the environmental approval process (see Figure 1-1). For those projects involving improvements to the Interstate Highway System or benefiting from federal funding, a NEPA approval would be required. Approvals for other non-Interstate tolling or pricing improvements would need to comply with state or local environmental processes. As mentioned earlier, the Feasibility Phase may involve the assessment of tolling and pricing concepts emerging from earlier phases of the decision-making framework if a more comprehensive approach is being followed. Alternatively, the consideration of tolling and pricing may begin directly with the Feasibility Phase if a specific pricing project is identified by public decision makers or private investors, or if a decision is made to consider the possible use of tolling or pricing on a highway improvement that is already undergoing environmental review.

4.3.1 Environmental Impact Assessment (P3/P4)

Environmental approvals for tolling and pricing projects are similar to those for traditional highway projects, with the exception that the specific impacts of tolling and pricing must be taken into account. There are differing levels of assessment depending on whether or not the tolling or pricing project could significantly affect the environment:

- Categorical Exclusion (CE) determination if there is no significant impact.
- Environmental Assessment (EA) if there is uncertainty. This may lead to a finding of no significant impact (FONSI) or result in the preparation of an environmental impact statement.
- EIS, which includes the following sub-steps:
  - Notice of Intent (NOI).
  - Draft Environmental Impact Statement (DEIS) comprising sections on 1) purpose and need, 2) definition of alternatives, 3) impacts assessment, 4) mitigation measures, 5) interagency coordination, and 6) public involvement.
  - Final Environmental Impact Statement (FEIS).
  - Record of Decision (ROD) approving an FEIS.
- A re-evaluation is needed to assess the impacts of pricing if the project has been initially completed as a facility.

A range of alternatives should be assessed, including both tolled and non-tolled alternatives. The positive impacts of pricing should be proven, and a range of possible impacts should be carefully analyzed. In addition to direct impacts on travel conditions in the corridor under study, possible indirect and unintended impacts should be considered, including traffic diversion to other facilities that could not accommodate it, and operational feasibility and safety, among others. These requirements make it almost mandatory to use a comprehensive regional travel model rather than a simplified corridor-level tool.

Environmental justice is one area of analysis which can be expected to require particular attention in an environmental review of tolling and pricing projects, compared to traditional highway improvements. Environmental justice assessments should focus on both income equity and geographic equity.

Income equity assessments should compare the mode choice decisions made by different income groups to determine to what extent lower income populations might be unduly affected by certain pricing concepts. As part of this effort, potential strategies to modify the pricing alternatives to mitigate their possible impact to lower income populations should be identified.

Low-income populations with no free route alternatives should be provided with improved transit service (improved by means of toll revenue) or discounted toll rates; barriers to the acquisition of transponders and toll accounts for low-income people should be eliminated. It should be understood that willingness-to-pay as a selection criterion represents a problem since it creates an income bias in the highway system development.

Environmental justice assessments can benefit from survey work conducted in association with outreach efforts and the refinement of travel demand models. Most models include

different mode choice models for travelers from different income groups. To implement an income equity analysis, the travel model should include the necessary level of segmentation (three to four income groups) in the trip generation, trip distribution, and mode choice models that allows for travel impacts to be distinguished for each group. If this is the case, model results can facilitate a quantitative assessment of environmental justice impacts. These analyses may be further supported by information gained from survey and outreach activities.

Geographic equity assessments should be undertaken to determine if tolling and pricing projects create any particular impacts in discrete regions within a given metropolitan area. Geographic analysis of impacts should be implemented, including allocation of benefits and costs.

Additional aspects such as participation equity, opportunity equity, and modal equity may also be considered if relevant.

4.3.2 Refining Tolling and Pricing Alternatives in the Feasibility Phase (R3/R4)

At the more advanced phases of project development, pricing alternatives are refined for all the basic dimensions considered at the previous stage, including physical layout, vehicle eligibility, pricing unit, and basic toll setting. New aspects are also considered at the Feasibility phase, such as toll collection technology and pricing differentiation. During the advanced phases of decision-making when the number of physical alternatives is reduced (and essentially each project is scrutinized on a one-at-a-time basis), it is appropriate to consider a variety of alternatives across multiple dimensions, seeking an optimal configuration of physical and pricing parameters. As these details become better defined, it is also possible to prepare more detailed and accurate estimates of construction costs.

In general, the following pricing project details should be considered for each alternative at this stage:

- Additional details on physical layout of the facility, including lane separation and access treatments.
- Additional details on vehicle eligibility, including all types of non-revenue vehicles allowed to use the facility.
- Additional details on the pricing unit, including bulk discounts for ETC, credit forms, etc.
- Pricing differentiation for eligible vehicles including such dimensions as:
  - Vehicle type
  - Auto occupancy
  - Truck size/number of axles
  - By emissions/fuel class
  - By day of week
  - By season
  - By residence of the vehicle owner
- Optimization of toll rates by time-of-day period or calibration of dynamic (state-dependent) pricing schemes. This refinement involves multiple sensitivity tests with the travel model. To reduce the number of model runs for multiple network and pricing alternatives, a limited number of pivot scenarios is defined and tested with a full model run, while the other scenarios are "interpolated" between the pivot points. If dynamic pricing is modeled, the travel model should include a special network equilibration procedure with endogenously specified tolls (discussed in Volume 2). Implementation of a dynamic pricing scheme requires certain technological components essential to manage traffic flow and meet level of service guarantees:
  - Real-time Advanced Transportation Management Systems (ATMS) that allow operators to detect incidents and implement a rapid response
  - Access ramp metering (traffic lights) to regulate the flow of vehicles entering congested highway facilities, such as those in Los Angeles
  - Dynamic pricing and toll eligibility that differentiates by vehicle type and occupancy
- Theoretically consistent setting of toll rates for each time frame can be done based on one of the following criteria:
  - System performance optimization (throughput) which reaches a maximum at approximately 45 mph for mixed traffic. Alternatively, a guaranteed level of service can be set as a constraint for managed lanes, while another criterion is optimized
  - Revenue maximization
  - Welfare maximization (user benefits)
- Toll collection technology and enforcement including a choice or mix of manual collection, ETC with transponder, and automatic vehicle identification (AVI) using character recognition that reads license plates. While AVI technology has improved significantly in recent years and made open road tolling the most promising technology, vehicle occupancy still requires significant enforcement. If both manual and ETC payment methods are planned, the travel model should include user segmentation by payment type—the corresponding multi-class network simulation model should incorporate toll plazas and associated delays (queues). When considering toll collection technology, it is important to account for the industry trend toward simple, unified, and interoperable technology, as well as the operation of customer service centers (Tollways Autumn 2005, Open Road Tolling). The following aspects should be taken into account when considering toll collection and enforcement options:
  - ETC is the most advanced technology (transponder or AVI); ideally there should be a common means of

toll collection using one technology, one customer service number/account, and one invoice per state (and eventually nationwide). Currently, open road tolling is appropriate for high volume urban settings with limited right-of-way, including ETL/HOT lanes.
  - A cash option still might be needed for casual users, but should be avoided whenever possible; standard toll booth lane capacity is only about 400 vehicles per hour (vph) compared with 1,400 vph for E-ZPass/transponder booths, and nearly free-flow throughput (about 2,000 to 2,400 vph at highway speeds) for open-road AVI tolling. ETC and manual toll collection should be combined at lower volume locations with a lower percentage of repeated customers.
  - Some federal tolling programs, such as the Value Pricing Pilot and Express Lanes Demonstration Program, require that all tolls on projects funded by the program are collected electronically.
  - ETC involves privacy issues; in some states the release of individual toll collection records to third parties is prohibited by law.

4.3.3 Project Cost (C3/C4)

For each project alternative (based on the specified details of the physical design and pricing form), cost estimates (based on the crude assumptions from stages C1/C2) must be refined to an acceptable level for a Feasibility Study and, if necessary, an Investment Grade Study. A good overview of the cost components and associated critical issues can be found in Washington State's 2006 tolling study. The following major cost components should be estimated in detail:

- Construction, operating, and maintenance costs for each major segment, including the following components:
  - Right-of-way acquisition
  - Procurement and project delivery
  - Soft costs (design and professional fees), construction engineering and inspection
- Technology, ITS, ETC, and enforcement equipment costs (capital and operations and maintenance) evaluated based on the system design, number of entries, length, and location (a per-trip unit price can be established based on the industry experience), including the following components:
  - Structures
  - Communications
  - Power
  - ETC equipment
  - Vehicle detection and violation trigger
  - Violation enforcement
  - Lane processing
  - Vehicle access
  - Post processing
  - Project delivery
- Operating, maintenance, and administrative costs including:
  - Insurance
  - State Patrol
  - Roadway
  - Facility maintenance
  - Engineering/traffic consulting
  - Capital renewals
- Customer service staff costs (back-office costs)
- Manual toll collection costs (if included)
- Costs of schedule limitations and risk associated with delays (essential for the risk analysis during an Investment Grade Study).

4.3.4 Traffic and Revenue Forecast (T3)

Travel demand forecasts are an integral part of the Feasibility phase. As described in greater detail in Volume 2, regional or corridor models are used at this stage of analysis, and the following model features are essential:

- The demand model should be properly segmented and include explanatory variables within each segment. The network assignment procedures should include user classes by vehicle type and value of time (VOT) for different time-of-day periods. The following dimensions for segmentation are necessary and form a minimal requirement for the travel model:
  - Four to five trip purposes (e.g., work, school, non-work home-based, non-work non-home-based, business-related non-home-based)
  - Three to four income groups (e.g., low, medium, high)
  - Three to four personal-vehicle-occupancy categories (e.g., SOV, HOV 2, HOV 3+)
  - Three to four time-of-day periods (e.g., AM, PM, mid-day, off-peak)
  - Three to four vehicle types (e.g., auto, truck, commercial vehicle, taxi)
- Inclusion of primary behavioral responses through corresponding choice sub-models:
  - Route choice (if alternate free routes or general-purpose lanes are provided)
  - Time-of-day choice (if congestion or variable pricing is applied)
  - Mode choice (if a strong transit alternative exists)
- Sensitivity to population, employment, and income growth is essential:
  - Regional socioeconomic, demographic, and land-use forecasts should be validated against observed trends and regional development plans

  - Trip generation and distribution models should include explanatory variables such as income and household size
- Proper network coding in the simulation procedures:
  - Main-lane and ramp gantry plazas with associated capacity constraints and delays for both ETC and toll booths
  - Time delay/savings and toll equivalent representation in volume-delay functions (generalized cost instead of travel time)
  - Vehicle eligibility and toll differentiation for each highway link
  - Vehicle classes assignment corresponding to vehicle type, eligibility, toll differentiation, and VOT group
  - Assignment and skimming procedures segmented by three to four time-of-day periods
  - Special toll equilibration for dynamic pricing
- Extensive model validation and calibration for the base year:
  - Replication of traffic and speed counts in the corridor by time of day
  - Replication of observed Census Transportation Planning Package (CTPP) statistics (Journey-To-Work tables by mode)
  - Replication of household survey statistics (mode shares, trip generation rates, peak factors)
- Summaries for evaluation criteria by geographic and socioeconomic segments for alternatives comparison:
  - Transportation
  - Travel time savings
  - Improved travel speed and reliability
  - Throughput
  - Modal shift
  - Traffic peak spreading
  - Financial (revenue)
  - Environmental (emissions by type, noise, fuel consumption)
  - Social and economic welfare (user benefits)
  - Potential safety impacts

4.3.5 Financial Feasibility (F3)

Methods of financial feasibility analysis are similar to those for financial plans included in Investment Grade Studies (discussed in phase F4), but with less detail and a larger number of alternatives. The ultimate goal of the financial feasibility analysis is to provide an estimate of total project cost compared to the debt leveraging capacity of the expected revenue stream. Financial feasibility is typically expressed as the potential for a project to be funded through bonds. A relative financial feasibility index (revenue versus construction cost) is frequently used as the evaluation metric for project screening and selection (*TTA Toll Feasibility Analysis Process* 2005).

It should be noted that low cost coverage does not necessarily make a particular pricing project infeasible. Financial feasibility considerations depend on the chosen financial model and availability of multiple funding sources, including public-sector funds and grants, private-sector equity investments, toll-backed debt (bonds), and use of revenue, among others. Financial feasibility calculations should be expressed in current dollars adjusted for inflation.

The financial analysis should also identify how much net excess revenue can be generated beyond operating and capital expenses. At a minimum the revenue model at this stage should include the following elements:

- Annualized revenues from congestion charging during the study period.
- Deductions for discounted and exempted vehicles.
- Capital costs of congestion charging equipment and construction expenses.
- Other up-front costs, including planning, land acquisition, and finance costs.
- Ongoing operating and administrative costs, including direct and indirect transaction fees, customer service center costs, other labor costs, and violation expenses.
- Ongoing capital expenses for replacement of equipment.
- Interrelations between tolls and congestion charges in light of any offset policy and the prospect of "toll shopping."
- Escalation projections for all cost and revenue inputs, including for the "ramp-up" of toll transactions during the initial years of operation.

The analysis should also determine the funding capacity generated from net toll revenues both on a year-by-year "pay-as-you-go" basis and as a leveraged amount. It should explore ways to manage this revenue source and stretch its benefit, such as by pooling it with other sources to improve its credit profile.

Another critical aspect of financial planning is development of a flexible strategy to account for unexpected incidents. Such a strategy would need to consider any changing political, social, and economic conditions, while simultaneously managing the financial component and public perception of pricing. Accordingly, the financial analysis should address the many trade-offs involved with tolling and pricing, such as increasing revenue generation, minimizing congestion, and reducing impacts on different user groups.

4.3.6 Institutional and Legal Framework (I3/I4 and L3/L4)

A wide variety of agencies can develop and operate toll facilities. They may already exist or be created for the specific purpose of implementing a single toll project or group of

projects. They may include turnpike authorities that predate the Interstate Highway System itself, as well as state toll authorities, county and local toll authorities, public benefit corporations, port authorities, and transit agencies. These sponsor agencies generally execute planning studies, complete environmental reviews, raise project financing, oversee construction, and ultimately operate the toll facilities.

The most fundamental factors in determining an appropriate institutional and legal framework for implementing tolling and pricing projects is whether the impetus for the project has arisen at the state or the local level. Given the many challenges associated with implementing tolling and pricing projects—particularly public and political acceptance—it is essential for the sponsor agency to support the project and earn the trust and confidence of local stakeholders. In situations where local governments take the initiative to meet local transportation needs by implementing toll projects—as is the case in Houston, Dallas, Miami, Orlando, Tampa, Denver, San Diego, and Orange County, California, among others—local sponsors are preferable. In some cases, state DOTs have been effective at advancing tolling and pricing initiatives.

State sponsorship works best in those states with one primary urban area where transportation needs and priorities of both state and local transportation authorities align. This approach has succeeded in Minnesota and Washington State. The state sponsorship approach is more challenging in states with more than one large urban area because perceived priorities often differ between the state level and local metropolitan areas competing to receive state funding and support.

Other factors that should be taken into account when recommending organizational structures for tolling and pricing projects include:

- Mission and responsibilities (can an agency perform in a more entrepreneurial manner than others?);
- Type of priced facility;
- Legal barriers and requirements;
- Financial and associated legal requirements;
- Mix of funding sources (tolls, public funds, federal credits, state financing authorities);
- Level of financial support (guarantee) from the sponsor;
- Debt issuance limitations and procedures;
- Creditworthiness of the sponsor;
- Approval of toll rates;
- The autonomy of the agency and impact on the financial markets (which would affect the bond rating process at the Investment Grade Stage); and
- Insulation from politics (full consideration of all technical and financial merits of projects and systems alongside realistic political considerations).

Traditionally in the United States, public agencies sponsoring tolling and pricing projects assume all financial responsibility for the design, construction, and operation of these facilities. However, more public agencies are opting to team with private sector partners to implement tolling and pricing projects on a PPP basis. PPP options introduce increased private sector responsibilities, potentially including transferring tasks normally done by the public agency to the private sector, combining typically separate services into a single procurement, and assuming owner-like roles, including arranging financing for the project. Given that most toll roads are financed wholly or in part by leveraging future toll receipts, it is possible for private entities to design, build, finance, and operate new toll roads for a specified period of time on a concession basis. In addition, some pubic owners of existing toll facilities have entered into long-term lease agreements with private partners to operate, maintain, and make improvements to those existing roads on their behalf.

PPPs allocate responsibilities to the party—either public or private—that is best positioned to manage particular activities and produce desired results. This result is accomplished by specifying roles, risks, and rewards that provide incentives for maximum performance and flexibility in the contract agreements between public agencies and their private sector partners.

The primary benefits of using PPPs to deliver transportation projects include:

- Expedited completion compared to conventional project delivery methods;
- Project cost savings;
- Improved ability to keep toll rates on pace with economic growth;
- Improved quality and system performance derived from using innovative materials and management techniques;
- Life-cycle asset management maintenance approach;
- Substitution of private resources and personnel for constrained public resources; and
- Access to new sources of private capital.

When planning a PPP, it is essential to understand the interests of the private partner, which may not necessarily align with the goals established for the regional transportation system. These interests may include:

- Gaining control of income-producing roadways as a basis for maximizing stockholder wealth; and
- Achieving a rate of return on investment over the life of project of 10 to 15%.

PPPs add an additional layer of complexity to the implementation of tolling and pricing projects, as sponsors typically

must go through a lengthy procurement process to award PPP projects. The following steps are normally involved:

- Selection of a third-party consultant/panel;
- Commission of an investment grade traffic and revenue study;
- Request for expressions of interest;
- Issuance of an RFP (conceptual)
- Shortlist of three to five candidates and issuance an RFP (detailed);
- Review of RFP responses and candidate selection by the panel; and
- Contract negotiation.

Operating and maintaining tolling and pricing projects requires additional institutional arrangements to be made, including:

- Customer service center staff and functions (these can be a centralized with one point of contact for all operations); and
- State-specified operation of private companies, if invited to develop toll facilities.

Recent experience with tolling and pricing proves that there are multiple models for implementing and operating these projects. Decisions regarding sponsorship will ultimately reflect agency capabilities, local conditions, and existing institutional relationships. Existing state and local laws and constitutional provisions may favor the selection of certain organizational options over others.

4.3.7 Public Outreach (O3)

Once the decision has been made to conduct a formal investigation of tolling and pricing options' feasibility, it is essential to introduce these concepts to the public and convey the rationale for evaluating them. Tolling and pricing are often new concepts, and public outreach involves a greater focus on education than, for example, that required for traditional roadway resurfacing or interchange reconfiguration projects. Outreach and education help the public to understand why this market-oriented approach has been taken, as well as the travel reliability and time savings benefits these projects would afford. Outreach efforts also need to communicate the critical function that user fees play in providing these benefits, supported with specific information on how tolls will be collected and then used.

Without such outreach, the public may greet the introduction of a toll facility with indifference, caution, or even hostility. Outreach also allows planners to gain feedback from the public and use that information to refine their plans and ultimately implement more effective projects. Information and feedback are exchanged through a variety of ways, including public meetings, focus groups, newsletters, websites, and formal hearings.

A temporary team of stakeholders may also assemble as a task force to assist in the investigation of tolling and pricing options and strategies for gaining public support. Task force members are usually appointed by public officials and come from a variety of backgrounds, including government, academia, industry, and the media. Task forces are usually active for a predetermined period of time, after which they are disbanded.

4.4 Investment Grade Stage (4)

As described in Section 3.1.6, most toll facilities are financed by borrowing debt backed by future toll revenues. A number of coordinated activities must take place to reach financial close. They begin with the completion of investment-grade traffic and revenue forecasts and the preparation of a financial plan. Documentation describing these analyses is then given to rating agencies, which review the materials and give the project an investment rating. With a rating in place, the project developer seeks potential investors and secures financing commitments. If adequate financing can be raised within the required timeframe, a closing date is set at which lenders provide the project developer with the proceeds from their various loans and other debt instruments. Also, upon reaching financial close, other official project agreements become valid and binding.

Investment grade studies are often completed in parallel with environmental assessments. Information on preliminary capital and annual operating and maintenance costs from these studies is frequently used to obtain a preliminary indication of the financial feasibility. Refined cost estimates are used for the final financial plan.

This section describes the different activities involved at the Investment Grade Stage of the decision-making framework for tolling and pricing projects (see Figure 1-1).

4.4.1 Investment Grade Traffic and Revenue Forecast (T4)

Investment grade traffic and revenue studies are similar to other travel demand forecasting efforts; they document current conditions, explore the potential for change in the future, and predict the traffic and revenue resulting from those changes. Investment grade studies generally include more substantial backup documentation, and are undertaken with sufficient detail and transparent assumptions, enabling potential investors to understand the risks of supporting the project. Investment grade traffic and revenue studies also utilize extensive, newly-collected data regarding

regional economic trends and activities, traffic information (including counts), travel times, trip origins and destinations in the corridor, land use analyses, household incomes, and surveys exploring the perceived value of time. It should be understood that the quality of the forecast may directly affect the project bond rating (i.e., the possibility to obtain the necessary loans and the interest rate associated with them). The three major rating agencies (Fitch Ratings, Moody's, and Standard and Poor's) conduct various tests on traffic and revenue forecasts (especially those produced by public agencies), and examine variations across input parameters, as well as the model structure itself (Standard and Poor's 2002–2005; Fitch Ratings 2003–2005).

For these reasons, investment grade studies require an advanced and well calibrated travel model integrated with the network simulation. It is not uncommon for an investment grade forecast to take one year or longer and upwards of $1 million to complete.

There are several important technical requirements for an investment grade study compared to less rigorous traffic and revenue forecasts produced for feasibility studies. They relate to the model structure and calibration, the way in which the model is applied, and to a number of post-modeling steps that convert the model outputs into the inputs needed for the financial plan.

The following aspects relate to the model structure and calibration of investment grade traffic and revenue studies:

- Presence of all three major relevant choice dimensions (route, mode, and time-of-day) as described earlier for stage F3 is recommended. Additional relevant features include:
  - More elaborate peak-spreading model distinguishing between the peak hour and "shoulders" within each broad period;
  - Flexible trip generation model sensitivity to accessibility improvements; and
  - Flexible trip distribution model fundamentally linked to the mode choice model by using mode-choice-inclusive values (logsums) as impedance measures.
- User segmentation by VOT across travel purposes, income groups, times of day, and vehicle type and occupancy, as described earlier for stage F3. Special attention should be paid to VOT segmentation by occupancy, since most models in practice assume that VOT is simply proportional to travel party size. In more advanced, microsimulation models, VOT can be specified in a probabilistic way (to account for situational variation), and can include Value of Reliability (VOR) as well (discussed further in Volume 2).
- Extensive, newly collected data and more rigorous model calibration is normally assumed. It should be understood that even a well-calibrated regional model might have certain discrepancies vis-à-vis traffic counts and/or speed surveys in a particular corridor or facility. It is essential to recalibrate the model based on the most recently collected data, including traffic counts, special surveys (e.g., users of a particular toll facility), and speed measurements in the relevant corridor. The calibration targets for a particular pricing study can be set in a more rigorous way. For example, while a ±15 percent average deviation from (daily) traffic counts is considered an acceptable range for a general-purpose regional model, a deviation of ±5% can be set for each time-of-day period for the relevant priced corridor. Additionally, a historical set of traffic counts for validation of the growth tendencies is highly recommended.

The following aspects relate to the model application:

- Toll rate optimization and multiple sensitivity tests with different toll and toll escalation scenarios.
- Risk analysis and risk mitigation measures. This includes identification and quantification of risk factors. A good overview of the common "suspects" in travel forecasting is provided in the periodical publications of the rating agencies (Standard and Poor's 2002–2005; Fitch Ratings 2003–2005) as well as in Washington State's tolling study (2006). It should be understood that contrary to the conventional travel forecasting culture that has been based on a deterministic interpretation of the model outcome, the culture of the investment world is based on a probabilistic view on the model outcome. A theoretically consistent inclusion of the probabilistic risk analysis in traffic and revenue forecasting procedures is an important avenue for synthesizing these viewpoints is essential. The following general risk factors are under scrutiny by rating agencies:
  - Start-up toll facilities are considered the most risky and are tested rigorously, especially when forecasts are completed by public agencies;
  - Forecasts prepared by project sponsors and bidders (interested parties) are generally higher than prepared by investors/bankers; this "optimism bias" is estimated at 20% or more. More aggressive forecasts can be accepted for PPP that do not need rating;
  - Traffic and revenue forecasting in dense urban areas is inherently more challenging and risky compared to forecasts for single facilities such as river crossings with a clear competitive advantage over limited alternatives;
  - Traffic patterns associated with well-defined, strong radial corridors appear to be more reliable;
  - VOT miscalculation and improper aggregation across different income groups/travel markets (that's why a proper model segmentation is essential);
  - Recession/economic downturn (GDP growth is correlated with traffic growth with some lags);

  - Slower future-year land-use development along the corridor. Reconsideration of population, employment, and income growth forecasts prepared by the MPO or DOT for the region/corridor is one of the frequent requests;
  - Lower time savings than the modeled ones;
  - Improvements to competing free roads;
  - Considerably lower usage by trucks; and
  - Lower off-peak/weekend traffic (40–50% of weekday) than is normally assumed (70–75% of weekday).

Specific risk factors for trucking market (essential if trucks constitute a significant share in the traffic):

- Less reliability should be placed on forecast if the trucking market is composed of a large number of small, owner-driver general haulers.
- Markets consisting of several, very large haulage companies transporting high-value or time-sensitive commodities are likely to be less volatile.

The following aspects normally relate to post-modeling steps, though any of them might be considered during the direct modeling process as well:

- Annualization of revenues including assumptions on weekend and holiday revenues, seasonality, and within-week variability. It is also important to consider that a weekend's VOTs are generally lower due to a mix of purposes and schedule flexibility. Whereas weekend and holiday traffic on a non-toll facility is generally around 70–75% of weekday traffic in urban areas, the portion of traffic using toll roads during weekends tends to be less.
- The yearly traffic and revenue stream needed for the financial plan is calculated by interpolating between and extrapolating beyond modeled years over long periods (40 to 50 years or longer). Capacity constraints (and adverse effects of congestion when traffic volume approaches capacity) should be taken into account for long-range if they are not directly simulated in the model.
- Detailed consideration of bulk discounts, person/vehicle type discounts, toll evasion (if any), and other revenue loss factors such as accidents/incidents, extreme weather, or special events, among others.
- Consideration of toll rate escalation (CPI, GDP, floor, ceiling) versus population income (and VOT) growth over a long period of time. The discussion of possible scaling for model coefficients to account for real income growth can be found in Volume 2.
- Detailed consideration of a ramp-up period. If it is not modeled as a dynamic behavioral response in the model (which is unfortunately the case with even the most advanced activity-based models), certain assumptions are made based on the past experience with similar projects. Specific ramp-up considerations are associated with ETC if no cash payment option is provided. In this case, the ramp-up period is almost zero for routine users and commuters, but might be very significant for occasional users and visitors. Table 4-2 presents typical initial ramp-up period assumptions for start-up projects (as revenue-stressed test) as recommended by Standard and Poor's (2004).

The model output has to be processed in a form suitable for the subsequent analysis. It is also important to ensure results' transparency and to identify key areas (e.g., origin-destination pairs and core travel markets) for which calculations can be demonstrated. The following output formats are useful for the subsequent financial plan:

- Toll revenues by year (those most probable within 80 and 95% confidence intervals and used to form optimistic and pessimistic curves);
- Toll revenue distribution for representative years; and
- Possible distribution of revenue available for debt and equity (e.g., most probable, lowest reasonable, highest reasonable) and such parameters as likely debt-to-equity ratio and associated debt service residual revenues available for equity participants.

Table 4-2. Ramp-up period assumptions for start-up toll projects.

Year	Projects		
	Low-risk	Average-risk	High-risk
1	80%	65%	45%
2	90%	75%	53%
3	100%	80%	60%
4		85%	65%
5		88%	70%
6		90%	73%
7			76%
8			78%
9 and later			80%

There are several complementary steps that are recommended before completion of the traffic and revenue forecast and financial plan. Rating agencies can be asked to provide a preliminary opinion and advice on how to strengthen the credibility of the forecast. A discussion can be initiated with the TIFIA Credit Program to ascertain what type of assistance would be reasonable to expect.

4.4.2 Financial Feasibility Plan (F4)

Once the traffic and revenue forecasts are complete, their results can be used to assemble a financial plan for the new toll facility. This formal document identifies the different funding sources and the bonding capacity the toll project will generate. SAFETEA-LU requires any project that costs more than $500 million, and receives federal assistance, to have a financial plan approved by FHWA. Financial plans must also be prepared for federal-aid projects costing over $100 million but are not normally submitted for approval.

Regardless of these requirements, financial plans are almost always prepared for the benefit of investors, bondholders, creditors, and public agencies responsible for financing the project. The financial plan must also include detailed estimates of construction and operation costs, as well as conservative assumptions of financing, interest rate, coverage ratio, and reserve account costs. This information is imported into a computerized cash flow model, which is used to identify and test different financial structures and arrive at an optimal solution.

It should be noted that most tolling projects ensure an initial "ramp-up" period where toll revenues may not be adequate to meet debt financing payments. However, after the facility becomes fully operational and local drivers have become accustomed to paying to use the new facility, usage and revenues often climb, providing healthier cash flows.

The financial plan will enable potential investors to evaluate the reasonableness of cost projections, the viability of different funding sources identified, and the likelihood that they would provide sufficient resources to complete the project as planned. The plan should include backup documentation showing how assumptions and determinations were made. It should also demonstrate that all project costs and risks have been evaluated and a reasonable plan for financing the project is in place.

The financial plan is based on a cash flow model that allows for the testing of different financial structures and assumptions (Tillman et al. 2006). Discounted cash flow analysis should demonstrate that the project specific cash flow payout schedule can be met. It is essential to analyze financial plans in detail if there are several competing proposals for the same project.

Toll-based financial models should be comprehensive and include different relevant funding sources, such as government grants, impact fees, and credit enhancements. Financial models should also consider projects' bonding capacity that can take advantage of the tax-exempt municipal bond market. Tolls can generally supplement funding, but may not be able to cover all implementation costs for more capital intensive projects. General use of toll revenue includes paying for toll system operation and maintenance, funding capital construction and maintenance, and funding other related components of a region's overall transportation system, potentially including transit.

The financial plan is based on the detailed estimates of construction, operation, and maintenance costs for each major segment, including all components described under C3/C4. The specific metrics and limitations of the financial plan include:

- Credit quality (equity contributions and guarantees);
- Statutory limitations for the agency to issue investment quality debt and for the state to support the financing;
- Debt service repayment;
- Debt service reserve accounts funded by the bond issue (usually 125% of the average annual debt service);
- Debt service coverage ratio;
- Capitalized interest during construction;
- Cost of finance (bonds);
- Cost escalation;
- Period of finance and interest rates, including stress tests; and
- Project equity and secondary sources of funds (e.g., subordinate debt, TIFIA loans, or direct contributions).

The financial plan will be reviewed carefully by potential lenders as well as public agencies that may be providing financial support to the project, such as FHWA or the TIFIA Credit Program. Initial reviews are usually completed within 30 days and will identify any major deficiencies, required backup documentation, or other clarifications. FHWA requires that all cost estimates be prepared in year-of-expenditure dollars and that inflation rate assumptions are documented. Detailed cost estimates for each major segment of the project are also required, as are drawdown requirements to pay for construction expenditures. These requirements normally involve a cash flow analysis to demonstrate that the "project specific" cash flow payout schedule can be met.

As a rule, each pricing project should be analyzed as standalone, single asset facilities, and subsequently, several selected projects can be analyzed under an integrated system approach to gauge levels of feasibility. Several strategies can be applied depending on the project pool formulation and the adopted regional pricing concept:

- Full funding of construction costs through tolls;
- Leveraging several projects in a "Regional System" (cross-subsidy); and
- Supporting projects with some federal/state monies.

If the project will be rated by one of the major rating agencies (Standard and Poor's, Fitch Rating, or Moody's), the following important aspects have to be taken into account:

- Documents required by rating agencies include:
  - Traffic and revenue forecast with risk analysis;
  - Financial plan;
  - Contractual documents for the construction and operation of the project, including all environmental and construction permits needed;
  - Financing documents, including trust indenture, bond insurance, or letters of credit;
  - Regional and local economic trends and other input data, such as population growth, employment growth, income levels, and traffic counts; and
  - Independent traffic and revenue forecasts (if available) and an engineer's feasibility report.
- General rating agency procedures and requirements include the following:
  - Stand-alone basis for assessment;
  - Reliable and conservative traffic and revenue forecasts;
  - BBB rating (minimum investment-grade rating required for issuing bonds) for start-up roads requires net revenue at least 1.7 times greater than senior lien debt payments; and
  - Government subsidy/credit guarantees are required for non-toll part of funding.
- Preliminary rating is often requested to assist a project sponsor in identifying what further steps must be taken to secure an investment-grade ranking BBB or higher. It is likely that most start-up toll roads will require some form of credit assistance and/or guarantees to gain this rating.
- Rating analysts evaluate the most important risk factors:
  - Reasonability of traffic and revenue forecast assumptions (see section F4 above);
  - External political and economic factors;
  - Existing or planned competition for the roadway;
  - Regional economic conditions; and
  - The break-even point for servicing debt.

When considering various public and private funding sources for a pricing project, it is important to take into account two possible types of tax-exempt revenue bonds—municipal bonds and private activity bonds. SAFETEA-LU provides the authority to issue up to $15 billion in private debt as tax-exempt facility bonds for highway projects approved by U.S.DOT. Any project which receives Title 23 assistance, including TIFIA, is qualified. At least 95% of the net proceeds of bond issues must be expended within five years from the date of issue.

If negotiations with prospective lenders are successful, a list of conditions precedent will be prepared and a date set for financial close. The conditions precedent generally involve evidence that the borrower has complied with all necessary legal and other formalities for the loan agreement to come into force. If they are met within the required timeframe, the funds can be disbursed, and construction of the new toll project can move forward.

4.4.3 Institutional and Legal Frameworks (I4 and L4)

Institutional and legal frameworks for the Investment Grade Stage are discussed in Section 4.3.6.

4.4.4 Public Outreach (O4)

Once the decision has been made to move a tolling and pricing project into implementation, the focus for outreach efforts generally transitions into providing information on the rationale for the decision to implement the project, updates on project status, information on how to use the facility, and marketing.

Community outreach and consensus building activities should continue as projects near financial close. As the number of tolling and pricing structures being assessed is narrowed down, additional information on those strategies still being considered needs to be provided to the public. Vetting these structures on the public stage provides the opportunity to develop a more nuanced understanding of how they are likely to be received and of ways in which they may be adapted to make them appeal to the widest possible audience. Ongoing outreach efforts also allow project sponsors an opportunity to demonstrate that they have been receptive to suggestions stemming from earlier outreach activities and to help build consensus and support for the tolling and pricing projects that are being analyzed in greater detail.

As construction begins, public outreach efforts generally become increasingly focused on promoting the use of the new toll facility. Marketing plans should discuss the benefits of the new project and keep the public and local media informed as construction progresses. Advertising should also direct people to project websites and newsletters that provide information on how to establish ETC accounts and any other helpful details.

PART 2

Pricing Project Case Studies

CHAPTER 5

Pricing Project Case Study Introduction

Part 2 of this report provides detailed case studies of the decision-making process for pricing by exploring five transportation agencies with experience in the planning and implementation of tolling and pricing projects. Vetted with the NCHRP project panel for NCHRP Project 08-57, the case study agencies have been selected because they provide institutional and geographic diversity and have studied or implemented different types of priced highway facilities procured under a variety of different models. Together the case studies lend perspective on the many different agencies that can be expected to explore using tolling and pricing in the future, as well as the different types of projects they can be expected to pursue.

The format for the case studies has been developed to align with the matrix structure (Figure 1-1) introduced in Part 1 of this volume tracing the different phases involved in decision-making formats together with the various disciplines involved. This structure allows the reader to cross reference academic discussions in Part 1 describing the different phases and technical aspects of decision-making frameworks with the actual experience of the five case study agencies in each of these areas. This structure can also be cross referenced with the travel demand modeling best practices for the same phases and disciplines described in Volume 2.

The case studies have been assembled using information provided in detailed interviews with staff from each of the agencies, together with a close review of source documents, including planning and feasibility studies of pricing projects, associated legislation, procurement documents for actual tolling and pricing projects, and technical articles and reviews providing commentary and perspective on the outcomes of the different efforts to implement pricing projects. Each of the case studies has involved follow-on dialogue between agency staff and the project team to clarify issues of interest, and each of the agencies has reviewed the case studies for accuracy.

Rather than addressing individual projects, the case studies document the collective pricing experience of transportation agencies. This presentation allows the reader to develop an appreciation for the continuum of events from the time that agencies first considered the use of pricing to the present, together with the outcomes of that work—the actual pricing projects that have been, or are in the process of being implemented at present. The case studies begin with a brief introduction describing the agencies involved and a description of pricing projects they have implemented, together with those that have been or are under consideration. The body of each case study is organized in the following sections:

1. Decision-Making Process
2. Technical Aspects
3. Current Status and Documentation
4. Summary of Critical Issues/Lessons Learned

The case studies conclude with a discussion of the lessons learned from the outcomes of the pricing work conducted by the agencies. These discussions focus on:

- The institutional structure of the agencies;
- The goals and objectives underpinning their interest in pricing;
- The planning process the agencies have embarked upon, together with an assessment of the political process in which they have been carried out; and
- The outcome of those efforts.

The case studies present the experience of planning and implementing priced highway projects for the five following agencies:

- Harris County Toll Road Authority (HCTRA)—a county toll road authority in Houston, Texas, established in 1983 by a popular county vote approving a $900 million bond

issue backed by the faith and credit of Harris County to develop two major toll roads. HCTRA has since developed 103 centerline miles of tolled expressways, and has additional projects in different phases of planning and implementation.

- Minnesota Department of Transportation (Mn/DOT)—a state department of transportation, Mn/DOT has also been at the forefront of the managed lane dialogue since the establishment of the FHWA Value Pricing Program in 1992. After many years of study extending over four gubernatorial administrations, Mn/DOT converted the 11-mile I-394 HOV lane to operation as a priced HOT lane facility in May 2005. Mn/DOT is also completing plans to convert and extend an HOV lane on I-35W to HOT operation as part of its Urban Partnership Agreement with U.S.DOT.
- Oregon Department of Transportation (ODOT)—a state department of transportation; in 2003 the Oregon Legislative Assembly passed Senate Bill 772, establishing the Oregon Innovative Partnerships Program (OIPP) within ODOT. Through the OIPP, ODOT has since completed a statewide assessment of pricing projects for procurement on a PPP basis. It awarded the right to develop three toll highway projects to the Oregon Transportation Improvement Group (OTIG). Following further feasibility assessment, plans to move forward with two candidate projects have been dropped, and the third project is on hold while ODOT narrows the number of physical options to be studied.
- San Diego Association of Governments (SANDAG)—the local MPO for San Diego County; having converted the eight-mile I-15 HOV facility to HOT operation in 1996, SANDAG is a recognized innovator in the U.S. pricing sector. The I-15 FasTrack is the nation's second operating HOT lane and the first toll facility in the United States to utilize real-time, dynamic pricing. SANDAG has embarked on an ambitious $1.1 billion expansion of the facility, and its long range Mobility 2030 plan features a regional network of variably priced HOT lanes.
- Virginia Department of Transportation (VDOT)—a state department of transportation, VDOT worked with local governments in Virginia to develop a small number of greenfield toll highway facilities during the mid-1970s to mid-1990s. In 1995, the State Legislature passed the PPTA, making Virginia the first state to authorize its DOT to enter into PPP agreements with private sector investors to develop toll roads. In the early 2000s, VDOT received unsolicited offers from private investors to build two major HOT facilities on congested highway corridors in greater Washington, D.C. While the region is poised to see a network of priced lane projects developed, plans to develop an overall regional vision for the use of pricing have yet to be completed.

5.1 Harris County Toll Road Authority

The Harris County Toll Road Authority (HCTRA) is a toll authority serving the Greater Houston area and a division of the Harris County Public Infrastructure Department. The HCTRA improves mobility and reduces traffic congestion in the Greater Houston area through the operation of urban toll highway systems. The HCTRA came into existence in 1983 with the voter approval of $900 million in bonds to create two toll roads—the Hardy Toll Road and the Sam Houston Tollway (mainlanes of Beltway 8). This case study reviews the decision-making process in the development of road pricing for operating and planned priced facilities up to now.

Decision-Making Process

5.1.1 Decision-Making Stages

The decision-making process in Houston is unique in that it rests with the Harris County Commissioners Court, which is comprised of only four elected commissioners and is presided over by the County Judge. This small number of people is vested with the power to make decisions on tolling and pricing issues in Houston. In addition, there is no zoning in Texas, and Houston operates as a free market, so when an opportunity comes up, the HCTRA can decide whether or not to pursue it.

Technical Aspects

5.1.2 Planning Aspects

5.1.2.1 Operating Priced Facilities in the Region

The Harris County Toll Road system covers approximately 103 route-miles of roadway in the Houston/Harris County area. The HCTRA's toll network is shown in Figure 5-1. The Authority collects tolls at nine traditional mainline plazas (seven are along Sam Houston Tollway and two on Hardy Toll Road), plus a number of mainlane toll installations located along the ETC-only Westpark Toll Road. In addition, HCTRA operates toll facilities for the Westpark Tollway extension and Fort Bend Parkway in adjacent Fort Bend County, which formed its own authority for project development. In December 2007, the Commissioner's Court of Fort Bend County voted to remove cash toll booths from Fort Bend Parkway and convert the facility into the nation's second fully electronic toll road.

The Hardy Toll Road is a 21.6-mile four- to six-lane toll highway running north-south between I-45 near the Harris County line and I-610 (North Loop) near central Houston. Construction on the toll road started in September 1984 and was completed by June 1988. Tolls for passenger cars driving

Figure 5-1. Existing toll facilities in Houston.

its full length are $2.50 ($1.25 north of Beltway 8 and $1.25 south of Beltway 8). There is an additional four-mile spur connecting the Hardy Toll Road with George Bush Intercontinental Airport for which there is a 75-cent toll.

Sam Houston Tollway is a 74-mile circumferential toll highway forming a loop around three quarters of the City of Houston and built between 1985 and 1997. Also known as Beltway 8, the Tollway crosses the Houston Ship Channel on Jesse H. Jones Memorial Toll Bridge to the east of downtown. Shortly after the crossing, there is an 18-mile gap between State Highway 59 and State Highway 90 in the northeastern flank of the city served by local access frontage roads. The entire corridor contains parallel, free local access frontage roads with ramps to the tolled mainlanes every one to four miles. The tollway generally provides four lanes of travel in the eastern and southern sections of Houston, and six to eight lanes in the eastern and northern sections of the city. The Tollway has seven mainline toll plazas as well as 19 tolling points at entrance and exit ramps with the frontage roads. HCTRA charges fixed rate tolls that vary by vehicle types. The cost of driving the entire length of the Tollway is $9.00 for passenger vehicles, or approximately 12 cents per mile.

Westpark Tollway is a 20-mile, four-lane toll road connecting Post Oak Boulevard in the Uptown District of Houston with State Highway 99 to the west in Fort Bend County. It runs roughly parallel to and south of Westheimer Road (FM 1093) in Harris County and concurrently with FM 1093 in Fort Bend County. The HCTRA and the Fort Bend County Toll Road Authority (FBCTRA) operate Westpark Tollway jointly. The 14-mile HCTRA section is simply named Westpark Tollway; however, the six-mile section of the toll road operated by the FBCTRA is named Fort Bend Westpark Tollway. Construction of the facility began in 2001. Portions of the road opened to traffic in May 2004, and construction was completed in August 2005. Westpark Tollway is the first fully electronic toll road in the United States. It has no manual toll booths, and motorists must have an electronic toll collection account to use the tollway.

The Fort Bend Parkway connects State Highway 6 near Sugarland in eastern Fort Bend County to US-90A in southwestern Harris County. It is proposed to reach a northern terminus at the southwestern edge of I-610 in the future. The toll road has two lanes in each direction with major interchanges at State Highway 6, Lake Olympia Parkway, and FM 2234. HCTRA administers the five-mile northern section

of the road, just south of Beltway 8 at the county line to US-90A. Construction began in July 2003, and the road opened to traffic on August 30, 2004.

5.1.2.2 HCTRA Projects Under Construction

The IH-10 Managed Lanes Project is a 12-mile project that extends from I-610 to SH-6, and connects to HOV lanes operated farther out in the corridor. Built as part of a full four-year reconstruction of this interstate corridor, the final phase of installing toll equipment on the four median-oriented managed lanes began in Spring 2008 and was completed in Fall 2008. HCTRA's contribution to the I-10 project is $237.5 million. When completed, the managed lanes will provide two express lanes in each direction with limited access in between. The managed lanes involved a partnership between HCTRA, TxDOT, and the Metropolitan Transit Authority of Harris County (METRO) in order to expedite the IH-10 reconstruction. HCTRA will operate the I-10 managed lanes and have the right to collect toll revenues on the facility until such time as it recuperates its investment. After that time, toll revenues from the managed lanes will revert to the State. During the peak periods of the respective peak directions, HOVs with three or more persons will be able to use the managed lanes for free, along with transit buses at any time of the day.

5.1.2.3 Current ETC Installations

The HCTRA has left-side oriented ETC facilities at all of its tolling points. The Authority's ETC system is known as EZ TAG and is manufactured by Transcore. The HCTRA offers toll discounts to EZ TAG users on some of its facilities. Westpark Tollway is the first open road tolling facility in the United States. As such, no manual tolls are collected, and all motorists using the tollway are required to have valid ETC transponders in their vehicles, which are available from either the HCTRA, a state-sponsored toll account program (TxTag), or from any other local toll authority operating in Texas. EZ TAG may also be used to pay for parking at any of Houston's airports.

In May 2006, the HCTRA introduced a new version of the transponder tag. Instead of a battery-powered radio transmitter, the new tag is an adhesive sticker with a button-sized radio frequency microchip in the middle and a reflective antenna system throughout the tag. These new tags are sold, rather than rented, so they help to save money over the life of the tag by eliminating the monthly $1 rental fee. The battery tag's $15 security deposit can be applied to the purchase of the sticker tag. A similar transponder is available through TxDOT's TxTag program.

5.1.2.4 Initiative in a Context of Regional Goals (Pricing Goals)

The HCTRA's overall goal is to improve regional mobility in Harris County. In June 2007, the HCTRA prepared a memorandum recommending a toll increase and rate setting policy to the County Court. It established the policy goals for rational and systematic increases in toll rates that:

- Do not supersede toll rate covenants;
- Maintain an investment grade rating for HCTRA of at least A;
- Are commensurate with toll rate policies associated with private operators of toll roads; and
- Allow for continued maintenance and orderly improvement of the HCTRA system.

The HCTRA recommended that tolls be adjusted annually at the greater of a) two percent, or b) the consumer price index for Harris County. The Authority also recommended that cash rates should be rounded to the nearest quarter and that EZ TAG rates be rounded to the nearest nickel, but always less than or equal to the cash rate. It proposed reevaluating this policy every five years.

The HCTRA has also advocated the implementation of value priced tolls on Westpark Tollway, where there is extensive peak direction congestion during peak periods, and right-of-way constraints make it impossible to widen the road beyond its current four-lane profile. The HCTRA attempted to increase the current $1.25 toll on the Tollway to $2.50 during peak periods in conjunction with the $0.25 toll increase that went into effect in September 2007. However, this proposition quickly encountered a swell of opposition, forcing the County Court to rescind its approval within a matter of days.

5.1.2.5 Proposed Priced Facilities and their Role in the Regional Network

Senate Bill 792, passed by the state legislature and signed by Governor Perry in June 2007, introduced sweeping changes in how future roads would be planned, built, delivered and paid for in Texas. The bill establishes statewide processes that (if upheld) will have a fundamental effect on decision frameworks for pricing projects in Texas. The bill is multifaceted and includes the following provisions:

- Based on some past experiences involving public-private partnerships, it places a two-year moratorium on private development of toll facilities in Texas, together with a list of projects exempted from the moratorium;
- It provides certain counties with the right of first refusal to develop a list of specified toll projects; and

- It sets forth "market valuation" procedures under which any toll project in the state of Texas must be developed.[1] The procedures require TxDOT and the local toll agency to agree at the outset of projects on a starting toll rate for the facility together with a rate increase formula. This information is used to develop traffic and revenue forecasts which are used to determine the project's market value. The market value is essentially the surplus revenues that can be extracted upfront from a toll project. In exchange for developing the new toll projects, a public agency must commit to investing the project's upfront value in other transportation improvements in the region. If the agency decides not to do so, TxDOT can take over the project and develop it either on a PPP or concession basis. Some observers believe that this approach will allow TxDOT to derive more revenue from market value concession toll projects than from the traditional public toll model.[2] Doing so also provides TxDOT with the ability to generate new income in the absence of fuel tax increases.

Local toll entities have a six-month period after a market valuation is approved to exercise their option to develop and operate a toll project. After this milestone, TxDOT earns the right to implement any toll project in the state. Robert Poole writes that,

> Basically, what this does is to institutionalize 21st-century tolling in Texas, whether done by local toll agencies, by private firms under toll concessions, or by TxDOT doing the tolling on a project but paying the concession company via availability payments.

On June 14, 2007, TxDOT released an ambitious list of 87 toll projects around the state with a construction value of many billions. Under SB 792, HCTRA has been invited to develop six projects. These represent a combination of projects that HCTRA has been planning, together with others that TxDOT has taken the lead in developing. The six projects are shown in Figure 5-2 and include:

- Hardy Toll Road Extension—from I-610 south to Downtown for which final plans, specifications, and estimates (PS&E) are complete.
- Beltway 8 NE—13-mile section completing the Sam Houston Tollway (Beltway 8) mainlanes, for which PS&E is 95 percent complete.
- Hempstead Managed Lanes/Toll Lanes—a managed lane facility from I-610 to the Grand Parkway parallel to US-290 for which construction is slated to begin in 2011.
- Fort Bend Parkway Extension—extension from SR 90 to I-610.
- Managed lanes/tollway in SH 288 median—extending from US 59 to the Grand Parkway, partly in Brazoria County.
- Fairmont Parkway East—running approximately from the southeastern quadrant of the Sam Houston Tollway to the port area near Galveston Bay in Fairmont.

These six projects would be exempt from the market valuation approach, but other projects of interest to HCTRA, including the Grand Parkway, would not be. At this juncture HCTRA is very likely to implement those projects that are the most developed (i.e., the Hardy Toll Road Extension, Beltway 8 NE, and the Hempstead Tollway).

5.1.3 Pricing Projects

5.1.3.1 Physical Layout (Description of Planned Pricing Projects)

Prior to the passage of SB 792, HCTRA had 11 major expansion projects in various stages of development. Together, these projects would add 550 lane-miles to HCTRA's toll road network at a cost of nearly $2.5 billion. These projects are described below. Four of the six projects that SB 792 invites HCTRA to implement are among the projects that HCTRA has been developing. They are noted with asterisks.

5.1.3.2 HCTRA Projects in Design

- The Sam Houston Tollway South Belt Widening Project is a 10-mile widening project that will extend from SH-288 to US-59 South and add two lanes in each direction to the existing toll road. The completion of final engineering design and the beginning of construction are scheduled for Summer 2009. Construction should extend for a period of two years at a cost of $99 million.
- The Hardy Toll Road Extension extends Hardy Toll Road 3.4 miles south from IH-610 North to US-59 (downtown). The extension will link the current Hardy Toll Road directly into downtown Houston alleviating congestion on other major highways. Final design of the Hardy Connector project is expected to be complete by the end of 2009 with construction beginning in Fall 2009 and extend for a period of approximately two years. The project has a total estimated cost of $300 million.
- The Sam Houston Tollway—Beltway 8 North East Project is a 13-mile project extending from east of US-59 North to

[1] Poole, Robert, "21st-Century Tolling: Unexpected Result of PPP Controversies," Public Works Financing, Volume II17, June 2007, pp 10-11.
[2] Baul Burka, "Unspinning SB 792," June 12, 2007, TexasMonthly.com, http://www.texasmonthly.com/blogs/burkablog/2007/06/unspinning-sb-792.php

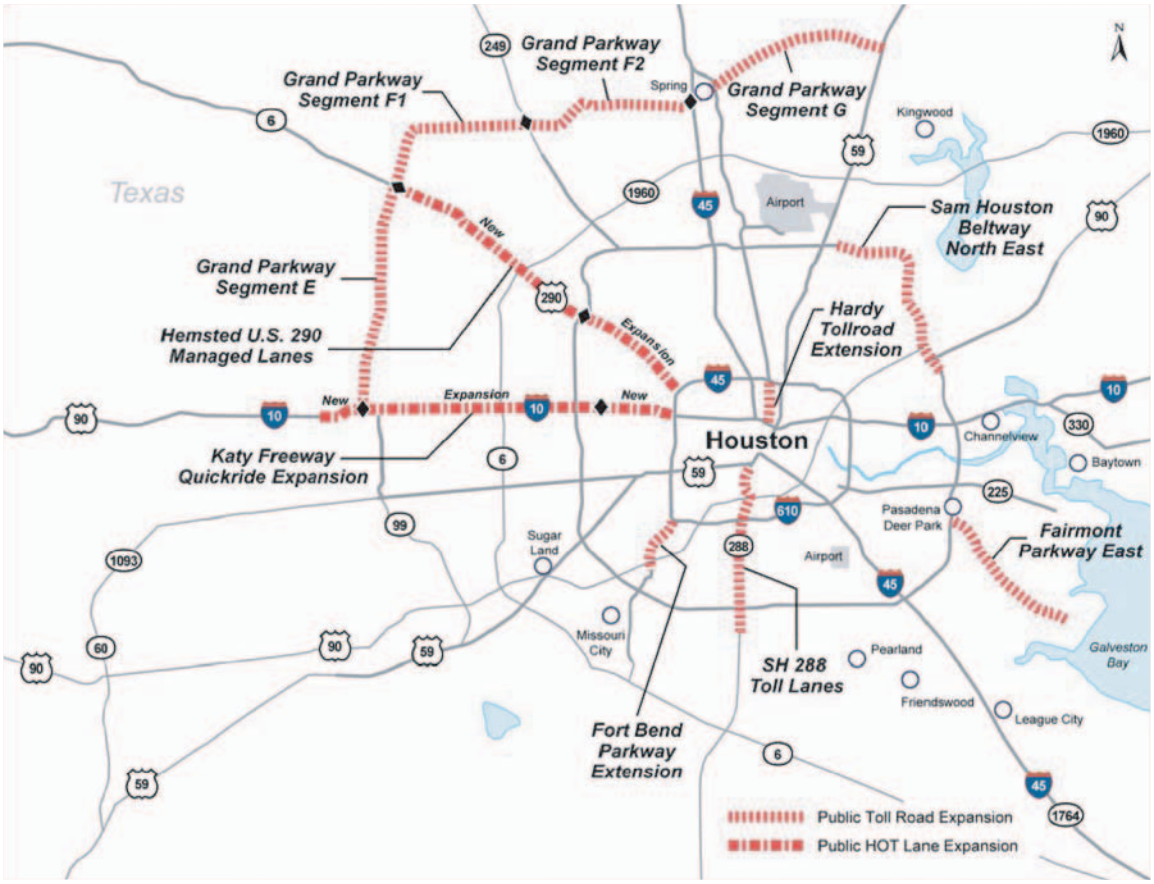

Figure 5-2. Proposed toll facilities in Houston.

south of US-90A East. Construction is expected to begin Summer 2009 with a Spring 2011 completion date at an estimated cost of $550 million. When completed, the tollway will provide three lanes in each direction. The SH-249 Direct Connector Project is a 2-mile project, connecting SH-249 to Sam Houston Tollway. The final engineering began in Summer of 2007 and was completed Spring 2008. Construction will extend from Summer 2008 to Spring 2010. The estimated construction cost is $20 million. When completed, the direct connector will provide direct access from southbound SH-249 to westbound Sam Houston Tollway for EZ TAG users.

- The Beltway 8 West Widening Project is a 3-mile widening of Sam Houston Tollway from Gessner to West Road. The final engineering ended Spring 2008. Construction began immediately following and will be completed Summer 2009. The estimated construction cost is $9 million. When completed, the tollway will have four lanes of traffic in each direction.
- The Sam Houston Tollway South Widening Project is a 0.75-mile widening of the northbound mainlanes from the south plaza to Boheme. The final engineering began February 2006 and was completed July 2007. Construction began August 2007 and was completed in late 2008 at a cost of approximately $8 million, providing five northbound mainlanes from south plaza to the Memorial exit ramp.

5.1.3.3 HCTRA Projects in Schematic Development

- The Grand Parkway Segment E is a 13-mile project, extending from IH-10 West to US-290. Engineering is complete through the schematics; the final engineering will begin Summer 2007 and was completed in Fall 2008. Construction will begin Spring 2010 and will be completed Spring 2012. The estimated construction cost is $330 million. When completed, the tollway will provide two lanes in each direction. This project is dependent upon a formalized agreement with TxDOT.
- The Grand Parkway Segment F1 is a 12-mile project extending from US-290 to SH-249. The schematic engineering was completed Summer 2008. The final engineering will begin Fall 2008 and be completed Summer 2010. Construction will begin Spring 2011 and be completed Spring 2013. The estimated construction cost is $291 million. When completed, the tollway will provide two lanes in each direction. This project is dependent upon a formalized agreement with TxDOT.

- The Grand Parkway Segment F2 is a 14-mile project, extending from SH-249 to IH-45. The schematic engineering was to be completed in Fall 2008. The final engineering will extend from that time to Summer 2010. Construction will begin Spring 2011 and be completed Spring 2013. The estimated construction cost is $287 million. When completed, the tollway will provide two lanes in each direction. This project is dependent upon a formalized agreement with TxDOT.
- The Grand Parkway Segment G is a 13-mile project, extending from IH-45 to US-59 North. The schematic engineering was completed Summer 2008. The final engineering will begin Spring 2009 and will be completed Fall 2010. Construction will begin Summer 2013 and be completed Summer 2015. The estimated construction cost is $322 million. When completed, the tollway will provide two lanes in each direction. This project is dependent upon a formalized agreement with TxDOT.
- The Hempstead/US-290 Managed Lanes* is a 22-mile project, extending from IH-610 to SH-99 (Grand Parkway). The schematic engineering was completed Fall 2007. The final engineering began in Spring 2008 and is to be completed Summer 2014. Construction will begin Spring 2010 and be completed Spring 2014. The estimated construction cost is $550 million. When completed, the managed lanes will provide two lanes in each direction. This project is dependent upon a formalized agreement with TxDOT.

5.1.3.4 Pricing Forms/Options (Types of Pricing)

The HCTRA's tolling policy uses a distance-based per-mile toll rate, rounded to the nearest quarter. It charges successively higher rates for two-, three-, four-, five-, and six-axle vehicles. HCTRA offers vehicles equipped with its EZ TAG ETC technology a $0.25 discount. However, manual and electronic toll rates are equal for all two-axle vehicles at onramp tolling locations for motorists paying in cash or with EZ TAG. New toll rates went into effect on September 3, 2007, increasing toll levels by $0.25 cents at toll plazas. This represents the first increase in toll rates since 2003. The HCTRA has also advocated unsuccessfully for variably priced tolling to be implemented on Westpark Expressway. This four-lane facility is built in a constrained railroad right-of-way and cannot be widened; it is congested during peak travel periods.

5.1.3.5 Initial Screening/Selection (Process for Identifying Pricing Projects)

In 2001 as a result of its relationship with TxDOT, the HCTRA identified 14 potential toll road projects. At that time, the State was prohibited by law from developing toll road projects. The HCTRA's former director, Wesley Freise, had a large say in what was included. Conceptual projects included development in the BNSF rail corridor and a bridge between Bolivar Peninsula and Galveston.

In 2003, HB 3588 was passed enabling state-sponsored toll road concessions in Texas. As a result, TxDOT viewed the HCTRA as a concession if projects were located on state right-of-way, and submitted a letter requesting that the HCTRA pay TxDOT $2.3 billion upfront, together with an unspecified share of future toll proceeds, in order to proceed with three pending toll projects.[3] During the past two to three years, the HCTRA has been trying to negotiate with the State to identify a list of investment priorities for the region. Early in 2007, the HCTRA identified a total of 53 individual projects representing $21 billion in new investment. The HCTRA was willing to fund $18 billion of that amount and also contribute additional money for the right to construct within state rights-of-way. The motivation behind the $21.5 billion plan was to assist TxDOT in improving mobility in the Houston area.

Now with the passage of SB 792 in June 2007, the situation has changed. The HCTRA has been invited to develop six projects, and they will likely implement those that are the most developed. These projects are listed in Section 5.1.2.5 and shown in Figure 5-2. As described in Section 5.1.2.5, should the HCTRA want to implement any of the other toll projects it has studied, SB 792 would require the Authority to complete a market valuation for the project and invest the upfront value of the project in other local transportation needs. This is likely to inhibit HCTRA's desire to lead the implementation of toll projects in Greater Houston that are not assigned to HCTRA in SB 792. The HCTRA has submitted a letter to TxDOT expressing its opposition to using the concession model as a starting point for market valuation terms and conditions.[4]

5.1.3.6 Toll Collection Technologies Considered

Some of the toll collection technologies considered and utilized by the HCTRA include EZ TAG, TxTag (interoperable on both HCTRA toll roads and any other toll road within the state of Texas), and Automatic Vehicle Classification (AVC) which counts the number of axles on various vehicles to ensure appropriate charges with 99.98% accuracy.

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[3] Burka, *op cit.*

[4] *Tollroadsnews,* November 11, 2007. http://www.tollroadsnews.com/sites/default/files/HC-TxDOT20071025.pdf

5.1.3.7 Project/Pricing Alternatives (Process for Defining Pricing Projects)

The HCTRA commissions its own engineering work and uses traditional design-bid-build procurements.

5.1.3.8 Project/Pricing Alternatives (Tolling Options)

See Pricing Policy Discussion in Section 5.1.2.4.

5.1.3.9 Evaluation of Alternatives (Process for Assessing Pricing Projects)

The HCTRA's normal decision-making framework is a two-step process focusing on the feasibility of individual toll road facilities. The HCTRA begins with preliminary traffic and revenue studies looking at the projects on a standalone basis to see if they would be feasible toll road investments. The HCTRA generally identifies revenue shortages during the ramp-up periods and then determines if it could use other sources to compensate for the gaps. If a decision is made to move forward, a financial quality traffic and revenue study is completed. For the information from these more detailed studies to be relevant, construction must begin within a year of the study's completion.

It now appears that the HCTRA may need to modify its evaluation procedures for projects that are not assigned to the Authority in SB 792 to comply with Texas' new market valuation process for new toll projects (see Section 5.1.2.5).

5.1.4 Cost Estimates

5.1.4.1 Conceptual Cost Estimate

The HCTRA uses standard cost estimate practices and develops increasingly detailed estimates of project costs as design becomes more advanced.

5.1.5 Traffic and Revenue Forecast

5.1.5.1 Forecasting/Modeling Tools (Analytical Tools for Assessing Pricing Projects)

The HCTRA's traffic and revenue consultant, Wilbur Smith Associates (WSA), has completed numerous traffic and revenue modeling assignments using the Houston Galveston Area Council's (HGAC) travel demand model. The following discussion describes the enhancements to the model WSA made to complete its 2002 *Updated Traffic and Revenue Study* for Westpark Tollway.

The primary objectives of the study were to estimate traffic and revenue on Westpark Tollway in 2005, 2015, and 2022, and advise on alternative tolling formats. WSA collected an extensive amount of data to prepare its forecasts including:

- Travel volumes on alternate competing facilities
- Travel times and speeds on alternate competing facilities
- Origin and destination surveys
- A major stated preference survey to determine the value of time for drivers in the corridor.

In addition, it also engaged a regional economist to develop new population and economic forecasts for the future analysis years. WSA used the forecasts to update trip tables from the HGAC travel demand model.

WSA completed a series of traffic assignments to test different toll rate assumptions and completed a toll rate sensitivity analysis to determine optimum toll levels. They also made adjustments to reflect the capacity of the four-lane toll road.

5.1.5.2 Summary of Traffic Forecasts

Traffic estimates for the conventional toll system scenario in year 2020 were expected to grow to 69,400 vehicles per day, about 33% higher than 2005 levels in the high traffic area east of the Sam Houston Tollway (Wilbur Smith Associates 1998). An updated traffic and revenue study, completed in 2002, showed a growth in daily traffic for the eastbound mainline of 42% over a 17-year period, from 22,300 vehicles per day in 2005 to 31,700 vehicles per day in 2022. Extensive traffic data collection and surveys also suggest the toll facility would serve as a successful traffic reliever as compared with other similarly designed facilities.

5.1.5.3 Summary of Revenue Projections

Annual toll revenue (in 2001 U.S. dollars without adjusting for inflation) is estimated to reach almost $50.6 million by 2015 and more than $55.2 million by 2020. However, assuming an inflation rate of 2.5% per year, the projected revenue nearly doubles over the same 15-year forecast period, growing from $47.4 million to $93.8 million (Wilbur Smith Associates 2002).

5.1.6 Financial Aspects

5.1.6.1 Revenue Use

Tolls collected on the HCTRA roadways are used to fund maintenance and upkeep of the existing toll roads and to meet future expansion needs without using tax dollars. All revenue generated from tolls is used to finance six major categories: operations, maintenance, construction projects, connectivity, debt service, and future projects.

In 2006, over 50% of toll revenue went toward maintenance, construction, and connectivity projects, as well as new

initiatives designed to enhance the future mobility of the region. Connectivity projects can and have been used for a wide range of purposes, including upgrades to county arterials and signal systems located many miles from a specific toll facility.

5.1.6.2 Supporting Federal Programs

The HCTRA funds all of its construction and operation costs independently using toll receipts and investment income. The Authority receives no assistance from the federal or state governments.

5.1.6.3 Financial Deal

The HCTRA's outstanding debt as of February 28, 2006, is summarized in Exhibit 1.

5.1.7 Institutional Framework

5.1.7.1 Name/Type of Agency

The HCTRA is a division of the Harris County Public Infrastructure Department.

5.1.7.2 Institutional Structure

After passage of the referendum in 1983, Harris County Commissioners Court, presided over by then County Judge Jon S. Lindsay, created the HCTRA, which is now a division of the County's Public Infrastructure Department. The HCTRA operates under three separate units: the Operations Division, which oversees all aspects of toll operations including revenue collections, facilities and maintenance, human resources, and incident management; the Engineering Division that manages

Exhibit 1. Toll Road Enterprise Fund of Harris County, Texas

TOLL ROAD ENTERPRISE FUND OF HARRIS COUNTY, TEXAS
NOTES TO FINANCIAL STATEMENTS
FOR THE YEAR ENDED FEBRUARY 28, 2006

A. Outstanding Bonded Debt – February 28, 2006 – Pertinent Information by Issue

Issue	Original Issue Amount	Interest Rate Range %	Term Issue	Maturity Range	Outstanding Balance February 28, 2006
Senior Lien Revenue Bonds					
Refunding Series 1997	$ 65,550,000	3.85-5.125	1997	1997-2024	$ 63,245,000
Refunding Series 2002	397,520,000	5.00-5.375	2002	2003-2032	392,145,000
Refunding Series 2004A	168,715,000	4.50-5.00	2004	2022-2034	168,715,000
Refunding Series 2004B	478,270,000	2.50-5.00	2004	2005-2022	462,805,000
Refunding Series 2005A	207,765,000	4.50-5.25	2005	2026-2030	207,765,000
Total Principal Senior Lien Revenue Bonds					1,294,675,000
Unamortized Premiums and Discounts					54,337,290
Total Senior Lien Revenue Bonds					$ 1,349,012,290
Unlimited Tax and Subordinate Lien Bonds (Tax Bonds)					
Refunding Series 1991 - CAB	$ 6,095,000	6.95-7.25	1991	2001-2008	$ 2,220,000
Refunding Series 1992A - CAB	13,820,000	5.80-6.80	1992	1997-2008	4,570,000
Refunding Series 1992B - CAB	3,100,000	5.80-6.80	1992	1997-2008	752,488
Refunding Series 1994 A	59,925,000	6.50-8.00	1994	2008-2024	59,925,000
Refunding Series 1994A - CAB	30,881,713	5.70-6.25	1994	2001-2007	7,359,310
Refunding Series 1995 A - CAB	1,500,000	5.80-6.05	1995	2002-2012	500,000
Refunding Series 1997	150,395,000	5.00-5.125	1997	2014-2024	150,395,000
Refunding Series 1997 - CAB	2,790,000	3.90-5.25	1997	1998-2013	1,200,000
Refunding Series 2001	120,740,000	6.00	2001	2009-2014	120,740,000
Refunding Series 2002	42,260,000	4.00-5.25	2002	2009-2014	42,260,000
Refunding Series 2003	321,500,000	3.50-5.00	2003	2009-2033	321,500,000
Total Tax Bonds					711,421,798
Unamortized Premiums and Discounts					33,886,282
Accretion of Discount - Compound Interest Bonds					88,462,430
Total Tax Bonds					$ 833,770,510

https://www.hctra.org/file_download/6/Fiscal+Year+2006.pdf

toll road design, engineering, construction management and right-of-way acquisition; and the Services Division which handles all EZ TAG customer services, violations, and information technology.

The HCTRA is a function of Harris County, which has four geographically based commissioners representing the county precincts. The County Judge presides over the County Court. These are the decision-makers that the HCTRA reports to. Responsibility for financing for the HCTRA's investments is delegated to Edwin Harrison, Director of Financial Services, for the County Department of Management Services.

5.1.7.3 Procurement Approach

The HCTRA procures its construction projects on a traditional design-bid-build basis. The agency lets separate contracts for design and construction activities. Projects are already fully designed when they are put out for bid. Construction contracts are generally awarded to the qualified bidder providing the lowest construction cost.

5.1.8 Legislation

5.1.8.1 Mandate

The HCTRA came into existence when, in September 1983, Harris County voters approved a referendum by a 7–3 margin to release up to $900 million in bonds to create Hardy Toll Road and Sam Houston Tollway to improve regional mobility and reduce traffic congestion in Greater Houston, an area known for rapid population growth. Its goal is to improve mobility within Harris County.

5.1.9 Public Outreach/Involvement

5.1.9.1 Public Involvement (Decision-Making Innovations)

A unique aspect of the HCTRA pricing decisions is that their roster of potential projects is closely linked with TxDOT. TxDOT has investigated or identified the need for the projects that the HCTRA has built, but was not able to implement them due to lack of funding. The HCTRA believes that the level of cooperation they enjoy with TxDOT is unique. In addition, the HCTRA also works closely with the local MPO, HGAC.

Current Status and Documentation

5.1.10 Current Status of Pricing Projects

See Section 5.1.6.1 Revenue Use.

5.1.11 Planning Studies or Reports

The HCTRA has completed a preliminary traffic and revenue feasibility study for Westpark Tollway (Wilbur Smith Associates January 1998), as well as an investment grade Updated Traffic and Revenue Study (Wilbur Smith Associates December 2002).

The HCTRA has also completed a preliminary traffic and revenue study for the proposed Beltway East project, as well as an investment grade study for that facility. These are the HCTRA's most recent planning studies.

Summary of Critical Issues/Lessons Learned

In its short 24-year history, the HCTRA has developed one of the largest regional toll road systems in the United States, with financial potential to greatly expand this system further. The HCTRA's capacity as a local, county-based organization has been key to its success. The HCTRA has benefited from Harris County's straightforward organizational structure, where the four commissioners who sit on the County Court have the power to formulate and implement local policy and investment decisions. The HCTRA was approved by a local vote by a 7-3 margin. This was a powerful and clear mandate and gave HCTRA the resources and authority it needed to be a successful toll road developer. This support established the Authority's focus on developing projects.

The HCTRA has also benefited from Houston having one of the highest population and employment growth rates of any city in the United States. According to U.S. Census data, Houston's population increased from 2.75 million in 1980 to 4.18 million in 2000, an increase of 52% in just 20 years. The demand for mobility grew even more quickly and led to an urgent need to expand the regional highway system. With access to toll revenues and the credit of one of the nation's largest counties behind it, the HCTRA was able to put new toll roads in place at a much faster pace than TxDOT's ability to add toll-free highways. The HCTRA has developed a reputation for delivering needed projects on time and within budget. As a local organization created to address an obvious local need, the HCTRA has garnered the support of the local business sector in Houston, as well as the population at large, as a result of its accomplishments.

As a toll authority, the HCTRA has a keen focus on projects and customer service. It has developed a flexible ETC system that includes the nation's first fully electronic toll road and allows its customers to use its ETC technology to pay for airport parking (facilities not operated by the County). HCTRA reports that its website is visited over 54,000 times

on an average day—once every 1.6 seconds—a fact underscoring the important role the Authority plays in the local community.

While the HCTRA accomplishments are impressive, they have become increasingly intertwined with the political process. With the passage of HB 3588 in 2003, TxDOT gained the authority to develop toll roads and began intervening in HCTRA's planning and project development activities on routes located within state-owned rights-of-way. As a result of this legislation, new partnering requirements needed to be established, because TxDOT was obligated under SB 3588 to seek the best investment options for projects that had both local and statewide strategic significance. Reaching a satisfactory process required a compromise to be reached and additional legislation (SB 792). In the end, this legislation pits the concession model TxDOT prefers for toll road development against the more traditional public authority toll model championed by the HCTRA. Some see the legislation as slanting the delivery process in favor of the concession approach by forcing agencies such as the HCTRA to extract greater value from proposed toll projects, or cede the right to develop them to the State, which would likely do so using a PPP approach.

The current status of the HCTRA's decision-making framework is unclear. Texas' 2007 toll road legislation gave the HCTRA the right of first refusal to develop six major toll road projects using the same model and decision-making practices that it has employed over its 20-year history. As a result of the size and scale of these projects, it is likely to take the HCTRA years and perhaps decades to develop them. However, should local priorities evolve and put the HCTRA in a position where it would prefer to develop different toll road projects, the State would have a large say in the decisions leading to their implementation and the tolling regimes under which they would be operated. TxDOT's new mandate provided through SB 792 plays a proactive role in the decision-making for local toll road issues and is a departure from the mandate established by the HCTRA, leaving prospects for the future in flux.

5.2 Minnesota Department of Transportation

The Minnesota Department of Transportation (MnDOT) has developed one operating HOT lane facility, the 11-mile, I-394 HOT lanes on the primary travel corridor between downtown Minneapolis and the city's western suburbs (Figure 5-3). The facility provides two reversible flow, barrier-separated HOV lanes on a three-mile section between I-94 in downtown Minneapolis and Trunk Highway 100 (TH 100), together with one non-barrier-separated lane in each direction between TH 100 and I-494. Originally developed as an HOV system, the I-394 managed lanes were converted to HOT service, opening on May 16, 2005. Single occupancy vehicles (SOVs) using the MnPASS lanes pay a toll ranging from $0.25 to $8.00 depending upon congestion levels and the distance traveled, with a different rate paid based on whether motorists travel on the reversible section, the diamond lane section, or both. The facility provides inbound (east) service from 6:00 a.m. to 10:00 a.m. and outbound (west) service from 2:00 p.m. to 7:00 p.m. MnPASS provides 11 access points, five eastbound and six westbound.

MnDOT has also been at the forefront of the managed lane dialogue since the establishment of the FHWA Value Pricing Program with the passage of Intermodal Surface Transportation Efficiency Act (ISTEA). The Department completed two regional studies of the feasibility of deploying pricing concepts in the Twin Cities region in the late 1990s, together with a follow-on study in the spring of 2005, at the same time the I-394 MnPASS lanes were poised to open to service. While MnDOT has a well articulated vision of the role that managed lanes can play in the region's future transportation system, only one additional corridor currently has an HOV lane that could be a candidate for conversion to HOT (I-35W south).

Decision-Making Process

5.2.1 Decision-Making Stages

5.2.1.1 Scoping Study (or "Exploratory/ Preliminary Phase")

MnDOT's March 1997 *Road Pricing Study* assessed a mileage based tax, together with the potential environmental, traffic, and equity impacts of 25 congestion pricing alternatives in the Twin Cities region. Thirteen of these options were subjected to more detailed analysis and travel demand modeling. The preferred option emerging from this study was to introduce pricing on 14 "congested" highway sections during five peak and four shoulder hours in the Twin Cities region. The study recommended a phased implementation of pricing on a regional basis and suggested criteria for prioritizing individual projects.

Following the completion of the Road Pricing Study, MnDOT commissioned a *Toll Lane System Preliminary Feasibility Study* to evaluate the impacts of a series of added-capacity lanes on 13 highway segments in seven corridors in the Twin Cities region. The study included a comparison of the different candidate HOT lane improvements, ranking them for prioritization purposes. HOT lane projects in the I-94 and I-394 corridor were ranked the highest due mostly to

Figure 5-3. Existing toll facilities in Minneapolis.

relatively high demand and low implementation costs. Sections that ranked lowest included TH-36 and I-35W due to both high costs and lower utilization levels.

Although the cost estimates used in the study were not rigorous, the study found that HOT lanes would have the potential to "guarantee toll revenue at levels above the cost of implementation and operation of the required electronic toll systems," and called for a toll lane demonstration project to be implemented before developing HOT lanes throughout the Twin Cities region.

The findings of MnDOT's 2005 *MnPASS System Study* were quite different. The purpose of this effort was to identify a potential regional toll lane system for the Twin Cities, together with information on the cost, operational, revenue, and system implications. This study found that public investment would be required to add new HOT capacity, with typical segments recovering between 15 and 55% of their implementation costs. While not self-sustaining, the study found that new revenue from the tolls could contribute to a portion of their construction.

The most financially viable managed lane widenings assessed in the MnPASS System Study were not included in the region's 25-year Transportation Policy Plan (TPP). Advancing the tolled expansions would require modifying the TPP and would likely delay other projects. However, the study found that it would take a substantial amount of time to leverage TPP funding in support of a MnPASS network, as this effort would also require a large public investment.

The findings of the MnPASS System Study were reviewed by a technical group and steering committee. These advisors suggested that there should be less emphasis on the immediate financial feasibility of individual segments and more attention paid to the development of an ultimate long-range managed lane system. They also felt that it was unusual to use financial payback criteria as a means of selecting projects in a metropolitan or statewide transportation planning context given that traditional highway projects do not generate revenue streams.

Given the limited ability of a potential MnPASS system to recover its implementation costs, MnDOT views the development of the regional HOT lane network envisioned in the MnPASS System Study as more of a long-term regional traffic management solution rather than a way to accelerate individual projects using toll-backed financing.

In the event that MnDOT moves forward with the implementation of the MnPASS vision, the System Study identified the following next steps:

- Demonstrating the MnPASS concept through evaluation of the I-394 HOV conversion;
- Conducting further systems analysis, including benefits and costs of MnPASS to other transportation alternatives;
- Conducting case studies of one or two corridors where technical issues could be explored in further detail; and
- Addressing institutional issues.

It should be noted that three years after the completion of the System Study, there are no major plans for expanding the highway system in the Twin Cities region.

5.2.1.2 Commercial and Financial Viability Assessment (or "Preliminary/Feasibility Phases")

The findings of the 1998 *Toll Lane System Study* indicated that the conversion of the I-394 HOV lane to HOT operation was by far the most financially feasible pricing project in the Twin Cities, given that it did not require the construction of new highway capacity. After a new administration took office in 2003, this project was advanced quickly and without additional feasibility assessments. Ultimately, the 11-mile, $10 million conversion project was the focus of a PPP procurement which attracted two bidders. The fact that the project garnered the interest of the private sector, with all its associated risks, attests to the vision the private sector has for these projects.

5.2.1.3 Implementation Development (or "Investment Grade Stage")

While the companies submitting bids on the project prepared their own in-house forecasts comparing project revenues and costs associated with the conversion of the I-394 HOV lanes to HOT operation, these are not publicly available. Wilbur Smith Associates (WSA) led the group that was awarded the concession to convert the I-394 HOV lanes to HOT operation and is well known for its work in investment grade travel demand studies. The firm also completed the 1997 and 1998 pricing feasibility studies for MnDOT and was fully versed in the use of the Metropolitan Council's travel demand model.

Table 5-1 shows the steps leading up to the implementation and opening of the I-394 MnPASS HOT lanes.

Table 5-1. Process for implementation of I-394 MnPASS HOT lanes.

2003	**Legislative Session: *High-occupancy toll lane legislation* passed by Minnesota Legislature.**
July 2003	Request for Proposals for Public/Private Partnerships issued
September 2003	Received two proposals for consideration
September 18, 2003	First I-394 Community Task Force meeting
October 7, 2003	Evaluation Team recommendation for selected RFPP deadline
October 14, 2003	Steering Committee approval of recommendation
November 5, 2003	Approval by Governor and Lt. Governor
November 6, 2003	Second Community Task Force meeting: Review proposal content
December 1, 2003	Contract negotiations and authorization
December 11, 2003	Informational Open House and third Community Task Force meeting
January 1, 2004	Project design begins
January, February, March, April, May, June, July, October 2004	Community Task Force meetings continue
Winter 2005	Governor's final review of proposed project
May 16, 2005	I-394 MnPASS Lanes opened

Technical Aspects

5.2.2 Planning Aspects

5.2.2.1 Operating Priced Facilities in the Region

The I-394 MnPASS HOT lane is currently the only priced highway facility in Minnesota. The project involved the conversion of an existing HOV facility to HOT operation and was undertaken on a PPP basis at a cost of approximately $10 million. The partnership group contributed discounted services, technology, and license fees to the project, but does not hold an equity position.

5.2.2.2 Current ETC Installations

The I-394 MnPASS uses standard, non-proprietary, read-write transponder ETC technology provided by Raytheon and is the first deployment of ETC technology in the state of Minnesota. The system uses open standard transponders which are manufactured by Telematics.

To use the facility, all paying vehicles must be equipped with a transponder. MnPASS is the first deployment of ETC in the state of Minnesota and includes notable advances in HOT lane enforcement. Each of the MnPASS toll gantries include beacons that indicate if a valid transponder has been read. Raytheon's transponders use a read-write technology that allows enforcement officers in squad cars on the corridor to determine whether or not there is a valid transponder in a vehicle using the lanes. Additional technology, called mobile enforcement transponder readers, allows the police to determine if the transponder was turned on as it passed the last toll gantry. Visual inspection by officers in the corridor is also a primary enforcement measure.

5.2.2.3 Initiative in a Context of Regional Goals (Pricing Goals)

The I-394 MnPASS goals include improving the efficiency of I-394, providing new options to travelers in the corridor, and maintaining free-flow speeds for transit and carpools via dynamic pricing. While historic HOV demand in the I-394 corridor was robust, it was often less than the available capacity, resulting in the perception among some residents that the HOV lanes were underutilized. As a result of this perception, MnDOT was directed by the Minnesota Legislature in 2000 to evaluate various options for increasing the utilization of the HOV facilities, including opening the HOV lane to use by all vehicles and the conversion to a HOT lane operation. At the same time an independent study group in the Twin Cities, called the Value Pricing Task Force, had completed their work recommending a demonstration project to evaluate the benefits of value pricing.

Based on the results of these studies, the legislature enacted High-Occupancy Toll Lane Legislation (160.93, Sec. 7) in 2003, authorizing MnDOT to implement user fees on HOV lanes in the state. Highlights of the legislation are as follows:

- The goal of the legislation is to improve the operating efficiency in trunk highway corridors and provide more options to travelers.
- Fees will be collected electronically or by other methods, which may vary in amount by time of day and may vary with congestion.
- Fees collected will be used to repay the trunk highway fund or other fund sources for cost of equipment and modification in the corridor, and to pay the costs of implementing and administering the fee collection system.
- Excess revenues shall be spent as follows: one-half for capital improvements in the corridor and one-half transferred to the Metropolitan Council for expansion and improvement of bus transit services in the corridor in which the funds are collected.
- Violators will be guilty of a petty misdemeanor.

5.2.2.4 Proposed Priced Facilities and their Role in the Regional Network

The I-394 MnPASS HOT lane is currently the only priced highway facility operating in the Twin Cities region. A second facility will open on the I-35W corridor in September 2009 as part of Minnesota's successful Urban Partnership Agreement (UPA) with the U.S.DOT (Figure 5-4). While MnDOT has conducted three studies on new highway capacity throughout the Twin Cities, in the form of optional toll lanes, these projects were found to have the potential to recover only 20% of their implementation costs and have not been moved forward. Active plans for further HOT expansion involving the construction of new capacity are not currently under consideration.

5.2.3 Pricing Projects

5.2.3.1 Physical Layout (Description of Planned Pricing Projects)

One additional priced facility is currently planned on I-35W between Downtown Minneapolis and the city's southern suburbs. This project is being developed in response to U.S.DOT's UPA program, which provides substantial one-time funding to five United States metropolitan regions to develop transit and highway projects designed to reduce congestion. The program was introduced in 2006 and provided interested cities with a three-month period to prepare their applications. The Twin Cities was one of five successful UPA candidates, and proposed a series of innovative improvements in the I-35W corridor. The use of dynamically priced

Figure 5-4. Proposed toll facilities in Minneapolis.

shoulder lanes came as a result of MnDOT staff's participation in an international study tour sponsored by TRB, which investigated the successful use of this concept in some European countries. The I-35W corridor improvements include the following elements:

- Priced dynamic shoulder lanes, similar to the I-394 MnPASS, on I-35W from 46th Street to downtown Minneapolis.
- Addition of a HOT lane in the Crosstown reconstruction project from 66th Street to 46th Street.
- Conversion of the HOV lane to HOT lane on I-35W from 66th Street to Burnsville Parkway.
- Construction of additional park-and-ride lots along the I-35W corridor north and south of Minneapolis.
- Construction of additional dedicated bus lanes in downtown Minneapolis.

- Partnerships with major employers along the I-35W corridor to promote flex-time and telecommuting programs.
- Use of additional Intelligent Transportation Systems technology.

5.2.3.2 Pricing Forms/Options (Types of Pricing)

The I-394 MnPASS HOT facility uses dynamic pricing, with the average peak period fee varying between $1.00 and $4.00 depending on the level of congestion in the MnPASS Express Lanes. Toll rates can rise up to a cap of $8.00 during periods of extreme congestion. This ensures that traffic in the MnPASS Express Lanes continues to flow at about 50 to 55 mph. A similar concept is proposed for the I-35W managed lane conversion/extension.

5.2.3.3 Initial Screening/Selection (Process for Identifying Pricing Projects)

Minnesota first considered the possibility of implementing pricing projects after the state passed legislation in 1993 allowing it to pursue the development of toll roads on a partnership basis. In 1993 and 1994 MnDOT established an office to help develop a solicitation process for partnership projects. At about the same time, the Department began to consider the possible conversion of HOV lanes to HOT operation. The impetus behind the consideration of pricing was multi-pronged and involved the establishment of the FHWA Value Pricing Pilot Program in the 1992 ISTEA authorization, high growth levels in the Twin Cities, legislative leadership and interest, and an overall maturing of the concept within MnDOT.

To help assist the department in understanding the potential for tolling in the state, MnDOT hired WSA to undertake the *Minnesota Road Pricing Study*. The purpose of this project was to explore the feasibility of developing new highway projects as toll roads. As part of its work, Wilbur Smith generated travel demand modeling scenarios so that potential private partners would have a basis for determining whether or not tolled facility investments in the state might be attractive to them. This initiative led to a spin-off investigation of managed toll lanes known as the *Toll Lane System Preliminary Feasibility Study,* which led to interest in the conversion of HOV facilities to HOT operation. This work was being done in the wake of the passage of ISTEA and the establishment of the Value Pricing Pilot Program.

As part of the outreach process used in the *Road Pricing Study,* MnDOT commissioned a Citizen's Jury to study the possible use of congestion pricing in the Twin Cities area. The jury heard five full days of testimony and debate on different aspects of congestion pricing and, in the end, concluded that while there was merit to the concept, the region was not ready for value pricing. Further, they argued that if the purpose of pricing was to raise money, a preferable option would be to raise the gas tax instead.

In 1995 MnDOT solicited PPP proposals through its TransMart® program. Potential private partners were invited to submit proposals for improvements they thought might be possible to develop on a PPP basis. MnDOT received five submittals, and from four strong offers selected the development of Truck Highway 212 in the southwest quadrant of the Twin Cities. While there was a strong rationale for this greenfield project, there was an effective campaign against the project within the communities it traversed. State law in Minnesota gives local communities veto power over toll road projects, and ultimately, the Mayor of Eden Prairie vetoed the project, not because she was opposed to it, but instead to demonstrate that it was inappropriate for Minnesota to give veto authority over a state project to a local jurisdiction.

MnDOT recognized that partnerships were not easy to implement but, in studying the use of pricing, was intrigued with the I-15 FasTrak and SR 91 Express lanes in Southern California, and as a result began to explore the possibility of implementing HOT lanes on I-394 serving Minneapolis and the western suburbs. At the onset, Minnesota officials were considering using a sticker system, as was used on the I-15 HOT lanes during its initial trial. However, equity proved to be a challenging issue, and the local community believed that those who had a sticker would be incentivized to use the facility at all times, leaving it unavailable to those who would want to use it occasionally. Upon conclusion of a legislatively required hearing on the matter, in which strong public dissatisfaction was voiced, Governor Carlson halted the HOT lane proposal saying that value pricing was an idea that was ahead of its time in Minnesota, and the concept should be saved for another day.

In 1999, Governor Ventura was elected. He was initially opposed to HOV lanes and had wanted to open the existing I-394 HOV lanes to general purpose traffic. Ultimately he gave up that idea when he was shown data that supported its continued operation and realized that in opening the facility to all traffic, the state would have to compensate the Federal government for the $150 million that it had invested in the I-394 lanes.

During the four years of the Ventura administration, MnDOT used the proceeds of a successful FHWA Value Pricing grant to continue outreach and educational activities. It established a Value Pricing Task Force comprised of legislators, mayors, and other members of the community. MnDOT convened the Task Force six times over a three-year period and made objective presentations on how value

pricing could address congestion issues in the Twin Cities. The forum resulted in a milestone change by providing an apolitical venue in which the members of the task force could explore the value pricing concept. The task force's final report stated that while it may not be the preferred means to manage congestion, value pricing was a concept worth trying.

When Minnesota's new governor Tim Pawlenty was elected in 2002, the state had a projected budget shortfall of $4.0 billion and he wanted to solve its problems without increasing taxes. While the new administration was skeptical about the I-394 proposal, U.S. Congressman Mark Kennedy from Minnesota had introduced the so-called FAST Lane concept to Congress. His idea was to use tolling to finance new highway capacity—including lane widenings—and remove them once the underlying debt had been paid off. Early in 2003, a big press event took place at which Congressman Kennedy and the Governor were both present, and the governor announced that he supported the FAST Lane concept in Minnesota, and that he supported the conversion of the underutilized I-394 HOV lanes to HOT operation.

As a result of MnDOT's experience with the Value Pricing Task Force, the Department recognized that as a public policy issue, the successful implementation of value pricing would require strong leadership. Value pricing is a highly complex notion that the general public does not naturally rally around, so the Department's strategy was to win the support of some key legislators along the I-394 corridor.

Events moved quickly. In the spring of 2003 the legislature, with the help of MnDOT, drafted legislation to make HOV to HOT conversion possible. The legislation was passed and signed by the Governor. By early September, MnDOT received proposals to undertake the conversion on a PPP basis and in December, it awarded a concession to a consortium comprised of Wilbur Smith, Cofiroute, Raytheon, and a number of local engineering firms. The private partners in this agreement offered discounted services and technology in the anticipation of gaining market advantage. The agreement provides no equity position for the private sector partners in this project.

5.2.3.4 Toll Collection Technologies Considered

MnPASS represents the first deployment of ETC technology in Minnesota. The implementation of the MnPASS project—including the selection and implementation of ETC technologies—was procured on a PPP basis. While the procurement documents specified the functional requirements that the ETC system would need to meet, MnDOT did not specify any specific ETC technologies.

5.2.3.5 Project/Pricing Alternatives (Process for Defining Pricing Projects)

See Section 5.2.1.1.

5.2.3.6 Project/Pricing Alternatives (Tolling Options)

MnPASS uses dynamic tolling designed to maintain travel speeds at 50 to 55 mph at all times. Toll rates are adjusted every three minutes based on travel conditions in the parallel general purpose lanes.

5.2.3.7 Evaluation of Alternatives (Process for Assessing Pricing Projects)

After MnDOT received the authority to convert the I-394 HOV lanes, it examined the feasibility of developing a regional network of HOT lanes in the Twin Cities in studies conducted in 1997, 1998, and 2005. However, the Department's most recent analysis found potential HOT lane expansions would only recover 22% of their implementation and operating costs on average, and decided that moving in this direction did not make sense from a financial perspective.

At the same time, MnDOT is seeing extraordinary increases in capital construction costs, which would dampen cost recovery even further. Although the development of an express lane network would provide mobility benefits, equity was perceived as a big issue. The perception was that a relatively small number of people would benefit from the improvements, but that they would only pay for a fraction of the cost of development and operations. MnDOT felt that this was a difficult concept to sell at the present time and does not plan to pursue it further.

5.2.4 Cost Estimates

5.2.4.1 Conceptual Cost Estimate

A wide variety of cost estimates have been prepared for the various pricing studies conducted in the Twin Cities region. Claims put forth in earlier studies conducted in the 1990s indicated that new HOT lanes added to existing highway corridors would have the potential to recover their implementation costs were ultimately found not to be true. The region's only operating HOT project involved the conversion of an existing HOV facility to HOT operation and was completed at a relatively modest cost of $10 million. Current plans call for the conversion of the existing I-35 HOV facility to HOT operation, together with the use of dynamically priced shoulder lanes and some auxiliary lane expansions. MnDOT's 2005 *MnPASS System Study* which revisits the concept of a regional network of priced lanes recognizes the fact that typical

HOT widenings only have the potential to recover 22% of their implementation costs on average. Furthermore, the study finds that those projects with the healthiest ability to recover costs are located on the region's periphery where land acquisition costs are lower.

Capital costs for the *MnPASS System Study* were prepared based on generic cross sections for various highway segments, and an analysis of existing median widths. Per-mile construction costs were prepared based on the number of additional lanes and shoulders required. Standard length, width, and depth cost estimate techniques were used for each generic cross-section type and then multiplied by the number of miles of each segment type.

Details on the capital cost estimates prepared for the *MnPASS System Study* are available at: http://www.mnpass.org/pdfs/050407mnpass_appendix_a.pdf

5.2.5 Traffic and Revenue Forecast

5.2.5.1 Forecasting/Modeling Tools (Analytical Tools for Assessing Pricing Projects)

Traffic forecasts for the initial regional pricing studies in 1997 and 1998 were conducted by WSA using the Metropolitan Council's travel demand model, with consideration for AM peak, PM peak, off-peak, and shoulder time periods for years 2000 and 2020. The traffic assignment models were modified to include consideration of tolled travel. These models tested the toll rates and traffic volumes under seven region wide scenarios. Optimal toll rates were determined by evaluating the revenue potential and traffic impact of several different toll rates.

WSA also modeled the potential revenue associated with a bypass ramp buy-in option. A ramp meter system is currently in place on the Twin City's freeways and is expected to be expanded in the future. Thus, a ramp meter bypass buy-in concept would be similar to the HOT lane concept, in that SOV traffic would be allowed to use the current HOV-only ramp meter bypass for a fee.

Additionally, market research was performed to:

- Test and refine messages aimed at informing the public of current and future congestion levels and forecasted funding problems;
- Test public response to the Congestion Relief Toll Lane System Initiative Concept;
- Determine the best method to present the toll initiative concept and make it understandable to the public; and
- Obtain input for developing and refining "messages" for use in the Communications Plan.

The market research plan was undertaken using focus groups and individual interviews with business and community representatives.

Further modeling of potential pricing applications was conducted by Cambridge Systematics and URS in support of the 2005 *MnPASS System Study*. The Cambridge Systematics team used the Metropolitan Council's travel demand model. Although the model anticipated the need to assess pricing options, a number of refinements were introduced to the model to enhance its capabilities.

The basic inputs to the model are the forecast year-specific socioeconomic estimates and transportation network representation. The networks are skimmed to provide zone-to-zone time and cost estimates, and the different model components are applied sequentially. If the assigned travel volumes imply travel times that are substantially different from the input times, the skims are adjusted and the model recalculates its results. Once the output travel times from the trip assignment are similar to the input travel times, the model application is complete.

The Cambridge Systematics team completed a number of modifications to the model. The most important were included in the mode choice model of new parameters to allow for the estimation of trips by tolled single-occupancy vehicles and trips by tolled high-occupancy vehicles. The output of the revised step model feeds into the existing highway assignment process from which summary measures of toll lane usage were derived.

The Metropolitan Council's mode choice model allowed for the introduction of new toll facilities for both SOVs and HOVs. However, it did not include any toll parameters, as no such facilities existed at the time the modeling work was completed. The consultant team derived appropriate toll parameters by looking at models developed in the 1997 *Road Pricing Study* as well as the 2000 *SR 91 Impact Study* in Southern California.

Further details of the enhancements are available in a technical memorandum prepared by the Cambridge Systematics team: http://www.mnpass.org/pdfs/techmemo3forecasting.pdf.

5.2.5.2 Summary of Traffic Forecasts

Traffic and revenue projections for the MnPASS System Study were prepared based on tests of toll rates ranging from $0.10 to $0.50 per mile. It was assumed that the entire MnPASS system would be subject to the same toll rates at the same time of day. Traffic and revenue estimates were based on toll rates that maximized the revenue of each potential MnPASS segment across all 24 time periods considered.

Detailed results of the travel demand forecasts prepared for the *MnPASS System Study* are available at: http://www.mnpass.org/pdfs/050407mnpass_appendix_b.pdf.

5.2.5.3 Summary of Revenue Projections

See Section 5.2.5.2.

5.2.6 Financial Aspects

5.2.6.1 Revenue Use

Tolls and other fees collected from the I-394 MnPASS system pay for operation of this facility. By law, any excess revenues collected are to be used to improve transit and other transportation needs in the I-394 corridor. MnDOT established the following provisions for the use of the I-394 MnPASS revenues:

- Paying for the costs of implementing and administering the fee collection system;
- Repaying the trunk highway fund or other fund source for cost of equipment and modifications in the corridor;
- Excess revenues shall be spent as follows:
  - One-half for capital improvements in corridor; and
  - One-half transferred to Metropolitan Council for expansion and improvement on bus transit services in corridors in which funds are collected.

5.2.6.2 Supporting Federal Programs

MnDOT has benefited from five successful grants from the FHWA Value Pricing Pilot Program to continue outreach and educational activities supporting HOT lanes and other pricing applications.

5.2.7 Institutional Framework

5.2.7.1 Name/Type of Agency

MnDOT has led the development of pricing projects in the Twin Cities region.

5.2.7.2 Institutional Structure

MnDOT is a state DOT led by the Commissioner of Transportation. Both the Commissioner and Deputy Commissioner oversee the following five divisions:

- Finance and Administration;
- Planning, Modal and Data Management;
- Engineering Services;
- State Aid for Local Transportation; and
- Operations.

5.2.7.3 Procurement Approach

The I-394 MnPASS project was procured on a design-build-operate-and-maintain basis as authorized in Minnesota Code §§ 160.84–93 which authorizes HOT lanes and allows MnDOT to entertain PPPs for toll facilities on a solicited and unsolicited basis.

5.2.8 Legislation

5.2.8.1 Mandate

Minnesota first considered the possibility of implementing pricing projects after the state passed legislation in 1993 allowing it to pursue the development of toll roads on a partnership basis.

In the spring of 2003, MnDOT assisted the legislature in developing draft legislation to make the conversion of HOV to HOT possible. It was passed, and in early September, MnDOT received proposals to undertake the conversion on a PPP basis. In December 2003, MnDOT awarded a contract to convert the I-394 HOV lane to a HOT lane to a consortium comprised of WSA, Cofiroute, Raytheon, and a number of local engineering firms.

Sections 160.84-92 of the Minnesota State Code (http://ros.leg.mn/revisor/pages/statute/statutechapter_toc.php?year=2006&chapter=160) enables MnDOT to enter development agreements with private sector entities to design, build, finance, and operate toll roads.

Section 160.93 of the Minnesota State Code (User Fees, High-Occupancy Vehicle Lanes, http://www.revisor.leg.state.mn.us/bin/getpub.php?type=s&year=current&num=160.93) gives MnDOT the authority to charge fees to SOV motorists to use HOV lanes. The purpose of the authority is to improve efficiency and provide more options to individuals traveling in highway corridors. The fees may be collected using electronic or other toll-collection methods and may vary in amount with the time of day and level of traffic congestion within the corridor.

5.2.9 Public Outreach/Involvement

5.2.9.1 Public Involvement (Decision-Making Innovations)

One of the hallmarks of Minnesota's Value Pricing Program has been a very inclusive outreach and education process. In 1999, after several failed attempts at developing pricing projects, MnDOT, through the University of Minnesota's Hubert H. Humphrey School of Public Affairs, established a Value Pricing Task Force comprised of legislators, mayors, interest groups, and other members of the community. The Humphrey Institute, acting on behalf of MnDOT, convened the Task Force six times over a two-year period. The mission of the Task Force was to consider how and if value pricing could address congestion issues in the Twin Cities. The forum provided an apolitical venue in which the members of the task force could receive objective information and explore the value pricing concept. The task force's final report stated that while it may not be the preferred means to manage congestion, value pricing was a concept worth trying.

Ultimately, the Task Force identified three potential projects recommended for further consideration.

At the time the decision was made to move forward with the conversion, the I-394 Community Task Force was established to help finalize details for the new facility. The committee chair was appointed by the Governor, and members included current and former state senators, legislators from the corridor, mayors, MnDOT technical experts, and a citizen member from each community along the corridor appointed by their respective mayor. Other interest groups were also represented on the committee, including trucking associations, livable cities advocates, and others. One MnDOT official reports that support for the I-394 conversion was "a mile wide and an inch deep.[5]" As such, it was important that the Advisory Committee recognized that the decision to go forward with the project had already been made and that while the Committee did not have the power to change that fact, they did have the ability to influence the project in substantive ways, both from a technical and operational standpoint.

Current Status and Documentation

5.2.10 Current Status of Pricing Projects

The I-394 MnPASS HOT lane has been operating since May of 2005. The most likely opportunity to expand the use of pricing would be the conversion of the 11-mile I-35W HOV lanes to HOT operation. This facility provides one diamond lane of traffic in each direction and connects I-394 to the area south of the Mississippi. MnDOT has included this concept in its Urban Partnership Agreement together with the use of dynamic shoulders. Although the *MnPASS System Study* has identified a number of possible HOT widenings around the Twin Cities region, at present long-range investment plans do not call for any major highway capacity expansions, including those explored in the study.

5.2.11 Planning Studies or Reports

- *Road Pricing Study Final Report,* prepared for MnDOT and the Twin Cities Metropolitan Council by WSA, March 1997
- *Toll Lane System Preliminary Feasibility Study,* prepared for MnDOT and the Twin Cities Metropolitan Council by WSA, January 1998. http://www.mnpass.org/pdfs/feasibility.pdf.
- *MnPASS System Study Final Report,* prepared for MnDOT by Cambridge Systematics with URS Corporation, April 2005. http://www.mnpass.org/systemstudy_archive.html.

[5]Kenneth Buckeye, personal communication.

Summary of Critical Issues/Lessons Learned

The transportation community in Minnesota has played a proactive and important role in supporting the use of pricing in the United States. MnDOT working together with the Metropolitan Council and the Humphrey School has been the recipient of five grants from the FHWA Value Pricing Pilot Program since its inception in 1992 and with the conversion of the I-394 HOV lanes to HOT operation, now operates the United States' fifth HOT lane facility. MnDOT's work in outreach and community involvement is exemplary and much of the Department's success can be credited to involving transportation stakeholders and members of the community at large in the decision-making process that has led to the implementation of the MnPASS on the I-394 corridor.

In spite of its success with the I-394 conversion, it is fair to say that MnDOT's pricing experience has been mixed. Prior to the opening of MnPASS there were no tolled highway facilities in the state of Minnesota, and it took MnDOT and its partners over 10 years of actively advocating to achieve the conversion of a single existing and underutilized HOV facility to HOT operation. More than any other single factor, Minnesota's experience with pricing demonstrates the extent to which decision frameworks are governed by local politics and the importance of the active support of the Governor when a state DOT is trying to implement a pricing project. Initially pricing was supported in Minnesota in the form of privately-financed toll roads with the passage of authorizing legislation in 1993. The state's first toll proposal was later rejected by a local mayor, and in the wake of that decision and the public's dissatisfaction with an initial HOV to HOT proposal on I-394, value pricing received a major setback. In announcing his decision to withdraw the I-394 HOT lane proposal, Governor Carlson stated that value pricing was an important concept that should be saved for a later date.

During the Ventura administration, MnDOT continued its exploratory studies of value pricing, assembling a Value Pricing Task Force comprised of elected officials and members of the public, and conducting two regional pricing feasibility studies in the Twin Cities. Having gone through these important steps, MnDOT was informed and ready to move quickly when the local political context changed with the election of Governor Pawlenty in 2002. At that time, circumstances were aligned leading to strong public support for pricing in Minnesota: the state was in debt; there was a new governor; the Twin Cities was experiencing unprecedented growth and congestion levels; the I-394 was an existing and underperforming HOV facility leading into downtown

Minneapolis; PPP legislation was in place; a task force had recommended exploring the possibility of using value pricing in the Twin Cities; and MnDOT had completed preparatory studies that had clearly identified the conversion of the I-394 HOV lanes to HOT operation as the most feasible and easily implemented of the various pricing options considered in the Twin Cities.

Together, these factors enabled MnDOT to issue a procurement for the I-394 HOT lanes quickly, without the need to conduct a corridor-specific study. Ultimately, the decision to procure the HOT conversion on a PPP basis simplified MnDOT's decision-making process because the Department's private partner, with the advice of the I-394 Community Task Force and MnDOT experts, was responsible for making detailed decisions on the ETC technology to be used, the configuration of the lanes and access to them, toll rates, and operating procedures. Because the purpose of the project was to increase the efficiency of the lanes, and because the private sector partner did not seek an equity position in the project, it absolved MnDOT from having to formulate detailed conclusions on the overall financial feasibility of implementing the I-394 conversion on a standalone PPP basis. If the procurement was successful it would be a clear indication that the project was feasible. Furthermore, MnDOT's strategy of procuring the project as a private partnership also leveraged the strategic importance of the project deploying the first ETC technology in the state. That meant that technology providers might be willing to make their equipment available at a very attractive cost, given that any subsequent pricing projects in the region would likely use their equipment as well, so as to facilitate interoperability.

The fact that MnDOT had clearly done its homework was essential to the success of the I-394 conversion, but one anomalous finding from the Department's earlier pricing investigations is worth highlighting—the impression from the 1998 *Toll Lane System Preliminary Feasibility Study* that HOT widenings on corridors throughout the Twin Cities would have the ability to be self-financing. Subsequent analysis included in the *MnPASS System Study* rectifies this misimpression and states clearly that new HOT lane capacity would only have the ability to recuperate an average of 22% of its investment costs. The *System Study* is also insightful for not judging potential HOT lane projects on their ability to recover costs, but on the contribution they make to the performance of the regional highway system. In spite of MnDOT's pioneering work in formulating a vision of developing a network of priced lanes throughout the Twin Cities, the concept has not been incorporated into the region's 25-year TPP and current plans do not call for any major highway widenings in the region.

5.3 Oregon Innovative Partnerships Program

The 2003 Oregon Legislative Assembly passed Senate Bill 772 to establish the Oregon Innovative Partnerships Program (OIPP) within the Oregon Department of Transportation (ODOT) (http://www.oregon.gov/ODOT/HWY/OIPP/). SB 772 gives ODOT broad authority to enter into contractual relationships in the form of partnerships with private sector firms and units of government. This legislation removes barriers to formation of public-private partnerships for Oregon transportation projects and provides numerous tools to encourage them (http://www.oregon.gov/ODOT/HWY/OIPP/docs/ESB772.pdf).

An Innovative Finance Advisory Committee held four meetings totaling 16 hours in its first year with the purpose of assessing Oregon's ability to implement PPPs. Senator Bruce Starr authored successful legislation that created a no-constraints system under which the state could enter into PPP agreements. Oregon spent a year completing the rules underpinning its PPP program.

The Oregon Transportation Commission began the process of identifying candidate PPPs by asking all ODOT divisions and offices to nominate projects that they thought would be appropriate for development on a PPP basis. ODOT then identified a number of selection criteria and assessed a total of 15 options. At this juncture, ODOT also consulted with industry players in the infrastructure development sector to ascertain the interest of potential PPP partners and also seek recommendations on moving forward with its PPP program.

The OIPP instituted a process over the summer and fall of 2004 to identify potential projects and solicit information about the potential feasibility and financial considerations necessary for PPPs. In November 2004, a Screening Committee met in accordance with the OIPP Operating Procedures to apply the published criteria and make recommendations to the Director and the Commission regarding the best candidates for early consideration under the OIPP. The screening criteria involved qualitative assessments of:

- Transportation need;
- Ability to leverage new revenue;
- Project feasibility;
- Potential to reduce implementation time; and
- Public support.

Based on this process, ODOT narrowed the field of PPP prospects down to three highway improvements, one rail project, and one "maintenance swap" opportunity involving the redevelopment of land occupied by an ODOT maintenance facility in exchange for the construction of a new one.

As a result of the industry consultation process, Oregon then moved forward with the three highway projects instigating a triple procurement where potential private partners could propose on any or all of the improvements:

- Sunrise Project;
- Newberg-Dundee Transportation Improvement Project; and
- South I-205 Corridor Project.

The projects were not developed to the point where ODOT could ask for hard bids. Instead it used a pre-development agreement approach where private partners could come in and complete the project development and subsequently engage in a second round of negotiation with the state for construction and operation of the facility. The Oregon approach is similar in some respects to the Comprehensive Development Agreement (CDA) approach used in Texas, but provides much more flexibility and leeway than the Texas model, where the state retains more control.

ODOT solicited comments on the procurement from both industry and local players. It also held a pre-proposal conference and made presentations on the projects to local stakeholders. In addition, ODOT held one-on-one meetings with five potential bidders. Out of this process, two bidders proposed on the PPP program—groups led by Bechtel and Macquarie. Bechtel proposed developing the projects using a 63-20 public benefit authority approach and was not prepared to invest its own funds in the projects. The Macquarie-led Oregon Transportation Improvement Group (OTIG) team adopted a concession approach where it would be compensated for roughly half of its investment costs by the state and recuperate the remainder from toll revenue.

ODOT preferred OTIG's approach and entered into two months of negotiation with the group. ODOT found that the OTIG team offered financial depth together with significant United States and international experience financing, building, and operating high quality transportation facilities. Moreover, OTIG was willing to take on significant upfront financial risk and proposed to develop all three projects, providing synergies and savings estimated at 30% of the standard costs of developing these projects. The Bechtel group was not willing to assume this degree of financial risk.

The OTIG consortium includes the following companies:

- Macquarie Infrastructure Group as the major partner and investor;
- Macquarie Securities USA as the financial advisor;
- Hatch Mott MacDonald as the technical advisor;
- Preston Gates Ellis as legal advisor; and
- Several other local and national sub-consultants.

ODOT also relied on consultants to assist with the negotiations. They included Carter Burgess, Nossaman Guthner Knox and Elliot, and PFM Capital Management LLC. In addition, ODOT engaged WSA to perform a due diligence review on Macquarie's travel demand and revenue forecasts, which was completed by Steer Davies Gleave. For the Newberg-Dundee Project, ODOT also retained Bear Stearns as its Concession Finance Advisors to evaluate potential OTIG work and to develop a "public sector comparator." This work involved an in-depth analysis of all OTIG numbers, assumptions, conclusions, revenue forecasts, and traffic forecasts to determine whether the Newberg-Dundee PPP project could be implemented as efficiently as if they were procured directly by the public sector.

Decision-Making Process

5.3.1 Decision-Making Stages

ODOT and OTIG agreed upon a flow of tasks or milestones to complete pre-development activities and reach the implementation phase for the three candidate PPP projects. The four milestones are as follows:

- **Milestone Zero: Scoping Study.** The Milestone Zero scoping study includes an assessment of technical and financial project features, and the identification of any major issues that must be addressed before moving into implementation. It also provides a basis for agreement between ODOT and Macquarie on the scope, schedule, and budget for further stages of the pre-development phase, and to reach a decision on whether or not it is prudent to continue such studies. Milestone Zero roughly corresponds to the Exploratory/Preliminary Phase terminology used elsewhere in this NCHRP study. Milestone Zero involves the following tasks:
  - Network Definition
  - Definition of Project Alternatives
  - Environmental Classification Assessment [For the South I-205 project, the "environmental classification assessment" referred to determining whether the project could get by with an Environmental Assessment (EA), because it was merely adding lanes entirely within the established right-of-way, or whether it would require the more costly and time-consuming EIS. The Sunrise Project was already well into the DEIS process, and a SEP-15 agreement with FHWA allowed the private partner to provide input into that process, as long as the decision-making and "ownership" of the DEIS was under the strict authority and supervision of ODOT and FHWA.]
  - Preliminary Public Information Plan

  - Preliminary Feasibility (sketch) Traffic and Revenue Analysis
  - Alternative Revenue Analysis
  - Project Cost Estimates (conceptual cost estimates)
  - Delivery Schedule and Risk Analysis (Risks reviewed included the level of public acceptance, economic conditions, material and labor prices, and available funding for tasks that needed to be undertaken by ODOT and/or Metro.)
  - Financial Feasibility Analysis
  - Work Plan Documentation
  - Development of Milestone One Scope
- **Milestone One: Commercial and Financial Viability Assessment.** Milestone One establishes the commercial and financial viability of the projects in greater detail using agreed-upon cost and revenue parameters. The outcome of Milestone One studies should allow ODOT and Macquarie to understand project feasibility with a high degree of confidence. Milestone One corresponds to Preliminary/Feasibility Phase terminology used elsewhere in this NCHRP study. Milestone One work projects will include the following:
  - Development Plan (Funding Options, Tolling, Preliminary Investment Grade Traffic Study, Preliminary Technical Review, Financial Feasibility Analysis, Project Viability Assessment, Public Communication, Education and Acceptance Plan)
  - Preliminary Implementation Plan (Allocation of Risk, Project Delivery Organizational Structure Implementation Agreement, Key Issues, Concession Agreement, Key Project Features)
  - Preliminary Financing Plan (Revenue Profile and Mechanisms to Bridge the Funding Gap, Financing Structure, Debt Financing Strategy, Alternative Financing Instruments, Construction Support Package, Financial Structure Summary)
  - Next Steps
- **Milestone Two: Implementation Development.** Milestone Two involves the development of an implementation agreement and preparation for the design-build procurement to implement the project as well as its financing plan. The work completed in Milestone Two will provide the contractual basis for the implementation phase. Upon completing Milestone One, the project will be developed to a point when near-final pricing and risk allocation can be completed and right-of-way could potentially be acquired. In the terminology used elsewhere in this NCHRP study, Milestone Two corresponds to Investment Grade Stage. The following deliverables will be completed:
  - Investment Grade Traffic and Revenue Study
  - Financial Plan Analysis
  - Regulatory and Local Approvals
  - Risk Analysis and Assignment
  - NEPA Analysis
  - Land Use Approvals Interchange Areas Management Plans
  - Design-Build Procurement
  - Right-of-way Delivery Plan
- **Milestone Three: Closing.** Milestone Three involves the preparation and negotiation of all formal agreements needed to bring the project to financial close. Upon completion of Milestone Three, the project will be ready to move into implementation. In the terminology developed for this NCHRP study, Milestone Three is not a part of the decision-making process per se, but an outcome of it. Milestone Three will involve the following deliverables:
  - Implementation Plan
  - Financing Plan
  - Final Implementation Agreement
  - Commercial and Financial Closing Documents

Technical Aspects

5.3.2 Planning Aspects

Each of the candidate PPP studies included in ODOT's PPP procurement had been studied previously and was included in Portland Metro's long range transportation plan. ODOT and OTIG ultimately agreed upon a four-step planning and implementation approach revolving around the completion of a series of reports and documentation for each of the projects:

- Milestone Zero: Scoping Study
- Milestone One: Commercial and Financial Viability Assessment
- Milestone Two: Implementation Development
- Milestone Three: Closing

At the end of each milestone the parties agree upon a set of working assumptions for moving to the next milestone. ODOT and OTIG also have the right to decide not to continue with the process. Milestones Zero and One constituted the Pre-Development phase for each project and took approximately 12 months to complete. These studies analyzed the feasibility of various technical, commercial, and financial options for the projects. In conducting the activities, OTIG adhered to all applicable regulations and requirements (environmental, public outreach, state, federal, and any other relevant requirements). Further explanation of the contents of the sequential milestone process is provided in Section 5.3.1.

5.3.2.1 Operating Priced Facilities in the Region

The State of Oregon currently has no operating tolled highway facilities, nor is any such facility under construction (Figure 5-5).

Figure 5-5. Existing toll facilities in Portland.

5.3.2.2 Current ETC Installations

Oregon's first ETC system is along SR 14, on the Hood River-White Salmon Bridge, across the Columbia River between White Salmon, Oregon, and Bingen, Washington. The system became operational in September 2007. The bridge is operated by the Port of Hood River (http://www.portofhoodriver.com/).

5.3.2.3 Initiative in a Context of Regional Goals (Pricing Goals)

The goals of the ODOT Innovative Partnership Program are to:

- Develop an expedited project delivery process;
- Maximize innovation; and
- Develop partnerships with private entities and units of government.

In addition to these first three toll road projects, Oregon is working to establish an overall toll policy for the state. ODOT is interested in examining pricing to help achieve its mobility goals and is currently preparing economic cost/benefit analysis for new roads planned in the Portland region, as well as a public outreach process to develop a better understanding how tolling would affect regional mobility and how it is perceived among local residents.

The goals articulated in SB 772 include expediting project delivery, maximizing innovation, and collaborating with private partners. They do not address pricing or tolling policy directly.

5.3.2.4 Proposed Priced Facilities and their Role in the Regional Network

The Oregon Office of Innovative Partnerships and Alternative Funding and OTIG have assessed three possible pricing projects in Oregon. These are located on the south and southwestern outskirts of greater Portland, as shown in Figure 5-6 and described below.[6] The alternatives involve combinations of pricing regimes together with different physical

[6] http://www.oregon.gov/ODOT/HWY/OIPP/docs/3proj_factsheet.pdf

Figure 5-6. Proposed toll facilities in Portland.

solutions involving various geographic coverages and lane configurations.

- The Sunrise Project involves the construction of a new, four-lane, limited access roadway to SE 172 (Segment 1) and additional transportation infrastructure to serve the newly incorporated city of Damascus (Segment 2). The Sunrise Corridor is a radial highway facility connecting Portland's eastern suburbs to the orbital I-205 highway. In 2004, Clackamas County and ODOT undertook a Supplemental Draft Environmental Impact Statement for the Sunrise Project, re-examining and building on information developed for the original Draft EIS completed in 1993.

  OTIG's analysis of the proposed Sunrise Corridor highway and parkway determined that projected toll revenues in six options would not cover even the cost of operation, much less the cost of construction. The analysis concludes that motorists would not see enough of a time savings to be willing to pay a toll on the new roadways—Oregon 212/224 would continue to serve as a free alternative.

  While the ODOT/OTIG toll study project has been terminated, the Sunrise Corridor project is still being pursued through traditional channels with Clackamas County as the lead agency. No construction funding has been identified. (http://www.deainc.com/sunrise/background.html; http://www.oregon.gov/ODOT/HWY/OIPP/docs/SunriseTalkingPtsMar2006.pdf)
- The South I-205 Corridor Project is examining the feasibility of adding one or two lanes in each direction of I-205 along a 10-mile segment of I-205 from I-5 to Oregon 212/224, or a longer segment to I-84, and widening the George Abernethy Bridge over the Willamette River. This portion of the orbital I-205 corridor is located in the southeast quadrant of the metropolitan Portland region. OTIG's analysis determined that several options warrant further investigation. ODOT will continue working with stakeholders and the public to winnow down the number of alternative improvements and perform regional planning and corridor work before assessing whether they would be feasible as PPPs. The Metro Regional Transportation Plan is currently in the process of being updated and the OTIG project is on hold while the update is completed.
- Newberg-Dundee Bypass Project is an 11-mile bypass route starting at the east end of Newberg and ending near Dayton

at the junction with OR 18. The bypass was proposed by ODOT as a four-lane, grade-separated expressway with four interchanges. OTIG has proposed an extension of the project using OR 18 from Dayton to a point south of McMinnville, creating a 20-mile limited access bypass.

OTIG completed its initial feasibility assessment of the Newberg-Dundee Bypass in December 2006, and Bear Stearns completed its independent review in June 2007. Bear Stearns found that the state could procure the project more cost effectively than OTIG, and as a result, ODOT terminated its agreement with OTIG to implement the Bypass on a PPP basis (http://www.newbergdundeebypass.org/).

5.3.3 Pricing Projects

5.3.3.1 Physical Layout (Description of Planned Pricing Projects)

See Section 5.3.2.4.

5.3.3.2 Pricing Forms/Options (Types of Pricing)

OTIG has assessed a number of pricing forms, including operating new highway capacity as HOT lanes, or express toll lanes open to all paying vehicles. OTIG assessed point tolling concepts as well as distance-based and corridor tolls. ODOT is encouraging the use of variable pricing. When OTIG's analysis for the Newberg-Dundee Bypass project indicated that the project would not be financially feasible if operated as HOT or express toll lanes, it also explored various concepts to toll all motorists traveling in the corridor. Further explanation of the pricing options considered for this project is provided in Section 5.3.3.6.

5.3.3.3 Initial Screening/Selection (Process for Identifying Pricing Projects)

In response to SB 772 the Oregon Transportation Commission asked all ODOT divisions and offices to nominate projects that they thought would be appropriate for development on a PPP basis. ODOT identified a number of selection criteria and assessed a total of 15 options. Next, it consulted with industry players in the infrastructure development sector to ascertain the interest of potential PPP partners and sought recommendations on moving forward with its PPP program. ODOT received input from the following organizations: Cintra, Bechtel, Ferrovial Agroman, Macquarie North America, CH2M Hill, Fluor Enterprises, Transurban, Hatch Mott MacDonald, Granite Construction, Washington Group International, HDR, Flatiron Construction, URS Corp., JP Morgan, Goldman Sachs, Peter Kiewit Sons, Inc., Lehman Brothers, HNTB Corp., Parametrix, and Balfour Beatty Construction, Inc.

Based on these discussions and through further analysis and discussion, ODOT narrowed the field of PPP prospects down to three highway improvements, one rail project, and one "maintenance swap" opportunity (involving the redevelopment of land occupied by an ODOT maintenance facility in exchange for the construction of a new one).

The criteria used to screen the initial list of suggested projects were developed jointly by ODOT and its program management consultant. For the selected criteria, categorized as Mandatory or Preferred, the concept was to assign a ranking (for example, between 1 and 5, with 5 being High and 1 Low) as an indication as to how well a project meets each of the criteria. Projects had to obtain a score of at least a 3, overall, on mandatory elements before they were evaluated for their treatment of preferred elements.

Category One—Mandatory

- **Revenue Contribution/Funding Considerations.** Whether it is a toll road, other user fees, approaches such as tax increment dedications, or other local contributions, what is the ability of the project under consideration to attract or generate a substantial contribution of non-state or non-tax resources that would not otherwise be available for an ODOT project? Also, the evaluation must consider to what extent ODOT funding will be required to complete the project and if those funds are likely to be available when needed.
- **Relative Financial Feasibility Index.** This evaluation would determine the viability of the proposed financial plan and its feasible implementation. Cost estimates, revenue, and general financial structures are examples of elements included in the assessment of the financial viability of a project. Although it is difficult to fully estimate construction costs, an analysis of the proposed cost of construction should be compared against the investment and revenues proposed. Projected cost information can be evaluated utilizing existing department methods.
- **Public (Local/ODOT/Political) Support.** These criteria will be partially addressed by the Category Two consideration, "Consistency with Statewide and Regional Plans" (below) but goes further. This takes into consideration issues such as, "Is there a local sponsor or champion for the project?" or, "Is there organized opposition to the project that is likely to materially extend the development timeline and/or costs?"
- **Leveraging of Private Sector Participation.** In considering issuing solicitations for an Innovative Partnership Project, it is important to assess whether the project in question is well suited for that approach. Some of the issues to consider include: What value can the private sector bring to the project development process? Is there a potential for the use of innovative construction approaches that will result in shorter build time, reduced construction cost, or improved function in comparison to conventional approaches?

- **Reduce Project Delivery Time.** Does this project have the potential to address an urgent or state-identified transportation need in a manner that will materially advance the project delivery time frame in light of current or anticipated levels of funding and existing transportation plans? Does the use of the Innovative Partnership process have the potential to enhance the ability to deliver this result?
- **Transportation Need.** Does this project address an important transportation need? What potential does this project have for a positive impact on congestion or access or improving unsafe conditions? This consideration can be broken down into three aspects:
  - *Congestion Relief/Access Improvements.* The proposed project should be reviewed for the overall improvements to meet traffic demand and relieve identified congestion or access problems, either existing or projected. Analysis of AADT, VMT and volume to capacity ratios are common approaches.
  - *Safety Impacts.* Related to congestion reduction evaluation, a safety impact analysis should identify reductions in traffic accidents. Improvements may occur on newly proposed alignments or have a positive impact on existing facilities.
  - *Other.* Does the project address some other urgent transportation need?

Category Two—Preferred

- **Economic Growth Considerations.** This type of criteria would take into consideration the projected growth in population and related growth in travel and traffic demands in the area surrounding a potential project. In addition, factors related to the economic stimulus of a project are valuable to overall consideration.
- **Consistency with Statewide and Regional Plan Goals.** Proposed projects will have a greater opportunity for implementation and funding if consistent with proposed statewide and regional plans. Acceleration of existing projects or enhancements to proposed improvements would improve the chances of implementation of a proposed project. This factor would also consider issues such as modal balance and regional balance.
- **Community and Environmental Impact Assessment.** Relative consideration should be given to the community and environmental value of a proposed project and the overall impact to adjoining properties and neighborhoods. Although not a fully executed environmental review, a broad assessment of the natural environment as well as the physical features of a proposed project should be considered.
- **Development Lead Time.** What is the timeline for assembling the elements necessary to move the project forward? Items such as the need for legislative changes, public votes, or lengthy environmental approvals will extend the development time and potentially impact the ability to achieve other goals.
- **General Risk Assessment.** Assess whether there is a practicable means of mitigating the risk of failure, or a high reward-to-risk ratio (in terms of both the benefits to the public and the private partner's investment incentive). Also consider the general ease or difficulty in constructing the proposed project and identification of potential obstacles. An overall cost-benefit assessment is one aspect of this analysis.

The MPO and local government representatives were involved at each stage of project selection, solicitation, evaluation of proposals, negotiation of agreements, and implementation of pre-development activities and work plan. Of the three projects that were included in ODOT's PPP procurement, two (the Sunrise Corridor and Newberg-Dundee Bypass) were already in existing plans and one (South I-205) was subsequently added.

As a result of the industry consultation process, Oregon moved forward with the three highway projects, initiating a triple procurement process whereby potential private partners could propose on any or all of the improvements. Because the projects were not fully defined, ODOT used a pre-development agreement approach where private partners could complete project plans and design, and then engage in a second round of negotiations with the state to implement them.

5.3.3.4 Toll Collection Technologies Considered

The Milestone Zero reports completed for the three candidate PPP projects discuss the various toll collection technologies used in the United States but do not make specific technology recommendations for the Portland projects. The Milestone One Report completed for the Newberg-Dundee Bypass assumes that that facility would offer both cash and ETC tolling options for the first 10 years of operations, before the cash option converts to video tolling. The tolling infrastructure installed at opening is assumed to be upgraded after 10 years, and then every 12 years until the end of the concession.[7]

5.3.3.5 Project/Pricing Alternatives (Process for Defining Pricing Projects)

ODOT is using a developer-led approach to defining pricing projects, where private partners determine final design

[7] http://www.oregon.gov/ODOT/HWY/OIPP/docs/NewbergDundeeS2Milestone1Report.pdf, page 99.

and assess alternative toll levels and pricing protocols. OTIG has assessed a number of different tolling schemes with alternative pricing differentiation and eligibility requirements in its quest to define alternatives that would be viable to develop on a PPP basis.

5.3.3.6 Project/Pricing Alternatives (Tolling Options)

OTIG has assessed a wide variety of tolling options for each of the candidate PPP projects. These include:

- Flat tolls;
- Variably-priced point tolls;
- Flat distance-based tolls;
- Variably-priced distance-based tolls;
- Variably-priced managed lanes priced for operation at 55 to 65 mph; and
- Shadow tolls.

Given that OTIG's work on the Newberg-Dundee Bypass is more advanced than the other two projects—having been included the Milestone One Report—they have done additional tolling option assessments on that project. OTIG's approach to the toll level for the Bypass is to charge a relatively low toll level at the opening and increase the rate as congestion increases in the future. It tested several different toll levels—both point- and distance-based—to gain an indication of the enhanced model's responsiveness to different toll rates and to develop more accurate forecasts.

OTIG found that the toll revenues from the Bypass alone would not be sufficient to finance the project. As a result, they studied a concept to toll all traffic traveling in the corridor on both the Bypass and the existing, congested and parallel OR 99W. They developed and assessed a variety of options, as shown in Table 5-2, testing different toll rates to identify levels that would fully fund the project beyond the contributions from ODOT for the entire right-of-way and $50 million toward construction costs.

Of the viable tolling options, the following scenario was carried for further sensitivity analysis as OTIG found the following toll collection scheme to be most publicly acceptable:

- Local Residents (defined as residents of the Newberg and Dundee area) do not pay a toll to use 99W and incur a flat toll of $1.00 to use the Bypass.
- Visitors (defined as users who remain in Newberg and Dundee for more than 2 hours) do not pay a toll to use 99W.
- All other motorists pay a toll of $3.50 to drive through the corridor.

However, an independent review, which included guidance from the U.S. Department of Justice found that the concept of exempting certain users from tolls based on place of residence is not clearly permitted under Federal law and might not survive legal challenge.

5.3.4 Cost Estimates

5.3.4.1 Conceptual Cost Estimate

OTIG prepared cost estimates for the three candidate PPP projects using high-level quantity takeoffs together with square footage, and/or linear foot costs, and/or unit prices from experience, and by using recent ODOT bid tabulations as appropriate. The cost estimates for the three projects are summarized below:

- The capital cost analysis identified a five-mile project in the Sunrise corridor ranging from $393 to $431 million and $884 to $923 million for a longer 10-mile project.
- OTIG prepared cost estimates for 12 options for the South I-205 Corridor. The construction costs of adding one to two additional lanes in the southern portion of I-205 were found to range from $184 to $481 million depending upon the project selected. The construction cost of adding one

Table 5-2. Tolling options assessed for the Newberg-Dundee bypass.

Tolling Option	Description
99W Tolling	All users pay toll to use 99W and the Bypass.
Pass Through Tolling– Local Residents Excluded	Local residents* do not pay to use 99W and incur a flat toll of $1.00 to use the bypass.
Pass Through Tolling– Local Residents and Visitors Excluded	Local residents* do not pay to use 99W and incur a flat toll of $1.00 to use the bypass. Visitors** do not pay the toll to use 99W.
Pass Through Tolling – Additional Local Communities and Visitors Excluded	Additional local communities*** do not pay to use 99W and incur a flat toll of $1.00 to use the Bypass. Visitors** do not pay the toll to use 99W.

* Local Residents are defined as residents of the Newberg and Dundee area
** Visitors are defined as users who remain in Newberg or Dundee for more than 2 hours.
*** Additional local communities are defined as residents of Newberg, Dundee and surrounding areas.

or two additional lanes to both the southern and northern portions of I-205 was between $382 and $1,137 million.
- The cost of the Newberg-Dundee Bypass was estimated at $493 million, as follows (in millions):

Construction	$260.0
Construction Engineering	21.9
Utilities Relocations	4.9
Tolling Infrastructure	2.4
Contingency—20%	57.8
Subtotal Construction	*347.0*
Design—10%	34.7
QA (Design and Construction)—3%	11.5
Subtotal Design and Construction	*393.2*
Right-of-Way	100.0
Total	**$493.2**

5.3.5 Traffic and Revenue Forecast

5.3.5.1 Forecasting/Modeling Tools (Analytical Tools for Assessing Pricing Projects)

To forecast the effects of pricing on travel behavior with greater accuracy, OTIG engaged transportation consultants at Steer Davies Gleave to enhance Portland Metro's regional travel demand forecasting model for evaluation of the three pricing projects.

For the Milestone Zero reports, this work was confined to independent checks of data and model output. Steer Davies Gleave also developed a new network model to account for speed differentials between managed and general purpose lanes, using Portland Metro's existing TranSims model on an EMME2 platform. The new network model was developed using McTrans' SATURN platform.

To complete the Milestone One Report for the Newberg-Dundee Bypass, OTIG needed to undertake enhancements to the TranSims model. OTIG categorizes the 10-mile bypass as a "congestion buster" toll facility used to avoid delays on the parallel network. As a result, Steer Davies Gleave undertook an extensive data collection effort to obtain recent and accurate information on travel patterns (and travel costs) in the corridor during different periods of the day. Origin-destination surveys of traveling motorists, traffic counts, and stated preference surveys were collected and used to inform the travel models (including trip tables across four times-of-day and trend rates for forecasting traffic growth). Some 220 surveys were completed over a five-day period. The following information was obtained:

- Origin-destination surveys at four locations over a 12-hour period to obtain a better understanding of daily trip patterns for both automobile and truck traffic. Questions were asked about income level, trip frequency, and residence location.
- A summary of journey times on the alternative routes in the corridor during four time periods.
- Traffic counts undertaken at all locations where origin-destination surveys were conducted for four time periods.
- A stated preference survey conducted to derive estimates of the value of time and other parameters reflecting intangible benefits of using the Bypass.

The data collected from the origin-destination surveys was used to prepare trip tables for each of the four time periods divided by trip purpose, vehicle type, and whether or not trip makers resided in the corridor. Steer Davies Gleave also reviewed demographic and economic factors influencing travel patterns, including population growth, number of households, economic growth, per capita income trends, and regional growth assumptions. This information was used to derive adjusted growth rates that were applied to the calibrated base trip matrices to produce overall growth rates for each travel period and origin-destination pair.

Overall, this process can be classified as a simplified approach, despite the effort to collect additional data. No mode choice or time-of-day choice model was applied. Instead, a direct generation and factoring of highway trip tables was used. Thus, only route choice was taken into account.

5.3.5.2 Summary of Traffic Forecasts

The Sunrise Project. OTIG has prepared preliminary traffic and revenue forecasts based upon existing traffic data in Table 5-3 and the assumptions in Table 5-4. The forecasts for both the Sunrise and I-205 Projects were carried out concurrently using the same modeling platform (the Portland Metro EMME-2 model).

Traffic and revenue forecasts as described in the Sunrise Milestone Zero Report considered a growth of greater than 5%, compounded traffic growth over 25 years, relied on all planned development at Damascus occurring within the proposed timescales, and did not consider the potential effect an economic recession or slow down would have on the development schedule. Thus, OTIG has presented a lower traffic growth assumption with the sensitivity analysis, considering the higher modeled growth case.

South I-205 Corridor Project. Traffic and revenue forecasts were conducted in the same manner as the Sunrise Project. No surveys were carried out for this preliminary analysis. However, a number of data sources were used, including:

- Midday and PM peak Metro model outputs
- 2005 ODOT Reconnaissance Study (draft dated October 2005)
- ODOT 2004 Transportation Volume tables

Table 5-3. OTIG daily traffic forecasts—Hwy 212/224.

Section	Direction	Midday	PM	ADT
East of 102nd Street	EB	1,484	2,242	
	WB	1,541	1,650	
	TOTAL	**3,025**	**3,892**	**54,891**
West of 135th Street	EB	1,206	1,858	
	WB	1,241	1,357	
	TOTAL	**2,447**	**3,215**	**44,677**
East of 135th Street	EB	1,029	1,583	
	WB	1,069	1,346	
	TOTAL	**2,098**	**2,929**	**32,799**
HWY 212 East of Rock Creek	EB	437	823	
	WB	412	511	
	TOTAL	**849**	**1,334**	**16,366**
HWY 224 East of Rock Creek	EB	387	570	
	WB	374	394	
	TOTAL	**761**	**964**	**13,744**

Source: Sunrise Project Milestone Zero Report, 2007.

Average daily traffic data was obtained from three permanent sites located on the I-205. These are:

- Stafford (03-016)—located east of I-5
- Lents (26-022)—located south of US26/Powell Blvd
- Yamhill (26-018)—located south of Stark St.

Newberg-Dundee Bypass Project. In generating traffic forecasts, OTIG utilized Oregon's system of Auto Travel Recorders (ATRs) throughout the state providing permanent traffic counts. Traffic growth has been relatively limited over the last 10 years, with traffic levels around 34,100 vehicles per day in 2005 and annual growth at 1.5%.

5.3.5.3 Summary of Revenue Projections

The Sunrise Project. The traffic and revenue forecasting model was developed based on the assumptions presented in Table 5-3 and a SATURN assignment model built for the PM and midday periods for two scenario years (2013 and 2030). Time period results were then annualized to provide annual traffic and revenue forecasts. Values between the modeled years were interpolated, while growth post-2030 was extrapolated at 1% per year. The revenue forecasts for all the alternatives range from $1.05 to $18.35 million in 2013 and from $6.02 to $47.3 million in 2030, both in nominal terms.

Table 5-4. OTIG traffic forecasting assumptions.

Assumption	Values	Comments
Base toll rate	$0.15/mile	Results in $0.53 for Sunrise Project and $1.95 for Sunrise Corridor
Toll charges	Distance	All scenarios have charges applied through distance tolling, i.e., a toll applied on each link according to the distance traveled on it
Sunrise Max. Speed	55 mph	
Tolling Operation	Assumed fully electronic (no delays)	
Trucks	Medium and heavy trucks have their own matrices form the METRO Model	
Truck factors	Heavy trucks pay 3x the toll, while medium trucks pay 2x the toll	
Growth	2.8% p.a.	Assumed for all years up to 2030 (based on half the EIS model output)
	1% p.a.	Post 2030
Ramp-up	0	Not accounted for
Value of Time (VOT)	$7-12/hr	Values from preliminary results from Newberg-Dundee SP exercises
VOT growth	1.0%	Annual growth, reflecting the increase in wealth (proportional to GDP) from users over time
Expansion factors	13 hrs for MD and 4 hrs for PM	Assumption based on an estimate of hours associated to each period on an average day
	300 days per year	

Source: Sunrise Project Milestone Zero Report, 2007.

Table 5-5. Modeling assumptions for South I-205 corridor.

Assumption	Values	Comments	Options Applied
Toll rates	Distance	Tolls applied on each link according to the distance traveled on it.	Options 1, 2a, 2b, 3a, and 3b.
	Point	Located on Abernethy Bridge	Options 2c, 2d, 3c, and 3d
Maximum speed	55–65 mph	Higher in the southern section	All options
Tolling operation	Assumed fully electronic (no delays)		All options
Trucks	Medium and heavy truck matrices from the Metro Model		Al options
Truck factors	Heavy trucks pay 3x the toll, while medium trucks pay 2x the toll (See comment below regarding Option 1a and 1b.)		All options (except Options 1a and 1b)
Traffic Growth	1.8%	Between 2005 and 2030	All options
	1%	Between 2030 and 2040	
	9%	Post 2040	
Ramp-up	0	Not accounted for.	All options
Rerouting assumptions	Cost elasticity: -0.18	Cost elasticity applied to each O-D pair to obtain the reduction in demand due to the implementation of tolls (see 13.3.1).	Applied to Options 2
Value of Time	$72–12/hr	Values from preliminary results from Newberg–Dundee SP exercises.	All options
VOT growth	1.0%	Annual growth, reflecting the increase in wealth (proportional to GDP) of users over time.	All options
Expansion factors	12 hrs for MD and 4 hrs for PM	Assumption based on PM model demand representing all peak hours (7:00–9:00, 16:00–18:00) and MD model demand representing Off Peak hours for an average weekday.	All options
	300 days per year		

Source: South I-205 Corridor Milestone Zero Report, 2007.

South I-205 Corridor Project. Based on the assumptions shown in Table 5-5 and the SATURN assignment model built for the PM and midday periods, forecasting results were annualized and traffic and revenue forecasts were provided for 2005, 2020, and 2030 as forecast outputs, with the values in-between interpolated, and post-2030 figures extrapolated (just as the Sunrise Project). For the alternatives with new lanes in the South only, revenue forecasts range from $0.96 to $100.94 million in 2013 and from $21.18 to $207.91 million in 2030. For the alternatives considering new lanes throughout both the South and North, the revenue forecasts range from $5.12 to $155.53 million in 2013 and from $52.35 to $321.13 million in 2030, all in nominal terms.

Newberg-Dundee Bypass Project. The results of the Bypass Tolling options are shown in Table 5-6. Revenue generated in the region is over $2 million in 2010, over $5 million in 2020, and over $10 million in 2030.

Table 5-6. Newberg-Dundee Bypass Options.

		2010		2020		2030	
Scenario	Toll	Revenue ($m)	AADT*	Revenue ($m)	AADT*	Revenue ($m)	AADT*
Bypass Point Tolling	$1.00	2.43	5,714	5.20	10,443	10.31	17,524
Bypass Distance Tolling	$0.10/mile	2.76	9,597	5.79	15,209	10.44	22,141

Source: Newberg-Dundee Milestone One Report, 2006.
* Defined as total corridor traffic on Bypass at Screenline 2.

5.3.6 Financial Aspects

5.3.6.1 Revenue Use

OTIG adopted a concession approach where it would be compensated for roughly half of its investment costs by the state and recover the remainder from toll revenue. All revenue generated by the candidate PPP project would be used to cover operating and capital costs.

5.3.6.2 Supporting Federal Programs

No formal plans were put into place to use the three candidate PPP projects. However, OTIG did identify the following potential funding sources:

- Transportation Infrastructure Finance and Innovation Act (TIFIA)
- Private Activity Bonds (PABs)
- Oregon Transportation Infrastructure Bank (OTIB)
- Grant Anticipation Revenue Vehicles (GARVEEs)

5.3.6.3 Financial Deal

OTIG did not finalize financing details for any of its candidate PPP projects in Oregon. However, it did state that it would evaluate and secure the most cost effective debt capital from any one or more of the international bank debt, bond, private placement, and monoline insurance markets. In addition, OTIG stated that it would examine alternative or complementary sources of public financing such as TIFIA and PABs.

OTIG intends to consider several financing options on a competitive tender basis from leading U.S. and international financial institutions. OTIG will employ a Multiple Track Approach, where all financing options are considered to obtain the most efficient financing.

5.3.7 Institutional Framework

5.3.7.1 Name/Type of Agency

Oregon Office of Innovative Partnerships and Alternative Funding (OIPP) was created within the State Department of Transportation to oversee the implementation of PPP projects in the state. (http://www.oregon.gov/ODOT/HWY/OIPP/)

5.3.7.2 Institutional Structure

The Office of Innovative Partnerships and alternative funding is located within ODOT's Highway Division of ODOT. Its seven-person staff is led by James Whitty.

5.3.7.3 Procurement Approach

The approach was a PPP procurement where the winning proposer was give the right of first refusal to design, build, finance, and operate three toll road/managed lane projects (see project overview for further details). The evaluation and ranking of proposals for negotiation was based on information contained in the proposals, gleaned from references, and obtained from interviews, if any. No evaluation and ranking was employed, in relative or absolute terms, guaranteeing acceptance of any proposal.

The proposals were assessed based on the four principal criteria and subcriteria set forth in the RFP. These criteria and subcriteria were translated into the technical review worksheets. A technical review team (TRT) was appointed to evaluate all proposals for compliance with four principal criteria in the following priority (highest to lowest):

- Qualifications and Experience
- Project Approach
- Public Support
- Compensation

The TRT (with input from the Technical Services Consultants) made initial recommendations to an Evaluation Team regarding additional information, requests for clarification, and interviews.

5.3.8 Legislation

5.3.8.1 Mandate

The 2003 Oregon Legislative Assembly passed Senate Bill 772 to establish the OIPP within the ODOT. SB 772 gives ODOT broad authority to enter into contractual relationships in the form of partnerships with private sector firms and units of government. This legislation removes barriers to formation of public-private partnerships for Oregon transportation projects and provides numerous tools to encourage partnership formation (http://www.oregon.gov/ODOT/HWY/OIPP/docs/ESB772.pdf).

The goals of the program are to:

- Develop an expedited project delivery process;
- Maximize innovation; and
- Develop partnerships with private entities ODOT

5.3.9 Public Outreach/Involvement

As part of the planning process for its PPP pricing project, ODOT has invited local involvement in the project development process. They also include two independent citizens—a

lawyer who serves on the Parkway Commission and a local MPO staff person—in all negotiations with OTIG. ODOT believes that this approach has been beneficial and has helped to win public support for its PPP process.

Current Status and Documentation

5.3.10 Current Status of Pricing Projects

- **The Sunrise Project.** While the alternatives studied in the Milestone Zero Report were technically feasible, none is likely to achieve financial feasibility with 100% funding by tolls. OTIG concluded that there was no commercial basis on which to carry any of the alternatives studied forward in their current form as tolled facilities, and OTIG and ODOT both agreed to terminate the Pre-Development Agreement for the project in January 2007.
- **South I-205 Corridor Project.** OTIG's Milestone Zero has been completed for the South I-205 Corridor project, but negotiations for the Milestone One work scope were placed on hold by the Oregon Transportation Commission. As the options were identified, it was recognized that regional and corridor planning activities were incomplete, and that it would be best to winnow down the number of alternative improvements before assessing whether they would be feasible to develop on a PPP basis. Once the range of alternatives has been narrowed, OTIG will determine if widening of the southern section can be accomplished through a PPP. Its initial findings are as follows:
  - The corridor tolling alternatives can be developed with identifiable revenue streams (e.g., tolling) in a manner that expedites ODOT's usual design and construction methods.
  - Pending further study, some of the managed lane alternatives may be developed with identifiable revenue streams in a manner that expedites ODOT's usual design and construction methods.
  - Revenue streams to support shadow tolling have not been identified. However, these alternatives are feasible should a funding source be identified.
  - There are no apparent fatal flaws for any of the alternatives in the areas of technical and environmental feasibility or public acceptance.
- **Newberg-Dundee Bypass Project.** OTIG completed its initial Milestone One Feasibility Assessment of the Newberg-Dundee Bypass in December 2006, and Bear Stearns completed its independent review of their findings in June 2007. Bear Stearns conducted a comparative analysis of public sector projects and found that, if Oregon were to implement this project directly (using a financial structure of 65% tax-exempt municipal debt, 25% subordinated TIFIA debt, and a 10 percent equity contribution), the revenues required to finance the project would be 32% lower than OTIG's target revenues. Their review also found that OTIG's pass-through tolling concept (where local residents and visitors would be exempted from paying tolls on route 99W), while popular among the local population, was not permitted under state and federal law and probably would not survive legal challenge. As a result of these findings, ODOT terminated its agreement with OTIG to implement the Bypass on a PPP basis and did not move forward to the Milestone Two level.

5.3.11 Planning Studies or Reports

- The Sunrise Project
  - Pre-Development Agreement
  - Milestone Zero Report: http://www.oregon.gov/ODOT/HWY/OIPP/docs/SunriseMilestone0ReportJan10.pdf
- South I-205 Corridor Project
  - Pre-Development Agreement
  - Milestone Zero Report: http://www.oregon.gov/ODOT/HWY/OIPP/docs/SouthI205Milestone0ReportJan10.pdf
- Newberg-Dundee Bypass Project
  - Pre-Development Agreement
  - Milestone Zero Report
  - Milestone One Report: http://www.oregon.gov/ODOT/HWY/OIPP/docs/NewbergDundeeS2Milestone1Report.pdf
  - Preliminary Findings Report: Analysis of the Proposed Concession Arrangement for the Newberg-Dundee Bypass Project

Summary of Critical Issues/Lessons Learned

Oregon has taken a leading role in exploring the use of alternative revenue sources as a sustainable means to fund future transportation improvements. In 2001, the Transportation Committee of the State House of Representatives sought initiatives to explore new areas. It established a Road User Fee Task Force, which was comprised of elected officials appointed by the governor and the speaker of the house. The task force explored new mechanisms to replace the gas tax. The task force looked at alternative fuel vehicles, gas-electric hybrids, liquid natural gas, and hydrogen. Noting the use of PPPs in other states, the legislature passed a second bill establishing a committee to explore the use of PPPs in Oregon, and soon thereafter, ODOT appointed a single staff member to run both efforts.

ODOT's experience with pricing comes as a direct result of legislative action that established OIPP within ODOT and

gave the Department a broad mandate to develop projects with private partners. Although Oregon's PPP legislation provides ODOT with the authority to accept unsolicited offers, the Oregon Transportation Commission has expressed preference for proceeding with formal solicitations. This preference results from a desire to control the project selection process. As a result, ODOT took the lead in identifying candidate projects for possible development on a PPP basis. The Department completed an internal review that identified 15 projects, and through consultation with private infrastructure services companies with direct experience in implementing PPPs, narrowed the field to three projects, which were offered to private developers in a joint procurement.

Although ODOT consulted with five potential proposers, only two responded to their 2005 PPP procurement, and only one of those was willing to invest its own equity in developing toll highways in Oregon. Now having completed preliminary analyses of each of the three projects, OTIG has concluded that it is not financially feasible to develop the Sunrise Corridor project on a PPP basis. ODOT has found that the Department could develop the Newberg-Dundee Bypass as a toll facility more efficiently than the structure laid out in OTIG's Milestone One Report for that project. As a result the Department has cancelled its plans to continue with the development of the Bypass as a PPP. The fate of the South I-205 project remains to be determined, with the project on hold while ODOT narrows the number of options to be considered by OTIG.

While it seems that Oregon has followed a rational decision-making process in response to SB 772, its results have been weak, and there are many questions that can be asked:

- Were ODOT's preliminary studies to identify potential PPP candidate projects rigorous enough?
- Was the decision to procure the three candidate projects as PPPs made prematurely?
- Has ODOT identified the right projects? Are there others that would have more robust financial profiles?
- Is highway demand in greater Portland not strong enough to make PPP toll projects feasible?
- Do the risks involved with implementing a region's first priced highway make it impractical to develop those facilities on PPP basis?
- Was OTIG asking for too much?
- Could OTIG have used a more efficient, less costly financial structure?
- Is there too much emphasis on financial feasibility?
- Was ODOT's tolling policy sufficiently developed at the time the projects were chosen?
- Would it have been easier to implement pricing projects in Portland if there were a greater emphasis on congestion relief?
- Is there public support for these projects?
- Does the political capital exist to find a way to actually implement PPP projects in Oregon?

Jim Whitty, the director of the Office of Innovative Partnerships and alternative funding manager with ODOT, provides helpful insight on the status of pricing projects in greater Portland. He believes that while there is support at the local government level for roadway pricing in the Portland area, "the difficulty is establishing sufficient public support to enable local policy makers to act." He wishes, "that Oregon's consideration of roadway pricing was a deliberate process, but [found] that is not the case," and believes that, "it is very unlikely for state agencies to develop a long-term vision for the role of pricing given that they are constrained by the political process."[8]

Another interesting dynamic with the ODOT pricing experience is the Department's emphasis on developing PPP toll projects rather than on the use of pricing as a means to address congestion and achieve regional mobility goals. Perhaps ODOT would have greater success in moving tolling forward if it did so by focusing on implementing a network of managed lanes that were priced to provide superior traffic service and introduce new transportation options. That approach might be more likely to resonate with a local community known for its forward-thinking land use and transportation policies.

5.4 San Diego Association of Governments (SANDAG)

SANDAG is designated as the metropolitan planning organization (MPO) for the entire San Diego County region. Now composed of 18 cities and county governments, SANDAG serves as the regional decision-making body responsible for transportation planning and development in the greater San Diego area.

One of SANDAG's key goals and priorities is to increase mobility for people and goods throughout the region. SANDAG is nationally recognized as an innovator in the implementation of variable pricing from its conversion of the I-15 HOV lanes to operation as the United State's second HOT lane facility in 1996. In 1998, SANDAG chartered new territory when it launched the nation's first dynamically-priced ETC system on the I-15 HOT lanes. This HOT facility is currently being expanded as part of SANDAG's $42 billion MOBILITY 2030 long range transportation plan, which also includes 75–80 miles of new HOT lanes in four freeway corridors. With MOBILITY 2030, San Diego is the first metropolitan

[8] James Whitty, telephone interview, July 11, 2007.

area in the United States to establish a long-range transportation plan featuring a regional network of managed lanes as one of its primary strategies to meet future mobility needs.

This case study reviews the decision-making process in the development of priced facilities, operating and planned priced facilities to date, and key success factors in the development and implementation of these facilities.

Decision-Making Process

5.4.1 Decision-Making Stages

SANDAG's process for approving pricing projects is to take the preferred strategy emerging from its Value Pricing Study Format to its Board. They provide the Board with a summary of the options assessed and the public outreach process, and then ask for their approval to move into implementation. SANDAG has the legislative authority to implement pricing projects.

SANDAG generally follows a seven-step process to codify decisions that move projects into implementation. This process is undertaken after the Value Pricing Study Format (described later in Section 5.4.3.7) arrives at a preferred strategy. The process involves the following steps:

- Bring preferred strategy to board of directors with revenue forecast and operational concept;
- Get approval by board;
- Gain authority to proceed;
- Finalize design + initial engineering;
- Obtain procurement document;
- Issue request for proposals; and
- Sign contracts.

Technical Aspects

5.4.2 Planning Aspects

5.4.2.1 Operating Priced Facilities in the Region

There are currently two operating priced facilities in the region. The first is the 8-mile, two-lane reversible flow HOT lane facility on I-15 between SR 56/Ted Williams Parkway and Kearny Mesa. These I-15 HOT lanes, called the I-15 Express Lanes, are under expansion.

The second is the South Bay Expressway (SR 125) which opened service on November 17, 2007. The South Bay Expressway connects the only commercial port of entry in San Diego to the regional freeway network and was made possible through a PPP. The southern 9.5-mile section of the 12.5-mile highway was recently constructed as a privately financed and operated toll road. The six-lane toll road was developed under California's AB 680 legislation passed in 1989.[9] SANDAG is responsible for the publicly funded segments known as the Gap Connector which links the tollway to the regional highway system in the north.

The HOT lanes on I-15 were originally built and operated as HOV lanes in 1988. Plans for the HOT conversion began in the early 1990s with SANDAG's efforts to develop air quality control plans. In 1991, City of Poway Mayor Jan Goldsmith, a SANDAG board member, recommended that SANDAG staff look at the possibility of drive-alone commuters paying a fee to use the HOV lanes with the revenues used to improve public transit in the I-15 corridor.[10] In part due to their sole access point, the existing HOV lanes were underutilized, while the parallel purpose lanes were often congested, particularly during peak periods. Aware of the Value Pricing Pilot Program created in the 1991 ISTEA authorization legislation, SANDAG embraced Goldsmith's concept of selling excess capacity on the HOV facility to single occupant motorists and using the proceeds to fund transit service in the corridor.

In May 1991, the SANDAG board passed a resolution to pursue a Value Pricing Demonstration. Following that milestone, Mayor Goldsmith also played a key role in moving the project past the state level hurdles. After moving to a position in the State Assembly, Goldsmith sponsored the original enabling legislation for the HOT facility. Passed in 1993, Assembly Bill 713 authorized a four-year demonstration project from 1994 through 1998. The statute also required that the lanes maintain a particular level of service for HOV users, and that net project revenues after operation expenses be used for transit service and HOV facility improvements in the I-15 corridor.

Following the revised eligibility criteria of the FHWA Value Pricing Pilot Program to include HOT lane projects, SANDAG won a $7.96 million grant in January 1995. The HOV lanes were opened to paying solo drivers in December 1996. Project implementation was structured in two phases, and the use of toll collection technologies on the facility has evolved over time (see Section 5.4.3.6). When the authorization for the original demonstration project was due to sunset in 1998, Assemblyman Goldsmith was an important advocate for its successful extension through January 2000 via AB 267. Since then, the legislation has gone through other rounds of sunset dates and extensions, and each time supporters in the State Assembly and Senate have been important backers.

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[9] http://www.fhwa.dot.gov/PPP/sr125.htm

[10] "San Diego's Interstate 15 High-Occupancy/Toll Lane Facility Using Value Pricing," Institute of Transportation Engineers, ITE Journal, June 1999, Hultgren, Lee, Kawada, Kim. http://findarticles.com/p/articles/mi_qa3734/is_199906/ai_n8865580

5.4.2.2 Current ETC Installations

The existing I-15 HOT lanes—two reversible lanes separated from adjacent roadways by concrete barriers—require paying vehicles to be equipped with SANDAG's FasTrak electronic toll collection technology (Figure 5-7).

As for the newly constructed South Bay Expressway, however, there is one cash toll plaza equipped with automated cash machines, with the goal of eventually converting to all electronic toll collection.

Operated by Transcore, FasTrak uses standard transponder technology. The FasTrak transponder is a small battery-powered radio device, which is mounted inside the vehicle on the windshield and identifies the customer's pre-paid toll account. Overhead antennas in the I-15 Express Lanes read the transponder and deduct the toll electronically from the customer's FasTrak account. An electronic sign located before the entrance to the Express Lanes gives customers advance notice of the current toll as they approach the lanes. Carpoolers and public transit riders, however, use these HOT lanes for free.

Electronic signs with the posted toll rate are placed in advance of the three I-15 Express Lanes entrances at the following locations:

- South of I-15 and Carmel Mountain Road
- South of I-15 and State Route 56/Ted Williams Parkway Northbound
- South of State Route 163 and Kearny Villa Road
- Along Kearny Villa Road on-ramp to State Route 163
- Along on-ramp from State Route 52 to I-15[11]

Traffic measuring devices are also required at the tolling point(s), setting the toll rate to reflect real time traffic conditions. On six-minute intervals the measured level of service (LOS) in the tolling zone is compared to the LOS in a toll rate lookup table to determine whether any adjustment should be made to the toll rate that is charged. By raising the toll rate, SOVs can be discouraged from using the facility when the measured LOS deviates from the targeted LOS.

One of the benefits of using FasTrak is that the system is used on a number of other toll facilities in California, including the 91 Express Lanes and the Foothill (SR 241), San Joaquin Hills (SR 73), and Eastern (SR 133, 241, and 261) Transportation Corridors in Orange County. In the San Francisco Bay area, FasTrak is used on the Carquinez, Benicia-Martinez, Richmond-San Rafael, San Francisco-Oakland Bay, Golden Gate, Antioch, San Mateo-Hayward, and Dumbarton bridges, as well as airport parking facilities.

[11] http://www.sandag.org/services/fastrak/faqs.asp?classid=29andfuseaction=home.classhome#6

5.4.2.3 Initiative in a Context of Regional Goals (Pricing Goals)

SANDAG's primary goal in using pricing is not to raise additional revenue but to move more people and goods. At the core of the Regional Transportation Plan "Mobility 2030" are seven policy goals:

- **Mobility**
  - Tailor transportation modal improvements to reflect supporting land uses in major travel corridors.
  - Make the Regionally Significant Transportation Network the highest priority for regional transportation funding.
  - Minimize drive alone travel by making it fast, convenient, and safe to carpool, vanpool, ride transit, walk and bike, and improve goods movement.
  - Better respond to traffic congestion through greater emphasis on the Congestion Management Program.
- **Accessibility**
  - Achieve a double-digit transit mode share during peak periods, with competitive transit travel times to major job centers.
  - Encourage walkability and better bicycle access within local communities.
- **Reliability**
  - Apply new technologies and management strategies to make travel services more reliable, convenient, and safe, and to reduce non-recurrent congestion.
- **Efficiency**
  - Measure the performance of the regional transportation system on a regular basis and manage its efficiency.
  - Develop cost-effective, voluntary incentive programs for major employers, schools, and residential areas with a goal of reducing peak period travel demand by at least 5% by 2030.
- **Livability**
  - Focus transit improvements in areas with compatible land uses that support an efficient transit system.
  - Use regional transportation funding as an incentive for smarter land uses.
- **Sustainability**
  - Focus roadway and transit improvements in urban/suburban areas, away from the region's rural areas.
  - Evaluate all reasonable non-capital transportation improvement strategies before pursuing major expansions to roadway or fixed guideway capacity.
- **Equity**
  - Provide equitable levels of transportation services for low-income, minority, and elderly and disabled persons.

In addition to the policy goals and objectives of the RTP, SANDAG strives for transparency through an extensive

Figure 5-7. Existing toll facilities in San Diego.

outreach program including focus groups, public meetings, forums, and pricing discussions.

5.4.2.4 Proposed Priced Facilities and their Role in the Regional Network

Pricing applications form an important role in San Diego's Mobility 2030 regional transportation plan which features 75–80 miles of HOT lanes, as shown in Figure 5-8. Key catalysts for the region's vision of developing a network of priced lanes include:

- SANDAG's success in securing Federal money to support pricing projects;
- The support of Mayor Jan Goldsmith who was a strong local advocate for pricing;
- Support from the State Assembly and removal of the 3-year sunset clause from the original pricing pilot project (California Streets and Highway Code § 149.1); and
- Permission from the State Assembly to price two additional corridors in the region (California Streets and Highway Code § 149.4).

The following priced corridors are under planning or construction:

- I-15 Express Lanes (Managed Lanes) are currently an 8-mile, reversible facility originally designated for HOV use, but converted for HOT use. SANDAG, in partnership with Caltrans, is working to expand the two-lane facility to create a four-lane, 20-mile HOT facility, with many entry and exit points. BRT will be integrated into this corridor, and pricing will move from per trip to per mile charges. Construction of the facility will occur in several different phases:
  - The first phase, between Centre City Parkway in Escondido and SR 56/Ted Williams Parkway, opened in the spring 2009. Several bridges along this stretch are being modified to accommodate the Managed Lanes. The Pomerado Bridge, which reopened for public use in January 2007, was demolished and completely rebuilt in just nine months. The new and improved bridge features four express lanes; a pedestrian and bicycle path; a signalized intersection at the west end; upgraded seismic standards; and aesthetic improvements to coordinate with other construction in progress on I-15.
  - The second phase will extend the Managed Lanes north from Centre City Parkway to SR 78 with completion slated for 2011.
  - The third and final phase of the project involves the retrofit and redesign of the existing 8-mile segment of Managed Lanes between SR 56/Ted Williams Parkway and Kearny Mesa. This piece will be operational in 2012.
- The entire construction of the facility is expected to be completed by 2013 and will operate 24 hours a day, 7 days a week.
- I-5 North Coast Corridor is a 26-mile widening project for new managed and HOV lanes for transit and carpools between La Jolla Village Drive (I-5) and Mira Mesa Boulevard (I-805) to Vandegrift Boulevard. The project proposes to add two Managed Lanes in each direction and potentially additional freeway and auxiliary lanes where needed. The project has been identified as a high priority project by SANDAG and is part of the TransNet Early Action Program. Currently, the project is in the preliminary engineering and environmental phase. Construction of the project is expected to be completed in 2015.
- SR 805/I-5 South Corridor is a proposed 28-mile facility in the median of the I-805 corridor between SR 905 and I-5 south of SR 54 to the international border. The facility will include four HOT lanes, two in each direction. Caltrans and SANDAG completed a corridor study for I-805 in 2005. Preliminary engineering and environmental studies are underway, and BRT service is scheduled to begin in 2010. All improvements are planned to be functioning by 2020.
- SR 52 is a proposed 10-mile reversible HOT facility from I-15 east to SR 67. The project will be completed in two phases and continues a number of improvements that have already been implemented in the corridor. The SR 52 East project will extend SR 52 from SR 125 east to SR 67 within the City of Santee and provide a freeway interchange to SR 67. The SR 52 West project will add one additional general purpose freeway lane in each direction and two reversible managed lanes from I-15 to SR 125.[12] SANDAG is completing an environmental planning study for this project through its Value Pricing Program. The SR 52 improvements are expected to cost approximately $654 million and will be funded by state through Proposition 1B and the region using the half-cent TransNet sales tax. Construction on the SR 52 East project was expected to begin in 2008, but was delayed. Original plans called for both SR 52 East and SR 52 West to be completed by the end of 2010, but in mid 2009 it appears unlikely that it will be completed within this timeframe.

Aside from HOT facilities, other pricing applications include:

- Compass—Auto; Smart Car Project.
- Smart Car Parking Pilot.
- Metered Parking Downtown.

[12] http://www.keepsandiegomoving.com/SR 52.html

Figure 5-8. Proposed toll facilities in San Diego.

- Dynamic Bike Lockers—conversion to an electronic standard with smart cards known as eLock Technology.
- Universal payment method; working toward one form of payment, one agency, and one account for all patrons.

5.4.3 Pricing Projects

5.4.3.1 Physical Layout (Description of Planned Pricing Projects)

See Section 5.4.2.4.

5.4.3.2 Pricing Forms/Options (Types of Pricing)

SANDAG's policy utilizes dynamic pricing on I-15 and intends to use this type of pricing on all pricing projects. Dynamic pricing reflects real time travel conditions and the desired use of the facility through minimum and maximum toll ranges. On the South Bay Expressway, however, a fixed pricing system is used. An axle multiplier is applied to the base toll with the expectation of increased truck traffic. Price levels will be set by the Board of California Transportation Ventures (CTV), the private developer of the facility.

5.4.3.3 Initial Screening/Selection (Process for Identifying Pricing Projects)

The process used by SANDAG to screen pricing alternatives on the I-805/I-5 South Corridor is indicative of the agency's approach on other pricing studies. In this case, an initial screening of alternatives involved a qualitative analysis and the development of a set of quantitative measures to capture the performance of each transportation alternative regardless of travel mode. The study area performance measures included:

- People moved;
- Travel time savings;
- Congestion relief;
- Number of work trips using alternative modes;
- Ratio of capital cost and TTS;
- Work/school trips within 30 minutes (peak periods) and non-work trips within 15 minutes (daily);
- Congested travel conditions at peak periods and daily; and
- Number of homes within 1/2 mile of a transit stop and jobs within 1/4 mile of a transit stop.[13]

Once a pricing strategy or alternative is chosen, the process for identifying toll levels depends on actual travel conditions in the corridors involved. The price levels are based on a toll rate table designed to maintain free flow conditions on the managed lanes. The history of SANDAG's approach to tolling is described in greater detail in Section 5.4.3.6.

5.4.3.4 Toll Collection Technologies Considered

All existing and future toll collection operations in greater San Diego use ETC, with the exception of one cash toll plaza in the South Bay Expressway, which will ultimately be converted to ETC only. In the near future, SANDAG has plans of moving toward network technology to more effectively price its managed lane facilities and detect and react to isolated traffic build-up on those lanes. The new algorithm (known as the "Toll Override" or "Override Algorithm") would be calculated in a back office computer located in the customer service center (rather than the tolling zone) where internet access is available to obtain the necessary web published Caltrans loop data.[14]

5.4.3.5 Project/Pricing Alternatives (Process for Defining Pricing Projects)

See Sections 5.4.3.7.

5.4.3.6 Project/Pricing Alternatives (Tolling Options)

During the initial phase of the I-15 HOT conversion, known as ExpressPass, users were issued a vehicle permit which allowed unlimited use of the HOV lanes. At first, only 500 monthly permits were sold, priced at $50 per month. SANDAG issued 200 more permits in February 1997 and one month later raised the permit price to $70 per month. In June of 1997, transponders were introduced on the facility. Whereas visual inspection was required previously to determine whether a vehicle had the required window decal permits, transponders allowed for electronic enforcement of permit requirements. The transponders also facilitated the collection of data about usage of the HOT lanes.

In March 1998, variably priced per-trip tolls replaced the flat monthly fee when FasTrak ETC technology was introduced on the HOT lanes. Dynamically priced tolls are collected electronically and are re-set every six minutes to reflect real-time traffic conditions. On normal commute days, the toll ranges between $0.50 and $4.00, depending on current traffic conditions; however, tolls may be raised up to $8.00 in the event of severe traffic congestion. The actual toll at any given time is posted on roadside signs to inform drivers of the current price for using the lanes. To preserve the carpooling incentives that existed with the original HOV lanes, carpools and other vehicles with two or more occupants may

[13] *I-805/5 South Corridor Study* (2005).

[14] *I-15 FasTrak Toll Modification Study* (2006).

always use the FasTrak lanes at no cost. The lanes operate only during peak hours in the direction of the commute. From 5:30 AM to 11 AM, all vehicles in the HOT lanes travel southbound; from 11:30 AM to 7:30 PM, all vehicles travel northbound.[15]

Beginning in late 2002, the Express Lanes experienced recurring congestion at the north end of the facility during the northbound commute. In order to maintain the target level of service (LOS) (about 21 vehicles per 30 seconds),[16] SANDAG wanted to better manage congestion on the lanes by instituting additional controls to lessen the demand by SOVs during periods of peak congestion. In 2004, SANDAG initiated a study to assess and modify the current electronic toll collection system. This study analyzes traffic patterns more thoroughly and identifies an appropriate procedure to vary the existing toll schedule based on information from points other than the loops on the south end.

In 2005, the I-15 Toll Modification Final Report was released including recommendations to address the changing traffic conditions on the I-15. Originally, only one tolling point existed approximately two miles from the southern end of the facility. As a result, value pricing was measured exclusively at the one tolling point, and when localized congestion occurred elsewhere in the facility, the system would not be able to detect the effects in sufficient time to trigger a toll adjustment.

In response, SANDAG has made enhancements to its electronic toll collection system, involving:

- The use of additional traffic measuring sensors to detect and react to congestion build-up in isolated areas in the corridor; and
- The use of additional traffic measuring sensors to determine when traffic congestion is so severe that it cannot be addressed by toll adjustments and Express Lanes must be closed to FasTrak vehicles.

Additionally, the 2005 assessment found that the primary cause for weak SOV response to price is because maximum toll levels were capped near $2.00 outside of narrowly defined peak hours. Maximum toll levels should be raised to reflect actual traffic demand within the adopted toll policy minimum ($0.50) and maximum ($8.00) price.

5.4.3.7 Evaluation of Alternatives (Process for Assessing Pricing Projects)

SANDAG has developed its own local "Value Pricing Study Format" which is similar to a Major Investment Study. They do their own traffic modeling in-house and embed it in the state's environmental review procedures in an attempt to streamline the process.

The typical protocol for completing these assessments is as follows:

- Conduct initial feasibility study (state and local)
- Create corridor plan
- Begin MIS process
- Select pricing
- Establish toll revenue study with environmental documents led by Caltrans (A timeline is built around the Caltrans study, and SANDAG usually defers the value pricing study near the end of the environmental process.)

Initial studies will generally address the following key issues:

- **Demand:** Is sufficient demand, in terms of AM and PM peak hour use, present in various time horizons to justify pricing managed lanes?
- **Access:** Can access be provided to the managed lanes with sufficient frequency to adequately meet transit, HOV, and priced demand?
- **Pricing Strategy:** What is the most appropriate pricing strategy for the corridor and why?
- **Impacts to Adjacent Traffic:** What are the impacts to adjacent traffic caused by managed lanes, and can these impacts be adequately mitigated?
- **Technology:** What are the functional and performance monitoring needs to support a pricing strategy?
- **Revenue:** What is the potential revenue generated from pricing the managed lanes?
- **Public Attitudes:** Are public, agency, and key stakeholder attitudes favorable toward pricing? What issues need to be addressed?
- **Equity:** What equity issues, if any, are created by pricing the managed lanes?

5.4.4 Cost Estimates

5.4.4.1 Conceptual Cost Estimate

I-15: The total cost for the freeway improvements, including expansion of FasTrak and the transit elements of the I-15 Managed Lanes, is estimated to be approximately $1.1 billion in current dollars.[17]

South Bay Expressway: The capital cost of the 12.5-mile, privately-financed South Bay Expressway was about $635 million, while that for the publicly funded GAP connector and interchange was $138 million.

[15] http://www.its.dot.gov/JPODOCS/REPTS_TE/13668_files/chapter_7.htm

[16] *I-15 Toll Override Study, Phase 1 Report* (2004).

[17] http://www.keepsandiegomoving.com/i15about.html

I-5 North Coast Corridor: Cost data for the I-5 remains in flux and is estimated to be as high as $1.3 billion.

SR 805/I-5 South Corridor: A preliminary cost estimate by Caltrans and SANDAG in 2004 estimated capital costs at $7.3 billion. Total costs including capital, operations, and maintenance is estimated to be about $8.2 billion.[18]

SR 52: SR 52 East is estimated to cost about $447 million and SR 52 West is estimated at about $209 million.

5.4.5 Traffic and Revenue Forecast

5.4.5.1 Forecasting/Modeling Tools (Analytical Tools for Assessing Pricing Projects)

SANDAG uses TransPLAN and is now updating its model to a TransCAD environment. The new model will include a new pricing sensitivity element which was not previously included. SANDAG adopted the new program (Series 11) in November 2007.

SANDAG is the first MPO to implement this program. Previously, SANDAG relied on proprietary models prepared by Wilbur Smith. Now they have developed their own tool to replicate what other proprietary models could do.

5.4.5.2 Summary of Traffic Forecasts

I-15: Over the last decade, ADT on the existing corridor has increased an average of 58% from 185,000 to 292,000 in 1999. Year 2020 (No Build) traffic projections show 380,000 ADT, an increase of approximately 30% over 1999 traffic volumes due to planned future development. Currently, there is a split with congestion only occurring in the peak direction. By 2020, traffic without the project would increase to the point where there is heavy congestion in both the peak and reverse peak directions.[19]

I-5 North Coast Corridor: Average daily traffic is expected to almost double to 430,000 daily vehicles by the year 2030, and over 10,000 daily truck trips are expected on the I-5.[20]

SR 805/I-5 South Corridor: Average daily traffic on SR-805 ranges from 110,000 to 250,000 vehicles with daily congestion lasting between two and four hours. ADT is expected to exceed 330,000 vehicles in 2030, with congestion lasting over six hours.[21]

SR 52: The completion of SR 52 to SR 67 is critical in that it provides an important link in regional traffic circulation plans. By the year 2025, the segment will carry approximately 110,000 vehicles a day.

[18] *I-805/5 South Corridor Study* (2005), p. 69.

[19] *Final Initial Study/Environmental Assessment* (2002), p. 5; <http://www.dot.ca.gov/dist11/I15managed/I-15/I-15.htm>

[20] http://www.sandag.org/index.asp?projectid=300andfuseaction=projects.detail

[21] http://www.keepsandiegomoving.com/i-805.html

5.4.5.3 Summary of Revenue Projections

I-15: Table 5-7 shows estimated annual toll revenues of up to $25.6 million in year 2015 (in 2001 dollars) for the I-15 Managed Lanes.

I-5 North Coast Corridor: Revenue evaluations assumed a toll rate structure based on the I-15 Managed Lanes for calibration purposes, including variable pricing of managed lanes based on volume-to-capacity ratio. Findings indicated that a per-mile toll and revenues would be higher in the southern portion of the I-5 corridor due to higher demand in this section. Two alternatives were studied: eight general purpose lanes (the current number) with four managed lanes (8+4) and 10 general purpose lanes with four managed lanes (10+4). In 2030 for the 8+4 alternative, there is no available capacity in the managed lanes for SOV toll users in the southern portion during peak periods. With a 10+4 alternative, the base toll (uncongested) for the entire length is $4.00 in 2015 ($0.16 per mile) and $6.00 in 2030 ($0.26 per mile), based on the derived validations from the SR 91 managed lanes in Orange County, California. In 2015, the toll is estimated to reach almost $14 during congested conditions based on future year dollar values. In 2030, the toll is estimated to be over $26 during congested conditions. A summary of forecast revenue is provided in Table 5-8.

Revenue forecasts were unavailable for the SR 805/I-5 South and SR 52 corridors.

5.4.6 Financial Aspects

5.4.6.1 Revenue Use

According to California code 149.1 (with respect to the I-15 HOT facility), "all remaining revenue shall be used in the I-15 corridor exclusively for (A) the improvement of transit service, including, but not limited to, support for transit operations, and (B) high-occupancy vehicle facilities and shall not be used for any other purpose."

Approximately $1.5 million per year is collected in I-15 toll revenues. More than $7 million in I-15 toll revenues has been used to fund express transit service in the corridor since 1997.[22]

For the value pricing and transit development demonstration program on two corridors in San Diego County, California Code 149.4 states:

> The revenue generated from the program shall be available to SANDAG for the direct expenses related to the operation (including collection and enforcement), maintenance, and

[22] http://www.keepsandiegomoving.com/i15about2.html

Table 5-7. Estimated I-15 annual toll revenue by scenario.

	Base Scenarios					Sensitivity Scenarios	
Year	A-1	A-2	B-1	B-2	C-1	B-1-a	B-1-b
2005	$7,654	$7,521	$7,784	$7,183	$7,688	$4,274	$16,259
2006	7,856	7,741	7,810	7,442	7,676	4,495	17,298
2007	8,063	7,968	7,836	7,711	7,664	4,727	18,403
2008	8,276	8,202	7,862	7,989	7,652	4,972	19,580
2009	8,495	8,442	7,888	8,277	7,640	5,229	20,831
2010	8,719	8,690	7,914	8,576	7,628	5,499	22,162
2011	8,894	9,019	8,105	8,680	7,790	5,812	22,819
2012	9,072	9,360	8,301	8,786	7,955	6,144	23,495
2013	9,254	9,715	8,501	8,893	8,123	6,494	24,191
2014	9,440	10,082	8,707	9,001	8,295	6,864	24,907
2015	9,629	10,464	8,917	9,111	8,471	7,255	25,645

Source: I-15 Managed Lanes Concept Plan, Wilbur Smith Associates, 2002.

Notes: (All Revenue in 2001 Dollars)
A-1: Flat Rate/All Entries
A-2: Flat Rate/Max. Trip Per Entry
B-1: Standard Per Mile Rate
B-1-a: Standard Per Mile Rate with FixedBarrier (2 lanes/direction)
B-1-b: Standard Per Mile Rate with Only HOV-3 + Free
B-2: Skewed Per Mile Rate
C-1: Standard Rate Per Segment

administration of the demonstration program. Administrative expenses shall not exceed three percent of the revenues.

All remaining revenue generated by the demonstration program shall be used in the corridor from which the revenue was generated exclusively for preconstruction, construction, and other related costs of high-occupancy vehicle facilities and the improvement of transit service, including, but not limited to, support for transit operations pursuant to an expenditure plan adopted by SANDAG.

Although SANDAG's primary goal is not to raise revenue, generating more revenue in the future may be increasingly important to support the services needed to maintain and improve mobility throughout the region.

5.4.6.2 Supporting Federal Programs

SANDAG was one of the first organizations to secure Federal monies to study pricing through the FHWA Value Pricing Program, which was established under ISTEA in 1992. As the recipient of four successful value pricing grants, these monies enabled SANDAG to convert the I-15 HOV lanes to HOT operation, assess its performance, refine HOT enforcement procedures, and undertake its smart parking initiative.

5.4.6.3 Financial Deal

TransNet. The TransNet program is a half-cent sales tax initially passed in 1978. In 2004, Proposition A passed, which provided funding for the expansion of the local transportation system through 2048. The program secures $14 billion through 2048 directed toward specific transportation projects for highway, transit, and local streets, roads, and arterials Each year, $1 million is dedicated to bicycle and pedestrian projects and another million is directed toward smart growth. One of the keys to the successful passing of this proposition was the implementation of an independent taxpayer oversight committee (ITOC) that monitors the use of the TransNet funds.

Table 5-8. Summary of I-5 managed lanes annual revenue (in millions).

	2030	
Location	8 + 4	10 + 4
s/o SR 56	$6.656	$4.329
s/o Via de la Valle	$6.274	$3.983
s/o Manchester Avenue	$2.076	$1.154
n/o Encinitas Boulevard	$2.421	$1.478
s/o Palomar Airport Road	$1.203	$0.837
n/o Carlsbad Village Drive	$0.882	$0.629
n/o SR 76	$0.227	$0.225
TOTAL	**$19.739**	**$12.635**

Source: I-5 North Coast Value Pricing Planning Study Concept Plan – Vol.1, PB Consult, 2006.

SANDAG approved the $3 billion TransNet Early Action Program to advance construction on improvements to I-5, I-15, I-805, SR 52, SR 76, and Mid-Coast corridors. SANDAG, Caltrans, and consultants from PBS&J, have created the TransNet Dashboard to keep stakeholders informed on the status of TransNet Early Action Program projects. The TransNet Dashboard provides up-to-date schedule, budget, and expenditure information.

Additional information on TransNet is available at: *http://www.keepsandiegomoving.com/home.html*

CMIA. In addition to TransNet, the Corridor Mobility Improvement Account (CMIA) provides approximately $4.5 billion in funding to reduce congestion, enhance mobility, improve safety, and promote stronger connectivity along key corridors throughout the state.

Voters approved the Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond of 2006 as Proposition 1B on November 7, 2006. This act includes a program of funding to deposit $4.5 billion into the CMIA. To determine the projects to receive portions of this funding, Caltrans submitted nominations to the California Transportation Commission (CTC) for review in January 2007.

On February 28, 2007, the CTC approved the following projects to receive CMIA funding:

- **I-15 Managed Lanes South Segment—**$350 million approved to fully fund this segment
- **I-5 Extension of the HOV Lane (I-805/Carroll Canyon Road to Manchester Drive)—**$82 million was added, combined with $52 million regional funds
- **I-805 Auxiliary Lanes (two southbound from E Street to SR 54)—**Commitment to program $19.4 million[23]

I-15: SANDAG and Caltrans have secured $199 million in TransNet funds for the complete construction of the Managed Lanes. Recently SANDAG secured $350 million and an additional $50 million in Proposition 1B STIP augmentation from the Corridor Mobility Improvement Account (CMIA) from the California Transportation Commission (CTC). To date, Congress has appropriated $4.7 million (FY 2004 $2 million; FY 2005 $1.7 million; FY 2006 $1 million) and $5 million was included in SAFETEA-LU.

South Bay Expressway: Developed as a PPP though CA AB680, the South Bay Expressway benefited from a $140 million TIFIA loan—the first ever provided to a private toll road development. The 38-year loan has a fixed rate borrowing cost equal to 30-year treasuries. $160 million for the northern segment GAP connector came from federal-aid matched with TransNet local transportation sales tax revenues. The remaining $635 million of project costs were raised by the private concessionaire, California Transportation Ventures (CTV).

SR 52 East: Along with the local TransNet half-cent sales tax funding, additional federal funds will be needed to address increases in right-of-way and bridge construction costs. Thus far, Congress has appropriated $1.5 million and $10 million was included in SAFETEA-LU.

5.4.7 Institutional Framework

5.4.7.1 Name/Type of Agency

SANDAG/Regional Planning Agency

5.4.7.2 Institutional Structure

SANDAG is composed of 18 cities and county governments, together serving as the regional decision-making body. SANDAG is governed by a Board of Directors composed of mayors, council members, and county supervisors from each of the region's 19 local governments. Supplementing these voting members are advisory representatives from Imperial County, the United States Department of Defense, Caltrans, San Diego Unified Port District, Metropolitan Transit System, North County Transit District, San Diego County Water Authority, Southern California Tribal Chairmen's Association, and Mexico. The Board of Directors is assisted by a professional staff of planners, engineers, and research specialists.

5.4.7.3 Procurement Approach

SANDAG's procurement approach is unique in that local transportation solutions are proposed to address local transportation needs and issues. Proposed projects are submitted to the Board and are chosen based on criteria set forth by the SANDAG legislative committee. The Legislative Program is approved by the Board of Directors on an annual basis. The program includes the agency's legislative policies and sets priorities for possible federal and state legislation and local activities for the calendar year. As part of the Legislative Program, the Board also approves a list of transportation projects for funding consideration during the annual federal appropriations process. The current list of approved transportation projects can be viewed at: http://www.sandag.org/organization/about/pubs/transportation_projects.pdf.

The Caltrans approach, however, utilizes a competitive bid, design-build approach such as the South Bay Expressway, which was funded by California Transportation Ventures (CTV).

[23] http://www.keepsandiegomoving.com/i5-cmia.html

5.4.8 Legislation

5.4.8.1 Mandate

AB 2032 (2004) Existing law (California Streets and Highways Code § 149.1)[24] authorizes SANDAG to conduct, administer, and operate a value pricing and transit development program on a portion of I-15 in San Diego County, under which single-occupant vehicles may use designated HOV lanes at certain times of day upon obtaining a permit and paying a fee, otherwise known as a HOT lane.

AB 2032 (2004) authorizes SANDAG, the Sunol Smart Carpool Lane Joint Powers Authority, the Santa Clara Valley Transportation Authority, and the Alameda County Congestion Management Agency to undertake similar value pricing programs involving various other HOT lanes under the jurisdiction of these sponsoring agencies. Specifically, California Streets and Highways Code § 149.4 authorizes SANDAG to conduct, administer, and operate a value pricing and transit development demonstration program on a maximum of two transportation corridors in San Diego County.[25]

The full text of AB 2032 can be obtained at the following web page: http://www.leginfo.ca.gov/pub/03-04/bill/asm/ab_2001-2050/ab_2032_bill_20040909_chaptered.pdf

In November 2004, voters approved Proposition A, extending the TransNet program to 2048. Proposition A also mandated the formation of an ITOC for TransNet. This committee will oversee the expenditure of TransNet funds and ensure that voter mandates are carried out. The ITOC may also make recommendations to improve the program's financial integrity and performance.

5.4.9 Public Outreach/Involvement

5.4.9.1 Public Involvement (Decision-Making Innovations)

SANDAG operates a Public Involvement Program, designed to inform and involve the region's residents in the decision-making process on issues such as growth, transportation, environmental management, housing, open space, air quality, energy, fiscal management, economic development, and public safety.

Public participation is encouraged at board and committee meetings, technical working groups, and ad hoc committee meetings. Additionally, outreach and market research have involved focus groups, telephone surveys, and intercept surveys to assess users' attitudes toward variable tolling when traveling in particular corridors. The findings from these preproject studies form the basis of strategies for pricing levels and customer communications.

Prior to launching its initial ExpressPass pilot in 1997, SANDAG worked with consultants to develop a project identity and background materials, as well as to formulate a promotion plan for Phase I of the project. A newsletter, the *I-15 Express News,* was used to introduce the ExpressPass Program as well as to provide updates about the facility as toll operations evolved. Town hall meetings were also held for communities in the corridor to publicize the project. To prepare for Phase II, when the facility transitioned from a monthly pass to per trip tolls, SANDAG used radio advertisements and a name-the-bus contest to raise public awareness of the coming changes.

Current Status and Documentation

5.4.10 Current Status of Pricing Projects

The current expansion of I-15 is being completed in three phases (described in Section 5.4.2.4) and is expected to be fully completed and open in 2013. For other pricing projects, please see Section 5.4.2.4.

5.4.11 Planning Studies or Reports

To date, SANDAG has completed Value Pricing Studies for I-15 (Wilbur Smith 2002) and I-5 (PB 2005/6). A corridor study for I-805/5 South was conducted by SANDAG and completed in June 2005. CH2M Hill has been working on a Value Pricing Study for SR 52, but that project is currently on hold. For links to the project websites and respective studies, please visit: http://www.sandag.org/index.asp?subclassid=10andfuseaction=home.subclasshome.

MOBILITY 2030, the long range regional transportation plan was completed and approved in November 2007. MOBILITY 2030 provides a public policy blueprint for the region's transportation and mobility plan for the next 25 years. The plan can be viewed at: http://www.sandag.org/index.asp?newsid=499andfuseaction=news.detail.

Summary of Critical Issues/Lessons Learned

Working together in partnership with Caltrans in the planning, implementation and operation of its pricing projects, SANDAG's pricing experience over the past 15 offers has benefited from several strong fundamentals, together with a locally developed vision that has moved forward in small and incremental steps. The process began in 1988 with the opening of a two-lane, eight-mile reversible-flow HOV facility on

[24] http://www.leginfo.ca.gov/cgi-bin/displaycode?section=shc&group=00001-01000&file=90-155.6

[25] http://www.leginfo.ca.gov/cgi-bin/displaycode?section=shc&group=00001-01000&file=90-155.6

the I-15 corridor leading north from Downtown San Diego. With only access and egress ramps connecting to various freeways and roadways on either end, the barrier-separated facility was underutilized—a fact which led a forward thinking elected official to suggest three years later that the facility might also be opened to paying SOV motorists.

This development coincided with the passage of ISTEA in 1991, which established the FHWA Value Pricing Pilot Program to test the concept of using roadway pricing as a tool to manage congestion. While the draft ISTEA legislation was being finalized, SANDAG's Board passed a resolution to pursue value pricing in San Diego, and later with the support of former mayor of Poway, Jan Goldsmith, who was then a state legislator, SANDAG received a number of approvals from the state that paved the way for the conversion of the I-15 HOV lanes to HOT operation.

Undeterred by the rejection of its initial grant application, SANDAG was successful in securing an $8.0 million grant from the FHWA Value Pricing Pilot Program in January 1995 to support the conversion of I-15. When the facility opened to HOT operation, subscribers were issued monthly permits and were required to display stickers on their vehicles in order to use the HOT lanes. After a two-year trial period that convinced local decision makers of the project's popularity and success, SANDAG replaced the sticker system with a transponder-based ETC system in March 1998, becoming the first transportation agency in the United States to charge real-time, dynamically priced tolls based on demand in the general purpose lanes.

SANDAG capitalized on the momentum generated from the success of the I-15 HOT conversion and studied the possible expansion of the I-15 HOT lanes as well as the use of the HOT concept in a number of other corridors. Unlike other state and regional governments conducting similar explorations around the country, SANDAG's interest in the use of pricing was not to generate a new revenue stream to support transportation needs, but rather to manage congestion and provide new travel options.

SANDAG's focus on the use of pricing to manage congestion was underpinned by two voter-approved referenda providing significant amounts of local funding for transportation improvements. Enacted in 2004, Proposition A extended a half cent sales tax dating from 1978, raising $14 billion in local transportation funding through 2048. Two years later, Proposition B provided an additional $4.5 billion in funding to reduce congestion, enhance mobility, improve safety and promote stronger connectivity along key corridors throughout the county.

Both of these elections ratified SANDAG's vision of developing a regional network of priced, managed highway lanes, as articulated in its long-range plan, MOBILITY *2030,* which was released in 2003. An additional factor in the success of SANDAG's propositions was the implementation of an Independent Taxpayer Oversight Committee to monitor the use of the TransNet funds and to keep stakeholders informed and up-to-date on the status, schedule, budget, and expenditures of TransNet Early Action Program Projects, which included improvement on the I-5, I-15, I-805, SR 52, SR 76, and Mid-Coast corridors.

In addition to being the first metropolitan area in the United States to develop an operating HOT lane facility, San Diego is home to the nation's first dynamically priced ETC system, and is the nation's first metropolitan area to include a regional network of variably priced managed lanes in its long-range transportation plan. SANDAG's success has built on strong fundamentals including an under-performing HOV facility, local political support for pricing, effective outreach, and a proven and innovative track record. An additional aspect distinguishing SANDAG's pricing program is that it is a local initiative instigated by a local transportation and planning authority to meet well recognized local needs. Together, these factors have enabled SANDAG to gain a local voter mandate for its use of pricing with the passage of Proposition A and 1B securing funding for a core of projects included in its long range strategic plan. As San Diego's MPO, SANDAG has created local policy that aligns with local projects and local needs. This has been integral to its success in embracing pricing as a means to manage congestion and meet regional transportation needs.

While San Diego's use of pricing is cutting edge, it is interesting to note that the region has relied upon traditional funding sources to implement its pricing projects. This began with pilot funds from FHWA for the $8 million conversion of the I-15 HOV lanes and continues with the use of local and federal funds for the $1.1 billion expansion of the I-15 HOT system. While most metropolitan areas in the United States do not have access to the magnitude of local funding provided through the TransNet program, the fact that SANDAG's pricing projects have not had to be self financed has simplified their implementation. This particular factor differentiates SANDAG from the other four case study agencies included in this report, each of which proposes to use project toll revenues to pay for all or a substantial part of their pricing projects. Nonetheless, SANDAG staff report that revenue generation is likely to play an increasingly important role in the future to meet investment needs.[26]

5.5 Virginia Department of Transportation

The Commonwealth of Virginia is one of a handful of states that has built new greenfield toll road facilities since the establishment of the Interstate Highway System. The

[26] Derek Toups, interview, October 12, 2008.

Commonwealth's first toll road was the Dulles Toll Road, a 14-mile, eight-lane toll highway that opened in 1984, connecting the Capital Beltway with Dulles International Airport. The Dulles Greenway, a 14-mile extension of the Dulles Toll Road was the State's second modern-era toll project. This project was sponsored by Loudoun County and was implemented as a PPP.

Tolling gained further momentum in the state with the passage of Virginia's revolutionary PPTA of 1995. Virginia became the first state in the country to allow the Virginia Department of Transportation (VDOT), local governments, and certain other public entities to enter into agreements authorizing private entities to develop and/or operate qualifying transportation facilities. One of the interesting aspects of the PPTA legislation is that it allowed the state to receive unsolicited offers to develop PPP projects. In the mid 2000s, VDOT received unsolicited offers to develop privately financed HOT lanes on both the I-495 Virginia Capital Beltway and on the I-95/I-395 corridor—two of the most heavily traveled highway corridors in the Northern Virginia suburbs of Washington, D.C. Meanwhile in Richmond, VDOT opened a new toll facility—the 8.8-mile Pocahontas Parkway—in 2002. This was only the second toll facility in the United States to be financed by a 63-20 public benefit corporation.

These various tolling projects are described in further detail in the remainder of this case study.

In addition to these pricing projects in Virginia, there are multiple pricing projects proposed in the neighboring state of Maryland including: Maryland West-Side Beltway/270, HOT lanes on I-95 north of Baltimore, HOT lanes on the Maryland portion of the I-495 Capital Beltway, and the new InterCounty Connector, a $2.4 billion, 18-mile, express toll lane facility in Montgomery and Prince George's Counties.

Decision-Making Process

5.5.1 Decision-Making Stages

PPTA procurements in Virginia are conducted in two phases. During the first or "conceptual" phase, proposers must submit the information on the following, with the recognition that specific details on certain aspects of the projects may yet to be developed:

- Qualification and Experience;
- Project Characteristics;
- Project Financing;
- Public Support; and
- Project Benefit and Compatibility.

Conceptual proposals may either be solicited by the VDOT, or submitted on an unsolicited basis. In the event that VDOT receives an unsolicited PPTA offer and decides to accept it, the Department is obligated to issue a request for solicitations for the project within one month of the decision to move forward in order to allow competing offers to be received.

VDOT then invites all or a shortlisted number of bidders to submit detailed proposals for further evaluation. In the event that variant offers are received as the result of a procurement initiated on an unsolicited basis, the detailed proposal phase enables VDOT to clarify the components of the project and request that all bids address parallel scopes of work to enable an "apples to apples" comparison.

The protocol for evaluating PPTA proposals in Virginia is as follows:

- **Phase One: Quality Control.** VDOT's quality control evaluation assesses whether the proposal addressed the needs identified in the appropriate local, regional, or state transportation plan and whether it identified public needs that may not be wholly satisfied with existing methods of procurement. The review also identifies whether the proposal will result in the availability of the facility to the public on a more timely, more efficient or less costly fashion and provide for cost and/or risk-sharing with private entities.
- **Phase Two: Independent Review Panel.** The Independent Review Panel (IRP) consists of members of the Commonwealth Transportation Board (CTB), VDOT representatives, and transportation professionals; members of the academic community; and representatives of other entities affected by the proposal. The IRP reviews and evaluates all proposals based on the evaluation and selection criteria specified in the PPTA guidelines. The IRP formulated recommendations to VDOT and the CTB on advancing PPTA offers to the detailed review phase.
- **Phase Three: CTB Recommendation.** Following Phase Two, the CTB reviews the conceptual proposals and any recommendations of the IRP and recommends whether to advance to a detailed proposal and further evaluation and action by VDOT under the PPTA. If public funds are proposed, the CTB is asked to recommend funding levels in order to advance to the next phase.
- **Phase Four: Submission and Selection of Detailed Proposals.** VDOT forms a proposal review committee to review the recommendations of the IRP and CTB, and may request that none, one, or more proposer(s) submit detailed proposals. Detailed proposals should be consistent with the recommendations of the IRP, CTB, and the provisions and evaluation criteria as defined in the Department's Request for Detailed Proposals (RFDP). Based upon a review of the detailed proposals, VDOT may select none, one, or more proposals for competitive negotiations.

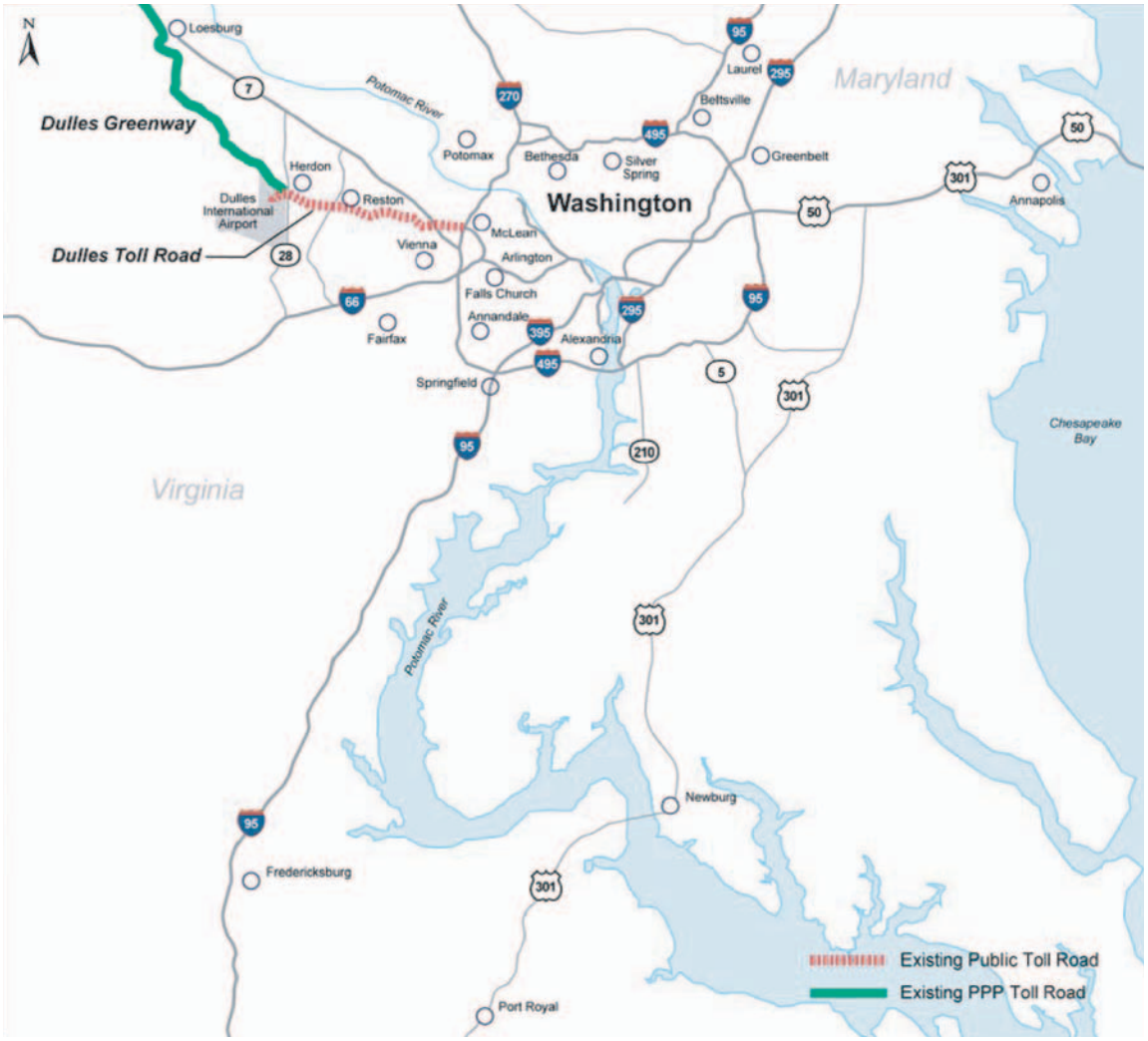

Figure 5-9. Existing toll facilities in Northern Virginia.

- **Phase Five: Negotiations.** If VDOT, upon review of the detailed proposal, determines (1) that the proposal meets the selection criteria established for evaluation, and (2) that initiation of the negotiation stage is in the public interest, VDOT may initiate the negotiation stage. Components of the negotiations for the interim and/or the comprehensive agreement address the rights and obligations of the parties, set a maximum return or rate of return to the private entity, determine liability, and establish dates for termination of the private entity's authority and dedication of the facility to the Commonwealth.
- **Phase Six: Interim and/or Comprehensive Agreement.** Once VDOT and the selected proposer have finalized the draft language of the interim and/or comprehensive agreement, the draft version is forwarded to the Office of the Attorney General for review and approval. The Commissioner has the statutory authority to enter into an agreement under the PPTA once the Department has received written approval of the procurement method from the Secretary of Transportation.[27]

Technical Aspects

5.5.2 Planning Aspects

5.5.2.1 Operating Priced Facilities in the Region

Virginia is currently home to five operating toll highway facilities. Figure 5-9 shows the two operating toll facilities in Northern Virginia.

Dulles Toll Road. Opened to service in 1984, Dulles Toll Road is a 14-mile, eight-lane limited access highway that is

[27] http://www.virginiadot.org/business/ppta-process.asp

owned and operated by VDOT. The facility extends from Capital Beltway to Dulles Greenway's (private toll road) Mainline Plaza and provides access to Dulles International Airport. The facility was built in the same corridor as Dulles Access Road, a four-lane, non-toll facility built in 1962 to provide access to the airport. Dulles Toll Road is one of the first toll facilities built by a state DOT since the establishment of the Interstate Highway System.

Dulles Greenway. Dulles Greenway (Figure 5-9) is a 14-mile, limited-access highway extending from the State-owned Dulles Toll Road, which carries traffic between Washington's Capital Beltway and Dulles Airport, to Leesburg. The two roads connect at a toll plaza. Drivers pay one toll, which the operators of the two facilities divide. Vehicles equipped with prepaid electronic tags may drive through "Fastoll" lanes without having to stop at a toll booth; their tags are read and their accounts debited automatically.

The Greenway is a real toll DBFO project, with operational responsibilities reverting to the Commonwealth of Virginia after 42.5 years. The developers receive the profits (assuming that the market eventually provides profits) for a long enough period to recoup their investment. Virginia's State Corporation Commission limits the rate of return on the project to 18%, but profits appear unlikely to approach that level anytime soon.

To finance the Greenway, the Toll Road Investors Partnership II (TRIP II) concession company put up $40 million in equity, and secured $310 million in privately placed taxable debt. Ten institutional investors led by CIGNA Investments, Prudential Power Funding Associates, and John Hancock Mutual Life Insurance Company provided $258 million in long-term, fixed-rate notes (due in 2022 and 2026). Three banks (Barclays, NationsBank, and Deutsche Bank AG) agreed to provide part of the construction funding and $40 million in revolving credit. Loans are to be repaid with toll revenues, and the financing is secured by a first mortgage and security interest in the developer's right, title, and interest in the facility.

When the Greenway opened to traffic in September 1995, tolls were $1.75 each way, but when traffic fell short of projected levels, the level was reduced to $1.00. This attracted more users, but not to the extent that the decrease in toll pricing led to increased revenues. Tolls were increased to $1.15 in July 1997 and the Virginia General Assembly allowed the speed limit on the facility to be increased from 55 to 65 miles per hour.

Still facing financial challenges, TRIP II restructured its debt in 1999 and agreed to an extension of the project. In 2001, the Virginia State Corporation Commission extended TRIP II's concession period for an additional 20 years to 2056. Tolls were increased most recently in September 2004 and feature varied peak and discounted off-peak point-to-point rates.

In August 2005, Macquarie Infrastructure Group (MIG) agreed to purchase TRIP II for $617.5 million. This included a payment of $84.5 million to Kellogg Brown and Root for its 13.3% share of the company, and $535 million to the Shenandoah Group, the family-held company that had bought out Autostrade's former 30% share to hold 86.5% of TRIP II's stock.

In July 2006, TRIP II sought regulatory approval for new toll rates on the Greenway, proposing variably priced tolls with a ceiling of $4.00, $4.50 and $4.80 during peak weekday periods in the peak direction in 2009, 2010 and 2012, respectively. Macquarie is also contemplating widening the facility to as many as 12 travel lanes.

Figure 5-10 shows the three operating toll facilities in the Richmond/Tidewater area.

Pocahontas Parkway. Pocahontas Parkway (Route 895) is an 8.8-mile tolled highway seven miles south of Richmond, Virginia (Figure 5-10). The four-lane road connects Chippenham Parkway at I-95 in Chesterfield County with I-295 south of Richmond International Airport in Henrico County. Pocahontas Parkway was the first construction project implemented under Virginia's PPTA of 1995 and is only the second transportation project nationwide to be financed through a 63-20 corporation. Construction began in the fall of 1998 and the Parkway was opened to traffic in stages between May and September 2002. The facility includes a high-level bridge over the James River and an interchange at Laburnum Avenue.

After 18 months of negotiation between VDOT and Transurban (USA), a private Australian toll road operator with subsidiaries in the United States, Transurban executed an Asset Purchase Agreement with the Pocahontas Parkway Association (PPA) and entered into the Amended and Restated Comprehensive Agreement (ARCA) with VDOT on June 29, 2006. Under the terms of the agreement, Transurban has acquired the sole rights to enhance, manage, operate, maintain and collect tolls on the Parkway for a period of 99 years. Transurban has also defeased all of PPA's underlying debt.

In exchange, Transurban has made an upfront lease payment of $548 million and agreed to construct a 1.58-mile, four-lane extension to Richmond International Airport, pending the award of a $150 million TIFIA credit. Financing for Transurban's long-term lease is comprised of $195 million in equity and subordinated debt provided by the company, and $420 million in senior debt provided by DEPFA Bank of Ireland, *Banco Espirito Santo de Investimento* of Spain, and *Bayerische Hypo-Vereins Bank* of Germany.

The TIFIA funds would be used to refinance approximately $95 million of the long-term senior bank debt, and pay for $7 million needed to upgrade the electronic tolling systems and approximately $48 million toward the construction of the airport connector.

Downtown Expressway and Powhite Parkway. These roads form a 16-mile highway network that extends from Interstates 95 and 195 in Richmond into central Chesterfield

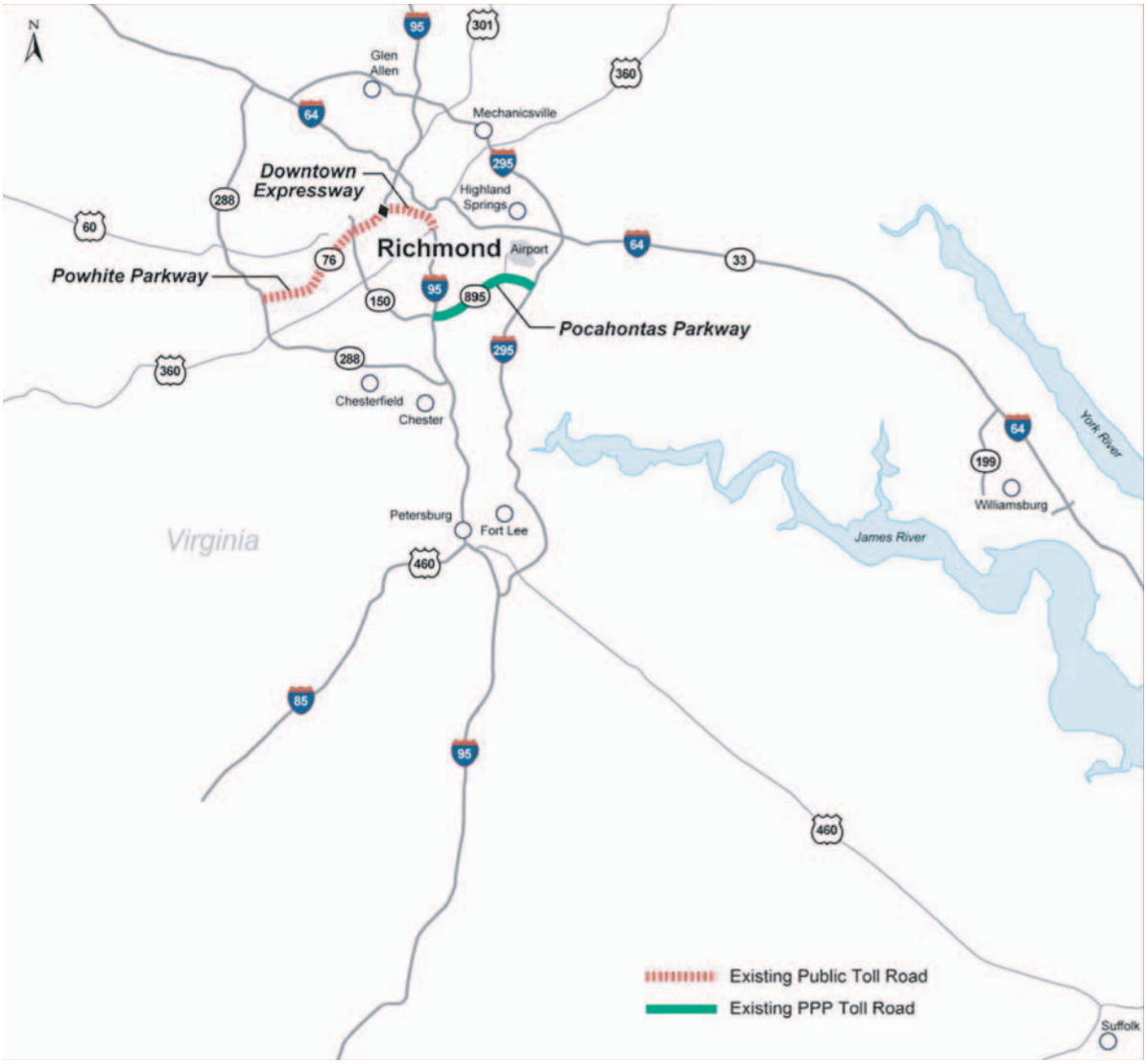

Figure 5-10. Existing toll facilities in Richmond/Tidewater area.

County. Tolls range from $0.15 to $1.50, depending on vehicle size and toll collection location. The Downtown Expressway and Powhite Parkway are operated by the Richmond Metropolitan Authority and opened to service in January, 1973.

5.5.2.2 Current ETC Installations

Dulles Toll Road, Dulles Greenway, Pocahontas Parkway, Downtown Expressway, and Powhite Parkway are equipped with EZpass ETC technology. The system offers interoperability with toll roads up and down the East Coast.

5.5.2.3 Initiative in a Context of Regional Goals (Pricing Goals)

There are no state-wide goals regarding the use of pricing. However, VDOT revised the PPTA of 1995 (§56-556 et seq. of the Code) implementation guidelines in accordance with the amendments enacted by the 2005 General Assembly. The state-wide goals established for the PPTA implementation guidelines are to encourage investment in the Commonwealth by private entities by creating a more stable investment climate and increasing transparency and public involvement in the procurement process. The implementation guidelines promote competition to create multimodal and intermodal solutions; increase flexibility in the development of interim agreements to accelerate required activities; and require greater commitments or guarantees by proposers with mandatory risk sharing.

To date, pricing projects in the greater Washington, D.C., region have arisen and been assessed on an individual basis. For example, the Transportation Planning Board of the Metropolitan Washington Council of Governments (MWCOG) approved amendments to that region's 2007 CLRP and

the FY 2008–2013 TIP in January 2007 and includes the I-95/395 HOT lanes, together with three other highway, interchange, and transit projects. However, as part of its current Regional Mobility and Accessibility Scenario Study, MWCOG is currently analyzing a network of proposed "variably priced lanes" on the Beltway and other major highways, supported by high quality bus services and complementary land use patterns with a 2030 analysis year. Figure 5-11 shows the regional network of priced lanes being assessed in that study in various combinations, together with other land use and transit initiatives.

Variably priced lanes are defined as toll facilities on which price changes occur automatically, based on congestion levels or other factors. As traffic gets heavier, prices typically go up. Variable pricing has become possible in recent years because technologies now permit electronic toll collection and

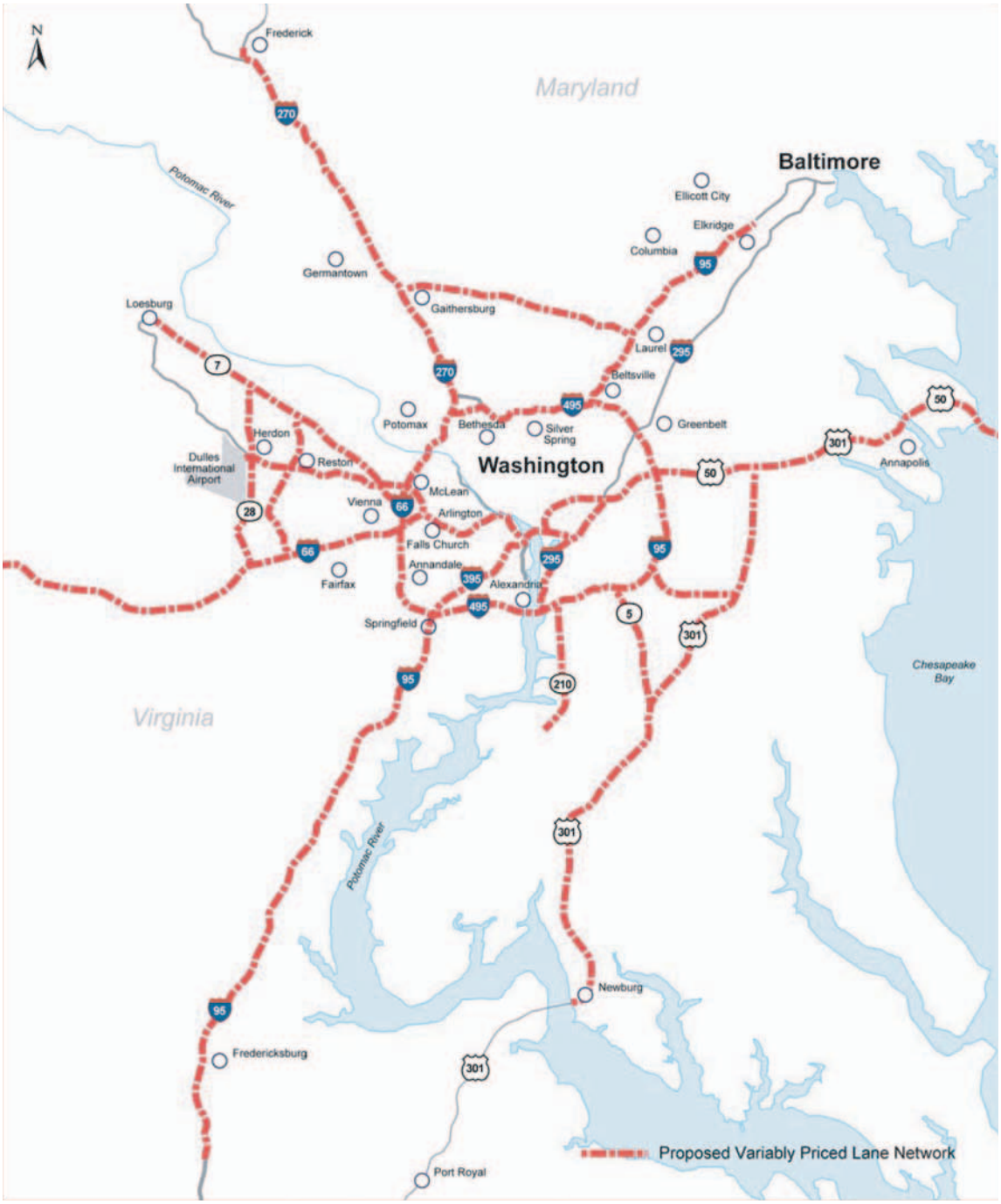

Figure 5-11. Metropolitan Washington Council of Governments' proposed variably priced lane network.

automatic price adjustment. HOT lanes are a form of variably priced lane that carpoolers typically use for free while others pay tolls. The region's long-range transportation plan already includes three variably priced facilities: HOT lanes on portions of the Beltway in Virginia, the I-95/I-395 corridor in Virginia, and the Intercounty Connector in Maryland.

The TPB voted on September 19, 2007, to form a TPB Scenario Study Task Force to review the results of the Regional Mobility and Accessibility Scenario Study and the status of TPB related efforts. The new Task Force will decide what future scenario planning activities are needed as well as what other TPB actions may be appropriate. This is an ongoing process and, in late 2007, has not resulted in any specific plans to formulate regional pricing goals other than the three HOT/ETL projects that have arisen independently and have been included in the TIP and the CLRP.

5.5.2.4 Proposed Priced Facilities and their Role in the Regional Network

I-495 Capital Beltway HOT Lanes. VDOT began the Capital Beltway Study in 1995, preparing a Major Investment Study (MIS) to identify the most promising transportation improvements for the Beltway corridor. The MIS evaluated 20 different strategies, and concluded that highway improvements would be the most effective transportation investment in the Beltway corridor.

In 1998, VDOT launched location and environmental studies for the recommended Beltway improvements. Initially, an Environmental Assessment was undertaken to determine if there would be significant impacts warranting a full EIS. A decision was made to prepare a full EIS and a Notice of Intent to do so was published in the Federal Register on July 11, 2000. The draft EIS (DEIS), which was completed in March 2002, provided comparisons of the operational benefits and environmental effects of the most feasible improvement alternatives plus a no-build option. Three mainline improvements were considered: (1) Concurrent HOV; (2) Barrier-Separated HOV; and (3) Express/Local with HOV.

In June 2002, VDOT received an unsolicited PPTA conceptual proposal from Fluor Daniel to develop, finance, design, and build HOT lanes on the beltway. VDOT advertised for competing proposals. None were received. In the spring 2003 VDOT submitted grant application to FHWA to study HOT lanes and other "value pricing" applications in Northern Virginia.

Based on the large number of comments on the DEIS received from local governments and the general public regarding the physical impacts associated with the proposed I-495 improvements, VDOT decided to evaluate modifications which would reduce the size of the candidate Build Alternatives, particularly at each of the 10 interchanges. Based on its HOT feasibility studies, the Fluor concept was incorporated into the NEPA review process as VDOT's preferred alternative. Public hearings held in spring 2005 indicated that the FEIS alternative garnered greater support than those analyzed in the DEIS. VDOT gained a ROD approving the project from FHWA on June 26, 2006. A subsequent reevaluation of the ROD was conducted to ascertain if refinements to the FEIS design remained consistent with the ROD, in terms of environmental and operational impacts. In October 2007, FHWA accepted the Reevaluation, agreeing with its conclusion that design refinements did not materially alter the ROD.

The project will involve a two-lane widening of the Capital Beltway in Virginia between Springfield Interchange and Old Dominion Drive (12 linear miles), both inner and outer loops (Figure 5-12).

The newly built capacity will be operated as general purpose lanes, with the existing inner lanes refurbished (mill and overlay) and operated as HOT lanes. The general purpose lanes and HOT lanes will be separated by a four-foot buffer with polyurethane pollard dividers.

In September 2007, Fluor-Transurban and VDOT reached an agreement in principle for the design, construction, operation, and maintenance of the Capital Beltway HOT lanes. This agreement was finalized on December 20, 2007.

Fluor has a 75-year concession on the HOT lanes. The state will provide $409 million or 24% of the estimated project implementation and financing costs of $1.7 billion. Any cost over-runs related to construction of the project as defined in the contractual documents would be borne by Fluor-Transurban, whereas VDOT retains the option to order "Owner-Directed" work to augment traffic flow within the project footprint.

Financial Close was achieved on December 20, 2007. Preconstruction activities (utility relocations, clearing and grubbing, etc.) began early 2008 as design elements were advanced. A Design Public Hearing was held in spring 2008 and heavy construction began in summer 2008 and will extend for five years to 2013.

I-95-/I-395 HOT Lanes. An unsolicited proposal was submitted on September 24, 2003, by a joint venture of the Clark Construction Group, Inc. (Clark), Shirley Contracting Company, LLC (SCC), and Koch Performance Roads, Inc. (KPRI), collectively identified as Clark/SCC/KPRI under the PPTA of 1995, as amended, to develop, finance, design, and construct new HOT lanes from approximately I-495 to Route 17. Pursuant to the PPTA Implementation Guidelines, the conceptual proposal was posted for 120 days beginning November 18, 2003, and ending March 17, 2004.

During the posting period, VDOT received one competing proposal. Fluor Virginia, Inc submitted the competing proposal, dated March 15, 2004, for VDOT's consideration. The

Figure 5-12. Proposed toll facilities in Northern Virginia.

Fluor BRT/HOT proposal expands and/or extends I-95/I-395 HOV lanes from the 14th Street Bridge to Massaponax and provides a transit component which links Massaponax to Dulles Toll Road corridor and other transit facilities in the Northern Virginia/Washington, D.C., area.

The I-95 PPTA differs from the Beltway initiative in that VDOT is reviewing two proposals. In addition, the corridor extends through multiple jurisdictions including areas controlled by two separate MPOs. The Metropolitan Washington CLRP includes three HOV lanes on I-395 from the I-95 junction to the District by 2010. HOV lanes are not included in the TIP.

Clark Proposal. Clark Construction Group proposes a $407 million project to improve 36 miles of I-95 from the Springfield Interchange in Fairfax County to Route 17 in Stafford County. The project would involve:

- Converting existing two HOV lanes between the Springfield Interchange and Route 234 (Dumfries Road) to three HOT lanes, then extend three HOT lanes from Route 234 to Route 17 in Stafford County;
- Building Phase 8 of the Springfield Interchange; and
- Providing a 20-year pavement warranty.

Fluor Proposal. Fluor Virginia, Inc. proposes a $1 billion project to improve 54 miles of I-95 from the 14th Street Bridge in Arlington County to Massaponax. The project will:

- Build a multimodal transportation facility between the 14th Street Bridge and Massaponax; and
- Locate the BRT/HOT lanes in the center of the existing HOV lanes north of Dumfries and as a new two-lane road from Dumfries to Massaponax.

Current Status. VDOT established a review committee to study the proposals and make a recommendation to the Commissioner for further action. This process led to the completion of a detailed review of the proposal and then a second recommendation to the Commissioner. As a result of that process, in March 2005, both proposers were asked to submit detailed proposals. In addition, both groups were asked to develop their proposals using the same beginning and end points. As a result the Clark/Shirley/Koch group extended their coverage north to the 14th Street Bridge and south to Massaponax. Detailed proposals were received in June and VDOT subsequently awarded the project to the Fluor-Transurban team.

VDOT is currently working with FHWA to complete the project's required federal environmental review process, while Fluor-Transurban moves forward with preliminary engineering, operations plans, and traffic and revenue studies. This collective effort will lead to the development of a final scope for the project and an ultimate determination on its viability. The environmental review process began in late 2006, and current estimates call for construction to begin in late 2009.

I-81 Corridor Improvements. In September 2002, VDOT solicited conceptual proposals from private entities to design, build, improve, maintain and/or operate all or parts of I-81 through Virginia. In January 2003, VDOT received two conceptual proposals: Fluor Virginia Inc. and STAR Solutions. The CTB voted to move both proposals to the next stage of review under the PPTA process.

In September 2003, VDOT received detailed proposals from both groups. The proposals were submitted to affected local governments with a 60-day comment period. The advisory panel was created, and review meetings were held in October, November, December, and January. A public comment session was held in January. In February 2004, the panel recommended to the Commonwealth Transportation Commissioner that he enter into negotiations with STAR Solutions.

After reviewing the panel's recommendation and extensive documentation, as well as touring the I-81 corridor, Commissioner Philip Shucet directed VDOT to enter into negotiations with STAR Solutions as the potential operator for I-81 improvements. Negotiations are still under way toward a comprehensive agreement. STAR Solutions' concept would add truck-only toll lanes to the I-81 corridor which is a heavily traveled truck route traversing the western spine of the state parallel to the West Virginia boarder.

Dulles Toll Road. On July 26, 2005, VDOT received an unsolicited conceptual proposal in accordance with the PPTA from the Dulles Corridor Mobility Consortium. The consortium, under the conceptual proposal named the Dulles Corridor Mobility Initiative (DCMI), sought a concession agreement to collect tolls, operate, maintain, and improve the Dulles Toll Road and Dulles Connector. VDOT reviewed the proposal and determined that it met all legal and policy requirements for initial review as set out in the current PPTA implementation guidelines. VDOT accepted the proposal and invited other private firms to submit competing offers by October 28, 2005. Four competing proposals were received from:

- Cintra USA, led by Cintra Concesiones de Infraestructuras de Transporte, S.A.
- Dulles Express, led by the Franklin L. Haney Company, LLC
- Dulles SmartLink, led by Transurban and Goldman Sachs and Co.
- Dulles to D.C. Loop, led by Virginia Mobility Associates, LLC

Four of the five conceptual proposals were advanced to the IRP procurement phase: Cintra, DCMI, Dulles Express, and Dulles SmartLink. This process was delayed due to a subsequent proposal from the Metropolitan Washington Airports Authority (MWAA), which is the owner of the right-of-way in the Dulles Toll Road corridor. This proposal would have MWAA assume responsibility for the operation of the Dulles corridor. Then on March 27, 2006, Governor Timothy M. Kaine announced that an agreement had been finalized with MWAA to assume responsibility for the Dulles Toll Road and completing the Dulles Corridor Metrorail Project. This development essentially canceled the PPTA process. However, it remains to be seen what course of action MWAA follows to make improvements to the toll road in the future.

Route 460. In February 2006, VDOT issued a solicitation for proposals per the PPTA for private partners to improve the Route 460 corridor in the Tidewater region between Suffolk and Petersburg (Figure 5-13). In September 2006, the Department received conceptual proposals from Cintra USA, Itinere, and Virginia Corridor Partners. These proposals rely on private investment, user fees, tolls, and other innovative financing methods to develop the project. An IRP has found all three to have merit and the Department will likely request that each firm submit more detailed proposals in early 2008. Current plans call for detailed proposals to be submitted by July 2008, with the Department entering into an interim or comprehensive agreement with its preferred bidder by December 2008. VDOT received detailed proposals in summer 2008 and as of spring 2009 had not selected a preferred bidder.

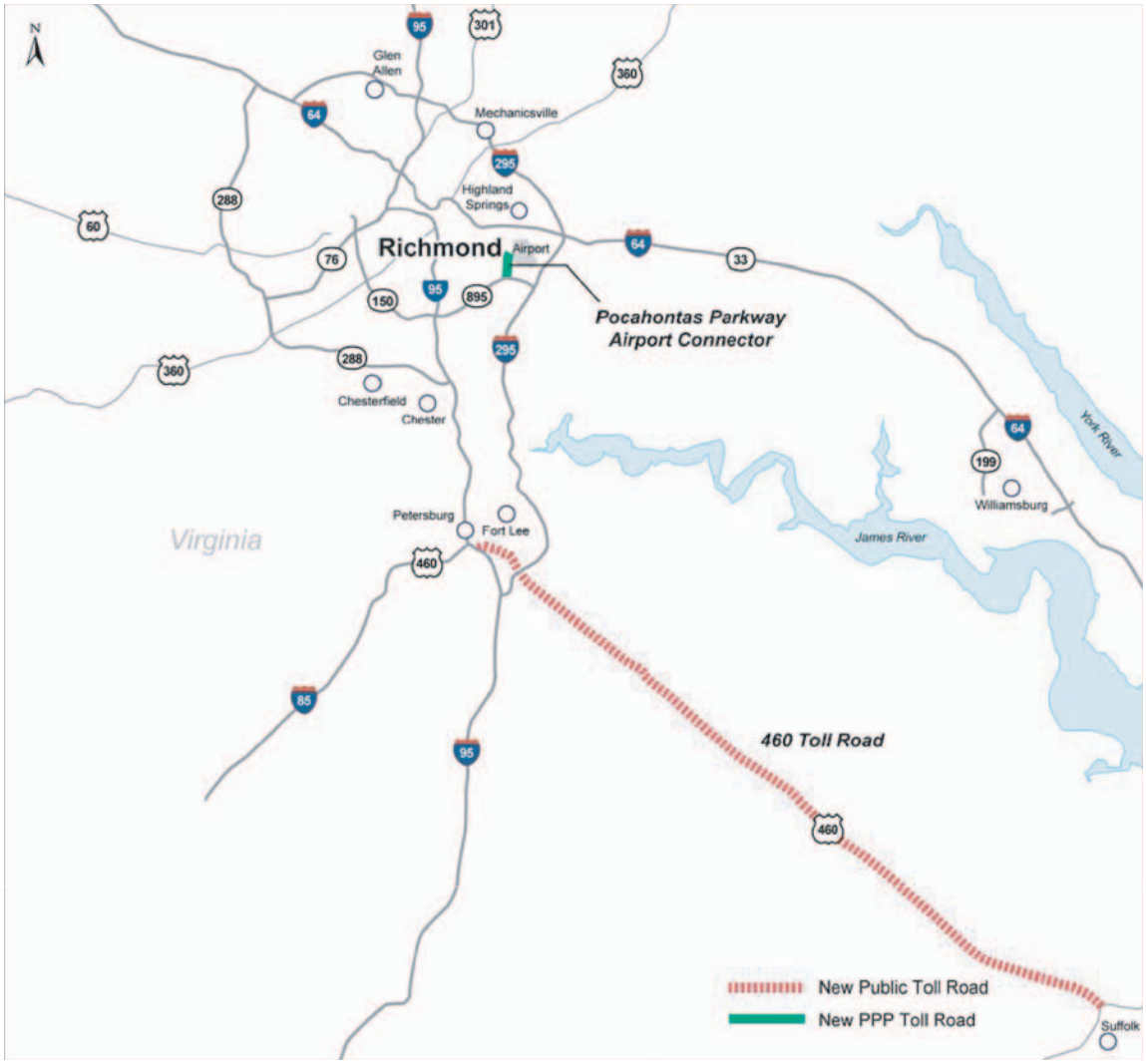

Figure 5-13. Proposed toll facilities in Richmond/Tidewater area.

5.5.3 Pricing Projects

5.5.3.1 Physical Layout (Description of Planned Pricing Projects)

See Section 5.5.2.4.

5.5.3.2 Pricing Forms/Options (Types of Pricing)

The I-495 Virginia Capital Beltway HOT lanes will feature dynamic pricing by segment (7 segments). Tolls will vary based upon congestion. The target is to maintain a flow of 1,600 vehicles per hour per segment at minimum travel speed of 45 mph during peak periods. Prices will be entirely dynamic and can change within seconds. They will be set according to an algorithm designed to maintain the 1,600 vehicle per hour flow. A toll cap imposed by VDOT has been discussed but has not been agreed to.

A memorandum to the Commonwealth Transportation Commissioner on business terms states that toll rates are expected to vary between $0.10 and $1.00/mile (6 cents to 60 cents/km) and the average trip on the facility is expected to cost between $5 and $6 during rush hours.[28]

5.5.3.3 Initial Screening/Selection (Process for Identifying Pricing Projects)

There has been no formal process used to identify the current pricing projects—I-495 Capital Beltway HOT lanes and the I-95/I-395 HOT lanes. The genesis of both pricing projects came from unsolicited proposals from potential private

[28] "Agreement reached on terms for investor financing of 3/4ths of cost of Virginia's Capital Beltway HOT lanes," *Tollroadsnews,* September 10, 2007. http://www.tollroadsnews.com/node/3125

partners who were interested in pursuing the design, financing, construction and operation of the facilities on a partnership basis as allowed through the PPTA.

5.5.3.4 Toll Collection Technologies Considered

Current plans call for the I-495 HOT lanes to feature open road tolling. Details regarding specific technologies were not available at the time research was undertaken for this case study.

5.5.3.5 Project/Pricing Alternatives (Process for Defining Pricing Projects)

The pricing for the I-495 Capital Beltway HOT lanes will be based on an algorithm targeting an hourly throughput of 1,600 vehicles per hour per segment during peak period. The pricing will derive from this algorithm. No toll cap was agreed to during the contract negotiations. Discussions remain underway on determining the "par value" at which the algorithm starts in order to calculate price. Many similar details remain to be worked out at the time the research for this case study was completed.

A similar approach is expected on the I-95/I-395 HOT lane facility as well.

5.5.3.6 Project/Pricing Alternatives (Tolling Options)

See Section 5.5.3.2.

5.5.3.7 Evaluation of Alternatives (Process for Assessing Pricing Projects)

Following the award of the I-495 and I-95/I-395 HOT lane concessions to Fluor-Transurban, VDOT has taken the lead in making decisions, working closely with its concessionaire and seeking input from coordinating agencies, as appropriate. The FHWA maintains approval authority for certain items. Depending on the nature and importance of the decision, the Secretary of Transportation, Commissioner of VDOT, Chief Engineer, Chief Financial Officer, VDOT Project Manager, and VDOT Discipline Managers have been responsible for signing off on decisions.

5.5.4 Cost Estimates

5.5.4.1 Conceptual Cost Estimate

The estimated capital cost of the I-495 HOT Lane Project is approximately $1.4 billion.

The initial estimated capital cost of the I-95/I-395 HOT Lane Project is approximately $1.0 billion.

5.5.5 Traffic and Revenue Forecast

5.5.5.1 Forecasting/Modeling Tools (Analytical Tools for Assessing Pricing Projects)

Forecasts were prepared using MWCOG's Regional Traffic Model. Post-processing of data (volumes, O/D, turning counts, etc.) was conducted to sanitize data for input to VISSIM and HCS. Other analytical tools included GeoPak and MS Project. The work also relied upon VDOT, FHWA, and AASHTO Standards.

5.5.5.2 Summary of Traffic Forecasts

Given that the I-95/I-395 HOT lane project was in the early stages of environmental review at the time this case study was prepared, summary traffic forecast data was not available.

5.5.5.3 Summary of Revenue Projections

Initial revenue estimates for the I-95/I-395 HOT lane project will be available once the EIS is completed.

5.5.6 Financial Aspects

5.5.6.1 Revenue Use

Project revenues from the I-495 Capital Beltway HOT lanes will be used by the project's private developer to repay its underlying debt of approximately $1.071 billion. The sources for the total project development cost of $1.929 billion include a $409 million grant from VDOT (approximately $349 million in equity from VDOT's private development partners); a $586 million private activity bond (PAB); and a $585 million TIFIA loan.

A similar combination of debt and equity is likely to be used for the I-95/I-395 HOT Lanes project.

5.5.6.2 Supporting Federal Programs

The I-495 Capital Beltway HOT lanes receive federal support through the TIFIA program as well as the authority to issue a PAB.

5.5.6.3 Financial Deal

VDOT and Fluor-Transurban reached an in-principal agreement for the implementation of the Capital Beltway HOT lane project in September 2007. On December 20, 2007

the two parties agreed in principle on the terms for financial close and established a window of time for Fluor-Transurban to seek more advantageous insurance coverage for the private activity bond. Key aspects in the in-principal agreement require Fluor-Transurban to:

- Finance and build a 14-mile stretch of HOT lanes (two lanes in each direction) on the Capital Beltway, based on a fixed-price, fixed-time design-build contract.
- Finance and build three new access points from the Beltway into Tysons Corner, build HOV connections from I-95 to the Beltway (known as Phase VIII of the Springfield Interchange), as well as reconstruct and improve many existing bridges, traffic lanes, overpasses, interchanges, and signs;
- Manage and fund all operations and maintenance of the HOT lanes (except snow/ice removal which will be done by VDOT) including major repairs and rehabilitation;
- Collect tolls from non-HOV vehicles. Tolls will vary and will be based on the level of congestion in the HOT lanes. During rush hours, the average trip cost is expected to be $5.00 to $6.00, and Fluor-Transurban must ensure free flow traffic conditions in the HOT lanes;
- Ensure that HOV vehicles and transit and commuter buses travel for free; and
- Return the HOT lanes to the Commonwealth in good order at the end of the agreement.

The agreement calls for the Commonwealth of Virginia to:

- Retain ownership and oversight of the HOT lanes;
- Have the right to build any other transportation improvement;
- Provide a $409 million financial grant to the project to support the construction of key elements including the final phase of the Springfield Interchange (Phase VIII), improvements to the I-66 interchange, participation in the regional congestion management plan, and reconstruction of the existing infrastructure; and,
- Provide emergency services to the project.[29] VDOT will not provide police protection. Fluor-Transurban must make separate arrangements for police protection with the Virginia State Police.

5.5.7 Institutional Framework

5.5.7.1 Name/Type of Agency

The operations concept for the Capital Beltway HOT lanes will be integrated with VDOT Northern Region Advanced Traffic Management Systems (ATMS); however, HOT lanes will be operated by Transurban, while the parallel general-purpose lanes will be operated by VDOT.

5.5.7.2 Institutional Structure

The Innovative Project Delivery Division of VDOT is responsible for developing and implementing a statewide program for project delivery via design-build, PPTA, and other contracting methods that expedite and improve project completion.

The division is also responsible for oversight of consultant procurement, policy establishment, compliance, and guidance. Program and project direction is in support of the Virginia Six-Year Improvement Program and in support of governor and General Assembly plans, with regard to high-level state and private sector partnership transportation initiatives.

5.5.7.3 Procurement Approach

Fluor-Transurban is wholly responsible for design and construction of both the general purpose and HOT lanes. The concessionaire is wholly responsible for operation of HOT lanes. A detailed maintenance agreement was negotiated in late 2007.

5.5.8 Legislation

5.5.8.1 Mandate

The PPTA, as amended, is the legislative framework enabling VDOT to enter into agreements authorizing private entities to develop and/or operate transportation facilities.

5.5.9 Public Outreach/Involvement

VDOT has undertaken a thorough outreach and public involvement program as part of the 12-year effort in obtaining the required environmental approvals for the I-495 Capital Beltway HOT lane project. This process involved numerous public meetings and hearings at which the public was invited to comment on the EIS process. Standard outreach materials were developed including a project newsletter and website. These resources are available at http://project1.parsons.com/capitalbeltway/.

Flour-Transurban has established an outreach website for both the I-495 Capital Beltway and I-95/I-395 HOT lane projects. It is available at: http://www.virginiahotlanes.com/.

VDOT has found that its focus on using throughput goals in determining toll levels has enhanced the "fairness" of the

[29] VDOT Press Release, September 10, 2007. http://www.virginiahotlanes.com/documents/Capital%20Beltway%20HOT%20Lanes%20Press%20Release.pdf

user fees from the motorist's perspective and made the project easier sell to the public.

Current Status and Documentation

5.5.10 Current Status of Pricing Projects

- By late 2007, 30% of the design has been completed for the I-495 HOT lane project. The project reached financial close on December 23, 2007, with heavy construction beginning in the spring of 2008. Fluor-Transurban's schedule calls for the facility to open to the public in the third quarter of 2012.
- The I-95/I-395 HOT lane project concession has been awarded to Fluor-Transurban and an environmental review began in late 2006. Current estimates call for construction to begin in late 2009.
- Negotiations on the I-81 Corridor Improvements with STAR Solutions began in 2004 and have not yet been concluded.
- Plans to improve the Dulles Toll Road through the PPTA process have been suspended due to the transfer of the operation of that facility to MWAA. It is not clear what actions MWAA will take in the future on possible improvements in the corridor.
- Current plans call for VDOT to issue a request for detailed proposals for improvements in the Route 460 Corridor in early 2008. VDOT hopes to enter into an interim or comprehensive agreement to develop a toll facility in the corridor by the end of 2008.

5.5.11 Planning Studies or Reports

A Capital Beltway Improvement Study was conducted late in the 1990s, which led to an extended EIS effort completed early 2006. At the same time VDOT was reviewing proposals from Fluor-Transurban and Clarke Construction, the former of which was recommended by a senior VDOT panel. The FHWA ROD was received in June 2006 and the partnership was officially kicked off in July 2006. A preliminary Traffic and Revenue Study was completed. A subsequent Reevaluation of the Environmental Impacts was undertaken and was approved by FHWA in June 2007. A revised traffic and revenue study was completed in the summer of 2007, and an Operational Analysis of Traffic is now being conducted.

Summary of Critical Issues/Lessons Learned

VDOT offers rich experience in the planning and implementation of tolling and pricing projects that extends over two decades. Distilling that experience to identify lessons learned is challenging due to the variety of pricing projects found in the state—both geographically and in terms of facility type—together with the different ways in which pricing projects have been moved forward. The Commonwealth saw a small number of pricing projects built in the 1970s and 1980s, with the opening of the Powhite Expressway in Richmond and the Dulles Toll Road in Northern Virginia. Then in the early 1990s, Loudoun County took the lead in developing the Dulles Greenway on a PPP basis. These early pricing projects—built at a time when new greenfield toll projects were by far the exception to the rule—provided momentum for the state's ground breaking PPTA legislation in 1995.

Virginia's PPTA legislation is particularly notable for allowing tolling projects to be proposed on an unsolicited basis or identified directly by the state. The PPTA's two-phase procurement structure allows proposers the freedom to identify the projects—or modifications thereof—that they think would be the most viable during the conceptual phase, and also enables the Department to request that all bidders propose on identical projects (identified by VDOT) during the detailed proposal phase.

Since the passage of the PPTA in 1995, Virginia has seen the completion and subsequent sale of the Pocahontas Parkway, the sale and likely expansion of Dulles Greenway, together with PPTA proposals to develop PPP toll road facilities in all areas of the state, both solicited and unsolicited. In all, five PPTA toll road proposals remain officially active, although it is likely that two of these will not proceed. The three remaining projects include:

- I-495 Capital Beltway HOT lanes: unsolicited procurement, awarded to Fluor-Transurban, ROD received in 2006, financial close expected in December 2007.
- I-95/I-395 HOT lanes: unsolicited procurement, awarded to Fluor-Transurban, currently in environmental review.
- Route 460: solicited procurement, request for detailed proposals likely to be issued in early 2008.

Although a comprehensive corridor planning process has been followed with the Route 460 project near Newport News, the State's HOT lane projects in Northern Virginia have arisen as unsolicited offers proposed by the private sector. Together with the existing toll roads near Washington, D.C., these HOT lanes, if built, would form the beginning of a regional network of priced highway lanes. However, it is interesting to note that the primary factors driving this trend are the region's high demographic growth and demand for mobility, together with the ability for private investors to identify for-profit opportunities capitalizing on the region's buoyant growth through the PPTA legislation. While a number of states have shied away from providing private partners with the ability to submit unsolicited offers to develop toll projects in their PPP enabling legislation, Virginia has created a process that is able

to accommodate unsolicited offers. While unsolicited offers may be complicated to manage, in Virginia they have proven to be the most fruitful source of pricing activity.

While it is interesting that market forces and the PPTA-granted flexibility for private investors to lead the development of pricing projects are pointing toward the development of a network of priced highway lanes in the Capital region, at present there is no formal regional vision for the use of pricing in helping the region meet its mobility needs. Although MWCOG organized a regional conference exploring the possibility of developing a HOT network in the Capital region, the concept is only beginning to be investigated on a project-specific basis. VDOT had plans to create such a vision for its Northern Virginia district, but put that initiative on hold while MWCOG completed enhancements to its travel demand model enabling it to assess the impacts of pricing on travel demand in greater detail. MWCOG is assessing the possible use of pricing in a number of regional alternatives being developed as part of its ongoing 2030 *Regional Mobility and Accessibility Scenario Study*.

Although MWCOG voted to establish a TPB Scenario Study Task Force to review the results of the Scenario Study and make decisions on future scenario planning activities in September 2007, it appears that this will be an extended effort. Currently there is no indication when MWCOG might arrive at a regional vision for the use of pricing and to date the only discrete regional actions supporting pricing involve updating MWCOG's TIP and CLRP to include the pricing projects identified independently through the PPTA process.

Given that the I-495 Capital Beltway HOT lanes is the first mega-project to be implemented through the PPTA, VDOT has had to establish a process for moving forward. VDOT appears poised to achieve success and will be able to apply that model to develop other large projects through the PPTA process.

PART 3

Synthesis and Best Practices

CHAPTER 6

Conclusions

6.1 Decision Frameworks

In synthesizing best practices among decision frameworks for tolling and pricing projects, it is necessary to focus on both the process embodied in the decision framework, as well as the various tools, analyses, and data inputs needed to make those decisions. As described in Chapters 2, 3, and 4, and shown in the case studies provided in Chapter 5, a multi-tiered framework can be identified for assessing tolling and pricing options. This framework involves successively detailed analyses beginning at the regional level and becoming increasingly focused on corridor-specific applications and finally on single solutions for which financing must be arranged. The decision framework involves the following stages:

- **Exploratory.** Conceptual analysis used at the regional or state level to compare the use of tolling and pricing in different corridors to identify locations where tolling or pricing would have the best potential for meeting established goals and, therefore, may warrant further study.
- **Preliminary.** Preliminary corridor-specific analyses to identify promising tolling and pricing concepts that may be included in the MPO process and ultimately moved forward to gain environmental approval and ultimate implementation. This level of analysis normally involves definition of tolling and pricing options and the preparation of sketch-level traffic and revenue estimates and feasibility assessments across an array of factors.
- **Feasibility.** Detailed analyses to identify preferred physical layout and tolling/pricing scheme for a specific project, and to prepare the documentation needed to determine the project's financial feasibility, gain environmental approvals, and move into implementation.
- **Investment Grade.** Final phase pursued only for those projects that will be financed by toll-backed debt involving the preparation of detailed investment-grade traffic and revenue forecasts and a finance plan required to obtain a financial rating. Such investment-grade financial ratings are required for bond issues in the United States.

In reviewing the processes followed by agencies sponsoring tolling and pricing projects around the United States, it is evident there is great flexibility in employing the decision-making framework. Agencies do not necessarily begin the process at the Exploratory Phase and then move successively through the different levels of analysis. Rather they may navigate upward or downward from phase to phase of the framework as local needs and policy dictate. In addition, given that many regions have multiple authorities responsible for different aspects of transportation planning and project implementation, tolling and pricing studies in a given region may be undertaken by more than one public agency.

6.2 Technical Aspects

Embedded in each of the four major stages of the decision-making framework are eight core technical aspects of analysis used to assess and evaluate tolling and pricing options at increasing levels of detail as projects progress through the four phases of analysis. As discussed in Chapter 4, these technical aspects provide a methodological core and are useful in classifying best practices. Each of the technical aspects overlaps with the same studies that are required when developing transportation improvements that do not involve tolling or pricing. Some of them remain essentially unchanged when dealing with tolling or pricing projects, while others are largely transformed when highway improvements involve tolls.

The following discussions provide brief summaries of the technical aspects associated with the study of tolling and pricing and identify how these analyses can be expected to differ when transportation improvements include pricing elements.

Transportation Planning (P). Regulated by the established NEPA and MPO planning processes, the assessment of any transportation improvement revolves around comprehensive analysis of the effects of potential projects on transportation and environmental conditions. With pricing, user fees are used as a tool to encourage trip makers to minimize travel during peak periods or use transit or other alternative trip modes, while the pure toll finance approach focuses on financial feasibility. Transportation analyses for tolling and pricing projects need to determine what are the specific effects of the tolling or pricing component of different alternative improvements, and how they would differ from the effects of the same improvements if they were not tolled. The ultimate goal of these analyses is to determine to what extent candidate improvement projects are aligned with regional transportation goals and plans and how the use of tolling or pricing would enhance or detract from their ability to do so.

Project Definition (R). With traditional highway improvements, project definition involves determining the physical design of a new or expanded roadway. With tolling and pricing projects, project definition also includes identifying and assessing different tolling regimens and policies, together with the electronic toll collection equipment that will be necessary to operate the facility. With managed lane applications, project definition also needs to address separation treatments and the location of access and egress points. During the earliest phases of analysis, project definition will include assessing different tolling options and determining an optimal toll rate. Later, the focus expands to include the assessment of the physical layout of the facility, access locations, cross-section design, pricing forms, and toll-collection technologies.

Cost Estimates (C). Capital cost estimating procedures for tolling and pricing projects are essentially the same as those for traditional highway improvements, with the exception that they also need to include the cost of electronic toll collection and enforcement equipment. Similarly, ongoing operation and maintenance cost estimates also need to include the cost of collecting tolls using ETC equipment and manual collection, as well as the associated back office accounting costs and the costs of enforcement. In the early stages of the decision-making framework, cost estimates are more conceptual and are analyzed in greater detail as the project moves through subsequent stages of the framework. Cost estimates are an essential input into financial feasibility assessments.

Traffic and Revenue Forecasts (T). Travel demand forecasting is an essential element of the overall analysis of any highway improvement. MPOs are required to maintain travel demand models and use them to assess both the regional and corridor-specific effects of transportation improvements. When modeling tolling and pricing projects, travel demand models rely on extensive survey work to understand how different types of tolling affect travel patterns. A motorist's willingness-to-pay to use a highway facility depends on several different factors including: trip purpose, travel time savings, income, household characteristics, transit options, and the availability of and travel conditions on alternative free routes. Sketch level analyses of tolling and pricing options can be conducted using standard assumptions on tolling elasticities. However, given that these elasticities can be expected to change from region to region, and often differ from corridor to corridor, original survey work is essential in the later phases of analysis.

Given that tolling and pricing projects are often financed on debt leveraged by future toll proceeds, traffic forecasting efforts for these projects also need to quantify the revenues expected to be raised from tolls. Similar to cost estimates, in the initial stages of the decision-making framework, traffic and revenue forecasts for the tolling and pricing alternatives are conducted at a preliminary sketch level, generally utilizing a regional traffic network that includes multiple improvement projects. As the physical parameters and pricing forms of the alternatives are further defined through later stages of the framework, traffic and revenue forecasts are refined using more advanced modeling tools and focus on individual tolling and pricing alternatives separately. Traffic and revenue forecasts are instrumental in choosing the preferred pricing alternative and toll rate optimization to meet the established regional goals. They are also an essential input into the assessment of the financial feasibility of tolling and pricing projects.

Financial Feasibility (F). This aspect evaluates the project's financial feasibility through the combination of expected revenues and additional available funds. Assessing financial feasibility is closely intertwined with the traffic and revenue forecasts and also includes the development of important assumptions on the use of the generated revenues and availability of other funding sources to support the project. Ultimately, the goal of this aspect is to develop a viable financial plan that substantiates full coverage of the project cost.

As seen with the I-495 Capital Beltway HOT lanes, the expansion of the Katy Freeway in Houston, or the I-15 in San Diego, oftentimes expensive projects involving managed lanes may not have the ability to be financed on a standalone basis using project revenues. In such cases, financing should be supplemented with other funding sources including: monies and guarantees provided through state or federal innovative finance tools, local monies from dedicated taxes, and outright grants. The use of project proceeds can always be expected to be of particular interest.

Institutional Assessment (I). Through the institutional assessment, an appropriate ownership structure for the project and the distribution of roles, responsibilities, and contractual agreements between the various entities with the project are identified. The institutional assessment is closely intertwined with financial issues, as well as legal issues that establish the rights and responsibilities of the various entities involved in

the project. These entities may include, but are not limited to: the public authority sponsoring the project, the entity responsible for collecting tolls, the entity responsible for enforcing the facility, the entity responsible for the maintenance of the physical infrastructure (both roadways and electronic toll collection equipment), and the possible involvement of a private-sector partner. Institutional arrangements for tolling and pricing projects can be expected to differ from those of traditional highway projects given that the authority to levy tolls is not extended to most departments of transportation and the fact that federal authority to implement tolling or pricing on the Interstate Highway System is limited.

Legal Review (L). This aspect, sometimes combined with the institutional assessment, provides analysis of the various legislative issues associated with pricing, and the possible need for enabling legislation to implement highway tolling or pricing, as well as for the sponsoring agency to collect tolls. Even if tolling authorities currently exist, the use of advanced pricing forms, such as fixed or dynamic variable pricing, discounts or exemptions, and issues associated with the use of project revenues may require specific approvals. Studies of possible tolling and pricing projects should include an assessment of the current legal structures and any changes that would be required to implement the different forms of pricing being considered.

Public Outreach (O). Given that tolling and pricing are often new concepts for the public, outreach plays a particularly important role throughout the decision-making process. The public outreach process involves two major aspects: 1) understanding which aspects and policies are generally acceptable and those that are not (generally accomplished by surveying different pricing concepts with key stakeholders and the public at large), and 2) educating the public on the need for pricing and the mobility benefits it offers.

Outreach efforts for tolling and pricing projects require a greater focus on education than those for traditional improvements. The public should understand why this market-oriented approach has been taken, as well as the travel benefits (e.g., reliability and time savings) the projects generate. Outreach efforts should communicate the critical function that user fees play in providing these benefits, as well as information on how tolls will be collected and how the proceeds will be used. Outreach efforts also generate critical feedback from the public on the particulars of different pricing strategies, enabling sponsors to refine their plans and ultimately implement more effective projects.

6.3 Case-Study Decision Frameworks and Lessons Learned

The detailed case studies provided in Chapter 5 demonstrate the wide variety of approaches that may be taken to assess the use of tolling and pricing. The cases demonstrate that agencies navigate from phase to phase of the evaluation framework as local needs, institutions, and policy dictate. While there is flexibility in the sequencing of decision frameworks and the agencies responsible for undertaking the different analyses, the case studies have also shown that the various technical aspects associated with the assessment of tolling and pricing remain constant. The following discussions describe the sequence of analyses completed in each of the case studies, together with lessons learned. Together the case studies demonstrate that the different goals for tolling and pricing projects have led to widely different end results.

6.3.1 HCTRA Decision-Making Framework

In Harris County, for example, voters approved the establishment of a local toll authority with the mandate to implement two toll roads. As a result, HCTRA began its work at the Feasibility Phase by defining its preferred engineering and pricing solution and then completing the financial feasibility and environmental studies needed to move directly into implementation. Given that HCTRA's projects have been financed solely from toll-backed revenue bonds, they have also completed investment grade traffic and revenue and financial studies for each of the toll facilities they have developed.

This sequence of analyses is depicted graphically in Figure 6-1. As Figure 6.1 shows, the HCTRA has replicated the decision-making and evaluation framework described above for each of its toll facilities, bypassing the Exploratory and Preliminary Phases altogether and completing Feasibility and Investment Grade assessments. Once the HCTRA had completed its initial set of core projects, TxDOT undertook its own independent assessment to identify highway improvements in Harris County that may be suitable for development as toll facilities. Based on this analysis, it has awarded the HCTRA the right of first refusal to develop a shortlist of projects. Prior to this development, the HCTRA had made its decisions on which facilities to implement based on its initial mandate approved by Harris County voters, local needs, and circumstance, such as the availability of a railroad right-of-way in an expanding portion of town. Politics and institutional relations have also figured heavily in the HCTRA's planning decisions, including its $237.5 million investment in the I-10 HOT lane project sponsored by TxDOT as part of its multi-billion dollar reconstruction of the Katy Freeway.

The HCTRA's technical analyses have been focused and are less voluminous when compared to some of their other cohorts. This reflects the fact that the HCTRA was established by local voters with a mandate to build two specific facilities. Moreover, decision-making has been straightforward, given that the HCTRA is a local authority in a county where extensive powers are vested in a group of four elected officials.

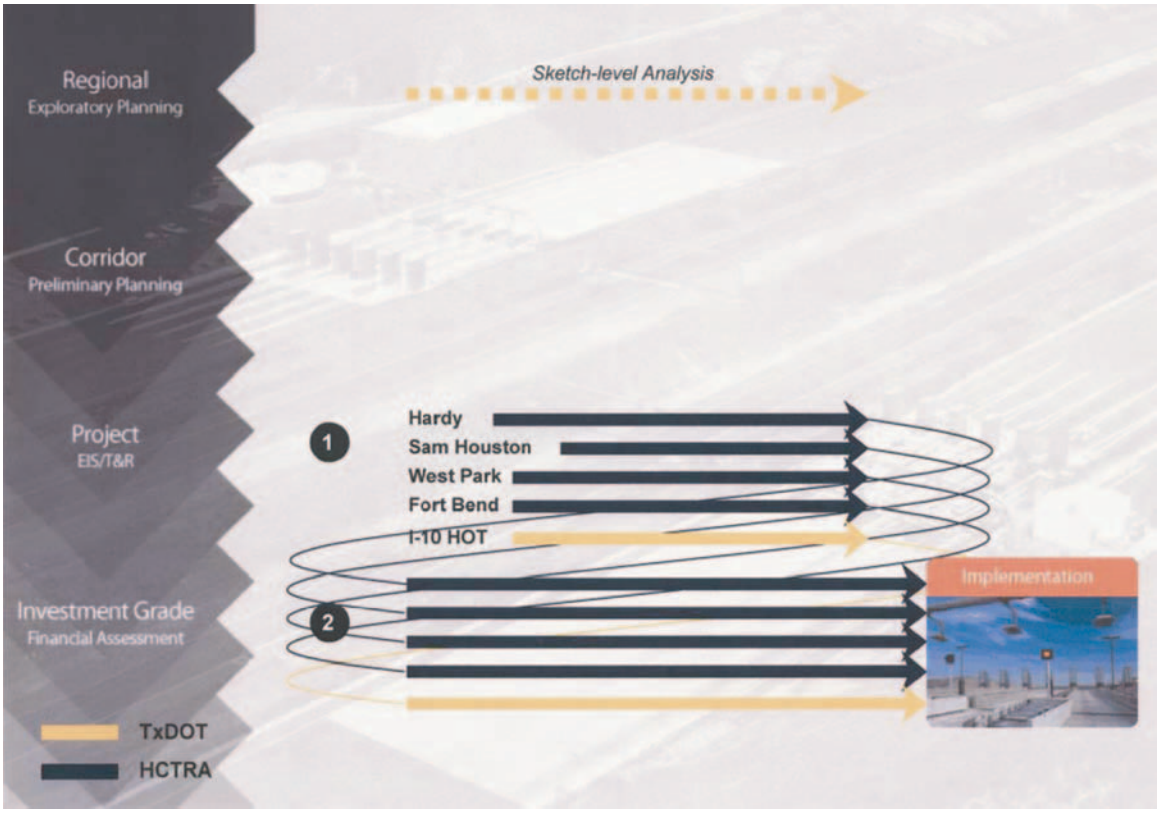

Figure 6-1. Harris County Toll Road Authority process.

These factors—together with Houston's ongoing growth into the nation's fourth largest city and ongoing need for new highway facilities—led to decisions to expand the HCTRA's network. The HCTRA has excelled in project implementation and operations and has developed 103 miles of toll road facilities in its 24-year history.

The HCTRA toll roads include the most heavily traveled highway corridors in a rapidly developing metropolitan area. This trend has also given the HCTRA a unique financial profile among local toll authorities in the United States. With healthy financials, the HCTRA is in a position where it can make decisions based on a wide range of strategic concerns, such as regional politics, institutional relationships, and regional goals—not just financial feasibility alone.

6.3.2 MnDOT Decision-Making Framework

MnDOT's work with tolling and pricing has been persistent and particularly innovative from the perspective of public outreach, yet the Department's ability to move projects forward has been intermittent and very much influenced by changing administrations. MnDOT has benefitted from ongoing support from federal tolling and pricing programs. As a result of early feasibility studies completed in the late 1990s, the Department knew that it wanted to focus its initial attempts at pricing on the conversion of the underperforming I-394 HOV facility leading west out of Downtown to HOT operation. This was a project that could be implemented quickly and at a minimal cost. However, the issue of roadway pricing was unpopular with a succession of gubernatorial administrations, and the I-394 conversion remained fallow for more than four years.

As shown in Figure 6-2, MnDOT has followed a relatively comprehensive decision-making framework, focusing first on regional feasibility studies and then on the I-394 corridor. However, the Department's progress was halting as a result of the lukewarm reception to pricing from two gubernatorial administrations. However, the Department's persistence and commitment to pricing allowed it to move quickly when opportunity afforded itself in 2002 with the election of Governor Pawlenty, who shared their support for the I-394 conversion.

MnDOT simplified the criteria for success by focusing on the congestion relief potential associated with pricing rather than on revenue generation and independent financial feasibility. MnDOT has also created synergies by working closely with the Hubert Humphrey Institute at the University of Minnesota to reach out to the local community and educate it on the benefits of pricing. On the I-394, performance and overall user satisfaction exceeded expectations. However, as a

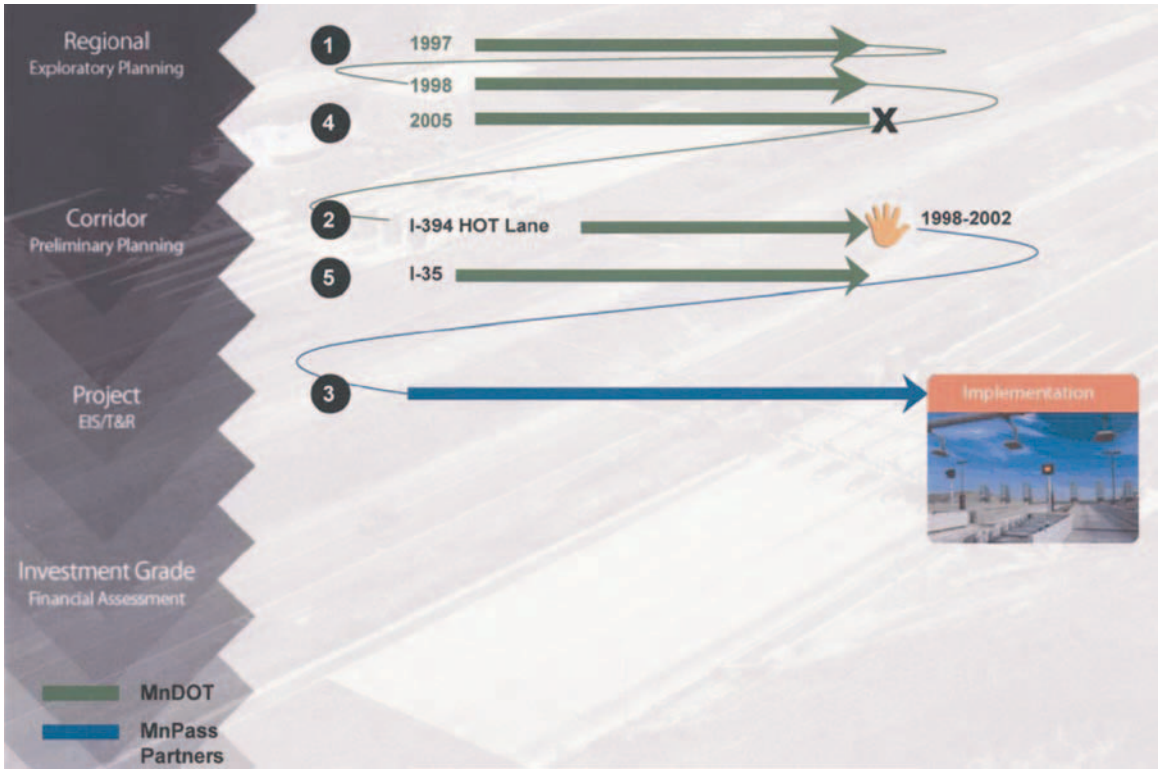

Figure 6-2. MnDOT process.

result of further studies that confirmed that additional HOV to HOT conversions or HOT expansions in the Twin Cities region were not financially feasible, MnDOT has no plans to pursue additional pricing projects.

This dynamic changed with the announcement, in the summer of 2006, of U.S.DOT's Urban Partnership Agreement (UPA) program. The UPA program provided a one-time grant pool in excess of $750 million for innovative pricing applications in five metropolitan regions across the United States. Minnesota took advantage of its strong foundations to propose an innovative expansion and conversion of the existing I-35 HOV lane to HOT operation. MnDOT's concept added over two miles of new capacity together with the use of dynamically priced shoulders on the final three-mile segment leading into Downtown Minneapolis. The Department was successful in securing a $133 million UPA grant and intends to open the completed I-35 HOV facility to HOT operation in September 2009.

6.3.3 Oregon DOT Decision-Making Framework

As shown in Figure 6-3, ODOT has pursued a rigorous comprehensive decision-making framework for the use of tolling and pricing in their state. Legislative action required the state to look at the potential use of PPPs in developing needed transportation improvements. In spite of the fact that Oregon was a mid-sized state with a relatively low growth rate and mature metropolitan regions, the ultimate criterion for success with the State's OIPP program vetting of candidate projects led ODOT to identify a shortlist of 18 projects across the state that were suitable for development as PPPs. As a result of an industry consultation process, ODOT narrowed the field of candidate projects to three highway expansions in the greater Portland region to be bundled in a single PPP procurement where a willing concessionaire would have the right of first refusal to develop each of the projects.

ODOT and its private partner OTIG established a rigorous sequence of phased analyses to test the financial feasibility of the three projects. This framework incentivized OTIG to complete a rigorous travel demand forecasting effort as well as to seek out innovative design solutions that would reduce right-of-way requirements and construction costs. OTIG also identified and assessed a wide range of tolling options, including innovative arrangements that have not been considered elsewhere.

While the Oregon OIPP program tapped into the private sector's efficiency and profit-seeking incentives, this strategy could not change the fact that greenfield toll road development or HOT widenings in existing corridors were not financially feasible on a standalone basis in a small and relatively congestion-free metropolitan area such as Portland.

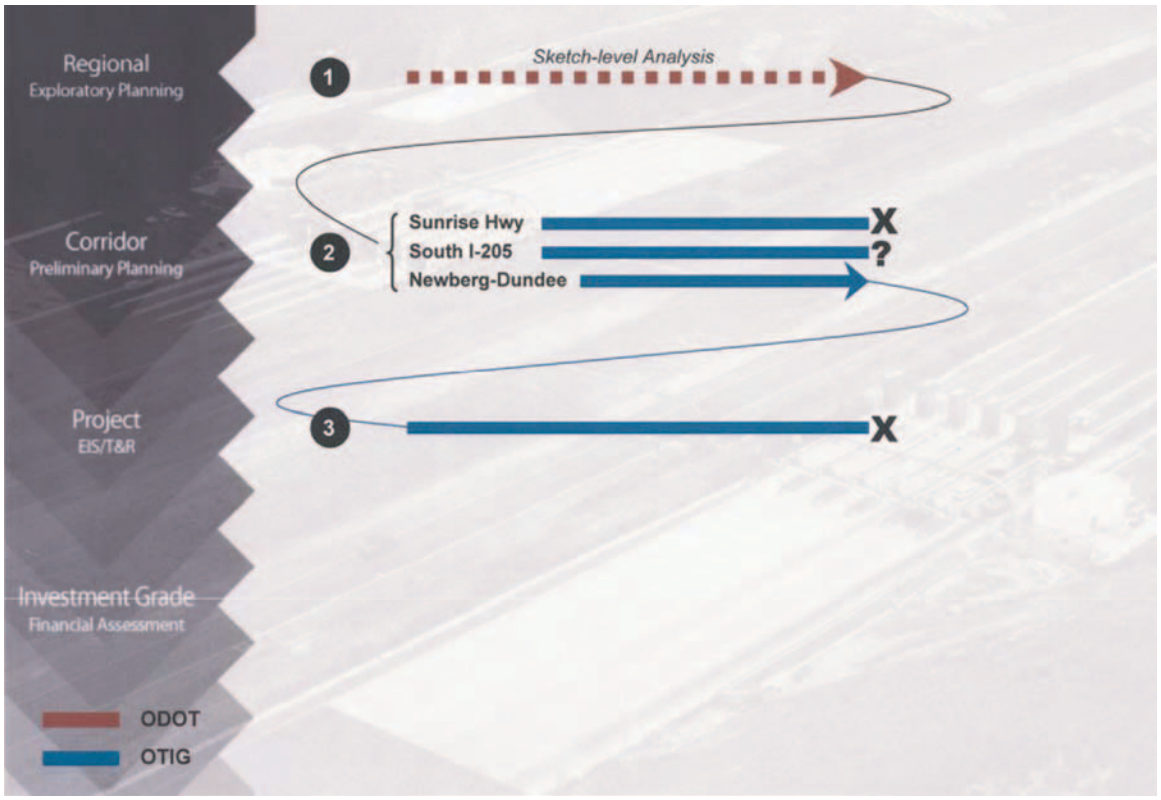

Figure 6-3. ODOT process.

While the projects in question did demonstrate the ability to recover a significant portion of their overall implementation and operating costs through tolls, local support and funding constraints were such that neither ODOT nor the local communities that the improvements would ultimately serve were willing to subsidize the funding gaps, and the projects have been curtailed. It is not clear how the projects selected for the OIPP program aligned with regional priorities. This begs the question of whether the outcome in Oregon would perhaps have been different if higher priority projects with greater utilization levels had been included in the OIPP program.

6.3.4 SANDAG Decision-Making Framework

As shown in Figure 6-4, SANDAG has followed a hybrid decision-making framework using both a project-specific and comprehensive approach to develop what is likely to become the United State's first regional network of new managed lanes. San Diego took advantage of the opportunity afforded by an underperforming, reversible-flow two-lane HOV facility and started small by converting it to HOT operation using a monthly sticker approach. Once it had determined that the HOT trial was viewed as a success by local residents, SANDAG made the conversion permanent and implemented the nation's first dynamically priced ETC system.

Building on its success with the I-15 HOV to HOT conversion and taking advantage of its dual role as the regional planning and congestion mitigation authority, SANDAG completed a comprehensive regional assessment of the feasibility of other HOT expansion projects focusing solely on the goal of congestion relief. As a result of these efforts, SANDAG identified the extension of the I-15 HOT lanes, as well as major HOT widenings in three additional corridors. In 2004, SANDAG took advantage of local voters' approval to extend the Transmit half-cent sales tax millage to 2048 to dedicate $3 billion of the resulting proceeds to the implementation of the Transmit Early Action Program, comprised of the I-15, I-805, SR 52, and SR 56 HOT lane projects. Through these important actions, SANDAG has included the development of a regional network of HOT lanes in San Diego's long range plan and has also secured $3 billion toward its implementation.

San Diego has developed a robust and incremental decision framework that has led to a vision of developing a regional network of HOT lanes extending across four corridors. Remarkably, due to the fact that it has access to extensive local funding, SANDAG has been able to base its decision on the benefits of the system solely on its congestion relief potential rather than its cost or overall financial feasibility. This result has been possible largely due to the local institutional

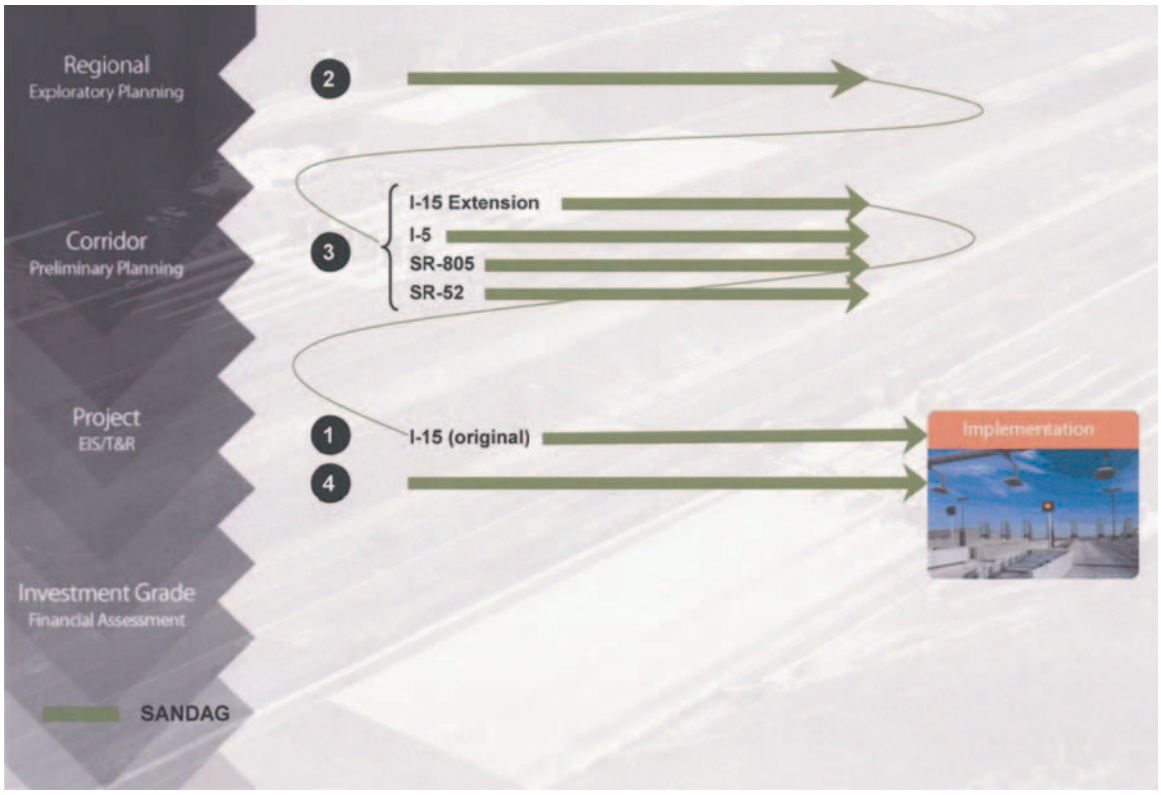

Figure 6-4. San Diego Association of Governments process.

structure which gives SANDAG—a forward-looking MPO in a rapidly expanding region—extensive powers, and it has stewardship over the revenue stream resulting from a lucrative local sales tax millage. While this nexus has resulted in extremely positive synergies in San Diego, it is not clear that it would be replicated in other locations.

6.3.5 VDOT Decision-Making Framework

Virginia is home to a number of tolling firsts in the United States and has seen a number of new toll facilities developed independently around the state. These include locally sponsored toll projects in Richmond dating from the early 1970s, and later, the Dulles Toll Road and Dulles Greenway, sponsored by VDOT and Loudoun County, respectively, in Northern Virginia. Tolling activity in Virginia gained additional momentum with the passage of the Virginia PPTA of 1995. This legislation gave the state and local governments the right to enter into partnerships with private entities to develop toll roads on both a solicited and unsolicited basis.

Virginia's more recent experience with PPP projects reflects the flexibility afforded in the PPTA Act. VDOT officials solicited proposals for the development of the Pocahontas Parkway in Richmond shortly after the passage of the PPTA. This long-planned roadway lacked funding and ultimately was built through the PPTA with a design-build contractor and financing through a 63-20 public benefit corporation.

These earlier projects have been considered on an individual basis by different district offices within VDOT, as well as local authorities. Figure 6-5 depicts the truncated decision-making framework followed more recently by VDOT regarding pricing projects in Northern Virginia. This reflects the fact that VDOT received two unsolicited offers through the PPTA to implement major HOT expansions on a PPP basis. The first involved the I-495 Capital Beltway, which was the subject of over seven years of environmental analysis assessing different widening concepts. Following the release of the DEIS in 2002, public comments suggested adding the new capacity as HOT lanes, and shortly thereafter, VDOT received an unsolicited offer from Fluor Daniel to add the new capacity at no cost to the state. A year later a competitor submitted a second unsolicited offer through the PPTA to add priced HOT lanes to the I-95/I-395 corridor. Fluor countered with a more elaborate proposal and ultimately was awarded a concession for that facility after extensive negotiations.

In many respects, the decision framework for tolling and pricing in Northern Virginia has been driven by the PPTA process, with the necessary NEPA and MPO actions adapted to align with the private offers VDOT has received.

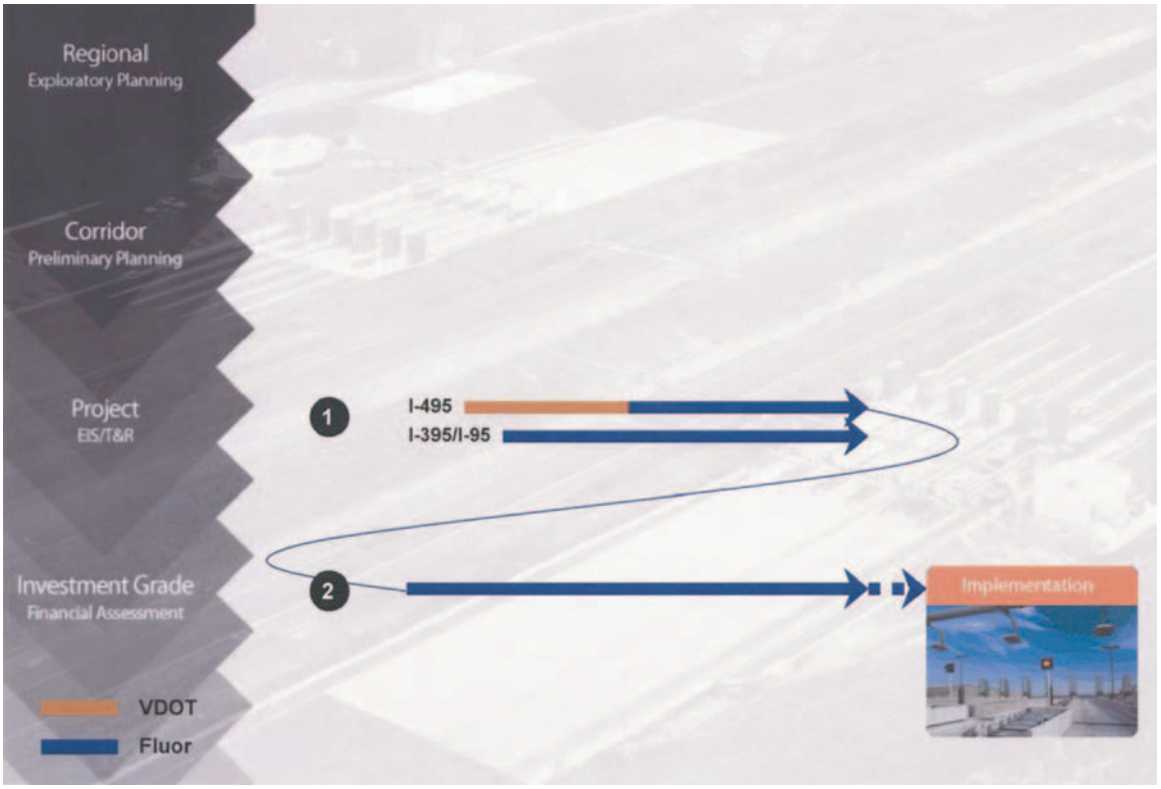

Figure 6-5. VDOT process.

VDOT's experience provides interesting contrasts to those of ODOT, which decided not to move forward with the OIPP projects because they were not financially feasible on a stand-alone toll-finance basis. While VDOT's private partner had originally claimed that it would be able to build the Capital Beltway HOT lanes at no cost to the state, final environmental approvals were not gained until 2007, and project costs were pegged at $1.7 billion. When the parties reached financial close in December 2007, VDOT agreed to contribute $409 million (24%) toward the construction of the project. While the department clearly would have preferred not to commit funding to the project, the expansion of the Capital Beltway was one of the highest transportation priorities in the state, so in the end, unlike ODOT, VDOT was willing to provide the needed funding to make the project financially feasible and reach financial close.

Plans and environmental approvals have not yet been completed for the I-95/I-395 HOT widening, but this is also a high visibility, high priority project. While some observers believe that the financial fundamentals of the I-95/I-395 project are stronger than those for the Capital Beltway, experience would suggest that VDOT would be willing to entertain providing a portion of the funding for that PPTA project as well, if it were needed to move forward.

While VDOT has focused its pricing studies on the later phases of analysis due to the fact that it received specific proposals through the PPTA, these projects complement other higher level pricing studies under way in Maryland and have led the MWCOGs to undertake a comprehensive regional study to identify an integrated network of priced lanes. Each of these studies throughout the region has reinforced the vision of developing a larger network of managed lanes, together with the understanding that this type of development makes sense in a region with high population growth and demand for mobility.

While a number of states have shied away from unsolicited offers to develop toll projects, Virginia has created a process that is able to accommodate them. Although they may be complicated to manage and are a relatively slow process, Virginia's unsolicited private offers to develop HOT lane projects appear to have supported a larger movement to consider the use of pricing throughout the Capital Region.

6.4 Synthesis

The experiences captured in the case studies demonstrate that the framework for considering the use of tolling and pricing is flexible and readily adaptable to local needs and conditions. It also demonstrates that rather than starting with larger regional studies, many locations are moving forward with the implementation of readily implemented, simpler projects such as the conversion of HOV lanes to

HOT operation, or the use of tolling and pricing on top priority projects. These efforts, in turn, may foster region-wide consideration for the more comprehensive deployment of tolling and pricing strategies as a means to meet regional mobility needs.

The study of decision frameworks for tolling and pricing has shown that while the framework is comprised of different levels of analysis, the technical aspects comprising them remain constant and largely unaltered from those of traditional highway improvements in many areas. While the different analysis areas are more or less consistent, the results of these investigations are often used and interpreted differently. This distinction reflects the wide difference in the overall goals and objectives underpinning the use of tolling and pricing applications around the country, and reveals the underlying trend that tolling and pricing are being used on an increasingly wide basis. As additional projects enter into operation, we will continue to learn more about the performance of tolling and pricing projects and how they can be managed to achieve desired goals. In the end, the evaluation framework and technical aspects comprising it have demonstrated great flexibility to help transportation planning professionals, elected officials, and public servants make informed decisions that reflect local needs and priorities.

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Abbreviations and acronyms used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation