Transportation 2040

toward a sustainable transportation system

Appendix F: Financial Strategy Background

MAY 20, 2010

Puget Sound Regional Council

APPENDIX F: Background to the Financial Strategy

Introduction

Financing Transportation Investments in a Growing Region

Transportation 2040 represents a considered strategy to address the sizable challenges associated with financing transportation investments. It is critically important that the region deliberately moves forward in developing new ways to pay for transportation projects and programs. Improving the transportation system is about achieving a broad range of other important objectives; cleaning up our environment, visiting with friends and families, making the most of our neighborhoods and our common infrastructure, and pursuing education, recreational and employment opportunities. The movement of people and goods is purposeful and creates value. Investments in this mobility are not just the niceties of a prosperous society, but are integral to the creation and maintenance of our economic and social well-being.

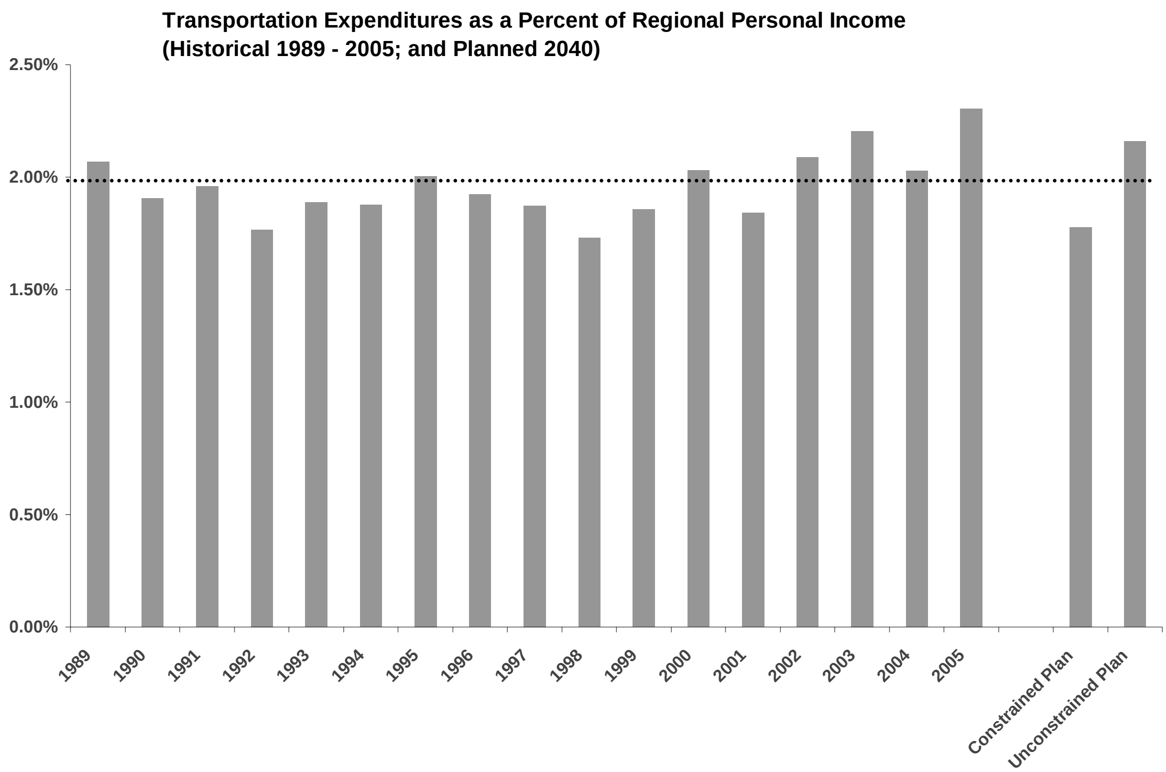
Like metropolitan regions throughout the nation, our region faces increasing problems with urban congestion and insufficient transit and other alternatives to driving. Citizens want better (or, at least, not deteriorating) mobility, yet the costs of providing new transportation capacity are increasing, the effectiveness of that capacity is often quickly compromised by growing traffic, and the public appetite for funding that capacity is waning. Limited public financial capacity for transportation infrastructure investment has encouraged transportation professionals and regional policy makers to begin discussing the potential benefits associated with reforming the way society pays for and finances transportation. The future of the fuel tax as a road finance approach is limited. Advances in vehicle technology and constant erosion of purchasing power from inflation have demonstrated the need to find other ways to pay for transportation investments. Business leaders, national experts, and state legislators are all coming to similar conclusions: traditional tax-based financing measures will not, by themselves, be sufficient to solve our transportation problems.

In the central Puget Sound region decision makers have been deliberately examining the problem of funding transportation through fees and tolls that apply to users of the transportation systems and services. Transportation 2040 sets out broad direction that moves the region toward a sustainable future in which investments can be made when they are needed, in a predictable manner, with revenues generated from those who benefit from the investments. This change can not occur overnight, but rather will only be the result of many individual steps, including legislative actions at the state and federal level. The specific path to a more sustainable approach to transportation finance cannot be known in advance with certainty, but the broader goals and outcomes represent a shared vision. Transportation 2040 presents a general scenario for the future of transportation finance in the central Puget Sound region, but recognizes there are still many important unanswered questions in policy, and embraces the need for flexible thinking about how these changes may come about.

Investments in transportation infrastructure and services are strongly linked to growth in the broader economy. As the central Puget Sound region grows over the next 30 years it will be important to ensure that there is the fiscal capacity to make investments in transportation systems. Getting the most out of transportation investments requires that the interplay between transportation investments, growth in economic activity, wealth generation, and public financial capacity shape the means through which the investments are financed.

But what level of total investment is enough? Over a period of nearly 20 years the central Puget Sound region has dedicated approximately 2% of its personal income to outlays on public sector transportation, and considerably more on private investments in personal and freight mobility. Transportation investments should be made when their benefits exceed their costs, but public sector budgets will define the limits of investment, so maintaining this level of historical effort can be seen as a minimum target for a sustainable transportation investment program. In particular, the region's fiscal capacity must be sufficient to support specific transportation needs associated with a growing regional economy.

Figure 1: Transportation Expenditures as a Percentage of Regional Personal Income



The principal transportation tax bases traditionally have been retail sales, registered motor vehicles, taxable motor fuel consumption, and the taxable value of motor vehicles. The allowable uses of nearly all existing transportation funding sources in the region are restricted to specific uses, by source, by expenditure, and often by geography or jurisdiction. Transportation infrastructure costs have been on the rise over the last few decades because of increases in material and labor costs, the costs of mitigating environmental impacts, and increased urban land values. Insufficient public resources have led to an increase in the unfunded backlog of maintenance projects, leading to higher overall costs in the future, and raising safety concerns. Meanwhile, existing transportation revenues are not keeping pace with travel demand, and the infrastructure investments needed to support this growing demand.

As the region grows and matures, so do its transportation assets. Aging infrastructure requires predictable investments in maintenance, preservation, and operations. Much of the region's infrastructure was built many decades ago and will require significant efforts in preservation, or will need to be replaced over the next three decades. And system investments that were started years ago need to be completed, such as pieces of the high occupancy vehicle network, and missing links in the road system. New urban infrastructure is expensive so providing new ways of moving freight and people around on existing infrastructure will be increasingly important as our region continues to urbanize. In the end, it is the growing peak travel periods that will be most compromised by growth if we fail to address the underlying demand for business related movement of people and goods.

Peak-period demand drives the need for new investments in roadway and transit infrastructure. Urban transportation systems are sized and built primarily in response to peak-period use. Serving and managing peak demand will require a broad range of approaches including strategic investments in new infrastructure, high occupancy services, time-of-day tolling, land use and development coordination, and other innovative strategies. Each of these needs has its own unique set of funding requirements, and some will necessitate new approaches to funding transportation altogether.

Emerging Issues in Transportation Finance

Successful implementation of Transportation 2040 will be dependent upon fulfilling the new revenue expectations of the financial strategy. Success on this front will require addressing a range of underlying issues facing the future of transportation finance, and require the region and state to develop new and innovative approaches to project finance and implementation. Some crosscutting issues in transportation finance include the following:

- The Future of Fuel Taxes. In the face of inflationary pressures and alternately fueled vehicles, the future of a fuel tax based approach to highway finance may be limited. Alternate approaches to collecting user fees have been contemplated for many years. Technical advances have revolutionized road user fee collection approaches and may someday offer a replacement alternative for fuel taxes. As the transportation sector strives to disentangle personal and freight mobility from carbon emissions, taxes on motor fuels will become an even less viable means of funding future investments.

- Bond Financing. Capturing future value in order to make investments today is a significant issue in transportation planning and investment. Historically transportation systems in the U.S. have been financed on a pay-as-you-go basis. This is no longer working well in high growth urban regions.

- Reliance upon Non-Transportation Related Tax Sources. Tax based approaches to transportation finance, as differentiated from use fees, may always result in inadequate revenues relative to anticipated investment needs. This is largely due to the poor relationship between fee charged and the costs the users of the system impose. Increased reliance on non-transportation related revenue sources, such as the sales taxes and municipal general funds, exposes transportation systems to greater revenue uncertainty as well as fails to ration scarce transportation resources and services.

- Geographic Equity for Statewide and Regional Sources. Politics lends itself to geographic divides, and these divisions have been a source of debate relating to the question of whether transportation dollars are distributed fairly. The issue of returns to the regions of Washington State of statewide transportation revenues will continue to be a focus of discussion. This is also true of the sub-regional investment policy that is part of Sound Transit program planning.

- Cost Burden Across User Groups. Who bears the costs of keeping our transportation system operational is an important question. It not only relates to issues of fairness and political viability, but also has implications for efficient transportation system management. Some users of the transportation systems impose greater costs on the system and other users than others. Heavy vehicles create more pavement and structural damage; commuters on busy roadways during the peak travel period impose delay on other users. The financial systems that support investments in transportation need to reflect these cost structures.

- Investment Rules and Prioritization. Financial constraint implies that investments may need to be prioritized if insufficient revenues become available to make all desired investments.

Lack of consistently applied approaches to project selection and prioritization can make preserving financial constraint in plan a challenge. Historically, and especially in other parts of the world, benefit-cost analysis has been employed successfully for transportation project evaluation.

Addressing Federal Requirements

Under federal law, the regional transportation plan must make reasonable financing assumptions, accounting for existing or new revenue sources which can be expected to be available over the life of the plan (Title 23 USC 134). Transportation 2040 does this, and outlines a set of conditions and assumptions that constitute a financial strategy for implementing the plan.

The metropolitan planning statutes state that the long-range transportation plan and regional Transportation Improvement Plan (TIP) must include a "financial plan" that "indicates resources from public and private sources that are reasonably expected to be available to carry out the program".[1] The purpose of the financial plan is to demonstrate fiscal constraint. These requirements are implemented in federal transportation planning regulations for the metropolitan long-range transportation plan, TIP, and Statewide TIP (STIP). These regulations provide, in essence, that a long-range transportation plan can include only projects for which funding "can reasonably be expected to be available".[2] Finally, the Clean Air Act's transportation conformity regulations specify that a conformity determination can only be made on a fiscally constrained long-range transportation plan.[3]

The fiscal constraint requirement is intended to ensure that metropolitan long-range transportation plans, TIPs, and STIPs reflect realistic assumptions about future revenues, rather than being lists that include many more projects than could realistically be completed with available revenues. Given this basic purpose, compliance with the fiscal constraint requirement entails an analysis of revenues and costs. The basic question to be answered is

> *"Will the revenues (federal, state, local, and private) identified in the TIP, STIP, or metropolitan long-range transportation plan cover the anticipated costs of the projects included in this TIP, STIP, or metropolitan long-range transportation plan, along with operation and maintenance of the existing system?"*

If the projected revenues are sufficient to cover the costs, and the estimates of both revenues and costs are reasonable, then the fiscal constraint requirement has been satisfied. Ideally, the financial strategy that supports the metropolitan long-range transportation plan needs to reflect "…the estimated costs of constructing, maintaining and operating the total (existing plus planned) transportation system",[4] including portions of the system owned and operated by local governments.

The financial component of Transportation 2040 provides a comparison of revenues and investment needs over the entire planning period, as an aid to determining if the region has the financial capacity to implement the plan. Financial planning for Transportation 2040 has been built upon previous efforts to design a framework for measuring the region's financial capacity, taking into account the unique circumstances of each program area — city streets, county roads, public transit, state highways, and state ferries.

The financial element of Transportation 2040 provides a comprehensive picture of the financing requirements for maintaining and improving the region's transportation system. The

[1] 23 U.S.C. 134(g)(2)(B) and 134(h)(2)(B)(ii)
[2] 23 CFR 450.322(b)(11)
[3] 40 CFR 93.108
[4] 23 CFR 450.322(b)(11)

transportation improvements identified in the financially constrained plan are estimated to cost approximately $190 billion (year 2008 constant dollars) for the period 2010–2040, including over $100 billion to operate, maintain, and preserve the existing system. Current-law revenues — generally existing sources of funds at current tax rates — were found to be sufficient to fund the on-going needs of the current system, but inadequate for adding new capacity needed to address existing deficiencies and population growth. The plan includes a financial strategy that identifies the importance of developing new statewide and regional sources of funding in order to support the plan's implementation.

The financial strategy reflects up to date financial assumptions and an assessment of the viability of current and potential new revenue sources. Major steps in the development of the financial strategy included the following:

- Employ most current tax-base forecasts with which to make revenue estimates for all transportation programs contained in the long-range regional plan.
- Obtain new information about project schedules and cost estimates from operating agencies. In addition staff has developed new estimates of programmatic costs for maintenance, preservation, and operation of existing systems.
- Report all cost and revenue information in a year 2008 constant dollar, as well as report financial summary information in year of expenditure dollars. All future year costs, where inflation has been included in cost estimates, are reported in constant dollar terms that retain inflation risk premiums for specific project elements as appropriate.
- Report plan financial information by program for the years 2010-2040, as well as for each decade of plan implementation.
- Develop a new revenue component of the plan financial strategy. This was a major topic for PSRC Board deliberation to ensure that the strategic element of the financial plan reflects Board policy and meets a reasonableness test.

This work has led to the development of a financial strategy that does the following:

- Makes the case for the development of new funding over the plan implementation period
- Adds specificity to a set of funding assumptions contained in the financial strategy of the previous plan (e.g., tolling, regional funding).
- Identified projects that may not be ready for implementation prior to the planning horizon due to financial constraints or other project readiness limitations.
- Developed an illustrative list of projects that are not covered by the plan's financial strategy, and would not be part of the plan's air quality determination.

Estimating Investment Needs by Program

Transportation projects and investments are implemented by numerous agencies that are organized, for financial analysis purposes, by implementing program. These programs are the same programs for which estimated revenues are allocated by use: city streets; county roads; local transit; Sound Transit; state ferries; and state highways. An “Other” category includes regional nonmotorized investments, regional demand management programs, regional Intelligent Transportation System (ITS) investments, and regional toll system deployments. Transportation investment costs in Transportation 2040 are compiled from both project and programmatic cost estimates. Project costs are provided by project sponsors for projects that are discrete and relate to Metropolitan Transportation System (MTS) facilities and services. Programmatic costs are estimated for non-discrete investments (e.g., maintenance and operations) and non-MTS facilities (e.g., collectors and distributors). This is consistent with federal guidance to consider all appropriate costs regardless of where they are incurred on the regional network.

Programmatic Estimates

PSRC estimates programmatic costs for various aspects of investment in the regional transportation systems. These estimates include maintenance, operations, and some aspects of system preservation for cities, counties, local and regional transit operations, ferry system operations and state highway system operations and maintenance. In addition, there are programmatic estimates of capital needs associated with the city and county programs that represent projects that are not part of the MTS, and therefore lack specific project-level estimates of cost.

Often multiple methods are employed to estimate programmatic costs in order to ensure that estimates are robust to different costing approaches. This is particularly true for city and county programmatic estimates where multiple jurisdictions are represented. In the case of state and transit programs it is possible to more closely rely upon agency specific estimates of their programmatic needs. PSRC has compiled BARS (budgeting accounting and reporting system) data for the period 1988-2007, summarizing maintenance costs by county, for county roads and city streets. These represent the full costs of maintenance for the streets and roads network. The maintenance cost methodology uses the most recent BARS data as the point of departure.

A recent effort to more precisely capture the costs of preserving road assets was jointly undertaken by PSRC and King County. This effort made use of road asset inventories, pavement quality ratings and recent bid materials to more completely reflect the costs of bringing existing assets up to standard and maintaining those standards throughout the planning period. This effort also led to a more detailed representation of a preservation backlog. A simple representation of programmatic cost estimation approaches is contained in Figure 2 below. City and county maintenance costs are estimated to grow at 3.8% in real terms over the 30-year planning period, while non-project capital requirements are estimated to grow at 2.5% in real terms. Local transit operations are estimated to grow at approximately 3% in real terms on a unit cost basis. Nonmotorized, travel demand management, ITS and toll system costs are also estimated programmatically through various detailed methods.

Figure 2: Summary of Programmatic Cost Methodology

Element	Approach
(1) Current Deficiencies/Backlog Costs	PSRC survey, expanded to county and regional totals (roads and bridge costs separately identified). New methods were introduced through work undertaken by PSRC and King County to assess pavement conditions and inventory. City of Seattle also provided a detailed inventory of preservation backlog needs.
(2) Future Local Maintenance Costs	Extend current annual maintenance costs from the Washington State Auditor's Office Budgeting, Accounting, and Reporting System (BARS) 542.00 account; expand proportionately for increases in C/L mileage by jurisdiction (includes both roads and bridges)
(3) Future Local Preservation Costs	Focus on roadway resurfacing costs and cycles; build from unit costs developed as part of the 1988 Roads Jurisdiction Study; compare results to actual annual roadway construction costs reported through BARS account 595.30 to protect against material error. New methods were introduced through work undertaken by PSRC and King County to assess ongoing pavement conditions and inventory.
(4) Bridge Maintenance/Preservation Costs	Bridge preservation costs were developed based on discussion with WSDOT.
(5) Local Transit Operations Costs	Local transit operations costs were estimated by employing unit cost estimates for bus service hours derived from observed data and operator judgment about future cost conditions. Service hours were an output of scenario travel modeling where service concepts were defined as an input but actual hours were a result of transit assignment on a congested network. Bus and base inventory and costs were also adjusted to be consistent with service. For BRT routes additional capital requirements were estimated to reflect road improvements that support the service concept.
(6) Sound Transit Operations Costs	Operating costs for Phase 1 projects were derived from Sound Transit's Financial Plan. Costs for subsequent phases of investment were scaled to the extent of capital expansion from operating cost assumptions included in the Financial Plan.
(7) State Maintenance and Operations Costs	Provide directly by WSDOT.
(8) Demand Management, ITS, Non-motorized Costs	Various cost models developed to estimate costs for individual strategies and investment scenarios.
(9) Toll System Costs	Toll system cost model developed for PSRC by Cambridge Systematics Inc. This model employs travel modeling data (toll transaction volumes and measures of the system extent) to estimate capital, operating, enforcement, payment processing costs for the deployment of various types of tolling approaches.

Project Estimates

Transportation 2040 contains hundreds of individual project that will be implemented as part of the Metropolitan Transportation System (MTS). These projects range from small scale investments to multi-billion dollar highway and rail projects. These projects are listed in the Program and Project List (Appendix B) of Transportation 2040. PSRC relies upon the implementing agencies to provide project cost estimates. Given the dozens of implementing agencies, the broad scale of investments, and the various levels of project engineering represented, it is expected that project cost estimating approaches will also vary considerably. PSRC invests considerable resources in the recording of project details in cooperating with all the various responsible agencies. This process helps to provide some greater level of consistency in the representation of projects and their costs, and also allows costs that are associated with various project implementation years to be characterized in constant dollar and year of expenditure equivalents. Larger projects, especially those implemented by the Washington State Department of Transportation and Sound Transit, have undergone exacting analysis of project implementation and cost risk and uncertainty. These methods are described in detail on the agencies' web pages. Where these estimation efforts have captured inflation, or other cost risks associated with discrete aspects of the project, the "premiums" are retained even when project costs are converted to a constant dollar basis.

Timing of Investment Needs

The transportation investments included in Transportation 2040 are described in detail in Chapter 5 of this document. The plan contains investments that are covered under the plan's financial strategy or constrained plan, but also contains investments that are as yet unprogrammed and not covered by the financial plan. As described above, the cost information about these investments has been assembled from detailed cost estimation methodologies appropriate to both broad programs of investments and individual projects. The Transportation 2040 database of transportation projects contains information about project costs and year of implementation. Programmatic estimates of the resources required to maintain and operate city, county, and transit programs have also been developed in a detailed manner that reflects the timing of these investment needs. Figure 3 below presents investments that are covered under the financial strategy for the major transportation programs by decade.

Figure 3: Financially Constrained Cost Summary 2010-2040

(millions of year 2008 constant dollars)

	Constrained 2010-2020	Constrained 2020-2030	Constrained 2030-2040	Constrained 2010-2040
Counties	**$ 4,400**	**$ 5,100**	**$ 6,200**	**$ 15,700**
Cities	**$ 9,000**	**$ 9,300**	**$ 9,400**	**$ 27,600**
Local Transit	**$ 11,200**	**$ 17,300**	**$ 28,700**	**$ 57,300**
Sound Transit	**$ 15,100**	**$ 12,400**	**$ 12,400**	**$ 39,900**
State Ferries	**$ 2,100**	**$ 2,300**	**$ 3,800**	**$ 8,200**
State Highways	**$ 16,000**	**$ 6,700**	**$ 11,000**	**$ 33,800**
Passenger-Only Ferries	$ 200	$ 200	$ 200	$ 500
ITS/Operations	$ 500	$ 500	$ 500	$ 1,400
Demand Management	$ 700	$ 400	$ 400	$ 1,500
Regional Non-motorized	$ 200	$ 100	$ 100	$ 300
Toll System	$ 400	$ 1,100	$ 1,500	$ 3,000
Other Subtotal	**$ 1,900**	**$ 2,200**	**$ 2,700**	**$ 6,800**
TOTAL	**$ 59,700**	**$ 55,300**	**$ 74,200**	**$ 189,300**

Estimating Current Law Revenues

Current State of Transportation Finance

Transportation funding in the central Puget Sound region draws mainly from a few primary tax bases. These include motor fuels sales, retail sales, motor vehicle market value, assessed property valuation, and vehicle registrations and licenses. In addition to taxes on these tax bases, transportation revenues are drawn from a combination of other sources, such as operating income and sources comprising city and county general funds.

- Cities and counties support transportation investments from a wide variety of funding sources. The state Legislature has authorized a number of local option taxes that have, in many instances, proved difficult to implement. At the same time a number of tax-limiting initiatives and growing demands for general fund dollars have made local commitments to transportation a challenge to sustain.

- Local transit authorities' primary source of funding is the sales tax. With the loss of Motor Vehicle Excise Tax revenues the local transit operators are increasingly dependent upon the sales tax, which is a less stable source of revenue; rising and falling with other economic factors.

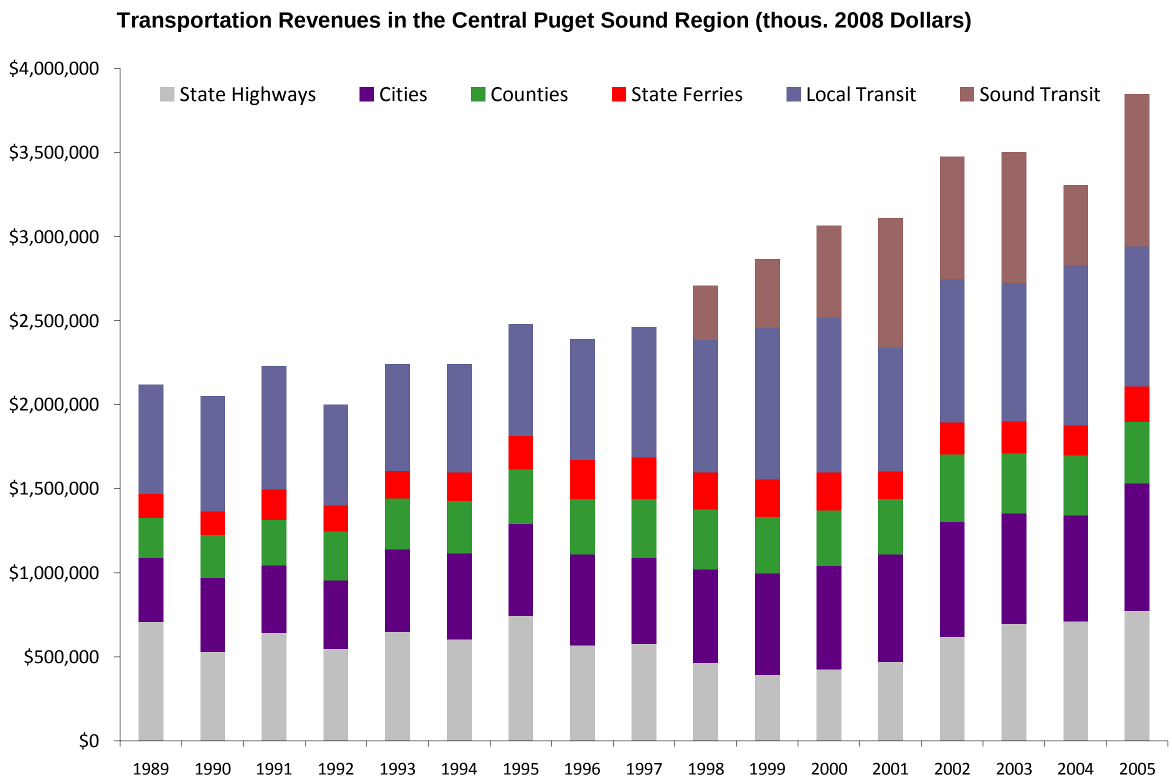
- The Washington State Ferries has also been affected by the loss of Motor Vehicle Excise Tax as well as the declining purchasing power of the fuel taxes. The result is an increasing reliance upon tariffs for operations and state budget allocation for capital investments. The state highway program is heavily dependent upon fuel tax revenues, from both state and federal taxes.

PSRC has compiled a history of sources and uses of funds for city streets, county roads, public transit, state ferries, and state highways through 2006, from reports prepared by the state. Streets and roads data derive from the budget accounting and reporting system (BARS) account structure, which cities and counties follow in submitting reports to the state for all financial activities. The PSRC database for streets and roads dates from 1988. The public transit data are drawn from the annual public transit report prepared by WSDOT, based on input from each transit operator in the state. These data date from 1989. State ferry and state highway data are drawn from county-level allocations for revenues and expenditures that are developed by WSDOT. WSDOT maintains a rolling ten-year history of these data.

The PSRC began assembling these databases after the 1995 MTP Financial Element was prepared. The 1995 Financial Element report relied on estimates of sources and uses of funds that, while the best immediately available, were drawn from a variety of reports that sometimes provided inconsistent measurements of what was actually being spent on transportation, and how those activities were being funded. Further, due the apparent lack of historical data, the 1995 report used only a single year of actual data (1992) as its point of departure. The current financial forecast is believed to be more accurate, since the historical sources and uses of funds are now measured in a consistent manner within each program. Also, it is now possible to contrast the forecast with historical trends for the past fifteen years.

Historical revenue information for major transportation programs is displayed in Figure 4 below.

Figure 4: Transportation Revenues in the Central Puget Sound Region



A number of substantial changes have occurred over the last decade that have had a significant influence on transportation finance. These changes include the passage of a number of tax-limiting citizen initiatives, legislative actions to secure additional transportation funds, and the voter approval of a number of transit tax measures.

- A number of citizen initiatives placed limits on state and local taxes including most significantly, the elimination of the statewide Motor Vehicle Excise Tax (MVET), and the limitation of property tax collections to a 1% annual growth rate, resulting in a decline of property tax rates for most taxing districts.

- The elimination of the MVET affected the state general fund and the Motor Vehicle Fund, which supports both highway and ferry funding. MVET funds were also used to support a city and county sales tax equalization program and were distributed directly to local transit providers and represented their second single largest revenue source after local sales tax revenue.

- Since 2000, local transit agencies have successfully garnered voter support to pass increases in the local sales tax rates that generate revenues for their transit operations.

- In 2003 and 2005, the State Legislature passed, and the Governor approved, statewide transportation funding packages that included fuel tax increases and increases in various other fees. The state funding packages dedicated significant dollars to highway projects in the central Puget Sound region. In addition, the packages included new ferry capital funds for auto vessel replacement and terminal improvements.

The starting point in the development of the Transportation 2040 financial strategy is an estimate of future revenues that will be available under current revenue law. When compared with plan investment costs, the current law revenue estimate provided the basis for determining the scope of new revenue strategies that need to be part of the plan.

Current Law Revenue: Sources, Uses, and Timing

The PSRC Regional Transportation Revenue Model ("the model") is an Excel workbook that presents historical and projected revenues, and associated tax bases (produced by the regional economic model), for the following uses of funds: city streets; county roads; local transit; Sound Transit; state ferries; and state highways. Collectively, these uses of funds comprise all elements of the public surface transportation system in the four-county Puget Sound region – King, Kitsap, Pierce, and Snohomish counties. The revenue projections are denominated in millions of nominal (or year-of expenditure) dollars through 2040. The revenue projections can be converted to constant dollars of any year in the time series covered by the model (1975-2040).

Figure 5: Schematic of Estimating Transportation Revenues

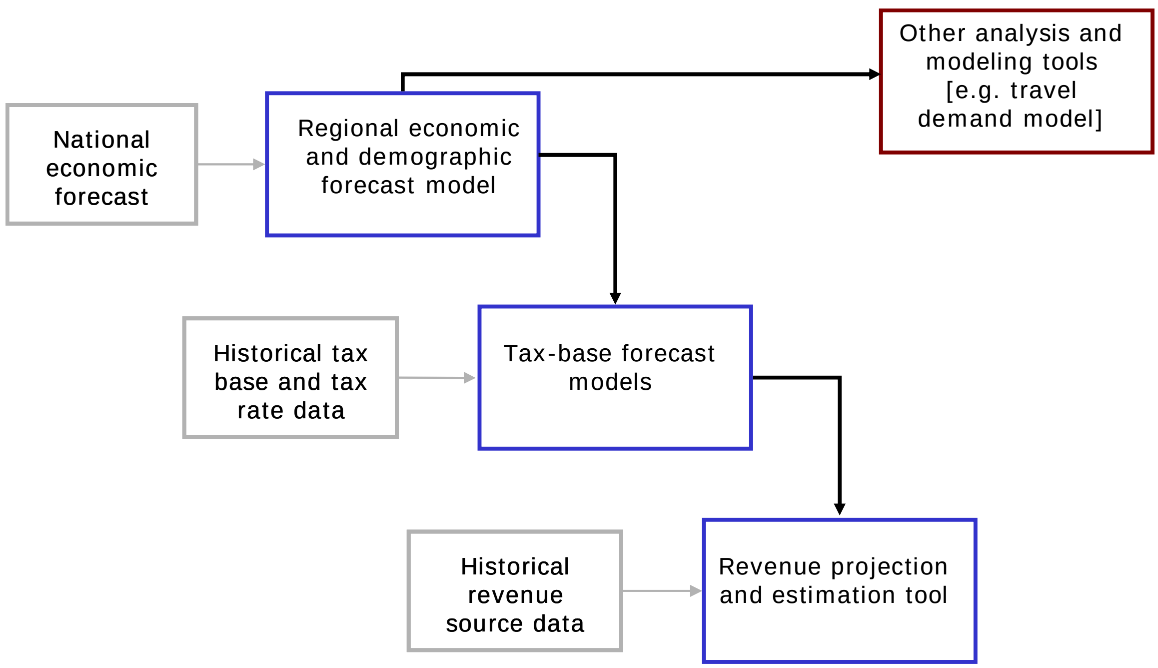


Figure 6 displays broad categories of current law revenue by source and decade.

Figure 6: Sources of Current Law Revenues

SOURCES OF TRANSPORTATION REVENUE	2010-2020	2021-2030	2031-2040	2010-2040
State Taxes on Motor Fuels	$6,200	$4,640	$3,900	$14,740
Registration and License Fees (incl. weight fees)	$810	$620	$600	$2,030
Other State Taxes and Fees	$330	$320	$430	$1,080
Other taxes and fees supporting general funds	$6,080	$6,000	$6,400	$18,480
Property Taxes (general or restricted)	$1,400	$1,150	$1,080	$3,630
Development and Impact Fees	$130	$120	$110	$360
Fares and Operating Revenues	$4,100	$4,000	$4,100	$12,200
Federal - FHWA	$1,700	$1,140	$990	$3,830
Federal - FTA	$1,490	$1,270	$1,270	$4,030
Sales Taxes (general)	$20,730	$16,810	$23,550	$61,090
Parking Taxes	$40	$30	$30	$100
Property Tax on Motor Vehicles (MVET)	$1,400	$1,000	$1,230	$3,630
Total Current Law Revenue	**$44,410**	**$37,100**	**$43,690**	**$125,200**

Current law revenues derive from forecasts of the principal transportation tax bases. The principal transportation tax bases are retail sales, registered motor vehicles, taxable motor fuel consumption, and the taxable value of motor vehicles. Future annual values for these tax bases are forecast using a series of models. The resulting forecasts of revenues are then converted to program revenue estimates, taking into account the distribution of revenues to each program, due either to legislated dedications or allocations, or past practice; and the percent of generated revenues that are returned to this region. Figure 7 below displays current law revenue estimates by transportation program and decade.

Figure 7: Current Law Revenues 2010-2040

(millions of year 2008 constant dollars)

PROGRAM	2010-2020	2020-2030	2030-2040	2010-2040
Counties	$ 3,200	$ 2,800	$ 2,900	$ 8,800
Cities	$ 6,900	$ 6,500	$ 6,700	$ 20,100
Local Transit	$ 10,500	$ 14,900	$ 19,100	$ 44,500
Sound Transit	$ 15,100	$ 7,200	$ 10,100	$ 32,400
State Ferries	$ 1,900	$ 1,700	$ 1,900	$ 5,400
State Highways	$ 6,800	$ 4,200	$ 3,100	$ 14,100
TOTAL	**$ 44,400**	**$ 37,100**	**$ 43,600**	**$ 125,200**

Tax on Fuels: Long-term Prospects and Alternatives

Taxes on motor vehicles and fuels have played an important role in the history of road finance. Early in the 20th century many roads were still built by private companies and financed through tolls. Often some public contributions were involved and financed through general taxes. In 1901 New York City imposed a vehicle registration fee, as private motor vehicles first began to impose costs on public infrastructure. By 1914 all states collected some form of vehicle registration fee. The federal government recognized a national role in highway finance early on, and the Federal Aid Road Act of 1916 provided grants to states to improve the public roads system and also prohibited tolls on Federal Aid facilities. This led to the formalization of State Road Authorities, and the implementation of fuel taxes. Oregon was the first state to implement a tax on motor fuels in 1919, but by 1929 all 48 states followed suit. Three years later, in 1932, the federal government levied a federal tax on fuel, solidifying the federated role in highway finance that persists today.

However, the period of reliance upon fuel tax financing may be coming to a close within the next few decades. Changes in vehicle technology and inflation continue to compromise the purchasing power of fuel tax proceeds. This path is unsustainable and new sources of reliable funding must be developed and phased in over time. There is growing interest in various approaches to replacing fuel taxes, and the central Puget Sound region has been at the forefront in some of the leading research. Vehicle charging technology is already available to allow a transition to another form of direct charging for road use. But many policy and program design issues remain unaddressed at this point. The central Puget Sound region and Washington State have some specialized experience with this topic. In 2006, the PSRC conducted a pilot project, the Traffic Choices study, to see how travelers change their travel behavior in response to variable charges for road use (variable or congestion-based tolling). The project observed driving patterns, but also learned about vehicle charging technology, some key policy issues and program design. A major piece of future work must involve a comprehensive design of a structural replacement for fuel taxes.

A number of policy and technical studies have been conducted over the last few years that examine the future prospects for taxes levied on fuel consumption. These studies including work sponsored by the Transportation Research Board, the U.S. Chamber of Commerce, Federal Highway Administration and two congressionally authorized national policy commissions (Surface Transportation Policy and Revenue Study Commission and the Surface Transportation Infrastructure Finance Commission). The general consensus is that fuel taxes need replacement within the next couple of decades in order to maintain fiscally sound transportation systems at the national, state and local levels. Other studies have examined the possible fuel tax replacement alternatives, including fixed vehicle fees, charges on miles driven, time-distance-place charges, tolling, and various types of road pricing. Transportation 2040 advances the notion that fuel taxes will need replacement within the plan's implementation horizon; and that use charges based on the amount of use and the costs of use will be phased in over the next few decades. There are many details to be resolved before any specific revenue program would be implemented, and this effort will require involvement from numerous interests from the public and private sectors and at all levels of governance. These areas of policy are beyond the scope of this document to resolve, but the central Puget Sound region and Washington State have begun serious efforts to begin to tackle this challenging aspect of the future of transportation finance. The PSRC makes a strong commitment, through Transportation 2040, to continue to pursue innovation and quality applied research on this important topic.

The Future Role of Tolling/Pricing

In 1995 the PSRC created a Transportation Pricing Task Force to contribute to public dialogue about the long-range financing and pricing of transportation investments. The Task Force concluded that a transportation financing structure based on variable roadway charging could provide significant benefits to society, and suggested it would be possible to better balance transportation supply and demand through price, much as is done in most other areas of our economic lives. The Task Force recommended that the region should:

- Promote transportation financing methods that are based on use, and help optimize system efficiency with the long-term goal of introducing variable roadway pricing.
- Continue to explore and adopt transportation demand modeling improvements and other analytical tools that better assess traffic management strategies.
- Work with communities, WSDOT, and local authorities to plan, design and implement a demonstration program prior to 2006.
- Develop and help fund a detailed outreach effort which seeks to inform, engage and build regional consensus around implementation of transportation pricing.

Much has happened since 1995 in the area of road tolling, both in the central Puget Sound region, and nationally. But the underlying structural problems in transportation finance remain. State and federal sources of transportation funding are designed to meet broad needs across diverse geography and are not always adequate to address the unique requirements associated with investing in growing urban regions. For example, the current system of highway finance relies heavily on flat fees: the motor-vehicle fuel tax (and licensing and registration fees). This system of flat fees necessarily has the effect of *under*charging peak use, and *over*charging off-peak use, at least in relative terms. The result is that:

- Roads are overused and experience queuing (congestion) during the peak periods.
- Users lose valuable time sitting in congestion.
- Use of the roads by High Occupancy Vehicles (HOVs) such as carpools and buses is less than it would otherwise be.

These problems, in turn, affect the investment incentives and fiscal balance of the transportation system. Congestion provides a misleading indicator as to which facilities or routes need more capacity, which, in turn, may cause road authorities to build some roadway capacity that the users themselves would not be willing to pay for. Such a system of finance can remain solvent only if aggregate gasoline tax revenues are sufficient to permit cross-financing of projects. When such a system is applied across a state or the entire nation, cross-financing raises large-scale fairness questions. One solution to this fiscal dilemma is to raise gasoline tax or other broad revenue sources, which can exacerbate underlying issues of fairness. Another is to use congestion tolling to explicitly recognize the true, differential cost of different road segments. The latter solution improves the management of current and new investment at the same time it helps resolve the transportation fiscal problem.

An economic principle for the efficient use of resources is that the users of those resources should pay their incremental or marginal cost. Applied to transportation, road users should bear the costs that their travel (use of the road resource) imposes on the roadway system. A comprehensive congestion-based tolling system would institute a structure of fees varying by time of day, type of road, and type of vehicle. Setting congestion prices correctly is important if the policy is to be fair and produce economic benefits. Congestion tolls should be viewed as tools for giving signals to people about the costs of their use of the system allowing them the opportunity to make sensible decisions based on those costs.

Generally, the effectiveness of congestion tolling is the greatest with broad geographic coverage. Broader coverage can reduce the problem of *diverted traffic*: traffic that is “tolled-off” the priced facility and now is using and congesting other roadways. A particularly bad form of this problem is *cut-through* traffic on local streets. Though barriers and policing can reduce the problem, the more efficient and fair way to deal with it is to correctly price the roadway and/or toll the alternative routes.

Making users pay, directly and immediately, for costs their use engenders encourages them to economize on costly activity. But implementing congestion tolling does not affect just price levels. The setting of tolls has to be coordinated with the highway investment process. Properly applied congestion tolling requires that the revenues be utilized in the most economically efficient manner. With tolling, there is a more direct relationship between the revenues and costs for individual road segments or projects, which facilitates doing feasibility analysis on a segment-by-segment basis. That makes it easier to rely on financial criteria to evaluate roadway projects since it will be clearer who pays and who benefits.

Congestion tolling, however, has the major disadvantage of not being a standard procedure. It is different, and raises new issues. Will it really work? Can the technology work reliably and at what cost? What about privacy: Should government be trusted with information about where citizens (or at least their vehicles) are at a certain time? Does congestion tolling create opportunities that the rich can afford but the poor cannot, and, if it does, is that fair? The answers to these and other questions are starting to take shape, but the next decade of experiences will provide a much better set of answers and public policies.

History of Tolling in the State and Central Puget Sound

Virtually all of the major bridges in Washington State were built with tolls. In all cases, the bridges were financed wholly or in part through bonds, and the bonds were repaid through toll collection. Once the initial construction bonds were paid off, the tolls were removed (see Figure 9). In many cases, the tolls came off well ahead of schedule when toll collections exceeded forecasts. By 1985, there were no more toll bridges in Washington, except for two bridges between Washington and Oregon: Bridge of the Gods is owned by the Port of Cascade Locks in Oregon, and Hood River Bridge is owned by the Port of Hood River in Oregon. Virtually all of these bridges from past decades had toll rates that appear modest by today’s standards but when inflation is considered, were in fact very high. For example, the $1.00 toll on the Longview Bridge in 1930 would have been worth over 23 dollars in 2005. A more recent example was the second Tacoma Narrows Bridge built in 1950, with a round trip toll of $1.00 –that would have been worth $8.77 in 2005.

In 2007, the second span of the Tacoma Narrows Bridge opened to traffic, with tolls of $3.00 for cars paying cash, and $1.75 for cars paying with the cashless *Good to Go!* transponder. Toll rates increased to $4.00 for cash and $2.75 for *Good-to-Go!* on July 1, 2008.

Washington State’s tolling experience has expanded beyond bridges to include the recently opened, the SR 167 high occupancy toll (HOT) lanes. This project is the state’s first HOT lanes implementation and includes variable pricing; tolls are collected using the state’s *Good to Go!* electronic toll collection system.

Figure 8: History of Tolling In Washington State

Facility	Dates of Toll Collection	Passenger Car Toll Rate[a]	Initial Toll Converted to 2005 Inflation-Adjusted Dollars
Longview (SR 433) *(Built in 1930, Purchased in 1947)*	1930-1965	$1.00	$23.02
Lacey V. Murrow Memorial Bridge (I-90) *First Lake Washington Bridge*	1940-1949	$0.50	$6.86
Tacoma Narrows Bridge (SR 16) *(First Bridge)*	1940-collapsed	$1.10	$15.10
Agate Pass Toll Bridge (SR 305)	1950-1951	$0.50	$3.99
Tacoma Narrows Bridge (SR 16) *(Second Bridge)*	1950-1965	$1.00	$8.77
Fox Island Bridge (SR 303)	1954-1965	$0.75	$5.36
Port Washington Narrows Bridge (SR 303)	1958-1972	$0.20	$1.33
Maple Street Bridge – Spokane	1958-1990	$0.10	$0.67
Vancouver/Portland Bridge (I-5)	1960-1966	$0.40	$2.60
Hood Canal Bridge (SR 104)	1961-1979	$2.60	$16.71
Biggs Rapids Bridge (U.S. 97) *(Sam Hill Memorial Bridge)*	1962-1975	$2.00	$12.73
Evergreen Point Bridge (SR 520) *Second Lake Washington Bridge*	1963-1979	$0.70	$4.40
Vernita Toll Bridge (SR 24)	1965-1976	$1.50	$9.15
Hood Canal Bridge (SR 104) *(Rebuilt)*	1982-1985	$4.00	$9.96
Tacoma Narrows Bridge (SR 16) *(New span)*	2007-present	$3.00 cash $1.75 Good to Go![b]	$2.73 cash $1.59 Good to Go!
S.R. 167 HOT Lanes	2008-present	$0.50-$9.00[c]	$0.45-$8.18

Source: Washington State Department of Transportation.
[a]Tolls shown are round-trip charges for a vehicle and driver only.
[b]Toll rates will rise on July 1, 2008 for cash paying customers; rate is $2.75 for *Good To Go!* customers.
[c]Dynamic pricing, depending on level of congestion.

Global and National Tolling Context

Tolling has been used for centuries to finance highways. For example, early road building in the United States relied heavily on private, profit-seeking entities, and the historical remnants of these early turnpikes can be seen in the numerous roads with the "turnpike" moniker. The earliest turnpike in the United States was the Philadelphia and Lancaster Turnpike Road, built in 1795. These early turnpikes ultimately failed, as more efficient canals and then railroads were developed in the mid-1800s.

It was not until the popularization of automobiles in the early to mid-20th century that toll-backed financing gained renewed popularity. Starting with the Pennsylvania Turnpike in the 1930s, state after state embarked on building intercity highways using toll revenue bonds. For the most part, these new highways were developed by special purpose authorities and were financed with bonds backed by the anticipated toll collections. This era of turnpike building extended into the 1950s and early 1960s, but was mostly extinguished by the advent of the Interstate Highway System begun in 1956. Though some of these early turnpikes paid off their debt and removed their tolls, most still operate as tolled facilities, since the need to upgrade, expand, and extend could be funded through continuing toll collection on the original facilities.

The late 1970s and 1980s saw another revival of the toll financing concept, this time focusing on urban expressways in a few fast-growing areas, where traditional revenue sources were inadequate to meet growing traffic demands.

In the 1990s and continuing into the early part of the 21st century, toll facility development continued, this time enhanced by the promise of electronic toll collection to reduce or eliminate the delays commonly associated with traditional toll roads. Electronic toll collection also opened the opportunity for new concepts in tolling, such as high occupancy toll (HOT) lanes, express toll lanes, truck only lanes, cordon tolling, and mileage-based pricing. Innovations are proceeding at a pace, whereby, it soon may be technically feasible to toll a broad spectrum of other roads, using global positioning satellites (GPS) or roadside short-range radio methods. Though the more recent activity has been more widespread than that in the 1970s and 1980s, tolling continues to be a solution primarily being done by a few states with intense traffic needs.

The advent of electronic toll collection has broadened the potential policy rationale for tolling. Whereas, the historical use of tolling has been to fund high-cost projects, it can now be used to manage congestion on a network with limited capacity. Economists have long argued that using flat user charges (the gas tax) does not reflect the true value of highway travel under congested conditions. Using price to manage demand is used in the airline, hotel, and telecommunications industries, to name a few. With electronic tolling, it can now be used in the highway industry, and many regions are starting to move in that direction.

Recent Trends in Tolling Applications

There are several recent trends in the planning and development of new tolling projects, as discussed below.

Existing Systems Leveraging New Capacity

Regions with successful and mature toll roads have a significant advantage when trying to develop new toll projects. Historically, many of the nation's toll roads were developed using revenue bonds, which meant that projects needed to generate enough revenue to cover debt service in the early years. However, once they got through these early years (sometimes with the help of general obligation guarantees), they quickly became money makers, and had excess revenue. Depending on the enabling legislation or relevant bond documents, this excess revenue from the existing system often could be used to subsidize extensions or entirely new toll projects.

A few recent examples of new toll projects being developed using system financing or guarantees are highlighted below.

- In Texas, toll road authorities in both Houston and Dallas have continued to build new facilities backed by revenue streams from existing systems.
- Florida's Turnpike and other agencies in Florida have built extensive systems of toll projects by using established revenue streams from earlier projects.
- In Massachusetts, excess revenues from the Massachusetts Turnpike Authority, obtained from toll increases, have been used to help close the funding gap in the Central Artery/Tunnel project, most of which is untolled.
- In New York City, the MTA uses toll revenues from its bridge and tunnel crossings to subsidize its transit operations.

Leveraging the revenue of an existing system can create concerns about interregional and intraregional equity. People may not always be willing to have the tolls collected on "their" part of the system used to support projects on a part of the system that they do not use; this unwillingness from users could change if tolls are channeled to public transportation improvements so that every user of the system benefits.

Startup Traditional Toll Facilities

Many regions are turning to tolling to enable construction of limited access highway projects (or bridges/tunnels) that are not being funded through general funding mechanisms. When funding highway projects on a pay-as-you-go basis, it can often take years or decades for enough dollars to be available to pay for a project. With tolling, the dedicated future revenue stream can be bonded, enabling the project development to be accelerated. Recent projects are being developed through the public sector, as well as through public-private partnerships.

Public Sector

Historically, toll roads were developed by special purpose public authorities that raised capital either through the sale of non-recourse revenue bonds backed by toll collections. With non-recourse bonds, shortfalls in toll revenue could result in default. Non-recourse bonds were used to finance most of the major eastern toll roads, such as the Massachusetts, Pennsylvania, and New Jersey turnpikes. In some cases, projects mitigated some of the default risk with backup pledges from government, either through general obligation bonds (where state or local governments pledged tax revenues to make up for any revenue shortfalls from tolls), or limited obligations of specific revenue sources (such as gas taxes).

In the mid-1980s, the toll road system in Harris County (Houston), Texas, was financed with bonds backed by both toll revenues and a general obligation pledge of the County. Likewise, in the mid-1990s, the E-470 Public Highway Authority developed a startup toll facility in the Denver region with partial support from a regional vehicle registration fee.

In contrast, the Foothill/Eastern and San Joaquin toll roads in Orange County, California, were developed by two public authorities (one for each corridor), largely through the use of non-recourse toll-backed debt.

For some projects, a combination of factors led to toll revenue in the early years to be considerably lower than forecast. Both Houston and Orange County toll road systems opened in the midst of severe economic recessions. This resulted in both financial and public relations difficulties. The E-470 project, in some ways, was the most speculative, as it was heavily dependent upon future traffic growth that would result from development spurred by the road itself. However, the risks inherent in the project were mitigated somewhat by both the pledge of the vehicle registration fees and the funding of deeply subordinated loans by the state DOT and local governments.

It is becoming increasingly difficult for new standalone projects to be self-supporting without revenue pledges from other sources (either non-toll or existing, mature toll facilities); this difficulty is probably due to the higher cost of road development. Between 2006 and 2007, the Texas Turnpike Authority opened the first three segments of SH 130, its first toll road that used a combination of TIFIA loans, bonds, state funds, and local grants.

Public-Private Partnerships

The mid-1990s brought greatly increased interest in the role of public-private partnerships (PPP) in the development of toll facilities worldwide. The interest in PPPs for this study is limited to situations where the private sector is responsible for contributing some or all of the capital needed to build a project. This may be contrasted with the *governmentally funded* design-build projects. In design-build projects, the private sector takes responsibility for delivering a project for a fixed price and a fixed date, but the funding ultimately comes from public sources, such as taxes (federal, state, or local grants or tax-supported bonds). For PPP, where the private sector contributes capital, the level of private involvement varies considerably from project to project. For example, the Dulles Greenway project in Virginia and the Camino Colombia project in Texas were actually owned by private investors. Other PPP have made use of 63-20 corporations, where ownership of the project resides in a publicly appointed nonprofit corporation, such as the Greenville Southern Connector in South Carolina and Pocahontas Parkway in Virginia.

All of these toll-based PPP have struggled in their early years, with the Greenway project requiring restructuring of its debt, and the Camino Colombia project recently going bankrupt and closing. The Camino Colombia project was recently bought by the Texas Department of Transportation (TxDOT) for less than one-quarter of its construction cost, and has been reopened. The Pocahantas Parkway, though originally financed through a 63-20 corporation, was recently transferred to a private concessionaire to operate and maintain the facility under a 99-year lease contract.

Many other attempts at developing toll roads as PPP have failed or been derailed, due to adverse public reaction or the changing needs of the public sector. In recent years, potential public-private toll road projects in Minnesota and Arizona were canceled. The Tacoma Narrows Bridge project in Washington started out as a PPP, but was converted to a traditional, publicly financed toll bridge after public protest over the private sector profiting from a public project. In Chesapeake, Virginia, the Chesapeake Expressway went through its development process with the intent of being financed and operated through a 63-20 corporation, but ultimately, the project ended up being developed and owned by the City of Chesapeake, since much of the risk that was to have been transferred to the private sector had been reduced through the project development process.

Developing toll projects as PPP is still in its infancy in the United States, with techniques and legislation evolving. High profile transactions involving existing toll facilities in Chicago and Indiana resulted in large up front payments in exchange for the right to collect tolls for periods of 75 to 99 years. These transactions have generated considerable controversy, with some claiming credit for erasing longstanding funding deficits while others criticize the transfer of control over decision-making from the public to the private sectors.

Outside of the U.S., the experience with PPP for infrastructure projects is more mature than in the U.S., and includes other areas of public infrastructure such as hospitals, schools, and prisons. The following is a partial list of toll projects in other countries that have used PPP to address transportation infrastructure needs:

- Australia – Melbourne CityLink
- Canada – 407 ETR
- Chile (Santiago) – largest urban open road toll system in the world
- Israel – Cross Israel Highway

Recent Innovations in Tolled Managed Lanes

The advent and rapid advancement of electronic toll collection technology allows for tolling to be applied in ways that were not possible a decade ago, making tolling faster and more convenient for both the drivers and the operating agency. In addition to the increased convenience to toll-paying customers, electronic toll collection allows for pricing to be used for traffic management purposes, in addition to, or even instead of, revenue generation.

Some of these new concepts have been implemented, while others are the subject of proposed legislation or policy discussion. The focus of this working paper is on these recent innovations in tolling, which have primarily been new or enhanced tolled managed lane applications. There are several types of such applications, described below.

HOT (High Occupancy Toll) Lanes

Fundamentally, a HOT (High Occupancy Toll) lane is a partial implementation of road user pricing—a notion that economists have been advancing for many decades as a method for improving the efficiency of utilization and investment in road capacity. In the case of a HOT lane, tolling a user for access to the managed lanes potentially offers road users a means of trading toll payments (cash costs) for reduced travel time costs. In economics parlance, HOT lane policy is tantamount to product differentiation—turning a single, uniform service product into one with two cost and service characteristics.

Such differentiation in price and service choice in general is thought to improve user welfare, because users can self-select the option that best suits their means and tastes. However, in the real world of HOT lanes, whether or the extent to which this is true depends on the manner by which tolls are set and a complex interplay amongst general purpose (GP) lane users, HOT lane payers, and users allowed to use the HOT lane without paying a toll.

For the typical driver, driving is a necessary activity to achieve other economic goals (employment, recreation, etc.), and not a productive activity in and of itself. When traveling on a freeway, users are giving up time spent doing something else. For most commuters, that time could be spent working. That is why the relative opportunity cost of time spent driving is thought to be related to commuters' hourly wages. However, other psychic costs enter the equation as well; a driver rushing to meet a plane flight may perceive a higher opportunity cost than the wage. However determined, the opportunity cost of travel time is referred to as the value of time.

Choosing whether or not to use a managed lane is an exercise in balancing travel time costs against other costs. In the case of a tolled managed lane facility, the choice of lane involves balancing the value of travel time savings (resulting from higher speeds) against the toll cost. Those users who perceived the value of the time savings to be in excess of the toll will choose the HOT lane; others with lower values of time will choose the GP lanes.

In the case where the HOT lane can be used for free if one forms a qualifying carpool (HOV), the decision involved balancing the value of travel time savings against the time and other costs of forming a carpool. People who do not value their time very highly may not mind the time cost of forming a carpool as much as individuals with high values of time. If this is true, then those who use the HOT lane as an HOV may have individually lower values of time than individuals who buy in to the HOT lane as a SOV. However, considering the higher occupancy of the HOV vs. the SOV the value of travel time per vehicle may be higher in the HOV case.

The lesson of this is that both tolls and policies toward HOV use of HOT lanes influence the choice of lane, and that individuals' value of time characteristics predispose both the mode of travel (HOV vs. SOV) and the choice of GP vs. HOT lane.

HOT lanes grew out of the recognition that some traditional HOV lanes were underutilized. HOT lanes allow a single-occupancy vehicle (SOV) to pay a toll to use HOV lanes which have excess capacity. A few examples of operating HOT projects are listed below:

- SR 91 Express Lanes (Orange County, California)
- I-15 FasTrak (San Diego, California)
- Katy I-10 QuickRide (Houston, Texas)
- I-25 HOT Lanes (Denver, Colorado)
- I-394 MNPASS (Minneapolis, MN)
- Washington State recently opened its first HOT lane on SR 167

HOT lanes are not one-size-fits-all. Each of the first three HOT lane projects had different policy motives. The SR 91 project grew out of a desire to increase capacity in a heavily congested corridor, and provided a way for a private partner to develop the project motivated by profit. The I-15 project grew out of a desire to utilize spare capacity on the HOV lanes, as well as the desire to cross-subsidize transit service in the corridor. The Katy Freeway QuickRide program was a way to obtain more productivity out of underutilized HOV lanes during the hours when HOV2s were not permitted to use them.

HOT lanes are an effective way to take advantage of underutilized capacity from existing HOV network, but one of the difficulties in such projects is distinguishing HOV traffic (who goes free, or pays reduced tolls) from traffic that should be paying tolls. To date, there is no technology that can automate the enforcement process so enforcement is performed with patrol officers using visual and technology-aided visual techniques.

Other issues related to HOT lanes include making sure the design adequately addresses ingress and egress from the tolled lanes, weaving traffic, signage and technology.

Express Toll Lanes

As with HOT lanes, express toll lanes are situated next to regular highway lanes. The difference from the HOT lane concept is that with an express toll lane, all personal automobiles using them pay a toll – there are no exceptions made for HOV; this reduces the revenue loss potential due to violations, as explained in the previous section. However, transit vehicles and/or registered vanpools would usually be allowed to operate for free. While these lanes typically represent added highway capacity, existing toll-free lanes also could be converted to toll lanes. Express toll lanes also could be located adjacent to traditional toll roads, but employ variable pricing (based on time of day and/or congestion levels) to maintain free-flowing traffic.

The Tampa-Hillsborough County Expressway Authority currently operates toll lanes elevated over the existing Lee Roy Selmon Crosstown Expressway (a toll road), and may be able to charge premium tolls for the express service; only vehicles equipped with transponders may use the express lanes, except trucks, which are not allowed. The Miami-Dade Expressway Authority also has been studying a similar project on its SR 836 toll road. Express toll lanes also are being actively studied in Maryland, Georgia, and Minnesota.

Truck-Only Toll (TOT) Lanes

Truck-Only Toll (TOT) lanes have the potential to improve safety and increase productivity in the trucking industry. One concept is dedicated toll truckways for long-haul truck movements. The toll truckways would be built next to existing roadways, but would be barrier-separated from general traffic to improve safety. The toll truckways could potentially be built to withstand greater vehicle weights, thus enabling a single truck driver to carry several times the payload than currently is permitted in most states. In theory, truckers would, therefore, be attracted to use the TOT lanes, because the toll cost would be offset by the additional safety and productivity. With the TOT lane concept, a single truckway lane would be provided in each direction of travel, with frequent passing lanes and staging yards near cities or major highway junctions. The concept also could involve a rebate of fuel taxes for mileage spent on the toll truckways. Separating truck traffic from auto traffic also has potential safety benefits by separating vehicles with different operating characteristics into separate traffic streams.

TOT lanes have been studied in the Los Angeles region on SR 60 and I-710, both of which are heavily utilized by trucks accessing the Ports of Los Angeles and Long Beach. The preliminary Los Angeles region studies found that urban TOT lane facilities would need to overcome challenges that include truck trips of short lengths, limited travel time savings during off-peak periods, and significant construction costs and geometric constraints related to adding lanes in an urban environment.

Another TOT lane concept involves urban corridors, which do not necessarily allow longer or heavier vehicles. Such a system of TOT lanes has been recently studied in the Atlanta metropolitan areas, with the findings that TOT lanes had a high potential for relieving congestion, potentially even more than HOV or HOT lanes. Some of the scenarios studied involved the conversion of existing and planned HOV lanes to TOT lanes. Such a policy would be unprecedented, and could be politically very difficult to implement. However, the study does point the way towards the potential for TOT lanes in dense urban regions with heavy truck demands.

Toll Managed Lane Issues

Tolled managed lane facilities in their various forms are an exciting and promising mechanism to generate revenue, manage traffic congestion, and improve operational efficiency. Some members of the public continue to be skeptical with respect to paying tolls, particularly when toll-free alternatives are available. One of the biggest challenges with tolling involves creating a common understanding of what is being proposed, and the policy or strategic basis for the particular proposal. Some of the key issues surrounding tolled managed lane concepts are discussed below. Particular attention is given to HOT lanes, as the HOT lanes variant of toll managed lanes are explicitly part of the Transportation 2040 implementation and financial strategy.

All Express Toll Lanes Depend on Congestion

Express toll lanes, whether HOV are allowed in for free or not, depend on congestion to be successful. It is congestion that creates the value offered by a lane managed through pricing. If there is no congestion, there is no need for such a facility. This means that express toll lane solutions are best suited in corridors where there is no opportunity to expand capacity, and where the traffic management potential of toll lanes provides a benefit to all travelers at some time when their personal value of time is high enough to warrant paying extra to be somewhere on time.

Traffic Management Benefits of Toll Lanes Depend on Tolls Forever

Traditionally, people expect tolls to be removed once the debt to finance a facility has been paid off. In the case of express toll lanes, the value of the project depends on the tolls staying on. It is the tolls that create the traffic management benefit, and that benefit will be lost if tolls are removed. This leaves the question of what should be done with the money collected by tolls on a managed lanes system.

Revenue Productivity

How much of the capital cost of a highway improvement can a toll lane project generate? Can it produce excess revenue to subsidize other highway or transit projects? There is a tendency to think that tolling projects can be big revenue generators, but in fact there are likely to be very few applications for which tolling could be fully self-supporting, except for projects that simply involve a conversion of existing general purpose lanes to tolling lanes. The success of express toll lanes depends largely on congestion levels in adjacent lanes and the tolling objective. In most metropolitan areas, such congestion only lasts for an hour or two during morning and evening rush hours – typically not enough to pay for an expensive infrastructure project. In addition, the sections of highway with the greatest need for capacity expansion are often the ones with the most geometric constraints – meaning that the upfront design and construction costs will be high. Increasingly, pricing projects are being considered for their potential traffic management capabilities, regardless of their ability to fund new infrastructure construction.

Policy Justification

It is important to clearly articulate the policy rationale for considering a tolling project. One rationale might be to simply provide a supplemental revenue source to enable a project to be built sooner than it would otherwise. Another might be to provide a congestion-free alternative in places where “building your way out of congestion” with conventional freeway lanes is not possible. Whatever the policy objective is for a particular project, it must be clearly articulated and justified for both decision-makers and the public in order for a new tolling project to be approved. If a facility manager wishes to have a solid justification for tolls levied, the manager has to articulate the objectives by which the facility should operate. We examine here the three primary objectives that can be implemented: MinLOS, RevMax, and CostMin. While the discussion below is specific to HOT lanes, this question of the toll policy objective is relevant to any implementation of road tolling.

- Minimum Level of Service [MinLOS] - It is a common practice for facility managers to use a minimum level of service as an objective for the setting of HOT lane tolls. This objective sets the toll based on the observed speed in the HOT lane, periodically adjusting the toll to keep traffic moving through the HOT facility. Though straightforward, this objective often produces erratic outcomes for the HOT facility, since the toll is solely a function of the speed in the HOT lane, as opposed to incorporating users' values of time. This type of pricing produces drastic movements in toll levels, making revenues and performance unpredictable. As an illustration, if speeds drop below a certain level, facility managers increase the toll an arbitrary amount to price users out of the HOT lane. Then, as HOT lane speed increases, tolls tend to be lowered until the HOT lane speed hit the minimum speed, which starts a new cycle of toll adjustment. This objective does not have an obvious link to an economic efficiency criterion. It is primarily a carryover from the HOV lane LOS criteria for shutdown of HOV lane restrictions on access.

- Revenue Maximization [RevMax] - Under this objective, the facility manager sets a toll on the HOT lanes so as to maximize the amount of toll revenue collected over a time period. To picture this, think of the facility manager as a salesperson, selling spots on the toll facility. The price of the product must be such that people are willing to pay for it, but also such that the quality of the product is not diminished. Under this objective, excessively low toll levels encourage large amounts of users to leave the GP lanes, hoping that the HOT lanes reduce travel time. The users, though, congest the free flow speed of the HOT lane, discouraging future use, as the HOT lane derives most of its value from the greater performance over the GP lanes. The lower speeds reduce the amount of cars flowing through the HOT lane for the time period and reduce revenues. At the same time, tolls set too high only allow those with the correspondingly high values of time to enter the HOT lane. While the HOT lane flows well with very few cars on it, the very few cars that are in the HOT lane generate very little revenue. Slightly decreasing the toll (which increases volume on the HOT lane) can raise revenue without affecting performance flow of the HOT lane. Under revenue maximization, the facility manager must set a toll that keeps people with a lower value of time off of the HOT facility, while at the same time maintaining sufficient volume on the facility to generate revenue.

- Travel Time Cost Minimization [CostMin] - The facility manager has the option of minimizing the total cost to the users for traversing the facility, both HOT and GP lanes. The user costs are the users' value of time, multiplied by the time it takes to traverse the facility. This objective incorporates the time costs of vehicles on both GP and HOT lanes. Based on the toll charged, users divide themselves into HOT lane and GP lane users. The facility manager can then see the proportion of drivers who choose the HOT lane, based on the toll. As described earlier, the toll charged determines the volume of vehicles in the HOT lane, which then affects total user cost on the entire facility. It may be, for example, that the toll that minimizes total user cost on the facility is one that sorts 20% of traffic into the HOT lane to travel at 25 mph, while the 80% in the GP lanes are traveling at 10 mph. This may not seem like an optimal solution, but any deviations from the toll will increase the total user cost, somewhere.

Equity

Equity considerations may emerge in public discussions, including "Lexus Lane" concerns (i.e., providing a highway lane that is only affordable to the wealthy) and geographic concerns (i.e., why travelers must pay a toll for certain parts of the transportation network, while other parts have no tolls). In some cases, the public also has expressed concerns about the private sector being in the business of collecting and setting tolls for a profit. They may not understand why, if the private sector is able to make a profit on such projects, the public sector does not simply develop the project on its own.

Implementation

Implementing new tolled managed lane projects often has particular challenges. For example, how would cars get in and out of the lanes – any time they want, via special ramps, or with merge/weave zones? Would tolling just happen during peak periods or all day? How would safety be affected? What happens if an accident blocks one or more tolled managed general purpose lane(s) for some period of time?

Toll Lanes Evidence from the PSRC Traffic Data

PSRC worked closely with the consulting firm ECONorthwest to examine the implications of toll lane policy options. This effort involved implementations of the PSRC travel demand model interacting with the ECONorthwest Toll Optimization Model, which is designed explicitly to examine such policy tradeoffs.

Figure 9 displays how revenues, toll levels and traffic volumes behave under the different constraints. The performance measures shown are based on the peak hour of 6:00 a.m. to 7:00 a.m. Inputs into the model are identical for each tolling objective. However, based on the tolling objective, the facility performance varies quite drastically. Under Revenue Maximization, traveler costs are much higher than CostMin or MinLOS. However, the RevMax objective, given some distribution of motorists' value of time, seeks to extract as much revenue out of the network as possible. This means effectively sorting those who have higher values of time into the HOT lanes, while the GP lanes have lower speeds. This is why the HOT lane speeds are much higher for the RevMax objective, as RevMax focuses solely on the performance and revenue from the HOT lane. Contrarily, CostMin and MinLOS are more inclusive of the entire facility, minimizing the cost of all drivers or maintaining some minimum LOS for both GP and HOT lanes. Even though, for these two constraints, the tolls are lower and the speed differential between the two lane groups is less, the revenue per vehicle miles traveled (VMT) is much lower. The choice of the objective ultimately rests with the facility manager, who must decide what the purpose of the HOT should be.

Figure 9: Facility Performance and Tolling Objectives

Performance Category	Tolling Objective		
	RevMax	CostMin	MinLOS
Total Revenue per Hour	$1,123,521	$378,345	$218,428
Revenue per VMT	$6.54	$0.91	$2.30
Total Travel Cost per Hour	$7,255,610	$2,109,941	$1,352,636
Total Travel Cost per VMT	$3.77	$1.10	$1.19
Average HOT Speed (mph)	60.01	52.73	50.60
Average GP Speed (mph)	38.44	46.74	45.89

Source: ECONorthwest TOM Output for PSRC

HOV Policy

Figure 10 summarizes the results of a simulation of HOT lane performance under the revenue maximization objective. It displays the results of the simulation for average hourly speed in the

HOT lane, GP lane and revenue for the HOT facility. There is a stark difference between the HOV 3+ and HOV 2+ free access restrictions. For the HOV 3+ specification, the revenues per VMT are higher and HOT lane speeds are faster compared to the HOV 2+ specification. This corresponds to the discussion above, showing that allowing HOV 2+ vehicles to use the HOT lane free of charge reduces the quality and performance of the HOT lane facility. From the manager's perspective, it is much more profitable to require HOV 2+ vehicles to pay the HOT lane toll.

Figure 10: HOT Lane Performance under HOV 3+ and HOV 2+

Specification	Performance Category	6:00 AM	7:00 AM	8:00 AM
HOV 3+	Total Revenue per Hour	$1,123,521	$821,921	$518,524
	Revenue per VMT	$6.54	$4.99	$3.36
	Total Travel Time Cost per Hour	$7,255,610	$5,596,997	$3,831,644
	Travel Time Cost per VMT	$3.77	$2.71	$1.97
	Average HOT lane Speed (mph)	60.01	60.01	60.08
	Average GP lane Speed (mph)	38.44	34.25	37.79
HOV 2+	Total Revenue per Hour	$348,882	$249,973	$157,082
	Revenue per VMT	$3.91	$2.95	$1.96
	Total Travel Time Cost per Hour	$3,193,070	$2,565,575	$1,852,314
	Travel Time Cost per VMT	$2.01	$1.54	$1.18
	Average HOT lane Speed (mph)	56.58	56.03	57.18
	Average GP lane Speed (mph)	40.15	37.71	41.33

Source: ECONorthwest TOM Output for PSRC

Tolling Implementation

Figure 11 shows how revenues and speeds differ under the different pricing schemes. Though speeds are similar across the two pricing schemes, revenues per VMT are higher for the dynamic pricing scheme.

Figure 11: HOT Lane Performance Under Dynamic and Static Pricing

Pricing Scheme	Performance Category	6:00 AM	7:00 AM	8:00 AM
Dynamic	Total Revenue per Hour	$1,123,521	$821,921	$518,524
	Revenue per VMT	$6.54	$4.99	$3.36
	Total Travel Time Cost per Hour	$7,255,610	$5,596,997	$3,831,644
	Travel Time Cost per VMT	$3.77	$2.71	$1.97
	Average HOT lane Speed (mph)	60.01	60.01	60.08
	Average GP lane Speed (mph)	38.44	34.25	37.79
Static	Total Revenue per Hour	$368,092	$503,497	$311,984
	Revenue per VMT	$2.52	$3.22	$2.11
	Total Travel Time Cost per Hour	$2,993,879	$3,813,598	$2,680,838
	Travel Time Cost per VMT	$1.55	$1.85	$1.38
	Average HOT lane Speed (mph)	60.14	60.08	60.14
	Average GP lane Speed (mph)	39.31	35.09	38.87

Source: ECONorthwest TOM Output for PSRC

Number of Lanes

Figure 12 illustrates how revenues and speed performance change when comparing a one lane HOT lane to a two lane HOT lane. Under the one HOT lane alternative, the average hourly toll is lower than the two HOT lanes alternative. This is due to the differing speeds in the GP lanes, as the two HOT lane alternative has GP speeds about four miles per hour slower than the one HOT lane alternative, indicating that the HOT facility generates a greater savings to drivers on the facility. A two HOT lane alternative also produces significantly more revenue for the facility than the one HOT lane alternative.

Figure 12: Number of Lanes and Facility Performance

Lane Alternative	Performance Category	6:00 AM	7:00 AM	8:00 AM
One HOT Lane	Total Revenue per Hour	$1,123,521	$821,921	$518,524
	Revenue per VMT	$6.54	$4.99	$3.36
	Total Travel Time Cost per Hour	$7,255,610	$5,596,997	$3,831,644
	Travel Time Cost per VMT	$3.77	$2.71	$1.97
	Average HOT lane Speed (mph)	60.01	60.01	60.08
	Average GP lane Speed (mph)	38.44	34.25	37.79
Two HOT Lanes	Total Revenue per Hour	$1,837,377	$1,479,909	$887,842
	Revenue per VMT	$4.68	$7.47	$4.95
	Total Travel Time Cost per Hour	$11,454,030	$9,474,496	$6,033,192
	Travel Time Cost per VMT	$12.21	$9.42	$6.37
	Average HOT lane Speed (mph)	60.14	60.13	60.16
	Average GP lane Speed (mph)	34.59	30.04	33.34

Source: ECONorthwest TOM Output for PSRC

Conclusion

HOT lanes are a way for facility managers to improve performance of freeways, reduce aggregate user travel cost, and generate revenue for the facility. From the user perspective, those with high values of time elect to use the HOT lane, provided that the HOT lane is able to reduce their travel costs on the facility. From the manager perspective, the implementation of the HOT lane depends on the objectives of the manager (revenue maximization, user cost minimization, etc.). Once that has been established, the manager faces constraints for the HOT lane, such as minimum or maximum toll levels (which may or may not distort the true optimal toll value), or a minimum level of service. Regardless of the objective, relative to an unmanaged but congested facility, a HOT lane can drastically increase network performance while raising much needed revenue at the same time.

Although it is understood that many modeling/policy specifications are not made at the sole discretion of the facility operator, the following list provides broad policy conclusions that facilitate toll optimization. In addition, despite these conclusions, it is often beneficial to test multiple options to assess toll or traffic sensitivity.

- HOT Lane Operating Objective - When revenue is not of paramount concern, pricing under a travel cost-minimizing objective is an optimal strategy. A HOT lane equipped freeway facility priced at the cost minimum will offer lower travel times costs than either a HOV lane equipped freeway or a pure GP lane freeway. A HOT lane facility priced to minimize user costs will benefit most users and will likely be more popular than a facility priced to maximize revenues. A HOT lane facility priced to maximize revenues will provide users with lower travel time costs than an equivalent HOV lane equipped freeway, but will likely provide users with higher travel time costs than a pure GP lane facility.

- Pricing Variability Regime – Dynamic pricing allows for real-time or near real-time facility pricing. Although less simple to implement than a static or semi-static pricing scheme, dynamic pricing improves facility responsiveness to traffic conditions and allows the facility to better achieve its pricing objective.

- HOV Policy – Reducing the number of free vehicles in the HOT lane will allow a facility to better achieve its pricing objective. An All-Pay HOV policy would be preferable over an HOV3+ policy, and an HOV3+ policy would be preferable over an HOV2+ policy.

- Toll Constraints – Toll constraints (in the form of instituting minimum or maximum tolls) can inhibit the HOT lane from achieving its pricing objective.

- Minimum Level of Service Constraint –The HOT lane pricing objective can be better achieved when no minimum level of service constraint is instituted. A minimum LOS constraint can reduce revenues and/or increase user costs.

Cordon, Area Pricing, and Parking Charges

A common feature of these approaches is a focus on charging for access to a limited geographic area. Cordon or area pricing is a relatively new concept: vehicles are charged a toll to enter a highly congested area. The concept has been in use in Singapore since 1975, and enacted in the central business district portion of London in 2003. The concept in London involves a flat toll of £8 to enter or drive within the tolled area during normal business hours. Tolls must be paid through registering daily either by phone or Internet, and enforcement is via an extensive array of cameras located throughout the zone. The toll has resulted in a significant reduction in congestion, with the revenue being used to subsidize additional transit services. Generally considered a success, the London cordon charge has expanded the charging zone and there was a plan, from the mayor's office, to start charging the most polluting vehicles £25 to enter the zone whereas the least polluting vehicles would get to go inside of the zone charge-free; the plan was politically unsuccessful and did not come to fruition. In addition, preliminary reports show that congestion in the original central zone has increased, although data are not conclusive and is yet to be determined if this increase is due to the expansion of the charging zone or other factors.

A key success of the scheme has been the improvements made to the public transportation system using the revenues generated by the pricing scheme, after operating and capital expenditures. Also, about 90 percent of the travel in the priced zone had been using transit even before the pricing program, meaning that relatively small percentage change in driving behavior yielded significant congestion improvement.

A similar concept was enacted in Stockholm, Sweden, and smaller implementations have been tried in Durham (UK), Rome (Italy). Cities that are considering some form of pricing to access determined zones during congested hours include Los Angeles, San Francisco, Bogota (Colombia), and Santiago (Chile). New York City was considering a congestion charging scheme as part of the U.S. Department of Transportation's Urban Partnership Agreement (UPA) but it did not come to fruition due to lack of political support.

Parking pricing is another policy tool that can help with the reduction of congestion. Technically, it is generally much easier to implement a parking pricing strategy than toll strategies, but parking pricing faces similar political obstacles to any user fee concept. And, pricing may only influence a certain percent of the drivers' population as many employers provide reimbursement or some other form of assistance to cover parking costs. In addition, other aspects need to be considered when analyzing the feasibility of parking pricing implementation like the effect parking pricing may have on businesses and equity issues.

The following are a few examples of areas that have implemented parking pricing strategies to discourage parking in central business cistricts (CBDs):[5]

- Boston, MA – Parking freeze in downtown Boston and two other neighborhoods limits growth in supply of off-street parking. Resident Permit Parking Program restricts unmetered on-street parking to CBD residents.
- California cities in air quality non-attainment areas – Parking "cash out" program provides employees the option of receiving either a free parking space or a cash payment equal to the value of that space.
- Canada, Sweden, and Australia – Employer-provided parking treated as a taxable fringe benefit (this applies to all cities in these countries).
- San Francisco, CA – Imposed 25% ad valorem tax on all commercial, off-street, non-residential parking transactions.
- Washington D.C. – Government employees required to pay for parking that formerly was free.

Motorists cruising in search of an on-street parking spot are another source of congestion in CBDs. This problem is aggravated when a CBD or other congested area applies incorrect pricing policies for parking, including cost-free parking. As a general rule, the lower the cost to park, the more vehicles the area may attract, hence more congestion. An innovative approach to parking pricing has been proposed by Donald Shoup,[6] whereby on-street meter prices are increased to market rates to encourage turnover of spaces, increase space vacancy rate, and reduce demand for cruising for parking. Prices are set so that an occupancy level of 85 percent is achieved at all times, allowing people with short errands to park easily, while everyone else heads right to off-street parking, which is less expensive. This concept has been tried in Redwood City, California, and is under consideration in other places as well.

Network Tolling

The current practice of highway pricing and investment policy is primarily a fiscal sufficiency procedure, rather than an efficiency-focused procedure. That is, it involves levying of taxes and fees to support highway preservation and investment expenditure, but not with an eye toward efficient utilization of existing facilities nor efficiency-guided investment in new capacity.

Projects are selected by a process that blends engineering and political considerations rather than the comparative benefits and costs of the projects. The fees are usually flat fees, implemented via motor fuel taxes and registration fees or occasionally, in the case of trucks, weight-mile charges. This approach to setting the "price" or user charges yields fees that do not vary by the facility used (freeway, arterial, local street, etc.), or the particular impact of the vehicle on congestion or roadway wear-and-tear.

In most states, the current pricing process is embedded in what is called the Highway Cost Allocation Study (HCAS) process. The HCAS process examines a predetermined set of prospective projects and sets motor fuel and (truck) weight-mile charges at levels sufficient to support these projects.

The relative share of the cost burden, between autos and trucks, and among truck weight-classes, is designed to achieve equity, in the aggregate, of cost shares amongst these vehicle

[5] Source: "Congestion Mitigation Commission Technical Analysis – Reducing Congestion by Discouraging Parking in New York City's Central Business District" Report by Cambridge Systematics, 2007
[6] Donald Shoup, "The High Cost of Free Parking", 2005.

classes. That is, across all projects, cars and trucks of various weight classes are paying, in the aggregate, their fair share of the costs the HCAS process attributes to them. This requires making judgments about the respective contributions each class makes to the capacity and wear-and-tear costs that will be associated with each project.

The problems with this current practices are two-fold:

- The fees charged are not sensitive to the particular costs a vehicle is imposing under the specific conditions of use. This means that many decisions are made about the use of a particular facility at a particular time in ignorance of the specific costs that are being imposed. A heavy truck has no disincentive to use a lightly-built road, for example, and a car adding itself to a congested roadway faces no consequence of its amplification of the congestion imposed on other vehicles.

- Investments in new capacity typically are made based on engineering criteria of the level of service (LOS) of a facility. If a facility is experiencing a lot of congestion (a very low level of service) it can become a candidate for additional capacity enhancement. The excess of benefits over costs generally is not used to guide investment.

These two problems interact. If a user is insensitive to the wear-and-tear burden it is imposing or its amplification of congestion, then (1) lightly-built roads will suffer excessive wear-and-tear, and (2) congestion on highways will be amplified. This, in turn, is translated by the project planning process into expanded preservation spending and capacity spending.

Thus, although the current system of cost allocation may preserve some crude “fairness” in the aggregate of the allocation of costs to vehicle classes, it creates disincentives for users to be cost-sparing. This yields a progressive “death spiral” of overuse and over-investment that is only stopped when users chaff at paying higher fees. The expected consequences of this are the poor state of repair of road surfaces and bridges, and the dissipation of valuable time, fuel and capital resources due to congestion.

Tolling is especially beneficial in the context of hypercongestion. Hypercongestion is a condition wherein turbulent interaction of vehicles reduces speeds and flows (vehicle volumes) below that observed when traffic is moving smoothly. For example, without hypercongestion, near free-flow speeds of 60 mph can be maintained at a high volume (say, 1700 vehicles per hour per lane). Under conditions conducive to hypercongestion, however, a second equilibrium is observed at much lower speeds (say, 15 mph) at the same volume. Generally, the higher the volume of vehicles interacting on a roadway, the more likely it is that hypercongestion will occur. Therefore, to the extent that tolling–by moderating vehicle volumes in the aggregate–creates a smoother flow of traffic, tolling can have very dramatic, positive effects on the speeds and flows. In these circumstances tolling, in effect causes the roadway to behave as if it has more capacity.

Setting prices that reflect actual costs, and no more, can be achieved by simply legislating to the standards of some simple economics.

- <u>Pricing congestion effects.</u> An important component of an efficient price is the value of the amplification of congestion (delay) that an additional vehicle adds to the travel times of others. When there are few other motorists on the road, the congestion effects are negligible and the appropriate toll increment is zero. If the level of service is very poor, tolls can rise to 40 cents per vehicle mile in typical applications. An alternative method of setting tolls is to legislate a stated level of service (speed or vehicle flow per hour) for various times of the day. Toll rates would then be evolved over time to be the lowest toll rate that achieves the stated level of service. This method gives motorists a way to monitor the integrity of the toll rule simply by observing whether speeds are at or above the agreed-upon speed.
- Pricing wear-and-tear effects. The effect of vehicles on the integrity and life of a roadway is a well-known relationship between the vehicle’s weight, number of axles, and the construction

standard of the roadway. These relationships have been established experimentally, and used for many years in the existing cost allocation processes. These relationships do not need to be re-invented for the application of this element of efficient pricing. All that needs be known are the characteristics of the vehicle and the durability classification of the roadway. The highest toll increments will be levied on heavy vehicles with few axles traveling on lightly-built roads, such a local streets. Data suggests that, in those aberrant cases, toll increments of a dollar or more per vehicle mile might be justified. Automobiles traveling on freeways built to interstate standards have essentially zero wear effects unless studded tires are being used.

Some professionals worry that the short run pricing perspective does not address the issue of how to pay for the investment in the roadway itself. In fact, however, if congestion pricing and investment policies are managed efficiently, congestion charges will generate enough revenue to finance capacity throughout time. The logic of this conclusion is subtle, but important, and worth elaborating upon. The key point is that pricing and investment are both focused on balancing user costs and benefits. The congestion and wear-and-tear increments of short-run prices actually do indicate the value of new or improved capacity:

- If the congestion component of short-run prices is high, it is because traffic delays are great and added capacity (which would relieve the congestion) thus is more likely to be cost-beneficial.

- Similarly, if the wear-and-tear costs are high, it is because the roadway is vulnerable to traffic loads and, hence, a project to improve the road's durability would be more likely to be cost-beneficial.

Investment policy itself balances these benefits against the investment cost of developing the facility. The investment rule says simply that road improvements should be undertaken if their benefits exceed their cost. Road improvements will not tend to be built, therefore, unless there has already been a history of congestion or operating charges that are equal to or greater than the cost of the new facility. In this sense, marginal cost pricing tends to generate sufficient revenue to finance highway improvements if investment follows the investment rule. The technical condition under which this occurs has been studied in the literature by a number of authors, and they are easily met.

Tolling all or most roads and highways has the potential to allow price to be used to manage demand on the entire road network while yielding revenue that can be used to make transportation improvements. Tolling networks of access controlled facilities can be implemented with tag and reader toll technology currently in standard use in the tolling industry. Tolling facilities with more limited access controls is another matter. Although other methods may be possible, tolling to this extent will most likely require the use of global positioning system (GPS) technology.

The best well-known implementation of GPS-based tolling is the Toll Collect project in Germany, which is only applied to commercial vehicles. The primary motivation for this implementation was to collect revenue from cross-country commercial traffic. The current rate is €0.12 per kilometer (~ US$0.30 per mile). A similar system is in place in Austria.

There have been several trials of GPS-based tolling in the United States, including one by PSRC and another by the State of Oregon. The Federal Highway Administration provided a grant to PSRC to conduct a pilot study, using GPS-based tolling, to evaluate drivers' behavior in response to road pricing. The study involved 275 participants, whose vehicles were equipped with on-board units (OBUs) to record the driver's trip pattern and evaluate the effects of road pricing on driver's behavior, with respect to trip choices. PSRC achieved the three goals set for the study: (1) describe behavioral response to the congestion-tolling of roadways; (2) better understand issues of policy related to the implementation of road network tolling; and (3) test an integrated system of technical solutions to the problem of tolling a large network of roads without deploying substantial hardware on the roadside.

Oregon Department of Transportation conducted a road user fee pilot program using GPS technology with the purpose of studying the feasibility of replacing the gas tax with a mileage-based fee and using GPS-based tolling for collecting congestion charges. The pilot included 285 vehicles and lasted 12 months. The study concluded that GPS-tolling is a viable alternative to the gas tax, privacy was protected, and driving was reduced during peak hours. Furthermore, over 90% of the program participants said “they would agree to continue paying the mileage fee in lieu of the gas tax.”

Issues with GPS-based tolling include the costs of upfront investment and privacy issues. Positive aspects include the enabling of distance-based tolling and equity (viable alternative to the gas tax, a regressive form of taxation).

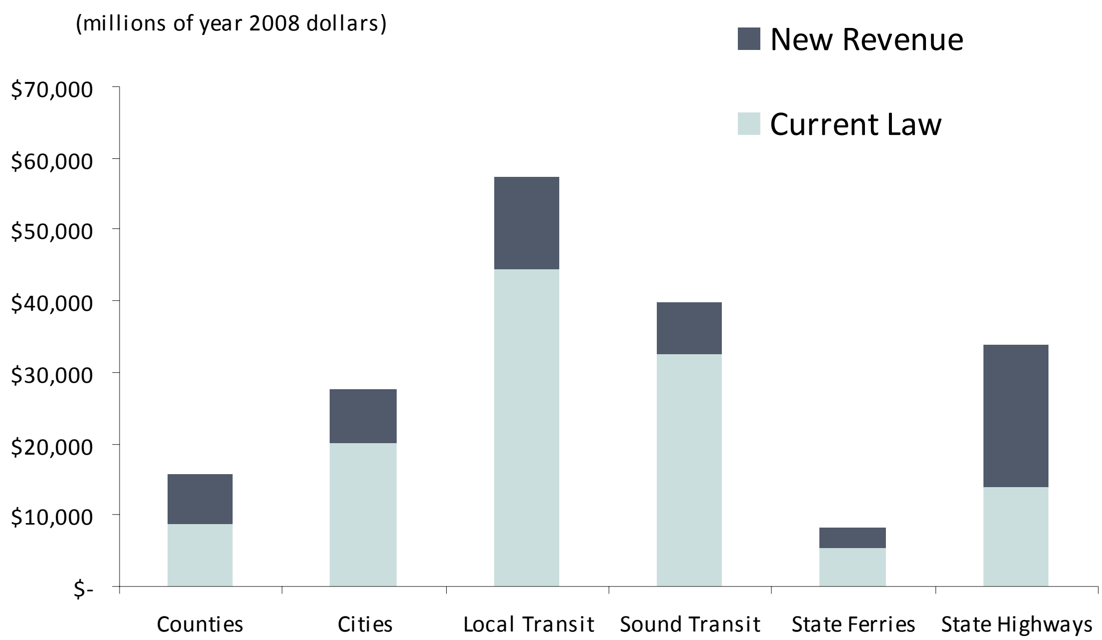
The PSRC’s Traffic Choices Study was a demonstration of one kind of network tolling. In addition to its success in behavioral analysis and technical demonstration the study also assessed various implementation challenges and developed high-level deployment architecture and cost estimates. These implementation costs were compared with expected program benefits (primarily benefits to the users of the system in the form of travel time savings) and demonstrated an extremely high net economic benefit. Results of the study can be found on the project web page http://www.psrc.org/transportation/traffic.

Tolling a network of access controlled facilities could be accomplished with various other kinds of tolling technology and program designs. Each approach has its advantages and limitations, but such implementations are both technically and administratively feasible. Transportation 2040 does not draw conclusions about various network tolling implementation details, but rather advances the more general notion of controlling costs on the road network and building financial resources for investment through charges for the use of the roads themselves. The limited viability of taxes on fuels, and limited success with controlling road congestion through non-price policies, suggests that a more comprehensive approach to charging for road use will be required within the next couple of decades, and thus within the plan’s implementation timeframe. It is this understanding that is the starting point for Transportation 2040’s general funding scenario that is outlined below.

New Revenue Assumptions and Estimates

A comparison of plan investment needs with current law revenues provides a picture of the new revenue requirements across the various transportation programs. New revenue requirements by program are displayed in Figure 13 below.

Figure 13: New Revenue Requirements



New Revenue Sources

The PSRC Transportation Policy Board considered a large number of potential new revenue sources when developing a financial strategy. This list of revenue sources included both state-wide and local options for funding transportation, and addressed a broad array of expected uses. Particular attention was paid to the various practical and legal constraints that would limit the uses of each source. Other matters of interest included expected revenue yield, the incidence of the tax burden on various users, implementation costs and challenges. The list of considered sources included the following items and their close substitutes:

- Fuel tax increases
- High Occupancy Toll Lanes
- Facility Tolls
- Highway System Tolls
- Distance Fees
- Taxes on Emissions (carbon tax)
- Sales Tax Credits (no tax on transportation projects)
- Sales Taxes on Auto Sales and Parts
- Sales Tax on Fuels
- Motor Vehicle Excise Tax (percent of value)
- Sales tax increase for local transit
- Sales tax increase for Sound Transit

- Increases in Transit Fares
- Increase in Ferry Tariffs
- New Development or Impact Fees
- Parking Surcharge
- Road Levy (property tax)
- Employee Tax
- Vehicle License Fee
- Street Utility Fees
- Weight-Distance Fees
- Container Fees
- Port Access Fees

New Revenue Risks and Uncertainty

Identifying new revenue sources necessarily involves considering the various aspects of funding risk and uncertainty associated with the authorization and administration of these sources. Estimating future yields from new sources is also a more uncertain exercise than estimating future yields from existing sources of revenue. The actual timing and magnitude of yields may vary from initial expectations. The sources of potential new funding listed above involve both the levying of new taxes on existing tax bases and the implementation of new approaches such a distance charges and tolling. Assumptions about the reasonableness of new revenues include both a political calculus and an analytical framework for the estimation of yields. PSRC worked with its Transportation Policy Board to devise a new revenue strategy that reflected expectations about what new revenue authority would be needed and could be viable from a policy perspective. Most new sources would involve some kind of new legislative authority. And as such the new revenue expectations should be taken as a blueprint for action and not a prescription of exact details relating to granting and implementation of revenue authority.

In particular, new user fees represent less charted territory, but are also clearly the way forward in transportation finance. Existing limitations of tax yields and the limited viability of extending further existing taxes suggests that user fees will play an important role in the future. The central Puget Sound region and Washington State have been carefully moving in a deliberate direction toward these approaches to finance, and have some demonstrated experience and knowledge about what will be involved in transitioning toward a user financed transportation system. A detailed description of all the design and implementation risks associated with this effort is beyond the scope of this document, but issues of public acceptance, governance, toll policy objectives, dispensation of revenues, fairness, privacy, and administrative burden are being actively considered and addressed as part of specific measures. Numerous materials developed by the PSRC, WSDOT and others provide a large body of research, public opinion findings, program design considerations, and policy analysis that are all relevant to the issues of how to minimize various risks and uncertainties associated with implementing future sources of new revenue.

Estimating New Revenue

As described above, estimating new revenues is an inherently uncertain exercise. Advanced forecasting tools can help to minimize uncertainty and allow an explicit treatment of specific dimensions of risk, but can never eliminate the uncertainty altogether. As a result, an ongoing effort to monitor progress and track revenue yields from various sources is an important part of the planning process.

From a forecast perspective, potential new transportation revenue sources are of two basic types. The first are sources that are a tax or fee related to some general economic activity largely unrelated to transportation system performance. For example, a tax on retail sales is only very indirectly related to how much or how people travel, or how goods are moved about and through the region. The second type of revenue source derives its value from some performance characteristics of the transportation system itself. The clearest examples of this type of revenue are transit fares and tolls. While the distinction is not exact it is still a useful general distinction that can guide the estimation of revenues.

A range of new transportation revenues are estimated by adjusting tax or fee rates that apply to a tax base for which the PSRC already has a forecast of future performance. These tax bases, and other general future expectations about the demographics of the region, include population, employment, the value of the vehicle fleet, volume of fuel consumption, the value of retail sales, and others. The transportation revenues that are estimated through this general approach (essentially an extension of the methods used to estimate current law revenue) include:

- Fuel tax increases
- Sales Tax on Fuels
- Motor Vehicle Excise Tax (percent of value)
- Sales tax increase for local transit
- Sales tax increase for Sound Transit
- New Development or Impact Fees
- Road Levy (property tax)
- Employee Tax
- Vehicle License Fee
- Street Utility Fees

In the case of tolls, fares and parking charges PSRC makes use of its travel modeling analytics to derive the revenue yield from various implementations of the toll or fare policy. For example, in the specific case of tolls, the yield is a function of the toll policy and consumer responses. If the toll is used to also improve the service quality (e.g., performance of the road network) then willingness to pay will increase. If the toll policy is designed to capture the greatest amount of consumer surpluses, then the revenue yield will be considerably larger than if the policy is to minimize the aggregate costs to the users. This latter policy objective (a more conservative assumption from the point of view of financial planning) has guided the specific analysis of future toll revenue yields.

Within the region, significant early steps to begin to address the issue of toll financing are underway. The state has implemented a high occupancy toll (HOT) lane pilot project on SR 167 and plans to toll the existing SR 520 Bridge in an effort to help finance its replacement. Transportation 2040 assumes the evolution of this path, with the conversion of existing high occupancy vehicle (HOV) lanes into additional high occupancy toll lanes in the first decade of the plan. Alongside this network of high occupancy toll lanes, major highway capacity projects – such as the replacement of the Alaskan Way Viaduct – will be at least partially financed through tolls.

Transportation 2040 includes the application of tolls on improved highway facilities as new investments are made, and suggests the eventual implementation of a whole system of tolled highways. This approach involves time-of-day variable tolls that are both funding investments and are managing the facilities to ensure reliable operations and travel speeds. In these cases maintaining existing vehicle restrictions on high occupancy vehicle lanes may not be necessary, or may even impede efficient operations. Transportation 2040 includes an expectation that toll management will replace the need for less refined forms of vehicle restrictions. However, if specific circumstances prevent toll management from providing appropriate speed and reliability for transit services using these corridors then vehicle restrictions may be retained in order to achieve this important policy objective.

Eventually, in the later years of the plan, the intent is to manage and finance the highway network as a system of fully tolled facilities. International, national and local research – including PSRC's Traffic Choices Study – have demonstrated that households and motorists faced with variable tolls make adjustments in their travel that will translate into large-scale reductions in roadway congestion.

These expectations about the future role of tolling are presented in more detail in Appendix B (Program and Projects List) and were represented in a detailed manner in the PSRC travel models. The models were used to analyze two periods in time 2025 and 2040. This allowed for the explicit treatment of toll revenue growth in response to growing demand within travel corridors. It was assumed that the network of HOT facilities would be fully operational by 2020, and that specific fully tolled projects would also produce revenues as the projects were completed. Tolls applied to a network of highway facilities were assumed to be in place by 2030 (replacing the HOT lanes and facility tolls where appropriate).

HOT lanes are estimated to yield approximately $200 million (in 2008 dollars) in 2020, resulting in over $2 billion (bonded revenues over the life of operations) available for facility investments net of the toll system implementation and operations costs. Facility tolling yields approximately $400 million (in 2008 dollars) in 2020, resulting in over $3 billion (bonded revenues over the life of operations) available for facility investments net of the toll system implementation and operations costs. Tolling a network of freeway facilities yields nearly $3 billion (in 2008 dollars) in 2030. This initial annual yield is estimated to grow by approximately 2% in real terms each year.

Other revenues that are estimated from travel modeling results include a fee related to vehicle use that replaces the fuel tax in the later year of the plan, transit fare adjustments, and parking charge revenues.

A General Funding Scenario

During the development of Transportation 2040 PSRC convened a subgroup of its Transportation Policy Board (Pricing Task Force and Transportation 2040 Working Group) to develop a financial strategy. The committee reviewed federal guidance and requirements, methods for estimating project costs and revenue projections. The committee reviewed the costs of the various programs in the plan, and compared these costs with projected revenues available under current legal authority estimated to be available for the different program areas. This group also deliberated over a variety of new revenue instruments and assumptions that could be included as a new regional financial strategy. The committee recommended that the financial strategy should describe a general scenario under which necessary revenues would become available, that would also retain the flexibility that allows specific new revenue actions to be defined and implemented by appropriate governmental bodies. In particular the committee worked under the following guidance:

- Securing funding to maintain and operate our current assets and services should be the highest priority. Approximately 60% of planned investments will simply maintain and operate the current system. This priority includes securing near-term revenue to maintain local transit operations, a growing backlog of local maintenance and preservation needs, and capital preservation needs of the state ferry and highway assets.
- Traditional tax financing (gas tax, etc.) will still play a central role in transportation finance, especially in the early years of the plan.
- There should be a nexus between new taxes, fees, or tolls and the uses to which the revenues are put. The revenue instruments should relate in some manner to the benefits the users receive and/or the costs that these users impose on the system and other users.
- There should be an increase reliance on road tolls that are phased in as new investments in capacity and alternatives are implemented, and as toll system technology and user acceptance evolves over time. To support this evolution, the tolls should be set in a manner that strives to improve travel benefits to all users (freight and people) of the transportation system, and the use of toll revenues should also evolve over time towards increasingly broader uses.
- The plan’s financial element should be based on a “general scenario” that allows flexibility in implementation

The new revenue “general scenario” will require legislative action across a broad range of governments including, cities, counties, the state and the federal government. As the regional planning body for the central Puget Sound region, PSRC will work collectively with its partners to advance appropriate legislative actions. The general funding scenario has three primary elements: (1) early revenue actions that support state, local, and regional investments, (2) a phasing in of new revenue sources that are based on the use of the transportation system, and (3) guidance on the use of tolling revenues.

1. Early Action to Support State, Local, and Regional Investments

Within the first decade of the planning period it will be necessary to identify additional transportation revenues that can address near-term requirements across a broad array of transportation programs.

Cities and counties will need to take action to increase transportation related taxes and will need viable new local options for transportation funding. Local actions could include road and property tax levy adjustments, impact and development fees, the implementation of taxes on parking and more coordinated parking pricing. Cities and counties also will need to work with the state Legislature to identify additional local option taxes and fees, and to secure a direct distribution of new statewide transportation taxes in a manner consistent with past practice.

Local transit operators will face significant near-term challenges just to maintain existing service without additional funding. Some operators still have the option of locally approved sales tax increases, but others do not. And a continued reliance upon sales tax revenues as a nearly sole source of non-operating revenues leaves these operators vulnerable to swings in the economic markets. Local transit operators will need to work with the state Legislature to secure a stable source of supplemental funding. Also, operators could begin to raise fares in the near-term in an effort to provide a stronger operating foundation. In the near-term Sound Transit will be focused on the delivery of the Sound Transit 2 program of investments, with funding secured by a recent public vote. Sales tax revenue volatility will continue to be a monitoring issue for the Sound Transit capital program as well as for near-term operations.

In the near-term the state highway and ferry programs will also require additional funding beyond current law. The Washington State Ferries has a new long-range plan and long-term finance study. And while long-term capital requirements present the largest financial issues for the ferry system, the near-term still requires additional operating revenues and adjustments to state funding practices. The highway program has a large amount of capital investment in the initial decade of the plan. A number of important projects are partially funded, or largely unfunded. Additional statewide funding, such as increases to the state fuel tax, will need to be identified in order to keep the highway program on track even as tolls and other user fees are being introduced.

2. The Phasing in of Tolls and Other User Fees

Transportation 2040 sets out broad direction that moves the region toward a sustainable future in which investments can be made when they are needed, in a predictable manner, with revenues generated from those who benefit from the investments. This change can not occur overnight, but rather will only be the result of many individual steps, including legislative actions at the state and federal level. The specific path to more sustainable transportation finance cannot be known in advance with certainty, but the broader goals and outcomes represent a shared vision.

The long-run viability of the fuel tax is in doubt. The future of the fuel tax has been explored by numerous studies[7], all with an eye toward identifying options for its eventual replacement. A general consensus is emerging around how best to address long-run issues in transportation finance that reaffirms the general principle of user financing, although the design of a specific tax or fee program is likely a number of years away.

In the central Puget Sound region significant early steps to begin to address this structural issue are underway, including the implementation of a HOT lanes pilot project on state route 167 and plans to toll the existing SR 520 Bridge in an effort to help finance its replacement. The evolution of tolling will likely continue on this pathway, with additional high occupancy toll lanes brought into operation in the first decade of the plan. Also, major highway capacity projects will be at least partially financed through tolls.

Eventually, in the later years of the plan the intent is to manage and finance the highway network as a system of fully tolled facilities. The idea that the variable tolling of roads can result in substantial improvements in traffic conditions is unfamiliar to most motorists. There is a natural skepticism about how this might work, and how individuals might be affected by such an approach to road financing. The Traffic Choices Study, however, has demonstrated that households and motorists faced with variable tolls do make the modest adjustments in their travel that will translate into large-scale reductions in roadway congestion. The sum total of individual decisions can be shown to result in important shifts in the time, amount, and mode of travel so as to minimize the amount of time the region's residents would be stuck in traffic.

[7] TRB Special Report 285: The Fuel Tax and Alternatives for Transportation Funding; Federal Surface Transportation Policy and Revenue Study Commission; Federal Surface Transportation Infrastructure Finance Commission.

3. Guidance on the Use of Tolling Revenues

A major portion of the benefits from any application of road tolling is locked up in the revenues that are generated. How these revenues are utilized is clearly a significant determinant of the value of the tolling program, and is an important part of gaining public approval.

Transportation 2040 advances the notion that road tolling must come with a strong commitment to dedicate revenues to the purpose of improving mobility, in the form of direct investments in transportation systems, or offsetting other existing transportation taxes and fees. Beyond this basic commitment, there are likely to be other specific constraints that get placed on the use of revenues from road pricing. Possibilities include at least the following:

- Limit the use of revenues to the corridor, or geography from which the revenues are generated
- Constrain revenues to only road investments
- Allow revenues to be used to support transit or other high occupancy vehicle services
- Remit some, or all, revenues to users of the transportation system through a reduction in, or elimination of, other transportation related taxes and fees

All of the above uses of revenues provide direct benefit to some of the users of the transportation system. Some approaches are more supportive of the toll payers themselves; others provide additional incentives for people to modify their travel behavior away from paying tolls. A major conclusion, however, is that how revenues do get used has a profound effect upon most of the important dimensions of policy related to road tolling.

In the near-term tolling will take the form of high occupancy toll lanes, and individual facility toll financing. In these instances toll revenues are essentially dedicated to making the investments in these corridors possible, and supporting the operations of these corridors directly, or indirectly. Supporting investments might include transit services within the corridor that provide an alternative mobility option.

In the longer-term, when a larger network of highway facilities are managed and financed with tolls, a broader consideration of possible uses for toll revenues may be warranted. It is even possible that it will be desirable to offset existing taxes and fees (say the elimination of a state tax on fuels, or vehicle fees) with toll revenues.

Figure 14 displays a representation of the general strategy for new transportation revenue that reflects the above assumptions and guidance. It should be noted that this is a general representation of a very large number of individual revenue actions that will be required to implement Transportation 2040. The timing and exact nature of each action can only be defined in strategic terms given the inherent uncertainty involved.

Figure 14: New Revenue General Scenario

(millions of year 2008 constant dollars)				
Funding Category	**2010-2020**	**2021-2030**	**2031-2040**	**2010-2040**
Local Sources				
Road Levy (property tax)	$1,000	$1,000	$1,100	$3,100
Other Local Sources (parking, license, and impact fees)	$2,300	$2,600	$2,900	$7,800
Transit Specific Sources				
MVET (transit)	$800	$1,300	$1,800	$3,900
Sales tax increase for local transit	$0	$900	$2,800	$3,700
Sales tax increase for Sound Transit (bonded)	$0	$5,100	$2,400	$7,500
Increases in Transit and Ferry Fares	$100	$400	$500	$1,000
Fuel Taxes, State Fees and Fuel Tax Replacements				
State Fuel Tax and Bonding Net Proceeds	$4,100	$1,000	$800	$5,900
Fuel Tax Replacement	$1,100	$2,100	$2,700	$5,900
HOT Lanes and Facility Toll Revenues				
HOT and Facility Toll Proceeds	$5,600	$1,100	$0	$6,700
Highway System Tolls (various modeled)	$0	$2,700	$24,700	$27,400
Offsetting fuel tax	$0	$0	($8,800)	($8,800)
Total New Revenue	**$15,000**	**$18,200**	**$30,900**	**$64,100**

Financial Summary Information

The financial summary for Transportation 2040 involves pulling together all the various aspects of the financial picture (estimation of current law revenues, estimation of programmatic and project cost estimates, and a representation of the plan's new revenue scenario) into a common framework. Figure 15 summarizes the financial information in a single table, with investment needs, current law revenues, and new revenues identified for each of the major programs. In addition, the table contains an estimate of costs associated with projects (unprogrammed investments) that are not part of the financially constrained plan.

Figure 15: Financial Summary 2010-2040

(millions of year 2008 constant dollars)

	NEEDS			REVENUES			
	Basic Needs	Expansion	Total	Current Law	New Revenue	Total	Unprogrammed Investments
Counties	$ 6,800	$ 9,000	$ 15,700	$ 8,800	$ 6,900	$ 15,700	$ 700
Cities	$ 14,200	$ 13,400	$ 27,600	$ 20,100	$ 7,600	$ 27,700	$ 200
Local Transit	$ 52,400	$ 4,900	$ 57,300	$ 44,500	$ 12,800	$ 57,300	$ 4,900
Sound Transit	$ 17,600	$ 22,300	$ 39,900	$ 32,400	$ 7,500	$ 39,900	$ 18,600
State Ferries	$ 6,700	$ 1,500	$ 8,200	$ 5,400	$ 2,800	$ 8,200	$ -
State Highways	$ 10,600	$ 23,200	$ 33,800	$ 14,100	$ 19,700	$ 33,800	$ 8,800
Other Regional	$ -	$ 6,800	$ 6,800	$ -	$ 6,800	$ 6,800	$ 3,300
TOTAL	**$ 108,200**	**$ 81,100**	**$ 189,300**	**$ 125,200**	**$ 64,100**	**$ 189,300**	**$ 36,500**

Year of Expenditure Financial Summary

As part of federal guidance on financial planning, regional plans are asked to provide financial information in year of expenditure dollars. The reasoning behind this requirement is worth examining in more detail. Fiscal constraint can only be meaningfully addressed through an accounting of all costs and revenues associated with the transportation systems covered in the plan, and over the entire planning period. Given the diversity of revenue sources (e.g., taxes on quantities versus taxes on prices) and elements of costs (e.g., labor, materials, and services) associated with the plan, an explicit treatment of the temporal distribution of costs and revenues (along with a consistent treatment of inflation and inflationary risks) must also be part of the financial analysis. These objectives have already been met in the reporting of costs on a constant dollar basis. Temporal detail has been explicitly retained, as has any specific treatment of inflationary risk included as part of project cost estimation. Figures 16 through 19 display year of expenditure equivalents for various financial data included in the financial strategy, covering current law revenues, financial need by program, new revenue sources and an overall summary of financial information.

Figure 16: Current Law Revenues 2010-2040 (Year of Expenditure)

(millions of year of expenditure dollars)

PROGRAM	2010-2020	2020-2030	2030-2040	2010-2040
Counties	$ 4,400	$ 4,700	$ 5,800	$ 14,900
Cities	$ 9,700	$ 11,000	$ 13,500	$ 34,200
Local Transit	$ 14,700	$ 25,300	$ 39,000	$ 79,000
Sound Transit	$ 21,100	$ 10,300	$ 20,600	$ 52,000
State Ferries	$ 2,600	$ 2,900	$ 3,800	$ 9,200
State Highways	$ 9,300	$ 7,100	$ 6,300	$ 22,700
TOTAL	$ 61,800	$ 61,300	$ 88,900	$ 212,000

Figure 17: Financially Constrained Cost Summary 2010-2040 (Year of Expenditure)

(millions of year of expenditure dollars)

	Constrained 2010-2020	Constrained 2020-2030	Constrained 2030-2040	Constrained 2010-2040
Counties	$ 6,300	$ 8,700	$ 12,600	$ 27,600
Cities	$ 12,400	$ 15,800	$ 18,200	$ 46,400
Local Transit	$ 15,700	$ 29,700	$ 58,800	$ 104,200
Sound Transit	$ 21,100	$ 20,300	$ 26,100	$ 67,600
State Ferries	$ 2,900	$ 3,900	$ 7,700	$ 14,500
State Highways	$ 22,300	$ 11,200	$ 22,700	$ 56,100
Passenger-Only Ferries	$ 200	$ 300	$ 300	$ 800
ITS/Operations	$ 700	$ 800	$ 900	$ 2,400
Demand Management	$ 1,000	$ 600	$ 900	$ 2,500
Regional Non-motorized	$ 200	$ 100	$ 200	$ 500
Toll System	$ 500	$ 2,000	$ 3,100	$ 5,600
Other Subtotal	$ 2,600	$ 3,800	$ 5,400	$ 11,800
TOTAL	$ 83,300	$ 93,500	$ 151,500	$ 328,300

Figure 2: New Revenue General Scenario (Year of Expenditure)

(millions of year of expenditure dollars)				
Funding Category	**2010-2020**	**2021-2030**	**2031-2040**	**2010-2040**
Local Sources				
Road Levy (property tax)	$1,400	$1,700	$2,200	$5,300
Other Local Sources (parking, license, and impact fees)	$3,200	$4,200	$5,700	$13,100
Transit Specific Sources				
MVET (transit)	$1,100	$2,100	$3,600	$6,800
Sales tax increase for local transit	$0	$1,500	$5,500	$7,000
Sales tax increase for Sound Transit (bonded)	$0	$10,500	$5,200	$15,700
Increases in Transit and Ferry Fares	$100	$600	$900	$1,600
Fuel Taxes, State Fees and Fuel Tax Replacements				
State Fuel Tax and Bonding Net Proceeds	$5,700	$1,600	$1,600	$8,900
Fuel Tax Replacement	$1,600	$3,700	$5,500	$10,800
HOT Lanes and Facility Toll Revenues				
HOT and Facility Toll Proceeds	$8,700	$1,100	$0	$9,800
Highway System Tolls (various modeled)	$0	$5,500	$49,200	$54,700
Offsetting fuel tax	$0	$0	($17,400)	($17,400)
Total New Revenue	**$21,800**	**$32,500**	**$62,000**	**$116,300**

Figure 3: Financial Summary 2010-2040 (Year of Expenditure)

(millions of year of expenditure dollars)

	NEEDS			REVENUES			
	Basic Needs	Expansion	Total	Current Law	New Revenue	Total	Unprogrammed Investments
Counties	$ 11,900	$ 15,800	$ 27,600	$ 14,900	$ 12,700	$ 27,600	$ 1,100
Cities	$ 24,900	$ 21,500	$ 46,400	$ 34,200	$ 12,200	$ 46,400	$ 1,800
Local Transit	$ 96,000	$ 8,200	$ 104,200	$ 79,000	$ 25,300	$ 104,300	$ 13,500
Sound Transit	$ 30,400	$ 37,100	$ 67,600	$ 52,000	$ 15,600	$ 67,600	$ 40,500
State Ferries	$ 12,100	$ 2,500	$ 14,500	$ 9,200	$ 5,300	$ 14,500	$ -
State Highways	$ 18,300	$ 37,900	$ 56,100	$ 22,700	$ 33,400	$ 56,100	$ 19,100
Other Regional	$ -	$ 11,800	$ 11,800	$ -	$ 11,800	$ 11,800	$ 5,600
TOTAL	**$ 193,500**	**$ 134,800**	**$ 328,300**	**$ 212,000**	**$ 116,400**	**$ 328,300**	**$ 81,600**