Appendix A.

Freight Funding and Financing Sources and Options

Washington State Freight Investment Study

Tasks 1 to 4: Funding and Financing Sources and Options

Working Paper

prepared for

State of Washington Joint Transportation Committee

prepared by

Cambridge Systematics, Inc.

with

Foster Pepper PLLC
Public Financial Management

November 2008

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working paper

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1.0 Introduction

This first working paper of the *Freight Investment Study* covers material from the first four tasks of the study. The purpose of the paper is to explore how freight investments are currently financed in Washington State and elsewhere, and to provide initial options for re-directing or leveraging taxes and fees to expand freight investments.

It contains the following sections:

- **Section 2.0: Existing and Potential Funding Incentives** evaluates existing and potential Federal, state, and local government freight-related project funding incentives;
- **Section 3.0: Current Industry Taxes and Fees** analyzes current taxes and fees paid by the freight industry and the projects those taxes and fees fund;
- **Section 4.0: Dedicated Revenue Streams for Freight Investment** highlights several national and international examples of revenue streams dedicated to freight investment;
- **Section 5.0: Case Study Examples** provides case study descriptions of how freight investments have been funded and financed in other states; and
- **Section 6.0: Options for Re-Directing or Leveraging Taxes and Fees** identifies options that Washington State could consider for re-directing or leveraging its taxes and fees for freight-related transportation improvements.

Important note: this paper was originally published in fall of 2007. For inclusion in the final report, the paper was updated to reflect more recent (2008) funding levels for Washington State taxes and fees. Federal tax and fee funding levels were not updated; in most cases updated numbers were not available.

2.0 Existing and Potential Funding Incentives

2.1 OVERVIEW

From an overall national perspective, the sources of funding that are typically used for freight improvements vary by mode:[1]

- Highway projects are usually funded using public-sector funding from Federal and state sources;
- Railroads are usually funded privately, although public money has been used to improve safety at highway-rail grade crossings and for smaller railroads, especially when there is a risk of a railroad being abandoned; and
- Ports are funded with a combination of public and private funds, port revenue, and revenue bonds.

This section identifies existing freight funding resources in the State of Washington and the amount of revenue by source. The intent of this evaluation is to provide a baseline assessment of what the revenue picture looks like without any new actions by the Washington State Legislature.

The remainder of this section is organized into the following subsections:

- **Federal Funds**, including formula grant programs, discretionary grant programs, non-U.S. DOT programs, and financing tools; and
- **State and Local Funds**, including the Freight Mobility Strategic Investment Board (FMSIB).

2.2 FEDERAL FUNDS

In August 2005, authorization for Federal funding programs was renewed in Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). There are a wide variety of SAFETEA-LU programs that are available and are being used to fund freight projects. These Federal funding programs for freight projects can be divided into the following main categories:

- **Formula grant programs** apportion funding annually to individual states based on a specified formula. These funds are then available to be used in

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[1] Source: *The Freight Story*, pp. 18-21, Federal Highway Administration, June 2006, http://www.ops.fhwa.dot.gov/freight/freight_analysis/freight_story/finan.htm.

each state for qualifying projects, subject to matching criteria and other Federal and state guidelines.

- **Discretionary grant programs** are provided to selected projects across the nation identified based on a particular selection process. Federal discretionary grants for freight investments were almost completely earmarked (i.e., directed by Congress to states, local governments, or projects in a nonapplication based manner) in the most recent Congressional reauthorization bill.
- **Non-U.S. DOT programs** include those sponsored by the U.S. Army Corps of Engineers, U.S. Department of Commerce, U.S. Department of Agriculture, and the Environmental Protection Agency.
- **Financing tools** are not actual revenue sources in that they must be repaid, but provide mechanisms for states to either borrow funds to advance delivery of particular projects or reduce tax responsibility in the form of tax credits or tax-exempt financing.

Federal funds available within each of these four categories are described in the following subsections.

Formula Grant Programs

Federal grant programs apportioned to states by formula are the most significant funding sources available for freight projects at the Federal level.

National Highway System (NHS)

The NHS is comprised of about 160,000 miles of roadway determined by the Federal government to be important to the nation's economy, defense, and mobility. The NHS includes the Interstate highway system, as well as selected other highways and arterials. The NHS program provides funding for NHS roadway projects, including intermodal connectors between the NHS and intermodal terminals. Eligible project activities include construction, reconstruction, resurfacing, and rehabilitation.

The Federal share of NHS funding is 80 percent, with a 20 percent local matching requirement from non-Federal funding sources. When the funds are used for Interstate projects to add high-occupancy vehicle (HOV) or auxiliary lanes, but not other lanes, the Federal share may be 90 percent. Certain NHS safety improvements have a Federal share of 100 percent.

The SAFETEA-LU Freight Gateways program created a new set-aside from each State's NHS apportionment for intermodal connector projects.[2] For these

[2] Source: http://www.ops.fhwa.dot.gov/freight/freightfactsheet.htm.

projects, the Federal share is up to 90 percent. Examples of such projects include the following:

- NHS routes connecting to and from intermodal freight terminals; and
- Strategic Highway Network (STRAHNET) connectors to strategic military deployment ports.

Funding Levels. The total SAFETEA-LU funding apportionment for the NHS Program is $29.4 billion from Fiscal Year (FY) 2005 to FY 2009. Washington State is estimated to receive about **$528.0 million** of this amount, or **1.8 percent** of the total. Annual historical and estimated NHS funding apportionments in Washington State are as follows:[3]

- *Historical:* FY02: $87.4 mil; FY03: $84.5 mil; FY04: $102.4 mil; FY05: $98 mil; FY06: $97.0 mil; FY07 $113.0 mil; and FY08: $111.0 mil.
- *Estimated:* FY09: $109.0 mil.

Surface Transportation Program (STP)

The STP program provides flexible funding for projects on any Federal-aid highway, bridges on public roads, transit capital investments, and intracity and intercity bus terminals and facilities. Freight projects that are eligible for STP funding include the following:

- Publicly-owned intermodal freight transfer facilities;
- Access to such facilities;
- Operational improvements to such facilities, including capital investments for Intelligent Transportation Systems;
- Preservation of abandoned rail corridors;
- Bridge clearance increases to accommodate double-stack freight trains;
- Capital costs of advanced truck stop electrification systems; and
- Freight transfer yards.

The SAFETEA-LU Freight Gateways program added publicly owned intermodal freight transportation projects that address economic, congestion, security,

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[3] Source data for all Washington State Federal formula grant historical funding apportionments are Highway Statistics publications from the Federal Highway Administration. Source data for all Washington State Federal formula grant estimated funding apportionments are SAFETEA-LU Funding Tables from the Federal Highway Administration. FY07 estimated apportionments include the distribution of equity bonus and revenue aligned budget authority funds, after penalty shifts, exclusive of 2 percent for statewide planning and research.

safety, and environmental issues associated with freight transportation gateways as STP-eligible projects.[4]

The Federal share of STP funding is generally 80 percent, with a 20 percent local matching requirement. For Interstate projects to add HOV or auxiliary lanes or for certain safety improvements, the Federal share may be 90 or 100 percent.

Funding Levels. The total SAFETEA-LU funding apportionment for the STP Program is $31.6 billion from FY 2005 to FY 2009. Washington State is estimated to receive about **$600 million** of this amount, or **1.9 percent** of the total. Annual historical and estimated STP funding apportionments in Washington State are as follows:

- *Historical:* FY02: $110.1 mil; FY03: $108.2 mil; FY04: $134.0 mil; FY05: $112.0 mil; FY06: $112.0 mil: FY07: $126.3 mil; and FY08: $124.0 mil.
- *Estimated:* FY09: $126.0 mil.

Interstate Maintenance

The Interstate Maintenance (IM) program provides funding for resurfacing, restoring, rehabilitating and reconstructing most routes on the Interstate System. These funds cannot be used to provide additional capacity on Interstate routes. Freight-specific projects are typically not eligible, although some activities may improve freight mobility.

IM funds are apportioned to States based on the following factors: one-third based on lane miles on Interstate System routes open to traffic; one-third based on total vehicle miles traveled on Interstate System routes open to traffic; and one-third based on state annual contributions to the Highway Account of the Highway Trust Fund attributable to commercial vehicles.

The Federal share of IM funding is generally 90 percent, with a 10 percent local matching requirement. For certain safety improvements, the Federal share may be 100 percent.

Funding Levels. The total SAFETEA-LU funding apportionment for the IM Program is $24.0 billion from FY 2005 to FY 2009. Washington State is estimated to receive about **$4471.0 million** of this amount, or **1.9 percent** of the total. Annual historical and estimated IM funding apportionments in Washington State are as follows:

- *Historical:* FY02: $77.2 mil; FY03: $75.9 mil; FY04: $105.0 mil; FY05: $88.0 mil; FY06: $88.0 mil: FY07: 98.0 mil; and FY08: $98.0 mil.
- *Estimated:* FY09: $99.0 mil.

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[4] Source: http://www.ops.fhwa.dot.gov/freight/freightfactsheet.htm.

Congestion Mitigation and Air Quality Improvement Program (CMAQ)

The CMAQ program was created in 1991 by the Intermodal Surface Transportation Efficiency Act (ISTEA) to provide funding for transportation projects that improve air quality, and help achieve compliance with national air quality standards set forth by the Clean Air Act. Since its founding, the CMAQ program has funded a variety of freight transportation projects, some of which are privately owned. Examples of these projects include intermodal facilities, rail track rehabilitation, and new rail sidings. CMAQ funds also can be used for construction activities that benefit private companies, if it can be shown that the project will improve air quality by removing trucks off of the road.

Funding Levels. The total SAFETEA-LU funding apportionment for the CMAQ Program is $8.4 billion from FY 2005 to FY 2009. Washington State is estimated to receive about **$152.0 million** of this amount, or **1.8 percent** of the total. Annual historical and estimated CMAQ funding apportionments in Washington State are as follows:

- *Historical:* FY02: $20.9 mil; FY03: $21.2 mil; FY04: $29.0 mil; FY05: $28.1 mil; FY06: $28.0 mil: FY07:$32.0 mil; and FY08: $32.8 mil.
- *Estimated:* FY09: $32.0 mil.

Highway Bridge Program

The Highway Bridge Program provides funding to enable States to improve the condition of their highway bridges through replacement, rehabilitation, and systematic preventive maintenance. Funds are apportioned among states based on each State's relative share of the estimated total cost to repair or replace deficient highway bridges. States must use a minimum of 15 percent of its apportioned funding for projects on off-system bridges (i.e., on non-Federal-aid eligible roadways).

The Federal share for Highway Bridge Program projects is 80 percent, with a local match requirement of 20 percent. For projects on the Interstate System, the Federal share is 90 percent.

Funding Levels. The total SAFETEA-LU funding apportionment for the Highway Bridge Program is $20.5 billion from FY 2005 to FY 2009. Washington State is estimated to receive about **$765.0 million** of this amount, or **3.7 percent** of the total. Annual historical and estimated Highway Bridge funding apportionments in Washington State are as follows:

- *Historical:* FY02: $90.9 mil; FY03: $90.5 mil; FY04: $125.0 mil; FY05: $148.0 mil; FY06: $145.0 mil; FY07: $153.0; and FY08: $154.0 mil.
- *Estimated:* FY09: $165.0 mil.

Highway Railroad Grade Crossing Program

The FHWA Section 130 Highway Railroad Grade Crossing program provides grants for the improvement of highway-railroad grade crossings that enhance safety, and other projects, including separation or protection of grades at crossings; the reconstruction of existing railroad grade crossing structures; and the relocation of highways or rail lines to eliminate grade crossings.

Funds from the FHWA Section 130 Program can be used to further freight rail projects, provided that the projects improve safety at grade crossings. In general, Federal funding is available at a 90 percent share. For certain projects (including signing, pavement markings, active warning devices, and crossing closures), the Federal share may be 100 percent.

Funding Levels. No funds were made available for the Highway Railroad Grade Crossing Program in FY 2005. The total SAFETEA-LU funding apportionment for the program is $877.8 million from FY 2006 to FY 2009. Washington State is estimated to receive about $ 20.0 million of this amount, or 1.9 percent of the total. Annual historical and estimated Highway Bridge funding apportionments in Washington State are as follows:

- *Historical:* FY04: $3.0 mil; FY05: $3.0 mil; FY06: $4.0 mil; FY07: $4.0; and FY08: $4.5 mil.
- *Estimated:* FY09: $5 mil.

Section 1303: Coordinated Border Infrastructure Program

The purpose of the Coordinated Border Infrastructure Program is to improve the safe movement of motor vehicles at or across the land border between the U.S. and Canada and the land border between the U.S. and Mexico. States may use funds in a border region, defined as any portion of a border state within 100 miles of an international land border with Canada or Mexico, for the following types of improvements to facilitate/expedite cross border motor vehicle and cargo movements:

- Improvements to existing transportation and supporting infrastructure;
- Construction of highways and related safety and safety enforcement facilities related to international trade;
- Operational improvements, including those related to electronic data interchange and use of telecommunications;
- Modifications to regulatory procedures; and
- International coordination of transportation planning, programming, and border operation with Canada and Mexico.

A border state may use funds to construct a project in Canada or Mexico if the project directly and predominantly facilitates cross-border vehicle and cargo movement at an international port of entry in the border region of the State.

Canada or Mexico must assure that the project will be constructed to standards equivalent to those in the U.S., and be maintained and used over the useful life of the facility only for the purpose for which the funds were allocated.

Funding by state is currently determined by formula; the formula-based program replaced the TEA-21 discretionary program in 2005. Funds are apportioned among border states based on the following factors related to the movement of people and goods through the land border ports of entry: 20 percent based on the number of incoming commercial trucks; 30 percent based on the number of incoming personal motor vehicles and buses; 25 percent based on the weight of incoming cargo by commercial trucks; and 25 percent based on the number of land border ports of entry.

The Federal share of Coordinated Border Infrastructure Program funding is generally 80 percent, with a 20 percent local match requirement. For Interstate projects to add high-occupancy vehicle or auxiliary lanes or for certain safety improvements, the Federal share may be 90 or 100 percent.

A border state may also transfer up to 15 percent or $5 million (whichever is less) of its funds to the General Services Administration (GSA), if the Secretary approves and GSA agrees. In this case, the state must provide its non-Federal share directly to GSA.

Funding Levels. The total SAFETEA-LU funding apportionment for the Coordinated Border Infrastructure Program is $831.5 million from FY 2005 to FY 2009. Washington State is estimated to receive about **$49.3 million** of this amount, or **5.9 percent** of the total (while the previously described Federal formula grant programs are apportioned to all 50 states, funds for this program are apportioned to only 15 designated border states. Washington State ranks 6th among the states in terms of funds received through this program, after Texas, Michigan, New York, California, and Maine). Annual historical and estimated Coordinated Border Infrastructure Program funding apportionments in Washington State are as follows:

- *Historical:* FY05: $7.3 mil; FY06: $8.5 mil; FY07 $10.0 mil; and FY08: $11.2 mil.
- *Estimated:* FY09: $12.4 mil.

Discretionary Grant Programs

Programs for which funding is identified at the discretion of the Secretary of Transportation or Congress include the following.

Section 1301: Projects of National and Regional Significance (PNRS)

The PNRS program was created by Section 1301 of SAFETEA-LU to provide grant funds for high-cost projects of national or regional significance, which may include freight-related highway or rail projects. Projects must have a total eligible project cost equal to or greater than $500 million, or 75 percent of the total Federal highway funds apportioned to the state where the project is located (in the most recent fiscal year). Federal shares for this program are generally 80 percent of project total cost. Eligible project activities include development phase activities, right-of-way acquisition, construction, reconstruction, and rehabilitation, environmental mitigation, construction contingencies, equipment acquisition, and operational improvements.

Funds are allocated to projects based on a competitive evaluation process based on the ability of projects to satisfy criteria that include, but are not limited to, generating national economic benefits, reducing congestion, and improving transportation safety. Applicants for PNRS program funding are required to provide the following information within the following 12 topics: Statement of Purpose, Eligibility, Project Map, Scope of Work, Cost Estimate, Stakeholder Identification, Funding Disclosure, Timeline, Project History, Transportation Planning, Coordinated Planning, and Environmental Process.[5]

Funding Levels. SAFETEA-LU authorized $1.78 billion for the PNRS Program from FY 2005 to FY 2009, for a total of 25 projects nationwide. Washington State is estimated to receive about **$220.0 million** of this amount, or **12.4 percent** of the total. This funding is going towards two listed state projects: the Alaska Way Viaduct and Seawall Replacement, and the Replacement of Alaska Way Viaduct and Seawall.

Annual PNRS funding levels in Washington State are as follows:

- *FY05:* $22.0 mil; FY06: $44.0 mil; FY07: $55.0 mil; FY08: $55.0 mil; and FY09: $44.0 mil

Section 1302: National Corridor Infrastructure Improvement Program

The National Corridor Infrastructure Improvement Program is a discretionary program that provides funding for construction of highway projects in corridors of national significance to promote economic growth and international or interregional trade. These corridors of national significance include major freight corridors. SAFETEA-LU authorized $1.9 billion for 33 earmarked projects.

The Federal share for projects under this program is 80 percent. When the funds are used for Interstate projects to add high-occupancy vehicle or auxiliary lanes, but not other lanes, the Federal share may be 90 percent. Certain safety improvements receive a Federal share of 100 percent.

Applicants for NCIIP funding are required to provide the following information within the following twelve topics: Statement of Purpose; Eligibility; Project Map; Scope of Work; Cost Estimate; Stakeholder Identification; Funding

[5] Source: http://www.ops.fhwa.dot.gov/freight/safetea_lu/1301_pnrs_guid.htm.

Disclosure; Timeline; Project History; Transportation Planning; Coordinated Planning; and Environmental Process.[6]

Funding Levels. SAFETEA-LU authorized $1.95 billion for the NCIIP Program from FY 2005 to FY 2009, for a total of 33 projects nationwide. Washington State is not receiving any NCIIP funding during this time period.

Section 1305: Truck Parking Facilities

This is a new pilot program that started in 2006. Eligible projects under Section 1305 include projects that:[7]

- Promote the real-time dissemination of publicly or privately provided commercial motor vehicle parking availability on the NHS;
- Open nontraditional facilities to commercial motor vehicle parking, including inspection and weigh stations, and park-and-ride facilities;
- Make capital improvements to public commercial motor vehicle parking facilities currently closed on a seasonal basis to allow the facilities to remain open year round;
- Construct turnouts along the National Highway System (NHS) to facilitate commercial motor vehicle access to parking facilities and/or improve the geometric design of interchanges to improve access to commercial motor vehicle parking facilities;
- Construct commercial motor vehicle parking facilities adjacent to commercial truck stops and travel plazas; and
- Construct safety rest areas that include parking for commercial motor vehicles.

Applicants for Truck Parking Facilities funding are to describe how the project, activity or improvement will relieve congestion in an urban area or along a major transportation corridor, employ operational and technological improvements that promote safety and congestion relief, and/or address major freight bottlenecks.

The Federal share for Truck Parking Facilities funding is generally 80 percent. For certain safety improvements, the Federal share may be 100 percent. A report on the Truck Parking Facilities program is due to Congress in August 2008.

Funding Levels. SAFETEA-LU authorized $25.0 million for the NCIIP Program from FY 2006 to FY 2009. The FHWA Office of Freight Management and Operations is currently reviewing year 2006 grant applications.

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[6] Source: http://www.ops.fhwa.dot.gov/freight/safetea_lu/1302_nciip_guid.htm.

[7] Source: http://www.ops.fhwa.dot.gov/freight/safetea_lu/truckparkingmemo.htm.

Section 1306: Freight Intermodal Distribution Pilot Grant Program (FIDPGP)

The FIDPGP pilot program was created under Section 1306 of SAFETEA-LU to provide grant funds to states to facilitate and support the development of intermodal freight transportation initiatives at the state and local levels for congestion reduction and safety enhancements, and to provide capital funds to address freight distribution and infrastructure needs at intermodal freight facilities and inland ports.

Applicants for FIDPGP funding are required to provide the following information within the following eleven topics: Statement of Purpose; Scope of Work; Project Map; Cost Estimate; Stakeholder Identification; Funding Disclosure; Timeline; Project History; Transportation Planning; Coordinated Planning; and Environmental Process.[8] A report on FIDPGP is due to Congress in August 2008.

Funding Levels. Congress earmarked all the grant funds from this program, totaling $30.0 million, to five states (Alaska, California, Georgia, North Carolina, and Oregon) for six projects (North Carolina has two projects), with each project receiving $1.0 million for the 5 years from FY 2005 through FY 2009.

Section 1702: High Priority Projects

The High Priority Projects Program provides designated funding for specific projects identified in SAFETEA-LU, some of which affect freight mobility. A total of 5,173 projects are identified,. The Federal share for projects under this program is generally 80 percent, with a local match requirement of 20 percent.

Funding Levels. SAFETEA-LU authorized $14.8 billion for the High Priority Projects Program from FY 2005 to FY 2009, for a total of 5,091 projects nationwide. Each high priority project is designated a specified amount of funding over the five years of SAFETEA-LU from FY 2005 to FY 2009. Washington State has a total of 129 high priority projects, or 2.5 percent of the total number of projects. Washington State is estimated to receive **$276.7 million** of High Priority Project funding, or 1.9 percent of the total.

Section 1934: Transportation Improvement Projects

The Transportation Improvement provision in SAFETEA-LU provides funding for earmarked transportation improvement projects designated under Section 1934. Some of these projects are freight-related and/or may affect freight mobility, including funding allocations for major freight corridor projects such as the Alameda Corridor East (California) and ReTRAC (Nevada). The Federal

[8] Source: http://www.ops.fhwa.dot.gov/freight/safetea_lu/1306_fidpgp_guid.htm.

share for Transportation Improvement Projects is generally 80 percent and 100 percent for certain safety projects.

Funding Levels. SAFETEA-LU authorized $2.56 billion for the Transportation Improvement projects from FY 2005 to FY 2009, for a total of 466 projects nationwide. Washington State is one of seven states that is not receiving any funding through the Transportation Improvement Projects program. The other six states that are not receiving funding are Arizona, New Hampshire, South Carolina, Texas, Wisconsin, and Wyoming.

Section 5204 (h): Freight Planning and Capacity Building Program

The Freight Planning and Capacity Building Program is an initiative to support enhancements to freight planning to better target investment and strengthen decision-making capacity of State and local agencies.[9] Eligible activities include research, training and education in best practices, peer exchange, data and analysis, agency reorganization, and public-private relationship building. The authorized funding level is $3.5 million total from FY 2006 to FY 2009.

Section 5209: National Cooperative Freight Transportation Research Program

The National Cooperative Freight Transportation Research Program is being established by the Secretary of Transportation in partnership with the National Academy of Sciences (NAS).[10] The program will be governed by an Advisory Committee selected by the NAS, and will recommend a national research agenda, solicit and review research proposals, award contracts, and disseminate research findings. The authorized funding level is $15.0 million total from FY 2006 to FY 2009.

Section 9002: Capital Grants for Rail Line Relocation and Improvement Projects

The Capital Grant Program for Rail Line Relocation and Improvement projects was created under Section 9002 of SAFETEA-LU to fund local rail-line relocation and improvement projects. States are eligible to receive grant funds from this program for the following types of rail projects:

- Rail line improvement projects serving the purpose of mitigating the impacts of rail traffic on safety, motor vehicle traffic flow, community quality of life, and/or economic development; and

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[9] Source: *Freight Provisions in SAFETEA-LU*, Slide 10, HOFM Director, September 2005, http://www.ops.fhwa.dot.gov/freight/policy.htm.

[10] Source: *Freight Provisions in SAFETEA-LU*, Slide 11, HOFM Director, September 2005, http://www.ops.fhwa.dot.gov/freight/policy.htm.

- Rail line relocation projects involving a lateral or vertical relocation of any portion of the rail line.

The Federal funding share for this program is up to 90 percent. At least 50 percent of the grant funds awarded under this program in a fiscal year must be provided as grant awards not exceeding $20 million each.

Funding Levels. Section 9002 of SAFETEA-LU authorizes, but does not appropriate, $350 million per year for each of the FY 2006 to FY 2009 period. No funds were appropriated for this program in FY 2006.

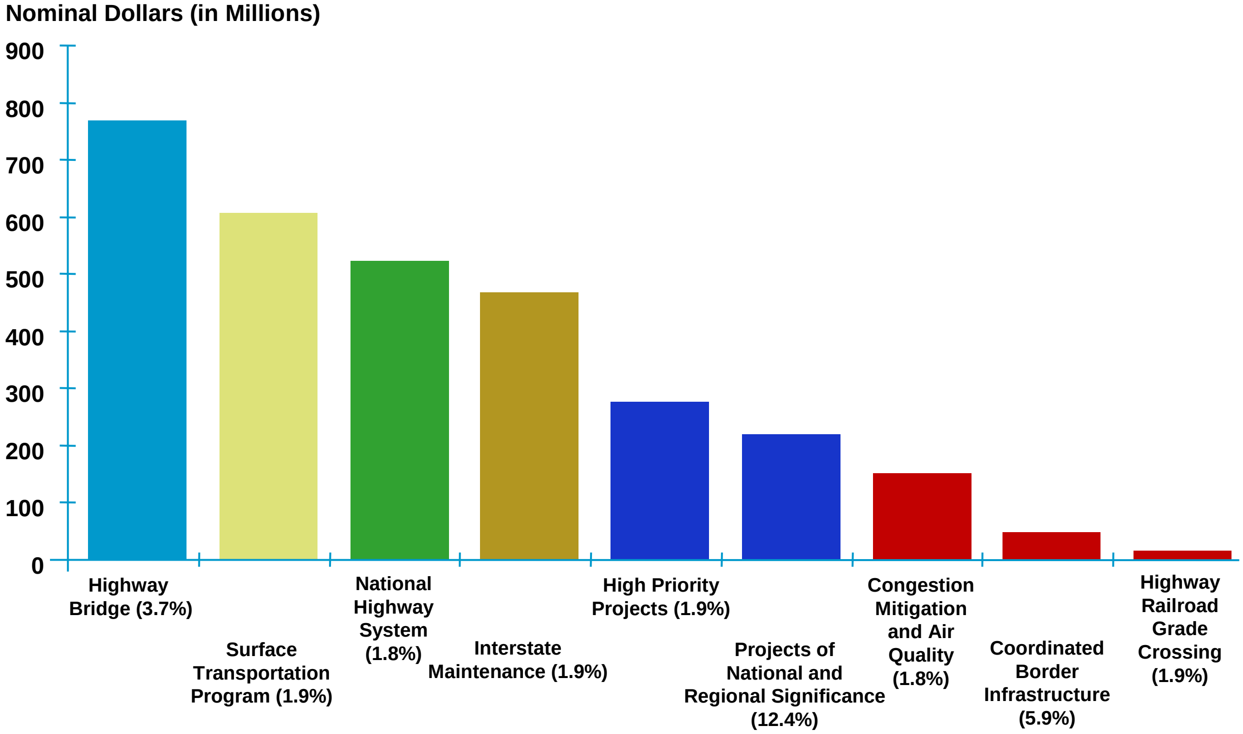
Ferry Boat Discretionary Program

The Ferry Boat Discretionary Program provides funds for the construction of ferry boats and ferry terminal facilities connecting to the NHS. Eligible locations represent logical extensions of the NHS roadways where construction of a bridge is neither practical or feasible. Ferry boat projects eligible under the program include services designed to carry motor vehicles from one point to another including commercial vehicles. The Federal funding share is 80 percent, with a 20 percent local match requirement.

Funding Levels. A set-aside of $20 million per year is provided for the construction or refurbishment of ferry boats and ferry terminals and their approaches that are part of the NHS in the states of Alaska, New Jersey, and Washington. The remaining funds ($167 million for fiscal years 2006 through 2009) are available for projects on a competitive basis. Because of the large number of requests, $2 million or less is typically awarded, in order to disburse funding to as many states as possible.

Figure 2.1 provides a summary of the Federal funding levels apportioned to Washington State by program from FY 2005 to FY 2009. The largest programs in terms of funding are the Highway Bridge ($768 million), Surface Transportation Program ($600 million), National Highway System ($528 million), and Interstate Maintenance ($471 million).

Figure 2.1 Estimated Federal Program Funding Levels for Washington State, FY 2005 to FY 2009



Source: Federal Highway Administration. Percentages reflect the percent of total program funding apportioned to Washington State (Washington State has 2.1 percent of the nation's total population). Washington State received no Federal funding from programs that include Transportation Improvement and National Corridor Infrastructure Improvement.

Findings from Figure 2.1 are as follows:

- Among the Federal formula-based programs, the most significant for Washington State in terms of estimated funding are the Highway Bridge Program ($767.9 million from FY 2005 to FY 2009), the Surface Transportation Program ($607.8 million), the National Highway System Program ($521.9 million), and the Interstate Maintenance Program ($467.5 million).
- Among the Federal discretionary programs, Washington State is estimated to receive $276.7 million from the High Priority Projects Program and $220.0 million from the Projects of National and Regional Significance Program from FY 2005 to FY 2009. Washington State will not receive any Federal funding from discretionary programs that include the Transportation Improvement Projects Program and the National Corridor Infrastructure Improvement Program.

Most of these Federal programs may be used for transportation projects that do not necessarily have freight as its primary objective. How much of this Federal funding for Washington State will be going to freight-related projects could not be determined.

Other Non-DOT Federal Funding Sources

Harbor Maintenance Trust Fund

The Harbor Maintenance Trust Fund (HMTF), established by the U.S. Army Corps of Engineers (USACE) in 1986, is the main source of funding for waterway infrastructure improvements.[11] The HMTF provides funding for operations and maintenance (i.e., dredging costs) of Federally authorized channels for commercial navigation. Ports located along Federal navigation channels are eligible to receive HMTF funding. The Trust fund depends on an ad valorem tax of 0.125 percent on cargo value and reimburses the Treasury for 100 percent of harbor operations and maintenance.

Funding Levels. The USACE FY2007 budget includes approximately $2.3 billion for Operations and Maintenance (O&M), of which $707 million (31.3 percent) will be appropriated from the HMTF. The funds are distributed among 21 designated USACE regions. The O&M budget for commercial navigation expenditures is estimated at $1.3 billion (56 percent).

Inland Waterways Trust Fund

The USACE Inland Waterways Trust Fund (IWTF) is another potential financing option for marine transportation improvements.[12] This trust fund was created out of the Inland Waterways Revenue Act of 1978 and depends on fuel taxes for revenue. The barge and towing industry pays a diesel fuel tax of 20 cents per gallon into the Trust Fund under landmark cost-sharing legislation enacted in 1986. These funds, after being matched by general revenues from the Federal government, are dedicated by law to underwrite the cost of modernizing locks and dams on the fuel-taxed inland waterway.

Funding Levels. Current funding levels through the Inland Waterways Trust Fund could not be identified.

U.S. Department of Commerce

The U.S. Department of Commerce Economic Development Administration (EDA) provides grants for projects in economically distressed industrial sites that promote job creation and/or retention. Eligible projects must be located within an EDA-designated redevelopment area or economic development center. Eligible freight-related projects include industrial access roads, port development and expansion, and railroad spurs and sidings. Grantees must provide evidence

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[11] Source: *Financing Freight Transportation Improvements Workshop Proceedings*, p. 4, http://www.ops.fhwa.dot.gov/freight/freight_analysis/financing.htm.

[12] Source: *Financing Freight Transportation Improvements Workshop Proceedings*, p. 4, http://www.ops.fhwa.dot.gov/freight/freight_analysis/financing.htm.

of economic distress that the project is intended to alleviate. Grant assistance is available up to 50 percent of the project, although the EDA could provide up to 80 percent for projects in severely depressed areas.

Funding Levels. During the last quarter of 2005, the EDA announced 117 grants greater than $100,000, totaling almost $103 million. These investments were part of projects that totaled over $240 million. EDA's Fiscal Year 2004 investments totaled approximately $278 million, with grants ranging from $12,000 to $5.6 million.

Economic Development Administration (EDA) Funds

The U.S. Department of Commerce's Economic Development Administration (EDA) provides grants for economic development projects in economically distressed industrial sites. A critical objective of the program is to promote job creation and/or retention in the region. Eligible projects must be located within an EDA-designated redevelopment area or economic development center. Freight-related projects that are eligible for funding from this program include: industrial access roads, port development and expansion, and railroad spurs and sidings.

Evidence of the economic distress that the project is intended to alleviate is required of the grantees. The program provides grant assistance up to 50 percent of a project cost; however, it can provide up to 80 percent of cost for projects located in severely-depressed areas.

Funding Levels. During the last quarter of 2005, the EDA announced 117 grants greater than $100,000, totaling almost $103 million. The total value of grants awarded under the program totaled over $240 million.

Community Facilities Program

The U.S. Department of Agriculture Community Facilities program provides three types of funding for the construction, enlargement, extension, or improvement of community facilities in rural areas and towns with a population of 20,000 or less. The three programs are the following:

1. Direct Community Facility Loans,
2. Community Facility Loan Guarantees, and
3. Community Facility Grant Program.

Grant assistance is available for up to 75 percent of project cost. Rail-related community facilities eligible for funding from this program include rail spurs serving industrial parks, and other railroad infrastructure in the region, such as yards, sidings, and mainline tracks.

Funding Levels. The Community Facility Program amounts to $297 million in direct loans, $208 million in loan guarantees, and $17 million in grants for FY

2007. The average loan, loan guarantee, and grant amounts are estimated to be $442,000; $860,000; and $32,000, respectively.

Environmental Protection Agency

Through EPA's Brownfield Revitalization Program, the Federal government provides grants and loans for brownfield site cleanup. Brownfield sites could be redeveloped for commercial, residential, and/or industrial uses, including intermodal facilities (e.g., rail-truck transfer facilities). Site cleanup grants provide up to $200,000 per site to fund cleanup conducted by cities, development agencies, nonprofit groups, and similar entities at sites that they own. A 20 percent match (of funds or in-kind services) is required, although this can be waived in the case of hardship. The Revolving Loan Fund (RLF) grants provide up to $1 million per recipient, available for five years, to establish state or locally administered loan funds. Local governments, states, Indian tribes, and entities such as redevelopment agencies, regional councils, and land clearance agencies are eligible for these capitalization grants.

Funding Levels. As of May 2006, EPA had awarded 202 RLF grants totaling $186.7 million, and 238 cleanup grants totaling $42.7 million.

Financing Tools

Loans and credit enhancement programs allow states to pursue transportation projects without the need to have all the upfront revenue in place. Projects can be completed in a much faster timeframe, which can reduce the cost of project delivery and yield project benefits more quickly. Financing has its limitations in the form of future year interest payments and claims on future funding levels (i.e., commitment of future monies that could otherwise be available for pay-as-you-go projects). Financing tools of particular relevance to freight projects include the following.

Section 1601: Transportation Infrastructure Finance and Innovation Act (TIFIA)

The Transportation Equity Act of the 21st Century (TEA-21) formally recognized the need to link intermodal freight needs to infrastructure investments and advocated new investment schemes. The Transportation Infrastructure Finance and Innovation Act (TIFIA), which was created in 1998 by TEA-21, allows funds to be borrowed from the Federal government rather than from the capital market. The strategic goal of the TIFIA program is to leverage Federal resources and stimulate private capital investment by providing credit assistance (up to one-third of the project cost) for major transportation investments of national or regional significance.

The TIFIA program has a minimum project cost threshold for eligibility, which is the lower of $50 million or 33 percent of a state's annual Federal-aid apportionment for highway projects. Interest rates are at the Federal funds' rate rather than the tax-exempt municipal market rate, and are lower than the taxable rate. Funds are underwritten by Federal funding sources from dedicated user revenue streams. The saving between taxable and treasury rates is often between 125 and 200 basis points. Both principal and interest payments can be deferred for at least five years and possibly up to 10 years.[13]

Through the SAFETEA-LU Freight Gateways program, the definition of a project for the TIFIA program was amended to include "a public or private freight rail facility."[14] As such, TIFIA eligibility was expanded to certain private rail projects. Eligibility for freight facilities now includes the following:

- Public or private freight rail facilities providing benefits to highway users;
- Intermodal freight transfer facilities;
- Access to freight facilities and service improvements, including capital investments for Intelligent Transportation System (ITS); and
- Port terminals, but only when related to surface transportation infrastructure modifications to facilitate intermodal interchange, transfer, and access into and out of the port.

Financing Levels. SAFETEA-LU authorized $122 million per year to pay the subsidy costs of supporting Federal credit under TIFIA. There is no limit on amount of credit assistance that can be provided to borrowers in a given fiscal year; the lending authority cap is a function of the agency's budget authority. Repayment of TIFIA loans must come from tolls, user fees, or other dedicated revenue sources. As of July 2006, TIFIA assistance amounted to $3.2 billion, leveraging $13.2 billion of investment in 14 transportation projects. Among these projects were:

- Reno Transportation Rail Access Corridor (ReTRAC), a 2.25-mile below-grade rail freight corridor, which received $51 million; and
- Washington Metropolitan Area Transit Authority Capital Improvement Program, replacing vehicles and rehabilitating facilities and equipment, which received $600 million.

There are currently no projects being financed through the TIFIA Program in Washington State.

Section 1602: State Infrastructure Banks (SIB)

The State Infrastructure Banks (SIB) program was started as a pilot program authorized under Section 350 of the National Highway System Designation Act of 1995 (NHS Act). SIBs are revolving infrastructure investment funds which are

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[13]Source: *Financing Intermodal Transportation*, p. 12, William Ankner, September 2003.

[14]Source: http://www.ops.fhwa.dot.gov/freight/freightfactsheet.htm.

established and administered by states and are eligible for capitalization with Federal-aid highway apportionments and state funds. The purpose of SIBs is to provide innovative and flexible financial assistance to states for rail, highway, and transit projects in the form of loans and credit enhancements.

Financial assistance is available to public and private entities through the SIBs. The assistance includes below-market rate subordinate loans, interest rate buydowns on third-party loans, loan guarantees, and line of credit for the FY 2005 to FY 2009 time period. The following Federal transportation funds may be used to capitalize SIBs:

- Highway Account. Up to 10 percent of the Federal-aid highway apportionments to the state for the NHS program, Surface Transportation Program (STP), Highway Bridge Program, and the Equity Bonus;
- Transit Account. Up to 10 percent of the Federal funds for transit capital projects under Urbanized Area Formula Grants, Capital Investment Grants, and Formula Grants for other than Urbanized Areas; and
- Rail Account. Federal funds for rail capital projects under Subtitle V (Rail Programs) of Title 49 USC.

A state setting up and using a SIB is obliged to match the Federal SIB capitalization funds on an 80 to 20 Federal/non-Federal basis. The exception is the use of funds from the highway account, where a sliding-scale matching provision applies.

Each SIB generally determines what types of credit products to offer, what interest rates to charge, how to screen applicants, and other matters related to the day-to-day business of the SIB. There is also discretion to determine what forms of repayment are acceptable. Even though it is desirable for a SIB to introduce new revenue streams (such as toll receipts) into the pool of funding available for transportation investment, it is possible for SIB loans to be repaid with existing state resources or even Federal funds.

Financing Levels. Washington State has established an SIB and has used it to finance three highway projects to date.[15] The cumulative total of these loans is $2.38 million, of which $0.49 million has been disbursed.

Of the 32 states that are currently using SIBs, Washington State ranks 18th in the number of highway projects financed and 25th in the cumulative total of loans. Ohio has used SIBs for the most projects to date at 74 projects; South Carolina ranks highest in the cumulative total of SIB loans at $2.7 billion.

[15]Source: *Highway Statistics 2005*, Table FA-22; Federal Highway Administration, October 2006.

Section 9003: Rail Rehabilitation and Improvement Financing (RRIF) Program

The Railroad Rehabilitation and Improvement Financing (RRIF) credit program was created under TEA-21 (later amended by Section 9003 of SAFETEA-LU) to help finance railroad capital improvements, particularly those that assist smaller short line and regional railroads. The RRIF program is administered by the Federal Railroad Administration (FRA) and provides financial assistance in the form of direct loans and loan guarantees to eligible recipients for the following types of rail projects:

- Acquisition, improvement, or rehabilitation of freight and passenger rail equipment and facilities, including tracks, yards, and bridges;
- Refinancing of outstanding debt incurred in the acquisition, improvement, or rehabilitation of freight and passenger rail equipment and facilities; and
- Development of new freight and passenger rail facilities.

Recipients eligible for direct loans and/or loan guarantees from the program include public and private entities, railroads, joint ventures (including at least one railroad), limited-option freight shippers (i.e., shippers who own a plant or facility served by no more than a single railroad), and interstate compacts consented to by Congress under Section 410(a) of the Amtrak Reform and Accountability Act of 1997. The RRIF program does not provide financial assistance for rail operating expenses.

Direct loans from the program can be used to finance 100 percent of the total project cost, while loan guarantees can be made for up to 80 percent of the cost of a loan, for terms of up to 25 years. The program requires applicants to cover the subsidy costs through payment of a “credit risk premium” equal to a fraction of the loan amount calculated based on the financial viability of the applicant and the value of the collateral provided to secure the debt.

Financing Levels. Thirteen loans, totaling $517 million, have been issued since 2002. The smallest and largest loans approved were $2.1 million for Mount Hood Railroad and $233 million for the Dakota, Minnesota & Eastern Railroad.

Section 11-1143: Tax-Exempt Financing of Highway Projects and Rail Truck Transfer Facilities (Private Activity Bonds)

A tax-exempt bond is an obligation issued by a state or local government where the interest received by the investor is not taxable for Federal income tax purposes. Tax-credit bond financing is a new form of Federally subsidized debt financing, where the investor receives a Federal tax credit. Because of the exception of Federal income tax on the interest earned, these bonds have a lower cost of financing compared to taxable bonds.

Section 11143 of SAFETEA-LU created a new type of exempt facility eligible to be financed with tax-exempt bonds. These exempt facility bonds may be used to finance certain surface transportation projects, projects for certain international bridges or tunnels, or facilities to transfer freight between truck and rail, provided the project or facility receives Federal assistance.

States and local governments are allowed to issue tax-exempt bonds to finance highway and freight transfer facility projects sponsored by the private sector. Passage of the private activity bond legislation reflects the Federal government's desire to increase private sector investment in United States transportation infrastructure, potentially resulting in new sources of money, ideas, and efficiency. Providing private developers and operators with access to tax-exempt interest rates lowers the cost of capital significantly and therefore enhances investment prospects.

Financing Levels. SAFETEA-LU includes a total national cap of $15 billion on private activity bonds. The U.S. Secretary of Transportation is directed to allocate this amount among qualified facilities.

GARVEE Bonds

GARVEEs permit states to pay debt service and other bond-related expenses with future Federal-aid highway apportionments. The concept is that Federal funds are guaranteed at a certain level and therefore should be treated as income to the state/local entities. Candidates for GARVEE financing are typically larger projects that have the following characteristics:[16]

- They are large enough to merit borrowing rather than pay-as-you-go grant funding, with the costs of delay outweighing the costs of financing;
- They do not have access to a revenue stream (such as local taxes or tolls) and other forms of repayment (such as state appropriations) are not feasible; and
- The sponsors (generally state DOTs) are willing to reserve a portion of future year Federal-aid highway funds to satisfy debt service requirements.

GARVEE bonds may be used for projects that improve interconnectivity to airports, ports and rail stations. They cannot be used to build a rail freight line or new infrastructure for Amtrak, or any purely private transportation purpose.[17]

The issuer of a GARVEE bond has significant flexibility in structuring the terms of the transaction. Coverage ratios, interest rates, the term of the obligation, the level of debt service reserves, and the use of bond insurance are all matters determined by the issuer and the credit markets. Some states may need enabling legislation to issue GARVEEs. In some states, legislation includes clauses that place limits on the volume of GARVEE debt that can be issued. Another key decision left to the state's discretion is how to structure the revenue pledge.

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[16]Source: *Innovative Finance Primer*, p. 16; Federal Highway Administration, April 2002.

[17]Source: *Financing Intermodal Transportation*, p. 12; William Ankner, September 2003.

Railroad Track Maintenance Credit

The Railroad Track Maintenance Credit authorized under Section 45G of the Internal Revenue Code provides tax credits to qualified taxpayers for expenditures on railroad track maintenance on railroad tracks owned or leased by a Class II or Class III railroad. The amount of tax credit provided is 50 percent of qualified railroad track maintenance and rehabilitation expenditures (including expenses for roadbed, bridges, and related track structures).

Eligible taxpayers qualifying for this credit include any Class II or Class III railroad, an entity transporting property on a Class II or a Class III railroad facility, or an entity furnishing railroad-related property or services to a Class II or a Class III railroad. The maximum credit allowed under this program is $3,500 per mile of railroad track owned or leased by an eligible taxpayer, or railroad track assigned to the eligible taxpayer by a Class II or a Class III railroad that owns or leases the railroad track. This credit program, which was released in 2004, was for a 3-year period from December 31, 2004 to December 31, 2007. However, for eligible taxpayers not having enough taxable income to make full utilization of the credit, the credits can be carried forward for a 20-year period.

Special Experimental Project 15

SEP-15 is an experimental process for FHWA to identify, for trial evaluation, new public-private partnership approaches to project delivery. It is anticipated that these new approaches will allow the efficient delivery of transportation projects without impairing FHWA's ability to carry out its stewardship responsibilities to protect both the environment and American taxpayers.

Title XI Financing

The marine industry has its own type of innovative financing mechanism for the building of U.S. vessels and the modernization of U.S. shipyard facilities.[18] This mechanism is known as Title XI and provides a U.S. government guarantee of private sector debt financing. The program offers up to 87.5 percent financing, longer term maturities (up to 25 years), and attractive interest rates. In order to meet the requirements for the program, the shipyard must have:

- Minimum of 12.5 percent equity must be funded or committed prior to any approval from MARAD;
- Positive working capital;
- Long term debt to equity ratio not exceeding 2:1; and
- Maintain net worth.

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[18]Source: *Financing Freight Transportation Improvements Workshop Proceedings*, p. 6, http://www.ops.fhwa.dot.gov/freight/freight_analysis/financing.htm.

2.3 STATE AND LOCAL FUNDS

At the state level, there are few dedicated revenue sources to support freight investments. The legislature has funded several accounts dedicated to freight projects, including the Emergent Rail Assistance program, the Freight Rail Assistance Bank, and accounts that support projects of the Freight Mobility Strategic Investment Board (FMSIB). These accounts are funded from traditional transportation revenue sources, such as motor vehicle registration fees, license fees, and fuel taxes. No dedicated freight funding sources at the local level were identified.

Freight Mobility Strategic Investment Board (FMSIB)

FMSIB provides matching funds for freight improvement projects of regional or statewide significance. Every other year, the board receives a slate of potential freight improvement project proposals from cities, towns, counties, ports, and Washington DOT. Potential projects must meet three important criteria:

- The project must be included in an established regional or state transportation plan;
- The project must fall on one of Washington's defined Strategic Freight Corridors (which are updated every two years by Washington DOT) or emerging corridors; and
- The project must provide a minimum 35 percent match.

The figure below shows the FMSIB project evaluation criteria.

Figure 2.2 FMSIB Project Evaluation Criteria

Project Evaluation Criteria	Weight
Freight Mobility for the Project Area	35 Max
Freight Mobility for the Region, State, & Nation	35 Max
General Mobility	25 Max
Safety	20 Max
Freight & Economic Value	15 Max
Environment	10 Max
Partnership	25 Max
Consistency with Regional & State Plans	5 Max
Cost	10 Max
Special Issues	8 Max
TOTAL	188 pts

Source: Freight Mobility Strategic Investment Board.

The FMSIB Capital Account was established in 2005 to receive levies from license fees, weight fees, motor vehicle or multimodal fees and private funds. The 2008 funding recommendations are estimated at over $350 million, providing matching funds for a total investment of almost $3.3 billion.

3.0 Current Industry Taxes and Fees

This section analyzes current taxes and fees paid by the freight industry, and the extent to which these taxes and fees could either be re-directed to freight investment or could be leveraged through other forms of financing. This section is organized into the following subsections:

- **Federal Taxes and Fees**, including Federal fuel taxes, heavy vehicle fees, and income taxes.
- **State Taxes and Fees**, including state fuel taxes, retail sales and use taxes, taxes with revenue going towards general state purposes, combined licensing fees, and other freight-related fees.
- **Forecast of Future State Revenue**, which provides projections of future state revenue provided by the Washington State Office of Financial Management.
- **Local Taxes and Fees**, including local option fuel taxes, sales taxes, and property taxes.
- **Summary**, which provides the estimated total transportation revenue from Federal, state, and local taxes and fees in Washington State.

3.1 Federal Taxes and Fees

The primary Federal taxes and fees paid by the freight industry which go towards transportation purposes are fuel taxes and heavy vehicle fees:

- **Gasoline Fuel Tax.** The Federal tax on gasoline fuel is 18.4 cents per gallon, of which 15.44 cents (83.9 percent) goes to the Highway Trust Fund, 2.86 cents (15.5 percent) goes to the Transit Account, and 0.1 cent (0.5 percent) goes to the Leaking Underground Storage Tank Trust Fund.[19] An increase to the Federal gasoline fuel tax rate was last authorized in 1993.

[19]Source: *Transportation: Invest In Our Future – Revenue Sources to Fund Transportation Needs*, p. 15, American Association of State Highway and Transportation Officials, April 2007.

In FY 2005, highway users in Washington State are estimated to have paid $407 million in gasoline taxes into the Federal Highway Trust Fund[20]. The majority of this revenue is derived from the use of personal automobiles, and a subset is derived from the use of light trucks and other gasoline-powered vehicles for freight-related purposes.

- **Diesel Fuel Tax.** The Federal tax on diesel fuel is 24.4 cents per gallon, of which 21.44 cents (87.9 percent) goes to the Highway Trust Fund, 2.86 cents (11.7 percent) goes to the Transit Account, and 0.1 cent (0.4 percent) goes to the Leaking Underground Storage Tank Trust Fund.[21] An increase to the Federal diesel fuel tax rate was last authorized in 1993.

  In FY 2005, highway users in Washington State are estimated to have paid $132 million in special fuels (primarily diesel) tax revenue to the Federal Highway Trust Fund.[22]

- **Heavy Vehicle Fees.** Federal heavy vehicle fees include a heavy vehicle use tax for trucks over 55,000 pounds, a 12 percent sales tax on new trucks over 33,000 pounds, and a tire tax for tires over 40 pounds. This revenue goes to the Highway Trust Fund.

  In FY 2005, highway users in Washington State are estimated to have paid $18.4 million in heavy vehicle use taxes, $50.4 million in truck sales taxes, and $7.9 million in tire taxes to the Federal Highway Trust Fund.[23]

The Highway Trust Fund is the primary funding source for a number of Federal programs used for freight-related and other transportation projects. Section 2.0: Existing and Potential Funding Incentives describes the Federal programs most relevant to the freight industry.

In addition, for-profit companies within the freight industry pay Federal income taxes in accordance with the U.S. Internal Revenue Service (IRS) tax code. This revenue goes toward a variety of purposes at the Federal level.

Figure 3.1 summarizes the primary Federal taxes and fees paid by Washington State users for the Federal Highway Trust Fund in FY2005. These include the

[20]Source: Highway Statistics 2005, Table FE-9, Federal Highway Administration, September 2006.

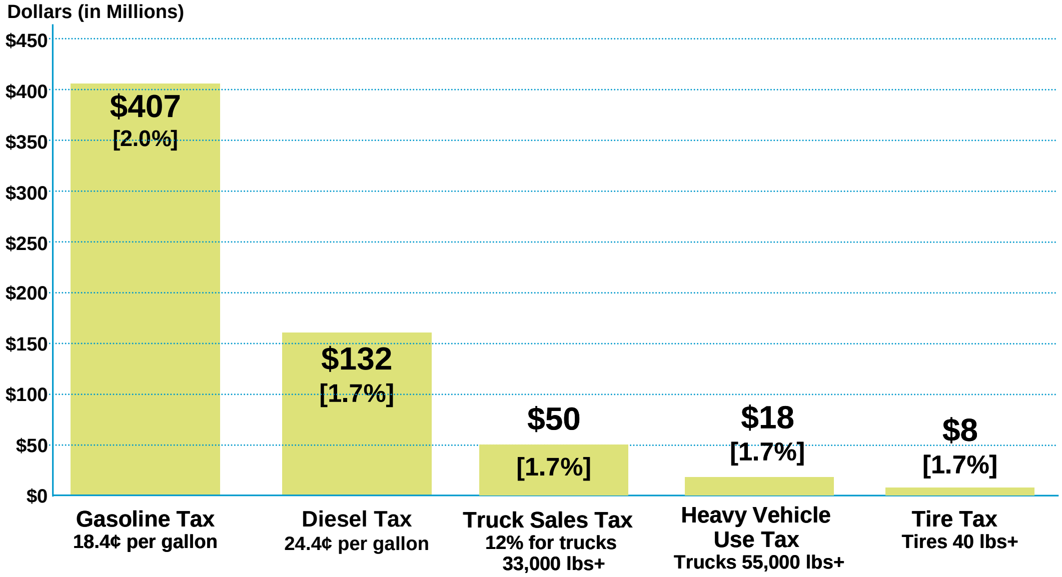
[21]Source: *Transportation: Invest In Our Future – Revenue Sources to Fund Transportation Needs*, p. 15, American Association of State Highway and Transportation Officials, April 2007.

[22]Source: Highway Statistics 2005, Table FE-9, Federal Highway Administration, September 2006.

[23]Source: Highway Statistics 2005, Table FE-9, Federal Highway Administration, September 2006.

gasoline tax ($407 million), special fuels tax ($132 million), truck sales tax ($50.4 million), heavy vehicle use tax ($18.4 million), and tire tax ($7.9 million).

Figure 3.1 Federal Revenue from Washington State Users, FY 2005



Source: Federal Highway Administration. Percentages reflect the percent of national taxes/fees estimated to be paid by users in Washington State (Washington State has 2.1 percent of the nation's total population).

3.2 State Taxes and Fees

State Taxes

The freight industry in Washington State is subject to a number of state taxes, including retail sales and use taxes, various property taxes, public utility (PUT) taxes, business and occupation (B&O) taxes, and taxes on fuels. Revenue from fuel taxes, transportation-dedicated vehicle retail sales and use taxes, and a portion of rental car taxes are allocated specifically to transportation purposes.

Taxes With Revenue Allocated to Transportation Purposes

The motor vehicle fuel tax, special fuel tax, and a 0.3 percent transportation-dedicated vehicle retail sales and use tax in Washington State are described below. The revenue from these taxes are used for transportation purposes.

- **Motor Vehicle Fuel Tax.** The motor vehicle fuel tax is imposed on all motor vehicle fuels, except diesel and other special fuels, when fuel is delivered from a refinery or import terminal in the state to an automobile, truck, trailer, or rail car. Gasoline is the primary fuel type in this category. The current state tax rate is 37.5 cents per gallon.

In FY 2009 (July 2008 to June 2009), an estimated $857 million in state gasoline fuel tax revenue will be generated in Washington State with the tax rate at 37.5 cents per gallon.[24] The majority of this revenue is derived from the use of personal automobiles, and a subset is derived from the use of light trucks and other gasoline-powered vehicles for freight-related purposes. The revenue is distributed to a number of different state agencies, counties, and cities. Under the 18th Amendment of the Washington State Constitution, motor vehicle fuel tax revenue may be used for highway-related purposes only, regardless of which agency spends the revenue. Highway-related purposes are inclusive of ferries, State Patrol activities, and Department of Licensing functions.

- **Special Fuel Tax.** The special fuel tax is imposed on diesel fuel and other special fuels (i.e., propane, natural gas) when fuel is delivered from a refinery or import terminal in the state to an automobile, truck, trailer, or rail car. The current state diesel fuel tax rate in Washington State is 37.5 cents per gallon (the same tax rate as for gasoline) or per 100 cubic feet for gases like propane. This tax rate held constant at 23.0 cents per gallon from 1991 to 2002, and has increased in phases since 2002 to its current rate with the approval of the 2003.

  In FY 2009, an estimated $343 million in state diesel fuel tax revenue will be generated in Washington State with the tax rate at 37.5 cents per gallon.[25] This revenue is distributed to a number of different state agencies, counties, and cities. As with the motor vehicle fuel tax, special fuel tax revenue may be used for highway-related purposes only.

- **Vehicle Retail Sales and Use Tax.** Persons or businesses who purchase or lease a new or used vehicle in Washington State pay a one-time retail sales and use tax equal to 0.3 percent of the vehicle selling or leasing price, with the revenue dedicated to transportation purposes. This percentage is in addition to the 6.5 percent state retail sales tax and other applicable local retail sales taxes.

  For FY 2009, the estimated revenue from the retail sales and use tax is estimated at $31.9 million.[26] This revenue is deposited in the Multimodal Transportation Account and is used for general transportation purposes.

  Data which breaks out the revenue from truck sales separately from automobile sales was not identified. The additional tax does not apply to

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[24] Source: Washington State *Transportation* Revenue Forecast Council, September 2008 Forecast.

[25] Source: Washington State *Transportation* Revenue Forecast Council, September 2008 Forecast.

[26] Source: Washington State *Transportation* Revenue Forecast Council, September 2008 Forecast.

farm vehicles, off-road vehicles, snowmobiles, or motor vehicles purchased by motor carriers for substantial use in interstate or foreign commerce. Therefore, only trucks used primarily for commercial movements within Washington State would be subject to this tax.

Individuals or businesses that rent vehicles pay a state rental vehicle sales tax of 5.9 percent of the rental contract amount in addition to the 6.5 percent state retail sales tax. About $23.2 million is estimated from this source in FY 2009.[27] This revenue is also deposited in the Multimodal Transportation Account and is used for general transportation purposes.

Taxes with Revenue Allocated to Other Purposes

- **Retail Sales Tax.** State retail sales taxes are collected by a business from its consumers on retail sales, unless there is a specific statutory retail sales tax exemption. The state retail sales tax is 6.5 percent; local and other retail sales taxes also apply. As noted previously, an additional state retail sales tax rate of 0.3 percent applies to sales and leases of motor vehicles.

  Purchases of trucks, trailers, component parts, and repair work by motor carrier permit holders for "substantial" use in interstate or foreign commerce are exempt from the retail sales tax. Substantial use in interstate/foreign commerce means the equipment is used in such commerce at least 25 percent of the time as measured by state boundary line crossings, mileage, or revenue.

  Proceeds of the state retail sales are deposited into the state's general fund, and is the state's principal source of tax revenue. In FY 2008, the state collected a total of $7,747 million in state retail sales taxes and $2,726 million in local sales and use taxes.[28] A breakout of those taxes paid by the transportation industry is not available because retailers do not record data about purchasers that would enable that information to be readily determined.

  The second largest source of general state revenue is the property tax, described to follow. Washington State does not have a personal or corporate income tax; the public utility tax and the business and occupation tax (also described to follow) are used in lieu of an income tax.

- **Use Tax.** The use tax is a tax on the use of goods or retail services in Washington when sales tax has not been paid. Examples include goods purchased in another state (with a sales tax lower than Washington State) that are used in Washington State, goods purchased from someone not authorized to collect sales tax, and goods purchased out of state by

[27]Source: Washington *State* Transportation Revenue Forecast Council, September 2008 Forecast.

[28]Source: Washington State Department of Revenue.

subscription, Internet, or mail order. The state use tax rate is 6.5 percent; FY2008 state revenue from this source was $518 million.[29] The distribution of use tax revenue is the same as for the retail sales tax.

- **Property Tax.** Property taxes are paid by many businesses in the transportation industry. Real and personal property taxes are collected by the county treasurer's office where the property is located. While the state does not collect property tax revenue directly, property taxes are a form of state revenue (revenue is distributed among the state and local governments according to state statute; the state uses property tax revenue for general government purposes). Each year's levy of regular (nonvoted) property taxes may not exceed one percent of the value of any piece of property; property taxes that have been voted on and approved may exceed that limit. In most Washington jurisdictions, voters have authorized a total property tax levy that exceeds one percent. Further, state law restricts the growth in total property tax revenues received by any taxing district (including the state) to one percent per year[30.]
- **Leasehold Excise Tax.** The leasehold excise tax is a 12.84 percent tax levied on interests in publicly owned real or personal property, most typically private leases of public property. Of that tax, 6.0 percent is allocated to the state, and 6.84 percent to various local governments. It is essentially in lieu of the property tax, which may not be imposed on public property. For example, it is common for warehouse or shipping companies that lease port or state property to pay the leasehold excise tax. Proceeds of the leasehold excise tax are distributed among the state and local governments according to a formula that differs somewhat from the formula for distributing the property tax.
- **Public Utility Tax.** The public utility tax is assessed on public service businesses including the operation of motor-driven vehicles used in transporting property. Examples of other businesses subject to public utility tax include passenger transportation and water utilities. The transportation of property across state boundaries, into and out of Washington, via "through freight billing" or shipments to ports for export, are allowed deductions for interstate transportation against the public utility tax (the Interstate Commerce Clause of the U.S. Constitution prohibits state taxation of interstate commerce). In general, this tax is computed only on trips that both originate and terminate within Washington State. The public utility tax is in lieu of state business & occupation tax for those activities to which the

[29]Source: Washington State Department of Revenue.

[30]Source: Washington State Department of Revenue.

public utility tax applies. Total state public utility tax receipts for FY 2007 were $365.2 million.[31]

Trucking businesses are potentially subject to two different public utility tax rates when "hauling for hire" (i.e., operating a motor vehicle to convey the property of others, including acting as an auto transportation company, common carrier, or contract carrier). The "Urban Transportation" rate is 0.642 percent and applies when the origin and destination of a haul are within: the corporate limits of the same city; five miles of the corporate limits of the same city; or five miles of the corporate limits of any two cities whose corporate limits are no more than five miles apart. The "Motor Transportation" rate of 1.926 percent applies to "hauling for hire" that does not meet the definition of "urban transportation." If a shipment crosses state boundaries, it is not subject to either tax rate.

Historical levels of public utility tax paid by the trucking industry in Washington State are as follows:[32]

- Urban Transportation (0.642 percent rate): Revenues have grown from $761,678 in FY2002 to $1.1 million in FY2007 (paid by 740 firms), a growth rate of about 8 percent per year.
- Motor Transportation (1.926 percent rate): Revenues have grown from $9.33 million in FY2002 to $14.8 million in FY2007 (paid by 3,125 firms), a rate of about 12 percent per year.

The vast majority (about 97 percent) of the public utility tax is deposited in the state general fund. The remainder is earmarked for the public works assistance account, from which money is loaned or granted to local governments for water, sewer and other infrastructure facilities.

- **Business and Occupation (B&O) Tax.** The B&O tax is a state gross receipts tax on the value of a business's products, gross proceeds of sale, or gross income. The tax rates vary by type of business, with major classifications including Retailing (0.471 percent), Wholesaling (0.484 percent), Manufacturing (0.484 percent), and Service & Other Activities (1.5 percent).[33] The B&O tax is not subject to deductions for labor, materials, taxes, or other costs of doing business.

Although the hauling for hire of freight is subject to the public utility tax and not the B&O tax, many trucking and transport businesses report some portion of their income under retailing, wholesaling, and service classifications that is subject to B&O tax. Gross receipts from the sale of motor vehicles, trailers,

[31]Source: Washington State Department of Revenue.

[32]Source: Ibid.

[33]Source: Ibid.

and component parts used in interstate or intrastate transportation, lease of motor vehicles and trailers, and repair/construction/cleaning services related to motor vehicles are all subject to the state B&O tax. The state maintains data on the amount of B&O taxes collected by manufacturing firms of heavy duty trucks within the state, but that information is not publicly available because of the limited number of firms that pay such taxes in Washington State.

- **Oil Spill Tax.** The oil spill tax is a five-cent tax assessed on each 42-gallon barrel of crude oil or petroleum products which is transported by ship or barge in Washington State waters and off-loaded at an in-state marine terminal. The proceeds of the four cent tax are used to cover the cost of oil spill prevention, response, and restoration programs. An additional one-cent may be levied depending on the fund balance in the state's oil spill response account and is used to cover state response costs. The amount of oil spill tax revenue collected in FY 2008 was $4.5 million.[34]

State Fees

In addition to these taxes, the trucking industry in Washington State pays a number of other fees which include combined licensing fees, oversize/overweight fees, commercial drivers license fees, commercial vehicle safety inspection fees, single trip permits, IFTA decals, IRP fees, and new replacement vehicle tire fees. Revenue from these fees is used specifically for transportation purposes. The fees are described below.

- **Combined Licensing Fees.** Trucks with a gross vehicle weight of over 4,000 lbs and commercial trailers registered in Washington State are assessed combined licensing fees that range from $40 to $3,402 annually depending on gross weight. For FY 2009, the revenue from combined licensing fees in Washington State is estimated at $174.9 million.[35] About $540,000 in additional annual revenue is derived from monthly combined licensing fees paid by truck owners who purchase licenses for periods of less than one year. This revenue is deposited primarily in the Motor Vehicle Account, State Patrol Highway Account, and Transportation Partnership Account and must be used for highway-related purposes.
- **Oversize/Overweight Fees.** Oversize or overweight vehicles are assessed special permit fees of $10 for a single trip (oversize), $10-$20 for a 30 day oversize permit, $70-$90 for a 30 day overweight permit, $100-$150 for a one year oversize permit, and $42 per 1,000 lbs for a 1 year overweight garbage truck permit. Fees for other overweight permits vary. The FY 2009 forecast projects revenue from oversize/overweight fees in Washington State at $6.6

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[34]Source: Washington State Department of Revenue.

[35]Source: Washington Transportation Revenue Forecast Council, September 2008 Forecast.

million.[36] This revenue is deposited in the Motor Vehicle Account and is used for highway-related purposes.

- **Commercial Drivers License Fees.** Drivers of commercial vehicles in Washington State pay $30.00 in renewal fees every five years. This fee increased by $10.00 with authorization of the 2005 Transportation Funding Package. For FY 2009 revenue from commercial drivers license fees is forecasted to be $1.67 million.[37] This revenue is deposited in the Highway Safety Fund and is used for administration of the commercial driver license program.
- **Commercial Vehicle Safety Inspection Fees.** Commercial motor vehicle carriers that have terminals in the state pay $10.00 annually per vehicle for safety inspection fees. For FY 2009, the revenue from commercial vehicle safety inspection fees is estimated to be $1.25 million.[38] This revenue is deposited in the State Patrol Highway Account and used for highway-related purposes.
- **Single Trip Permits.** Special fuel (primarily diesel fuel) users who temporarily enter the state for commercial purposes (maximum of three days) pay a single trip permit of $25.00. For FY 2009, the revenue from single trip permit fees is estimated at $262,000.[39] This revenue is deposited in the Motor Vehicle Account and is used for highway-related purposes.
- **International Fuel Tax Agreement Decals.** Motor carriers in Washington State pay $10.00 annually per set of decals for the International Fuel Tax Agreement (IFTA). For FY 2009, the revenue from IFTA decals is estimated at $ 316,000[40] This revenue is deposited in the Motor Vehicle Account and is used for highway-related purposes. The IFTA is described in more detail below.
- **International Registration Plan Fees.** Motor carriers in Washington State involved in interstate commerce pay fees in support of the International Registration Plan (IRP). This includes a $5.00 fee per plate, a $2.00 cab card fee, a $2.00 validation tab fee, and a $4.50 vehicle transaction fee. For FY

[36]Source: Washington State Transportation Revenue Forecast Council, September 2008 Forecast.

[37]Source: *Transportation Resource Manual*, Washington State Joint Transportation Committee, January 2009.

[38]Source: Washington State *Transportation* Revenue Forecast Council, September 2008 Forecast.

[39]Source: *Transportation Resource Manual*; Washington State Joint Transportation Committee, January 2009.

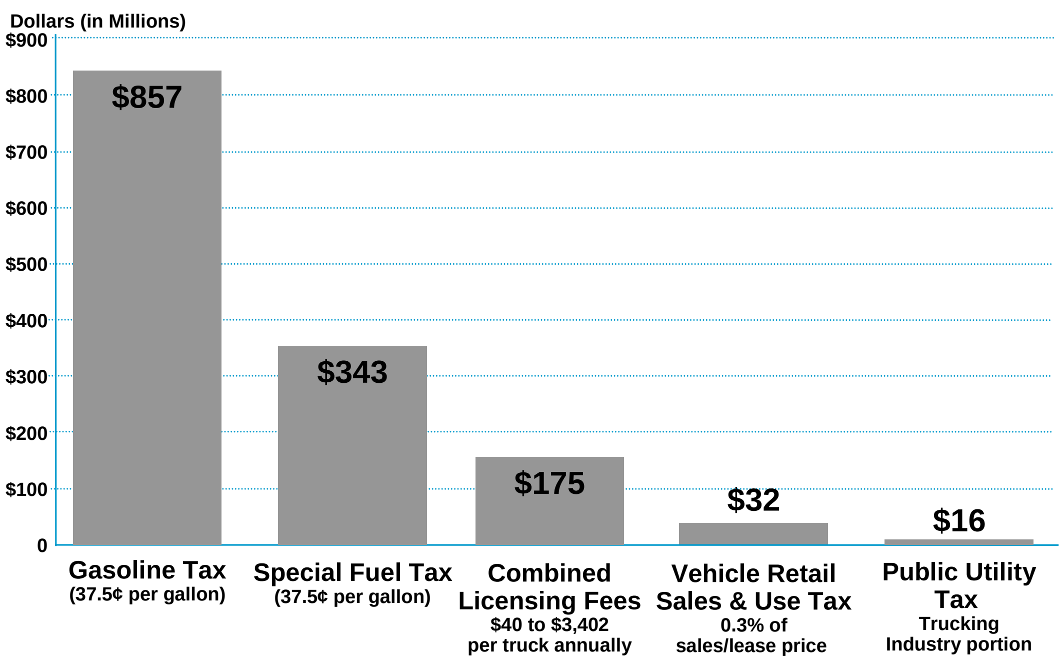
[40]Source: Washington State *Transportation* Revenue Forecast Council, September 2008 Forecast.

2009, revenues from IRP fees are estimated to be $750,000.[41] This revenue is deposited in the Motor Vehicle Account and is used for highway-related purposes. The IRP is described in more detail below.

- **New Replacement Vehicle Tire Fees.** In 2005, the Washington State Legislature reinstated a new replacement vehicle tire fee of $1.00 for each new tire sold in the state. The fee does not apply to retreaded tires or to tires installed on a new or used vehicle when the vehicle is first purchased. In FY 2008, $3.4 million was collected from these fees and placed in a Waste Tire Removal Account to clean up and prevent unauthorized piles of waste vehicle tires. For the 2007-09 biennium, the Legislature has authorized a transfer to the state motor vehicle account of the excess fund balance of $5.6 million.

Figure 3.2 summarizes the major state sources of freight-related revenue projected to be earned in 2009. The values shown for public utility taxes paid by the trucking industry are estimated based on 2007 earnings.

Figure 3.2 Major State Sources of Freight-Related Revenue
FY09 Projections



Source: Washington State Transportation Revenue Forecast Council. All values are projections for 2009 (September 2008 forecasts), except public utility taxes paid by the trucking industry, which were estimated based on 2007 data. Only a portion of motor vehicle fuel tax revenue is freight-related.

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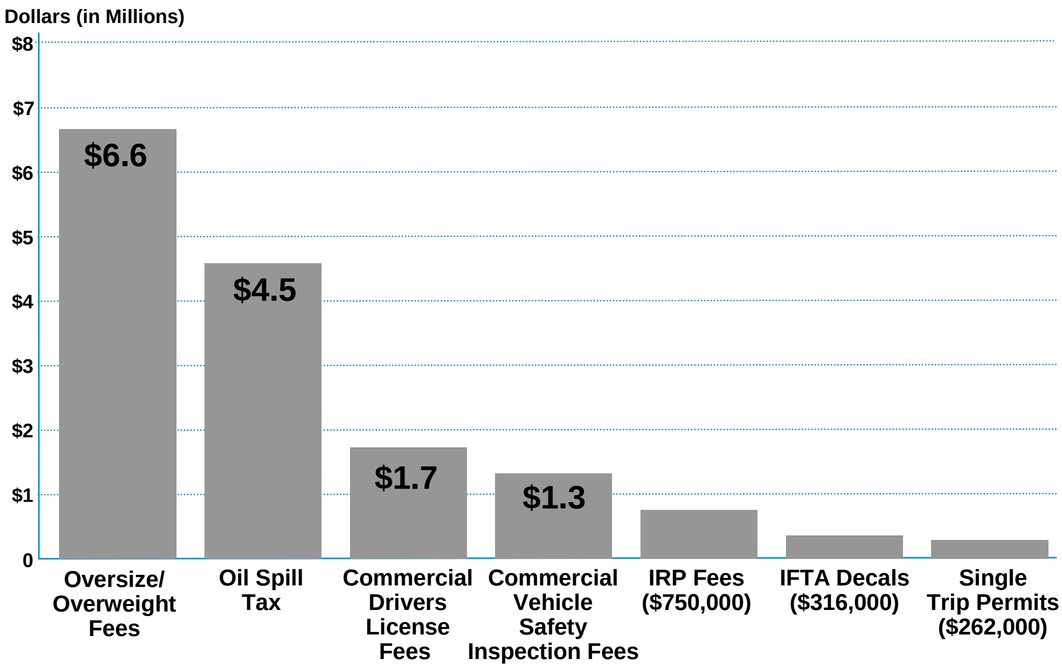
[41] Source: *Transportation Resource Manual*, Washington State Joint Transportation Committee, January 2009.

Figure 3.3 summarizes the smaller state sources of freight-related revenue estimated to be generated in FY2009. These include oversize/overweight fees ($6.6 million), oil spill tax ($4.5 million in FY 2008), commercial drivers license fees ($1.7 million), commercial vehicle safety inspection fees ($1.25 million), IRP fees ($750,000), IFTA decals ($316,000), and single trip permits ($262,000).

Figure 3.3 Smaller State Sources of Freight-Related Revenue
FY09 Estimated



Source: Washington State Department of Revenue; Transportation Resource Manual, Joint Transportation Committee, January 2009.

IFTA and IRP

The International Fuel Tax Agreement (IFTA) and the International Registration Program (IRP) have been established to make sure that the transportation revenues collected by states are allocated between the states appropriately. The IFTA pertains to commercial vehicle fuel tax revenue, and the IRP pertains to commercial vehicle registration fee revenue.

International Fuel Tax Agreement. Since 1997, fuel use taxes on heavy vehicles have been administered throughout North America under the International Fuel Tax Agreement (IFTA), a multijurisdictional organization that provides a uniform framework for the imposition of such taxes.[42] IFTA covers the operations of interstate commercial and combination vehicles which 1) have two

[42]Source: *IFTA: An Introduction*, American Trucking Association, June 2005.

axles and a gross vehicle weight or registered gross vehicle weight over 26,000 pounds; 2) have three or more axles regardless of weight; or 3) are used in combination when the weight of the combination exceeds 26,000 pounds. This definition corresponds to the IRP definition as well.

IFTA employs the base-state concept to make fuel use tax administration and compliance simpler and more uniform. With the base-state system, motor carriers report fuel tax obligations to all IFTA members by filing one report and paying one lump sum of "net tax" to its base state. If the carrier shows an additional liability on its report to some IFTA states, and a credit owed from others, it pays only the net liability (or claims only the net credit). The base state pays those states which it owes more tax and recoups credits from states that owe it more tax by reconciling the reported carrier fuel tax obligations with the actual state-by-state collection of fuel tax revenue.

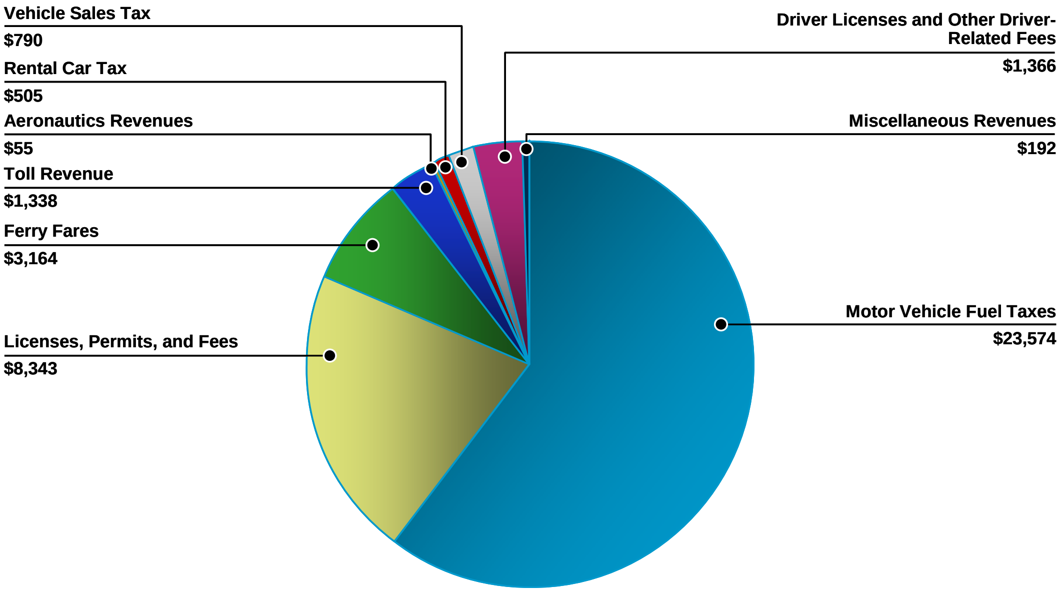
International Registration Program. The International Registration Plan (IRP) is a base-jurisdiction registration reciprocity agreement among the jurisdictions of the United States and Canada that provides for the payment of apportioned commercial motor vehicle registration fees on the basis of fleet miles operated in the various jurisdictions.[43] Through the IRP, each fleet owner reports vehicle registration fee revenue and fleet miles operated by state to its base jurisdiction. The fees are then reapportioned among the other IRP jurisdictions based on: percentage of mileage travel in each jurisdiction, vehicle specific information, and maximum weight.

3.3 Forecast of Future State Revenue

Figure 3.4 shows the 2009 to 2025 state transportation revenue forecast. The projected 16-year total is $39,259 million. About 60 percent of the revenue is projected to be derived from motor vehicle fuel taxes; 21 percent is projected from licenses, permits, and fees; and the remaining 19 percent is projected from a number of other sources including ferry fares, driver licenses and other driver-related fees, toll revenue, the vehicle sales tax, and the rental car tax.

[43]Source: *The International Registration Plan: An Introduction*; American Trucking Association, June 2005.

Figure 3.4 State Transportation Revenue Forecast, 2009-2025



Source: Washington State Office of Financial Management September 2008 Transportation Revenue Forecasts.

3.4 Local Taxes and Fees

Local taxes and fees that apply in Washington State include:

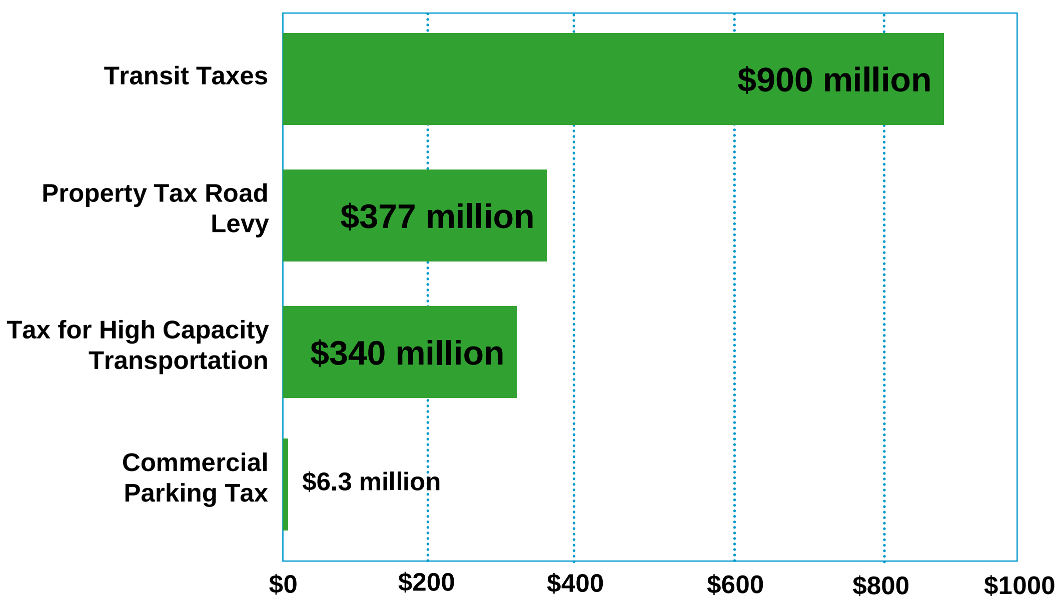
- **Local Option Fuel Tax.** Counties and Regional Transportation Investment Districts (RTIDs) have the authority to levy an additional motor vehicle fuel tax and/or special fuel tax for local transportation purposes. The maximum authorized rate is 10 percent of the state rate. To date, no county or RTID has enacted the local option fuel tax.[44]
- **Property Taxes.** Local property tax revenue, collected by the county treasurer offices and distributed to local governments, fund a wide variety of general government activities. This including roads, bridges and other infrastructure through a property tax road levy. Many port districts levy a property tax to help fund their operations and capital needs.
- **Sales and Use Taxes.** Local retail sales and use tax rates range from 0.5 to 2.4 percent, and are used to fund government activities including transportation.

[44] Three cities (Blaine, Nooksack, and Sumas) do assess a border area motor vehicle and special fuel tax of 1 cent per gallon, and together collected $137,604 in FY 2005 (Source: *Transportation Resource Manual*, Washington State Joint Transportation Committee, January 2009).

- **Other.** Other transportation options that have been implemented by local governments include a commercial parking tax; motor vehicle excise tax (prohibited at the state level but permitted at the local level; trucks over 6,000 pounds are exempt); employer tax; business and occupation tax; household/ utility excise tax; and motor vehicle license fee.
- **Transportation Benefit Districts.** Can be established citywide up to multicounty. The purpose is to finance the construction of, and operate, improvements to roadways, high capacity transportation systems, public transportation systems, and other transportation management programs. The options are: Sales and use tax; motor vehicle license renewal fee; excess property tax levies; tolls; late comer fees; development fees; and, LID formation.

Figure 3.5 summarizes the major sources of local transportation revenue generated in Washington State in FY2007. These include transit taxes ($900 million), the property tax road levy ($377 million), the tax for high capacity transportation ($340 million), and the commercial parking tax ($6.3 million).

Figure 3.5 Local Transportation Revenue in Washington State
FY 2007



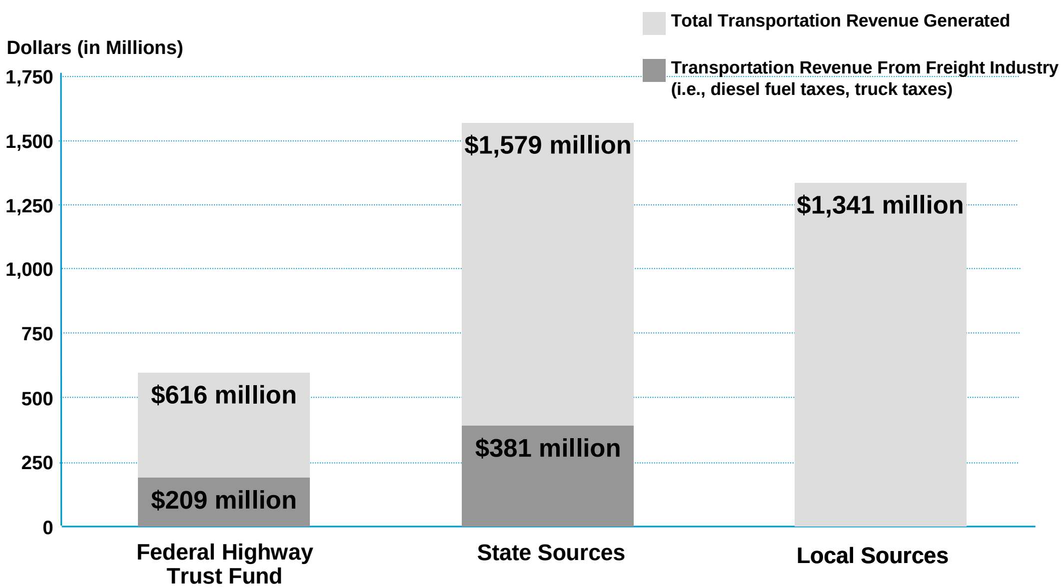
Source: Transit tax: amount reflects revenue during 2007 as reported by the Department of Revenue. Property tax road levy: amount reflects revenue collected during 2007 as reported by the County Road Administration Board. High Capacity Transportation: amount reflects taxes imposed by the Regional Transit Authority during 2007 as reported by the Department of Revenue and Sound Transit. Source: Transportation Resource Manual, Washington State Joint Transportation Committee, January 2009. Not shown: Border Area Fuel Tax ($176,000).

3.5 SUMMARY

Figure 3.6 summarizes total transportation revenue generated from Washington State users in FY2005, the last fiscal year for which complete data is available for all levels of government:

- An estimated $616 million was paid by Washington State users into the Federal Highway Trust Fund. Of this, an estimated $209 million (34 percent) was paid by the freight industry (i.e., diesel fuel taxes, truck taxes).
- An estimated $1,579 million was generated at the state level for transportation purposes. Of this, an estimated $381 million (24 percent) was paid by the freight industry.
- An estimated $1,341 million was generated at the regional and local level for transportation purposes. Data was not available to break out how much of this amount was paid by the freight industry.

Figure 3.6 Washington State Transportation Revenue, FY2005



Source: Federal Highway Administration; Washington State Department of Revenue; Transportation Resource Manual, Washington Joint Transportation Committee, January 2009.

Note: For state sources, FY2005 data was used for this chart to be consistent with the latest available Federal and local data. For local sources, the portion of revenue derived from freight-related businesses could not be determined.

4.0 Dedicated Revenue Streams for Freight Investment

Washington State is not alone in its need to find innovative sources of financing to accommodate its growing freight infrastructure needs. Many jurisdictions around the country and the world are facing the same challenge, and some have generated solutions that may be applicable to Washington State.

This section of the report provides several national and international case study examples of revenue streams dedicated to freight investment. For each case study, we describe the amount of the revenue source, the types of projects funded, and the program costs and benefits. Consideration of program costs and benefits is important given the frequent need to justify freight investments and to determine to what extent project benefits are distributed equitably among those who have paid for them.

The case studies illustrate the range of funding sources states and nations are drawing on. Examples of dedicated funds for freight investment include direct sources such as user fees and taxes, and indirect sources such as general obligation bonds issued to fund a stream of freight projects. In the search for appropriate case studies, we determined that there are few examples of large revenue streams (>$100 million per year) dedicated solely for freight projects. Nevertheless, many states have established low interest loan or grant programs for specific types of freight investments, such as preservation of rail lines or small-scale port improvements.

The first four case studies in this section focus on very large sources of funds available for freight improvements, including Germany's Toll Collect; Oregon's Transportation Investment Act; California's Trade Corridor Improvement Fund; and Florida's Strategic Intermodal system. These examples are most relevant to Washington State, which has very substantial infrastructure needs. The examples demonstrate how other states have gone about generating or redirecting large amounts of funds towards freight projects.

The next case study provided is the Virginia Rail Enhancement Fund, a state grant program which provides $23 million per year in annual funding for passenger or freight rail improvements. The last case study provided is the Connect Oregon program, which authorizes bonds and lottery revenue for multimodal transportation purposes.

Truck Distance-Based User Fees

Germany's Toll Collect

Overview.[45] Recognizing the infrastructure costs imposed by heavy trucks, the German government implemented the world's first country-wide distance-based electronic truck tolling system in January 2005. The tolls apply exclusively to trucks that have a gross vehicle weight 12 tons or more using German's 7,500 miles of Federal roadways.

The tolls were implemented not only to recoup the estimated $3.4 billion Euros in costs per year associated with wear-and-tear from heavy vehicles, but also to ensure a level playing field between German and foreign trucks. Thirty-five percent of truck-kilometers on the motorways are made by foreign-registered vehicles that neither pay taxes nor comply with EU emission standards, giving them an advantage over German trucks.

To collect the tolls, a combination of satellite positioning systems (GPS) and mobile communications network (GMS) was placed in all trucks, whether foreign or domestic. The systems allow for determination of position, toll calculation and transmission of toll amount to the collection center. The toll collection system was developed and is operated by Toll Collect, a public private partnership that includes the German Ministry of Transport, Deutsche Telecom, Daimler-Chrysler Financial Services, and Cofiroute.

Toll rates very by numbers of axles and emission category from 9 to 14 euro-cents per kilometer ($0.19 to $0.30 Euro-cents per mile, average of $0.26). The toll rate was set too low to cover the entire cost of the yearly infrastructure damage associated with trucking. This was done to reduce the economic burden on the trucking industry.

Costs and Benefits. System revenues between January 2005 and July 2006 were 4.6 billion Euros ($6.0 billion or $13 million to $14.5 million per day). One-half of the revenues goes towards road infrastructure, and one-half is split between other freight modes, including rail (38 percent) and waterways (12 percent). The rationale behind this split is to maintain competition between modes. Road authorities have opposed this due to the other subsidies the government already gives other modes, such as the $23.6 billion in subsidies given to the rail industry. Road authorities would like to keep all of the revenues, which they view as road user fees. They complain that 100 percent of the revenues earned from distance-based fees on rail carriers are invested in rail projects.

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[45]Source: State and Local Policy Program, Hubert Humphrey Institute of Public Affairs, University of Minnesota. Scanning Tour Summary Report: Pricing Experience in Northern Europe: Lessons Learned and Applicability to Minnesota and the United States, October 2006. pp. 11-16, http://www.hhh.umn.edu/img/assets/20844/5790_Scan_Tour_Report.pdf.

Nevertheless, the system has gained political acceptance among the trucking groups, which believe it has helped improve their competitiveness vis-à-vis foreign trucks. They have passed on the cost of the program to consumers, as evidenced by an estimated 0.15 percent increase in the price of consumer goods.

Vehicle Title and Registration Fees; Truck Weight-Distance Fees

Oregon's Transportation Investment Acts (OTIA I, II, and III)

Overview.[46] Oregon's legislature responded to the state's transportation infrastructure needs by passing three Transportation Investment Acts (OTIA I, II, and III) between 2001 and 2003. The bond does not focus specifically on freight investments, but many of the projects benefit freight, and a significant portion of the funds are dedicated to improving bridges for freight operations.

OTIA I increased driver and motor vehicle fees to secure $400 million in bonds to increase lane capacity and improve interchanges ($200 million), repair and replace bridges ($130 million), and preserve road pavement ($70 million). OTIA II added $50 million for projects to increase lane capacity and improve highway interchanges, $45 million for additional bridge projects, and $5 million to preserve road pavement. The $500 million in bonds from OTIA I and II was combined with matching funds from local governments. This allowed ODOT and local governments to deliver transportation projects across Oregon worth a total of $672 million.

The third phase of the Oregon Transportation Investment Act (OTIA III) focuses specifically on the need to retrofit aging bridges. Many of the State's aging bridges require load limits for safety reasons. These load limits impede the flow of goods throughout the State, forcing heavy trucks to make costly detours. Passed in 2003, OTIA III uses existing ODOT funds and Federal advance construction money, as well as increases in title, registration, and other driver and motor vehicle fees, to bond a total of $2.46 billion. In addition, the 2003 Legislature approved an increase of nearly 10 percent in the weight-mile tax for commercial vehicles over 26,000 pounds gross vehicle weight to support the bond issue.

Costs and Benefits. As of July 2006, the DMV fee and the weight-mile tax increases have raised a total of $396.9 million since the first fee increases approved by the Legislature went into effect in 2001.

Projects for the first two phases of the OTIA program were selected through an extensive public input process. Local governments and Area Commissions on

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[46] Oregon Department of Transportation. Oregon Transportation Investment Act Financial Foundation. http://www.oregon.gov/ODOT/HWY/OTIA/financial.shtml; Policy on Formation and Operation of ACTs; http://www.oregon.gov/ODOT/COMM/docs/acts/ACTPolicy0603.pdf.

Transportation (ACTs) worked together to recommend project lists to the Oregon Transportation Commission, which approved the final choices.

An ACT is a voluntary association of government and nongovernment transportation stakeholders and has no legal regulatory, policy or administrative authority. ACTs have a voting membership that includes at least 50 percent elected officials within the ACT boundaries, who may come from cities, counties, metropolitan planning organizations, tribal governments, port officials, and transit officials. The remaining membership is made up of stakeholder groups such as members of the freight and trucking industry, advocacy groups, and so on. ODOT also has a vote on each ACT.

General Obligation Bonds

California's Trade Corridor Improvement Fund

Overview.[47] In 2006, California voters passed proposition 1B, a bond measure that provides nearly $20 billion for transportation infrastructure improvements. Part of the bond ($2 billion) was earmarked for the Trade Corridor Improvement Fund, a source of finance for infrastructure improvements along Federally designated "Trade Corridors of National Significance" or other corridors with a high volume of freight movement. The proposition also stipulates that TCIF funds should be used for:

- Highway capacity improvements and operation improvements to more efficiently accommodate the movement of freight, particularly at the state's seaports;
- Freight rail system improvements, especially around seaports and airports;
- Port capacity and efficiency improvements; and
- Truck corridor improvements, including dedicated truck facilities or truck toll facilities.

The funds in the TCIF must be made available through an annual Budget Act approved by the Legislature, and are allocated to the California Transportation Commission.

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[47] California Transportation Commission, June 4, 2007, Draft Proposed Trade Corridor Improvement Fund Programming Framework Alternatives, http://www.catc.ca.gov/TCIF_DRAFT_Framework_Revised060407.pdf; Office of the Legislative Analyst, State of California, 7/20/2006, Proposition 1B, the Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006, http://www.lao.ca.gov/ballot/2006/1B_11_2006.pdf; California Business, Transportation, and Housing Agency and the California Environmental Protection Agency, January 2007, Goods Movement Action Plan, http://www.arb.ca.gov/gmp/docs/gmap-1-11-07.pdf.

Since passage of the bond measure, the California Transportation Commission has been meeting with stakeholder groups, working out a policy framework for allocation of funds and developing draft selection criteria. This has involved consultation with the Trade Infrastructure and Goods Movement Action Plan submitted to the Commission by the Secretary of Business, Transportation and Housing and the Secretary of Environmental Protection. The GMAP lists specific candidate projects for TCIF funding.

Costs and Benefits. The freight industry will benefit directly from freight infrastructure improvements through reduced costs and faster shipping times. Residents of California are likely to benefit indirectly from economic growth associated with freight improvements and from reduced pollution.

The funds for proposition 1B will be generated from the sale of General Obligation bonds, which are not backed by any specific funding source. The cost of debt associated with proposition 1B will be paid by existing and future residents of California. The California Legislative Analyst estimates that the state will likely make up the principal and interest payments on the proposition from the state's General Fund over a period of about 30 years.

Traditional Sources

Florida's Strategic Intermodal System

Overview.[48] Florida's Strategic Intermodal System (SIS) was established in 2003 to enhance Florida's economic competitiveness by focusing limited state resources on those transportation facilities that are critical to Florida's economy and quality of life. The SIS is a statewide network of high-priority transportation facilities, including the State's largest and most significant commercial service airports, deepwater seaports, freight rail terminals, passenger rail and intercity bus terminals, rail corridors, waterways, and highways.

Components of the SIS were designated by the Department of Transportation (DOT) in 2002, under the guidance of a 41-member Steering Committee. The Steering Committee represented the DOT and 31 statewide stakeholders with an interest in the future of Florida's transportation system, economy, and quality of life. Members included representatives from local governments, the private sector freight community, environmental interest groups, and others.

The SIS is not a funding source per se but rather a system for prioritizing critical transportation projects. No new funding source was designated for SIS projects. Instead, the SIS caused existing funds for capacity enhancements (funds left after

[48] Cambridge Systematics project files for NCHRP Project 8-53, "Integrating Freight Into Transportation Planning and Project Selection Processes," Ongoing; Personal Communication, staff of Florida Department of Transportation Office of Policy Planning, September 18, 2007.

system maintenance expenditures and distribution to public transit have been made) to be redirected towards strategic intermodal transportation priorities. Whereas in the past, one-half of all funds for new capacity were designated towards strategic transportation priorities and one-half went towards other highway needs, now 75 percent of capacity funds go towards strategic transportation priorities. In addition, after 2005, the legislature directed several hundred million dollars per year from the general fund to go towards the SIS.

Although the SIS did not provide new transportation funds to the state, it has increased funding emphasis on freight projects, since it allows nonhighway projects to compete for state transportation funds. As a result, the SIS has dramatically expanded the State's involvement in funding freight projects across modes for both passenger and freight operations.

Costs and Benefits. Implementation of the SIS began in 2004 with the identification and funding of 36 projects on SIS connectors totaling $100 million. Overall, SIS funding is expected to amount to $2 billion per year by 2015.

SIS projects are funded through a combination of sources that flow to the State's transportation budget and its general fund (e.g., motor fuel taxes, vehicle registration fees). The exact source of SIS funds is not tracked.

Tax on Rental Vehicles

Virginia's Rail Enhancement Fund

Overview.[49] In 2005, Virginia created the Rail Enhancement Fund as a dedicated source of funding for passenger and freight rail improvements. Three percent of the motor vehicle rental tax and interest on past earnings provides over $25 million per year for the fund. Other funds supplement the rental car tax, including at least 4.3 percent from any transportation bonds issued.

Projects must have a minimum of 30 percent matching contributions from a railroad, regional authority or local government source or a combination thereof. At least 90 percent of funds are to be spent on capital improvements.

Projects are selected based on the recommendations of a Rail Advisory Board (RAB). The RAB consists of nine members appointed by the Governor, including

[49] Eastern Federal Lands Highway Division (EFLHD), Heartland Corridor web site, http://www.efl.fhwa.dot.gov/special_projects/heartland-corridor-clearance-project/, accessed on August 20, 2007; Personal conversation with staff of the Rail Enhancement Fund, September 2007; Virginia Department of Rail and Public Transportation, Rail Enhancement Fund Policy Goals and Implementation Guidelines, FY2005-2006, October 20, 2005. http://www.drpt.virginia.gov/studies/files/Rail-Fund-Guidelines-10202005.pdf; Virginia Department of Rail and Public Transportation, Rail Enhancement Fund Project Descriptions, December 12th, 2005, http://www.drpt.virginia.gov/studies/files/REF-Proj-Descriptions-12-15-2005.pdf.

representatives of industry (CSX and Norfolk Southern Railroads), government (Hampton Roads Planning Commission and Fairfax County), and other organizations, such as the nonprofit Rail Policy Institute.

Examples of projects funded in fiscal year 2005 include rail line acquisitions, rail yard expansions, new track construction, railroad switch upgrades, and other projects. The largest projects to be financed through the fund were associated with Heartland Corridor effort, a series of freight capacity expansion projects between Chicago and the Port of Virginia.

One of these projects consisted of clearing tunnels to accommodate double-stack intermodal trains and constructing an intermodal facility in Roanoke to transfer containers between rail and trucks. The Rail Enhancement Fund provided over $20 million for this portion of the project, which is expected to reduce travel length between the Port of Virginia and Chicago by 233 miles. The planned intermodal facility in West Virginia will also provide cost savings to shippers who currently must move containers by truck.

Another $25.8 million from the Rail Enhancement Fund was provided for the Commonwealth Rail Relocation portion of the Heartland Corridor project. The rail relocation involves moving the existing rail line out of densely populated areas and eliminating 14 at-grade crossings. The project is expected to divert containerized traffic from the regional highway network, thereby improving highway safety and reducing congestion.

Costs and Benefits. Rail infrastructure improvements in Virginia primarily benefit the shipping industry and local governments adjacent to rail infrastructure. Virginia residents also benefit indirectly from economic development associated with improved transportation infrastructure.

Since all Rail Enhancement Fund projects require a 30 percent match from industry or government sources, there is direct connection between those who pay for projects and those who benefit from them. The projects, however, do not benefit the primary contributors to the Rail Enhancement Fund, namely individuals who purchase rental car services. This lack of benefit may not have arisen as a political issue since vehicle renters are likely to be from outside the State.

State Lottery Funds

Oregon State's ConnectOregon

Overview[50,51] ConnectOregon is a lottery bond-backed initiative that is funding the multimodal transportation investments needed to secure Oregon's position in the competitive global marketplace. It is the first major funding program focused on nonhighway transportation, including rail, air, marine and transit. Grants and loans towards these projects will leverage investments made in the State's highway network and the Statewide Transportation Improvement Program. Multimodal investments are seen as an economic development tool, since freight volumes in Oregon are expected to double in the next twenty years and major economic sectors depend heavily on freight transport. Multimodal transportation is seen as necessary in developing the strong, diverse and efficient system the Legislature looks to establish.

Project Costs. The Oregon Legislature first approved the ConnectOregon initiative in 2005. It authorized $100 million in bonds and the redirection of lottery revenues to Oregon's Multimodal Transportation Fund. This authorization is known as ConnectOregon I and currently has 41 projects. Of these projects, seven are under construction, three are near completion and the remainder in the design phase. In 2007, the Legislature approved another $100 million authorization for ConnectOregon II.

Funds are provided to project applicants in the form of grants or loans. In the case of grants, a matching contribution of 20 percent from private, local and/or Federal sources is necessary for qualification with higher levels encouraged. Both grants and loans require a 2 percent fee from the recipient that will go towards a statewide multimodal study of the transportation system.

Factors included in project selection were outlined in the statute and include:

- Transportation cost reduction for Oregon businesses;
- Benefits multiple modes;
- Critical link in statewide or regional transportation system;
- Financial contribution by applicant;
- Potential for construction and permanent job creation; and
- Construction readiness.

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[50] Oregon Department of Transportation and Oregon Economic & Community Development Department, Connect Oregon, December 2004, http://www.oregonbusinessplan.org/pdf/Connect_Oregon_Summit_ Final.pdf.

[51] Oregon Department of Transportation, Connect Oregon, 2007, http://www.oregon.gov/ODOT/ COMM/CO/index.shtml.

Each of Oregon's five geographic regions (made up of combinations of counties) must receive at least 10 percent of the bond proceeds. If a project is eligible for funding from the State Highway Trust Fund or requires continuing subsidies from ODOT, it does not qualify for ConnectOregon.

The ConnectOregon II project selection process is being managed by the Oregon Transportation Commission (OTC), with the help of a Final Review Committee that is currently under development. The Committee will be composed of representatives from the following organizations:

- State Aviation Board;
- Freight Advisory Committee;
- Public Transit Advisory Committee;
- Rail Advisory Committee;
- Marine Project and Planning Advisory Committee;
- Area Councils on Transportation; and
- Portland metro area committee.

The Final Review Committee will prioritize all the projects and create one draft list of projects for the OTC to review at a public hearing in the summer of 2008.

Project Benefits. The expected benefits of the ConnectOregon Program are:

- Improved transportation and efficiency allows for Oregon to better compete in global marketplace and is critical to prosperity, jobs and economic benefits;
- Level of funding allows a breadth of projects and therefore statewide benefits;
- Attracts and leverages private and Federal dollars through investment in other modes; and
- Investment in other modes can relieve congestion on roads leading to a more sustainable transport infrastructure.

5.0 Case Study Examples

This section of the report describes how several large freight infrastructure projects were funded and financed. Each case study example includes a project overview; the amount and sources of funds used for the project; and a description of the project costs and benefits. The costs and benefits of each project demonstrate the connection (or lack of connection) between those who pay for freight improvements and those who benefit from them. The case study examples are:

- Corridor Program-Based Funding and Railroad Equity: Freight Action Strategy (FAST) for the Everett-Seattle-Tacoma Corridor;
- Port User Fees: Alameda Corridor;
- Taxes and Railroad Equity: Reno Transportation and Rail Access Corridor;
- Developer Equity and Accessibility Payments: Port of Miami Tunnel;
- Tolls and Developer Equity: Trans Texas Corridor I-35 (TTC-35);
- Rail Car Fees: Shellpot Bridge Replacement;
- Railroad Equity: Chicago Region Environmental and Transportation Efficiency (CREATE) Program; and
- Port Fees, Gasoline Taxes, and Federal Funds: Virginia Port Authority Craney Island Terminal.

The examples illustrate the fact that large freight projects often require multiple, complex funding sources, even when a dedicated revenue stream is available. They also demonstrate the range of funding sources that can be directed towards freight investments, some of which may be applicable to freight projects in Washington State. Instead of being financed through a single revenue stream, most large freight investment projects are financed through a package of sources, including grants from Federal and state sources of support; equity and in-kind contributions from the private sector; new taxes and fees; and debt backed by new taxes and fees or other sources.

This case study examples also highlight financing tools (e.g., California's infrastructure bonds) and institutional arrangements (e.g., Trans Texas Corridor). Although financing tools and institutional arrangements can provide financing for specific freight projects, a long-term, stable source of funds for freight infrastructure must be derived from either fees or taxes. This is the case even if the user fees are collected by a private entity, as will likely occur in the case of the Trans Texas Corridor.

Corridor Program-Based Funding and Railroad Equity

Freight Action Strategy (FAST) for the Everett-Seattle-Tacoma Corridor

Overview.[52] Trade is a vital part of Washington State's economy. The Puget Sound Regional Council has identified it as the "most trade-dependant state in the nation" based on trade volumes as a share of gross state product. The Ports of Seattle and Tacoma together make up the third largest container load center in North America, and both are growing rapidly. As a result, freight congestion and other negative transportation impacts have increased.

The FAST partnership brings together 26 stakeholder groups, including local cities, counties, ports, Federal, state and regional transportation agencies, and railroad and trucking interests, to solve freight mobility problems through coordination. Together, they developed a framework for selecting and funding freight projects in the region. To date, 25 related but independent projects in the Everett-Seattle-Tacoma corridor have been selected for their expected impact on improving freight mobility and mitigating the impacts of freight growth.

An initial project selection phase in 1998 resulted in the first fifteen projects, of which ten are complete. The Phase II prioritization process selected ten projects in 2002 and construction has begun on some of these. The completion of all FAST corridor projects will lead to grade separation of most major arterials crossing rail lines to ports – improving rail and highway capacity and reliability – along with other operational improvements.

This corridor-based approach, instead of a more limited project-based one, allows Federal funds to be reallocated based on project status. However, recent Federal earmarks for specific projects (instead of programs) has lead to competition between individual projects for limited funding. There is no longer Federal funding to support the program's more flexible funding approach, but stakeholders continue to meet monthly. The model is generally considered a success, but no longer financially feasible without a new revenue stream.

Project Costs. In the 10 years since FAST was established $568 million of public and private funding has been leveraged for strategic freight mobility improvements. The remaining 15 projects have an estimated budget of an additional $300 million (as of April 2006).

A Memorandum of Understanding signed between stakeholders in December 2002 outlines funding participation goals[53]:

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[52] FAST Corridor Brochure. April 2006. www.psrc.org/fastcorridor/.

[53] Puget Sound Regional Council, Memorandum of Understanding among the principle parties of the FAST Corridor, December 2002.

- The Federal Government – in TEA 21 and other targeted efforts – has a goal to contribute forty percent of program costs.
- The State of Washington, through the Washington State DOT, the Freight Mobility Strategic Investment Board and the Transportation Investment Board has a goal to cover forty percent of program costs. The trucking community contributes to this percentage through fuel taxes and fees.
- The Ports of Seattle and Tacoma would collectively contribute seven percent of program costs.
- Union Pacific and Burlington Northern Santa Fe Railroad Corporations would be responsible for three percent of program costs.
- Each project's parent agency would finance the remaining ten percent of project costs.

These figures represent spending for the entire program and may vary by project. The share contributed by each group was determined based on the expected benefits they would receive from the projects that had been selected.

Project Benefits. The FAST corridor program has already improved port access and eliminated major arterial and rail crossings through grade separation. These infrastructure improvements have a wide spectrum of benefits.

- Conflicts between urban center growth and freight growth have been mitigated.
- Truck mobility has increased due to improved capacity and travel time reliability along major arterials.
- Emergency response has been made more reliable as potential barriers in roads are removed. Communities along rail routes have been reconnected.
- Separated grade crossings have led to increased operating speeds for railroads as well as better overall safety.
- Increased truck and rail mobility has led to increased capacity for freight at the ports.

These improvements have allowed the State of Washington to retain its strong position in national and international trade. Another benefit of the FAST program is that it has allowed funds to be redirected to projects which are ready to begin construction, and has promoted a strategic and integrated approach to project selection leading to more efficient and effective use of available funds.

Port User Fees

Alameda Corridor

This section should have new stuff with the additional fees.

Overview. The Ports of Long Beach and Los Angeles are the two busiest container ports in the country and, together, the fifth busiest port complex in the world, handling hundreds of billions of dollars of cargo each year. Recognizing that the rail network serving the ports was not sufficient to accommodate rapidly increasing cargo volumes, the Alameda Corridor Transportation Authority initiated the Alameda Corridor project, a multistage, $2.4 billion effort to improve the efficiency and capacity of rail service in the area. The project included consolidation of four low-speed branch rail lines, elimination of conflicts at more than 200 at-grade crossings, and provision of a high-speed freight expressway.

Project Costs and Revenues (for all these, I couldn't change the font color from red.). The Alameda Corridor projects were funded through a unique blend of public and private sources. The major source of finance comes from user fees charged to the railroads using the facility. The fees help to repay a revenue bond of $1.165 billion, which is just under half of the project cost. The Alameda Corridor Transportation Authority (ACTA) issued the bond.

Railroads pay uniform fees as follows: $18.04 per loaded 20' container (TEU) (accounts for 93 percent of revenue), $4.57 for each empty waterborne container (5 percent), $4.57 (per TEU) for nonwaterborne containers that use the rail corridor, and $9.13 for tankers, coal carriers and other types of loaded rail cars.[54,55] Fees are charged to rail intermodal moves along the corridor-between the Ports and the rail hubs east of Downtown, whether they are by truck or by rail. Nevertheless, locally moving containers and those coming from or going to the inland via truck only are not subject to the fees.

From the project opening on April 15, 2002 until June 30, 2006, $263.4 million had been collected. Revenues for FY08 are expected to be $95.6 million. This revenue from user fees is in line with projections to meet debt obligations.[56]

Project Benefits. Shippers experience the major benefit of the Alameda Corridor project in the form of faster and more reliable transit times and reduced traffic. For a specific shipper to finance efficiency improvements at this level is financially infeasible. By spreading costs across containers, which are the widest base, some of the economic impact of project construction is mitigated. Shippers have reported passing the user charge through to their shipper and carrier customers.

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[54] Effective January 1, 2007, increasing 1.5 to 3 percent per year.

[55] Alameda Corridor Transportation Authority. Program & Operating Budget. Fiscal Year 2007/2008. http://www.acta.org/PDF/Program%20Budget-FY08_final.pdf.

[56] Alameda Corridor Transportation Autority. Basic Financial Statements. June 20, 2006 and 2005, http://www.acta.org/financial_reports/Basic%20Financial%20Statements%20June%2030,%202006%20and%202005.pdf.

Local residents also benefit from the project through reduced traffic congestion at rail crossings; reduced pollution from trains and idling automobiles and trucks; and indirect economic benefit from improved freight operations.

Taxes and Railroad Equity

Reno Transportation Rail Access Corridor (ReTRAC)

Overview. The Union Pacific Railroad's Central Corridor mainline between Oakland, California and the Midwest runs directly through downtown Reno, separating many of the casinos and other downtown businesses from other parts of the city. The City of Reno's interest in modifying this corridor to reconnect the city dates back to the Great Depression, when the United States Bureau of Public Roads proposed that the railroad be elevated. At that time, the Reno City Engineer recommended that the tracks be depressed instead, to avoid creating a barrier through the city. By 1942, the Chamber of Commerce endorsed the depressed trainway project as the "…*number one civic improvement for the readjustment period after the war*."

Beginning in April, 1996, the city, in conjunction with UP and (the then-separate) SP Railroads, funded a "Railroad Merger Mitigation Alternatives" study. The study identified alternatives, preliminary cost estimates, and schedules. The City Council's analysis established the Reno Transportation Rail Access Corridor (ReTRAC) Project, a below grade railroad transportation corridor, as the best long-term value for the region.

A design-build contract was awarded in August 2002, moving the project forward into the design and construct phases. The depressed rail trench was completed and opened to rail traffic in November 2005, with other project elements completed in 2006. After construction was completed, the City of Reno became owner of former UP's right-of-way along the 2.3-mile corridor.

Project Costs and Revenues. The ReTRAC cost of $280 million was met through a combination of financing sources, including loans backed by local taxes; contributions from the UP Railroad; Federal funds and financing mechanisms; and other sources. These included:

- A Federal TIFIA loan of $50.5 million;
- Cash and in kind contributions from UP amounting to over $58 million. These included the donation of land, air rights, right-of-way, construction and funding of the track ballast and ties, and funding the signal system. The construction of track ballast and ties accounted for $17 million of the $58 million in contributions. The rest consisted of in-kind donations of land and air rights to the City of Reno that would generate revenue to pay back the TIFIA loan;

- Approximately $21.3 million in Federal grants, earmarked within the TEA-21 legislation. These funds were passed to the City of Reno through the Nevada DOT;
- Local taxes, including a 1/8 cent sales tax in Washoe County and a special assessment district in downtown Reno (used to pay back a $50.5 million TIFIA loan); a 1 percent occupancy tax on hotels in downtown Reno (proceeds directly funded the ReTRAC project);
- Lease income from UP properties;
- Bond Proceeds. The City of Reno issued $111.5 million in Revenue Obligation bonds for the project; and
- Cash-on hand and interest earnings. Almost $80 million were be provided in pay-as-you-go funding.

Project Benefits. One of the keys to the successful implementation of the ReTRAC project was the identification of the key regional stakeholders and the ability of the City of Reno to describe potential benefits of the project to those stakeholders. The public has benefited from the project through reduced vehicle delays and congestion, reduced noise and emissions, and safety improvements for vehicles and pedestrians by the removal of 11 at-grade crossing. The public also gained from indirect project benefits such as improved aesthetics and job creation associated with construction.

Private sector benefits include improved and more efficient freight rail operations. The rail speed through downtown Reno was 20 miles per hour before the completion of the project. The project allows rail speeds of 60 miles per hour. The trench was designed to accommodate a new connection to the North Reno branch, which connects two other UP routes (Overland Route and Feather River Route).

Developer Equity and Accessibility Payments

Port of Miami Tunnel

Overview.[57] Nearly 5,500 large trucks and buses travel to and from the Port of Miami (POM) through downtown streets each weekday. Existing truck and bus routes restrict the port's ability to grow, drive up costs for port users, present safety hazards, and congest and limit redevelopment of the northern portion of Miami's Central Business District. To increase port access and keep the port competitive, the Florida Department of Transportation, working in cooperation

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[57] Port of Miami Tunnel. Presentation at the 2007 FICE/Florida DOT Project Management Conference.http://www.dot.state.fl.us/projectmanagementoffice/PMConference2007 /Presentations/State of Florida Department of Transportation. Port of Miami Tunnel Web site: http://www.portofmiamitunnel.com/.

with Miami-Dade County, the Port of Miami, the City of Miami and other local stakeholders, is planning a package of port improvements, including a new tunnel to the port; roadway work on Dodge and Watson Islands; and widening of the MacArthur Causeway Bridge.

Project Costs and Revenues. Preliminary estimates for the Port of Miami Tunnel project are in excess of $1 billion. The project is being procured as a public-private-partnership designed to transfer the responsibility to design, build, finance, operate, and maintain the project to the private sector. The project will be financed through the following sources:

- Florida Department of Transportation Strategic Intermodal System funds of approximately $500 million (one-half of the project costs).
- County/port funds, including $100 million in voter-approved general obligation bonds; $114 million directed by the MPO from state gas taxes dedicated to Miami-Dade County; $50 million in right-of-way; and $113.5 in funds expected from port users.
- City funds, including $50 million in Community Redevelopment Area funds and $5 million in right-of-way.

The Port, which is controlled by the county, is investigating whether it will need to cover its share by tolling the tunnel and the Port Boulevard bridge. The Port may be able to provide its contribution through its current fee structure, but if project costs increase, the port may implement an "open road toll" to finance all or part of its obligation. The toll rate will depend on project total cost, traffic counts, and Port's competitive position at the time of tunnel opening. Preliminary indications are that the toll, charged upon exiting, may be in the range of $2 to $3 per car, and between $5 to $7 per truck and bus.

Florida DOT's portion of the project cost will be paid to the project concessionaire (a group headed by the French company Bouygues Travaux Publics) in phases as construction are completed, thus reducing the risk to the public sector.

Florida DOT will pay ongoing project operating and maintenance costs to the concessionaire as annual "accessibility payments." These payments begin with the opening of the facility and inflate over time. They include the relatively fixed capital, operations, maintenance and major maintenance costs. The payments hinge on performance standards and may be reduced if they are not met. The concession may be terminated on substandard performance and the facility is to be returned to the Florida DOT at the end of the concession in a contract-specified condition.

The environmental process for the project is currently underway. The project location and alignment have been identified and a concessionaire (the Miami Tunnel Access Consortium) has been selected. A 47-month construction schedule will begin upon execution of a concession agreement and the project could be operational by 2012.

Project Benefits. The Port of Miami Tunnel will provide a direct connection from the Port of Miami to highways via Watson Island to I-395. This direct connection will reduce shipping times and improve port access, keeping the port competitive in future years. It will also relieve congestion and pollution caused by buses and trucks moving through downtown streets.

Tolls and Developer Equity

Trans Texas Corridor I-35 (TTC-35)

Overview. The Trans-Texas Corridor I-35 (TTC-35) is part of a proposed statewide multimodal network of transportation routes that will incorporate existing and new highways, railways, and utility rights-of-way. Each corridor is envisioned to include:

- Separate lanes for passenger vehicles and large trucks;
- Separate freight and passenger rail lines; and
- Utility and telecommunication lines.

The new TTC-35 will roughly parallel the alignment of Interstate 35, a major NAFTA corridor serving the largest port of entry, Laredo, on the Mexican border. Heavy interstate truck traffic, including high percentages of NAFTA trade, combined with local congestion on IH-35 has made it one of the most congested Texas corridors. The planned TTC-35 corridor will provide a less congested alternative to I-35.

Construction of TT-35 is proceeding in stages, with different financial packages for each segment. The first four segments were constructed through a design-build contract, with Texas DOT providing most of the funds through a $2.2 billion dollar bond issue. Two of those four segments are complete and two are under construction. This case study focuses on the finance of segments 5 and 6 which are currently in the planning phase.

Project Costs and Revenues. To finance construction of segments five and six of the planned corridor, the state has entered into a Comprehensive Development Agreement (CDA) with Cintra-Zachry, a private corporation. Execution of the CDA required enactment of new authorizing legislation. The 2003 legislation allows everything from design, construction, financing and operation to be delegated to the private sector, in return for concession payments or revenue sharing.

Cintra-Zachary will finance the design, construction and operation of the two segments at an estimated total cost of over $1.3 billion, which will be paid for through a combination of developer equity ($331.4 million), bank debt ($596.5 million), and a TIFIA loan ($412.1 million). In return, Texas DOT will give the company a one-time concession fee of $25 million payable upon notice to proceed, and will share the toll revenues over the 50-year term of the concession agreement. The State's share of revenues will increase as the road becomes more successful, and will also increase depending on the speed limit the state sets on the road (higher speed limit, more revenue). After the 50-year term, the roadway will be returned to the State.

This financial arrangement allows Texas DOT to transfer the finance, construction, and operating risks wholly to the private sector developer. By doing so, Texas DOT is able to gain the construction of this major project with no state highway fund contributions. Texas DOT has gained $311 million in developer equity contributions, reducing the amount of the project cost that needs to be financed by project revenues through public or private debt.

Planning for the route got underway in March 2005, when Texas DOT and Cintra-Zachry signed a comprehensive development agreement covering only the planning stages of the project ($3.5 million). As of 2007, the project alignment had not been selected and construction had not been authorized.

Project Benefits. The TTC-35 project is expected to provide several benefits to Texas' residents and to the freight industry. In particular, the new route will offer an alternative, uncongested route for trucks, which comprise a large percentage of existing traffic along the corridor. The route will also accommodate increases in freight traffic which are expected throughout the state. By 2025, statewide freight volumes are expected to grow by 132 percent over 1998 levels, with a 403 percent increase over 1998 levels by 2060. Construction and operation of the corridor are expected to have significant economic impact, producing an estimated 434,000 permanent jobs at project maturity.

Rail Car Fees

Shellpot Bridge Replacement

Overview. The Port of Wilmington, Delaware is a full-service deepwater port located at the confluence of the Delaware and Christina Rivers, 65 miles from the Atlantic Ocean. The Port is a major Mid-Atlantic import/export gateway for a variety of maritime cargoes and trade, and is also a leading container port on the Delaware River handling more than 200,000 twenty-foot equivalent units (TEUs) per year for the Dole Fresh Fruit Company and Chiquita Banana North America.

Rail service to the Port is provided over Norfolk Southern's line, using the Shellpot Bridge to cross the Christina River. The Shellpot Bridge is a swing-style railroad drawbridge originally constructed in 1888 on timber piers.

Conrail, which owned the bridge prior to its merger with Norfolk Southern and CSX, discontinued service over the bridge in December 1995. Closure of the bridge degraded service into the Port of Wilmington, as the Edgemoor Yard (on the north side of the river) was effectively stranded, and port-related traffic was rerouted on the Northeast Corridor (NEC), increasing transit times and decreasing reliability. In addition, some of this freight traffic was rerouted through Wilmington Station, a passenger rail station served by Amtrak and Southeastern Pennsylvania Transportation Authority (SEPTA) trains.

The Delaware DOT and the Norfolk Southern Railroad both recognized the need to repair the aging bridge. However, Delaware DOT was concerned about spending money on a piece of privately owned infrastructure without knowing whether the public benefits would be fully realized. Norfolk Southern was hesitant to invest right away because the Conrail merger had left very little capital and the railroad felt that the return on investment may not be high enough to appease their stockholders.

Project Costs and Revenues. The solution to the concerns of both Norfolk Southern and Delaware DOT was an innovative financing scheme backed by rail car fees. Delaware DOT provided a $5 million grant and an $8.9 million loan to Norfolk Southern Railroad to repair the bridge. Norfolk Southern agreed to repay the $8.9 million loan will be repaid based on the number of rail cars that it runs on the bridge, with guaranteed minimum annual payments over 20 years. Minimum payments are subject to increases every five years-$150,000 in the first five years to $300,000 in the last five years. This minimum will guarantee that half of the loan is paid back. Fees are determined based on a sliding scale: $35 per car for the first 5,000 cars decreasing to $5 per car when there are greater than $50,000 cars using the bridge. The sliding scale is meant to encourage bridge use. The bridge will be the first railroad toll bridge in the U.S. with annual payment terms[58].

This kind of agreement allowed both parties to share in the risks and rewards of restoring the bridge by allowing Delaware DOT to receive a guaranteed minimum payback on its loan and simultaneously encouraging NS to utilize the restored bridge to the largest degree possible. Even if the bridge were not utilized at all, Delaware DOT would make back its money from the loan from the minimum payback guarantees. If the restored bridge is a success, Delaware DOT has a chance to make back actually more than the original outlay of the loan, which can then be invested into other projects. At the same time, NS is encouraged to make better use of the restored bridge, as the more volume they put across it, the lower the per car tariff is. By allowing them to improve their service in and around Wilmington, they also have a chance to expand their business and provide a viable option to truck movements in the region.

Project Benefits. The $13.5 million restoration project, completed in 2004, allows freight cars to run directly to the Port of Wilmington, and provides the port and neighboring industrial sites with greater flexibility for scheduling inbound and outbound train service. Since Norfolk Southern contributes directly to the project finance through rail car fees, there is consistency between project costs and benefits.

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[58] *Shellpot Bridge is Getting Back on Track.* Port Illustrated, July/August 2003.

Railroad Equity

Chicago Region Environmental and Transportation Efficiency (CREATE) Program

Overview. Chicago is a national railroad hub and the busiest rail gateway in the United States. It accounts for one-third of the nation's freight rail traffic. The aging railroad system in Chicago is already congested and is not equipped to meet growing demand for rail service. The CREATE program seeks to address existing and future congestion issues on the rail system, which are expected to bring adverse effects to the national economy and the transportation system if they are not addressed in the near future.[59]

The CREATE program encompasses the rationalization, reconstruction and upgrade of five passenger and freight rail corridors in Chicago. The program is operated through a Public-Private Partnership that includes the Illinois Department of Transportation (IDOT), the City of Chicago Department of Transportation (CDOT), Metra, Amtrak, six of the largest North American freight railroads (Burlington Northern Santa Fe, CN, Canadian Pacific, CSX, Norfolk Southern, and Union Pacific), and switching railroads Belt Railway Company of Chicago (BRC) and Indiana Harbor Belt Railroad (IHB).

The CREATE program will include approximately 78 projects, such as:

- Grade separation of six railroad crossings (rail-rail flyovers);
- Grade separation of 25 highway-rail crossings;
- Viaduct improvements;
- Grade crossing safety enhancements; and
- Extensive upgrades of tracks, switches, and signal systems.

Thirty-two projects are planned for design and/or construction for the initial 3-year plan (2007 to 2009). The projects that have advanced into this phase include six highway-rail grade crossing separations, four rail-rail flyovers, 21 railroad infrastructure improvements (tracks, switches and signals), and the viaduct improvement program.

Project Costs and Revenues. The cost of the CREATE program was estimated in 2003 at $1.534 billion, of which $232 million will come from the railroads, as specified in the JSU. The percentage of private participation was based on an estimation of the economic benefits that the private sector will gain with the implementation of the program. The remaining funding will come from the public sector, including Federal, state, and local partners.

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[59] CREATE program website; http://www.createprogram.org.

Given funding limitations, the CREATE program will be implemented in phases, with Phase I currently underway. The cost of phase I is $330 million, of which $100 million comes from the Federal Projects of National and Regional Significance Program, $100 million from the freight railroads, and $30 million from the City of Chicago. The State of Illinois is expected to provide the remaining $100 million to fund Phase I, which depends largely on whether a state capital bill is passed in 2007. Of the 32 projects in Phase I, two have been completed, while the remaining projects are currently in design or construction. The CREATE partnership will pursue additional Federal funding in the next reauthorization, and also plans to pursue nontraditional sources for transportation funding.

Project Benefits. As part of a systemwide upgrade, three main stakeholder groups will benefit: freight shippers through additional routes and capacity. Passenger traffic will benefit from the new express corridor and other capacity improvements (signaling, switches, and flyovers) that will result in improved timekeeping, and highway users benefit through reduced congestion due to grade separation and more efficient rail traffic routing. Railroads will benefits from: 1) reduced fuel consumption and operating expenses; 2) increased rail capacity; 3) faster and more reliable deliveries; and 4) better utilization of rolling stock.

The CREATE program will also produce significant local, regional, and national benefits. It will expedite the movement of rail cargo throughout the Chicago region, saving money for rail customers who will be able to reduce their inventory levels. It will also be time savings to rail commuters, reduced delays at grade crossings for motorists, improved air quality, economic benefits associated with construction jobs, reduce highway congestion, and improve commute times for passenger rail users.

Port Fees, Gasoline Taxes, and Federal Funds

Virginia Port Authority Craney Island Terminal

Overview. Deep channels and a safe, ice-free harbor have made Virginia's Ports some of the busiest on the East coast. Much of the traffic flows through terminals operated by the Virginia Port Authority (VPA), which include the Norfolk International Terminals, the Portsmouth Marine Terminal, the Newport News Marine Terminal, and the Virginia Inland Port in Front Royal-which are operated by its affiliate, Virginia International Terminals, Inc. Collectively, these terminals are referred to the Port of Virginia.

Traffic at the Port of Virginia is growing. It handled nearly 2.05 million TEUs in 2006 and is expected to handle 2.5 million TEUs annually by 2008. In the next 30 years, it is expected to grow by 400 percent. To handle the increase, the Port Authority has a number of planned and ongoing capacity expansion projects. According to the Port Authority's 2040 Master Plan, $3.1 billion will be invested in these improvements by 2032.

One of the most expensive and ambitious of the improvement projects is the planned Craney Island Terminal, which will be the fourth marine terminal under the VPAs jurisdiction. The new terminal is expected to cost $2.2 billion, of which $712 million will fund the Eastward Expansion, a rapid filling of the terminal area with dredged material from local waterways, and $1.5 billion will cover the cost of the marine terminal and related infrastructure. When completed, the Craney Island Terminal facility will accommodate 2.5 million TEUs, doubling the capacity of the Port of Virginia.

Project Costs and Revenues. The funding package for the Craney Island Terminal has not yet been finalized. The VPA is currently considering whether to seek out investment from private partners to cover some of the project costs. Assuming no private funds were available, the costs would be expected to be covered as follows[60]:

- Fifty-three percent of the project costs, or $1.26 billion, is expected to come from terminal revenues generated from fees that ship lines and customers pay to use the existing VPA facilities. This revenue stream may be used to back a major bond issue.
- Thirty-two percent of project costs, or $776 million, is expected to come from the Commonwealth Port Fund, a dedicated fund created in 1987 for port development. Funds from the CPF come from an earmarked 4.2 percent of Virginia's Transportation Trust Fund (gasoline and automobile taxes). This revenue stream may also be used to back a major bond issue.
- The final 15 percent of project costs, or $356 million, are expected to come from an earmarked portion of the Federal Water Resources Development Act, a law that funds water-related projects. As of September 2007, Congress passed the bill with veto-proof margins. However, money will not be available unless appropriated through the annual Federal budgeting process.

Project Benefits. The new Craney Island Terminal is expected to provide a number regional and national benefits. National economic development benefits, in the form of transportation cost savings and greater economic efficiency, have been estimated at $5.95 billion over 50 years, or $345 million a year (using a Federal discount rate of 5.3 percent).

Regional and local benefits in the form of jobs and wages associated with construction and operation of the terminal and increases in regional economic activity associated with the terminal, were estimated through an economic impact study. The study considered direct, indirect, and induced benefits of terminal construction, including the impacts of an estimated 100 new distribution centers that would be needed to handle the increased port activity.

[60]Source: The Craney Island Connection (a publication of the Virginia Port Authority and the U.S. Army Corps of Engineers), Volume 1, Issue 3, September 2007.

Altogether, impacts on the regional and state economy were estimated at $5.27 billion annually. That figure includes the impact of 54,255 new jobs and $1.65 billion in wages associated with terminal development. It also includes $155 million in additional taxes that will flow to local and state government each year[61].

[61] Craney Island Feasibility Study Update, Presented to the VPA Board of Commissioners January 25, 2005.

6.0 Options for Re-Directing or Leveraging Taxes and Fees

Washington State has a number of options that could be considered for re-directing or leveraging its taxes and fees for freight-related transportation improvements. This section focuses primarily on options available at the state level. Options at the Federal and local levels would also be possible, pending discussion with the appropriate decision-makers and stakeholders.

6.1 Review of Existing Process

The revenue from freight-related taxes and fees collected by the state is pooled in with state transportation revenue derived from other Federal and state sources. The total revenue collected is then distributed to several entities:[62]

- **Washington State Department of Transportation (WSDOT)**;
- **Other state agencies** including the Washington State Patrol (WSP), the Transportation Improvement Board (TIB), the Department of Licensing (DOL), and the County Road Administration Board (CRAB); and
- **County governments, city governments, and port districts**.

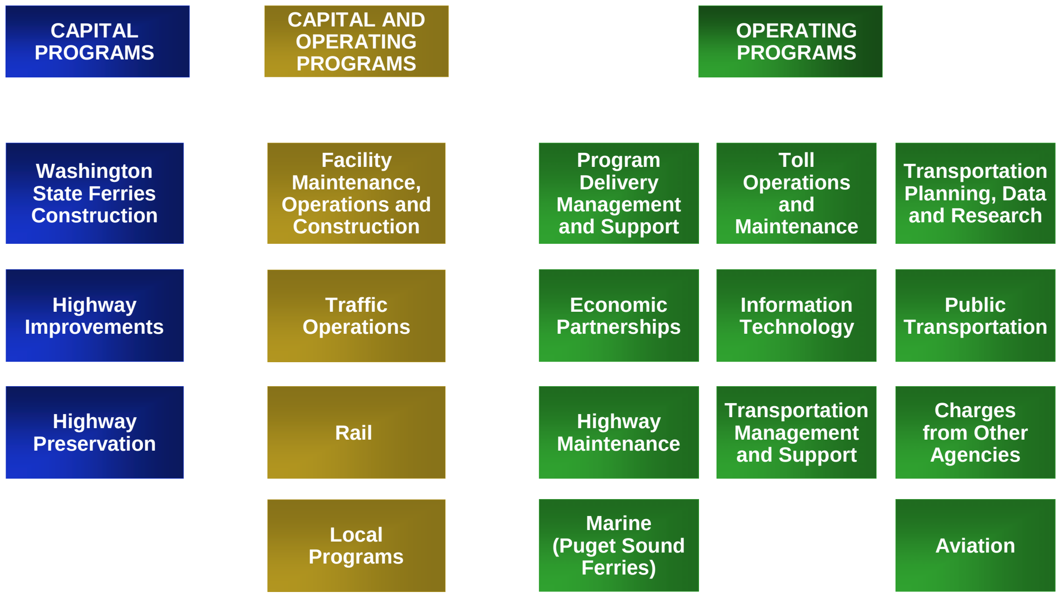
In addition, a certain portion of state transportation funding goes towards bond repayment (i.e., payment of principal and debt service).

The revenue from particular funding sources are legislatively mandated to be used only for specific transportation purposes. Most notably, revenue from the motor vehicle fuel tax and the special fuel tax must be deposited in the State Motor Vehicle Fund and are to be used exclusively for highway purposes, as stated in the 18th Amendment of the Washington State Constitution. Highway purposes has been interpreted to include state highways, ferries, certain highway-related transit facilities, and freight-related highway projects (such as projects to facilitate the movement of trucks).

Among the agencies that receive transportation funding, WSDOT is the agency with the most responsibility for the funding and delivery of freight projects. Figure 6.1 shows the current WSDOT program structure.

[62]Source: *Washington State Transportation Budget: An Overview*, page 10; Office of Program Research, January 2005.

Figure 6.1 Washington State DOT Program Structure



The WSDOT program structure shown in Figure 6.1 is used for budgeting and funding appropriation purposes, with each program representing a certain mix of projects and functional activities. There are two main types of programs:

- **Capital programs**, which fund longer-lived projects such as the construction of roads, bridges, rail infrastructure, and ferry terminals.
- **Operating programs**, which fund noncapital, day-to-day expenses of running the agency and its programs.

Of the 18 WSDOT programs, three are capital programs, 11 are operating programs, and four have both a capital and an operating element. For the four programs with both capital and operating elements, separate appropriations are made for each component.[63]

For the FY 2007 to 2009 budget, the top five programs in terms of funding (Highway Improvements; Highway Preservation; Marine [Puget Sound Ferries]; Highway Maintenance; and Washington State Ferries Construction) represented about 86 percent of the total WSDOT budget.[64] About 75 percent of the single

[63] While these 18 programs represent the highest-level "roll-up" of the current WSDOT budget, in some cases separate appropriations are made at the subprogram level or at the project level for particular designated projects.

[64] Source: *WSDOT Budget Methodologies Study*, pp. 2-3; Cambridge Systematics, Inc., June 2006.

largest program, the Highway Improvement program, is earmarked for specific projects.

While many of the WSDOT programs are currently being used to fund freight-related projects and activities, no program has freight as its sole purpose. The program with objectives that are tied most closely to freight is the Rail Program:

- The Rail Capital Program provides financial assistance for light density freight rail systems to preserve freight rail service to communities throughout the state, and for emergent freight rail assistance projects to improve the movement of goods throughout the state and to the ports.[65] This is in addition to management and funding of the state's investment in the capital components of the rail passenger program.
- The Rail Operating Program provides support, administration, coordination, and planning for both freight rail and passenger rail.

For FY 2005-07, the Rail Capital Program budget was $88.1 million and the Rail Operating Program budget was $36.5 million.[66] The total budget of $124.6 million represented 2.8 percent of the total FY 2005 to 2007 budget.

6.2 Options for Redirection

An option that Washington State could consider would be to put state tax and fee revenue paid by the freight industry into a separate funding program specifically for freight-related projects and activities across multiple modes (highway, rail, ports). The most significant of these funding sources are the special fuel (i.e., diesel) tax and combined licensing fees paid by trucking companies, which together currently generate more than $360 million in revenue annually.[67]

There is a key distinction between taxes and fees in this respect, as defined by Washington State:[68]

- Taxes are imposed to raise money for any governmental purpose, with no relationship between the tax burden and the benefit to an individual taxpayer.

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[65]Source: *Washington State Department of Transportation 2005-07 Current Law Budget*, pp. 7 and 12; adopted by the Washington State Transportation Commission, Aug 2004.

[66]Source: *Engrossed Substitute Senate Bill 6091*; Washington State Legislature, approved May 2005.

[67]Under the 18th Amendment of the Washington State Constitution, special fuel tax revenue may be used for highway purposes only. This places limitations on the types of freight related projects that such revenue may be used for.

[68]Source: *Taxes vs. Fees: A Curious Confusion,* p. 364; Gonzaga Law Review, Volume 38, Number 2, 2002/03.

- Fees, or user charges, are imposed to pay for governmental costs directly associated with the activity or activities for which the fee is being levied.

In this respect, it may be easier from a political and legal standpoint to dedicate state freight-related fees (i.e., combined licensing fees, oversize/ overweight fees) to freight projects as opposed to state taxes that freight businesses pay (i.e., public utility tax, business and occupation tax). This relationship may have been affected by Initiative 960, passed in November 2007.

The motor vehicle fuel tax and special fuel tax are different in this regard in that, while referred to as a "tax," they are thought of and treated more as a user charge or fee. They may be used for highway purposes only, as specified by the 18th Amendment of the Washington State Constitution.

The freight aspects of the existing Rail Program could continue to be funded through the existing program. Alternatively, the Rail Program could be split to separate freight rail functions from passenger rail functions. The freight rail functions would then be funded through the separate freight funding program.

A more thorough analysis would need to be undertaken to assess the specific impacts that implementing this option would have in Washington State. This analysis hinges on assessing freight-related project needs relative to the amount of revenue derived from the freight industry:

- If freight industry revenue is greater than freight-related project needs, Washington State can address the needs by redirecting freight industry revenue to those projects. The implications of doing so on the delivery of nonfreight related projects would need to be addressed.
- If freight industry revenue is less than freight-related project needs, then needs must be met by using transportation funding from outside the freight industry for freight-related projects, and/or increasing the amount of tax and fee revenue that the freight industry pays (through rate increases or improved compliance/enforcement).

Another important consideration is how to encourage direct financial investments from the private sector in freight-related projects, above and beyond the taxes and fees that the private sector is mandated to pay. One of the WSDOT programs is Transportation Economic Partnerships, which provides management support for the development of partnerships with private firms to develop and operate needed transportation facilities and activities.[69] In FY 2005-07, the budget for the Transportation Economic Partnerships program was $1.1

[69] Source: *Washington State Department of Transportation 2005-07 Current Law Budget*, p. 7, adopted by the Washington State Transportation Commission, August 2004.

million, or about 0.02 percent of the total budget.[70] The activities of this program could be reviewed and potentially changed or expanded to have more of a direct freight focus.

Public-private partnerships must have roles and responsibilities clearly defined. Looking at the freight rail industry as an example, the public sector can invest in the freight-rail infrastructure, but the railroads must be responsible for providing effective and cost-competitive services that will attract and retain shippers. There are other issues that railroads must take on as well, such as developing new business models for network ownership and operation, improving service reliability, and dealing with the possibility of mergers and acquisitions.

FHWA states that "The development of organizations and institutional relationships to improve freight transportation is needed to provide freight with a stronger voice in state and regional planning. These relationships are especially important in developing and financing freight projects in multistate transportation corridors."[71]

6.3 Options for Additional Funding

There are a number of possibilities for Washington State to raise additional funding for freight-related transportation projects:

- **Container Fees.** Fees could be assessed on containers that move in or out of ports, which would be placed in a trust fund dedicated to freight-related improvements nationwide. The most successful container fee program to date is the Alameda Corridor, described in Section 5.0: Case Study Examples.

  "PierPASS" is a related practice that began in July 2005. PierPASS is a not-for-profit entity created by marine terminal operators to reduce congestion and improve air quality in and around the Los Angeles and Long Beach ports. Any loaded ocean container picked up at or delivered to the Ports of Los Angeles or Long Beach by road during peak hours – 3:00 a.m. to 6:00 p.m. Monday through Friday – is subject to the PierPASS Traffic Mitigation Fee (TMF).[72] Payment is the responsibility of the Beneficial Cargo Owner (the importer or exporter); the trucking community and water carriers are not responsible for payment. The TMF is $100 per 40-foot container (FEU) and

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[70] Source: *Engrossed Substitute Senate Bill 6091*, Washington State Legislature, approved May 2005.

[71] Source: http://www.ops.fhwa.dot.gov/freight/institution_bldg.htm.

[72] The TMF does not apply to empty containers or to full intermodal containers departing or arriving via the Alameda Corridor for import or export and/or that pay the waterborne Alameda Corridor Transportation Authority (ACTA) fee.

$50.00 per 20-foot container (TEU). The program is credited with diverting up to 30 percent of the truck traffic out of the peak period.

AASHTO estimates that a container fee of $30 on every 20-foot cargo container at all U.S. ports could generate about $2 billion per year.[73] A thorough analysis of the application of container fees in Washington State will be provided as part of Task 6.0: Assessment of Marine Cargo Diversion of the study, using the port elasticity and diversion model to be calibrated and applied by Dr. Leachman of the CS team.

Currently in Washington State, containers that access on-dock rail facilities offered by Washington State ports pay a fee not unlike the Alameda Corridor fee. Only fee payers have access to the on-dock rail, and the fees are used only to pay for that service.[74]

It is noted that the PierPASS program, which generates revenue for extending gate hours as opposed to for transportation projects, is designed to solve problems that have not yet appeared in the Pacific Northwest to date (i.e., congestion at terminal gates). Also, the majority of truck movements at ports do not occur at peak-congestion times for the general transportation system (i.e., morning and evening rush hours).

- **Indexing the Special Fuel Tax.** The purchasing power of the special fuel tax will decline significantly over time due to inflation and rising construction costs. Indexing the special fuel tax to the Consumer Price Index (CPI) or another inflationary index would preserve the purchasing power of the diesel fuel tax over time. Florida and Maine index their fuel tax rates based on inflation annually. Other states, such as Kentucky, Nebraska, North Carolina, New York, Pennsylvania, and West Virginia have a variable fuel tax component that is adjusted based on the price of motor fuel.
- **Sales Tax on Special Fuel.** Another option would be to collect a sales tax on special fuel, which would be automatically indexed over time to the retail price of special fuel. States that currently collect sales taxes on motor fuels include California, Georgia, Hawaii, Illinois, Indiana, Michigan, and New York. The sales tax percentage of these states generally range from 4 to 6 percent. Under the 18th Amendment, special fuel tax revenue may be used only for highway purposes which puts limitations on the types of freight projects that such revenue may be used for.

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[73]Source: *Transportation: Invest In Our Future – Revenue Sources to Fund Transportation Needs*, p. 33, American Association of State Highway and Transportation Officials, April 2007.

[74]Source: *Comments on September 2007 Draft Working Paper*, p. 2, Port of Tacoma and Port of Vancouver, October 19, 2007.

- **Combined Licensing Fees.** Indexing the combined licensing fees for trucks to inflation is another way to increase the amount of transportation revenue over time.
- **Motor Vehicle Excise Tax.** Prior to the year 2000, owners of motor vehicles, trailers, and semi-trailers in Washington State paid a motor vehicle excise tax (MVET) of 2.2 percent annually of the vehicle value, of which 0.2 percent was dedicated to state transportation.[75] The MVET in Washington State was repealed by the State Legislature effective January 2000, due to voter concerns about equity. Re-enacting the MVET at the state level may be possible if these concerns can be addressed.

  States that currently have an MVET in place include Arkansas, Colorado, Iowa, Kansas, Louisiana, Maryland, Missouri, New Mexico, Oklahoma, and Texas. Among these states, Texas has the highest tax rate at 6.25 percent.
- **Weight Distance Tax.** The weight distance tax, which is assessed on trucks based on actual mileage traveled in the state, is a way to generate revenue in a way that is linked to actual costs to the transportation system (heavier vehicles impose much higher wear and tear on roads than lighter vehicles).

  The weight distance tax is currently used in four states: Kentucky, New Mexico, New York, and Oregon. Oregon charges the highest rates among the four states, with rates ranging from 4 cents per mile traveled for trucks of 26,000 pounds to 14 cents per mile for trucks of 78,000 pounds or more. Oregon collected $266 million in revenue from the weight distance tax in 2006.[76] This is followed by New York with $116 million, Kentucky with $85 million, and New Mexico with $76 million. More information on Oregon's weight distance tax (i.e., Oregon's Transportation Investment Acts) is provided in Section 4.0: Dedicated Revenue Streams for Freight Investment.
- **Public Utility Tax and B&O Tax.** The portion of the public utility tax and the business and occupation (B&O) tax paid by the trucking/transportation industry could be dedicated to be used for transportation projects that have a freight emphasis. This puts the revenue generated by motor carriers directly into projects that improve freight mobility and reliability.
- **Customs Fees.** Customs revenues are derived from duties on imported goods passing through international gateways. AASHTO estimates that

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[75] Source: *Transportation Resource Manual*, Washington State Joint Transportation Committee, January 2009.

[76] Source: Cambridge Systematics based on phone calls and web site information.

dedicating 5 percent of customs fees to port intermodal connections via rail and highways would bring in $1.8 billion per year.[77]

- **Other Funding Options.** Other funding options that could be considered at the state level include:
  - Vehicle-Miles Traveled Fee. A vehicle-miles traveled (VMT) fee is a funding option that may become feasible from a technology standpoint within the next few years. The main advantage of a VMT fee relative to a motor fuel tax is that it preserves its purchasing power over time based on direct use of the roadway system, and will not depreciate due to greater fuel efficiencies or expanded use of alternative fuel vehicles. The Oregon DOT is currently conducting a pilot test designed to demonstrate the technical and administrative feasibility of implementing an electronic collection system for user fees based on vehicle miles traveled.
  - Tolling. The most promising candidates for future toll facilities are for new roads or when adding additional lanes to existing roads. In Washington State, tolling began in summer 2007 on the Tacoma Narrows Bridge. The toll rate for automobiles is $3.00. The Washington State Comprehensive Tolling Study provided examples of other locations throughout the State where tolling could be applied. The Trans-Texas Corridor will use tolling as a revenue source, as described in Section 5.0: Case Study Examples.
  - Vehicle Rental Tax. Washington State currently charges 5.9 percent of the contract amount for rental vehicles and dedicates this to transportation uses. This rate could be increased. The Virginia Rail Enhancement Fund is using the vehicle rental tax as a revenue source, as described in Section 4.0: Dedicated Revenue Streams for Freight Investment.
  - Sales Tax. Some states dedicate state sales tax revenues for transportation purposes. These include California, Indiana, Massachusetts, New Jersey, New York, Pennsylvania, and Virginia for transit purposes. Kansas and Utah allocate a portion of its sales taxes for highway expenditures.
  - Lottery Revenue. The ConnectOregon program is using lottery revenue for multimodal transportation investments, as described in Section 5.0: Case Study Examples.

Section 4.0: Dedicated Revenue Streams for Freight Investment and Section 5.0: Case Study Examples are intended solely as a point of reference regarding how freight projects are being funded in Washington State and in other locations. The specific funding options that make sense for a particular project are case-specific

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[77] Source: *Transportation: Invest In Our Future – Revenue Sources to Fund Transportation Needs*, p. 33, American Association of State Highway and Transportation Officials, April 2007.

and depend on factors including project costs, project benefits by beneficiary, existing transportation funding mechanisms, and the economic and political climate regarding new or re-directed taxes and fees.

In addition to options for the state to generate revenue, there are also a number of options for local governments to generate revenue as well. Local options taxes have been adopted in one form or another in at least 46 states. All counties in Washington have enacted some type of local option sales and use tax. Other local option funding mechanisms that are currently authorized in Washington State to generate transportation revenue include motor fuel, vehicle, employer, business and occupation (B&O), and household taxes. Applications could be at either the regional or local level.

Other local funding options that could be considered include:

- Hotel Tax. As described in Section 5.0: Case Study Examples, the Reno Transportation Rail Access Corridor is using a 1 percent occupancy tax on hotels in downtown Reno as a source of revenue.
- Community Facility Districts (CFDs). CFDs are flexible and creative funding mechanisms used to fund infrastructure projects, especially in states that include California, Arizona, Illinois, New Mexico and Hawaii. With CFDs, there is no specific benefit nexus requirement between the properties paying the special tax and the specific facilities being funded.
- Development Impact Fees. Development impact fees are a mechanism to have new development pay its fair share for regional infrastructure. The fee is paid once, often when the building permit is issued. The assumed impact fees and resulting estimated revenues are generally based on benefit nexus criteria, which for transportation improvements means trip-end data that reflects relative use of improvements.
- Tax Increment Financing (TIF). TIF consists of the flow of increased property taxes generated by the incremental increase in the assessed value of properties within a designated area resulting from a new infrastructure project. The incremental revenue above and beyond defined baseline values are called TIF revenues, and a portion of these revenues are retained by an Increment Area or financing district to fund public improvements and certain limited types of private improvements.

The private sector can directly participate in project funding through such mechanisms as in-kind contributions or the leasing or concession of property. A more thorough description of possibilities for private sector participation will be provided in future study deliverables, in the return on investment analysis for specific projects.

6.4 Options for Project Financing

There are also options for Washington State to consider with respect to project financing:

- **Bonds.** Washington is one of few states that pledges its full faith and credit to the payment of transportation bonds secured by motor fuel taxes. The "double-barreled" pledge of both the taxing power of the State and a dedicated revenue stream provides a very cost-effective way to access the capital markets. WSDOT also maintains a 16-Year Financial Plan that outlines expected operating and capital uses of transportation funding. Some state DOTs model expected cash flows for 5- to 10-year periods, but Washington's approach appears to be unique. As noted in Section 3.3, both the TPA and Nickel Accounts from revenue derived from the motor fuel tax are nearly 100 percent leveraged for construction projects.

  As described in Section 4.0: Dedicated Revenue Streams for Freight Investment, California's Trade Corridor Improvement Fund is using general obligation bonds for a wide range of transportation improvements.

- **Investment Tax Credits.** The Association of American Railroads is pushing for Federal investment tax credits and tax deductions for freight rail improvements which improve capacity.[78] This would stimulate private capital investment by railroads as well as shippers, intermodal carriers, and other companies that make qualified expenditures for capacity expansion projects. AASHTO has indicated its support for this concept, provided that a satisfactory mechanism for determining public benefit can be mutually determined with the railroads. AASHTO estimates that such a measure at the Federal level could generate new, private investment capital of $6 billion over a five-year period ($1.2 billion per year).

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[78] Source: *Transportation: Invest In Our Future – Revenue Sources to Fund Transportation Needs*, pp. 32-33, American Association of State Highway and Transportation Officials, April 2007.

Appendix B.

Port and Modal Elasticity of Containerized Asian Imports Via the Seattle-Tacoma Ports

Draft
Port and Modal Elasticity of Containerized Asian Imports via the Seattle-Tacoma Ports

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Dec. 11, 2007

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NOTE: The contents of this report reflect the views of the author who is responsible for the facts and accuracy of the data presented herein.

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EXECUTIVE SUMMARY

This study determines the economic viability and impact on demand for Puget Sound Port services from assessment of additional port user fees to fund improvements to transportation infrastructure aimed at ensuring efficient and environmentally sound access to the ports. This Port and Modal Elasticity Study analyzes the long-run elasticity of port demands as a function of access fees, determining what levels of fees would induce traffic diversion to other ports or induce shifts in modal shares (truck vs. rail) at the Puget Sound ports (the Ports of Seattle and Tacoma). These shifts also may depend upon the point in the overall logistics supply chain at which user fees are assessed.

Methodology and Observations:

1. A Long-Run Elasticity Model previously developed for studying the San Pedro Bay ports was applied to analyze imports at the Puget Sound ports with updated data.[1] This model allocates imports to ports and modes so as to minimize total inventory and transportation costs from the point of view of importers. Current capacities, contractual obligations and other short-run impediments to shifting traffic among ports and modes are not considered in the long-run model.
2. The long-run model was exercised for a single scenario in which fees on container loads imported from Asia are assessed at the Puget Sound ports without any improvements to access infrastructure. No new fees are assumed at any other ports. The entire volume of waterborne containerized imports from Asia to the continental United States was considered in the analysis.
3. Transportation service quality (measured in terms of mean and variance of container flow times) and transportation rates prevailing in mid-2007 are assumed. Landside channels considered include local dray and long-distance trucking of marine boxes, inland-point intermodal (IPI) rail movement of marine boxes, trans-loading from marine boxes to domestic truck trailers at a trans-loading facility in the hinterland of the port of entry, and trans-loading from marine boxes to domestic rail containers at a trans-loading facility. Supply-chain strategies that are considered include direct shipment of marine containers to regional distribution centers, and consolidation-deconsolidation strategies wherein shipments to several regional distribution centers are pooled as far as a trans-load facility or import warehouse located in the hinterland of the port of entry.

It is concluded that:

[1] The development of the Long-Run Elasticity Model and its application to analysis of the elasticity of imports via the San Pedro Bay ports is detailed in "Port and Modal Elasticity Study," prepared by Leachman & Associates LLC for the Southern California Association of Governments in September, 2005. The report is available at http://www.scag.ca.gov/goodsmove/pdf/FinalElasticityReport0905rev1105.pdf. An academic presentation of the methodology made be found in "Port and Modal Allocation of Waterborne Containerized Imports from Asia to the United States" by Robert C. Leachman, appearing in *Transportation Research Part E*, **44** (2), P. 313 – 331. The academic article may be purchased from http://dx.doi.org/10.1016/j.tre.2007.07.008.

1. Puget Sound import volume is very elastic with respect to potential container fees. If unmatched by new fees at other ports, even relatively small fees of $60 per FEU or less would render supply-chain channels using other ports more economically attractive for imports to be consumed in most markets located east of the Rockies.
2. For imports routed via the California ports vs. the Puget Sound ports to most points east of the Rockies and north of the Mason-Dixon Line, total transportation costs for both supply chains featuring direct shipping of marine boxes to inland market regions and supply chains featuring consolidation – deconsolidation are very competitive. Total transportation costs for direct shipping of marine boxes to certain inland US regions also are very competitive between Canadian West Coast ports and Puget Sound ports. These factors make imports quite elastic to potential fees at Puget Sound.
3. As fees are instituted at other West Coast ports, the Puget Sound ports may choose to match them to maintain market share, or, if unmatched, gain market share.

The analyses and conclusions expressed herein are solely those of the consultant and do not necessarily reflect the views of the Puget Sound ports, other agencies sponsoring this project, nor any stakeholder in Asian – US maritime trade.

1. OVERVIEW

To explain and ultimately predict the allocation of containerized imports to ports and landside modes, it is useful analyze the economics of both inventory and transportation from the importers' points of view. The vast majority of imports from Asia are consumer goods imported by US retailers or by the vendors of goods marketed by these retailers. It is thus appropriate to describe inventory and transportation economics for imports in terms of those faced by a retailer of imported goods.

Importers face two basic types of inventory costs sensitive to the choice of port of entry and to the choice of landside transportation mode. One is the cost of pipeline inventory for goods in transit from Asian factories to regional or national distribution centers that serve the importer's retail outlets in the United States. This cost is a linear function of the average transit time of the supply channel, the average declared value of the imports assigned to that channel, and the quantity routed via that channel. The other is the cost of safety stocks maintained at destination distribution centers. These stocks are established as a hedge against uncertainties in transit times and against potential errors in sales forecasts over the lead time from when the goods were ordered. This cost is a complex non-linear function of the variability in lead times and transit times of the shipping channels utilized, the volume assigned to each channel, and the statistical error in sales forecasts. It also is a function of whether shipments are made directly from Asian origin to destination distribution center, or whether shipments to multiple destinations are consolidated from Asian point of origin to a trans-loading warehouse located in the hinterland of the port of entry, then de-consolidated at that point and re-loaded in domestic containers or trailers for landside transport to the multiple destinations. Trans-loading (interchangeably described in this report as consolidation-deconsolidation) pools the variability in forecast errors across the various destination regions and pools the variability in transit time from the factory in Asia to the port of entry across the shipments that are consolidated. When many destinations are consolidated, trans-loading enables a substantial reduction in destination safety stocks. Mathematical formulas to calculate required destination safety stocks for the cases of direct shipping and trans-loading are applied in this study. The required safety stocks are sensitive to the distribution of sales forecast errors. The required safety stocks also are very sensitive to the mean and standard deviation of transit times. Such parameters were estimated by the consultant for various ports of entry, destination cities, and alternative transportation channels.

It was found that, for many importers, the cost of their safety stocks is comparable to or even larger than the cost of their pipeline stocks. Moreover, for importers of high-value goods, the total cost of their pipeline and safety stock inventories can be larger than the total cost of transporting their goods from Asia to their destination distribution centers.

Both types of inventory costs are linear functions of the value of the goods imported. Differences between inventory costs for direct-shipping and trans-loading options are relatively small for importers of low-value goods but relatively large for importers of high-value goods. For this reason it was important for this study to establish the distribution of values of goods imported from Asia. 2005 data from the World Trade Atlas (WTA) was furnished to the consultant by the Port of Long Beach. The WTA reports the total value declared to US customs for imports from Asia for 99 commodity types. The Port of Long Beach also furnished the consultant with 2005 PIERS data on TEU volumes imported from Asia by commodity type. The PIERS data for each of the commodity types was joined to the WTA data to establish a distribution of imports by declared value per TEU. This in turn was joined to data from the Pacific Maritime Association concerning the mix of marine container types (20ft, 40ft, 45ft) that are imported and the consultant's estimates concerning the mix of standard and hi-cube 40-foot containers in order to estimate the average declared value per cubic foot for each commodity type. Grouping commodities by similar declared values, an overall distribution of import volume vs. declared value was obtained. This distribution is displayed in Figure S-1. The maroon bars are directly derived from the WTA and PIERS data; this raw distribution is much lumpier than reality because a single average declared value has been associated with each commodity type. The light blue bars represent the consultant's smoothing of the data.[2] This distribution suggests a declared value of about $9 per cubic foot to be the most common one, with steadily declining volumes as the declared value extends up to a maximum of $72 per cubic foot.

[2] As may be seen in the figure, the shape portrayed by the blue bars suggests a Pareto distribution.

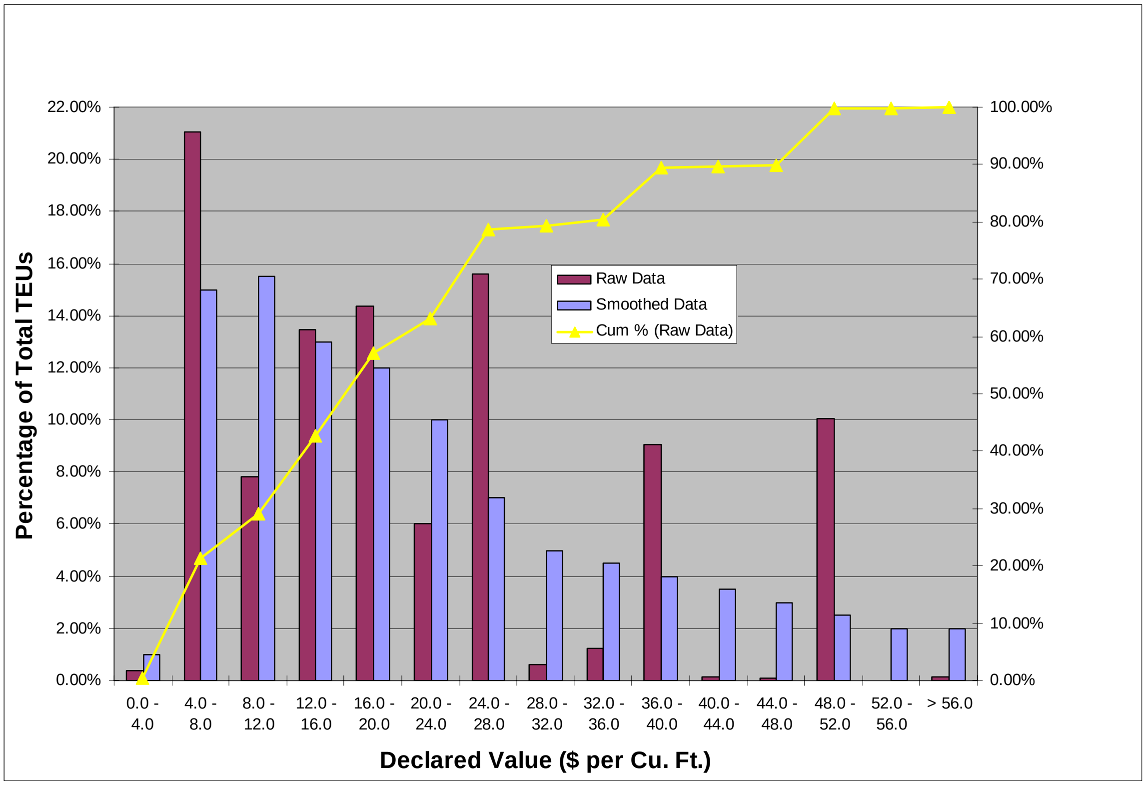

Figure S-1. Distribution of Declared Values for 2005 Asian Imports Through US West Coast Ports

Inventory and transportation costs for the top 83 importers of containerized Asian goods were specifically modeled in this study.[3] An average declared value for each of these importers was estimated by the consultant based on the types of commodities imported. 2004 PIERS import volumes reported in the Journal of Commerce for these importers were scaled by the consultant to more realistic figures for their imports from Asia.[4] The consultant estimates that these importers accounted for about 32% of total containerized Asian imports to the US. To account for the other 68% of imports, 19 categories of so-called "proxy miscellaneous" importers were defined at $4 increments in declared value from $2 up to $70 so as to fill out the above distribution of declared values. Inventory and transportation costs also were analyzed for these proxy miscellaneous importers. To estimate total nation-wide logistics costs for containerized Asian imports, it was assumed that every modeled importer (i.e., the 83 large importers and the 19 proxy miscellaneous ones) is nation-wide in its distribution of imported goods, with the geographical distribution of its import volume proportional to the distribution of purchasing power across the Continental United States.

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[3] In May, 2005, the *Journal of Commerce* published a list of the top 100 importers of goods in ocean-borne containers, derived from PIERS data. Seventeen of these importers were excluded from this analysis because their imports predominantly come from origins other than Asia.

[4] Volume statistics derived from PIERS data are low compared to actual volumes. Actual volumes for some importers were found to be as much as 33% higher than PIERS-reported volumes.

Alternative transportation channels available to importers include the following:

- Steamship Line or NVOCC[5] provides inland-point intermodal (IPI) service. Steamship Line arranges transfer of marine container from vessel to rail and rail line haul movement, all under one rate. Line/Carrier or customer may arrange dray from destination rail ramp to destination distribution center. In this report, we term this the "Direct Rail" channel.

- Steamship Line or NVOCC provides only transportation to port gate with container mounted on a chassis. Customer separately arranges for marine container to be transported from port gate to destination distribution center via long-haul truck or local dray. In this report, we term these the "Direct Truck" and "Direct Local Dray" channels.

- Steamship Line or NVOCC provides transportation to warehouse in the hinterland of the port of entry. Dray from port gate to warehouse may be arranged by Line or by customer. Customer contracts with a third-party logistics firm (sometimes a subsidiary of the Steamship Line or the NVOCC) to provide deconsolidation and trans-loading into domestic trailers or containers. Customer contracts with an intermodal marketing company (IMC) to provide dray from trans-load warehouse to rail ramp in port of entry hinterland, rail line haul and destination dray. In this report, we term this the "Trans-load Rail" channel.

- Same as immediately above as far as the trans-load warehouse. From that point, customer contracts for movement via long-haul truck or local dray to destination distribution center. We term these the "Trans-load Truck" and "Trans-load Local Dray" channels.

For the purposes of this study, 21 destination regions were defined encompassing the Continental United States, and a single destination city was selected within each region. The destination city so selected was one the consultant believes is representative as a locus for regional distribution centers operated by large retail importers. Rates charged as of mid-2007 by steamship lines, railroads, IMCs, trucking companies and dray companies to these destinations via ten major North American ports of entry (Vancouver, BC, Seattle-Tacoma, Oakland, Los Angeles – Long Beach), Houston, Savannah, Charleston, Norfolk and New York – New Jersey) were researched by the consultant. Many rates are confidential and vary by customer or service provider.. In some cases, an average of a basket of rates was utilized in this study. The data collected for the matrix of 10 ports and 21 destinations by channel was not complete. But enough data was available to infer a structure to the rates, and missing rates were estimated to fit this structure.

In this report, specific rates are not divulged. Only our estimates of the overall transportation charges per cubic foot of capacity are reported for the various channel-port-destination combinations.[6] It is important to note that transportation rates to inland

[5] Non-vessel-operating common carrier.
[6] See Table 18 in Chapter 6.

points are in considerable flux. As their multi-year contracts with the railroads expire, steamship lines are facing rate increases in the range of 25-40% in new single-year contracts. At the time of this study, some lines still are enjoying legacy long-term contracts, while others bear the new burden of substantial rail rate increases. Market shares of the lines have shifted significantly over the last two years. In the course of this study, the consultant found considerable disparity in inland-point-intermodal (IPI) rates offered by the various lines, much more so than in 2005. This market turbulence will continue for several more years until the last of legacy contracts expires.

In general, we find that the total transportation and handling cost for the Trans-load Rail channels ranges $0.02 - $0.10 more per cubic foot of imports than for the Direct Rail channels from the West Coast ports and $0.25 - $0.30 more per cubic foot in lanes from East Coast ports. Trans-loading to truck is $0.60 - $0.80 more per cubic foot than Direct Rail in lanes from West Coast ports and $0.05 - $0.15 more per cubic foot in lanes from East Coast ports.

The trade-off of transportation and inventory costs leads to the result that small importers, importers with few destinations, and importers with low average values of their imports minimize their total inventory and transportation costs by using direct shipping channels. Importers that are nation-wide in scope (i.e., that ship imports to multiple destinations that may be consolidated as far as the port of entry), have moderate or high average values for their imports, and have sufficient overall volume minimize their total transportation and inventory costs by trans-loading their imports in the hinterlands of one or several ports of entry.

It is estimated that, in 2004, the largest of the 83 major importers (Wal-Mart) imported an average of 580 TEUs per week to each of the 21 destination regions defined in this study; the smallest shipped an average of only 10. The shipping volume for the smallest of the 83 major importers is marginally sufficient for practicing the trans-loading strategy. It was therefore assumed that all importers in the proxy miscellaneous categories are too small to practice trans-loading, i.e, we assumed all proxy miscellaneous importers solely utilize direct shipping channels.

The transportation cost matrix, the transit time matrix and the formulas computing pipeline and safety stocks were combined into an overall model termed the Long-Run Elasticity Model. For each importer and each alternative strategy for the allocation of imports to ports and channels, this model calculates the total transportation and inventory costs. For each of the 83 major importers and for each of the 19 proxy miscellaneous categories, the model was exercised to compute total costs for the following alternative import strategies:

- Direct shipping of marine containers to destinations using the least costly port-landside channel available. (This strategy is attractive to importers of low-valued commodities.)

- Direct shipping of marine containers to destinations using the least costly West Coast port and landside mode combination available. (This strategy is attractive to importers of moderate- and high-valued commodities but who are too small or too regional to utilize a consolidation – de-consolidation strategy.)

- Trans-loading of marine containers into domestic containers in the hinterlands of the four ports of Seattle-Tacoma, Los Angeles-Long Beach, Savannah and New York-New Jersey. Destinations are assigned to trans-load centers so as to roughly equalize volumes at each center. The least costly transportation channels from trans-loading centers to destinations are selected. (This strategy is attractive to importers of moderate-valued commodities who are large and nation-wide in scope.)

- Trans-loading of marine containers into domestic containers in the hinterlands of only one or several West Coast ports (Seattle-Tacoma, Oakland, LA-Long Beach). Destinations are assigned to trans-load centers so as to roughly equalize volumes at each center. The least costly transportation channels from trans-loading centers to destinations are selected. (This strategy is attractive to importers of high-valued commodities who are large and nation-wide in scope.)

Total costs were tallied for each alternative strategy for each importer and the best strategy was identified. Then total import volumes passing through the Puget Sound Ports were tallied across importers. This process was repeated assuming the application of a fee on loaded containers imported through the Puget Sound Ports. This fee was assumed to be borne by the importer. Reacting to such fees, direct-shipping supply chains may be adjusted to shift imports previously routed via the Puget Sound ports to either California or Canadian ports. Consolidation – de-consolidation supply chains may be adjusted to supply the Pacific Northwest region from California de-consolidation facilities. Fee values in increments of $30 from $0 to $1200 were tested in runs of the Model. Combining results, an elasticity curve of port demand vs. fee value was constructed.

Elasticity Results

The Long-Run Elasticity Model was applied to a single scenario assuming a fee is applied at the Puget Sound ports but no new fees are applied elsewhere. Results are summarized as follows. For a $0 fee, the best distribution strategies as a function of average declared value of imports are summarized in Table S-1.

The Model output suggests that a large nation-wide importer of furniture or building materials, such as Home Depot or Lowe's, should opt for direct shipping of their imports. It suggests that a large "big-box" department store importer such as Wal-Mart, K-Mart, or Target should trans-load imports at multiple ports, while an importer of high-value electronics such as Sony or Samsung should trans-load all its imports at only one West Coast port. By and large, these predictions are borne out by actual practice.

Table S-1.
Import Strategy as a Function of Declared Value – As-Is Scenario

Importer type	**Declared Value Per Cubic Foot**	**Least-cost import strategy**
Large importer	$0 – $13	Direct shipping using nearest port
Large importer	$13 – $20	Trans-load at multiple ports
Large importer	$20 and up	Trans-load only at LA-Long Beach
Small importer	$0 – $40	Direct shipping using nearest port
Small importer	$40 and up	Direct shipping using only West Coast ports

As an increasingly larger fee is imposed, the Model predicts that some importers are induced to change strategy. For example, an importer of high-valued goods currently trans-loading in both Southern California and the Kent Valley might be induced to begin trans-loading all inland volumes in Southern California and only handling Pacific Northwest traffic through the Seattle-Tacoma ports, once the fee is large enough. As the fee is progressively increased, eventually the importer will be induced to discontinue importing through the Puget Sound Ports altogether and truck or use rail to supply its Southern California distribution center from its trans-load warehouse in the hinterland of the Seattle-Tacoma or Oakland ports. The “break points” in fee value for each importer, i.e., where the importer has the economic incentive to change strategy, are calculated using the Long-Run Elasticity Model. At these points the importer’s volume through the Puget Sound Ports is predicted by the Model to be reduced.

Figure S-2 displays the resulting elasticity curves. Shown are curves for (1) total imported containers via the Puget Sound Ports vs. container fee and (2) total imported containers via the Puget Sound Ports containing inland cargoes that are trans-loaded vs. container fee. As may be seen, imports at the Puget Sound Ports are quite elastic even for very low fees. Trans-loading shipments have an economic incentive to re-route via California for even very small fees. For a fee of $60 per FEU, the model predicts trans-loaded volumes are by and large eliminated, while total volume drops by 30%. At a fee of $150, port volumes have dropped in half, and at about $450, the Model predicts that nearly all importers are driven away from the Puget Sound ports.

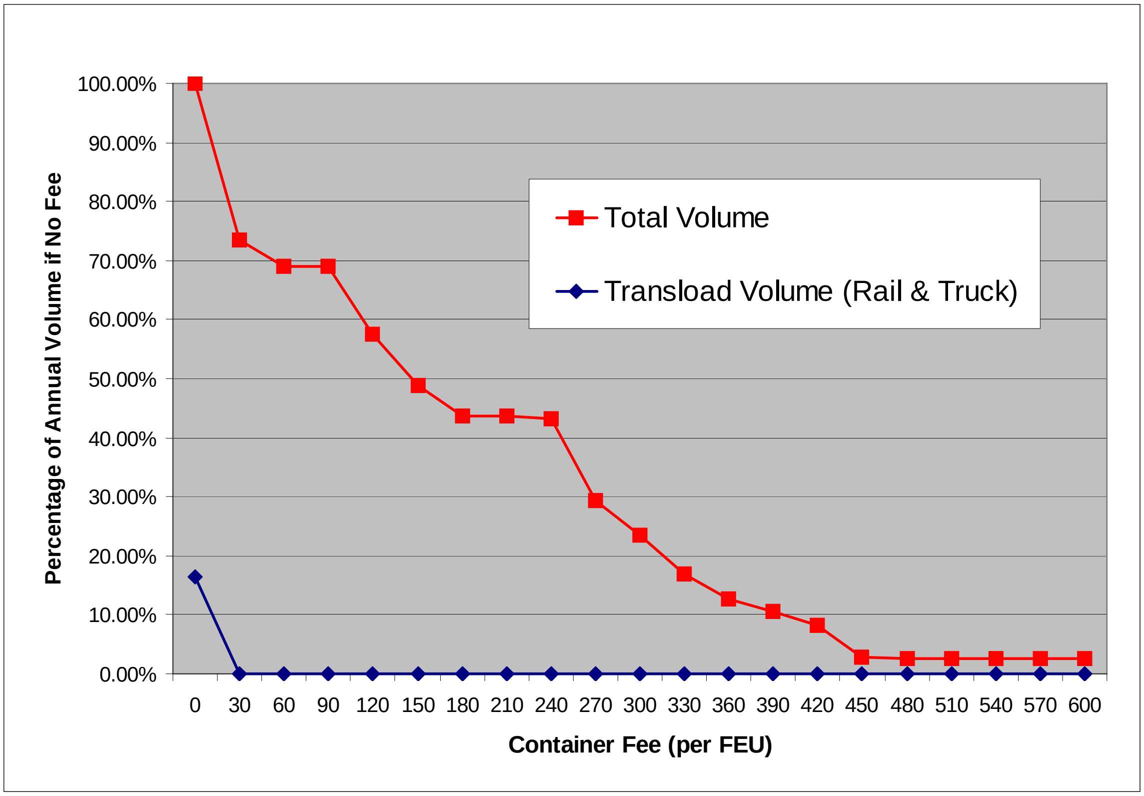

Figure S-2.
Elasticity of Imports via the Puget Sound Ports

Excluded Factors

Certain factors are excluded from the Long-Run Elasticity Model; their qualitative impacts are summarized as follows.

Some importers utilize port terminals as virtual warehouses (whereby the importers deliberately delay picking up goods not yet needed at their distribution centers). Others maintain warehouses in the hinterland of the port of entry specifically for this purpose. Economies afforded by these practices are not included in the Model. Qualitatively, these practices extend the economies of trans-loading; in effect, the break-point in the average value of imported goods for which trans-loading is more efficient than direct shipping is shifted downwards.

Rail transportation charges input to the Model do not include any surcharges for re-positioning equipment. What matters most in this regard is the relative cost of rail shipment of marine containers vs. cost of rail shipment of domestic containers. If these charges are comparable, the Model’s allocations of imports to channels will remain valid.

But if re-positioning charges per cubic foot for one of these types of equipment became much larger than for the other, model input parameters would need to be adjusted.

It is important to note that the diversification of supply chains as a hedge against port congestion risk is not considered in the model. After the congestion experienced at the San Pedro Bay Ports during the peak of the 2004 shipping season, many importers diversified their supply-chain strategies to feature increased use of the Puget Sound ports. Moreover, several steamship lines shifted vessel strings from Southern California to the Puget Sound ports for the 2005 shipping season; these actions increased the Puget Sound ports' shares of so-called discretionary imports, i.e., IPI shipments where choice of port is up to the steamship line. Congestion at the San Pedro Bay ports was much reduced during 2005, and so for the 2006 season, those vessel strings moved back to Southern California.

The value of risk mitigation perceived by importers and by steamship lines may well exceed relatively small values for container fees assessed at the Puget Sound ports. This consideration suggests an increase in the Puget Sound port volumes above values calculated by the Model, especially for small fee values.

Short-Run vs. Long-Run: Proper Interpretation of Model Results

In the short run, there are many factors inhibiting the shifting of imports to other ports or alternative channels. There are multiple dimensions of capacity constraining the channel volumes: vessel frequencies and capacities, available transit slots through the Panama Canal, lift capacities at port and rail terminals, available draymen, available trans-loading warehouses, and line-haul capacities of rail and truck channels in the various lanes. Moreover, steamship lines are committed to relatively long-term port contracts whose fee structures provide the incentive for the lines to tender large volumes and mandate stiff penalties for premature withdrawal. In turn, rates paid by large importers to steamship lines, often involving volume guarantees, are negotiated annually.

The Long-Run Elasticity Model analyzes transportation and handling rates, values of goods, and transit time statistics faced by importers to determine the least costly allocation of imports to ports and channels. Transit time statistics are exogenously supplied to the model and are not updated if the Model shifts substantial traffic volumes between ports or modes. The Model results should be interpreted as indicating the fee points at which importers would experience an economic incentive to reduce import volumes through the Puget Sound Ports.

Given a scenario in which there is economic incentive to shift imports between modes or between ports, there will be inertia inhibiting such shifts. Major shifts in import traffic may require considerable time to implement. Thus, in the short run, Puget Sound Ports' traffic will be significantly more inelastic than the predictions of the Long-Run Model. However, given strong economic incentives for importers to shift traffic, one may expect *in the long run* that desired terminal and line haul capacities will get built, new port and importer contracts will be negotiated, vessel strings will be adjusted, new trans-loading warehouses will be erected, and dray forces will be adjusted.

The Long-Run Elasticity Model is intended to inform the public policy dialogue concerning potential container fees. It also could be used to assess potential major investments in access infrastructure for the Puget Sound Ports. Such infrastructure may require up to a decade to build, and financing instruments may require up to three decades to retire the principal. It seems very unwise to rely solely on estimations of short-run elasticity to justify such investments. Investment of large sums of public monies in long-term infrastructure should be confirmed to be sound on the basis of long-run elasticity calculations.

Conclusions

Puget Sound import volume is very elastic with respect to container fees. Total inland transportation charges via Puget Sound ports vs. other West Coast ports are very competitive to many destinations east of the Rockies for most types of imports.

Lacking improvements in access infrastructure that improve transit times or otherwise improve the economics from the importer's point of view, and without offsetting fee increases at other West Coast ports, in the long run even a small container fee at Puget Sound may drive significant amounts of traffic away from the Puget Sound ports. The Long-Run Elasticity Model predicts that a $60 per FEU fee on inbound loaded containers at the Puget Sound ports would cut total import volume at the Puget Sound ports by approximately 30%. The model predicts a fee of $150 would cut traffic in half. These estimates of volume reductions are likely somewhat larger what would actually happen, given the value of diversification of supply chains perceived by large importers.

Institution of container fees without offsetting fees at other West coast ports seems unwise. However, as fees are instituted at the California ports, they may be matched at Puget Sound in order to create a revenue source for infrastructure improvement and environmental impact mitigation without loss of market share, or, if unmatched, market share at the Puget Sound ports may be grown.

2. INVENTORY COSTS BORNE BY IMPORTERS

The choice of transportation mode and route by importers of Asian goods depends on a number of factors. Clearly, transportation charges for the alternative modes and routes are important. But other factors play an important role as well. Differences in transit time, in required inventory levels, and in labor required for labeling, repackaging, and other handling may result in substantial differences in inventory costs, handling costs and sometimes even significant differences in sales revenues. The economics of these factors therefore must be jointly analyzed with transportation costs.

In this chapter, economic models are described that analyze inventory and distribution costs arising from these factors. Analytical methodology and supporting data are presented to compute the value to shippers of transit time, inventory and logistics factors as a function of commodity values.

Also discussed in this chapter are other factors that influence logistics decision-making, including re-packaging and labeling services by trans-loaders, the supply of 53-foot containers at various ports, the desire on the part of importers to diversify risks of delays from congestion arising in specific shipping channels or at specific ports.

Types of Inventory

Alternative strategies for goods imported from Asian vendors to U.S. demand points typically feature differences in the mean and standard deviation of transit time, as well as differences in the opportunity for consolidation and de-consolidation of shipments serving multiple demand points. These differences impact the inventory costs of the importer.

The vast majority of imports from Asia are retail goods. The origins for imports are typically factories in China and elsewhere in Asia, and the destinations are regional distribution centers (RDCs) that supply the importer’s retail outlets or retail customers within the region. Differences in inventory costs resulting from use of alternative supply channels typically extend only as far as the RDC, not to the store or customer level.

There are two types of inventory costs influenced by the choice of supply channel. One is the working capital required to finance goods in transit (so-called “pipeline stock”). The other is working capital required to finance stocks of goods at destination RDCs. The overall stocks of goods at destination RDCs may be subdivided into what is called “cycle stock” and what is called “safety stock.”

Average pipeline stock is simply the product of the average transit time and the average shipment size. Larger pipeline stocks result from using supply channels with longer transit times

At any given time, cycle stock at a shipment destination is the unused portion of the stock that arrived in the previous replenishment. This stock level equals the amount of the shipment just after a shipment arrives, then steadily drops to zero just before the next shipment arrives. Its average value is therefore equal to one half of the average shipment quantity.

Safety stock is required by retailers who strive to have stock on hand to service customer demands without delay. This stock level is maintained as a hedge against potential delays to shipments and potential errors in sales forecasts upon which the shipment quantities were based. That is, if customer demands are to be met without backorder, safety stocks are necessary to buffer against unpredictable surges in demand while replenishment orders are in transit and against unpredictable extensions in transit times for replenishments. Use of supply channels that entail a longer transit time and/or a more unreliable transit time result in the need for larger safety stocks at destinations.

As noted above, the vast majority of imports from Asia are retail goods. It is therefore important to understand the impact of the choice of supply channel on safety stock. Let us first consider the simplest case of a single destination for imported goods. Suppose the frequency of shipments from Asia is once every R time periods. Suppose the lead time between ordering goods from Asia and receipt at destination has mean value L and standard deviation σ_L. Further, suppose the mean absolute percentage error in sales forecasts made one period ahead is *MAPE*. The mean absolute deviation in forecast errors is defined as $MAD = MAPE * D$ where D is the expected (forecasted) demand per period. It is well-known that the standard deviation is related to the mean absolute deviation by

$$\sigma = (1.25)(MAD) = (1.25)(MAPE)(D) \text{ .}$$ [7]

Considering the replenishment lead time and the frequency of replenishments, sales must be forecasted over an interval of length $(L+R)$ in order to determine the proper quantity to be ordered from the Asian supplier. To analyze the impact of differences in lead time, the growth of forecast errors as a function of lead time must be characterized. Mathematically, the standard deviation of forecast errors grows with lead time according to the general model

$$\sigma_{R+L} = (L+R)^c \, \sigma_D$$

where c is a constant that depends on the correlation of week-to-week sales (i.e., does higher-than-expected sales last week imply higher-than-expected sales this week) and σ_D is the standard deviation of errors in one-period-ahead forecasts. Perfectly correlated sales would imply c=1. We shall assume in this analysis that c=0.5, which has been found to be accurate for household consumer products.[8] That is, to good approximation,

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[7] Any of the many academic texts on production and inventory control would serve as a useful reference for the mathematics in this chapter. See, for example, *Decision Systems for Inventory Management and Production Planning*, E.A. Silver and R. Peterson, John Wiley & Sons, 1985.
[8] See "Optimal Planning and Control of Consumer Products Packaging Lines," in *Optimization in Industry*, T. A. Ciriani and R. C. Leachman, John Wiley & Sons, 1993.

forecast error grows as the square root of the time interval over which sales are forecasted. Hence the standard deviation of forecast errors over (L+R) is

$$\left(\sqrt{L+R}\right)\sigma_D \ .$$

As a function of the standard deviations of the transit time and the sales forecasting errors, the required level of safety stock *ss* may be expressed as

$$ss = k\sqrt{(L+R)\sigma_D^2 + D^2\sigma_L^2}$$

where R denotes the time between replenishments, L denotes the average transit time, σ_L denotes the standard deviation of transit time, D denotes the average shipment quantity per replenishment, σ_D denotes the standard deviation of forecast errors and k is a safety factor corresponding to the desired probability of no stockout.

To illustrate, suppose $k = 2$; this value corresponds to a 98% probability of no stockout, a typical value chosen for the safety factor. Suppose $\sigma_L = 2.5$ days, $D = 1000$ cases per day, $\sigma_D = 200$ cases, $R = 3$ days and $L = 7$ days. Then the required safety stock is

$$ss = 2\sqrt{(10)(40{,}000) + (1{,}000{,}000)(6.25)} = 5{,}158 \ .$$

The average cycle stock at the destination is

$$(R)(D)/2 = (3)(1000)/2 = 1{,}500 \ ,$$

and the pipeline stock is

$$(L)(D) = 7{,}000 \ .$$

Thus, in this case, the safety stock at the destination is much larger than the cycle stock and equal to about 74% of the pipeline stock.

If the variability in transit time were reduced to $\sigma_L = 1.0$ days, the safety stock level would drop to *ss* = 2,366, i.e., a reduction of more than fifty percent. If in addition the mean lead time were reduced to 5 days, the safety stock level would drop to *ss* = 1,131, or about 22% of the required safety stock for the original data. The pipeline stock would drop to 5,000, i.e., 5/7ths or about 71% of the required pipeline stock for the original data.

From this small example, one can conclude that (1) cycle stock is independent of the selection of a supply chain channel, (2) pipeline stock is linear in the average transit time, and (3) safety stock is non-linear and highly sensitive to the average and standard deviation of transit time.

Inventory Holding Costs

Typically, the cost of working capital is expressed as an interest rate times the amount of capital invested per unit inventory times the average inventory level. For the simple example above, the relevant inventory costs per unit time are expressed as

$$(i)(V_P)(L)(D) + (i)(V_{RDC})(ss)$$

where i is the interest rate, V_P is the amount of capital tied up in a unit of pipeline stock, $(L)(D)$ is the average pipeline inventory level, V_{RDC} is the amount of capital tied up in a unit of RDC safety stock, and ss is the level of safety stock at the RDC. (We have omitted the cost of cycle stock because that cost is independent of supply channel alternative.)

As imports move through the supply chain, they accumulate more cost. First, the vendor in Asia must be paid to procure the goods. Next, the local transportation in Asia and the steamship transit must be paid for. If other vendors are involved for North American landside handling, they must be paid. Finally, handling at the importer's own destination RDC entails more accumulated cost.

One index to the amount of capital tied up is the value declared to US customs. This value typically includes the cost of purchase of the goods from the Asian vendor plus the cost of transportation and logistics services up to the termination point for the importing carrier. If from that point onwards additional carriers or logistics providers are utilized to move the goods to the RDC, those costs are not included in the declared value. Costs of handling at the destination RDC also are not included.

For the purposes of this study, we shall make the assumption that pipeline inventories are valued by importers at 125% of the value declared to Customs. We shall further assume that RDC inventories are valued at 150% of the value declared to Customs.

The appropriate interest rate to apply depends on a number of factors. If the goods represent replenishment of goods with long-term demand, then an interest rate reflecting the cost of working capital for the importer is appropriate. A reasonable value for this is assumed to be 20 percent.

A higher interest rate is more appropriate if retail prices are declining with time or if the products experience rapid obsolescence, such as is the case for technology goods, style goods and goods for special sales events. For example, prices of many electronics products such as personal computers, video games, hand-held devices, etc., decline as much as fifty percent in the first year they are marketed and become completely obsolete within 2-3 years. Style goods are even more extreme, some having a selling season of only several months. In such cases, larger requirements for pipeline stocks and safety stocks result in revenue loss, and such losses should be accounted for in inventory costs. For such cases, a more appropriate value for the interest rate is 50 percent.

The sales of most retailers are a mixture of event items and standard items. We shall assume a simple average of the two cases, i.e., an interest rate of 35 percent is assumed for the purposes of costing pipeline and safety stocks. In the case of electronics and fashion item importers, we assume an interest rate of 50 percent.

Distribution of Values of Asian Imports

Inventory costs associated with both transit time and the location of mixing/distribution warehousing depend crucially on the values of the cargoes shipped. The best logistics strategy for merchants of, say, electronics or fashion apparel may be quite different than that for merchants of, say, furniture or textiles.

The consultant therefore undertook an effort to determine the distribution of declared values of containerized imports from Asia. Year 2005 customs data for U.S. West Coast ports, as summarized by PIERS and by the World Trade Atlas (WTA), were provided by the Port of Long Beach to the consultant. The PIERS data provided total TEUs imported from Asian origins through US West Coast ports, broken out by 100 commodity codes. The WTA data provided total declared values for the Asian imports passing through US West Coast ports, again broken out by the 100 commodity codes. The PIERS summarization of customs data includes logic to allocate Code 00, Miscellaneous Manufactured Goods, among other more specific categories, based on its reading of the description of the shipment contents on each bill of lading; the WTA summarization does not. In order to match PIERS and WTA data, the consultant therefore made a judgment to express Category 00 as a weighted combination of other commodity codes. This enabled the consultant to determine the average declared value per TEU for each of the 99 other (more specific) commodity codes.

Next, data from the Pacific Maritime Association web site was downloaded concerning the mix of 20-foot (12.3%), 40-foot (80.3%) and 45-foot containers (7.4%) carrying imports through West Coast ports during 2003. A further breakdown of 40-foot containers into standard (40%) and high-cube (60%) was assumed. Usable cubic capacities for these four sizes of marine containers are as follows:

20-foot: 1,169 cu. ft.
40-foot standard: 2,395 cu. ft.
40-foot high-cube: 2,684 cu. ft.
45-foot: 3,026 cu. ft.

The weighted-average cubic capacity per TEU works out to be 1,274.4 cu. ft. This in turn led to an estimate of the average declared value per cubic foot of shipping capacity for each commodity code. Table 1 displays the fifteen highest-volume commodity codes imported from Asia through US West Coast ports in 2005. The table also displays the average declared value per cubic foot of usable container capacity. As may be seen, furniture and bedding is the highest-volume commodity, with an average declared value of only $7.87 per cubic foot. Next highest is electronics and electrical equipment, with an average declared value of $39.24 per cubic foot, and so on.

Table 1
Total Volume and Average Declared Value by Commodity
For 2005 Asian Imports Through US West Cost Ports

Commodity	**TEUs (1000s)**	**Average declared value ($ per Cu Ft)**
Furniture & Bedding	2,069	7.87
Electronics & Elec Eqpt	1,001	39.24
Machinery	970	51.08
Toys, Games & Sports Eqpt	902	16.57
Motorcycles & Auto Parts	734	24.65
Plastic goods	600	14.63
Apparel - not knitted	586	25.60
Steel goods	471	15.43
Footwear	426	24.91
Rubber goods	399	14.37
Leather goods	290	16.14
Wooden goods	280	8.24
Misc manufactured goods	253	22.94
Apparel – knitted	241	59.93
Ceramic goods	215	6.34
All other	2,669	

Source: PIERS, WTA and PMA data

The commodity codes were then grouped by ranges of declared values, resulting in a distribution of total shipment volume vs. average declared value. The results are graphed in Figure 1. The maroon bars correspond to the raw data derived from PIERS, WTA and PMA databases. Because a single average declared value is associated with each of the 99 commodity codes in lieu of the actual range of declared values for each code, the depicted distribution is lumpier than reality. The real distribution of declared values must exhibit a Pareto-like shape. The light blue bars in the figure represents the consultant’s smoothing of the raw data into a more realistic distribution. As may be seen, the distribution of declared values reaches a peak at the low end of the spectrum ($8-$12 per cubic foot of container capacity), with the distribution extending up to $175 per cubic foot in steadily declining volumes.

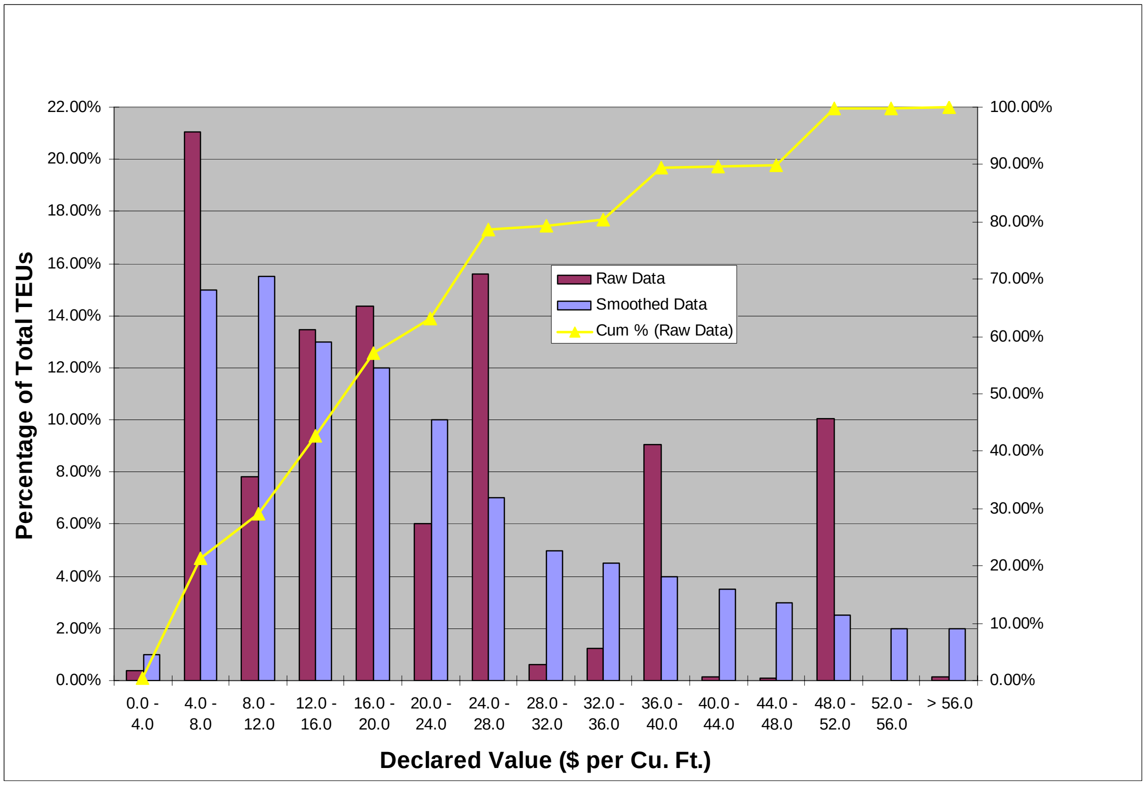


Figure 1.
Distribution of Declared Values for 2005 Asian Imports Through US West Coast Ports

It should be kept in mind that Figure 1 displays the value per cubic foot of container capacity and not the value per cubic foot of the actual cargo within the container. Anecdotal evidence received from trans-loaders suggests that, while shippers strive to fully utilize the available space, sometimes the full cubic capacity can not be utilized because of inability to stack cargoes, need for handling space, racking or blocking and bracing, etc. Moreover, some shipments, such as steel manufactured goods, may reach weight limits before cube limits.

A second factor to keep in mind is that the declared values reflect the manufactured or purchased cost of the goods in Asia rather than their retail values in North America. Retail values are roughly double the declared values.

Large Retail Merchant Importers

A different view of the PIERS data is a break-down by importer. The May 30, 2005 issue of the *Journal of Commerce* published a list of the top 100 US importers via ocean container transport. The consultant adopted this list, less 17 companies (all food and beverage, paper or chemical companies) who the consultant believes are not major importers of Asian goods. The remaining 83 are all large retailers or vendors of goods such as tires, electronics or appliances that are ready for retail marketing. While the imports these companies make are not solely sourced from Asia, the consultant believes the vast majority are. Moreover, the PIERS data is known to be very incomplete. For example, the *JOC* article lists Target Corp. as importing 202,700 TEUs in 2004. In contrast, Target Corp. advises the consultant that in 2004 it actually imported from Asia 315,766 TEUs, i.e., the PIERS figure for Target is low by more than a third.

Table 2 displays the resulting list of large retail merchant importers. Shown are the consultant's estimate for the average declared value of imports, the PIERS-reported volume, the volume inflated by 10% (a level that in the consultant's judgment is a suitable assumption for the merchant's import level from Asia, for the purposes of this study). Also shown is the average off-peak weekly volume to one of 21 equal-size demand regions spanning the continental United States. This is derived assuming 50% of the annual shipping is concentrated in three peak months of late summer and early fall.

Table 2
Largest US Importers of Asian Goods Via Ocean Container Transport

Importer	Type	Assumed avg. value per cu. ft. for Asian imports	PIERS 2004 Import Volume (TEUs)	Actual 2004 Asia Volume (TEUs)	Assumed 2004 Asia Volume (TEUs)	TEUs per week per region (off-peak)
Wal-Mart	Big box	$15	576,000		633,600	387
Home Depot	Furniture	$9	301,200		331,320	202
Target	Big box	$20	202,700	315,766	222,970	136
Sears (K-Mart)	Big box	$20	186,000		204,600	125
Ikea	Furniture	$9	100,000		110,000	67
Lowe's	Furniture	$9	100,000		110,000	67
Costco	Big box	$20	66,400		73,040	45
Ashley Furniture	Furniture	$9	63,800		70,180	43
Payless ShoeSource	Shoes	$25	54,200		59,620	36
Samsung	Electronics	$40	52,800		58,080	35
Matsushita	Electronics	$40	52,100		57,310	35
Toyota	Auto parts	$20	52,000		57,200	35
GE	Appliances	$25	51,800		56,980	35
Williams-Sonoma	Appliances	$25	50,000		55,000	34
Mattel	Toys	$17.50	49,300		54,230	33
Pier 1 Imports	Big box	$10	48,100		52,910	32
Nike	Shoes	$25	47,900		52,690	32
Sony	Electronics	$40	47,100		51,810	32
Michelin	Tires	$15	46,100		50,710	31
J C Penney	Big box	$20	45,000		49,500	30
LG	Electronics	$40	43,300		47,630	29
Bridgestone	Tires	$15	42,500		46,750	29

Limited Brands	Big box	$30	41,300	45,430	28
Dollar General	Big box	$15	40,000	44,000	27
Toys R Us	Toys	$17.50	39,300	43,230	26
Big Lots	Big box	$10.00	36,300	39,930	24
Ford	Auto parts	$20	29,700	32,670	20
Dorel	Furniture	$9	28,700	31,570	19
Nissan	Auto parts	$20	28,500	31,350	19
Yamaha	Auto parts	$20	27,300	30,030	18
Philips	Electronics	$40	27,200	29,920	18
Michaels Stores	Big box	$10	27,100	29,810	18
Whirlpool	Appliances	$25	26,800	29,480	18
Canon	Electronics	$40	26,200	28,820	18
Walgreen	Big box	$10	25,500	28,050	17
Rooms to Go	Furniture	$9	24,200	26,620	16
Thomson	Electronics	$40	24,200	26,620	16
Federated	Big box	$25	23,700	26,070	16
Emerson	Elec Eqpt	$40	22,600	24,860	15
Marubeni	Machinery	$50	21,800	23,980	15
Jarden	Appliances	$25	21,800	23,980	15
Reebok	Shoes	$25	20,600	22,660	14
Hankook	Tires	$15	20,400	22,440	14
Dollar Tree	Big box	$10	20,000	22,000	13
Natuzzi	Furniture	$9	19,654	21,619	13
Goodyear	Tires	$15	19,400	21,340	13
Family Dollar	Big box	$10	19,300	21,230	13
Retail Ventures	Big box	$15	18,800	20,680	13
TJX (T J Maxx)	Big box	$20	18,200	20,020	12
Sharp	Electronics	$40	17,900	19,690	12
Conair	Appliances	$25	17,800	19,580	12
Liz Claiborne	Apparel	$40	17,500	19,250	12
Toyo	Tires	$15	16,900	18,590	11
Toyota	Auto parts	$20	16,000	17,600	11
JoAnn Stores	Textiles	$20	15,900	17,490	11
FoxConn	Electronics	$40	15,400	16,940	10
Caterpillar	Machinery	$50	15,300	16,830	10
Gap	Apparel	$40	14,800	16,280	10
DaimlerChrysler	Auto parts	$20	14,600	16,060	10
May	Big box	$18	14,500	15,950	10
TPV International	Electronics	$40	14,500	15,950	10
Best Buy	Electronics	$40	14,400	15,840	10
Bombay	Furniture	$9	14,300	15,730	10
Fuji	Film	$80	14,300	15,730	10
BMW	Auto parts	$20	14,200	15,620	10
Haier	Appliances	$25	14,200	15,620	10
Hasbro	Toys	$17.50	14,200	15,620	10
Salton	Appliances	$25	14,100	15,510	9
Suzuki	Auto parts	$20	13,700	15,070	9
Linens 'n Things	Textiles	$20	13,600	14,960	9
OfficeMax	Big box	$12	13,400	14,740	9
Epson	Electronics	$40	13,400	14,740	9

Coaster of America	Furniture	$9	13,300	14,630	9
Staples	Big box	$12	13,200	14,520	9
Yazaki	Auto parts	$20	12,900	14,190	9
Ricoh	Electronics	$40	11,600	12,760	8
Brother	Electronics	$40	11,600	12,760	8
Applica	Appliances	$20	11,100	12,210	7
Adidas-Solomon	Shoes	$25	10,800	11,880	7
Footstar	Shoes	$25	10,500	11,550	7
Hamilton Beach	Appliances	$25	10,400	11,440	7
Honda	Auto parts	$20	10,300	11,330	7
CVS (Eckerds)	Big box	$10	10,200	11,220	7
Avg. value per cu ft		$18.79			
Total TEUs			3,447,654	3,792,419	
Subtotals:					
Big box			1,445,700	1,590,270	
Furniture			665,154	731,669	
Electronics			371,700	408,870	
Appliances			218,000	239,800	
Auto parts			219,200	241,120	
Tires			145,300	159,830	
Shoes			144,000	158,400	
Toys			102,800	113,080	
Elec eqpt			22,600	24,860	
Machinery			37,100	40,810	
Textiles			29,500	32,450	
Apparel			32,300	35,530	
Film			14,300	15,730	

As may be seen, the volume towards the end of the list is quite low; Eckerds was importing on average only 215.7 TEUs per week. If the Continental US were divided into 21 distribution regions, this would be only about 10 TEUs per week per region. The off-peak weekly volume per region is only 7 TEUs. For such merchants the transloading strategy is marginally feasible from a volume point of view, quite apart from whether or not it is economically attractive.

For the purposes of this study, the major importers listed above are considered to be the only candidates for transloading. As will be discussed in Chapter 5, these importers were subjected to an economic analysis to determine what import strategy (trans-load at one port, trans-load at multiple ports, direct shipping via nearest port, direct shipping via West Coast ports) is economically best.

The remaining total import volume from Asia is assumed to be confined to direct shipping and assumed to have cargo values distributed such that distribution of total imports fills out the light blue bars in Figure 1.

The Economic Impact of Consolidation and De-consolidation

The amount of safety stock required among several RDCs can be reduced if their shipments are consolidated for a portion of the overall lead time for replenishment, then de-consolidated according to updated demand forecasts. Because fluctuations in sales served by the various RDCs are partially off-setting, and because the impact of an extended transit time for one or several containers may be shared across the RDCs, much less safety stock is required at the destinations.

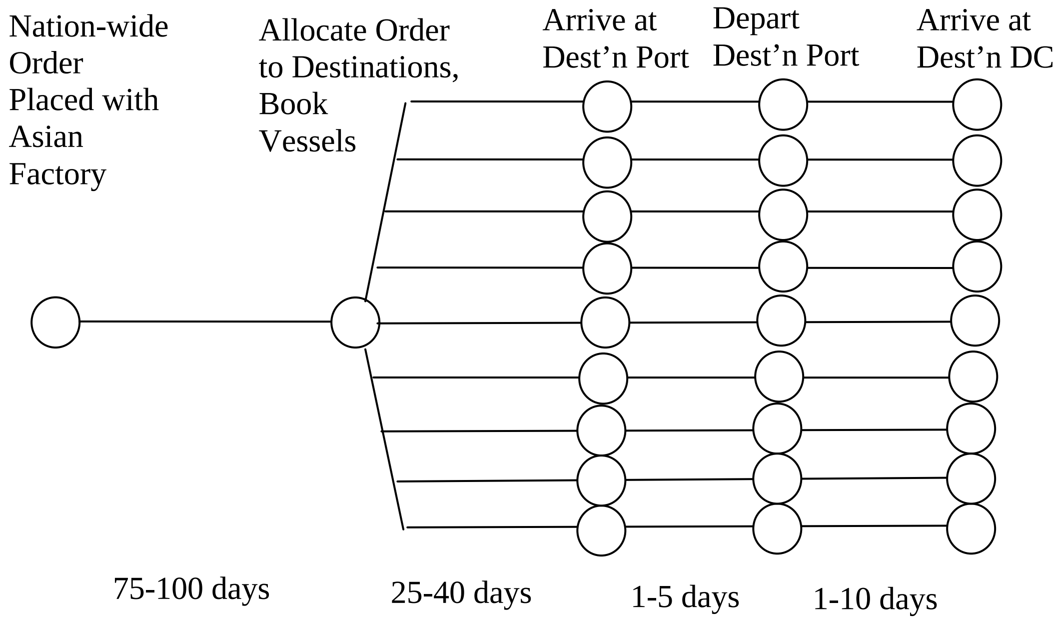
For example, suppose there are ten RDCs, each serving the same amount of retail demand. Suppose ten containers of goods are ordered each week, one for each RDC. If sales are 10% higher than expected at 5 RDCs but 10% lower at the other 5 RDCs, then no safety stock is required to meet demands if the ten shipments were consolidated. Further, suppose one of the 10 containers gets delayed by customs in Asia and misses its scheduled vessel and must transit on the next vessel one week later. If the ten shipments were pooled, each RDC could receive 90% of what was ordered. If not, one RDC would receive nothing. In the former case, a 10% safety stock is adequate; in the latter a 100% safety stock is required.

The consolidation-deconsolidation strategy is implemented by large, nationwide retailers as follows. Rather than shipping direct from Asia to its North American RDCs, shipments are made from Asian suppliers to de-consolidation facilities located in the hinterland of one or several North American ports of entry. Blanket orders covering nation-wide demands are issued to the vendors in Asia, typically on the order of 90 days before the desired shipment date. Not until shortly before vessel bookings are secured is the blanket order subdivided by port of entry, typically about 14 days before vessel departure. Total transit time to the North American port of entry, from the time containers are tendered at the origin port until the time containers can be picked up at the destination port, ranges from 14 to 30 days. Three days before arrival of a vessel at a destination port, the decision is made as to how to allocate the total shipment on the vessel among RDCs served by the port of entry, and this decision is electronically transmitted to the de-consolidation facility.

The importer conducting direct shipping from Asia to RDCs also can furnish its Asian vendors with blanket orders covering nationwide demands, but it must decide the RDC destination before booking vessels for departure from Asia. This avoids the extra handling cost and lead time of de-consolidation at the ports of entry, but it exposes the RDCs to forecast errors over a longer lead time and it denies the RDCs the opportunity to pool transit time risks.

The lead times for direct shipping and consolidation – deconsolidation are diagrammed in Figure 2. Under either alternative, blanket nation-wide orders may be placed with Asian suppliers, so that variations in demands across the importer's regional distribution centers are pooled. Under the direct shipping alternative, the order must be allocated to destination distribution centers before vessels are booked, resulting in 26 – 55 days of lead time exposure during which destination demands are not pooled. Under the trans-

Direct Shipping:



Transloading:

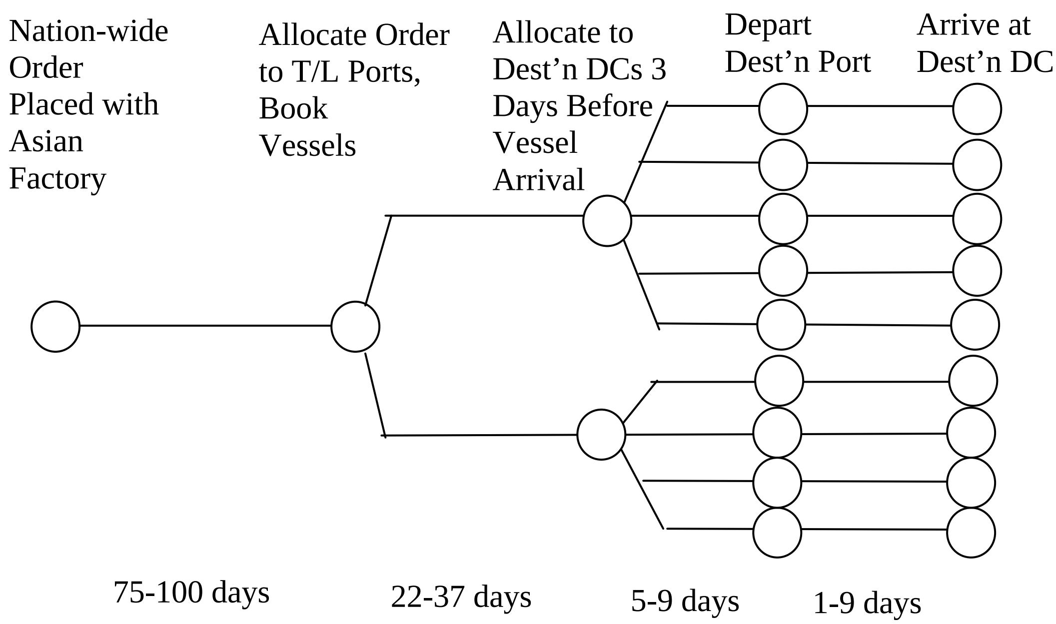


Figure 2
Structure of Ordering Lead Times
for Direct Shipping and Transloading Alternatives

loading alternative, only the trans-load port is selected before vessel booking, and demands of distribution centers serviced by a single trans-load port are still pooled. Three days before vessel arrival at destination port, allocations are made to destination distribution centers, resulting in only 6 – 18 days of lead time exposure during which destination demands are not pooled.

Differences in transit time between the alternatives are explained as follows. From arrival at port of entry to departure from port of entry, the trans-loading alternative takes 2-3 days longer considering the priority given to inland-point intermodal shipments when unloading vessels and releasing boxes for pickup at marine terminals, the time to dray to the deconsolidation warehouse, the time to sort and trans-load goods, and the time to dray to the domestic rail ramp and await the next rail departure. From departure from port of entry to arrival at destination DC, transit time for the direct shipping alternative is 0-1 days longer because in many lanes marine stack trains have slower schedules than domestic container trains. Specific transit time assumptions by port and lane are provided in Tables 3 and 4.

To more easily quantify the safety stock savings from the consolidation-deconsolidation strategy, we first develop the mathematical formulas for safety stocks for the direct shipping and the consolidation-deconsolidation strategies for the simplified case of N equal-demand RDCs and M de-consolidation facilities each serving M/N RDCs.

Notation for Parameters:

D - nation-wide average sales volume per week (in physical units, not dollars).
MAPE – mean absolute percentage error (expressed as a fraction of one) in one-week-ahead forecasts of nation-wide sales.
N – number of RDCs. The sales volume per week served by each RDC is initially assumed to be D/N. (We relax this assumption later on.)
M – number of ports carrying out trans-load de-consolidation of Asian shipments. Each such trans-load facility is assumed to supply N/M RDCs. (We generalize this later on.)
R – time between replenishment orders (from Asian suppliers). R is assumed to be 1 week for all importers.
L_{AO} – mean lead time (expressed in weeks) from when order is placed until port of entry for shipment is selected.
L_{AW} – mean lead time (expressed in weeks) from when port of entry for shipment is selected until shipment completes over-water transport from Asia and commences land transport from North American POE to RDC. In the case of trans-loading L_{AW} includes the time to trans-load the goods at a POE trans-loading facility.
L_W – mean lead time (expressed in weeks) from departure from point of origin until shipment commences land transport from POE to RDC. In the case of trans-loading L_W includes the time to trans-load the goods at a POE trans-loading facility.
L_{NA} – mean lead time (expressed in weeks) from when shipment commences land transport from POE until processed through the RDC.
$\sigma_{L_{AW}}$ – standard deviation of L_{AW}.
$\sigma_{L_{NA}}$ – standard deviation of L_{NA}.
k – safety factor determining the level of safety stocks at RDCs. (Choosing k = 2 implies approximately a 98% probability of no stock-out.)

Formula for Pipeline Stock

The total in-transit inventory is simply

$$(L_W + L_{NA})(D) \ . \qquad (1)$$

Formulas for Safety Stocks

The standard deviation of errors in one-week-ahead forecasts of nation-wide sales is approximately given by

$$\sigma_D = (1.25)(MAPE)(D) \, .$$

Assuming independence of forecast errors across RDCs, the standard deviation of errors in one-week-ahead forecasts of sales served by a single RDC is

$$\sigma_D / \sqrt{N} \ .$$

The formulas for nation-wide safety stocks are different for the case of direct shipping from Asia to the RDCs and the case of de-consolidation of bulk shipments from Asia at a trans-load facility near the port of entry. We develop the formulas for these two cases as follows.

Direct Shipping

We assume uncertainties in water-side and land-side lead times are independent. We further assume errors in sales forecasts grow as the square root of lead time. If there were only a single RDC with demand rate D and variance of forecast errors σ_D^2, the generic formula for the required safety stock is

$$k\sqrt{L_{AO}\sigma_D^2 + (L_{AW} + L_{NA} + R)\sigma_D^2 + D^2(\sigma_{L_{AW}}^2 + \sigma_{L_{NA}}^2)} \, .$$

Considering the fleet of N RDCs each with demand rate D/N and variance of forecast errors σ_D^2/N, the required total nation-wide safety stock is

$$(k)\sqrt{L_{AO}\sigma_D^2 + N^2(L_{AW} + L_{NA} + R)(\sigma_D^2 / N) + N^2(D/N)^2(\sigma_{L_{AW}}^2 + \sigma_{L_{NA}}^2)}$$

or

$$(D)(k)\sqrt{[L_{AO} + (N)(L_{AW} + L_{NA} + R)](1.25)^2(MAPE)^2 + (\sigma_{L_{AW}}^2 + \sigma_{L_{NA}}^2)} \ . \quad (2)$$

De-consolidation at Trans-load Facilities

We assume each of the M trans-load facilities serves N/M RDCs. Fluctuations in demands among these RDCs over the lead time L_{AW} may be pooled. The generic formula for the total safety stock across N RDCs served by an individual trans-load facility is[9]

$$(k)\sqrt{(L_{AO})\sigma_D^2 + (L_{AW})\sigma_D^2 + (N)^2(L_{NA}+R)(\sigma_D^2/N) + (N)^2(D/N)^2(\frac{\sigma_{L_{AW}}^2}{N} + \sigma_{L_{NA}}^2)} \; .$$

The total nation-wide safety stock in the case of M trans-load facilities each serving N/M RDCs is then

$$(k)\begin{bmatrix} L_{AO}\sigma_D^2 + (M)^2(L_{AW})\sigma_D^2/M \\ + N^2(L_{NA}+R)\sigma_D^2/N \\ + (N)^2(D/N)^2(\frac{M}{N}\sigma_{L_{AW}}^2 + \sigma_{L_{NA}}^2) \end{bmatrix}^{1/2}$$

or

$$(D)(k)\sqrt{[L_{AO} + (M)(L_{AW}) + (N)(L_{NA}+R)](1.25)^2(MAPE)^2 + (\frac{M}{N}\sigma_{L_{AW}}^2 + \sigma_{L_{NA}}^2)} \; . \qquad (3)$$

Note that if $M = N$, then (3) reduces to (2) (the formula for the case of direct shipping), as expected.

Numerical Examples

Suppose $N = 21$, $M = 3$, $D = 6{,}072$ TEUs per week, $MAPE = 0.06$, $L_{AO} = 7$, $L_{AW} = 4$, $L_W = 2$, $L_{NA} = 1$, $R = 1$, $\sigma_{L_{AW}} = 5/7$, $\sigma_{L_{NA}} = 1/7$ and $k= 2$. (These are believed to be fairly realistic data for a large US "big-box" retailer.)

Applying formula (1), the total pipeline inventory is

$(2 + 1)(6{,}072) = 3D = 18{,}216$ TEUs.

Next, we calculate safety stocks. Applying formula (2), direct shipping results in total nation-wide safety stock equal to

[9] The derivation of this formula for the case of $M = 1$ and no variance in lead times is provided in "Centralized Ordering Policies in a Multi-Warehouse System with Lead Times and Random Demand," by Gary Eppen and Linus Schrage, in *Multi-Level Production/Inventory Control Systems: Theory and Practice*, L. B. Schwarz, Editor, North Holland, 1981, pp. 51-68.

$(6,072)(2)\ [(7 + (21)(4+1+1))(1.25)^2(0.06)^2 + (5/7)^2 + (1/7)^2\ ]^{½} = 2.262D = 13,733$ TEUs.

Applying formula (3), de-consolidation of Asian imports at three trans-load facilities results in a nation-wide safety stock equal to

$(6,072)(2)\ [(7 + (3)(4) + (21)(1+1))(1.25)^2(0.06)^2 + (1/7)(5/7)^2 + (1/7)^2\ ]^{½} = 1.321D = 8,023$ TEUs.

Note that the trans-loading option reduces RDC safety stocks by (2.262 – 1.321) = 0.941 weeks of demand. Put another way, the retailer's supply chain is reduced by about 7 days.

Let's suppose the investment in landed imports is $20 per cubic foot, assume 1,250 usable cubic feet per TEU, and assume an inventory carrying cost of 20% per year.

For direct shipping, the total inventory cost is

$$(18,216 + 13,733)(1,250)(\$20)(0.20/52) = \$3,072,019 \text{ per week}$$

or about $159.7 million per year.

The savings in nation-wide safety stock from de-consolidation at the POEs is calculated as

$$(13,733 – 8,023)(1,250)(\$20)(0.20/52) = \$549,038 \text{ per week}$$

or about $28.6 million per year.

Expressed a different way, the de-consolidation savings per cubic foot of imports is

$$(\$549,038) / [(6,072)(1,250)] = \$0.0723$$

This savings is linear in the total import volume, the value of the imports and in the assumed inventory carrying cost, but it is non-linear in the numbers of RDCs and POEs, the forecast error, and the standard deviations of the lead times. Advantages from de-consolidation grow with

- Increasing import volume (linearly)
- Increasing import value (linearly)
- Increasing inventory carrying cost (linearly)
- Increasing numbers of RDCs (square root function)
- Decreasing numbers of POEs (square root function)
- Avg. forecast error (square root function)

To illustrate, if we reduce N to 7 but keep M = 3, the savings declines to $0.0379 per cubic foot. i.e., abut half. Even if M is reduced to 1 (while N is 7), the savings is reduced to $0.0561 per cubic foot. This suggests that de-consolidation is much more attractive to relatively large retailers with a nation-wide or nearly nation-wide market. In particular, de-consolidation offers no savings at all to the retailer with only one nation-wide distribution center (as there is nothing to consolidate).

If we keep N = 21 but reduce M to 1, the savings grows from $0.0732 to $0.0839, i.e., by about a penny per cubic foot. This suggests that if the total of transportation plus pipeline inventory costs is significantly lowered by using multiple ports of entry, then it is efficient to carry out trans-loading and de-consolidation at several ports situated to take advantage of land transportation economies (e.g., Los Angeles, Seattle and Norfolk) rather than at just one (e.g., Los Angeles).

Finally, if we again consider the case of N = 21 and M = 1 but set $MAPE$ = 0.09 (as might be the case for new electronics or style goods), the savings from transloading is $0.0988. This suggests that for such kinds of items, consolidation-deconsolidation is extremely valuable, as it is essential to be able to control inventories as tightly as possible.

The Impact of Congestion

Suppose the trans-loading channel suffers congestion (e.g., a severe shortage of draymen), while the direct-shipping channel does not (e.g., it uses on-dock rail). We retain the original example data except we suppose for the trans-loading channel that L_{NA} = 2, and $\sigma_{L_{NA}}$ = 4/7. That is, transit times to pass through the POE rise by a week, and the standard deviation grows by three days. In this situation, the savings in nation-wide safety stock for the trans-loading option over the direct shipping option drops to $0.0312 per cubic foot. If the standard deviation was even worse, e.g., $\sigma_{L_{NA}}$ = 7/7, then the cost of safety stock becomes $0.0201 *more* per cubic foot than that for the direct shipping option. It is clear that the impact of congestion is economically very severe for retailers, to the point that it may become necessary for them to abandon de-consolidation in favor of direct shipping, if that is the only way that the congestion can be avoided.

Generalization for Varying Lead Times and Volumes

The general case is where there are multiple North American ports of entry and multiple destination RDCs. The different combinations have different lead times. Moreover, the volumes at the various RDCs are not necessarily equal. The complex formulas for the general case are provided in the appendices.

Assumed Values of Lead Time Parameters

Lead time parameters for assessing inventory costs were assumed as follows:

L_{AO} – 60 days

L_{AW} – 24.5 days plus vessel transit time plus port-to-ramp time for inland rail intermodal shipments of marine containers
L_{AW} – 24.5 days plus vessel transit time plus port-to-gate time for truck or local dray shipments of marine containers
L_{AW} – 24.5 days plus vessel transit time plus port-to-warehouse transit time for deconsolidation/trans-load shipments
L_{NA} – truck transit time for inland truck shipment of marine containers
L_{NA} – rail transit time plus one day for inland rail intermodal shipments of marine containers
L_{NA} – one day for local delivery of marine containers
L_{NA} – two days plus rail transit time for trans-loaded inland rail intermodal shipments
L_{NA} – truck transit time for inland truck shipment of trans-loaded cargo
L_{NA} – one day for local delivery of trans-loaded cargo

Port-related transit time parameters were assumed as shown in Table 3.

Table 3
Assumed Lead Time Parameters

Port	**Asia to Port**		**Port to Mount** (on-dock rail)		**Port to Gate** (off-dock rail and truck)		**Port to T/L Whse**	
	Mean	Std Dvn	Mean	Std Dvn	Mean	Std Dvn	Mean	Std Dvn
Vancouver – Prince Rupert	15	5	2	2	3	2	3	2
Seattle-Tacoma	15	5	2	2	3	2	3	2
Oakland	15	5	2	2	3	2	3	2
LA-Long Beach	14	5	2	2	3	2	3	2
Houston	22	5	2	2	3	2	2	2
Savannah	28	5	2	2	3	2	2	2
Charleston	27	5	2	2	3	2	2	2
Norfolk	28	5	2	2	3	2	2	2
NY-NJ	26	5	2	2	3	2	3	2

In addition to the above, direct rail movement of marine containers was assumed to have a standard deviation of 3 days. Rail movement of trans-loaded cargo (in domestic containers) was assumed to have a standard deviation of 1 day. Truck and local dray movements were assumed to have a standard deviation of 0.25 days.

Transit Times for Inland Movements

The mean transit times for inland truck and rail movements depend on origin-destination pairs. Average transit time parameters, expressed in days, were established for each channel from each port to each destination. For rail movements, rail schedules (showing total hours from cut-off at origin ramp to release at destination ramp and showing frequency of service) were obtained from various rail and service web sites. Generally, an extra day at destination was added to allow for drays to and from rail ramps. For transcontinental, inter-railroad movements of marine carriers, the consultant sometimes added an extra day or two based on our experience. For truck movements, the consultant estimated transit times directly. These transit times are summarized in Table 4.

Table 4
Assumed Mean Transit Times for Inland Truck and Rail Movement (Days)

Port	Destination	Rail - 40ft Container	Rail 53ft Container	Direct Truck
Charleston	Atlanta	2	2	1
Charleston	Baltimore	3	1	2
Charleston	Boston	4	3	3
Charleston	Charleston	NA	NA	NA
Charleston	Charlotte	3	NA	1
Charleston	Chicago	4	4	3
Charleston	Cleveland	5	5	2
Charleston	Columbus	5	5	2
Charleston	Dallas	4	3	3
Charleston	Harrisburg	5	4	2
Charleston	Houston	6	6	3
Charleston	Kansas City	7	6	3
Charleston	Los Angeles	NA	NA	6
Charleston	Memphis	3	3	2
Charleston	Minneapolis	5	5	4
Charleston	New York	4	2	2
Charleston	Norfolk	3	2	1
Charleston	Oakland	NA	NA	7
Charleston	Pittsburgh	6	5	2
Charleston	Savannah	3	2	1
Charleston	Seattle-Tacoma	NA	NA	7
Charleston	Toronto	7	7	3
Houston	Atlanta	5	4	2
Houston	Baltimore	6	5	3
Houston	Boston	7	6	4
Houston	Charleston	6	6	3
Houston	Charlotte	6	6	3
Houston	Chicago	4	4	3
Houston	Cleveland	5	4	3

Houston	Columbus	5	4	3
Houston	Dallas	2	1	1
Houston	Harrisburg	6	5	4
Houston	Houston	NA	NA	NA
Houston	Kansas City	4	4	2
Houston	Los Angeles	7	7	4
Houston	Memphis	3	3	2
Houston	Minneapolis	7	7	3
Houston	New York	7	7	4
Houston	Norfolk	7	6	3
Houston	Oakland	NA	NA	5
Houston	Pittsburgh	6	5	4
Houston	Savannah	7	6	3
Houston	Seattle-Tacoma	NA	NA	6
Houston	Toronto	8	8	5
LA-Long Beach	Atlanta	8	6	6
LA-Long Beach	Baltimore	9	7	7
LA-Long Beach	Boston	9	7	8
LA-Long Beach	Charleston	10	8	6
LA-Long Beach	Charlotte	9	8	6
LA-Long Beach	Chicago	6	5	4
LA-Long Beach	Cleveland	8	6	5
LA-Long Beach	Columbus	8	6	5
LA-Long Beach	Dallas	6	4	3
LA-Long Beach	Harrisburg	9	7	6
LA-Long Beach	Houston	6	4	4
LA-Long Beach	Kansas City	6	4	3
LA-Long Beach	Los Angeles	NA	NA	NA
LA-Long Beach	Memphis	6	5	4
LA-Long Beach	Minneapolis	8	7	4
LA-Long Beach	New York	9	7	7
LA-Long Beach	Norfolk	9	8	7
LA-Long Beach	Oakland	NA	NA	1
LA-Long Beach	Pittsburgh	8	6	6
LA-Long Beach	Savannah	10	8	6
LA-Long Beach	Seattle-Tacoma	4	3	3
LA-Long Beach	Toronto	8	7	6
Norfolk	Atlanta	3	3	2
Norfolk	Baltimore	4	4	1
Norfolk	Boston	5	5	2
Norfolk	Charleston	3	2	2
Norfolk	Charlotte	2	2	1
Norfolk	Chicago	4	3	2
Norfolk	Cleveland	4	4	2
Norfolk	Columbus	4	4	2
Norfolk	Dallas	5	5	3
Norfolk	Harrisburg	4	4	1
Norfolk	Houston	6	6	3
Norfolk	Kansas City	6	5	3
Norfolk	Los Angeles	NA	NA	7

Norfolk	Memphis	4	3	2
Norfolk	Minneapolis	7	4	3
Norfolk	New York	4	4	1
Norfolk	Norfolk	NA	NA	NA
Norfolk	Oakland	NA	NA	7
Norfolk	Pittsburgh	4	4	2
Norfolk	Savannah	4	3	2
Norfolk	Seattle-Tacoma	NA	NA	7
Norfolk	Toronto	6	5	2
NY-NJ	Atlanta	4	2	2
NY-NJ	Baltimore	NA	NA	1
NY-NJ	Boston	NA	NA	1
NY-NJ	Charleston	5	5	2
NY-NJ	Charlotte	4	4	2
NY-NJ	Chicago	3	2	2
NY-NJ	Cleveland	3	3	2
NY-NJ	Columbus	3	3	2
NY-NJ	Dallas	6	5	4
NY-NJ	Harrisburg	NA	NA	1
NY-NJ	Houston	8	6	4
NY-NJ	Kansas City	5	4	3
NY-NJ	Los Angeles	NA	NA	7
NY-NJ	Memphis	5	4	3
NY-NJ	Minneapolis	5	3	4
NY-NJ	New York	NA	NA	NA
NY-NJ	Norfolk	3	2	1
NY-NJ	Oakland	NA	NA	7
NY-NJ	Pittsburgh	3	3	1
NY-NJ	Savannah	5	5	3
NY-NJ	Seattle-Tacoma	NA	NA	7
NY-NJ	Toronto	4	3	2
Oakland	Atlanta	9	7	6
Oakland	Baltimore	10	7	7
Oakland	Boston	10	7	8
Oakland	Charleston	11	9	7
Oakland	Charlotte	9	9	7
Oakland	Chicago	7	5	5
Oakland	Cleveland	9	6	6
Oakland	Columbus	9	7	6
Oakland	Dallas	7	5	3
Oakland	Harrisburg	10	8	7
Oakland	Houston	7	5	3
Oakland	Kansas City	7	5	3
Oakland	Los Angeles	NA	NA	1
Oakland	Memphis	7	5	4
Oakland	Minneapolis	8	7	5
Oakland	New York	10	8	7
Oakland	Norfolk	10	7	7
Oakland	Oakland	NA	NA	NA
Oakland	Pittsburgh	9	7	6

Oakland	Savannah	11	9	7
Oakland	Seattle-Tacoma	NA	NA	2
Oakland	Toronto	9	8	7
Savannah	Atlanta	1	1	1
Savannah	Baltimore	3	2	2
Savannah	Boston	3	3	3
Savannah	Charleston	NA	NA	1
Savannah	Charlotte	3	3	1
Savannah	Chicago	4	3	3
Savannah	Cleveland	5	4	3
Savannah	Columbus	4	4	3
Savannah	Dallas	4	4	4
Savannah	Harrisburg	5	4	3
Savannah	Houston	5	4	4
Savannah	Kansas City	6	4	4
Savannah	Los Angeles	NA	NA	6
Savannah	Memphis	3	3	2
Savannah	Minneapolis	7	4	4
Savannah	New York	4	2	3
Savannah	Norfolk	3	2	2
Savannah	Oakland	NA	NA	6
Savannah	Pittsburgh	5	4	3
Savannah	Savannah	NA	NA	NA
Savannah	Seattle-Tacoma	NA	NA	7
Savannah	Toronto	7	7	5
Seattle-Tacoma	Atlanta	9	7	5
Seattle-Tacoma	Baltimore	9	7	5
Seattle-Tacoma	Boston	9	8	5
Seattle-Tacoma	Charleston	11	8	5
Seattle-Tacoma	Charlotte	10	9	5
Seattle-Tacoma	Chicago	6	5	3
Seattle-Tacoma	Cleveland	8	6	4
Seattle-Tacoma	Columbus	8	6	4
Seattle-Tacoma	Dallas	8	8	4
Seattle-Tacoma	Harrisburg	9	7	5
Seattle-Tacoma	Houston	10	7	5
Seattle-Tacoma	Kansas City	8	6	3
Seattle-Tacoma	Los Angeles	4	3	2
Seattle-Tacoma	Memphis	8	7	4
Seattle-Tacoma	Minneapolis	5	4	3
Seattle-Tacoma	New York	9	7	5
Seattle-Tacoma	Norfolk	9	8	5
Seattle-Tacoma	Oakland	NA	NA	2
Seattle-Tacoma	Pittsburgh	9	6	4
Seattle-Tacoma	Savannah	11	11	6
Seattle-Tacoma	Seattle-Tacoma	NA	NA	NA
Seattle-Tacoma	Toronto	8	7	4
Vancouver, BC[10]	Atlanta	9	8	5

[10] Vancouver lead time data is assumed to apply to Prince Rupert.

Vancouver, BC	Baltimore	10	8	5
Vancouver, BC	Boston	10	8	5
Vancouver, BC	Charleston	11	10	5
Vancouver, BC	Charlotte	10	9	5
Vancouver, BC	Chicago	7	5	3
Vancouver, BC	Cleveland	9	7	4
Vancouver, BC	Columbus	9	7	4
Vancouver, BC	Dallas	9	9	4
Vancouver, BC	Harrisburg	10	8	5
Vancouver, BC	Houston	12	9	5
Vancouver, BC	Kansas City	9	8	3
Vancouver, BC	Los Angeles	NA	NA	2
Vancouver, BC	Memphis	7	6	4
Vancouver, BC	Minneapolis	6	5	3
Vancouver, BC	New York	10	8	5
Vancouver, BC	Norfolk	10	9	5
Vancouver, BC	Oakland	NA	NA	2
Vancouver, BC	Pittsburgh	10	7	4
Vancouver, BC	Savannah	11	11	6
Vancouver, BC	Seattle-Tacoma	NA	NA	1
Vancouver, BC	Toronto	6	5	4

3. TRANSPORTATION CHARGES

There are many individual transportation charges assessed by various parties concerning the movement of containerized imports. Some of these charges are specifically billed to importers, some are absorbed by carriers and covered by their overall rate charged to the importer. Table 5 documents various land-side charges and distinguishes those billed to the customer vs. those absorbed by the carrier. Three types of carriers are shown: steamship line, non-vessel-owning common carrier, and intermodal marketing company.

For the purposes of this study, a matrix of transportation and handling charges as faced by importers was developed for specific ports of entry and alternative modes of transport as follows.

Alternative Ports of Entry

Nine major groupings of North American ports of entry were included in the analysis, as follows:

* Vancouver – Prince Rupert, BC. Consolidation – deconsolidation to US points via Canadian ports of entry is assumed to be infeasible because of assessment of both Canadian and US duties on imports. Only direct shipping via these ports is analyzed.

* Seattle – Tacoma, WA. Assumed trans-load warehouse site is Fife, WA.
* Oakland, CA. Assumed trans-load warehouse site is Tracy, CA.
* Los Angeles – Long Beach, CA. Assumed trans-load warehouse site is Ontario, CA.
* Houston, TX. Assumed trans-load warehouse site is Baytown, TX.
* Savannah, GA. Assumed trans-load warehouse site is Garden City, GA.
* Charleston, SC. Assumed trans-load warehouse site is Summerville, SC.
* Hampton Roads, VA (referred to as Norfolk throughout this report). Assumed trans-load warehouse site is Suffolk, VA.
* Port of New York – New Jersey. Assumed trans-load warehouse site is 50% East Brunswick, NJ and 50% Allentown, PA.

There are other ports handling Asian imports to North America, but in much smaller volumes than handled by the above ports. There also are prospects or potential for future volumes of Asian cargoes to US destinations through the Ports of Manzanillo and Lazaro Cardenas and a proposed new port near Ensenada, all on the West Coast of Mexico. However, US-destined volume via the Mexican ports at this time is negligible, and rate quotations are scarce.

Destinations

The typical large US importer/retailer operates regional distribution centers that restock retail stores located within an overnight driving distance. Typically, on the order of 15-30 regional centers are required to service all the retail outlets within the continental United States and Canada. This suggests that a reasonable approximation of import trade flows may be made by considering a comparable number of destination zones, each with one regional distribution center as a destination for Asian imports.

To model inland transportation costs, the continental United States was divided into 21 destination regions. It was assumed that a regional distribution center (RDC) located in a suburb of a major city within each region was the destination for all imported goods consumed within the region, as detailed below. Transportation costs for alternative modes/channels for Asian imports via alternative potential ports of entry to these distribution center sites were developed.

The destination regions and assumed site of the RDC within the region are as follows:[11]

Seattle Region – including Washington, Oregon, Idaho and Montana. Regional distribution center assumed to be in Fife, WA.
Oakland Region – including Wyoming, 50% of Colorado, 67% of Utah, 34% of California, and 33% of Nevada. Regional distribution center assumed to be in Tracy, CA.

[11] A percentage specified for a state defines the portion of import volume terminating in that state that is assumed to be assigned to a distribution center in the named region. For example, 50% of imports terminating in Pennsylvania are assumed to be served from an importer's Harrisburg Region distribution center, and 50% are assumed to be served from the importer's Pittsburgh Region distribution center.

Los Angeles Region – including Arizona, New Mexico, 66% of California, 67% of Nevada, 33% of Utah, and 50% of Colorado. Regional distribution center assumed to be in Ontario, CA.
Dallas Region – including Oklahoma and 50% of Texas. Regional distribution center assumed to be in Midlothian, TX.
Houston Region – including Louisiana, Mississippi and 50% of Texas. Regional distribution center assumed to be in Baytown, TX.
Memphis Region – including Arkansas, Tennessee and Kentucky. Regional distribution center assumed to be in Millington, TN.
Kansas City Region – including Kansas, Nebraska, Iowa and Missouri. Regional distribution center assumed to be in Lenexa, KS.
Minneapolis Region – including North Dakota, South Dakota, Minnesota and 50% of Wisconsin. Regional distribution center assumed to be in Rosemount, MN.
Chicago Region – including Illinois, Indiana, Michigan 50% of Wisconsin. Regional distribution center assumed to be in Joliet, IL.

Table 5
Transportation Costs – Charges Separately Billed to Customer vs. Charges Absorbed by Carrier
("Yes" indicates charge is separately billed to customer by carrier,
"No" indicates charge is absorbed by carrier and must be covered by overall rate)

	Carrier Type		
Type of Charge	SSL on through B/L	NVOCC on through B/L	IMC B/L
Terminal gate charge for truck/dray	No, always paid by SSL		
JPA terminal gate charge (Alameda Corr.)	No, always paid by SSL/collected by RR		
PierPass charge for truck/dray	Yes - surcharge always paid by customer		
Dray to warehouse in Port of Entry hinterland	Yes for Group 4 rate	Yes for Port B/L	
Trans-load from marine container to domestic trailer or domestic container	Not involved	Yes	
Truck line-haul of marine container	Yes for Group 4 rate	Yes for Port B/L	
Truck line-haul of domestic trailer	Not involved	Yes	
Dray of domestic trailer or container from warehouse to origin rail ramp	Not involved	Yes	
Rail line-haul of marine container	No for MLB/IPI	Yes for SSL Port B/L No for SSL IPI B/L	Yes for Third Party International (TPI)
Destination dray of marine intermodal container	Yes for SDD B/L No for CY	Yes for SDD B/L No for CY B/L	

	B/L		
Rail line-haul of domestic trailer or container Destination dray of domestic intermodal trailer or container Third party booking fee (IMC) for rail intermodal movement	Not involved	In some cases – but most likely not	Yes

Abbreviations: B/L – bill of lading, SSL – steamship line, NVOCC – non-vessel-owning common carrier, IMC – intermodal marketing company, MLB – mini-land-bridge, IPI – inland point intermodal, SDD – store-door delivery, CY – container yard pick-up by customer, Group 4 rate – applies to store-door delivery in the Port of Entry hinterland.

Columbus Region – including 50% of Ohio. Regional distribution center assumed to be in Springfield, OH.
Cleveland Region – including 50% of Ohio and 25% of New York. Regional distribution center assumed to be in Chagrin Falls, PA.
Pittsburgh Region – including West Virginia and 50% of Pennsylvania. Regional distribution center assumed to be in Beaver Falls, PA.
Harrisburg Region – including 50% of Pennsylvania. Regional distribution center assumed to be in Allentown, PA.
Atlanta Region – including Alabama, Georgia and 50% of Florida. Regional distribution center assumed to be in Duluth, GA.
Savannah Region – including 50% of Florida. Regional distribution center assumed to be in Garden City, GA.
Charleston Region – including 50% of South Carolina. Regional distribution center assumed to be in Summerville, SC.
Charlotte Region – including North Carolina and 50% of South Carolina. Regional distribution center assumed to be in Salisbury, SC.
Norfolk Region – including Virginia. Regional distribution center assumed to be in Suffolk, VA.
Baltimore Region – including Maryland, DC and Delaware. Regional distribution center assumed to be in Frederick, MD.
New York Region – including New Jersey, Connecticut and 75% of New York. Regional distribution centers are assumed to be located 50% in East Brunswick, NJ and 50% in Allentown, PA.
Boston Region – including Rhode Island, Massachusetts, New Hampshire, Vermont and Maine. Regional distribution center assumed to be in Milford, MA.

The Journal of Commerce PIERS database is a summarization of US customs data concerning containerized imports. Tabulations are available by port, commodity code, shipper, destination and quantity of containerized imports. The Port of Long Beach supplied the consultant with PIERS data for the West Coast ports for the 2005 calendar year. MARAD supplied the consultant with a summarization of PIERS data concerning imports from Asia through all US ports for the 2005 calendar year.

Unfortunately, many types of aggregate statistics derived from PIERS are unreliable. MARAD advised the consultant that only about 20% of the import records have correctly filled out destination records, and it cautioned against using the PIERS data as a base for analyzing the geographical distribution of imports.[12]

The consultant believes the vast majority of containerized imports from Asia to the United States are retail goods. It is reasonable to expect that the geographical distribution of destinations for retail imports should be the same as the geographical distribution of retail sales. Furthermore, it is reasonable to expect that retail sales may be indexed to purchasing power in each region, i.e., average income times population in each region.

The consultant obtained population and personal income data by state from U.S. Dept. of Commerce web sites. For the purposes of the elasticity analysis in Chapter 5, the distribution of import volumes by destination region was assumed to be proportional to total purchasing power in each region. Data on per-capita personal incomes by state and state populations were obtained by the consultant from US Dept. of Commerce web sites, then aggregated into the regions as defined above. The results are displayed in Table 6. This distribution is assumed to apply to all of the 83 major importers as well as every category of proxy miscellaneous importer.

Transportation Modes

When considering the shipment of containerized Asian imports to North America there are various options available to importers:

- Alternative vessel operating common carriers and non-vessel operating common carriers (NVOCCs), and alternative ports of entry.
- Through movement of marine containers from port of entry to inland destination via local dray ("Direct Dray") or long-haul truck ("Direct Truck").
- Through movement of marine containers from port of entry to inland destination via rail double-stack train and final dray from rail terminal to destination. An initial dray from port terminal to origin rail terminal is required if the rail terminal is not on-dock ("Direct Rail").
- Dray of marine containers from port of entry to a transloading warehouse in the hinterland of the port of entry, transloading to the goods to a 53-foot trailer for truck movement to inland destination or local dray ("Trans-load Truck" or "Local Trans-load").
- Dray of marine containers from port of entry to a transloading warehouse in the hinterland of the port of entry, transloading to the goods to a 53-foot trailer, dray to origin rail terminal, rail movement of the 53-foot trailer via premium

[12] To illustrate the uselessness of destination data with PIERS, the most common destination shown for imports through the Port of Los Angeles was "Unknown". Next was California, and third most common was "Puerto Rico"(!).

intermodal train service, and final dray from rail terminal to destination ("Trans-load Rail Trailer").

- Dray of marine containers from port of entry to a transloading warehouse in the hinterland of the port of entry, transloading to the goods to a 53-foot container, dray to origin rail terminal, rail movement of the 53-foot container via double stack train, and final dray from rail terminal to destination ("Trans-load Rail Container").

The portions of the overall movement of each vehicle type (marine container, 53-foot trailer or 53-foot container) may be procured separately from multiple vendors, or they may be purchased as a bundled service from a single service provider. The vendors may be carriers or they may be third parties such as NVOCCs or intermodal marketing companies (IMCs).

Table 6
Assumed Distribution of Import Volumes by Destination Region

Region	Percentage of total imports
Seattle-Tacoma	4.024
Oakland	6.629
Los Angeles	11.782
Dallas	4.572
Houston	5.576
Memphis	3.765
Kansas City	4.219
Minneapolis	3.262
Chicago	10.990
Cleveland	3.807
Columbus	1.888
Pittsburgh	2.653
Atlanta	6.915
Savannah	2.811
Charleston	0.597
Charlotte	3.220
Harrisburg	2.161
Norfolk	2.740
Baltimore	2.870
New York	11.229
Boston	4.290
Total	100.000

Further complexity arises because many rates are contractual and confidential, with different rates applying to different customers.

The consultant was able to view rates offered by various vendors. The costs reported herein are based on averages across baskets of rates charged by various vendors to various customers and therefore do not necessarily reflect the specific rates of any individual contract or individual carrier.

Components of Transportation Costs

Costs components that were estimated include the following:

- All modes/channels: steamship line rate from Shanghai to dockside at each port of entry for a 40-foot container, plus wharfage and landing charges absorbed by the line
- Direct Rail: Weighted average of JPA gate charge, dray to near-dock rail ramps and dray to off-dock rail ramps
- Direct Rail of 40-foot container: Rail line haul rate (Note: This is an estimation of the difference between steamship rate for store-door delivery at a warehouse site near port of entry and steamship rate for inland point intermodal.)
- Direct Rail of 40-foot container: Destination dray
- Direct Truck or Direct Dray of 40-foot container: Truck line haul rate or local dray rate
- All trans-load modes: Dray from port to site of trans-load warehouse plus trans-loading fee
- Trans-load Rail Container: Dray from trans-load warehouse to domestic rail ramp
- Trans-load Rail Container: Rail line haul rate
- Trans-load Rail Container: Destination dray
- Trans-load Rail Container: Third-party (e.g., IMC) booking fee
- Trans-load Truck or Local trans-load: Truck line haul rate or local dray rate

In certain cases, weighted-averages of charges serve as the basis for costs, such as weighted averages of dray rates to near-dock terminals, to off-dock terminals, and mount charges for loading on-dock rail, or weighted averages of destination drays from rail ramps operated by different railroads.

As indicated above, many transportation rates are part of confidential contracts. For reasons of confidentiality, costs that are reported reflect the average of a basket of rates from multiple carriers rather than the specific rates of any particular contract or carrier. To further protect confidentiality, we report only total costs per cubic foot for each channel.

Domestic and marine vehicles have different cubic capacities. International cargo moves in 20-foot, 40-foot and 45-foot containers and has done so for many years. In contrast, the vehicles utilized for U.S. domestic freight have become progressively larger. Nowadays, the domestic truck fleet consists almost entirely of 53-foot trailers. Domestic containers and trailers used in rail intermodal service also have grown in size, from 40-foot trailers used in the early 1970s to 48-foot and 53-foot boxes today.

Domestic freight vehicles are not only longer than international containers, they are also taller and wider. The usable cubic space thus grows faster than the increment in length. Table 7 displays the useable cubic space of various vehicles. Note that a standard 53-foot domestic container offers about 60% more useable space than a standard international 40-foot container; a 53-foot truck offers about 71% more useable space.

The vast majority of Asian imports are cube freight, in the sense that cubic capacities are reached before weight capacities are reached. To properly compare transportation costs, it is therefore necessary to express costs on a cost per cubic foot basis. For the purposes of this analysis, we have assumed shipments in 40-foot marine containers are 60% in high-cube 40-foot boxes and 40% in standard 40-foot boxes, leading to the weighted average cubic capacity shown in Table 7. Shipments trans-loaded into domestic containers for rail intermodal movements are assumed to utilize hi-cube 53-foot containers. For cube freight, this means the contents of five marine (40-foot) containers may be stuffed into three domestic (53-foot) trailers or high-cube containers.

Table 7. Space Capacities of Containers and Trucks

Vehicle Type	Usable Space for Lading (cubic feet)	Space as a % of Avg 40ft Space
20ft standard container	1,163	45.29%
40ft standard container	2,395	93.26%
40ft hi-cube container	2,684	104.52%
Wtd. Avg. 40ft container	2,568	100.00%
45ft standard container	3,026	117.83%
48ft standard container	3,471	135.16%
53ft standard container	3,830	149.14%
53ft hi-cube container	3,955	154.01%
53ft truck	4,090	159.27%

Note: The equipment specifications shown above represent those most commonly found in the industry. Actual specifications vary from carrier to carrier and across carrier fleets.

Transportation Unit Costs

Table 8 provides the estimated rates per cubic foot for shipment from Shanghai to the selected North American destinations via the alternative ports of entry listed above. It is assumed that freight shipped is cube freight, and that the cubic space of transportation vehicles is fully utilized. Not all port-destination pairs are shown; unreasonable combinations, such as Vancouver – Houston or New York – Dallas are omitted. All figures are expressed in dollars per cubic foot. The total transportation cost ranges from $1.40 up to $3.00 per cubic foot of vehicle capacity, depending on the destination, choice of port and choice of mode.

Table 8
Transportation Rates Per Cubic Foot,
Shanghai – Selected North American Destinations

Port	Destination	Direct Rail	Transload Rail 53ft Container	Direct Truck	Transload 53ft Truck	Direct Dray
Charleston	Atlanta	1.65	1.95	1.61	1.80	NA
Charleston	Baltimore	1.79	2.05	1.83	1.94	NA
Charleston	Boston	NA	2.16	2.11	2.13	NA
Charleston	Charleston	NA	NA	NA	NA	1.50
Charleston	Charlotte	NA	NA	1.55	1.76	NA
Charleston	Chicago	1.79	2.00	2.09	2.12	NA
Charleston	Cleveland	1.77	2.07	1.95	2.02	NA
Charleston	Columbus	1.76	2.05	1.89	1.98	NA
Charleston	Dallas	NA	2.11	2.22	2.21	NA
Charleston	Harrisburg	NA	2.12	1.93	2.01	NA
Charleston	Houston	NA	2.10	2.19	2.19	NA
Charleston	Kansas City	NA	1.99	2.24	2.22	NA
Charleston	Los Angeles	NA	NA	3.29	2.92	NA
Charleston	Memphis	1.69	1.94	1.93	2.01	NA
Charleston	Minneapolis	NA	2.14	2.41	2.33	NA
Charleston	New York	NA	2.11	1.98	2.04	NA
Charleston	Norfolk	1.67	2.10	1.73	1.88	NA
Charleston	Oakland	NA	NA	3.54	3.09	NA
Charleston	Pittsburgh	1.88	2.10	1.89	1.98	NA
Charleston	Savannah	NA	1.94	1.61	1.80	NA
Charleston	Seattle-Tacoma	NA	NA	3.63	3.14	NA
Charleston	Toronto	NA	2.37	2.35	2.29	NA
Houston	Atlanta	1.65	1.91	1.85	1.91	NA
Houston	Baltimore	NA	2.22	2.37	2.23	NA
Houston	Boston	NA	2.33	2.69	2.45	NA
Houston	Charleston	NA	1.96	2.09	2.05	NA
Houston	Charlotte	NA	1.95	2.07	2.04	NA
Houston	Chicago	1.72	1.83	2.12	2.07	NA
Houston	Cleveland	NA	1.98	2.29	2.18	NA
Houston	Columbus	NA	1.95	2.18	2.11	NA
Houston	Dallas	NA	NA	1.45	1.62	NA
Houston	Harrisburg	NA	2.21	2.44	2.28	NA
Houston	Houston	NA	NA	NA	NA	1.33
Houston	Kansas City	1.59	1.81	1.84	1.88	NA
Houston	Los Angeles	NA	1.99	2.49	2.31	NA
Houston	Memphis	1.52	NA	1.70	1.79	NA

Houston	Minneapolis	1.76	2.07	2.19	2.12	NA
Houston	New York	NA	2.16	2.53	2.35	NA
Houston	Norfolk	NA	2.07	2.33	2.21	NA
Houston	Oakland	NA	NA	2.78	2.51	NA
Houston	Pittsburgh	NA	2.17	2.34	2.22	NA
Houston	Savannah	NA	1.94	2.07	2.04	NA
Houston	Seattle-Tacoma	NA	NA	3.20	2.79	NA
Houston	Toronto	NA	2.18	2.55	2.36	NA
LA-Long Beach	Atlanta	1.73	1.80	2.45	2.23	NA
LA-Long Beach	Baltimore	1.80	1.88	2.80	2.47	NA
LA-Long Beach	Boston	1.85	2.03	3.11	2.69	NA
LA-Long Beach	Charleston	1.74	1.90	2.68	2.39	NA
LA-Long Beach	Charlotte	1.74	1.82	2.61	2.34	NA
LA-Long Beach	Chicago	1.48	1.59	2.34	2.15	NA
LA-Long Beach	Cleveland	1.60	1.67	2.59	2.33	NA
LA-Long Beach	Columbus	1.58	1.68	2.49	2.25	NA
LA-Long Beach	Dallas	1.51	1.60	1.85	1.81	NA
LA-Long Beach	Harrisburg	1.73	1.92	2.77	2.45	NA
LA-Long Beach	Houston	1.58	1.60	1.96	1.89	NA
LA-Long Beach	Kansas City	1.47	1.56	1.98	1.90	NA
LA-Long Beach	Los Angeles	NA	NA	NA	NA	0.90
LA-Long Beach	Memphis	1.52	1.57	2.16	2.02	NA
LA-Long Beach	Minneapolis	1.54	1.82	2.20	2.05	NA
LA-Long Beach	New York	1.80	1.92	2.91	2.55	NA
LA-Long Beach	Norfolk	1.76	1.87	2.83	2.49	NA
LA-Long Beach	Oakland	NA	NA	1.08	1.27	NA
LA-Long Beach	Pittsburgh	1.70	1.91	2.63	2.36	NA
LA-Long Beach	Savannah	1.74	1.86	2.63	2.36	NA
LA-Long Beach	Seattle-Tacoma	1.24	1.48	1.64	1.66	NA
LA-Long Beach	Toronto	1.65	1.89	2.76	2.44	NA
Norfolk	Atlanta	1.71	2.08	1.83	1.97	NA
Norfolk	Baltimore	NA	NA	1.58	1.80	NA
Norfolk	Boston	1.85	2.09	1.84	1.98	NA
Norfolk	Charleston	1.70	1.99	1.74	1.90	NA
Norfolk	Charlotte	1.63	1.96	1.64	1.84	NA
Norfolk	Chicago	1.72	2.06	2.07	2.12	NA
Norfolk	Cleveland	1.74	2.01	1.79	1.94	NA
Norfolk	Columbus	1.72	2.00	1.83	1.97	NA
Norfolk	Dallas	NA	2.32	2.43	2.37	NA
Norfolk	Harrisburg	1.73	2.03	1.65	1.84	NA
Norfolk	Houston	NA	2.30	2.43	2.37	NA
Norfolk	Kansas City	NA	2.11	2.29	2.27	NA
Norfolk	Los Angeles	NA	NA	3.45	3.05	NA
Norfolk	Memphis	1.75	2.05	2.07	2.13	NA
Norfolk	Minneapolis	NA	2.20	2.34	2.31	NA
Norfolk	New York	1.76	2.02	1.68	1.87	NA
Norfolk	Norfolk	NA	NA	NA	NA	1.52
Norfolk	Oakland	NA	NA	3.69	3.21	NA
Norfolk	Pittsburgh	1.76	2.05	1.72	1.89	NA

Norfolk	Savannah	1.72	2.07	1.95	2.05	NA
Norfolk	Seattle-Tacoma	NA	NA	3.61	3.15	NA
Norfolk	Toronto	NA	2.15	2.06	2.12	NA
NY-NJ	Atlanta	1.89	2.12	2.09	2.22	NA
NY-NJ	Baltimore	NA	NA	1.58	1.88	NA
NY-NJ	Boston	NA	NA	1.61	1.90	NA
NY-NJ	Charleston	NA	2.14	2.03	2.18	NA
NY-NJ	Charlotte	NA	2.11	1.94	2.12	NA
NY-NJ	Chicago	1.80	2.06	2.04	2.19	NA
NY-NJ	Cleveland	1.70	2.01	1.78	2.02	NA
NY-NJ	Columbus	1.68	2.02	1.85	2.06	NA
NY-NJ	Dallas	NA	2.31	2.63	2.58	NA
NY-NJ	Harrisburg	NA	NA	1.49	1.82	NA
NY-NJ	Houston	NA	2.29	2.67	2.61	NA
NY-NJ	Kansas City	NA	2.10	2.38	2.41	NA
NY-NJ	Los Angeles	NA	NA	3.57	3.21	NA
NY-NJ	Memphis	NA	2.10	2.28	2.35	NA
NY-NJ	Minneapolis	NA	2.23	2.37	2.41	NA
NY-NJ	New York	NA	NA	NA	NA	1.60
NY-NJ	Norfolk	NA	2.11	1.72	1.97	NA
NY-NJ	Oakland	NA	NA	3.66	3.27	NA
NY-NJ	Pittsburgh	1.74	2.04	1.72	1.97	NA
NY-NJ	Savannah	NA	2.14	2.24	2.32	NA
NY-NJ	Seattle-Tacoma	NA	NA	3.62	3.24	NA
NY-NJ	Toronto	1.79	2.13	1.81	2.04	NA
Oakland	Atlanta	1.79	1.83	2.69	2.39	NA
Oakland	Baltimore	1.84	1.86	2.95	2.56	NA
Oakland	Boston	1.89	2.11	3.20	2.72	NA
Oakland	Charleston	1.80	2.08	2.97	2.57	NA
Oakland	Charlotte	1.80	1.88	2.88	2.51	NA
Oakland	Chicago	1.52	1.61	2.46	2.23	NA
Oakland	Cleveland	1.64	1.75	2.69	2.39	NA
Oakland	Columbus	1.62	1.76	2.66	2.36	NA
Oakland	Dallas	1.59	1.73	2.14	2.02	NA
Oakland	Harrisburg	1.77	2.00	2.92	2.54	NA
Oakland	Houston	1.66	1.76	2.28	2.11	NA
Oakland	Kansas City	1.51	1.59	2.22	2.07	NA
Oakland	Los Angeles	NA	NA	1.12	1.33	NA
Oakland	Memphis	1.56	1.67	2.42	2.21	NA
Oakland	Minneapolis	1.54	1.80	2.38	2.18	NA
Oakland	New York	1.84	1.98	3.04	2.62	NA
Oakland	Norfolk	1.82	1.88	3.11	2.66	NA
Oakland	Oakland	NA	NA	NA	NA	0.98
Oakland	Pittsburgh	1.74	1.98	2.79	2.45	NA
Oakland	Savannah	1.80	1.89	2.88	2.51	1000.00
Oakland	Seattle-Tacoma	NA	NA	1.44	1.55	NA
Oakland	Toronto	1.68	1.87	2.87	2.51	NA
Savannah	Atlanta	1.62	1.95	1.57	1.77	NA

Savannah	Baltimore	1.78	1.98	2.03	2.08	NA
Savannah	Boston	NA	2.09	2.38	2.31	NA
Savannah	Charleston	NA	NA	1.60	1.79	NA
Savannah	Charlotte	NA	1.93	1.57	1.77	NA
Savannah	Chicago	1.79	1.97	2.11	2.13	NA
Savannah	Cleveland	1.77	2.06	1.97	2.03	NA
Savannah	Columbus	1.76	2.05	1.94	2.01	NA
Savannah	Dallas	NA	2.08	2.17	2.17	NA
Savannah	Harrisburg	NA	2.05	1.94	2.01	NA
Savannah	Houston	NA	2.13	2.17	2.17	NA
Savannah	Kansas City	NA	1.97	2.18	2.18	NA
Savannah	Los Angeles	NA	NA	3.24	2.88	NA
Savannah	Memphis	1.67	1.89	1.89	1.98	NA
Savannah	Minneapolis	NA	2.10	2.42	2.34	NA
Savannah	New York	NA	2.04	2.18	2.18	NA
Savannah	Norfolk	1.66	2.02	1.93	2.01	NA
Savannah	Oakland	NA	NA	3.44	3.02	NA
Savannah	Pittsburgh	1.88	2.09	1.95	2.02	NA
Savannah	Savannah	NA	NA	NA	NA	1.49
Savannah	Seattle-Tacoma	NA	NA	3.62	3.13	NA
Savannah	Toronto	NA	2.37	2.56	2.43	NA
Seattle-Tacoma	Atlanta	1.81	1.87	2.87	2.43	NA
Seattle-Tacoma	Baltimore	1.84	1.86	2.93	2.47	NA
Seattle-Tacoma	Boston	1.87	2.02	3.15	2.61	NA
Seattle-Tacoma	Charleston	1.82	1.93	3.05	2.55	NA
Seattle-Tacoma	Charlotte	1.80	1.85	3.01	2.52	NA
Seattle-Tacoma	Chicago	1.48	1.59	2.39	2.11	NA
Seattle-Tacoma	Cleveland	1.60	1.67	2.64	2.27	NA
Seattle-Tacoma	Columbus	1.60	1.69	2.62	2.26	NA
Seattle-Tacoma	Dallas	1.86	1.78	2.45	2.15	NA
Seattle-Tacoma	Harrisburg	1.75	1.93	2.87	2.43	NA
Seattle-Tacoma	Houston	1.87	1.80	2.68	2.30	NA
Seattle-Tacoma	Kansas City	1.59	1.60	2.24	2.01	NA
Seattle-Tacoma	Los Angeles	1.33	1.49	1.68	1.63	NA
Seattle-Tacoma	Memphis	1.59	1.59	2.60	2.25	NA
Seattle-Tacoma	Minneapolis	1.45	1.55	2.08	1.90	NA
Seattle-Tacoma	New York	1.80	1.90	2.99	2.51	NA
Seattle-Tacoma	Norfolk	1.82	1.85	3.02	2.53	NA
Seattle-Tacoma	Oakland	NA	NA	1.44	1.47	NA
Seattle-Tacoma	Pittsburgh	1.74	1.92	2.75	2.35	NA
Seattle-Tacoma	Savannah	1.82	1.93	3.05	2.55	NA
Seattle-Tacoma	Seattle-Tacoma	NA	NA	NA	NA	0.90
Seattle-Tacoma	Toronto	1.66	1.87	2.80	2.38	NA
Vancouver, BC	Atlanta	NA	1.81	2.95	2.52	NA
Vancouver, BC	Baltimore	1.84	1.95	3.01	2.56	NA
Vancouver, BC	Boston	1.95	2.00	3.22	2.70	NA
Vancouver, BC	Charleston	NA	2.07	3.13	2.64	NA
Vancouver, BC	Charlotte	NA	1.85	3.08	2.61	NA
Vancouver, BC	Chicago	1.50	1.56	2.47	2.20	NA

Vancouver, BC	Cleveland	1.62	1.65	2.72	2.37	NA
Vancouver, BC	Columbus	1.60	1.65	2.69	2.35	NA
Vancouver, BC	Dallas	NA	1.81	2.53	2.24	NA
Vancouver, BC	Harrisburg	1.84	1.93	2.95	2.52	NA
Vancouver, BC	Houston	NA	1.83	2.76	2.39	NA
Vancouver, BC	Kansas City	NA	1.74	2.32	2.10	NA
Vancouver, BC	Los Angeles	NA	1.63	1.76	1.72	NA
Vancouver, BC	Memphis	1.58	1.66	2.68	2.34	NA
Vancouver, BC	Minneapolis	1.47	1.58	2.16	1.99	NA
Vancouver, BC	New York	1.84	1.94	3.07	2.60	NA
Vancouver, BC	Norfolk	NA	1.85	3.10	2.62	NA
Vancouver, BC	Oakland	NA	NA	1.51	1.56	NA
Vancouver, BC	Pittsburgh	NA	1.85	2.82	2.44	NA
Vancouver, BC	Savannah	NA	2.05	3.13	2.64	NA
Vancouver, BC	Seattle-Tacoma	NA	NA	0.99	1.15	NA
Vancouver, BC	Toronto	1.70	1.85	2.88	2.47	NA
Prince Rupert, BC	Atlanta	NA	NA	NA	NA	NA
Prince Rupert, BC	Baltimore	1.84	NA	NA	NA	NA
Prince Rupert, BC	Boston	1.95	NA	NA	NA	NA
Prince Rupert, BC	Charleston	NA	NA	NA	NA	NA
Prince Rupert, BC	Charlotte	NA	NA	NA	NA	NA
Prince Rupert, BC	Chicago	1.50	NA	NA	NA	NA
Prince Rupert, BC	Cleveland	1.62	NA	NA	NA	NA
Prince Rupert, BC	Columbus	1.60	NA	NA	NA	NA
Prince Rupert, BC	Dallas	NA	NA	NA	NA	NA
Prince Rupert, BC	Harrisburg	1.84	NA	NA	NA	NA
Prince Rupert, BC	Houston	NA	NA	NA	NA	NA
Prince Rupert, BC	Kansas City	NA	NA	NA	NA	NA
Prince Rupert, BC	Los Angeles	NA	NA	NA	NA	NA
Prince Rupert, BC	Memphis	1.58	NA	NA	NA	NA
Prince Rupert, BC	Minneapolis	NA	NA	NA	NA	NA
Prince Rupert, BC	New York	1.84	NA	NA	NA	NA
Prince Rupert, BC	Norfolk	NA	NA	NA	NA	NA
Prince Rupert, BC	Oakland	NA	NA	NA	NA	NA
Prince Rupert, BC	Pittsburgh	1.76	NA	NA	NA	NA
Prince Rupert, BC	Savannah	NA	NA	NA	NA	NA
Prince Rupert, BC	Seattle-Tacoma	NA	NA	NA	NA	NA
Prince Rupert, BC	Toronto	1.70	NA	NA	NA	NA

Transportation Cost Comparison

As may be seen in Table 8, overall handling and transportation costs to trans-load to 53-foot containers are generally a little more from West Coast ports than total costs for direct rail movement in marine containers and sometimes even less, generally ranging $0.02 - $0.10 per cubic foot more. For reverse intermodal movements from East Coast ports, overall handling and transportation costs to trans-load to 53-foot containers generally range $0.25 - $0.30 per cubic foot more than that for direct rail movement of marine containers. Trans-loading to a domestic truck is generally cheaper than direct trucking of the marine box, if any significant distance is involved. Trucking generally ranges $0.60 - $0.80 more per cubic foot than that for direct rail movement from West Coast ports, and generally ranges $0.05 - $0.15 more per cubic foot that that for direct rail movement from East Coast ports. Short-haul truck is sometimes comparable or even less than rail.

These comparisons set the stage for the overall economic allocation of imports to channels. As will be shown, low-value goods are most cheaply handled in the direct channels. Moderate-value and high-value goods that are shipped in enough volumes and distributed over wide enough areas to be amenable to trans-loading are more cheaply handled in the trans-loading channels.

Transloading vs. Direct Shipment

The opportunity at de-consolidation to trans-load into the larger domestic vehicles enables importers to partially defray the added expenses of the side trip to a de-consolidation warehouse in the hinterland of the port of entry. That is, the reduction in line haul transportation costs (per cubic foot of cargo) partially offsets the added costs associated with one extra lift and two extra drays, the costs for the transloading/deconsolidation activity itself, and the increment in pipeline inventory.

While there are some heavy cargoes in Asia – U.S. trade such as imported steel, it is our impression that the vast majority of containerized imports consist of relatively light cargoes that reach space limits before reaching weight limits. We estimate typically 48 hours (two days) is lost for cargo that is to be immediately de-consolidated and trans-loaded to domestic containers or trucks. Thus transloading entails up to two additional days of pipeline inventory for the importer and corresponding additional inventory carrying costs.[13] At the same time, the opportunity for mixing and reallocation of cargoes at a transloading warehouse in the port of entry hinterland offers the opportunity to reduce safety stocks at destinations with corresponding reductions in inventory carrying costs, as analyzed above.

Thus deconsolidation/transloading vs. direct shipping is a trade-off between added transportation expenses and reduced inventory expenses. As will be discussed in Chapter 7, a certain minimum volume and a nation-wide fleet of RDCs are required for an importer to potentially benefit from the transloading strategy. Among those with such a scale and scope, it turns out that for low-value goods the transloading strategy does not pay. For moderate-value and high-value goods, it pays off.

Growth of the Domestic Container Fleet

[13] Domestic stack train schedules are often faster than marine stack train schedules. The overall increment in pipeline inventory is less than two days in some lanes.

The feasibility of the transloading strategy depends upon an adequate supply of domestic vehicles. Tracing the growth and mix of domestic intermodal container fleet over the last several years, we are able to confirm a substantial increase in the supply of 53-foot containers. Table 9 documents this growth. In 1998, only 14% of the domestic container fleet consisted of 53-foot boxes. But by 2002, 53-foot boxes accounted for almost half of the fleet. Considering expiration dates of current leases and anticipated retirements, we project that by 2007 more than 85% of the fleet will consist of 53-foot boxes.

Table 9
Domestic Container Fleet, 1998 to 2007

	1998	**2000**	**2002**	**2007 Projected**
48 foot	76,112	77,670	65,124	24,045
53 foot	12,500	34,758	56,686	138,436
Total	**88,612**	**112,428**	**121,810**	**162,481**
53ft % of total	***14.1%***	***30.9%***	***46.5%***	***85.2%***

	48 foot Containers			**53 foot Containers**		
Carrier	***1998***	***2000***	***2002***	***1998***	***2000***	***2002***
UP	11152	12823	11723	0	6436	8936
BNSF	16000	16000	13500	0	1500	4004
NS	6020	6004	5800	0	4997	4921
CSX	6550	6498	8030	0	0	4750
CP	5200	5100	5100	0	1000	2600
CN	4600	4550	4500	0	500	1400
KCS	1050	1045	1496	0	100	100
PACER SS	17990	17950	13000	0	5725	9200
JB HUNT	7550	7500	1500	12500	14500	20500
TFM	0	200	475	0	0	0
FXE	0	0	0	0	0	275
TOTAL	**76,112**	**77,670**	**65,124**	**12,500**	**34,758**	**56,686**

Note: Some small operators with fleets of less than 500 units may have been omitted.
Some carriers contribute to pools (e.g., NACS, EMP). Ownership shown here by carrier.

These figures confirm that the supply of 53-foot domestic containers became adequate in recent years to support the West Coast distribution warehousing and transloading strategies pursued by large importers in recent years. Considering that the fleet size of 53-

foot containers will continue to grow, we expect continued growth in transloading volumes.

An important point concerning transloading is that Southern California is by far the largest West Coast market for inbound domestic freight. It would be more difficult for the Bay Area, Seattle/Tacoma or Vancouver to develop transloading traffic to the extent that has happened in Southern California, simply because the supply of domestic 53-foot containers is smaller (reflecting the smaller amounts of westbound domestic freight traffic). To the extent that West Coast distribution and transloading is economically attractive to importers of Asian-manufactured goods, the SPB Ports have a competitive advantage for this traffic, owing to Southern California's more generous supply of 53-foot containers. Nonetheless, as the fleet size of 53-foot containers enlarges, we anticipate the levels of transloading activity at other West Coast ports to increase.

4. INTANGIBLE FACTORS

In Chapter 5 we introduce a Long-Run Elasticity Model that calculates allocations of Asian imports to ports and supply channels based on the economics of transportation and inventory from the importers' point of view. There are a number of important intangible factors not incorporated in the quantitative analyses of the Model, summarized as follows.

Port Terminals as Virtual Warehouses

Some importers deliberately delay pick-up of containers from port terminals. If demand at destination has slowed compared to forecasts made when the goods were ordered, and so the goods in the container are not yet needed, such importers use the port terminal as a virtual warehouse. Certain very large importers have negotiated with the steamship lines for very large amounts of free time[14] for their containers awaiting dray pick-up at the port terminals.

This has several effects. First, this creates greater opportunity for trans-loading importers to re-direct imported goods where they are most needed, thereby reducing safety stock requirements at destination distribution centers. This enhances the value of the trans-loading channel in a way that is not included in the formulas developed in Chapter 2.[15] Second, it increases congestion and decreases throughput at port terminals. More acreage is required as the terminal has in effect been converted into a virtual import warehouse. Third, the steamship lines observe that the average dwell time at port terminals for "store-door" (i.e., local and trans-load) import boxes is much larger than for inland-point intermodal boxes. In order to maximize box utilization, they tend to prioritize inland point intermodal boxes in the way they stow cargo on their vessels and the way they

[14] Reportedly, 21 days in one case.
[15] The same is true if the importer implements a port-hinterland warehouse (as opposed to merely deconsolidating and immediately cross-docking and re-shipping all imports).

unload the vessels. This has the result that the average transit time from vessel arrival to rail interchange for the Direct Rail channel (AKA inland point intermodal) is one to three days less than the average transit time from vessel arrival to local warehouse delivery for boxes moving in the Trans-load channels. This is ironic, in that shippers of high-value goods, for whom managing inventories tightly is most important, are allocated the longest lead times.

Diversification of Congestion Risk

During the summer of 2004, serious congestion (which the industry press – and many customers – termed a "meltdown") was experienced at the San Pedro Bay Ports. Many vessels were greatly delayed from unloading, and unloaded containers were further delayed awaiting dray or rail pick-up because of shortages of staff and equipment. In interviews with 3PL firms and carriers, we were advised that many shippers were unable to divert substantial cargoes to other ports, as they did not have adequate redundancy engineered into their logistics systems. We are advised there is now widespread recognition among importers of the need to diversify their logistics strategy, to have alternatives readily available in case a meltdown develops in one particular shipping channel or at one particular port. We have received considerable anecdotal evidence that shippers have increased their arrangements for transloading services at ports other than San Pedro Bay.

To the extent that importers divert traffic purely for the purpose of diversifying the port channels utilized, this factor suggests the Long-Run Elasticity Model may be too high in its predictions of volume through the SPB Ports.

Other Cost Factors

Third-party logistics firms providing transloading services to importers sometimes are hired to perform other services besides sorting-by-destination and transloading the imported goods. Commonly provided outbound distribution services include piece-count and/or manifest verification by SKU (stock-keeping unit), and attaching bar codes. Other services sometimes provided include stretch-wrapping or palletization, and, much less often, short-term storage.

We are advised by 3PL firms that the vast majority of containerized imports from Asia are simply floor-loaded in the container. All of the above types of tasks need to be completed before the goods may be handled through mechanized regional distribution centers. That is, piece-counts must be made, the goods need to be stretch-wrapped, and bar codes need to be attached. If these activities were not done at the transloading warehouse in the port hinterland, they would have to be done upon arrival at the inland regional distribution center itself or else at a mixing center in Asia before sea shipment. Stretch-wrapping in Asia would entail a loss of usable cubic capacity in the container. If labor costs at inland distribution centers are higher than at the port hinterland warehouses, there is an economic incentive to perform these activities in the port hinterland.

These factors may enhance the attractiveness of the trans-loading option compared to the cost calculations made using the formulas developed in Chapter 2.

Regional Importers

In the Long-Run Elasticity Model we assume the top 83 Asian importers are nation-wide in the scope of their distribution operations. If any are regional in nature, their eligibility for trans-loading may be sharply curtailed compared to the assumptions of the Model.

The Model also assumes that "generic" importers that account for the rest of Asia – U.S. imports are not eligible for trans-loading (because they are too small or too regional). Moreover, it is assumed that, in aggregate, for all levels of declared value, the geographical dispersion of their destinations is proportional to the geographic dispersion of purchasing power in the United States.

If any of the "generic" importers actually practice trans-loading, the Model misses this. If in aggregate the destinations of generic importers are distributed differently from the distribution of purchasing power, the Model misses this, too.

Taken together, these factors are off-setting and do not suggest a major bias in Model calculations.

Short Run Vs. Long Run Factors

The Long-Run Elasticity Model exercised in Chapter 5 analyzes given transportation rates, values of goods, and transit time statistics faced by importers to determine the least costly allocation of imports to ports and channels. Transit time statistics are exogenously supplied to the model and are not updated if the Model shifts substantial traffic volumes between ports or modes. The Model results should be interpreted as indicating the fee levels at which importers would experience an economic incentive to reduce import volumes through the SPB Ports.

In the short run, there are many factors inhibiting the shifting of imports to other ports or alternative channels. There are multiple dimensions of capacity constraining channel volumes. Moreover, steamship lines may be committed to relatively long-term port contracts whose fee structures provide the incentive for the lines to tender large volumes and mandate stiff penalties for premature withdrawal. Given a scenario in which there is economic incentive for importers to shift their import volumes between modes or between ports, there will be inertia inhibiting such shifts. Major shifts in import traffic may require considerable time to implement. In the short run, San Pedro Bay Ports traffic will be significantly more inelastic than predictions derived using the Long-Run Model.

Notwithstanding these factors, given strong economic incentives for importers to shift traffic, one may expect *in the long run* that desired terminal and line haul capacities will get built, new port contracts will be negotiated, vessel strings will be adjusted, new trans-loading warehouses will be erected, and dray forces will be adjusted. For that reason, the evaluation of potential major investments in ports access infrastructure, requiring many years to construct and many more years to recoup the investment, is best done considering the long-run elasticity of port demand.

Nonetheless, the short-run evolution of ports traffic is of considerable interest. The most prominent short-run factors inhibiting the shifting of port and channel volumes in the short run are therefore discussed in more detail below.

Capacity and Congestion

The Long-Run Elasticity Model described in Chapter 5 does not include any capacity constraints. Imports are assigned to channels based on minimization of the importers' costs – including transportation charges in each channel, and inventory costs resulting from the pre-specified transit times and opportunities for consolidation/deconsolidation.

Transit time parameters used in Model calculations are exogenously supplied by the user and remain fixed during the Model's calculations. In reality, the mean and standard deviation of transit time both increase dramatically as utilization of a channel is increased to high percentages of its capacity. (What happened in the summer of 2004 at the SPB Ports is an obvious case in point.) Moreover, it is likely that service providers using congested channels may be motivated to increase their charges or curtail service.

Most North American ports are operating close to their current capacities during peak shipping season. If there were to be massive diversion of traffic away from the SPB Ports, it is doubtful this traffic could be accommodated without substantial infrastructure investments in other port regions.

In the analysis of current traffic volumes and current costs, the Elasticity Model predicts feasible allocations of imports to channels. In analyzing scenarios with marginal changes in costs or volumes, the Model can be expected to provide reasonable predictions of short-run behavior. At issue is the analysis of scenarios with added costs (e.g., container fees) that entail a major departure from current costs. The Model's traffic calculations in that case may be very inconsistent with the existing available capacity. Moreover, transportation rates are likely to change in such a scenario.

Thus in cases where the Long-Run Elasticity Model responds to strong economic incentive by calculating major traffic shifts, there is the question of whether sufficient capacity exists (or can be created) to allow such a shift. The interpretation of Long-Run Elasticity Model results for scenarios very different from current economics must therefore be tempered.

There are numerous examples of this, some discussed below.

Panama Canal

The Panama Canal is an example of a capacity-constrained channel. The Canal is reported to be operating very close to capacity. Importers report that securing space on vessel strings transiting the Canal is becoming increasingly difficult.

In some scenarios it could be called upon to analyze, the Long-Run Elasticity Model's calculations may call for higher levels of utilization of the Canal, perhaps even infeasible volume levels through the Canal.

One might expect that if there is very strong demand for increased Canal capacity, investment in its expansion would follow. Indeed, in 2006, the Government of Panama held a referendum among the populace asking whether or not the Country should build a third set of locks – and supply the water necessary to operate them – in order to accommodate post-Panamax vessels, a multi-billion-dollar undertaking. This referendum was approved. It is estimated that a decade or more will be required to complete the project.

Larger Vessels

Another aspect of the Panama Canal capacity issue is the fleet mix of the steamship lines. Some lines are investing heavily in post-Panamax vessels with capacities on the order of 10,000 TEUs. A number of lines already operate 8,000 TEU vessels. Such large vessels are confined to service in Asia – Europe or Trans-Pacific lanes. While the introduction of such vessels displaces older Panamax vessels that can be re-deployed in strings passing through the Panama Canal, the overall fleet capacity has a declining fraction that is eligible for that type of service.

Deconsolidation Capacity

The consultant has heard estimates to the effect that, considering the total warehouse capacity suitable for deconsolidation activity in the hinterlands of all North American ports of entry, 65% is located in Southern California. Displacing a large fraction of the trans-loading activity in Southern California is simply not feasible without more investment in warehouse capacity in other port regions. How "large" is infeasible is at present not quantified. By how much trans-loading capacities can be increased (and at what cost) at the various ports is at present not quantified.

Port Capacities

Capacities at ports are multi-dimensional. One aspect of capacity concerns dock labor to unload and re-load vessels and transfer containers onto chasses and rail well cars. Another aspect concerns the supply of dray labor to haul boxes from the port gate to off-dock rail terminals and warehouses in the region. A third aspect concerns the ability of rail terminals and rail lines to handle increased traffic.

All of these aspects of capacity were severely strained in 2004 peak season in Southern California. Many shippers responded by shifting some of their 2005 import volumes to Seattle-Tacoma and, to a lesser extent, to Oakland. Several steamship lines shifted selected vessel strings from San Pedro Bay to Puget Sound for the 2005 shipping season. Because congestion in Southern California was much abated in 2005, these strings were shifted back to San Pedro Bay for the 2006 season.

A Long-Run Elasticity Model calculation that calls for a large shift of volume from one port to another must be judged in light of the multi-dimensional capacity of that port.

Productivity Differences Among Ports

Throughput rates (measured in lifts per hour or TEUs per acre or vessel moves per quay foot) vary among ports. Certain East Coast ports exhibit better numbers than West Coast ports. Certain Asian ports exhibit number even better than the best US East Coast ports.

Where a port lags the performance of others, this suggests there is an opportunity to improve and thereby increase capacity. Improvements may involve labor issues, technology or both. Thus capacity at the ports is a moving target.

There is a chicken-and-egg phenomenon here: The incentive to improve productivity increases dramatically as the volume is increased. Thus current “capacity” limits at each port might not be the real limits. Instead, as volumes are pushed towards those limits, efforts to improve productivity will accelerate and “capacity” will be increased.

Vessel Operator-Port Contracts and Other Inertia

Steamship lines enter into long-term contracts with ports. The rents are a function of volume; generally, the lines have an economic incentive to sustain high volume at the port (thereby decreasing the port charges per container). A Long-Run Elasticity Model calculation that calls for a large shift of volume from one port to another must be judged in light of the contractual disincentive.

Many importers enter into contracts with steamship lines. These contracts often entail volume commitments by origin – destination pair. Once an economic incentive exists for an importer to switch from direct shipping to inland points to trans-loading in the hinterland of the port of entry, such contracts may delay or impede the transition.

Every importer must make considerable effort to develop a supply-chain management system. A Model calculation that calls for major shifts in supply-chain strategy (e.g., switch from trans-load to direct-ship) may in turn trigger the need for re-engineering the supply-chain management system. Thus there may be some inertia or time lag on the part of importers to change their supply-chain strategy, even when economic incentive exists to do so.

Container Repositioning Surcharges

Traditionally, merchandise traffic in lanes between central or eastern US points on the east end and West Coast points at the west end was heavier westbound than eastbound. (Westbound traffic was termed the "headhaul" and eastbound traffic was termed the "backhaul".)

The growth in Asian imports has changed that; eastbound traffic is now greater, much greater during peak shipping season. There is considerable upward pressure on eastbound rates for domestic containers and trailers, especially during peak shipping seasons. As a result, in some lanes at certain times of the year, equipment repositioning surcharges are being assessed.

Similarly, there is upward pressure on rates for direct inland movement of marine containers. At present, as a rough average, there is one export load for every three-to-four import loads. Most marine containers moved to inland points are returned to the ports empty. This average is declining, and in certain lanes the steamship lines are applying surcharges to inland point intermodal rates because of the dearth of backhaul business in those lanes.

A Long-Run Elasticity Model calculation that predicts either a large increase in trans-loading or a large increase in direct inland point movement of marine containers must be interpreted with caution. A large swing in the relative demands for domestic vs. marine containers would likely entail a commensurate change in the relative re-positioning charges for those types of equipment. Transportation rates input to the Model may require adjustment.

5. ELASTICITY CALCULATIONS

Modeling Procedure

The transportation costs developed in Chapter 3 and the inventory cost formulas developed in Chapter 2 were combined to compute total costs for importers. The 83 major importers listed in Table 2 were subjected to these calculations. We assume each importer applies a single homogenous supply-chain strategy to handle all of its imported goods at the least overall cost for the assumed average declared value of its imports (as specified in Table 2). The importer's total assumed volume (also shown in Table 2) was allocated among the destination regions defined in Chapter 3 in proportion to the purchasing power in each region (Table 6).

To account for the remaining import volume, a set of "proxy miscellaneous" importer categories were generated, not eligible for transloading, stratified along the value distribution of Figure 1 in value increments of $4 per cubic foot from a low of $2 to a high of $70. The relative total volumes in each value category, including both large importers and proxy miscellaneous importers, are displayed in Table 10.

Table 10
Assumed Distribution of Import Volumes by Declared Values

Declared Value Per Cubic Foot	Fraction of Total Misc. Imports	Declared Value Per Cubic Foot	Fraction of Total Misc. Imports
$2	0.010	$38	0.040
$6	0.150	$42	0.035
$10	0.155	$46	0.030
$14	0.130	$50	0.025
$18	0.120	$54	0.020
$22	0.100	$58	0.010
$26	0.070	$62	0.005
$30	0.050	$66	0.003
$34	0.045	$70	0.002

The total amount of proxy miscellaneous imports was calibrated so that sum of proxy miscellaneous imports and major-shipper imports added to the total imports from Asia to the USA. The volumes for each proxy miscellaneous value category also were allocated to destination regions in proportion to the purchasing power in each region (as defined in Table 6).

Elasticity Analysis

For each importer, total costs for alternative strategies were computed to deduce the least-cost strategy for each type of importer. The alternative strategies so tested are as follows:

- Direct shipping via nearest port to each region
- Direct shipping via least-cost West Coast ports to each region (least cost considering all transportation and inventory costs)
- Trans-load only at LA – Long Beach, then least-cost shipping
- Trans-load Los Angeles Region imports at LA – Long Beach, but trans-load everything else at Seattle-Tacoma, then least-cost shipping

- Trans-load only at Seattle-Tacoma, then least-cost shipping
- Trans-load only at Oakland, then least-cost shipping
- Trans-load only at Seattle/Tacoma and LA – Long Beach, then least-cost shipping
- Trans-load at Seattle/Tacoma, LA – Long Beach and Norfolk, then least-cost shipping
- Trans-load at Seattle/Tacoma, LA – Long Beach, Savannah and New York, then least-cost shipping

Total costs were tallied for each alternative strategy for each importer and the best strategy identified. For major importers, the break points in value and the corresponding optimal supply-chain strategy were found to be as summarized in Table 11.

Table 11
Efficient Supply-Chain Strategies as a Function of Avg. Declared Value for Large Nation-Wide Importers – As-Is Scenario

Value Range ($ per cu ft)	Strategy
0 – 13	Direct shipping using least-cost port-landside channel
13 – 20	Trans-load at multiple ports
20 and up	Trans-load only at LA – Long Beach

For the proxy generic importers (those lacking the scale and/or scope for transloading), the optimal supply-chain strategies were found to be as summarized in Table 12.

Table 12
Efficient Supply-Chain Strategies as a Function of Avg. Declared Value for Regional and Small-Scale Importers – As-Is Scenario

Value Range ($ per cu ft)	Strategy
0 – 40	Direct shipping using cheapest port-landside channel
40 and up	Direct shipping using least-cost West Coast port

This analysis was repeated with the addition of a variable container fee assessed on all containers entering through the Puget Sound ports. Fee values expressed in increments of $30 per 40-foot container ranging from $0 to $1,200 were tested. The direct and trans-load volumes via Puget Sound were then totaled for each fee value in order to construct curves of volume vs. container fee.

As the value of the fee was increased from zero, certain importers would be induced to change strategies in order to minimize total cost. For example, trans-load importers might be induced to shift trans-loading to other West Coast ports or open up trans-load centers at East Coast ports. Direct shippers might be induced to ship solely using other ports.

As a concrete example, consider a large, nation-wide importer with an average declared value of $14 per cubic foot. Its optimal policy for Puget Sound fee values between $0 and $29 is to trans-load imports using facilities in the hinterlands of ports on both Coasts, including a facility in the Kent Valley. For fee values between $29 and $57, its optimal policy changes to direct-shipping via the cheapest port-landside channel; its traffic through the Puget Sound ports is reduced to only imports destined to the importer’s Pacific Northwest regional distribution center. For a fee at Puget Sound greater than $330, the importer’s optimal policy is to abandon the Puget Sound ports entirely, and truck its PNW RDC volume from the Port of Vancouver.

As another concrete example, consider a direct shipper with an average declared value of $10 per cubic foot. With no fee, its optimal policy is to direct ship to each of its RDCs using the least-cost port and landside channel. All of its volume to the PNW and Minneapolis RDCs and about half of the volume to the Chicago RDC are supplied via the Puget Sound ports. For fees in the range of $0 to $120, the optimal policy is to supply all of the Chicago RDC volume via the San Pedro Bay ports. The PNW and Minneapolis RDCs continue to be supplied via the Puget Sound ports for a fee in this range. For fees in the range $120 to $269, only traffic local to the PNW is routed through the Puget Sound ports. For a fee greater than $269, the Puget Sound ports are abandoned entirely, and PNW RDC volume is trucked down from Vancouver.

Figure 3 displays the elasticity results. This can be construed to represent the case where container fees are assessed but are not used to pay for improvements to the ports and port access infrastructure. Shown are curves for the total inbound Asian import volume (in FEUs) via Puget Sound as well as the portion of inbound volume that passes through deconsolidation warehouses (i.e., trans-load volume). The elasticity curves are somewhat “lumpy” because so many importers share the same average declared value of imports and so it is optimal for many of them to reduce Puget Sound volumes at the same point on the fee scale.

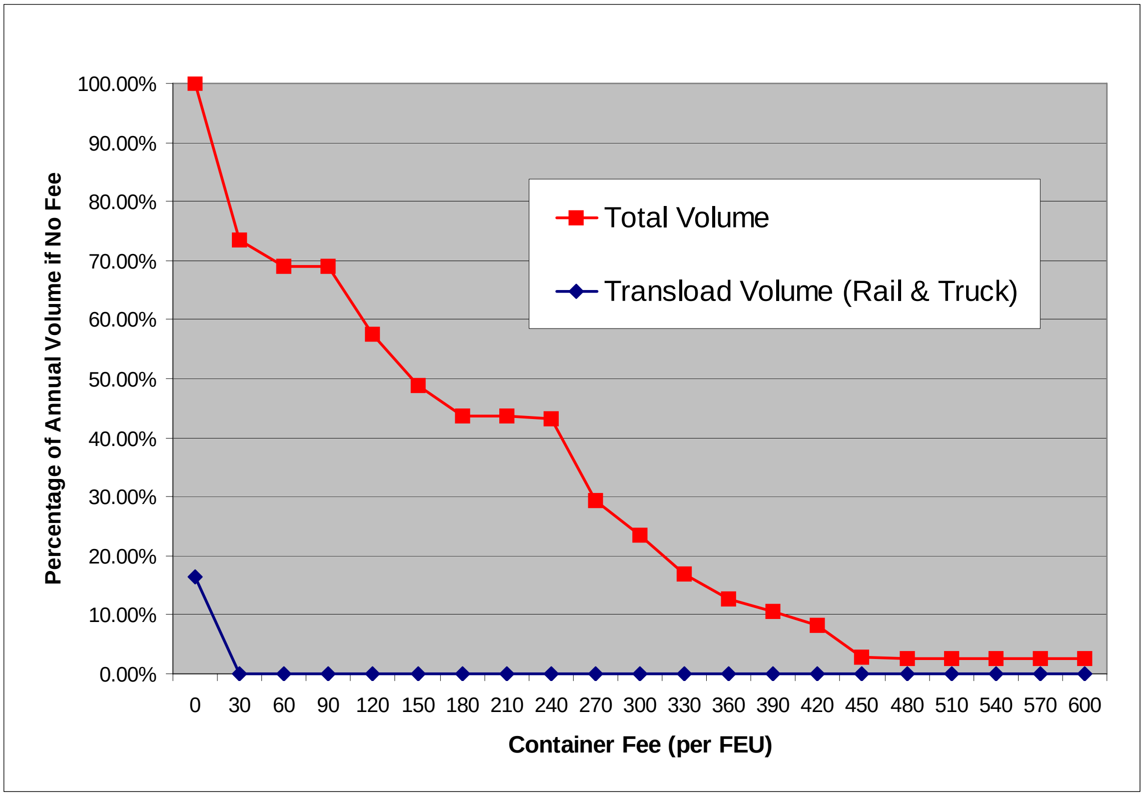


Figure 3.
Elasticity of Imports via the San Pedro Bay Ports, As-Is Scenario

Note that the model predicts that, at present, about 17% of imports through the Puget Sound Ports pass through deconsolidation centers.

As may be seen, imports routed via the Puget Sound ports are quite elastic, even for very low fees. Fees in the range of $30 - $90 per FEU provide incentive to shift to other ports 30% of imports currently routed via Puget Sound. A fee of about $150 renders about 50% of imports cheaper to re-route via other ports.

Model Limitations and Proper Interpretation of Results

As discussed in Chapter 4, there are important limitations to the Long-Run Elasticity Model. Most importantly, the model includes no capacity limitations in any channel or at any port. Transit time statistics are exogenously supplied to the model and are not updated if the Model shifts traffic between ports or modes. Limitations on available warehouse space for trans-loading activity are not considered.

The model results should be interpreted as indicating the points at which importers would experience an economic incentive to reduce import volumes through the Puget Sound ports. Whether it is actually feasible in the short run for them to do so, considering capacity limitations, increased congestion at other ports, contract commitments, etc., is beyond the scope of the Long-Run Elasticity Model. Moreover, the Long-Run Model tacitly assumes capacity improvements will be made at other ports and in landside channels emanating form those ports so as to accommodate any projected diversions of traffic now handled via the Puget Sound ports.

Given a scenario in which there is economic incentive to shift imports between modes or between ports, there will be inertia inhibiting such shifts. Major shifts in import traffic may require considerable time to implement. Thus, in the short run, Puget Sound ports' traffic will be significantly more inelastic than the predictions of the Long-Run Model. However, given strong economic incentives for importers to shift traffic, one may expect *in the long run* that desired terminal and line haul capacities will get built, new port contracts will be negotiated, vessel strings will be adjusted, new trans-loading warehouses will be erected, and dray forces will be adjusted.

The Long-Run Elasticity Model is intended to inform public policy concerning potential fees and potential major investments in access infrastructure for the Puget Sound ports. Such infrastructure may require up to a decade to build, and financing instruments may require up to three decades to retire the principal. It seems very unwise to rely solely on estimations of short-run elasticity to justify such investments. Investment of large sums of public monies in long-term infrastructure should be confirmed to be sound on the basis of long-run elasticity calculations.

6. CONCLUSIONS

Puget Sound import volume is very elastic with respect to container fees. Total inland transportation charges via Puget Sound ports vs. other West Coast ports are very competitive to many destinations east of the Rockies for most types of imports.

Lacking improvements in access infrastructure that improve transit times or otherwise improve the economics from the importer's point of view, and without offsetting fee increases at other West Coast ports, in the long run even a small container fee at Puget Sound may drive significant amounts of traffic away from the Puget Sound ports. The Long-Run Elasticity Model predicts that a $60 per FEU fee on inbound loaded containers at the Puget Sound ports would cut total import volume at the Puget Sound ports by approximately 30%. The model predicts a fee of $150 would cut traffic in half. These estimates of volume reductions are likely somewhat larger what would actually happen, given the value of diversification of supply chains perceived by large importers.

Institution of container fees without offsetting fees at other West coast ports seems unwise. However, as fees are instituted at the California ports, they may be matched at Puget Sound in order to create a revenue source for infrastructure improvement and environmental impact mitigation without loss of market share, or, if unmatched, market share at the Puget Sound ports may be grown.

APPENDICES.

Safety Stock Formulas for the General Case of Lead Times and Volumes Varying by Region

The general case is where there are multiple North American ports of entry and multiple regional distribution center (RDC) destinations. The different combinations have different lead times. Moreover, the volumes at the various RDCs are not necessarily equal. We add the index *n* for RDC and the index *m* for POE. The parameters are generalized as follows:

D - nation-wide average sales volume per week (in physical units, not dollars).
MAPE – mean absolute percentage error (expressed as a fraction of one) in one-week-ahead forecasts of nation-wide sales.
D_n = amount of sales distributed from RDC *n*. We assume $\sum_n D_n = D$ and the proportion of nation-wide sales handled by each RDC is fixed.
D_{mn} = amount of imports en route to RDC *n* that are passed through port *m*. We assume $\sum_m D_{mn} = D_n$.
R – time between replenishment orders (from Asian suppliers). R is assumed to be 1 week for all importers.
L_{AO} – mean lead time (expressed in weeks) from when order is placed until port of entry for shipment is selected.
$L_{AW}(m)$ – mean lead time (expressed in weeks) for a shipment from point of origin to port of entry *m*, measured from when port of entry for shipment is selected until RDC is selected for land transport from POE *m*.
$L_W(m)$ – mean lead time (expressed in weeks) from departure from point of origin until RDC is selected for land transport from POE *m*.
$L_{NA}(m,n)$ – mean lead time (expressed in weeks) from when RDC *n* is selected for land transport from POE *m* until processed through the RDC *n*.
$\sigma_{L_{AW}}(m)$ – standard deviation of $L_{AW}(m)$.
$\sigma_{L_{NA}}(m,n)$ – standard deviation of $L_{NA}(m,n)$.
k – safety factor determining the level of safety stocks at RDCs. (Choosing *k* = 2 implies approximately a 98% probability of no stock-out.)

Formula for Pipeline Stock

The total in-transit inventory is expressed as

$$\sum_{m,n} \left(L_W(m) + L_{NA}(m,n)\right) D_{mn} \, . \qquad (4)$$

Expression (4) is the generalization of expression (1).

Formulas for Safety Stock

In the direct shipping case, the total nation-wide safety stock is expressed as

$$(k)\left[\begin{array}{l} L_{AO}(1.25)^2(MAPE)^2D^2 \\ +\left(\sum_n\left(\frac{\sum_m D_{m,n}\sqrt{L_{AW}(m)+L_{NA}(m,n)+R}}{D_n}\right)\sqrt{\frac{D_n}{D}}(1.25)(MAPE)D\right)^2 \\ +\left(\sum_{m,n}D_{m,n}\sqrt{\sigma^2_{L_{AW}}(m)+\sigma^2_{L_{NA}}(m,n)}\right)^2 \end{array}\right]^{1/2} \tag{5}$$

Expression (5) is the generalization replacing expression (2).

In the de-consolidation case, the total nation-wide safety stock is expressed as

$$(k)\left[\begin{array}{l} L_{AO}(1.25)^2(MAPE)^2D^2 \\ +\left(\sum_m\sqrt{\sum_n\left(\frac{D_{m,n}L_{AW}(m)}{D_n}\right)\left(\frac{D_n}{D}\right)(1.25)^2(MAPE)^2D^2}\right)^2 \\ +\left(\sum_n\left(\frac{\sum_m D_{m,n}\sqrt{L_{NA}(m,n)+R}}{D_n}\right)\sqrt{\frac{D_n}{D}}(1.25)(MAPE)D\right)^2 \\ +\left(\sum_{m,n}D_{m,n}\sqrt{\frac{\sum_m D_{m,n}}{\sum_n D_{m,n}}\sigma^2_{L_{AW}}(m)+\sigma^2_{L_{NA}}(m,n)}\right)^2 \end{array}\right]^{1/2} \tag{6}$$

Expression (6) is the generalization replacing expression (3).

Appendix C.

BST Associates Review of Port and Modal Elasticity Study

BST ASSOCIATES

BST Comments on the Leachman Report

Findings

BST Associates has reviewed the Leachman Report and concurs with its conclusions. The Leachman elasticity report concludes that:

- If fees are imposed at Puget Sound ports but not competing ports, the Puget Sound ports could lose substantial volumes of cargo.
- If fees are raised at other ports, Puget Sound ports could match those fees and maintain market share.

Puget Sound import volume is very elastic with respect to potential container fees. If unmatched by new fees at other ports, even relatively small fees of $60 per FEU or less would render supply-chain channels using other ports more economically attractive for imports to be consumed in most of the markets located east of the Rockies.

- BST concurs that Puget Sound container traffic is very elastic based upon recent market response patterns. Puget Sound ports have recently lost market share without any imposition of user fees.
- In addition, Seattle will lose intermodal traffic to Prince Rupert since COSCO has decided to shift its US Midwest intermodal traffic from Seattle to Prince Rupert. The province of BC and Government of Canada have subsidized the development of the Canadian Gateway (i.e., the Federal Government has put $590 million into the project and the BC Provincial Government has contributed $150 million). This includes a direct public subsidy for construction of the container terminal in Prince Rupert and inland infrastructure.

For most points east of the Rockies and north of the Mason-Dixon Line, the total transportation costs for cargo routed through California ports are competitive with Puget Sound ports, regardless of whether the cargo moves directly in ocean containers or is transloaded into domestic equipment. Canadian West Coast ports are also very competitive with Puget Sound ports in regard to the total transportation costs for shipping of ocean containers to certain inland US regions. These factors make imports quite elastic to potential fees at Puget Sound.

- BST concurs that, for intermodal container traffic destined for the northern states located east of the Rocky Mountains, Puget Sound competes with other West Coast ports in both California and British Columbia (and perhaps Mexico when they develop), as well with all-water services to East/Gulf Coast ports. The combined ocean and rail rates from alternative ports are similar to those via Puget Sound ports to key inland destinations.

As fees are instituted at other West Coast ports, the Puget Sound ports may choose to match these fees and maintain market share, or, if unmatched, to gain market share.

- Leachman assumes that the proposed fees for Washington ports are not used to improve infrastructure and that fees are not raised at competing ports.
- At the present time, a number of container charges are being implemented or contemplated at other West Coast ports, including (but not limited to):
    - PierPASS in Los Angeles and Long Beach, which imposes a fee on containers trucked during the day to help subsidize nighttime operations. This is an example of a charge that improves operational productivity and has increased port productivity in Los Angeles and Long Beach. Other charges may be used to fund infrastructure improvements that could improve productivity, but there is a significant temporal problem between when the fees are paid and when the improvements are made (it could be several years).
    - Clean Air Program: Long Beach and Los Angeles recently initiated a $35 per TEU charge to help pay for replacement of older (dirtier) trucks. This fee provides a benefit to the community but does not improve the productivity of container movements. The Port of Vancouver has also imposed a clean air franchise fee. It is unclear whether these charges will be applied in Prince Rupert, Mexican or East/Gulf Coast ports.
    - The cumulative impacts of these (and other) fees have not been fully evaluated. Some of these charges may be implemented at other ports on the US West Coast (including those in Washington). If these types of fees are implemented at the Washington ports but not at all competitive ports, such as those in Canada, Mexico, and the US East and Gulf Coasts, further impacts to Puget Sound's share of container traffic could be expected.

As explained below, the Leachman findings are based on approximately one-third of the container traffic that moves via the Ports of Seattle and Tacoma (i.e., imports from Asia). We suspect that the impacts on exports and empty international containers are as sensitive if not more so than imports. Thus, the Leachman findings may under-estimate the impacts on Puget Sound container traffic.

General Commentary

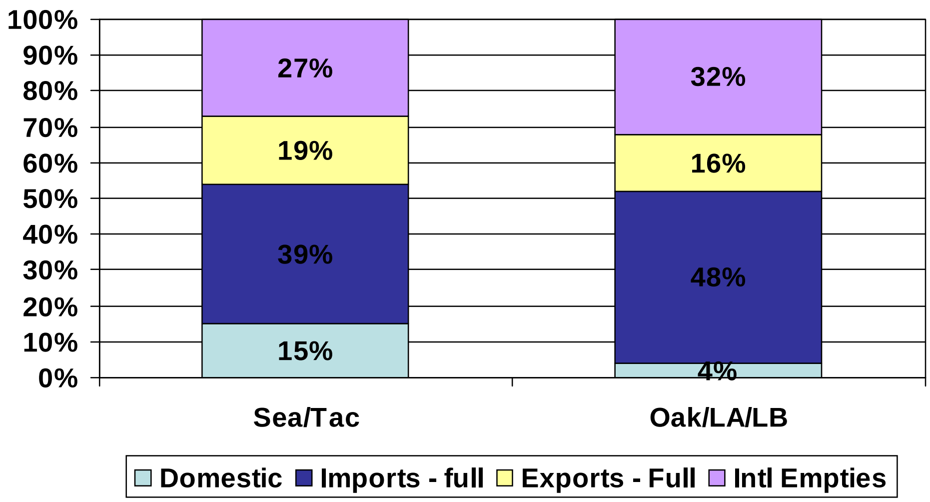
The Leachman elasticity report is based on imports from Asia (specifically those from China).

Dr. Leachman's COMMENT: The entire volume of imports from Asia to the USA is considered in the Leachman model and report, not just imports from China.

BST Final Comment: Understood. The confusion stemmed from the transportation costs presented from Shanghai in Table 8. These are apparently a subset of the model outputs.

This is a relatively small but very important subset of the total containerized cargo base moving through Puget Sound ports. For the Puget Sound ports, foreign imports represent around 39% of total container volume. The remaining 61% consists of empty containers (27%), full international export containers (19%), and domestic containers (15%). Of the full import containers moving through Puget Sound ports, China accounts for around 63%. Consequently, the Leachman model addresses around ~36% ~~25% (63% x 39%)~~ of the total container traffic moving through the Puget Sound ports.

Figure 1 – Distribution of Container Cargo by Type



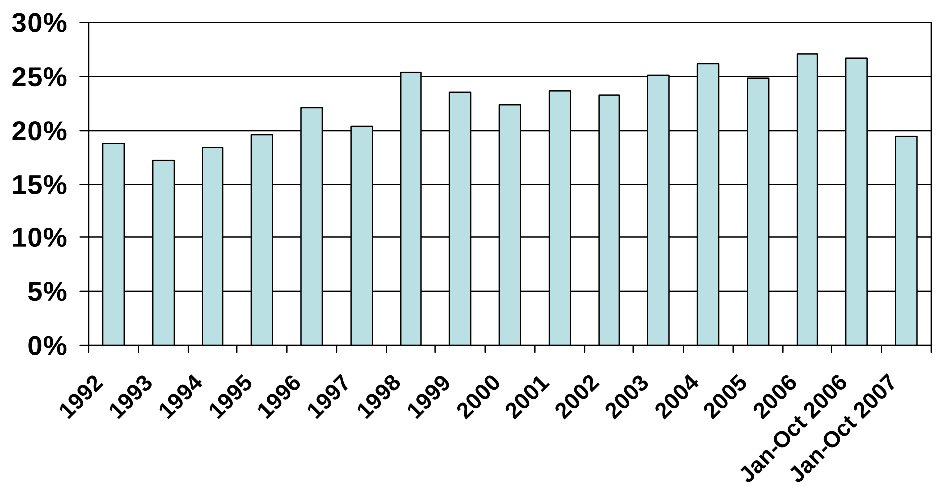
*Dr. Leachman's COMMENT: The entire volume of imports to the USA from Asia is considered in the Leachman model and report, not just imports from China. I would estimate that about **36%** of total container flows through the Puget Sound ports are accounted for by imports from Asia to the USA. Moreover, the prevailing rate structures from the US railroads impose stiff penalties on steamship lines if westbound rail container volumes through each of the major West Coast port areas (Southern California, Northern California, Puget Sound) are not kept in balance with eastbound rail container volumes. Thus westbound empty container movements are strongly tied to decisions on how the lines handle Asian imports.*

BST Final Comment: BST concurs that relative changes in rail rates have been the key force in shifting intermodal containers from the PNW to the PSW. This practice underscores our concerns about the impact on exports and empties. Please see additional information presented below.

This could be problematic because we expect that the sensitivity of exports and empties may be greater than that for imports for the following reasons.

The recent trend for empty containers at Puget Sound ports has shown a significant decline in this type of traffic. From 1996 through 2006, empty containers represented 20% to 28% of total international containers (full + empty). Generally, empties trended upward during this period in response to the stronger growth of imports relative to exports. However, in 2007 (YTD through October) empties fell to less that 20% of international container traffic. Some, but not all, of this shift can be explained by increased export volumes. The number of empties appears to be declining at Puget Sound ports and at other West Coast ports. This will negatively affect the terminal operators in Puget Sound since empties generate revenue for them. It could also affect rail service and rates because the railroads are forcing shippers to fully utilize railcars in both directions. A decline in empties returning by rail to Puget Sound could exacerbate this situation. Finally, the supply of empties is important for local and regional exporters.

Figure 2 – Trend in Puget Sound Empty International Containers as a Percent of Total International Containers



Dr. Leachman's COMMENT: The real reason for the decline in empty container movements through Puget Sound ports is as I explained above. Rail rates to steamship lines were revised starting in 2006 to impose stiff penalties if westbound and eastbound container flows to any of the three West Coast major port areas are out of balance. Before these new rates, it was advantageous to steamship lines to return most empties to Asia via the Puget Sound ports, as this saved about two days of cycle time on their containers as well as reduced fuel consumption for vessels moving up the Coast from California to the Puget Sound ports before returning to Asia.

BST Final Comment: See below.

The proposed fee could also impact exports moving via the Puget Sound ports. In some cases, the products exported through Puget Sound ports are commodities whose prices are set in world markets. An example is waste paper, which has an average value of $2,500 per FEU (around $130 per metric ton). Waste paper is the largest export from US West Coast ports. A fee on this product could decrease or eliminate shipments through Puget Sound ports. A secondary impact of the decreased exports of waste paper would likely be increased use of landfills.

Other key Puget Sound exports are competitively produced along the entire West Coast. An example of this is animal feeds, which are purchased or produced by companies with operations throughout the region, such Anderson Hay and Grain. Anderson has operations in eastern Washington (exports via Seattle and Tacoma), eastern Oregon (exports via Portland, Seattle and Tacoma), northern California (exports via Oakland) and Southern California (exports via Los Angeles and Long Beach). As with waste paper, this product also has a price established in world markets. Unilateral imposition of a fee at Puget Sound ports fee could negatively impact exports here, causing a loss of local jobs in the state as well as a loss of revenue to container terminal operators.

Finally, some exports such as pork and beef arrive in Puget Sound by rail (either direct intermodal or refrigerated boxcar for reload into containers). These exports fit into the category of discretionary products that can be diverted to other ports if it is less expensive to do so. The tight competitive nature that Leachman describes for intermodal imports also applies to these discretionary exports.

Port charges at Seattle and Tacoma are currently lower than at competing ports on the West Coast. These charges have been kept low to provide a competitive edge. However, a decline in container volumes has the affect of increasing the average or marginal cost of port operations for fixed costs such as rent.

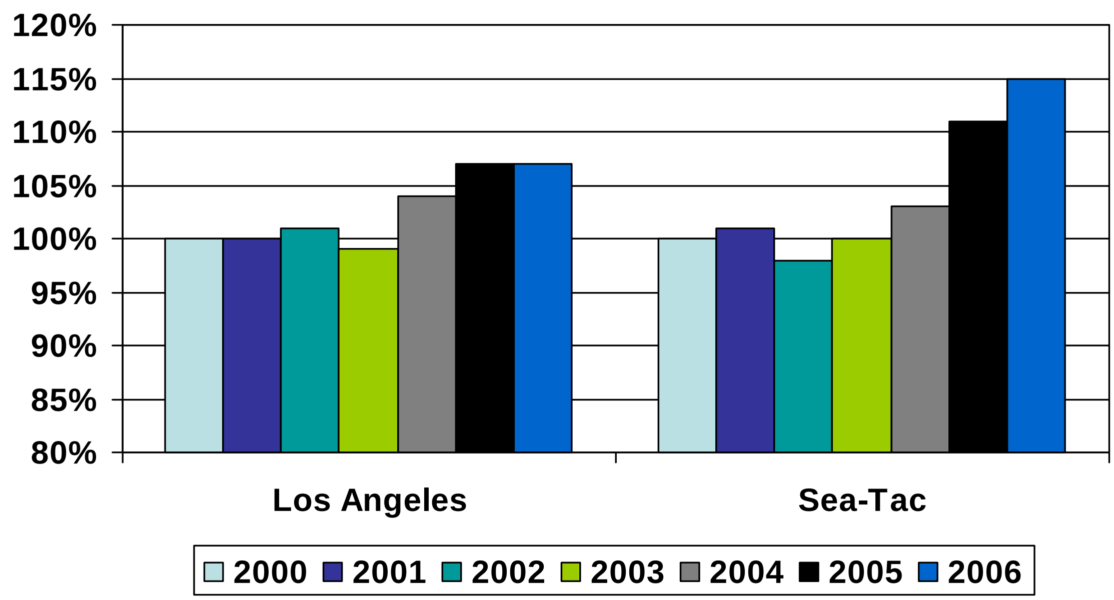
Figure 3 – Prince Rupert Port Authority Identification of Potential Export Accounts

Domestic container traffic accounts for a larger share of total container traffic at Puget Sound ports than it does at competing ports in California and British Columbia. Officials in Alaska and Hawaii have already voiced their opposition to additional fees. In response to the unilateral imposition of new fees in Puget Sound there is some potential for loss of domestic traffic. In particular, exports from Southeast Alaska that currently move through Puget Sound ports could shift to Prince Rupert or other ports. As shown in Figure 3, Prince Rupert has evaluated potential export opportunities, and is targeting Alaskan and inland US refrigerated and dry cargoes.

For these reasons, BST Associates believes that the sensitivity of the container markets in Puget Sound could be larger than identified in the Leachman report.

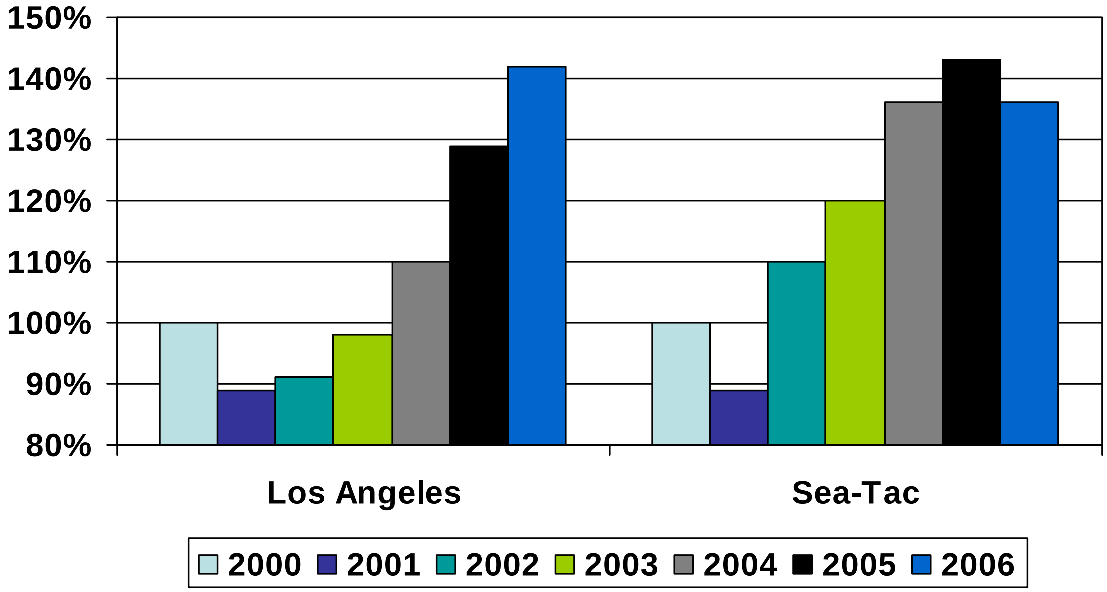
BST Final Comment: BST concurs that a relative change in rail rates has been a major force in shifting some intermodal containers from the PNW to the PSW. Figure 4 illustrates the relative rail rate increases for westbound full containers from Chicago to the US West Coast. Rail rates from Chicago to LA/LB increased approximately 7% in between 2000 and 2006, while rates from Chicago to Sea-Tac increase by 15% over the same period. Up until 2004 the increases in rail rates to Sea-Tac was comparable to the increase to LA/LB. .

Figure 4 – Relative Rail Rates Chicago to USWC ($/full TOFC-COFC unit; index 2000 = 100%)



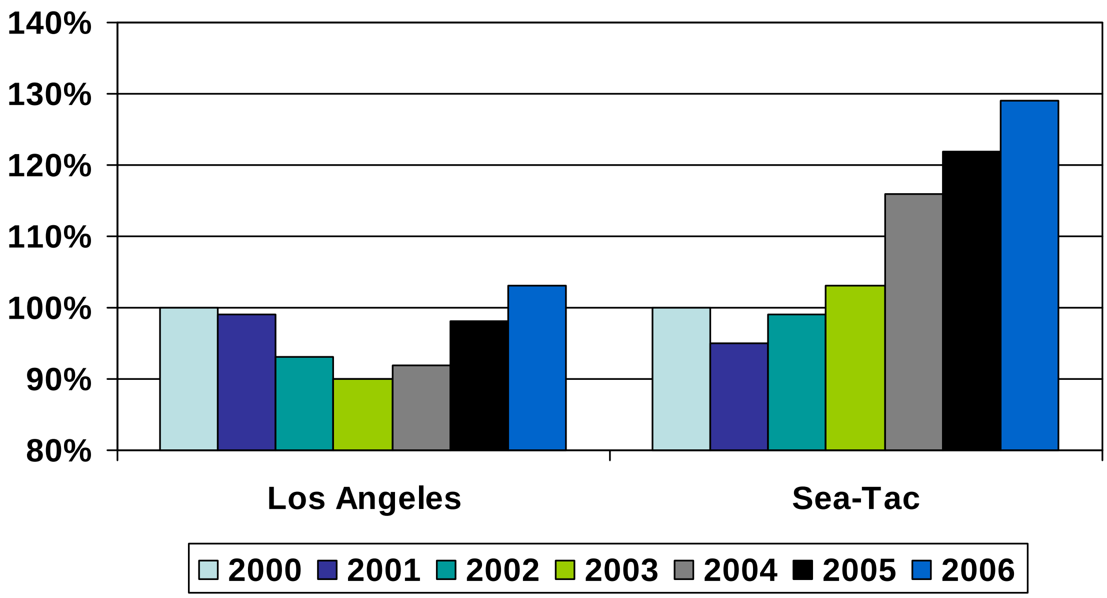
BST Final Comment: As a result of these rate increases, LALB has experienced faster growth in full westbound container traffic. In 2006, full westbound traffic decreased in Sea-Tac while it increased at LALB. See Figure 5.

Figure 5 – Full TOFC/COFC Traffic from Chicago to USWC (index 2000 = 100%)



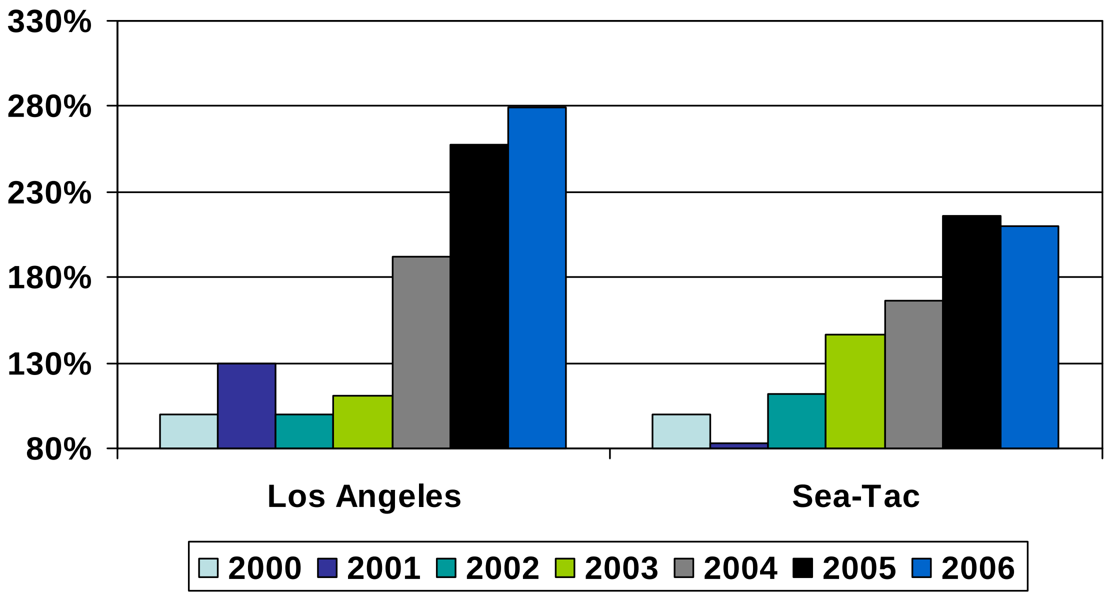
BST Final Comment: The situation was even more pronounced for westbound empty containers. Figure 6 illustrates the relative rail rate increases for empty westbound containers from Chicago to the US West Coast. Rates from Chicago to the Los Angeles area were increase approximately 3% between 2000 and 2006, while rates to Sea-Tac were increased by nearly 30% over 2000 levels.

Figure 6 – Relative Rail Rates Chicago to USWC ($/empty TOFC-COFC unit; index 2000 = 100%)



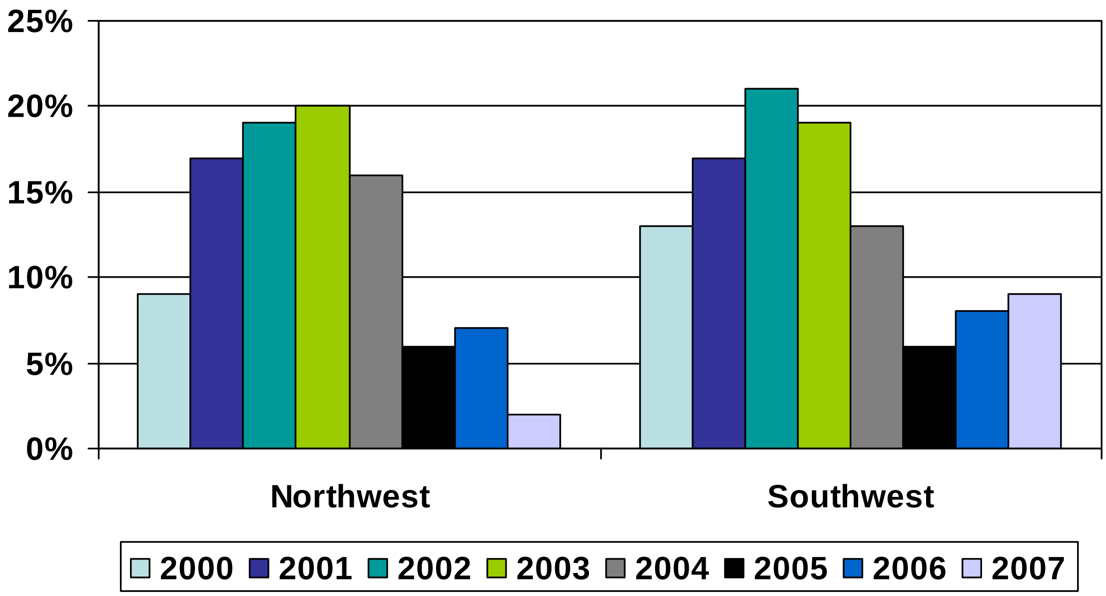
BST Final Comment: The resulting impact on westbound empties is shown in Figure 7. Westbound empties from Chicago bound for LALB were up 180% over 2000 levels while empties bound for Sea-Tac were up only 110% over 2000 levels but actually fell in absolute terms between 2005 and 2006.

Figure 7 – Empty TOFC/COFC Traffic from Chicago to USWC (index 2000 = 100%)



BST Final Comment: The railroads have largely accomplished their goal of balancing rail traffic, as show in Figure 8. Imbalances were 15% to 20% during the period 2001 and 2004. Now the bidirectional imbalances are under 10%.

Figure 8 – Rail Unit Imbalances via US Southwest and Northwest Port Regions (% imbalance)



Specific Assessment of the Leachman Model

We have the following specific questions and/or comments about the Leachman report.

- We understand the need to protect confidential data but there are several conclusions or public data inputs that are not sufficiently documented. This makes it difficult to validate study inputs, as well as results.
    - We request the actual numbers on elasticity that underlie Figure S-2 in the Puget Sound report and Figure S-3 in the San Pedro Bay report. A spreadsheet with the values would be appreciated.

Dr. Leachman's COMMENT: I have enclosed such a spreadsheet with this mailing.

BST Final Comment: Received.

- How long is long run and how long is short run? The model purports to be long-run but apparently uses current published rates. Leachman says that in the long run everything that is intermodal is discretionary, but more discussion on this issue should be provided.

Dr. Leachman's COMMENT: As explained in the report, "long run" and "short run" refer to the suitability of the model for supporting long-term and short-term decisions, not to particular time frames for evolution of trade flows. In the Long-Run model, service quality at other ports is assumed to be fixed, even when substantial volumes are diverted to those ports. The idea is that investments or fees in the home port need to be justified even if other ports make changes to accommodate more market share at current service quality. Since decisions about investments in infrastructure have very long-term implications (e.g., 20-30 year bonds), this assumption is prudent to support such decision-making.

BST Final Comment: There is an uneven (or differential) rate of terminal and inland rail development at alternative corridors. This could create congestion at individual ports and present an opportunity or constraint for competitors.

- Leachman developed a transportation cost matrix using 10 ports (only 9 appear in the text of the report):

Row	Ports	Assumed trans-load warehouse site
1	Vancouver, BC.	Abbotsford, BC.
2	Seattle-Tacoma, WA.	Fife, WA.
3	Oakland, CA.	Tracy, CA.
4	Los Angeles – Long Beach, CA.	Ontario, CA.
5	Houston, TX.	Baytown, TX.
6	Savannah, GA.	Garden City, GA.
7	Charleston, SC.	Summerville, SC.
8	Norfolk, VA.	Suffolk, VA.
9	Port of New York – New Jersey.	50% East Brunswick, NJ and 50% Allentown, PA.
10		

- Is the 10^{th} Prince Rupert? Is it reasonable to assume that rates for Prince Rupert are similar to those for Vancouver BC? We assume that more attractive rates have been offered at Prince Rupert in order to attract COSCO.

Dr. Leachman's COMMENT: The above table shows only the ports with economically practical trans-loading services available to use in connection with consolidation – de-consolidation inventory strategies, not all ports included in the model. (Consolidation – de-consolidation of Asia – US imports is not economically feasible via Canadian ports because of the need to pay double customs duties.) Two other ports included in the analysis are Prince Rupert and Lazaro-Cardenas. Prince Rupert has very competitive IPI rates to Chicago and Memphis that were included in the analysis. Rates to other points from Prince Rupert also were included. LC has rates and service somewhat competitive to Texas and southeastern points. These also were included.

BST Final Comment: 11 port areas were examined.

- Leachman's model develops costs for 21 US regions. How are these regions defined, and do they make sense? What is the build-up for these regions – counties, MSAs, BEA regions? This should be specifically provided and mapped.

Dr. Leachman's COMMENT: Each region is represented as a single location where all Regional Distribution Centers (RDCs) serving that region are assumed to be located. The distribution of goods from RDC to retail outlets within each region is common to all logistics alternatives. Thus the build-up and mapping of regions are irrelevant. The choice of locations for RDCs in the model reflects actual current practice at several large US retailers. For ease of reference, I repeat from the report the definitions of regions:

BST Final Comment: These regions appear reasonable but it would be useful for the reader to have them better defined. Our goal in providing a peer review was to verify or compare estimates where possible. The documentation in the report does not allow this to be accomplished.

1	Atlanta	Atlanta Region – including Alabama, Georgia and 50% of Florida. Regional distribution center assumed to be in Duluth, GA.
2	Baltimore	Baltimore Region – including Maryland, DC and Delaware. Regional distribution center assumed to be in Frederick, MD.
3	Boston	Boston Region – including Rhode Island, Massachusetts, New Hampshire, Vermont and Maine. Regional distribution center assumed to be in Milford, MA.
4	Charleston	Charleston Region – including 50% of South Carolina. Regional distribution center assumed to be in Summerville, SC.
5	Charlotte	Charlotte Region – including North Carolina and 50% of South Carolina. Regional distribution center assumed to be in Salisbury, SC.
6	Chicago	Chicago Region – including Illinois, Indiana, and Michigan 50% of Wisconsin. Regional distribution center assumed to be in Joliet, IL.
7	Cleveland	Cleveland Region – including 50% of Ohio and 25% of New York. Regional distribution center assumed to be in Chagrin Falls, PA.
8	Columbus	Columbus Region – including 50% of Ohio. Regional

		distribution center assumed to be in Springfield, OH.
9	Dallas	Dallas Region – including Oklahoma and 50% of Texas. Regional distribution center assumed to be in Midlothian, TX.
10	Harrisburg	Harrisburg Region – including 50% of Pennsylvania. Regional distribution center assumed to be in Allentown, PA.
11	Houston	Houston Region – including Louisiana, Mississippi and 50% of Texas. Regional distribution center assumed to be in Baytown, TX.
12	Kansas City	Kansas City Region – including Kansas, Nebraska, Iowa and Missouri. Regional distribution center assumed to be in Lenexa, KS.
13	Los Angeles	Los Angeles Region – including Arizona, New Mexico, 66% of California, 67% of Nevada, 33% of Utah, and 50% of Colorado. Regional distribution center assumed to be in Ontario, CA.
14	Memphis	Memphis Region – including Arkansas, Tennessee and Kentucky. Regional distribution center assumed to be in Millington, TN.
15	Minneapolis	Minneapolis Region – including North Dakota, South Dakota, Minnesota and 50% of Wisconsin. Regional distribution center assumed to be in Rosemount, MN.
16	New York	Minneapolis Region – including North Dakota, South Dakota, Minnesota and 50% of Wisconsin. Regional distribution center assumed to be in Rosemount, MN.
17	Norfolk	Norfolk Region – including Virginia. Regional distribution center assumed to be in Suffolk, VA.
18	Oakland	Oakland Region – including Wyoming, 50% of Colorado, 67% of Utah, 34% of California, and 33% of Nevada. Regional distribution center assumed to be in Tracy, CA.
19	Pittsburgh	Pittsburgh Region – including West Virginia and 50% of Pennsylvania. Regional distribution center assumed to be in Beaver Falls, PA.
20	Savannah	Savannah Region – including 50% of Florida. Regional distribution center assumed to be in Garden City, GA.
21	Seattle-Tacoma	Seattle Region – including Washington, Oregon, Idaho and Montana. Regional distribution center assumed to be in Fife, WA.
22	Toronto	Not included in study

- Leachman allocates imports to these regions based on purchasing power from US Dept of Commerce. This data (purchasing power by region) should be provided in the report. We have used retail sales, population, income and employment in other analyses and found little overall variation. However, using purchasing power may introduce income elasticity effects, specifically if higher income groups avoid the big box retailers. This could occur in New York, for example, and may lead to a misallocation of import containers.

Dr. Leachman's COMMENT: See Table 6 in the report. My opinion is that income elasticity differences from region to region are negligible. The big-box retailers are well-patronized in all regions of the country. Moreover, the import strategies of the big-box importers have been adapted recently to supply chains involving wholesalers and smaller retailers.

BST Final Comment: We understand the reasons for the assumption but it could be tested empirically.

- Imports were allocated to 8 US regions in the San Pedro Bay Report. The split is based on 1996 data from the 1998 *Long-Term Cargo Forecast*.

Dr. Leachman's COMMENT: The allocation of the imports to regions in the 2005 report was solely for the purposes of studying discretionary traffic. It had nothing to do with the Elasticity Model. In the Elasticity Model there is no allocation of imports to regions based on 1996 data. Imports are allocated to destinations solely based on 2005 purchasing power statistics for the 21 continental US regions as defined above.

BST Final Comment: Understood.

  - How were imports allocated to the 21 destinations, and why use such old data?

Dr. Leachman's COMMENT: See above comment.

BST Final Comment: Understood.

  - We concur with the difficulty of using PIERS data but question how the theoretical allocation of imports by purchasing power is ground-truthed with other data that reflect actual practices? More discussion on this aspect would be helpful.

Dr. Leachman's COMMENT: The predictions of the model in terms of import strategies practiced by individual retailers correlate well with actual practice.

BST Final Comment: Again, our goal in providing a peer review was to verify or compare estimates where possible. The documentation in the report does not allow this to be accomplished.

- Import values (declared values) came from the World Trade Atlas (Global Trade Information Services). This database has a reported 99 commodity types. Is the data at 2-digit HS? If so, there may be some significant problems with weighted averages of value, cube and weight.
  - TEU volumes were developed from PIERS data
  - WTA value and PIERS TEU volumes were combined by commodity type. Again, is this 2-digit HS?

- Since PIERS commodity codes includes some codes that don't appear in the Harmonized System ("00"), the values of these were allocated to the other 99 categories based on a weighted average. Does it make sense to allocate them that way, or do the goods in this category fall primarily in a small number of the other categories?

Dr. Leachman's COMMENT: Please read page 21 of the report where the handling of the PIERS and WTA data is explained. The two-digit commodity codes in PIERS and WTA match except for one. It is important to account for all imports and have consistent totals of PIERS and WTA data. This is why an allocation of the mismatched code was necessary. In the end, only a single weighted-average declared value for each commodity code is obtained. As explained in the text, some of the codes are very aggregate, leading to an unrealistic, lumpy non-Pareto-like curve. I smoothed out each value category and re-summed; the resulting distribution is a Poisson-like or Pareto-like curve, which I strongly believe is the shape of the real distribution. This is my judgment.

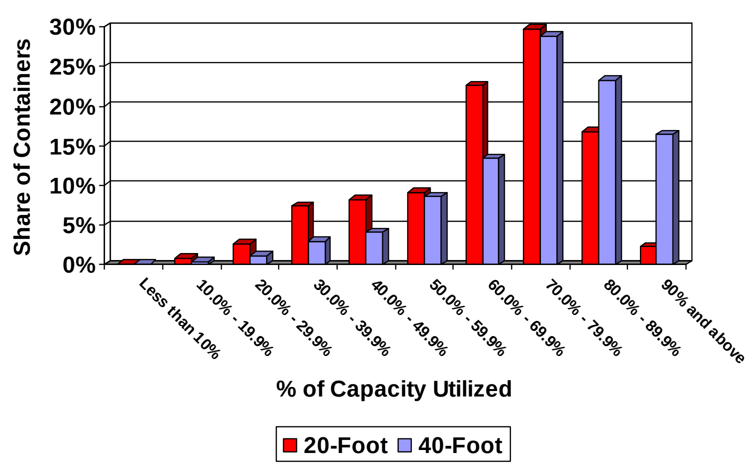
BST Final Comment: The lumpiness may be realistic which could impact model results.

- Leachman calculated a weighted-average container size (1,274.4 cubic feet per TEU) and applied that to all 99 commodity groups.
  - This is the capacity of the container, not the volume of the commodity.
  - Why not use the container size field from PIERS? Why not use the containerized volume field from PIERS?

Dr. Leachman's COMMENT: I only have TEU totals for each commodity in the PIERS summaries that I receive. But I doubt such detail could have any significant impact on the analysis.

BST Final Comment: Perhaps it would have no impact. However, our concern remains that it may lead to an over-estimate of low cube transloadable cargo.

Figure 9 – Percent of Container Capacity Used in 20- and 40-foot Containers[1]



[1] Sorce: 2005 PIERS data for the Ports of LA and LB

- Figure 9 suggests that most cargo does not cube out. By using the $/cu ft of the container, the impact of transportation charges on product value may be understated. However, this may be partially compensated for by using low value and high value products.

Dr. Leachman's COMMENT: What matters is the $ per cu ft of container capacity that is shipped, not the $ per cu ft of actual imports.

BST Final Comment: The transportation cost using $ per cu ft of cargo would likely be higher than using the container capacity. This could result in larger impacts from unilateral imposition of fees.

- Leachman presents the TEU volumes by declared value per cubic foot, in $4.00 increments. It is a lumpy graph, but on Page 52 of the San Pedro Bay report Leachman states that the real distribution must exhibit a Pareto or Poisson-like shape.
    - Why must it be smoothed? Smoothing could also under-estimate the impact of transportation charges on lower valued cargo.

Dr. Leachman's COMMENT: See comment above. I do not believe the smoothing has any impact whatsoever of low-valued cargoes.

BST Final Comment: Perhaps and perhaps not.

-
    - Aren't there distinct groups (i.e. furniture, clothing, electronics) that account for most of the containerized imports? There are different rates for these products.

Dr. Leachman's COMMENT: See Table 1 for the contributions of the top 15 commodities. Transportation rates paid by major importers generally are not distinguished by commodity.

BST Final Comment: Is this true for smaller importers? Our point here is that the ocean rates are averages and could have more or less impact on specific importers. According to the Leachman report, large importers account for around 3.8 million TEUs (page 26). However, there were 13.5 million TEUs from Asia (Chins, NE Asia and SE Asia) in 2006. Large imports thus only accounted for 28% of the Asian import trade. Our question focuses on whether the model relies too much on large importers and thus under-estimates the impacts from imposition of fees.

- Leachman states that retail values are roughly double the declared values. What is the basis for this? Table 1 shows that the retail sales in shoe stores are 46% higher than the duty value of imports. Since 98% of shoes are imported this is a useful example of the ratio of sales to import value.

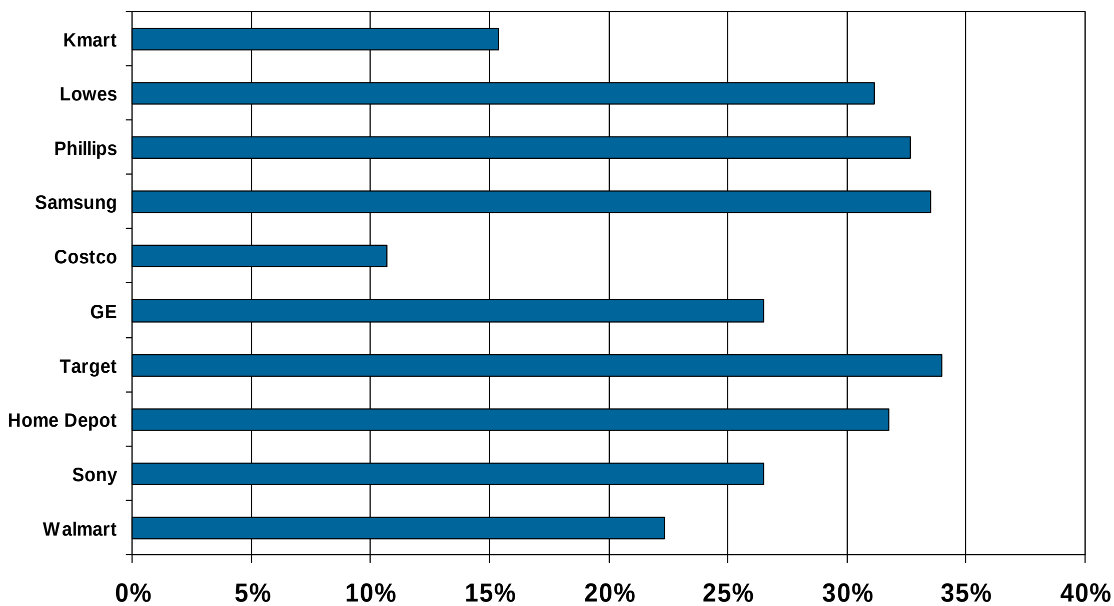
Table 1 – US Shoe Store Sales in 2006

	Millions
Shoe Store Sales	
Total Retail Sales	25,488
Import Value	17,493
Sales ratio to Import Value	146%

Dr. Leachman's COMMENT: My statement said "roughly double". It is general long-standing practice that retail prices are roughly double wholesale prices. This comment is not really part of model development. What matters is how importers value pipeline and RDC inventories compared to declared values. Please read page 20 to ascertain the assumptions that are made.

BST Final Comment: We agree that this is the traditional concept but wonder if introduction of big-box retailers with slim margins are putting additional pressure on rate differentials. Major retailers have a relatively small margin to operate with – between 11% and 34% of the value of sales (see Figure 10). The main method to create profits has been by squeezing transportation costs.

Figure 10 - Margin between Sales & Costs of Goods Sold



- Should the retail value be used instead of import duty value?

Dr. Leachman's COMMENT: Please read page 20. Pipeline and RDC inventories are valued at levels intermediate to declared value and retail value. This is consistent with practice in actual large retailers I have met with.

BST Final Comment: Understood with reservations.

- Inventory costs for the top 83 importers of containerized Asian goods were modeled. These top 83 importers accounted for just 32% of US containerized imports from Asia.
    - o Leachman estimated the average declared value for each of these firms based on PIERS and interviews.
    - o PIERS numbers were adjusted to estimated actual numbers by adding 10%. However, Target apparently reported that their imports were under-reported by PIERS (330,000 TEU actual vs. 202,000 reported), so why use 10%?

Dr. Leachman's COMMENT: My judgment. Other importers reported the PIERS numbers were closer to their actual figures.

BST Final Comment: Understood with reservations.

- o The remaining 68% of import volume was divided into 19 increments of cubic-foot values, ranging from $2.00 per cubic foot to $70.00 per cubic foot, in $4.00 dollar increments. This is a big assumption and distribution in the smoothed manner may overstate the value of the cargo.

Dr. Leachman's COMMENT: No. Please read report carefully. Remaining import volume was assigned to the value categories such that the overall distribution, including the large importers, matched the smoothing of the actual overall value distribution in Figure 1.

BST Final Comment: Understood with reservations.

- o We agree with the use of the inventory carrying cost but are not exactly sure how it was done in the model.

  a. Low value products incur a 20% carrying cost. High valued products can carry up to a 50% carrying cost. However, it is not known what specific rates were used.

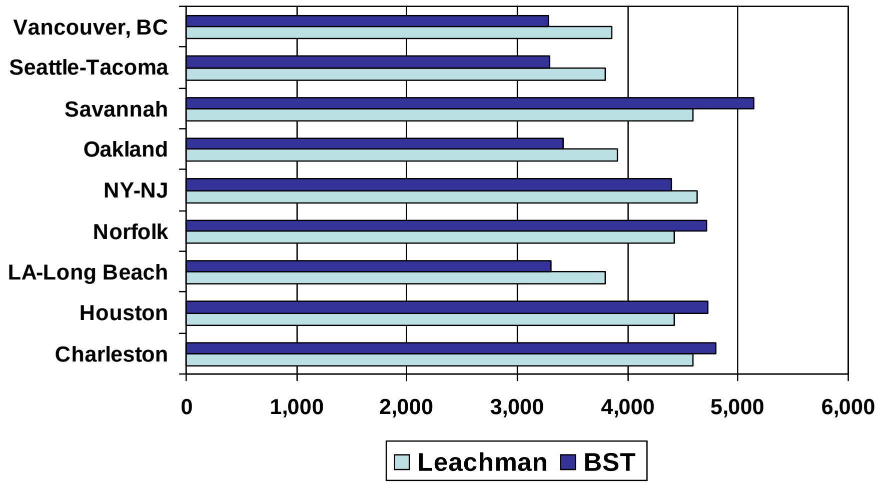
Dr. Leachman's COMMENT: 50% carrying costs apply only to electronics and fashion goods importers. For all others, 20% is assumed.

BST Final Comment: Understood.

  b. We assume that the number of days of the trip is divided by 365 days times the value of the product times the carrying cost rate. As an example, a low valued product via Seattle to Chicago would incur 29 days (23 mean lead time plus 6 day transit time)/365 times $15/cu ft times 20% = $.24/cuft or $613 per 40 foot container carrying cost.

- Transportation costs (Leachman) were modeled based on stated tariffs and confidential data from interviews. It is unclear exactly what source was used. As a crosscheck, BST Associates compared the rate per container with other sources of data (Drewry for ocean & port charges, plus STB data for rail rates to Chicago). There is a significant difference between the Leachman and BST estimates. BST is 10% to 15% lower for West Coast intermodal to Chicago and 5% to 10% higher for East Coast intermodal to Chicago.

Figure 11 – Comparison of Transportation Rates from Shanghai to Chicago via Selected Gateways ($ per 40 foot container)



Dr. Leachman's COMMENT: I stand by my rates. They reflect actual contracts and quotations used in the trade. I suspect rates BST obtained for imports via the West Coast are lower because they do not include destination dray, and there may be differences in fuel cost recovery surcharges. I suspect rates BST obtained for imports via the East Coast are higher because large, nation-wide importers have negotiated better rates than are offered to other customers.

BST Final Comment: Our sources are updated annually and represent another basis for assessing rates. It is unclear how close the confidential contract rates paid by larger importers are to the rates charged to smaller importers, who represent the majority of imports.

- Leachman indicates that long-term rail contracts are ending, and as a result some steamship lines are seeing rail rates increase by 25% to 40%, which leads to a lot of disparity in IPI rates. Leachman also indicates that rail rates do not include charges for repositioning equipment.
    - Anecdotal information suggests that new intermodal rates (to the Midwest) favor Los Angeles and Long Beach over Oakland and Puget Sound. This differential is said to partially explain the shift of cargo back to Los Angeles and Long Beach in 2006 and 2007.

Dr. Leachman's COMMENT: No. The shift back to LA and Long Beach in 2006 and 2007 is due almost entirely to two factors: (1) Certain lines shifted vessel strings from LA-LB to Seattle-Tacoma for the 2005 shipping season as a response to the 2004 meltdown at LA – Long Beach. Because the 2005 shipping season at LA-LB was much improved, the lines shifted the strings back to LA-LB for the 2006 season. (2) The rail rates taking effect in 2006 and 2007 require lines to balance inbound and outbound rail container flows at each port area. This forced many more empties and export containers to shift from Seattle-Tacoma to LA-LB in 2007.

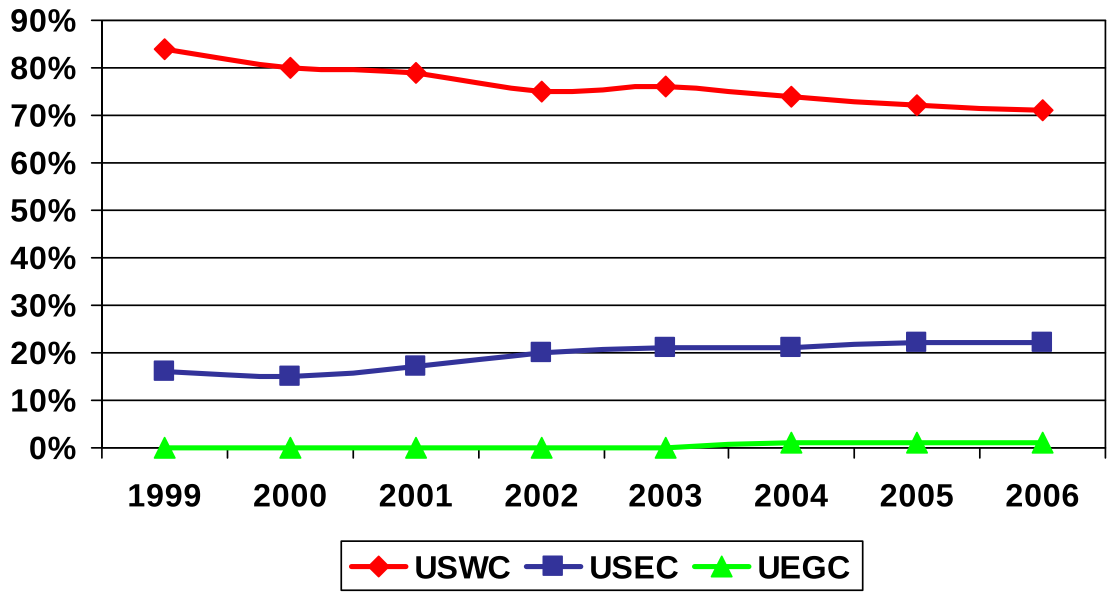
BST Final Comment: Our point is that these shifts occurred due to differential rates as described above.

- A recent article in The Journal of Commerce suggests that increased US West Coast intermodal rail rates have led to a shift to all water services[2].

Dr. Leachman's COMMENT: Not clear. Panama Canal costs are way up for the steamship lines, so they have sharply raised all-water rates. I think on balance the all-water market share has not changed appreciably.

BST Final Comment: Ocean rates for all water services have increased significantly relative to USWC rates. Despite this, market share has continued to increase. It is constrained by Panama Canal capacity at the present time but this will change in the long-run. Also, new services using the Suez are coming on line. See Figure 12.

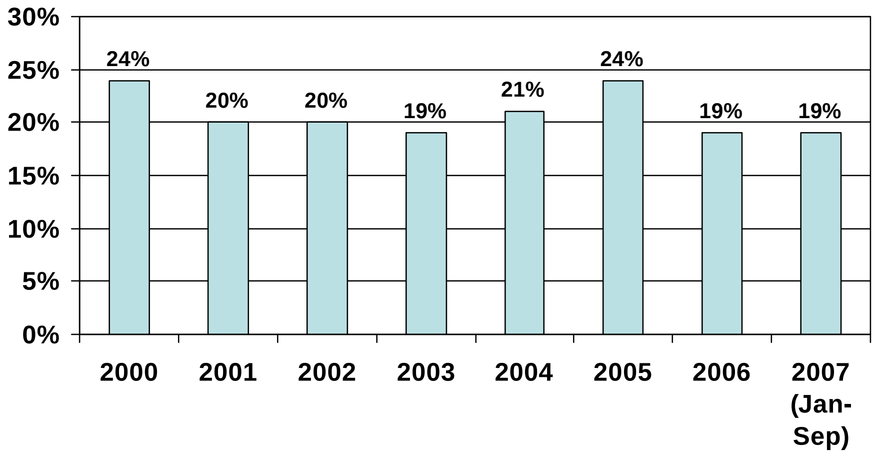
Figure 12 – Market Share of US Imports from China



2 December 17, 2007, page 46

- As shown in Figure 13, Puget Sound ports gained market share in 2004 and 2005 and then lost share in 2006 and 2007 YTD. This illustrates the sensitivity of imports to rate differentials.

Figure 13 – Puget Sound Share of West Coast ISO Boxes bound for the Midwest[3]



Dr. Leachman's COMMENT: No. It illustrates the sensitivity to port congestion and to the new requirement to balance westbound and eastbound container flows at each port. The meltdown at LA – Long Beach in summer of 2004 caused the shift up to Seattle – Tacoma. The success of PierPASS caused the shift back. The new requirement from the railroads for balanced flows caused a further shift of westbound containers. It was not an issue of significant rate differentials, unless one insists on referring to the penalties for imbalanced flows as "rates".

BST Final Comment: We are not insisting but we think that changes in rates and capacity can shift cargo quickly.

- Diversification of supply chains as a hedge against port risk is not considered. Leachman states that the value of risk mitigation due to using multiple ports may more than offset proposed container fees.
    - Isn't this what is happening in the shift of containers to Vancouver and Prince Rupert as well as East/Gulf coasts and perhaps Mexico in the future?

Dr. Leachman's COMMENT: I was speaking primarily about large importers practicing consolidation – deconsolidation at multiple ports. They choose ports of entry and make investments in import warehouses. Diversification is important to them and it is something they can control. For importers using IPI services to direct-ship marine boxes to inland RDCs, they have little control over port of entry. So in that case diversification of ports is something of value to, and controlled by, the lines rather than the importers. My opinion is that the lines are not pursuing diversification to the extent that large importers are pursuing it. Expansion into Prince Rupert and Mexico is not being driven by the lines. Instead, the lines are being solicited to do it by port developers and landside carriers serving those new ports.

BST Final Comment: This has the same effect.

[3] The source for this data is IANA and includes Western Canada, Pacific Northwest (Washington and Oregon) and Pacific Southwest (California)

- Leachman says that for small importers, ones with few destinations, or for low-valued commodities, transloading does not make sense.
    - Some third-party logistics providers serve the smaller importers. It is unclear what criteria are used to determine large versus small shippers.

Dr. Leachman's COMMENT: It is not a matter of capital facilities. In fact, all the large importers outsource trans-loading to third parties. The issue is having sufficient volume to do the 5-to-3 re-packing of the contents of marine boxes into domestic boxes without having half-box-loads left over. See page 26 of the report. My rule-of-thumb is at least 10 TEUs per week to each RDC during the off-peak season is required to practice consolidation-de-consolidation. Because some wholesalers are now practicing this strategy, with their retail customers playing the role that RDCs do in a large importer, the trans-loading practice has expanded to embrace smaller importers.

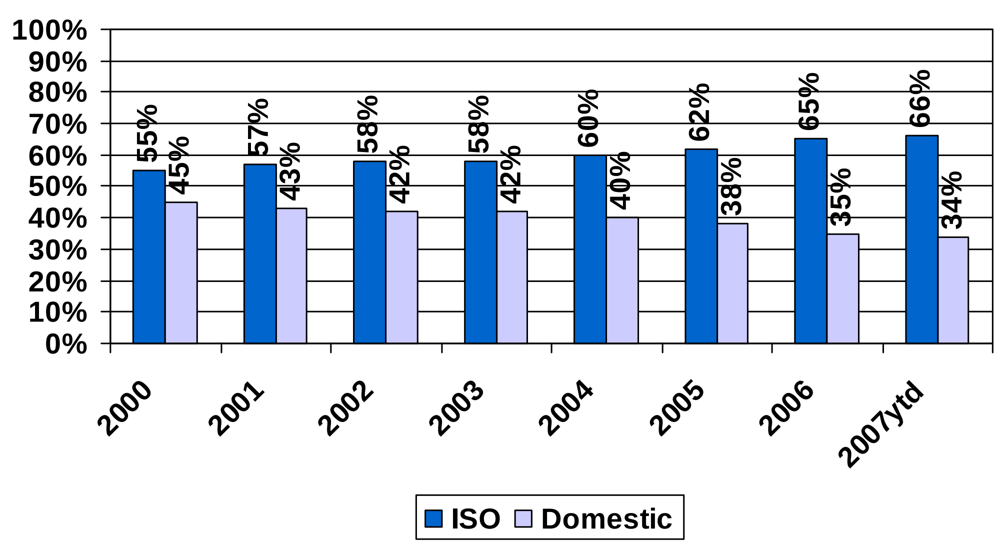
BST Final Comment: Understood but the viability of transload also has to do with the cargo characteristics (low cube can take better advantage of transload than cargoes that weight out).

- As a result, for the 19 proxy groups (68% of imports) transloading does not make sense, so they are assumed to be 100% IPI intermodal. Does that make sense? The decision by Maersk and Cosco to reduce inland points may increase transloading. However, there is little anecdotal evidence that this is occurring yet?

Dr. Leachman's COMMENT: I watch IANA and port data closely. As of mid-2007, trans-loading had not picked up significant market share of Asian imports USA-wide. But I believe its market share grew in the second half of 2007 and will continue to grow in the coming years. As a percentage of total import volume through the Ports of Seattle and Tacoma, trans-loading has picked up substantial share since 2005.

BST Final Comment: The jury is still out. We don't see any see any growth in transload through October 2007.

Figure 14 – IANA Data for Southwest Region Eastbound



- The model assumes that 50% of shipping occurs over three months in late summer & early fall. Why is that?

Dr. Leachman's COMMENT: This was merely a comment in the 2005 report. Traditionally, this shipping peak was the case, reflecting the dynamic pattern of US retail sales over the year. But the peak has substantially smoothed out in recent years. The build-up starts earlier, and the increased use of gift coupons has spread sales into January and February. Actually, the model makes no such assumption about volume dynamics. The model is static.

BST Final Comment: Understood.

Appendix D.

Benefit-Cost Analysis Methods and Approach

Puget Sound Regional Council

Benefit Cost Analysis Methods and Approach

In coordination with Cambridge Systematics
For the Joint Transportation Committee, Washington State Legislature

Benefit Cost Analysis Methods and Approach

Table of Contents

1. Summary

The Puget Sound Regional Council (PSRC) has developed a set of procedures and methods for project and program evaluation that fall generally into the category of transportation benefit-cost analysis. The purpose of these methods is to be able to produce information about project or program performance relative to a baseline set of conditions where the project or program has not been implemented. Benefit-cost methods produce information about the relative magnitude of benefits and costs that accrue (over time) to society as a result of any given action.

The logic of the benefit-cost framework follows naturally from the underlying economic principles of a private-market oriented economy, but also is widely accepted in the context of public project selection. Indeed, in the State of Washington, statutory requirements to evaluate project benefits and costs give additional weight to using benefit-cost analysis as the central, organizing principle of an evaluation methodology.

The PSRC commissioned the development of custom benefit-cost accounting software from the consulting firm ECONorthwest. ECONorthwest was the prime author for the revised "A Manual of User Benefits for Highways, 2003" published by AASHTO and referred to as the "Red Book"[1]. The primary methods for estimation of user benefits that underpin the PSRC Benefit-Cost Analysis (BCA) tool are the same as those developed for the "Red Book", and those developed for a companion manual for estimation of transit user benefits.

2. Economic Analysis – Purpose and Approach

Compare Benefits with Costs

The purpose of benefit-cost analysis is to be able to compare the benefits associated with a policy or investment with the costs of implementing the policy or investment. If the sum of the benefits of the project or policy exceeds the costs then there is a general economic argument supporting the action to make the investment or implement the policy. In its broadest form benefit-cost analysis is a framework for social accounting, where any benefit or cost that can be measured and monetized is weighed against all other benefits or costs. In practice, benefit-cost analysis most often has to assume a more limited scope of review due to limits in available information supporting the estimation and monetization of all consequences of the proposed investments or policies. Happily, economic analysis of transportation projects is a well developed field, where the primary benefits accrue to the users of the transportation system and yield well to established methods of estimation.

Benefit-cost analysis can be used to guide decisions about the relative ranking, or prioritization, of numerous investment options, or can be used to determine the economic usefulness of making any given investments in the first place. Like any analysis technique, benefit-cost analysis is subject to numerous constraints, from the accuracy of the data used in the estimation process, to uncertainty about values to be employed in the analysis (either due to incomplete science or philosophical and ethical disputes). The purpose of analysis is not to resolve all such disputes, or eliminate uncertainty (and thus the need for judgment), but rather to provide a rich body of information assembled in a disciplined manner that can aid decision makers when faced with difficult investment or policy decisions. To this end, benefit-cost

[1] ASSHTO; A Manual of User Benefit Analysis for Highways, 2nd Edition

analysis must make key analytical assumptions clear, and must be able to demonstrate the sensitivity of its findings to modifications to these key assumptions.

Benefit-cost analysis is clearly the dominant evaluation methodology in economics generally, and in transportation specifically. The reason is that benefit-cost analysis is an extension of the principle that the purpose of any system to select among project and program alternatives is to improve the well-being of the community net of any burden on society's scarce economic resources.

In this setting, the well being of the community is used in the economic welfare sense; i.e., that the goal of human endeavor is to increase economic utility or welfare. These terms have formal, quantitative meaning in economic theory and are amenable to measurement, given appropriate data. In essence, the notion is that the economic welfare of the citizenry must be balanced against the burden placed on society's limited economic resources. In this use, the notion of economic resources includes not only human labor, energy, raw materials and man-made physical capital, but also the amenity value of natural resources such as clean air and water.

The logic of the benefit-cost framework follows naturally from the underlying economic principles of a private-market oriented economy, but also is widely accepted in the context of public project selection. Indeed, in the State of Washington, statutory requirements to evaluate project benefits and costs give additional weight to using benefit-cost analysis as the central, organizing principle of the evaluation methodology. Hence, the rest of this report proceeds with the assumption that benefit-cost analysis is the primary organizing principle of project and program evaluation and selection. This is appropriate given both the compelling case made by economic theory, and the nearly-universal adoption of this concept in modern market and governmental decision processes.

Accepting comprehensive benefit-cost analysis as the appropriate analytical framework solves most, but not all, of the problems of practical implementation of a project and program evaluation framework. Accepting this framework has several numerous practical, as well as theoretical, advantages:

- There is a large literature on how to treat almost all of the elements of a benefit-cost analysis, such as calculation of transportation project benefits, adoption of appropriate discount rates, etc.
- The fact that benefit-cost analysis uses monetary measures dovetails well with budgetary and financing issues, which are also in monetary terms;
- Formal methods have been established to deal with uncertainty in the decision environment;
- Formal rules of project prioritization and selection follow naturally from the benefit-cost framework.

Limitations of Benefit- Cost Analysis

Performing truly comprehensive benefit-cost analysis in a complex practical setting, however, introduces some empirical and policy challenges. Specifically:

- Benefit-cost analysis theory does not offer good guidance on how to balance net gains to one part of the community that come at the expense of net losses to another part of the community. In technical terms, benefit-cost theory does not tell the analyst how to make inter-personal comparisons; it assumes that if there are net gains to the community as a whole, that the community will devise a means of balancing, or effecting compensation between, "winners" and "losers". If, for some reason, such compensation schemes cannot be implemented or accepted, benefit-cost theory offers no guidance as to how to proceed.
- The requirement that all benefits and costs be monetized can be a challenge to comprehensive benefit-cost analysis in settings where difficult-to-value benefits or resources (such as amenity values) dominate the decision context at hand. Procedures should be developed to introduce estimates of such benefits. These procedures, involving such techniques as contingent valuation or

multicriterion weighting methods, should be built into the evaluation framework if they are deemed generally to be important.

- Project and program definition can be complex in a setting where project initiatives can be combined or staged in multiple ways. Benefit-cost analysis works best in setting where a project or program is compared against all, reasonable alternatives. To the extent that project elements can be combined in multiple ways, the number of alternatives can proliferate. This can leave the analyst with an unreasonable evaluation burden. Hence, methods should be employed to define and configure project alternatives in a way that does not (a) leave out the most valuable alternative or (b) dissipate analyst resources on alternatives with low value. Candidate project screening methods thus need to be adopted which, while operating on benefit-cost principles, are less demanding than comprehensive benefit-cost analysis, yet respect the analytical and budgetary context of the framework.
- The evaluation framework must fit well operationally, and organizationally, within existing organizational parameters. Although an organization such as PSRC may need to be prepared to modify its internal structure and resources to embrace an evaluation framework, it may be too costly or too cumbersome (relative to other organizational goals) to do so. In the PSRC context, for example, it is important to make the evaluation framework consistent with the existing modeling resources of the organization, because these are expensive to develop and are already embedded in other decision processes, and to take advantage of newer modeling resources as they become available through model improvement programs. This means that the evaluation framework should be adapted over time to make the most of available technical resources
- In an ideal world, all cost-beneficial projects would be implemented. In reality, budgetary, political, and organizational constraints limit the projects that may be implemented. Even if these constraints do not limit the set of projects perpetually, they impose timing or sequencing constraints that have the same conceptual effect.

For the purposes of the PSRC application of the BCA tool, there are some general limitations in the application:

- It does not trace the “capitalization” of user benefits throughout the economy (it measures initial demand, not final demand).
- It does not solve for “social weighting” of benefits/costs that accrue to specific segments of the economy (distributions among user groups).
- It requires explicit treatment of a social discount rate that may not reflect all perspectives on inter-generational distribution issues.

There are also some specific limitations in the BCA tool:

- It is limited by the data produced by the travel models, and modeling assumptions.
- It does not explicitly treat seasonality of traffic/travel.
- There is limited knowledge about some long-run dimensions of costs (i.e. emissions).

What Are Costs and Benefits

Most of the economic benefits of transportation improvements result from travel time and cost savings to transportation system users, such as reductions in travel time (time savings), vehicle operating costs, accidents, and improvements in the reliability of transportation systems or services, quantified as reductions in travel time. Most of the other benefits from transportation investments are indirectly a product of these primary user benefits. For example, changes in land values in close proximity to a new transportation project are largely the result of the “capitalization” of the future stream of travel time benefits in real estate. Counting these changes in land value in addition to the travel time benefits to transportation system users would result in the double counting of the initial benefit. The benefits of transportation projects may be either positive or negative, as would be the case if travel times were to increase as a result of some intended action. This is potentially confusing terminology, as a negative benefit seems like an oxymoron. By convention the results of the investment are captured as benefits (whether good or bad), while the costs of the investment are limited to the actual costs (capital, operating, etc.) associated with implementing the project or policy.

Benefit-Cost Analysis Approach

The starting point for any analysis of transportation investments must involve a systematic means of estimating the project's effects on traffic and travel demand. The PSRC BCA tool was designed to make use of comprehensive databanks produced by the PSRC regional travel demand forecasting models. A project is characterized in the travel models' transportation networks for one or more analysis years, the models are run for both a build case (a network where the project has been implemented) and a base case (a network where the project has not been implemented). The PSRC BCA tool generates estimates of user benefits (travel time savings, travel reliability benefits, vehicle operating cost savings, and accident risk reduction benefits, and vehicle emission reduction savings) directly from mathematical transformations (consumer surplus calculations) of the differences between the build and base cases.

A number of complicating factors must be treated consistently in benefit-cost analysis. Typically, the benefits from transportation projects accrue over time, while the costs may be largely front-loaded. Any investment or policy where benefits and costs accrue over notably different time frames must explicitly treat the time value of money. This is done through the use of a social discount rate that reduces all future values to their present value equivalents. Also, travel models generally produce information about "average" conditions; PSRC models an average weekday condition for a particular future year. Since benefits from transportation projects will not be limited to a single weekday, expansion factors must convert the average weekday benefits to annual values.

The basic steps in the benefit-cost analysis process are as follows:

1. Define the *Project Alternative* and the *Base Case*
2. Determine the level of detail required
3. Develop basic user cost factors (values of time, vehicle unit operating costs, accident rate and cost parameters, vehicle emission rate and cost parameters, etc.)
4. Select economic factors (discount rate, analysis period, evaluation date, inflation rates, etc.)
5. Obtain traffic performance data (for *Project Alternative* and *Base Case*) for explicitly modeled periods
6. Measure user costs (for *Project Alternative* and *Base Case*) for affected link(s) or corridor(s)
7. Calculate user benefits
8. Extrapolate/interpolate benefits to all project years (unless all time periods are explicitly modeled)
9. Determine present value of benefits, costs

The PSRC BCA tool is entirely consistent with the steps presented in the "Red Book" and outlined above, where steps 1, 2, and 5 are handled directly in the PSRC regional travel demand models; steps 3 and 4 are user defined parameters in the BCA tool; steps 6 and 7 are internal processes of the Benefit-Cost Analysis Tool program; and steps 8 and 9 are implemented in a standard spreadsheet software package.

Regional Travel Modeling

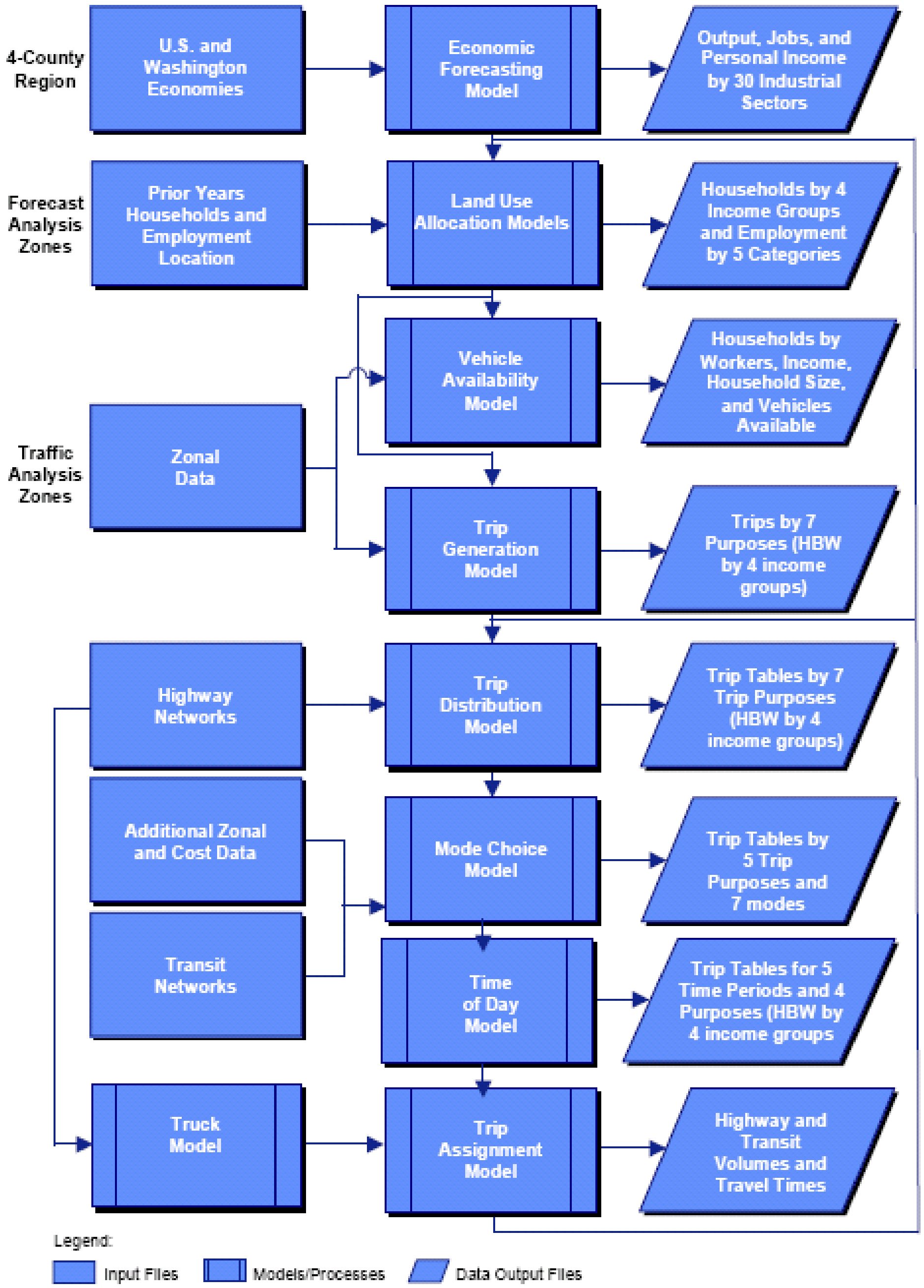
The PSRC regional travel model is structured around theories of micro- and macroeconomics, economic geography, and sociology, and is therefore an appropriate modeling setting for generating transportation performance data that is a primary input to the benefit-cost analysis process. Travel models are supplied with economic conditions, land use distributions, transportation system user revealed preferences, and transportation supply conditions. The travel models incorporate a number of discrete choice models that represent utility maximizing behavior, and assignment and feedback procedures that ensure a demand-supply equilibrium condition.

For example, the probability of a trip maker choosing a mode of travel is a function of the "utility" of that mode versus the aggregate utility of all available modes. Borrowed from the microeconomics theory of consumer behavior, a utility function measures the amount of satisfaction one receives from the consumption of a certain good; in this case, the use of a particular mode of travel. The linear utility function of each mode is composed of variables describing the characteristics of the alternative and those of the decision-maker.

Assigning trips to transportation networks involves procedures that are likewise consistent with a framework for producing measures of user benefits. The highway assignment uses an equilibrium procedure to assign carpool and non-carpool trips to the roadway network for different time periods. This is a user optimal procedure that is based on the assumption that each traveler chooses a route that is the shortest time (and cost) path. See *PSRC Travel Model Documentation (for Version 1.0)* for more details on the PSRC Travel Models[2]. Figure 1 below displays the various elements of the PSRC Travel Models.

[2] http://www.psrc.org/data/tdmodel/model_doc(final).pdf

Figure 1: Land Use and Travel Demand Forecast Process



4. Benefit-Cost Analysis Methods

Comparison against a Baseline

The conceptual framework for estimating the economic benefits from transportation improvements is relatively straightforward. Measuring benefits requires that each project or policy being considered be compared against some alternative scenario. The alternative scenario, or counterfactual, is a state of the world without the improvement (that maintains current transportation system conditions into the future), or a state of the world with some alternate improvement project. To conduct the benefit-cost analysis, benefit and cost levels are estimated for the two different scenarios. The differences in costs and benefits are the economic impacts linked to the project.

It is very hard to measure the total benefits that a transportation alternative generates; in general, we must be content with measuring how it performs relative to some base case ("marginal analysis"). This seeming limitation is actually an advantage:

- Marginal analysis forces one to articulate the key, distinguishing features of the new policy or investment.
- Where alternatives cannot be distinguished from one another on a particular criterion, that criterion is irrelevant to policy choice and can be ignored.
- All behavioral models (such as those embedded in PSRC's regional travel demand models) are much more accurate if they report the effects of incremental changes rather than absolute values for a particular investment 30 to 40 years in the future.

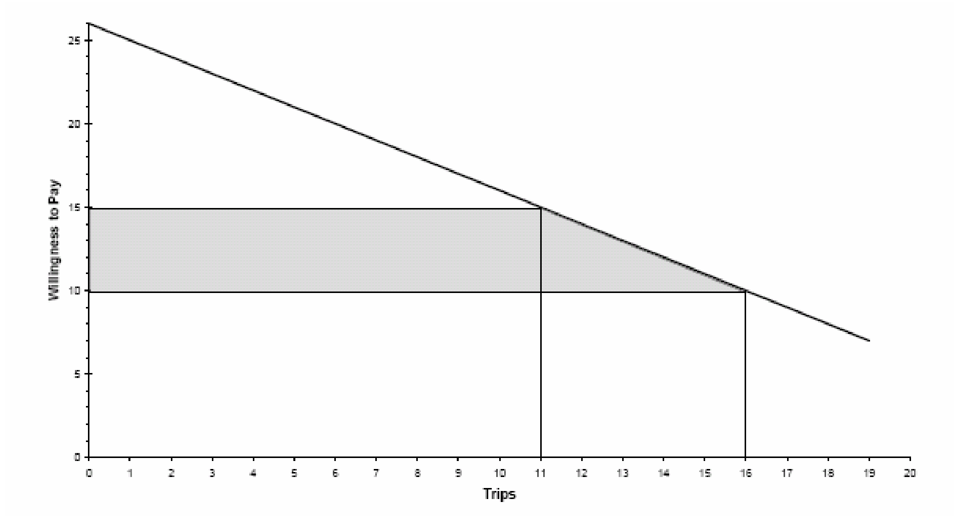
Measuring Costs and Benefits

Transportation investments provide benefits directly to users in the form of travel time savings, and reductions in other costs of travel. When the perceived costs of a trip are reduced consumer surplus increases. As travel times are reduced between any origin and destination, users already making this trip enjoy lower costs while new users (for whom the willingness to pay was less than the old cost of the trip) now take advantage of a travel opportunity that was not attractive to them before. This leads to a simple approach to calculating the benefits of the improvement: simply subtract the consumer surplus without the improvement from the consumer surplus with the improvement. To do so, we need to know only two things:

• The willingness-to-pay (demand) relationship that is involved, and
• The effect of the improvement on the users' perception of his/her cost of travel.

We don't have to know very much about the willingness-to-pay relationship to implement this procedure. All we need to know is the effect on additional travel of a change in travel costs. A simple example is illustrated in Figure 2. Figure 2 depicts willingness to pay at various trip levels, and allows calculation of the consumer surplus without the project improvement (when the cost per trip is 15 cents per trip), and with the project (which reduces the cost per trip to 10 cents per trip). This calculation is implemented by taking the area above the cost line and below the demand curve. Note that for the existing trips, all we need to know to calculate the change in consumer surplus is the difference in the cost without and with the improvement (i.e., 15.0 – 10.0 = 5.0 cents per trip). For new trips the benefit calculation is approximated by one-half the change in trip cost times the change in number of trips.

Figure 2: Stylized Calculation of Consumer Surplus



$$B = (U_0 - U_1)\frac{(V_0 + V_1)}{2} = \Delta U \frac{(V_0 + V_1)}{2}$$

where:

U_0 = user cost without the improvement

U_1 = user cost with the improvement

V_0 = trip volume without the improvement

V_1 = trip volume with the improvement

This basic user benefit calculation can be made more detailed to recognize the major sources of user benefits: the savings in travel time, operating cost, reliability, and accident costs, and the consumer surplus that such savings generates. The user benefit calculation also incorporates induced traffic demand by incorporating traffic volumes with and without the project[3].

[3] ASSHTO; A Manual of User Benefit Analysis for Highways, 2nd Edition

$$B_{chst} = \Delta U_{chst}\left(\frac{V_{chst,0}+V_{chst,1}}{2}\right)L = (\Delta H_{chst} + \Delta OC_{chst} + \Delta AC_{chst})\left(\frac{V_{chst,0}+V_{chst,1}}{2}\right)L_s$$

where:

B_{chst} = user benefit to vehicle or user class c, at travel hour h, on link s, in project year, t

ΔU = change in per - VMT user cost

$\Delta H = H_0 - H_1$ = change in per – VMT (or per - user) valuer of travel time (without minus with)

$\Delta OC = \Delta OC_0 - \Delta OC_1$ = change in per - VMT (or per - user) operating costs (without minus with)

$\Delta AC = \Delta AC_0 - \Delta AC_1$ = change in per - VMT (or per - user) unreimbursed accident costs (without minus with)

V_0 = vehicles (or users) of class c in hour h without the improvement

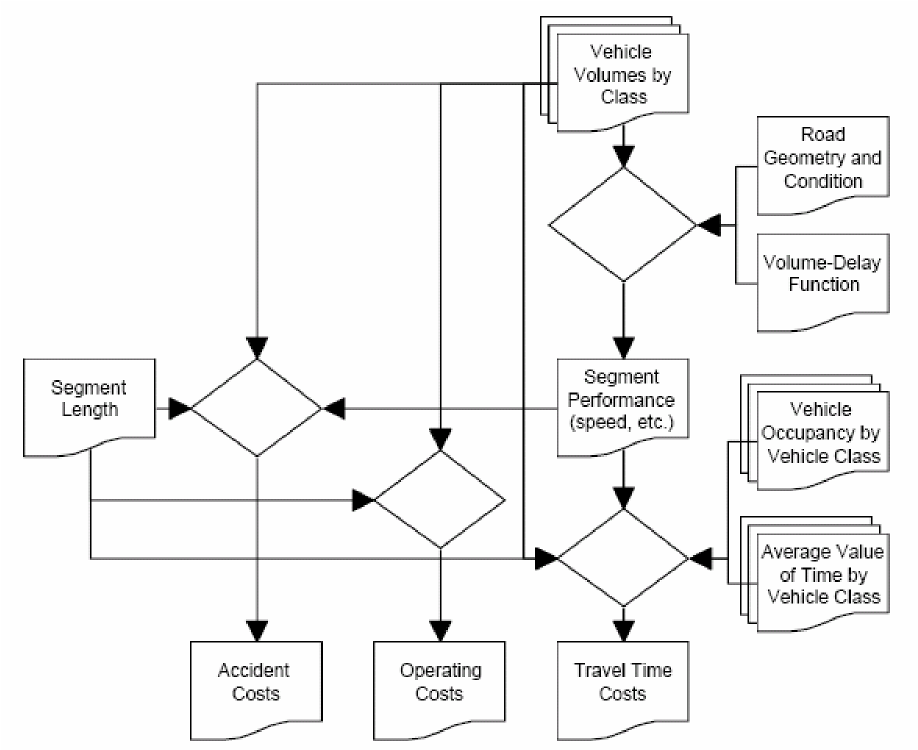
V_1 = vehicles (or users) of class c in hour h with the improvement

L = the segment or corridor length, in miles

It is important to note that projects have more than one type of user. As such the PSRC regional travel demand models and the BCA tool represent multiple user classes. These classes of users exhibit different values of time, or choose different modes of use, or are influenced by the improvement in a different way. In addition, the user benefits will vary with the time period of the travel day being modeled, the project year, and the segment or corridor affected by the project improvement. The proliferation of the number of user classes, facility segments, project years and travel times makes the accurate measurement of user benefits something that must be done using an organized accounting of all of the calculations, such as that which is implemented in the PSRC BCA tool.

The formula, above, is a basic building block of user benefit analysis; and therefore is simply referred to as the User Benefit Formula (UBF). The UBF is applicable to all user benefit calculations that involve changes in perceived user cost, and which play out over various origins and destinations or the various segments of travel corridors. It is general enough to be applied to analysis that is done by corridor, by road segment, by vehicle class or by user class. Figure 3 is a stylized representation of the relationships between dimensions of user costs and the segmentation of users and linkages to project characteristics (such as might be represented in the travel models).

Figure 3: Stylized Representation of the User Cost Linkages



In particular, the following project or program impacts are, typically, easily monetizable and are included in the PSRC BCA tool.

- Travel time savings. There have been many studies of travel-time savings that have established that the value of travel time saved is closely linked to the wage rate of passengers in autos and transit vehicles, and the wages paid to drivers plus the time cost of cargo inventory for commercial vehicles.
- Accident cost savings. The literature provides adequate guidelines on how to value mortality, morbidity and property loss consequences of accidents.
- Vehicle operating cost savings. There is an extensive literature, for vehicles of all types that can be used to relate changes in network performance characteristics to vehicle cost savings.
- Travel time un-reliability savings. These are the value of the benefits of improved reliability associated with the policy or investment. Reliability is the degree to which facility performance (speeds) vary from the mean or typical condition. A high degree of variation implies that there is a higher risk of experiencing particularly onerous conditions; low variation implies lower risks. The risk is translated into a "certainty equivalent", or willingness-to-pay for the reduction in risk. This is implemented in the BCA tool by correlating speed variances with average speeds that are produced by the PSRC regional travel demand model.
- Facility operating cost impacts. Facility operating-cost impacts are quite idiosyncratic with respect to the type of facility, the local environmental conditions, local labor and materials costs, etc. However, the Highway Cost Allocation studies, performed both by states and the federal government, provide useful information and models (of such thing as pavement and bridge wear, etc.) of such cost impacts.
- Facility capital cost impacts. Ex ante costing of highway and transit improvements provides adequate information on the capital cost side of benefit-cost analysis. There is high uncertainty

to these capital costs and, empirically, cost overruns have been common. However, benefit-cost analysis provides a means (through the use of sensitivity analysis and the use of risk premia incorporated in discount rates) to accommodate this uncertainty. In the State of Washington, this effort is aided considerably by the Washington Department of Transportation's (WSDOT) unique efforts to study construction cost variance on the highway side. The Transit Cooperative Research Program (TCRP) of the National Academy of Sciences (NAS) is soon to conduct a study of transit project cost variance.

- Vehicle emissions costs. There has been extensive study of the effects of various pollutants and noise emissions on the mortality and morbidity of populations, and the damage done to plants and property. In addition, there are engineering models of the effect of traffic conditions and vehicle vintage on emissions per mile. Therefore, air and noise pollution impacts generally can be monetized and directly incorporated in benefit-cost calculations.

Estimating Streams of Annual Benefits and Costs

Analysis of user benefits relies upon the modeling of the project improvements and base case within the PSRC regional travel models. In general practice, the models will be used to analyze more than one analysis year both with the project and without the project being implemented. This results in user benefits that pertain to the specific years of analysis. For example, a project that is scheduled for implementation in the year 2018 might be included in a year 2020 and year 2040 model network. These networks, compared to the year 2020 and 2040 baseline will yield benefits for each time period. For the purposes of benefit-cost analysis, these static benefits are then converted into streams of benefits over time, say for each year between the implementation year and some terminal year (e.g. 2018-2048). Various approaches to interpolation and extrapolation can be used to produce the necessary streams of benefits. Appropriate extrapolation methods depend upon the source of the single year estimates of benefits that may or may not already include growth in all day traffic, real income growth, and other factors that influence the growth of user benefits over time. For our purposes, where a sophisticated travel demand model is employed, simple interpolation and extrapolation rules are sufficient, and least subject to risks of unintentionally introducing estimation bias.

Discounting Benefits and Costs to Present Values

Streams of benefits, and costs, are needed in order to properly treat the time valuation of resources. Future benefits and costs must be converted into present value terms by applying an appropriate discount rate.

Present value calculations are important since society has the option of using the funds that are being dedicated to the project being evaluated for some other purpose instead. Spending resources on the project in question has an opportunity cost, which represent the benefits foregone by not making some alternative investment. Since financial markets tell us that we could always invest these resources with high probability of some known future returns on the investment (in a low risk security), future benefits and costs should be discounted relative to benefits and costs experienced today. This is another way of saying that foregoing consumption today must be compensated with an opportunity for higher levels of consumption tomorrow.

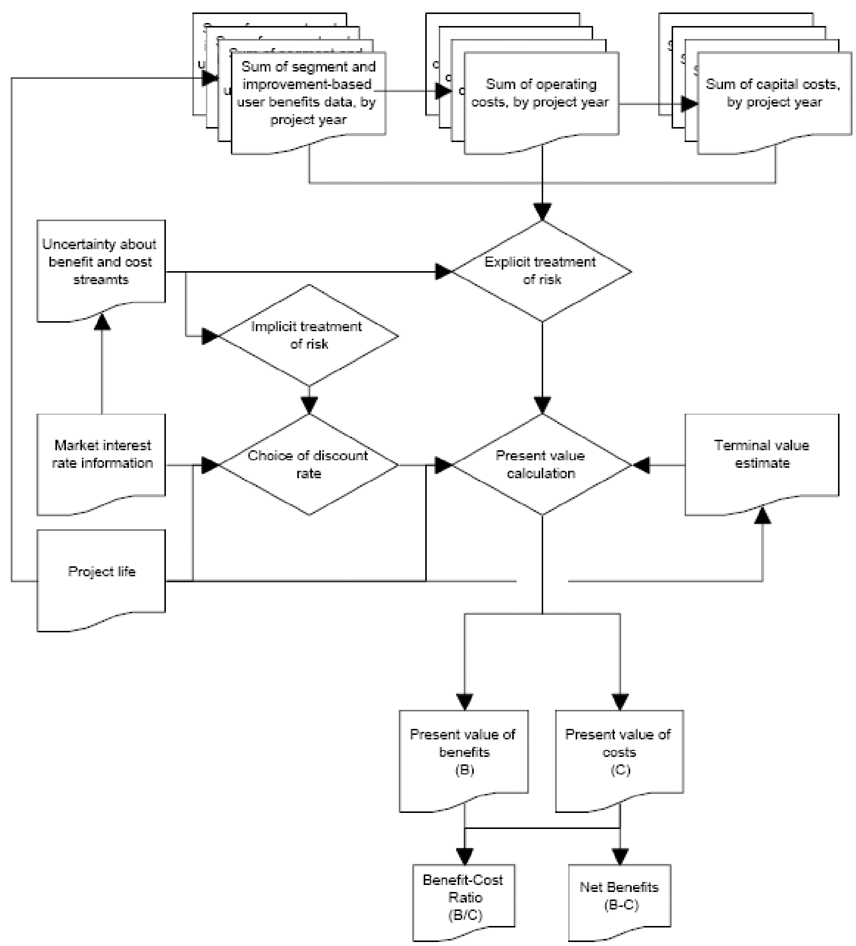
The choice of discount rate, the factor applied to future benefits and costs in translating them to present values, is an important assumption in any benefit-cost analysis. The "Red Book" has the following to say about the choice of discount rates:

> *When there is no risk or uncertainty about the stream of future benefits and costs, and the social rate of time preference is the same as the private rate, transportation projects should be discounted using the riskless interest rates that prevail in private financial markets. The reason is*

that public projects are taking resources away from private projects, and they should be permitted to do so only if they offer a commensurate return. A good choice for the discount rate, thus, is the riskless rate of return that financial markets are currently offering over the same horizon as a cost or benefit element.

Figure 4 is a stylized representation of the present value calculation process.

Figure 4: Stylized Representation of Present Value Calculations



Unit Cost Inputs and Other Parameters

A number of key assumptions must be made in order to develop estimates of the user benefits from transportation projects and programs. Many of these assumptions are themselves estimated from observations about behaviors or about prices determined through market transactions. Examples of assumptions about behavior that are important to the benefits-cost framework are the values of time for users of the transportation system. These values of time are estimated from observations about users' choices in the face of time and cost tradeoffs. A key issue is to ensure that the assumptions that are incorporated into the travel demand modeling of the performance of the transportation project or investments (such as users' values of time) are consistent with similar assumptions employed in the benefit-cost analysis. This is true for the PSRC BCA tool, as these important assumptions are taken directly from the travel model used to generate the project performance information.

Other important assumptions include unit costs associated with required resources or expected damages; for example, the costs of one ton of any given pollutant, where the pollutant may cause a range of damages including damages to structures, the environment, and human health. Appendix 3 includes tables of key assumptions that are included in the PSRC BCA tool, and their default values.

5. Description of the Baseline and Alternative Scenarios

Description of the Baseline Scenario

Action alternatives require a baseline for consistent comparison during an evaluation process. The baseline scenario is the counterfactual (what happens in the case of no action taken) and as a result is a point of departure for estimating benefit-cost results of build scenarios.

Determining what is "most likely to happen" absent new transportation efforts in the region requires careful judgment. There is a natural tension between two primary principles in deciding what is most likely: the baseline should be both realistic (in that it is not a "straw man" that assumes nothing is done) and conservative (such that any project or program that is a subject of ongoing deliberation is not included). By convention, a "current law revenue"[4] scenario is used as the basis of defining baseline conditions:

> "This package assumes a constrained list of transportation investments identifying only those projects/programs that can be implemented with existing revenue sources under current law revenue assumptions. The package also assumes the current pricing of travel, and implementation of local comprehensive plans with existing incentive and regulatory approaches in place. The Current Law Revenue package also utilizes population and employment forecasts through 2030."[5]

PSRC is applying similar assumptions during the 2010 regional transportation plan update process. Appendix 4 describes the baseline alternative for the 2010 update to Destination 2030, the Puget Sound region's long-range transportation plan, which was used as a base case for this analysis.

[4] Destination 2030 DEIS p. xiii
[5] Ibid. pp. 55-56

Appendices

Appendix 1: Benefit Cost Analysis and Least Cost Planning

The Washington State law pertaining to regional transportation plans that are prepared by Regional Transportation Planning Organizations (RTPO) was amended in 1994 to require "least-cost planning." Specifically, the language states that the regional transportation plan must be "based on a least-cost planning methodology that identifies the most cost-effective facilities, services, and programs" [RCW 47.80.030(1)]. This amendment was sponsored by Senator Drew, who was asked on the Senate floor about his intention in requiring RTPOs to institute a least-cost planning methodology. Senator Drew responded:

> *I recognize that least-cost planning methodologies for transportation are just being developed, will need to be assessed and will take some time to validate. My intent with this amendment is for regional transportation planning organizations to incrementally implement these methodologies as they are developed, and to be at the forefront in developing and testing these least-cost planning methodologies. . . . Since regional transportation plans are to be reviewed at least every two years, there will be opportunity for least-cost planning methodologies to be implemented for future plan updates. It is my intent that the Department of Transportation should recognize this intent in implementing this bill.*
>
> *Journal of the Senate, p. 540.*

In accordance with this intent, the Washington State Department of Transportation (WSDOT) has adopted regulations pursuant to RCW 47.80.070 to establish minimum standards for development of regional transportation plans. WAC 468-86-030 defines least-cost planning as "a process of comparing direct and indirect costs of demand and supply options to meet transportation goals and/or policies where the intent of the process is to identify the most cost-effective mix of options".

Least-cost planning is a set of methods developed for resource planning in the electric utility industry. The planning procedures are designed to help identify new resource development to meet future demand loads through the most cost effective means. Typically, least-cost planning generalizes the investments in new power generating capacity, or demand side control programs, in order to identify the mix of strategies that offer a cost-effective approach to future demand conditions. Specific resource investments are then designed, or acquired as particular opportunities arise. There has been some considerable interest in applying these practices to transportation planning. However, some significant differences between transportation and energy resource planning have made such a simple application to transportation difficult. For example, in energy planning benefits can be expressed in a constant unit of analysis (kilowatt hour), while this is not possible for transportation analysis. It is possible to overcome some of these limitations in the transportation arena, by defining least-cost planning as essentially a strategic planning exercise with benefit-cost analysis at its core.

Appendix 2: Regional Plan Update Evaluation Framework

The update to the region's long-range transportation plan (Transportation 2040), will involve a formal analysis of a range of plan alternatives, followed by a deliberative process that develops and selects a preferred alternative which becomes a defining element of the updated plan. This report outlines an approach to alternative analysis that integrates quantitative analysis (land use and travel modeling) with qualitative assessment (policy analysis). VISION 2040, the region's growth strategy, is the organizing framework for the evaluation; its goals, objectives and policies have guided the development of evaluation criteria and the organization of policy analysis.

An integrated analysis report (analysis of VISION 2040 policy and transportation evaluation criteria) outlines the process through which the alternatives studied in the Regional Transportation Plan and Environmental Impact Statement (EIS) will be evaluated[6]. The ultimate purpose of the evaluation is to inform the Puget Sound Regional Council's selection of a preferred transportation alternative and further development of a draft transportation plan that becomes the detailed transportation element of the region's growth, transportation and economic development strategy, VISION 2040.

The nature of the process is that the policy analysis and criteria include both quantitative and qualitative measures. The criteria are primarily the quantitative assessments that relate to a series of goals set forth in VISION 2040. In the absence of a comprehensive weighting of the measures, judgment will be key to the selection of a preferred alternative. Many of the quantitative measures that constitute the evaluation criteria are produced by a set of benefit-cost analysis methods that are tightly integrated with the PSRC regional travel models.

VISION 2040 provides the regional policy framework that the transportation plan should help to implement. Multicounty Planning Policies (MPP) adopted in VISION 2040 provide guidance, commitments, targets and additional direction applicable to the development of the region's transportation system. The multicounty planning policies provide an integrated framework for addressing the environment, development patterns, housing, economic development, transportation, and other public services and facilities. Transportation alternatives will be screened and then analyzed for the degree to which they support the overarching goals of the six major multicounty planning policy sections.

PSRC staff has worked closely with staff from agencies around the region, and with groups of elected and civic leaders, in the crafting of Draft Transportation Plan Alternatives that will be analyzed during the environmental review and plan development processes. Construction of the draft alternatives began by defining a baseline which includes both existing transportation facilities plus future transportation investments that can be implemented with funds available through currently authorized transportation revenue instruments. Delineation of other draft alternatives occurred through the addition to the baseline of different transportation tolling/pricing strategies. Guided by the VISION 2040 goals and policies, the analysis results, and professional judgment, additional "near term" strategies (system management, transit, and demand management strategies) were added to each alternative, and "long term" strategies for investments in capital expansion were identified as well. The alternative development process and the definitions of the draft alternative are contained in a separate document which can be found online at the PSRC web site[7]. Analysis of the plan alternatives will be a multi-step process that involves:

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[6] http://www.psrc.org/projects/mtp/integratedanalysisreport.pdf
[7] http://www.psrc.org/projects/mtp/alternativesexecsum.pdf

1. An initial screening of the draft alternatives prior to their “release” by the Transportation Policy Board and the Executive Board for formal analysis under SEPA. This initial screening involves assessing the draft alternatives against a limited set of the VISION 2040 Policy Focus Areas, based on the assumptions (projects, programs, and discrete elements) that define each alternative.
2. The technical analysis of alternatives (once “released” by the PSRC Boards for formal analysis) using the PSRC integrated land use and travel models, as well as tools to measure air quality impacts and user benefits impacts.
3. An assessment of alternatives using measures that are part of the Transportation 2040 Evaluation Criteria. These measures are produced as a result of the technical analysis itemized above.
4. A comprehensive policy analysis designed to assess the ability of each alternative to support the policies contained in VISION 2040. The policy analysis will make use of the criteria measures wherever appropriate. In addition to criteria measures, the policy analysis will draw on other model statistics as appropriate.
5. An analysis of environmental impacts under the formal SEPA review process. Transportation alternatives will be evaluated for the degree to which they are consistent with or improve upon the values analyzed in the VISION 2040 Environmental Impact Statement.

Analysis of the alternatives is designed to produce information that is useful to the development of a Preferred Transportation Alternative and a Draft Transportation Plan.

Appendix 3: Benefit-Cost Analysis Tool Default Rate and Cost Parameters

Values of Time in Year 2000 Dollars

Field	AM	MD	PM	EV	NI
Bike	40.32	40.32	40.32	40.32	40.32
HBW Drive 1	9.57	9.57	9.57	9.57	9.57
HBW Drive 2	17.64	17.64	17.64	17.64	17.64
HBW Drive 3	25.71	25.71	25.71	25.71	25.71
HBW Drive 4	33.33	33.33	33.33	33.33	33.33
HBW Transit IVT 1	3.99	3.99	3.99	3.99	3.99
HBW Transit IVT 2	7.23	7.23	7.23	7.23	7.23
HBW Transit IVT 3	10.84	10.84	10.84	10.84	10.84
HBW Transit IVT 4	13.8	13.8	13.8	13.8	13.8
HBW Transit Wait 1	9.99	9.99	9.99	9.99	9.99
HBW Transit Wait 2	18.09	18.09	18.09	18.09	18.09
HBW Transit Wait 3	27.13	27.13	27.13	27.13	27.13
HBW Transit Wait 4	34.53	34.53	34.53	34.53	34.53
HBW Transit Walk 1	9.99	9.99	9.99	9.99	9.99
HBW Transit Walk 2	18.09	18.09	18.09	18.09	18.09
HBW Transit Walk 3	27.13	27.13	27.13	27.13	27.13
HBW Transit Walk 4	34.53	34.53	34.53	34.53	34.53
Heavy Trucks	50.0	50.0	50.0	50.0	50.0
Light Trucks	40.0	40.0	40.0	40.0	40.0
Medium Trucks	45.0	45.0	45.0	45.0	45.0
Other Driving	15.68	15.68	15.68	15.68	15.68
Other Transit IVT	10.0	10.0	10.0	10.0	10.0
Other Transit Wait	25.02	25.02	25.02	25.02	25.02
Other Transit Walk	25.02	25.02	25.02	25.02	25.02
SR2	30.14	19.29	22.91	20.5	26.52
SR3	38.09	21.28	26.88	20.5	26.52
Vanpool	101.73	37.19	26.88	21.28	87.38
Walk	31.15	31.15	31.15	31.15	31.15

Vehicle Operating Costs (Year 2000 Dollars per Mile)

Auto:	0.12
Light Trucks:	0.2
Medium Trucks:	0.28
Heavy Trucks:	0.5

Vehicle Emissions Costs (2000 Dollars)

Pollutant	Cost per Metric Ton
Carbon Dioxide	32.0
Carbon Monoxide	380.0
Sulfur Oxide	9800.0
Nitrogen Oxide	9800.0
Volatile Organic Compound	7800.0
Particulate	6500.0

Vehicle Emissions Rates

Pollutant	Speed Class	Car	Light	Medium	Heavy
Carbon Dioxide	0	1357.8	2263.0	3602.18	6003.634
Carbon Dioxide	10	707.913	1179.855	1818.994	3031.656
Carbon Dioxide	20	580.256	967.094	1460.924	2434.873
Carbon Dioxide	30	522.231	870.385	1303.373	2172.289
Carbon Dioxide	40	487.415	812.359	1217.437	2029.061
Carbon Dioxide	50	475.81	793.017	1167.307	1945.512
Carbon Dioxide	60	452.6	754.333	1131.5	1885.833
Carbon Monoxide	0	17.38078	18.61221	9.589714	9.589714286
Carbon Monoxide	10	11.94305	13.68565	5.2992	5.2992
Carbon Monoxide	20	10.88275	12.80585	3.06955	3.06955
Carbon Monoxide	30	10.73525	12.78785	2.19005	2.19005
Carbon Monoxide	40	11.261	13.47045	1.9572	1.9572
Carbon Monoxide	50	12.0252	14.26415	2.23635	2.23635
Carbon Monoxide	60	12.7825	14.80366	2.767	2.767
Sulfur Oxide	0	0.0	0.0	0.0	0.0
Sulfur Oxide	10	0.0	0.0	0.0	0.0
Sulfur Oxide	20	0.0	0.0	0.0	0.0
Sulfur Oxide	30	0.0	0.0	0.0	0.0
Sulfur Oxide	40	0.0	0.0	0.0	0.0
Sulfur Oxide	50	0.0	0.0	0.0	0.0
Sulfur Oxide	60	0.0	0.0	0.0	0.0
Nitrogen Oxide	0	0.517142	0.721285	1.923785	1.923785714
Nitrogen Oxide	10	0.3757	0.53525	1.53435	1.53435
Nitrogen Oxide	20	0.3402	0.4845	1.30545	1.30545
Nitrogen Oxide	30	0.33425	0.47265	1.25245	1.25245
Nitrogen Oxide	40	0.3433	0.48085	1.36145	1.36145
Nitrogen Oxide	50	0.3619	0.4952	1.7043	1.7043
Nitrogen Oxide	60	0.37675	0.505666	2.129166	2.129166667
Volatile Organic Compound	0	1.446071	1.876928	0.902428	0.902428571
Volatile Organic Compound	10	0.68695	0.9613	0.5176	0.5176
Volatile Organic Compound	20	0.54405	0.80735	0.3524	0.3524
Volatile Organic Compound	30	0.49575	0.75805	0.2704	0.2704
Volatile Organic Compound	40	0.4714	0.733	0.2261	0.2261
Volatile Organic Compound	50	0.46275	0.7143	0.20495	0.20495
Volatile Organic Compound	60	0.472666	0.70525	0.200333	0.200333333
Particulate	0	0.0116	0.0113	0.0381	0.0381
Particulate	10	0.0116	0.0113	0.0381	0.0381
Particulate	20	0.0116	0.0113	0.0381	0.0381
Particulate	30	0.0116	0.0113	0.0381	0.0381
Particulate	40	0.0116	0.0113	0.0381	0.0381
Particulate	50	0.0116	0.0113	0.0381	0.0381
Particulate	60	0.0116	0.0113	0.0381	0.0381

Accident Costs

Accident	Cost per Accident
Property	2600.0
Injury	75500.0
Fatality	2500000.0

Accident Rates

VC Range	Functional Class	Property	Injury	Fatality
0	1	0.0	0.0	0.0
0	2	0.0	0.0	0.0
0	3	0.0	0.0	0.0
0	4	0.0	0.0	0.0
0	6	0.0	0.0	0.0
0.25	1	0.0	0.0	0.0
0.25	2	0.0	0.0	0.0
0.25	3	0.0	0.0	0.0
0.25	4	0.0	0.0	0.0
0.25	6	0.0	0.0	0.0
0.5	1	0.0	0.0	0.0
0.5	2	0.0	0.0	0.0
0.5	3	0.0	0.0	0.0
0.5	4	0.0	0.0	0.0
0.5	6	0.0	0.0	0.0
0.75	1	0.0	0.0	0.0
0.75	2	0.0	0.0	0.0
0.75	3	0.0	0.0	0.0
0.75	4	0.0	0.0	0.0
0.75	6	0.0	0.0	0.0
1	1	0.0	0.0	0.0
1	2	0.0	0.0	0.0
1	3	0.0	0.0	0.0
1	4	0.0	0.0	0.0
1	6	0.0	0.0	0.0
1.25	1	0.0	0.0	0.0
1.25	2	0.0	0.0	0.0
1.25	3	0.0	0.0	0.0
1.25	4	0.0	0.0	0.0
1.25	6	0.0	0.0	0.0
1.5	1	0.0	0.0	0.0
1.5	2	0.0	0.0	0.0
1.5	3	0.0	0.0	0.0
1.5	4	0.0	0.0	0.0
1.5	6	0.0	0.0	0.0
1.75	1	0.0	0.0	0.0
1.75	2	0.0	0.0	0.0
1.75	3	0.0	0.0	0.0
1.75	4	0.0	0.0	0.0
1.75	6	0.0	0.0	0.0

Appendix 4: Baseline Specification

DEFINING THE BASELINE

Overview

This appendix describes the baseline alternative for the 2010 update to Destination 2030, the Puget Sound region's Regional Transportation Plan, which was used as a base case for this analysis. The following sections specify the process used to arrive at the baseline definition then the details of the baseline itself.

Basic Assumptions in Specifying the Baseline Alternative

Since what is realistic and conservative can be defined in terms of financial planning PSRC fiscally constrained the baseline subject to any non-controversial guidance on the setting of investment priorities within that constraint. The basic assumptions adopted in constructing the baseline were:

- The updated plan's base year is 2006 and its planning horizon is year 2040 (hereinafter "current levels" means "levels in year 2006")
- Baseline financial constraint is defined by current law revenue authority (as currently enacted) forecast through 2040
    - Revenue streams were be estimated for each program area
    - Forecast risk was addressed by choosing a final forecast with a level of probability acceptable to the ATG
    - Future actions assumed in each program area in the baseline were limited to the estimated revenues in that program area (additional limitations may been applied)

Financial Forecast for the Baseline Alternative

PSRC staff forecasted future current law revenue in various program areas to establish what financial constraints might apply. In broad terms the conclusions of this analysis were:

- Cities and Counties – ability to channel general funds to transportation investments is diminishing, to the extent that by 2022 jurisdictions such as King County will face a shortfall in both capital project and maintenance/preservation program areas.[8]
- Local Transit – in general operating costs have exceeded the basic inflation rate in the period 2004-2007. Although revenues will grow into the future as regional population grows and it is unlikely that operating costs will grow at the recent rate indefinitely, operators will be able to fund schedule maintenance and at most modest increases to service (described below).
- Regional Transit – tax authority for Sound Move can support schedule maintenance in existing bus service, already-planned Sounder commuter rail service expansion, and already-planned Central Link Light Rail service.
- Ferries – revenues can support the maintenance of existing service.
- Highways – Nickel and TPA capital projects are funded; pre-existing revenues continue to be needed to support maintenance and preservation within the region and throughout the state.

[8] Transportation Needs Report 2008. King County Metro. Draft, March 2008.

General Decision Rules Applied to Potential Future Investments in the Baseline Alternative

The following decision rules were applied in identifying proposed future investments from the currently adopted Destination 2030 and current regional TIP that were included in the No Action alternative:

- All existing transportation physical facilities would continue in service at full design capacity unless changed or removed by actions or events specifically identified in the baseline. In cases of deferred maintenance or insufficient forecasted current law revenue the operating agency assisted the ATG in characterizing future facility performance degradation in sufficient detail to allow the plan update analysis to proceed.
- All projects and investments with implementation phases (right-of-way acquisition and/or construction) programmed in the current regional TIP were INCLUDED
- All projects in the currently adopted Destination 2030 with "Approved" status were INCLUDED (except for special cases identified in the last item below)
- Potential investments described in the recent Sound Transit 2 (ST2) package, or in potential new variations thereof, were EXCLUDED (subject to "case-by-case" discussions described below)
- Projects and programmatic investments not included by the above rules were included per the request of sponsoring agencies in cases where the agency articulated a financial plan compatible with the overall regional 2040 current law revenue forecast (for example, fully or partially funded projects identified in the recent State Highway System Plan update that might not yet have PSRC Approval)
- The inclusion or exclusion of certain future investments was determined on a case-by-case basis:
    - Alaskan Way Viaduct
    - SR 520 from I-90 to I-5
    - Link Light Rail extension to Northgate
    - State Ferry Capital Program
    - County Ferry service
    - I-5 repaving
    - Local roadway preservation

BASELINE ALTERNATIVE SPECIFICATION

This section summarizes key aspects of the baseline alternative assumed in preparing forecast model runs.

Demographics, Employment, Economics, and Land Use

- Population and employment growth and distribution through 2040 will occur per the regional land use vision described in the VISION 2040 plan
- Locations within the region assumed in the analysis to generate or attract especially high volumes of trips (for example, SeaTac Airport, Seattle Center, and major logistics centers, which are labeled "special generators") will remain unchanged through 2040
- Trips generated by or attracted to regional "special generators" will be factored by population and employment growth in future analysis years
- General and truck trips generated by or attracted to locations outside the four-county region will be factored by population and employment growth in future analysis years

Roadway and Nonmotorized Systems

General

All assumptions for future years below use existing facilities on the ground in year 2006 as their starting point unless otherwise mentioned.

Existing and Future Network Characteristics

- Roadway and Nonmotorized facility functional classification (where applicable) and capacity will remain unchanged except for changes made by future projects specifically identified as belonging in the Baseline Alternative. The following special case assumptions deserve special mention:
  - Alaskan Way Viaduct will remain in service in its present configuration with three general purpose lanes northbound and southbound.
  - SR 520 Bridge will remain in service in its present configuration with two general purpose lanes eastbound and westbound.
  - I-5 will be repaved at a point early enough in the planning period to retain its full existing capacity at a cost of approximately $2 billion.
  - Old SR 509/City Waterway Bridge in Tacoma: The City Waterway Bridge, also known as 11th Street Bridge or Murray Morgan Bridge was closed to vehicle traffic. This facility will be shown as closed in the baseline since there are no known fully funded efforts for replacement or refit.

Existing and Future Pricing and Costs

- The Tacoma Narrows Bridge will be the only tolled roadway facility
- Tacoma Narrows Bridge tolls will scale with predicted inflation (in other words, will remain the same in constant dollars) but will end at the end of year 2030 when the bonds are projected to be paid off.[9]
- Locations within the region that apply parking charges will not change
- Future parking costs will be forecast by scaling to 1.5% over the predicted inflation rate
- Auto and truck operating costs will be forecast into the future by scaling with predicted inflation

HOV Practice

- Baseline will assume that HOV practice will maintain existing 2+ and 3+ thresholds so that the action alternatives analysis can consider different options. To be included in an action alternative, proposals for different practices will need to be accompanied by WSDOT assertion of an appropriate process that could implement such proposals.

Other aspects of the Roadway System

- Vehicle fleet mix (model, age, fuel type, efficiency) will remain unchanged from 2006

Financial Rationale for Roadway and Nonmotorized Systems Assumptions

- State Highways Program
  - “Nickel” and “TPA” funds intended to fully fund specific projects (such as the specific I-405 widening projects) are committed and those projects will be constructed as planned.
  - Other state current-law revenues will be sufficient to maintain the existing system at present capacity and to fund the remaining state capital projects.

[9] http://www.wsdot.gov/projects/sr16narrowsbridge/

- The baseline will assume that the rate of return to the region of regionally-generated state transportation funds will remain sufficient to supply the approximately $2 billion necessary for the I-5 repaving.

- Local Roadways
    - The baseline assumes that city and county general funds available for transportation investments will continue to decline into the future although local revenues will grow with population growth. The default assumption was that the baseline included no future local capital roadway projects except those explicitly identified by local agencies as fundable and necessary to meet statutory growth requirements. The default baseline assumption is that preservation and maintenance of existing facilities could be sustained through 2040 with current law revenue.

Ferry System

General

The regional plan update baseline uses the assumptions compiled by Washington State Ferries (WDF) for its long range planning effort underway at the time of writing. These assumptions are summarized below and detailed in the technical memorandum entitled "WSF Base Year and Future Baseline LOS Update—Key Assumptions."[10]

Washington State Ferries (WSF) Service

- WSF will maintain its existing service configuration (year 2006) through 2040.
- WSF will maintain the existing service levels (year 2006) through 2040.

Other Ferries Service

- King County will operate a passenger-only ferry (POF) on the Vashon-Seattle run.
- Seattle-Vashon POF service will have three weekday Vashon-to-Seattle morning sailings (first two return to Vashon) and three weekday Seattle-to-Vashon evening sailings (first two return to Seattle).[11]
- West Seattle to Seattle CBD Water Taxi service will commence year-round service by year 2010 in the peak period (6:30am to 9am and 4:30pm to 7pm).[12]

Existing and Future Pricing

- WSF rates will increase 2.5% per year every October (starting from May 2006 fares) and ending in October 2019 (the 2019 rates would apply to year 2020). After 2020, rates would scale with predicted inflation.[13]
- Seattle-Vashon fares will start at $4.25 adult one-way per trip (in May 2006) and scale the same as WSF fares as described above.[14] (Note that this is slightly higher than fare assumptions in a King County briefing paper, which assumed only inflation).[15]

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[10] WSF Base Year and Future Baseline LOS Update – Key Assumptions. Parsons Brinckerhof (February 25, 2008)
[11] King County Passenger-Only Ferry Project Briefing Paper (November 7, 2007). (http://www.kingcounty.gov/council/ferry_district.aspx) p. 4
[12] Ibid. p 5
[13] WSF Base Year and Future Baseline LOS Update – Key Assumptions. Parsons Brinckerhof (February 25, 2008) p.1
[14] Ibid. p. 2.

- West Seattle-Seattle fares will start at $3.00 adult one-way per trip and scale with predicted inflation.[16]

Ferry Terminal Parking

- Parking locations and capacities will remain unchanged except for changes made by future projects specifically identified as belonging in the No Action Alternative
- Parking costs will start at 2006 levels and scale by 1.5% over predicted inflation to reflect observed historical trends.

Financial Rationale for Ferry System Assumptions

- Washington State Ferries (WSF) is now engaged in updating its system plan which will cover service and financial planning. PSRC will assume for now in the baseline that the state will fund WSF ferry service levels described above but will confirm with WSF—hopefully in September 2008--before beginning final alternatives analysis under SEPA.

Transit Systems

General

All assumptions for future years below use existing facilities and services on the ground in year 2006 as their starting point.

Regional Transit (Sound Transit Program Area)

Light Rail

- Link Light Rail system run from SeaTac Airport through downtown Seattle to the Husky Stadium, and on the existing Tacoma Link.
- Link Light Rail service will be[17]:
    - Central Link (2010 to 2040): 6 to 7.5 minute headways during AM and PM peaks, 10 minute headways midday and evening, 15 minute headways night
    - Tacoma Link (2006 to 2040): 10 minute headways during AM & PM peaks and midday, 20 minute headways evening and night

Commuter Rail

- Sounder Commuter Rail system will run from Everett to Seattle ("north line") and from Tacoma To Seattle ("south line") in 2006 with some south line service to Lakewood starting 2011
- Sounder Commuter Rail service[18]:
    - North line 2006
        - 2 southbound AM peak trips
        - 2 northbound PM peak trips
        - 1 southbound AM peak trip of "Rail Plus" share program with Amtrak
        - 1 northbound evening trip of "Rail Plus" share program with Amtrak
        - 1 northbound AM peak trip of "Rail Plus" share program with Amtrak
        - 1 southbound evening trip of "Rail Plus" share program with Amtrak
    - North line beyond 2006

[15] King County Passenger-Only Ferry Project Briefing Paper (November 7, 2007). p. 14
[16] Ibid. p. 15
[17] Sound Transit "2008 Service Implementation Plan" (http:/www.soundtransit.org/x1195.xml)
[18] Ibid.

        - 3 southbound AM peak trips starting 2007
        - 3 northbound PM peak trips starting 2007
        - 4 southbound AM peak trips starting 2008
        - 4 northbound PM peak trips starting 2008
        - 1 southbound AM peak trip of "Rail Plus" share program with Amtrak
        - 1 northbound evening trip of "Rail Plus" share program with Amtrak
        - 1 northbound AM peak trip of "Rail Plus" share program with Amtrak
        - 1 southbound evening trip of "Rail Plus" share program with Amtrak
    - South line 2006
        - 2 northbound AM peak trips
        - 2 southbound PM peak trips
    - South line beyond 2006
        - 4 northbound AM peak trips starting 2007
        - 1 southbound AM peak trip starting 2007
        - 4 southbound PM peak trips starting 2007
        - 1 northbound PM peak trip starting 2007
        - 6 northbound AM peak trips starting 2008
        - 2 northbound PM peak trips starting 2008
        - 6 southbound AM peak trips starting 2008
        - 2 southbound PM peak trips starting 2008
        - 8 northbound AM peak trips starting 2011, first six of which start in Lakewood
        - 2 northbound PM peak trips starting 2011, both of which originate at Tacoma Dome
        - 8 southbound PM peak trips starting 2011, last six of which terminate at Lakewood
        - 2 southbound AM peak trips starting 2011, both of which terminate at Tacoma Dome

Regional Bus Service

- Existing regional bus service configuration will remain unchanged except for changes described in the Sound Transit 2008 Service Implementation Plan (ST 2008 SIP) to:
    - connect service to future Park and Ride facilities that will come online under other baseline assumptions
    - connect certain bus routes to Link Light Rail stations
- Service levels will:
    - increase 0.5% of 2006 levels per year for schedule maintenance

<u>Intermediate Capacity Transit</u>

- Baseline assumes no new ICT service anywhere in the region

<u>Local Transit (Bus Service from providers other than Sound Transit)</u>

Kitsap Transit (KT)

- service configuration in the baseline
    - regional model now treats operations under KT's worker-driver program as regular fixed-route service; regional model will be changed to represent these as extended vanpool type of service
    - worker-driver runs will remain the only direct KT connections to the Bremerton Shipyard
    - local service will be added to cover the new Quadrant development in Port Orchard

- worker-driver and vanpool will be added to serve South Kitsap Industrial Area (SKIA)
- cross-sound passenger-only ferry (PoF) is only in demonstration mode and will NOT be included in the baseline

- service levels in the baseline
  - fixed route service will be maintained at 2007 levels until 2010, at which time there will be a one-time 2% service increase[19] (with the addition of new service configuration noted above) with the assumption that sufficient revenue will be generated to maintain the 2010 scheduled service level as-is from 2010 to 2040
  - 20 vanpool vans will be added in 2012[20]

King County Metro

- service configuration in baseline
  - Rapid Ride service will be included starting in years shown in parentheses on these routes:

		Weekdays						
Route	Direction	Begin	AM Peak	Midday	PM Peak	Evening	Night	End
Ballard (15th Ave only) to Seattle CBD (2010)	Inbound	5:00	7.5	15	15	15	30	1:00
Seattle CBD to Ballard (15th Ave only) (2010)	Outbound	5:00	15	15	7.5	15	30	1:30
W Seattle to Seattle CBD (2011)	Inbound	5:00	7.5	15	15	15	30	1:00
Seattle CBD to W Seattle (2011)	Outbound	5:00	15	15	7.5	15	30	1:30
Aurora Village to Seattle CBD via SR 99 (2013)	Inbound	4:30	7.5	15	15	15	30	0:30
Seattle CBD to Aurora Village via SR 99 (2013)	Outbound	5:30	15	15	7.5	15	30	1:30
Federal Way to SeaTac via Pacific Highway South (2010)	Inbound	24 hrs	10	15	10	15	30	24 hrs
SeaTac to Federal Way via Pacific Highway South (2010)	Outbound	24 hrs	10	15	10	15	30	24 hrs
Bellevue to Redmond (2012)	Inbound	5:00	10	15	10	15	30	0:00
Redmond to Bellevue (2012)	Outbound	5:30	10	15	10	15	30	0:30

  - minor route adjustments will be made to connect to Link Light Rail stations as Link comes online
  - all other service routes will remain the same as 2008 throughout future baseline years
  - a new south base will be constructed by 2016 (necessary to support service increases and schedule maintenance)
- service levels in baseline

[19] 2006-2012 Transit Development Plan, Kitsap Transit, p. 15 (see http://www.kitsaptransit.org/capital/Planning.html)
[20] Ibid.

- fixed route service levels will grow 2% of 2006 levels per year up to and including 2016 (this growth INCLUDES the Rapid Ride Service) and 1% of 2006 levels per year afterward
- Rapid Ride service levels will stay fixed throughout 2040 (see above)
- schedule maintenance consumes one third of the service increase in any given year
- baseline will assume that rideshare (vanpool) investments will double the program's ridership from 2007 to 2016[21]

Community Transit

- service configuration in baseline
  - Swift BRT service will be added from Everett Station in the City of Everett along Pacific Avenue, down Rucker Avenue, Evergreen Way and Highway 99 to the Aurora Village Transit Center in Shoreline starting 2009 [22]
  - by 2013 CT will add a new route between north, east and south Snohomish County extending service running between Marysville and Lake Stevens south along SR 9 to Cathcart Way and then west along 132nd St SE and 128th St to Mariner park & ride
  - the planned route restructure in south Snohomish County proposed for 2011-2013 and potential growth in service area will be addressed in the action alternatives (not in the baseline) to aid in Community Transit service planning
- service levels in baseline
  - fixed route will increase 17% of 2008 levels by 2013, with sufficient investment after that to maintain 2013 schedules[23]
  - fixed route increases will be focused in selected corridors per the Community Transit Transit Development Plan 2008-2013 (see pp. 126-129)
  - vanpool fleet will grow from 358 vehicles to 383 in 2008 with 7,000 added revenue service hours, but with no additional growth in the baseline through 2040
  - DART paratransit services will have these increases in total service hours in the years shown in parentheses: 4,000 (2008) 1,000 (2009) 9,000 (2010) 1,000 (2011) 1,000 (2012) and 1,000 (2013). Baseline assumes that 2013 service levels will be maintained through 2040.

Everett Transit

- service configuration in baseline
  - will remain the same as current 2008 routing
- service levels in baseline
  - fixed route will be assumed to remain constant through 2040 (sufficient revenue to maintain existing schedules, but no new service)[24]

Pierce Transit

- service configuration in baseline
  - will largely remain unchanged, with minor adjustments as indicated in the Pierce Transit Transit Development Plan 2008-2013 (see pp. 13-16)

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[21] King County Metro Strategic Plan for Public Transportation, 2007-2016. p 4-33
[22] Transit Development Plan 2008-2013, Community Transit, p. 126 (http://www.commtrans.org/?mc=commtrans&subcat=15)
[23] Ibid p. 121
[24] Transit Development Plan 2007-2012 and Annual Report 2006, Everett Transit, p. 10 (see www.everettwa.org/Get_PDF.aspx?pdfID=902)

- service levels in baseline
    - fixed route service will grow 11% of 2008 levels by 2013[25] per priorities set out in the Transit Development Plan
    - vanpool fleet will grow 19% of 2008 size by 2013[26]

Other Transit

- Transit access percentage (the proportion of persons within an analysis zone with access to transit) will remain unchanged
- Timed transfer points (where separate bus routes "connect" reliably) will remain unchanged

Park and Ride Facilities

- Park and Ride locations and capacities will remain unchanged except for changes made by future projects specifically identified as belonging in the baseline (see Appendices A and B)

Financial Rationale for Transit Systems Assumptions

- Sound Move, the original Sound Transit authorizing referendum, granted ST sufficient funds to complete light rail from SeaTac Airport to the University District.

- Sound Move granted ST sufficient fund authority to sustain (but not expand) service levels as they will be by end 2013.

- Local transit agencies' financial pictures vary, but in general recent years have seen operating costs escalating faster than inflation (4% to 5% per year). Agencies report that they are also seeing higher demand for paratransit services as the percent of the population eligible for such services increases. For these reasons, the baseline assumptions above for fixed level service remain modest.

- King County Metro Vanpool ("rideshare") funds 100% of operating costs from user fees and increased ridership 20% from 2006 to 2007.[27] Metro analysis indicates that this trend can be sustained to achieve the doubling of vanpool ridership by 2016 assumed in the baseline.[28]

[25] Transit Development Plan 2008-2013, Pierce Transit, p. 12 (see http://www.piercetransit.org/)
[26] Ibid.
[27] Rideshare Operations Monthly Performance Indicators, December and YTD 2007. King County Metro. Roger Bruckshen. 1/29/08.
[28] Personal communication from Rideshare Manager Syd Pawlawski, 3/27/08

Bibliography

General References on Cost-Benefit Analysis

Adler, M. D., Eric A. Posner (Eds.) Cost-Benefit Analysis: Legal, Economic, and Philosophical Perspectives, 2001.

Boardman, A.E., Cost-Benefit Analysis: Concepts and Practice (2nd Edition), 1998.

Gal, Tomas (Editor), et al, Multicriteria Decision Making: Advances in McDm Models, Algorithms, Theory, and Applications (International Series in Operations Research & Management Science, 21), 1999

Doumpos, M. and Constantin Zopounidis, Multicriteria Decision Aid Classification Methods (Applied Optimization, V. 73) 2002

Londero, E., Benefits and Beneficiaries: An Introduction to Estimating Distributional Effects in Cost-Benefit Analysis, 1997

Layard, R. and Stephen Glaister (eds.), Cost-Benefit Analysis, June 1994.

Malczewski, J. GIS and Multicriteria Decision Analysis . 1999.

Panos M. Pardalos (Editor), et al, Advances in Multicriteria Analysis (Nonconvex Optimization and Its Applications ; V. 5), 1995

Puttaswamaiah, K. (Editor) Cost-Benefit Analysis: Environmental and Ecological Perspectives, 2002.

Saaty TL, The Analytic Hierarchy Process , NY, McGraw Hill, 1980

Zerbe, R. and Dwight Dively, Benefit-Cost Analysis in Theory and Practice, Harper Collins, New York, 1994.

References on Specific Topics in Project Evaluation

American Association of State Highway and Transportation Officials, Guide for the Design of High Occupancy Vehicle Facilities. Washington, DC (1992).

American Association of State Highway and Transportation Officials, Highway Safety Design and Operations Guide, 1997. Washington, DC (1997).

American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets, 1994. Washington, DC (1995).

Apogee Research Inc., "Research on the Relationship Between Economic Development and Transportation Investment." NCHRP Report 418, Transportation Research Board, National Research Council (1998).

Arnott, R., and Small, K., "The Economics of Traffic Congestion." American Scientist, Vol. 82 (September–October 1994) pp. 446–455.

Arrow, K., “Essays in the Theory of Risk Bearing.” Markham Publishing, Chicago, IL (1970).

Bauer, K., and Harwood, D., "Statistical Models of At-Grade Intersection Accidents." No. FHWA-RD-96-125, Federal Highway Administration, Washington, DC (1996).

Bell, M., and McGuire, T., "Macroeconomic Analysis of the Linkages between Transportation Investments and Economic Performance." NCHRP Report 389, Transportation Research Board, Washington, DC (1997).

Blincoe, L., Seay, A., Zaloshnja, E., Miller, T., Romana, E., Luchter, S., and Spicer, R., "The Economic Impact of Motor Vehicle Crashes, 2000." DOT HS 809 446, National Highway Traffic Safety Administration, Washington, DC (2002).

Blincoe, L., "The Economic Cost of Motor Vehicle Crashes, 1994." National Highway Traffic Safety Administration, Washington, DC (1996).

Bonneson, J., and McCoy, P., "Capacity and Operational Effects of Midblock Left-Turn Lanes." NCHRP Report 395, Transportation Research Board, Washington, DC (1997).

Calfee, J., and Winston, C., "The Value of Automobile Travel Time: Implications for Congestion Policy." Journal of Public Economics, Vol. 69, (1998), pp. 83–102.

Cambridge Systematics, "Multimodal Corridor and Capacity Analysis Manual." NCHRP Report 399, Transportation Research Board, Washington, DC (1998).

Cambridge Systematics, "The Value of Travel Time" (Section 8.2) in Revisions to HERS. Federal Highway Administration, Washington DC (1997).

Cambridge Systematics, "Methods for Capital Programming and Project Selection." NCHRP Synthesis 243, Transportation Research Board, Washington, DC (1997).

Cohn, L., Watson, R., and Roswell, "Transportation Planning Handbook." Institute of Transportation Engineers (1992).

DeCorla-Souza, P. "Applying the "Cashing out" Approach to Congestion Pricing." Transportation Research Record, Vol. 1450, (1994), pp. 34–37.

DeCorla-Souza, P. "Comparing Cost-Effectiveness Across Modes." Federal Highway Administration, Metropolitan Planning Division, Washington, DC (1993).

DeCorla-Souza, P., and Cohen, H., "Accounting for Induced Travel in Evaluation of Urban Highway Expansion." Federal Highway Administration, Washington, DC (1998).

DeCorla-Souza, P., Everett, J., and Gardner, B., "Evaluating the Options in Urban Areas with SOV Capacity Restrictions." Federal Highway Administration, Washington, DC (1994).

DeCorla-Souza, P., and Jensen-Fisher, R., "Comparing Multimodal Alternatives in Major Travel Corridors." Transportation Research Record, no. 1429, (1994), pp. 15–23.

Delucchi, M., "Emissions of Criteria Pollutants, Toxic Air Pollutants, and Greenhouse Gases, from the Use of Alternative Transportation Modes and Fuels." UCD-ITS-RR-96-12, Institute of Transportation Studies, University of California, Davis, Davis, CA (1996).

Delucchi, M., "Environmental Externalities of Motor-Vehicle Use in the U.S." Journal of Transport Economics and Policy, Vol. 34, no. 2, (May 2000).

Delucchi, M., "The Annualized Social Cost of Motor-Vehicle Use in the U.S. 1990–1991." Institute of Transportation Studies, Davis, CA (1996).

ECONorthwest and Parsons Brinckerhoff Quade & Douglas, "Estimating the Benefits and Costs of Public Transit Projects: A Guidebook for Practitioners." TCRP Report 78, Transportation Research Board, Washington, DC (2001).

Eberts, R., McMillen, D., "Agglomeration Economies and Urban Public Infrastructure." In Handbook of Regional and Urban Economics, Volume 3, edited by Cheshire, P. and Mills, E., 1999.

Feldstein, M., "The Social Time Preference Discount Rate in Cost Benefit Analysis." In Neoclassical Microeconomics, edited by Ricketts, M., Vol. 2, Gower, (1988), pp. 191–210.

Fuller, J., Hokanson, J., Haugarrd, J., and Stoner, J., "Measurements of Highway User Interference Costs and Air Pollution and Noise Damage Costs." Final Report 34. DTFH61-80-C-00153, Federal Highway Administration, Washington, DC (1983).

Gillespie, J., "Estimating User Costs as a Basis for Incentive/Disincentive Amounts in Highway Construction Contracts." FHWA/VTRC 98-R12, Virginia Transportation Research Council, Charlottesville, VA (1998).

Gluck, J., Levinson, H., and Stover, V., “Impacts of Access Management Techniques.” NCHRP Report 420, Transportation Research Board, Washington, DC (1999).

Gomez-Ibanez, J. "The Political Economy of Highway Tolls and Congestion Pricing." Transportation Quarterly, Vol. 46, No. 3, (1992), pp. 343–60.

Gomez-Ibanez, J., and O’Keefe, M., "The Benefits from Improved Investment Rules: The Case Study of the Interstate Highway System." DOT/OST/P-34/86-030, U.S. Department of Transportation University Research Program, Cambridge, MA (1985).

Gomez-Ibanez, J., Small, K., and National Research Council (U.S.). Transportation Research Board. "Road Pricing for Congestion Management : A Survey of International Practice." National Academy Press, (1994), 77.

Greene, D., Jones, D., and Delucchi, M., "The Full Costs and Benefits of Transportation: Contributions to Theory, Method, and Measurement." (1997).

Hallenbeck, M., "Choosing the Route to Traveler Information Systems Deployment: Decision Factors for Creating Public/Private Business Plans." Washington State Transportation Center, ITS America (1998).

Harwood, D., Council, F., Hauer, E., Hughes, W., and Vogt, A., "Prediction of the Expected Safety Performance of Rural Two-Lane Highways." FHWA-RD-99-207, Federal Highway Administration, Washington, DC (2000).

Hauer, E., “Observational Before-After Studies in Road Safety: Estimating the Effect of Highway and Traffic Engineering Measures on Road Safety.” Pergamon Press, Elsevier Science Ltd., Oxford, England (1997).

Hensher, D., "Value of Travel Time Savings in Personal and Commercial Automobile Travel." (May 1995).

Hicks, J., “The Valuation of Social Income.” Economica. (1939).

Institute of Transportation Engineers, "A Toolbox for Alleviating Traffic Congestion and Enhancing Mobility." ITE, Washington, DC (1997).

Jack Faucett Associates, "The Costs of Owning and Operating Automobiles, Vans and Light Trucks." Federal Highway Administration, Washington DC (1991).

Kaldor, N., “Welfare Propositions in Economics.” The Economics Journal, Oxford, England (1939).

Kittelson and Associates, "Roundabouts: An Informational Guide." Publication No. FHWA-RD-00-067, Federal Highway Administration, McLean, VA (2000).

Knudson, B., "The Value of Travel-Time: Estimates of the Hourly Value of Time for Drivers, Passengers, and Cargo in Oregon, 1997." Oregon Department of Transportation (1998).

Lee, D., "Full Cost Pricing of Highways." U.S. Department of Transportation, Research and Special Programs Administration, Cambridge, MA (1994).

Lee, D., "Uses and Meanings of Full Social Cost Estimates." Bureau of Transportation Statistics, U.S. Department of Transportation, John A. Volpe National Transportation Systems Center, Cambridge, MA (1995).

Lee, D., United States Federal Highway Administration, and Transportation Systems Center, "Methods for Allocating Highway Costs." U.S. Dept. of Transportation Federal Highway Administration; National Technical Information Service Distributor (1981).

Levinson, D., Gillen, D., Kanafan, A., and Mathieu, J., "Chapter 4: Highways." In The Full Cost of Intercity Transportation—A Comparison of High Speed Rail, Air, and Highway Transportation in California: Institute of Transportation Studies, University of California at Berkeley (1996).

Lewis, D., "Road User and Mitigation Costs in Highway Pavement Projects." NCHRP Synthesis 269, Transportation Research Board, Washington, DC (1999).

Litman, T., "Evaluating Public Transit Benefits and Costs." Victoria Transport Policy Institute, Victoria, BC (1999).

Litman, T. "Guide to Calculating Transportation Demand Management Benefits." Victoria Transportation Policy Institute, Victoria, BC (1999).

Lomax, T., Turner, S., and Shunk, G., "Quantifying Congestion: Volume 1." NCHRP Report 398, Transportation Research Board, Washington, DC (1997).

Lomax, T., Turner, S., and Shunk, G., "Quantifying Congestion: Volume 2—User's Guide." NCHRP Report 398, Transportation Research Board, Washington, DC (1997).

Louis Berger & Associates Inc., "Guidance for Estimating the Indirect Effects of Proposed Transportation Projects." NCHRP Report 403, Transportation Research Board, National Research Council, Washington, DC (1998).

MacKenzie, J., Dower, R., and Chen, D., "The Going Rate: What It Really Costs to Drive." World Resources Institute (1992).

McGee, H. W., Hughes, W., and Daily, K., "Effect of Highway Standards on Safety." NCHRP Report 374, Transportation Research Board, Washington, DC (1995).

Meyer, J., and Gómez-Ibáñez, J., "Autos, Transit, and Cities." Harvard University Press, Cambridge, MA (1981).

Meyer, J., Gómez-Ibáñez, J., Tye, W., and Winston, C., "Essays in Transportation Economics and Policy: A Handbook in Honor of John R. Meyer." Brookings Institution Press (1998).

Miller, T., Viner, J., Rossman, S., Pindus, N., Gellert, W., Douglass, J., Dillingham, A., and Blomquist, G., "The Costs of Highway Crashes. Final Report to the Federal Highway Administration." The Urban Institute, Washington, DC (1991).

Mitretek Systems Inc., "Intelligent Transportation Systems Benefits: 2001 Update." FHWA-OP-01-024, Federal Highway Administration, Washington, DC (1999).

Mitretek Systems Inc., "Intelligent Transportation Systems Benefits: 1999 Update." FHWA-OP-99-012, Federal Highway Administration, Washington, DC (1999).

Munnell, A., "How Does Public Infrastructure Affect Regional Economic Performance?" New England Economic Review (September/October 1990) pp. 11–32.

National Highway Institute, "Estimating the Impacts of Transportation Alternatives: Participant's Notebook." FHWA-HI-94-053, Federal Highway Administration, Washington, DC (1994).

National Highway Traffic Safety Administration, "Traffic Safety Facts 1999." Washington, DC (2000).

Neuman, T., and Glennon, J., "Cost Effectiveness of Improvements to Stopping-Sight Distance Safety Problems." Transportation Research Record 923, Transportation Research Board, Washington, DC (1983).

Persaud, B., "Statistical Methods in Highway Safety Analysis A Synthesis of Highway Practice." NCHRP Synthesis 295, Transportation Research Board, Washington, DC (2001).

Small, K., Chu, X., and Noland, R., "Valuation of Travel-Time Savings and Predictability in Congested Conditions for Highway User-Cost Estimation." NCHRP 2-18(2), Transportation Research Board, Washington, DC (1997).

Small, K. editor, "Congestion Pricing : Special Issue." Kluwer Academic, Norwell, MA (1992).

Small, K., and Kazimi, C., "On the Costs of Air Pollution from Motor Vehicles." Journal of Transport Economics and Policy, Vol. 29, No. 1 (1995), pp. 7–32.

Small, K., National Cooperative Highway Research Program, American Association of State Highway and Transportation Officials, and National Research Council (U.S.). Transportation Research Board, "Valuation of Travel-Time Savings and Predictability in Congested Conditions for Highway User-Cost Estimation." NCHRP Report No. 431, Transportation Research Board, Washington, DC (1999).

Small, K., Winston, C., and Evans, C., "Road Work : A New Highway Pricing and Investment Policy." Brookings Institution, Washington, DC (1989).

Tedesco, S., Alexiadis, V., Loudon, W., Margiotta, R., and Skinner, D., "Development of a Model to Assess the Safety Impacts of Implementing IVHS User Services." Proceedings, IVHS America (1994).

Texas Transportation Institute. "Microcomputer Evaluation of Highway User Benefits." Program Report 7-12, Transportation Research Board. National Cooperative Highway Research, Washington, DC (1993).

Transcore, "Integrating Intelligent Transportation Systems within the Transportation Planning Process: An Interim Handbook." FHWA-SA-98-048, Federal Highway Administration, Washington, DC (1998).

Transportation Research Board, "Highway Capacity Issues: 1998." Transportation Research Record No. 1646, Transportation Research Board, Washington, DC (1998).

Transportation Research Board, "Highway Capacity Manual." Special Report 209, Washington, DC (2000).

U.S. Department of Transportation, "The Value of Travel Time: Departmental Guidance for Conducting Economic Evaluations." Washington, DC (1997).

Walls, J., and Smith, M., "Life-Cycle Cost Analysis in Pavement Design—Interim Technical Bulletin." FHWA-SA-98-079, Washington, DC (1998).

Weinblatt, H., Stowers, J., Mingo, R., and Wheeler, P., "Alternative Approaches to the Taxation of Heavy Vehicles." Transportation Research Board Report 416, National Research Council, Washington, DC (1998).

Weisbrod, G., and Weisbrod, B. "Assessing the Economic Impact of Transportation Projects: How to Choose the Appropriate Technique for Your Project." Transportation Research Circular, Transportation Research Board Report 477, (October 1997) pp. 7–27.

Zegeer, C., Hummer, J., Reinfurt, D., Herf, L., and Hunter, W., "Cost Effective Geometric Improvements for Safety Upgrading of Horizontal Curves." FHWA-RD-021, Federal Highway Administration, Washington, DC (1991).

Zegeer, C., Hummer, J., Reinfurt, D., Herf, L., and Hunter, W., "Safety Cost-Effectiveness of Incremental Changes in Cross-Section Design Informational Guide." Report No. FHWA/RS-87-094, Federal Highway Administration, Washington, DC (1987).

Zegeer, C., Hummer, J., Reinfurt, D., Herf, L., and Hunter, W., "Safety Effects of Cross-Section Design for Two-Lane Roads, Volume I." Report No. FHWA/RD-87/008, Federal Highway Administration, Washington, DC (1986).

Appendix E.

FAST-FMSIB Project Descriptions

Appendix E. FAST-FMSIB Corridor Project Descriptions

This Appendix presents brief descriptions of the 15 projects that were included in the cost-benefit analysis discussed in Section 3 of the Freight Investment Study Final Report.

These projects appear on either the priority lists of the Freight Action Strategy Team (FAST) Corridor Coalition, the Freight Mobility Strategic Investment Board (FMSIB), or both.

North Canyon Road Extension

Project Description

- New overcrossing of the BNSF mainline from Pioneer Way to 62nd Avenue E.
- Total Benefits are linked to the construction of new bridges over the Puyallup River and over Clarks Creek.

Freight Benefits

- Accommodate freight and general purpose highway growth;
- Mitigate existing freight and general purpose highway congestion; and
- Allow for closure of an existing at-grade crossing; thereby improving safety and traffic flow, both for highway and rail.

East Marginal Way

Project Description

- Provide a northbound and southbound grade separation on Duwamish Avenue South.
- Project was fully funded, but because of construction delay there is a shortfall.

Freight Benefits

- Improve safety by eliminating rail/highway conflicts at the existing at-grade crossing;
- Reduce vehicle delay at railroad tracks through grade separation;
- Improve air quality by reducing delay-related idling of trucks and other vehicles;

- Facilitate greater efficiencies in an area of significant intermodal and multimodal activity; and
- Complement ITS activity at the Port and City.

South Spokane

Project Description

- South Spokane Viaduct widening (unfunded)
- Eastbound off-ramp (fully funded)

Freight Benefits

- Improve safety on a route that has one of the highest accident-per mile ratios within the City;
- Reduce traffic delay caused by current narrow lanes and lack of shoulders;
- Improve capacity for trucks by more than 10 percent;
- Enhance access to the State's largest manufacturing and industrial center; and
- Complete seismic reinforcement of the 60-year old structure.

M Street SE Grade Separation

Project Description

- Grade-separated crossing with BNSF/Stampede Pass
- Widen 'M' Street SE for two lanes in each direction to help relieve congestion
- New roadway connection between 'M' Street SE and 'R' Street/Auburn-Black

Freight Benefits

- Reduce rail and vehicle delays;
- Improve emergency vehicle access;
- Increase roadway capacity to accommodate 2030 traffic volumes; and
- Improve safety by eliminating 53 daily at-grade school bus crossings.

70^{th} Avenue E and Valley Avenue Widening

Project Description

- Phases 2 and 3 unfunded
- Phase 2 – Widening 70^{th} Avenue E from the northern edge of the UPRR tracks to the northern leg of the 20^{th} Street E./70^{th} Avenue E. intersection
- Phase 3 – Grade-separated crossing at the UPRR tracks for 70^{th} Avenue E

Freight Benefits

- Eliminate Vehicle/Train conflicts and delays;
- Improve freight mobility between existing industrial property and businesses in the Cities of Fife, Sumner, Puyallup, and Pierce County; and Port of Tacoma facilities at Commencement Bay and Fredrickson; and
- Provide the key link to complete the North-South Interregional Access, the regional I-5 Freight Bypass, the Cross-Cascades Access, the Green River Valley Access, and the Cross Valley Access.

Lincoln Avenue Grade Separation

Project Description

The Lincoln Avenue grade separation will raise Lincoln Avenue over key railroad tracks used for intermodal rail operations within the Port area

Freight Benefits

- Improve both road and rail efficiency throughout the Tacoma Tide flats;
- Improve safety for passenger vehicles, trucks, and pedestrians;
- Eliminate road blockages that can last up to 30 minutes, improving truck access to the terminals and other businesses;
- Provide enhanced operational flexibility for rail and truck operations; and
- Allow additional rail access to port terminals that have on-dock intermodal yards.

Lander Street Overpass

Project Description

The South Lander Street Overpass project would relieve a serious east/west chokepoint in the Duwamish Manufacturing and Industrial Center.

Freight Benefits

- Improve safety on an arterial road that currently crosses BNSF mainline railroad tracks;
- Reduce truck and traffic delays caused by train crossings;
- Enhance access to the one of the largest port operators in the country;
- Improve truck access to SODO and Duwamish industrial area destination; and
- Help keep traffic moving during Alaskan Way Viaduct replacement.

Willis Street Grade Separation

Project Description

Separate both the BNSF and UP railroad tracks on Willis Street (SR 516) between SR 167 and Central Avenue

Freight Benefits

- Provide a critical, grade-separated link through the commercial/industrial/ central area of Kent;
- Eliminate rail/auto accidents;
- Link the valley warehouse/industrial center to SR 167 and I-5;
- Reduce freight and auto delays;
- Eliminate at-grade conflicts; and
- Allow for increased rail speeds.

S 228th Street Grade Separation

Project Description

- Phase 1 – Extend S 228th Street to Military Road complete;
- Phase 2 – Separate both the BNSF and UP railroad tracks crossing S 228th Street BNSF separation is fully funded;

Freight Benefits

- Eliminate rail/auto accidents;
- Reduce freight and auto delays;
- Eliminate at-grade conflicts; and
- Allow for increased rail speeds.

Strander Boulevard

Project Description

- Extension of Strander Boulevard to the east of West Valley Highway (SR 181)
- Roadway overpass structure to provide grade separated crossings of the UPRR and BNSF railroads

Freight Benefits

- Connect the Cities of Renton and Tukwila, and provide significant congestion relief to existing arterials;
- Provide direct access to the Boeing Longacres site;
- Eliminate at-grade conflicts; and
- Reduce freight and auto delays.

Everett Overcrossing

Project Description

- Construction of two overcrossings over BNSF's rail line:
  - Extension of 41st Street from east of I-5 over the BNSF rail line and down to the Riverfront redevelopment area. Project completed.
  - Grade separation of Lowell River Road over the BNSF main line west of Rotary Park. This phase has a funding gap. Amount to be provided by the city of Everett.

Freight Benefits

- Increase safety;
- Reduce congestion; and
- Improve freight mobility. This route is the primary east-west rail corridor for intermodal trains serving 36 trains per day.

SR 202 Corridor-widening

Project Description

This project involves widening of the roadway and the existing bridge for efficient truck movement.

Freight Benefits

- Reduce freight and auto delays;
- Improve safety; and
- Reduce vehicle emissions.

SR 18 Widening

Project Description

- Widening of the SR 18 from Issaquah-Hobart Road to I-90 to four lanes
- Improvements to existing truck climbing lanes

Freight Benefits

- Improve safety;
- Reduce passenger and freight travel times; and
- Mitigate pollution by building drainage facilities to capture and clean highway runoff.

Other Projects

Limited Information

- I-5 Port of Tacoma Road Overcrossing
- S 212th Street Grade Separation
- 8th Street-UP Grade Separation

Appendix F.

Competitive Impacts of Tax and Fee Mechanisms

Appendix F. Competitive Impacts of Taxes and Fee Mechanisms

Introduction

This section describes how the imposition of new or higher taxes and fees on private industry and consumers could affect Washington's economy. It presents the theoretical impacts since the findings of this study do not recommend new or higher existing fees or taxes at this time.

Taxing or charging private industry or consumers to fund public infrastructure (call this a *project* alternative) must always be evaluated in the context of its opportunity cost, which is the full economic effect of reducing funds available for consumer and business spending. On the other hand, if the revenue funds freight projects that remove significant bottlenecks or improve logistic efficiencies, then business costs are reduced and firms increase their productivity. The *project* benefits lead to increased economic competitiveness and market share, and thus enhance the state's economy in terms of business retention and growth (e.g., higher business sales, personal income, and employment).

These benefits, however, must be compared to the *no-project* benefits of leaving the money in the private sector, where it may be spent by businesses on new plants and equipment, distributed as profits, and by taxpayers on personal consumption. Private-sector spending, just like the benefits from the *project* improvement, generates statewide economic benefits in terms of business output and employment. A careful quantitative comparison between the benefits of *project* and *no-project* alternatives can demonstrate whether spending on freight infrastructure produces a better economic outcome than private spending.

Even a careful and direct quantitative comparison of *project* and *no-project* alternatives, however, requires some simplifying assumptions. For example, the relative costs of doing business (and moving goods) in Washington State are the same as compared to alternative locations. This assumption is of particular importance when the businesses serve national or international markets, and therefore have greater discretion in terms of choice of shipping routes, distribution locations, or gateways. We know in fact that businesses locate in Washington State or use its ports for many reasons beyond the relative cost of taxes and fees, which are both tangible (e.g., proximity to raw or intermediate inputs or diversity of shipping channels) or intangible (e.g., quality-of-life or business relationships). Some of these reasons will reduce the effects of higher taxes and fees, especially in the short term (roughly three to five years).

These other locational advantages for Washington State – or put another way, the relative disadvantages of the next best alternative location – are complex and often regarded as proprietary information by private firms that use it for competitive advantage against their rival firms, or to negotiate concessions from port authorities, jurisdictions, and public agencies. Even when such information is revealed, obtaining it requires dozens of interviews with the logistics managers of shipping companies, beneficial cargo owners (BCO), carriers, distributors, receivers, etc. These challenges make it difficult to quantitatively evaluate how firms will absorb higher taxes and fees, and thus impact the State's economy.[65]

Some Relevant Results from Port Diversion Analysis

While the initial reaction of firms to higher fees or taxes may be difficult to model, the port elasticity model, developed and applied by Dr. Robert Leachman[66] provides a robust analysis of potential diversion from Puget Sound ports if various levels of container fees were imposed. This quantitative estimate of diversion constitutes the most challenging part of a full economic analysis of the impact of container fees. The results, however, showed that there would be significant diversion of containers at the lowest fee level that the port elasticity model could evaluate ($30 per TEU). Therefore, the Policy Group concluded that container fees were likely to comprise only one funding option with modest potential. The economic consequences to Washington State's economy were not analyzed.

Such an analysis could be accomplished using a range of tools beginning with input/output (I/O) analysis (using Washington State's I/O model), but would require making some significant assumptions in order to convert the raw numbers of diverted containers to a range of increased business costs that could be fed into the I/O model. The results would be rough estimates of the multiplier effect, which would show how such a decrease in container flows and an increase in the cost of moving goods in Washington State would ripple through the State's economy. This simple order of magnitude estimates is more useful for comparing the relative impacts of alternative taxing scenarios than forecasting absolute estimates of impacts in the future.

In order to calculate a more accurate change in business costs, we would need to conduct interviews with shippers to gauge their reaction and/or undertake

[65] The reaction of drivers, consumers or taxpayers to higher tolls, fuel taxes, or other taxes is less complex and can be evaluated using off-the-self economic software such as REMI or TREDIS. This study, however, is focused on user fees on businesses rather than the population.

[66] Dr Leachman's analysis of the impacts of container fees on container volumes into Puget Sound ports is available at: http://www.leg.wa.gov/documents/LTC/jtc/Freight/Leachman_Report.pdf. A version will be attached to the final report.

simulation modeling. Dr. Leachman conducted such modeling for the impacts of container fees in the two San Pedro Bay ports in Southern California, but in that case there was little diversion at fees over $200 per TEU and significant generation of revenue. Furthermore, his analysis estimated the effects of spending the container fee revenues to remove bottlenecks in the flow of freight out of the San Pedro Bay ports. In his analysis of the Washington State ports, however, there was significant diversion of containers at fees above $30 per TEU (which was the lowest the model could analyze).

The analysis of freight user fee funding sources prepared for Task 8 of this study shows the revenues that could be obtained from fee levels of between $1 and $30 per loaded TEU (based on 2007 imported container volumes)[67]. The results in annual revenue show total revenues ranging between $2 million and $45 million, respectively. (The section also describes the critical assumptions). If a fee were charged on both imported, exported and empty containers, annual revenues from a $1.00 per TEU fee would generate $3 million, and a $30 fee would generate $100 million. This is roughly double what could be raised by applying the fee to imports only.

Other Analyses of Tax and Fee Impacts on State Economies

There has been limited related research undertaken on the effects of higher fees or taxes on the state's economy. One of the few examples is a study conducted by the Washington Research Council titled, *Taxing Business* (Policy Brief, PB 04-05 September 1, 2004).[68] This study used a REMI economic model to evaluate the effects of business and occupation tax (B&O)[69] and sales tax on statewide employment and personal income. The analysis, however, examined a revenue-neutral substitution of these taxes with a hypothetical increase in a flat income tax, which is not the same as just increasing a tax or fee (e.g., fuel taxes or license fees) to generate additional income for transportation. Nevertheless, the analysis does show what could happen when the tax burden is shifted from businesses to consumers. The results, however, only provide a very theoretical measure of how business hiring can be affected by taxation. The selected

[67] The Draft Task 8 report may be accessed at: http://www.leg.wa.gov/documents/LTC/jtc/Freight/DR2_Task8_Sept08_100608.pdf An updated version will be attached to the final report.

[68] http://www.remi.com/uploads/File/Articles/article_139h.pdf, Washington Research Council, 108 S Washington Street, Suite 406, Seattle, Washington 98104-3408, (206) 467-7088, www.researchcouncil.org.

[69] The business and occupation tax (B&O) is similar to a sales tax, although the number of transactions subject to the B&O is far greater than the number subject to the sales tax (for 2003, $318.9 billion versus $87.7 billion). The B&O tax applies to most business revenues at rates that range from 0.138 percent to 3.3 percent. The tax generated $1.9 billion in revenue for the state during fiscal year 2003.

findings summarized below are only intended as illustrative. They are not reliable measures of actual outcomes.

- When the B&O tax is replaced with a flat-rate income tax, employment in 2010 is 22,500 greater than the baseline scenario. Real disposable personal income per capita is 0.02 percent lower in 2010 with the B&O eliminated, compared to the baseline simulation.
- If the state sales and use taxes are reduced to a level that results in a revenue loss just equal to the B&O's revenue and the lost revenue is replaced with a flat-rate tax on personal income, employment in 2010 is boosted by 5,400 compared to the baseline, while real disposable personal income per capita is reduced by 0.08 percent.
- Eliminating the B&O adds 17,000 more jobs than an equivalent reduction in the sales tax. This results indicates that per dollar raised, the B&O tax is more destructive to business activity in the State than the sales tax is.
- If the sales tax on business purchases is reduced by the amount equivalent to the B&O and the revenue is replaced with a flat-rate income tax, then employment increases by 28,400 in 2010 compared to the baseline scenario, and increases real disposable personal income by 0.07 percent.

These results indicate that economic activity is hurt much more by the sales tax on business than on consumers. With the business sales tax reduction, the State has 35,400 more jobs and 0.23 percent more personal income than with the consumer sales tax reduction.

The authors contend that the results of this study are only illustrative and do not predict the full effects of shifting the tax burden from business to households. Furthermore, they list specific assumptions that lead to an overstating of the economic benefits. Finally, the REMI model, used to analyze the effects of shifting tax burdens between businesses and household, is only an extremely simplified abstraction used to understand a specific policy question and not a comprehensive analysis of a real economy.

Nevertheless, the exercise supports the premise stated at the beginning of this section that that business taxes create a drag on economic activity. What also is equally true is that tax revenues spent to remove freight bottlenecks generate economic development. Rigorous and reliable economic analysis of these closely intertwined policy goals is still beyond the reach of current state of the practice.