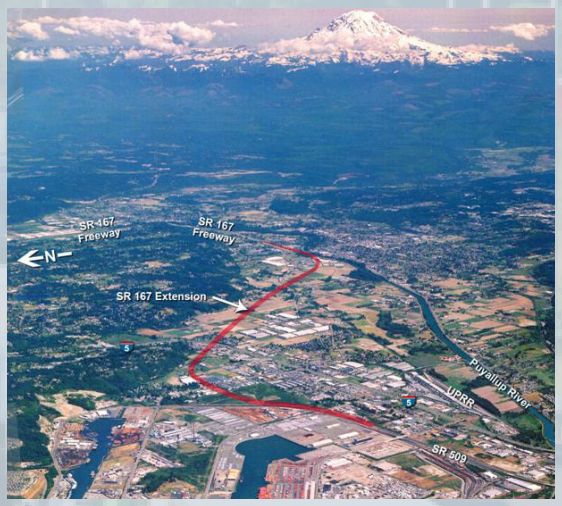
An Economic Assessment of the SR 167 Extension Project



Final Report: April 5, 2007

Washington State Department of Transportation

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AN ECONOMIC ASSESSMENT OF THE SR 167 EXTENSION

EXECUTIVE SUMMARY

Background and Study Context

The SR 167 Extension project is comprised of a six-lane divided freeway connecting I-5 and the current end of SR 167 in Puyallup and a four-lane freeway connecting I-5 to SR 509 near the Port of Tacoma. The project is expected to provide congestion relief, increase safety, and allow for faster and more efficient freight movement, particularly to and from the Port of Tacoma.

Given the likelihood that future funding for SR 167 and other major regional projects will require voter-approval, the Washington State Department of Transportation (WSDOT) requested an economic analysis of the SR 167 Extension project that will, first, inform the regional discussion about the role and value of the SR 167 Extension to the Pierce County and regional economies, second, discuss the impacts of different phasing options and, third, inform regional, state, and federal-level discussions about potential funding alternatives.

Economic Impacts of the SR 167 Extension

Economic impacts of the SR 167 Extension were broken into two broad categories: (1) direct impacts to users of the transportation system and (2) indirect impacts including business and economic development benefits. Indirect benefits to the Port of Tacoma were highlighted because of the significant impact this project has on Port activities.

Direct benefits to users of the road network. User benefits are primarily composed of reductions in congestion and travel times as a result of the project. Using the Pierce County regional transportation model, travel times with and without the project were compared and the net improvement was converted into dollars. These benefits projected over 30 years, from an assumed build year of 2015, totaled $940 million for a full build of the extension and $450 million for a partial build.

It is important to note that these total travel time savings are conservative estimates that only encompass a portion of the true user benefits associated with the SR 167 Extension. Limitations in the travel model did not allow for significant user benefits from parts of the region outside Pierce County to be modeled. Additional operational and safety benefits associated with the project are also not included in the totals. The SR 167 Extension will allow trucks to arrive and leave the Port of Tacoma through a limited access route and reduce travel on the congested local street system. This will improve congestion and safety on the local streets considerably.

Economic development impacts on Port of Tacoma operations. A primary indirect impact of the SR 167 Extension is the support the project lends to the containerized cargo industry in the region and future growth of Port of Tacoma operations. The shipment of containerized cargo is responsible for generating the majority of direct jobs and business revenue at the port. Puget Sound container traffic is projected to grow from 4.15 million TEUs in 2005 to 14.3 million TEUs in 2025. Approximately three quarters of the 10 million TEU increase projected by 2025 is expected to occur at the Port of Tacoma (see Exhibit 8).

The growth in container volumes has, and will continue to generate substantial amounts of business revenue, jobs, and taxes for Washington State. By 2025, total annual statewide economic output is estimated to increase by $3.5 billion due to the growth of the containerized cargo industry. Pierce County accounts for approximately $2.1 billion of the $3.5 billion projected growth in annual economic output. The increased economic activity generated by the Port of Tacoma is estimated to support an additional 79,000 jobs and $1.2 billion in wage income statewide. Over the twenty years between 2005 and 2025, the potential growth in container volumes translates to an estimated total of $30.2 billion in economic output with $10.1 billion in new wage income for the State of Washington.

The ability of the Port of Tacoma to deliver these economic benefits to the region and the State is critically dependent on the Port's ability to achieve its projections for container volumes, *vis-a-vis* its ability to compete with other North American ports for the forecasted growth in West Coast container traffic. It is estimated that approximately 80% of all port-of-entry decisions are discretionary. Transit time and total transportation costs are important inputs that factor into a shipper's decision when selecting a port-of-entry.

Construction of the SR 167 Extension is an essential piece of an integrated regional transportation system that supports and improves freight movement to and from the Port of Tacoma through more efficient connections with the rail and road systems. Without the SR 167 Extension, the Port of Tacoma (and all Puget Sound ports) would find it more difficult to compete with other U.S. and Canadian ports for the movement of containers.

Other indirect benefits and considerations. A range of other indirect benefits are generated by the SR 167 project including:

- **Efficient use of remaining industrial land.** The Fife Valley is facing a rapidly declining pool of vacant and developable industrial lands. Many warehousing and distribution facilities are moving farther from the central Puget Sound region to available land in neighboring counties. The SR 167 project will improve reliability of the regional transportation system and create economic development opportunities closer to Pierce County's urban center in Tacoma. A more reliable transportation system will also allow companies to utilize existing land and facilities more efficiently.

- **Urban center connectivity in Pierce County.** Tacoma is the largest city in Pierce County and is its urban, economic, and legislative center. However, Tacoma lacks key transportation connections with a growing number of urban and suburban centers within the county, particularly to the east. The SR 167 Extension will increase connectivity between Tacoma and neighboring communities to the east, creating economic opportunities and allowing Tacoma to reach its full potential as an urban center.

- **Investment avoidance.** The SR 167 project will draw many trips off arterial roads and onto the freeway network. Current arterials and highways in Pierce County, specifically, River Road in Puyallup and SR 99 in Fife were not designed to carry current and projected vehicle volumes and loads. Current tractor trailer traffic to and from the Port of Tacoma causes significant pavement wear and necessitates more investment in road maintenance and preservation. Construction of the SR 167 Extension would accommodate forecasted traffic and could produce long-term cost savings by reducing rehabilitation and construction costs on existing arterials.

AN ECONOMIC ASSESSMENT OF THE SR 167 EXTENSION

1.0 BACKGROUND AND STUDY CONTEXT

1.1 Report Purpose

The Washington State Department of Transportation (WSDOT) has completed the Final EIS for the SR 167 Extension Project. As the regional, state, and federal-level discourse proceeds on alternatives and funding for projects of regional and state significance, there is an increasing interest in the potential economic value of investments in major transportation facilities.

Given the likelihood that future funding for SR 167 and other major regional projects will require voter-approval, WSDOT requested an economic analysis of the SR 167 Extension project that will, first, inform the regional discussion about the role and value of the SR 167 Extension Project to the Pierce County and regional economies, second discuss the impacts of different phasing options and, third, inform regional, state, and federal-level discussions about potential funding alternatives.

1.2 SR 167 Project Background

The SR 167 Extension, shown in Exhibit 1, is a six-lane divided freeway, including carpool/transit lanes, connecting I-5 and the current end of the freeway section of SR 167 in Puyallup. The extension also includes a four-lane freeway connecting I-5 to SR 509 near the Port of Tacoma. Access to the new freeway will be provided by interchanges at SR 509, I-5, Valley Avenue E, SR 161 (North Meridian), and a partial interchange at 54th Avenue. The project is expected to provide congestion relief, increase safety, and allow for faster and more efficient freight movement, particularly to and from the Port of Tacoma. This version of the project is hereafter referred to in this document as the full build scenario.

A scaled back version of the full build scenario is also analyzed in this study. The partial build scenario, also known as "Proposal A," connects SR 509 to the current end of SR 167 with partial access at Valley Avenue E, but does not build the interchange with I-5. The economic impacts of both the full build and partial build scenarios were analyzed in this study.

Exhibit 1
Map of the SR 167 Extension

Source: WSDOT website, 2006

2.0 ANALYTICAL APPROACH – FRAMEWORK

The impacts of a transportation improvement like the SR 167 Extension Project can be broken into two broad categories: (1) impacts to users of the transportation system who are directly affected by a transportation improvement – referred to hereafter as *user benefits* or *direct benefits* and (2) impacts to other parties that are not direct users of the improvement – referred to hereafter as *indirect benefits* or *non-user* benefits.

User benefits can be thought of as benefits drivers and passengers enjoy when directly utilizing a road facility. These direct benefits are typically calculated by estimating travel costs in three areas: travel time costs, vehicle operating costs, and safety costs. This study analyzes and quantifies travel time costs explicitly and qualitatively considers the likely impact of operating and safety costs. User benefits are addressed in Section 3.0 of this report.

Indirect benefits include environmental impacts, effects on economic development opportunities, and impacts on land use and development patterns. One of the primary indirect impacts of the SR 167 Extension is the support the project lends to the international cargo industry in the region and the future growth of Port of Tacoma operations. The potential economic value future Port of Tacoma operations will bring to the State and region is identified and the role SR 167 plays in supporting these operations is discussed in Section 4.0. Additional indirect benefits including other economic development opportunities in surrounding local communities and effects on land use and development patterns are covered in Section 5.0.

Collectively, the direct user benefits and indirect non-user benefits capture the economic value that is either directly attributable to the SR 167 Extension project or indirectly dependent on the successful implementation of this segment of the regional transportation infrastructure.

3.0 DIRECT USER BENEFITS – TRAVEL TIME IMPACTS

A transportation improvement project results in benefits enjoyed by direct users of the transportation project as well as non-users who are indirectly affected by performance of the transportation system. This section will discuss the methods used to estimate the direct user benefits of the SR 167 Extension. Indirect benefits, or non-user benefits, such as land use and economic development impacts are addressed in Section 4.0 of this report. Other indirect impacts, namely environmental impacts, are outside the scope of this report and dealt with separately in the EIS process.

3.1 Overview of Direct User Benefits Concept

User benefits of a road improvement are typically determined by estimating the change in travel costs in three areas: travel time costs, vehicle operating costs, and safety costs. The SR 167 Extension is a mobility project incorporating capacity and connectivity improvements so the majority of user benefits for this project should be exhibited in travel time savings. A conceptual example of travel time user benefits calculations and an explanation of the consumer surplus concept is presented in Appendix A. Vehicle operating cost savings, which tend to be minor in relation to travel time savings[1], and safety costs are not explicitly calculated in this analysis but are discussed later in Section 3.6.

3.2 Specifications and Limitations of the Travel Model

All estimates of traffic volumes and travel times were generated using the Pierce County EMME/2 Travel Demand Model developed in 2002. The model utilizes the traditional four-step modeling process of trip generation, trip distribution, mode split, and traffic assignment. No changes to underlying land use and network assumptions were made to the 2002 model.

The estimate of the economic value of user benefits is only as good as the estimate of travel time impacts that are derived from the underlying traffic analysis. There are several characteristics and limitations of the Pierce County model that have an impact on the user benefits estimation methodology. The following describes these major limitations and the implications for this analysis:

Travel model calibrated to Pierce County. The Pierce County travel model is based on the Puget Sound Regional Council (PSRC) four-county regional model, but is calibrated to Pierce County travel patterns. Traffic Analysis Zones (TAZs) in the model are disaggregated to a detailed scale in Pierce County and aggregated into larger zones farther away from Pierce County (e.g. north King County and Snohomish County). The transportation improvements assumed in the model's 2030 build-out

[1] "User Benefit Analysis for Highways Manual (Redbook)." American Association of State Highway and Transportation Officials. August 2003: 2-4.

scenario do not include slated improvements outside Pierce County. Exhibit 2 shows a map of the TAZ groups used in this economic analysis.

> **Implications on Economic Analysis:** Travel time estimates outside Pierce County have less specificity and include more unexplainable variation, particularly in TAZ groups farthest away. For this reason, travel time costs for trips to and from extremely far locations are ignored in this analysis. The areas excluded from the analysis include Snohomish County, Kitsap County, King County north of the Kent Valley (Seattle, the Eastside), and the far eastern section of Pierce County.

Model calibrated to PM Peak; Mid-day outputs not available. Trip making and distribution behavior in the travel model have been calibrated to the afternoon PM Peak period, making estimates during this time period the most reliable. However, the model does not have calibrated AM peak hour or mid-day (off-peak) components, which would be necessary to complement the PM peak numbers and produce a reliable estimate of travel time savings over an entire day.

> **Implications on Economic Analysis:** Given the limitations of the model, the economic analysis uses daily average travel time values to estimate changes in travel times. While the daily averages may be less reliable than using the PM Peak period estimates (since the model was calibrated to PM peak), this approach avoids overstating the travel time savings and the estimates of economic benefit (which would be likely if the analysis relied on PM Peak results only).

Land use assumptions were fixed regardless of the build scenario. When a major transportation project like the SR 167 Extension is built, land use patterns around the project and in areas impacted by the new transportation corridor are affected. The SR 167 project is not expected to induce unplanned regional growth, but it could alter the rate, timing, and location of development within the corridor area as planned by local and regional jurisdictions. These possible impacts on the timing and location of future growth were not incorporated into the no-build and build scenarios in the travel model. Population and employment distributions used in this analysis were based on the PSRC's regional distribution pattern and were fixed for the full build, partial build, and no-build scenarios.

> **Implications on Economic Analysis:** The model was not able to capture travel time savings resulting from shifts in rate, timing, or location of development in the corridor area. The fixed land use assumptions and trip tables essentially hold demand constant, regardless of how supply (the transportation network) changes.

Exhibit 2
Study Area Traffic Analysis Zone Groups

Source: Berk & Associates, 2006

3.3 Detailed Methodology and Assumptions Used to Calculate Travel Time Benefits

1. **Definition of base scenario (no-build) and project alternative scenarios (partial build and full build).** The travel time comparison between build and no-build scenarios is made in the year the project is built and a horizon year representing a reasonable timeframe within which benefits should be considered. For this analysis a build year of 2015 and a horizon year of 2045 were selected. The Pierce County travel model is set up to model travel patterns based on 2002 and 2030 population and employment distributions so the trajectory of user benefits between these two data points was used to estimate user benefits between the assumed build year of 2015 and the 2045 horizon year.

   No-build and build scenarios were developed for both 2002 and 2030. The no-build scenarios modeled travel patterns without the SR 167 Extension. Two different build scenarios were modeled in this analysis – a full-build of the SR 167 Extension and a partial-build scenario, referred to as Proposal A.

2. **Process daily trip counts for 2002 and 2030.** Four origin-destination (O-D) trip count matrices were obtained showing the daily number of trips to and from each of the TAZ groups included in the regional travel model. The four matrices covered 2002 and 2030 trips split between two types of traffic – single-occupancy vehicles (SOV) and high-occupancy vehicles (HOV). Within the SOV category, trips were split between non-commercial and commercial (mainly freight) trips. Truck trips to and from the Port of Tacoma were modeled separately by Heffron Transportation, Inc. (a consultant for the Port of Tacoma) and the results of this analysis were used to inform the commercial truck trip allocation. The final trip count matrices are listed below:

   - 2002 SOV commercial trips
   - 2002 SOV non-commercial trips
   - 2002 HOV trips
   - 2030 SOV commercial trips
   - 2030 SOV non-commercial trips
   - 2030 HOV trips

3. **Calculate the change in travel time.** A set of eight O-D matrices showing weighted average daily travel times to and from each TAZ group were then used to calculate the change in travel time between the build and no-build scenarios. The eight travel time matrices are listed below:

   - 2002 No-build SOV travel time
   - 2002 No-build HOV travel time
   - 2002 Build SOV travel time
   - 2002 Build HOV travel time
   - 2030 No-build SOV travel time
   - 2030 No-build HOV travel time
   - 2030 Build SOV travel time
   - 2030 Build HOV travel time

4. **Calculate daily consumer surplus in terms of travel time savings.** Travel time consumer surplus was calculated for each O-D pair for each of the six types of trips listed in step 2. The basic formula used for each O-D pair is listed below:

$$\frac{\text{Number of trips} * \text{Change in travel time (in minutes)}}{\text{60 (to convert to hours)}} = \text{Hours of travel time change per day}$$

5. **Annualize daily consumer surplus totals.** Daily consumer surplus values were annualized by multiplying them by 300.[2]

6. **Convert consumer surplus from vehicle-hours to person-hours.** Consumer surplus hours (which are in the form of hours saved per vehicle trip) were converted to person-hours by multiplying them by average vehicle occupancy (AVO) factors used in the travel model. The AVO for commercial trips was assumed to be 1.0; for non-commercial trips, AVO gradually increased from 1.18 in 2002 to 1.35 in 2030.

7. **Estimate dollar value of consumer surplus.** The annual consumer surplus, in person-hours, was converted to 2006 dollars by using value of time factors that vary depending on the type of trip. The value users assign to their travel time depends on the opportunity cost of that time, which is assumed to be proportional to the wage of the traveler. The U.S. Department of Transportation[3] and the American Association of State Highway Transportation Officials[4] have provided guidance on a range of accepted wage rate factors for different trip types. Based on this guidance, the following proportions of the wage rate were used as value of time factors in this study:

   - Non-commercial SOV trips: 50% of the wage rate.

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[2] In transportation analyses, there are assumed to be 250 workdays during the year, during which the greatest congestion occurs. This means that 115 non-work days exist, during which time congestion still exists, although generally at a moderated level. The assumption in this analysis is that the 115 non-work days will see congestion-relief benefits that are about half of the congestion relief benefits generated during a typical workday. To simplify calculations, the congestion relief benefits of 50 workdays were added to the base 250 workdays for a 300 day annualization factor.

[3] "The Value of Travel Time: Departmental Guidance for Conducting Economic Evaluations," U.S. Department of Transportation, 1997, revised February 2003: 11-13.

[4] "User Benefit Analysis for Highways Manual (Redbook)." American Association of State Highway and Transportation Officials. August 2003: 5-3.

- Non-commercial HOV trips: 60% of the wage rate for the driver and 40% of the wage rate for passengers.
- Commercial trips: 120% of the wage rate, which reflects the fact that travel time for commercial trips not only costs the wage rate of the driver, but also the fringe benefit costs incurred by the business owner.

The wage rate used in this study is based on the latest employment and earnings data from the Washington State Employment Security Department. These data were used to estimate an average hourly wage for workers in King and Pierce Counties, the counties that comprise the majority of trips analyzed in the travel model. In 2006, the estimated average hourly wage for King and Pierce Counties is $24.57 per hour. The percentages above were applied to this base wage rate to produce the following value of time factors:

- Non-commercial SOV trips: $12.28
- Non-commercial HOV trips: $14.74 for the driver and $9.83 for passengers
- Commercial trips: $29.48

Total hours saved in each of the trip categories were multiplied by the value of time factors and summed to produce a total dollar value of travel time user benefits for the year.

8. **Extrapolate and discount user benefits in future years.** The total travel time consumer surplus values in 2002 and 2030 were used to extrapolate the consumer surplus from an assumed completion in 2015 out to a project horizon year in 2045. Wage growth was assumed to grow by 1% faster than inflation over the life of the project. In order to discount future benefit streams to 2006 dollars, a real discount rate of 3.5% was used.

9. **Repeat analysis for partial-build scenario.** Steps 2 through 8 were repeated for the partial build Proposal A scenario.

3.4 Observed Travel Patterns

The addition of the proposed SR 167 Extension results in shifts in the travel patterns on several roadways and creates congestion relief for commuters in several nearby communities. Listed below are a few highlights of the travel pattern changes and travel time improvements created by the project.

Full Build Scenario

- **Trips shift off River Road (Existing SR 167), Valley Avenue and North Meridian.** The most significant shift in trips occurs along River Road (Existing SR 167) (east-west traffic), Valley Avenue (east-west traffic) and North Meridian north of the SR 167 interchange (north-south traffic). Most of the trips on these arterials shift to the SR 167 Extension and the new connection to I-5. The project also causes a slight reduction in trips using SR 512 to gain access to I-5 northbound, as the new extension provides a better alternative.

- **Travel times improve between Tacoma and eastern cities.** Travel times to and from the Port of Tacoma and Tacoma City Center area improve most significantly with communities to the east and southeast. The extension improves travel times to and from Puyallup, Sumner, and points east as well as central areas including South Hill, Fredrickson, and Graham. In general, the majority of eastern and central Pierce County communities gain an improved connection with the Tacoma urban center.

- **Travel times improve between the Kent Valley and Puyallup/South Hill.** Travel times improve between the Kent Valley and communities along the SR 167 and North Meridian corridor (Sumner, Puyallup, South Hill, Fredrickson, and Graham). Trips that used to use North Meridian north of the SR 167 interchange gain access to I-5 with the extension and are able to reach destinations in the Kent Valley faster.

- **Travel time savings are largest in the build year and diminish over time.** Even before discounting future benefit streams, the travel time savings are greatest in the build year. In the simulated 2002 build scenario, travel times throughout the system improve, even along north-south routes using I-5. By 2030, congestion on I-5 before and after the SR 167 interchange begins to cause travel time delays that reduce total system user benefits. This congestion is partially fueled by additional trips gaining access to I-5 via the SR 167 Extension. As a result, there remain net gains in overall mobility, but these gains are reduced gradually over time.

Partial Build Scenario

- **Similar travel pattern shifts in smaller magnitude.** The partial build (Proposal A) scenario causes trip shifts very similar to the full build scenario but with less magnitude. Travel time improvement patterns are similar to the full build scenario but not as large.

- **2030 congestion on I-5 is not as severe.** In 2030, the congestion levels on I-5 are not as severe in the partial build scenario because there is no interchange with SR 167.

Sample Trips to Illustrate Travel Time Improvements

Exhibit 3 shows travel time improvements for a few selected trips during the afternoon rush hour. As described earlier, trips between the Tacoma area and points east and trips between the Kent Valley and the Puyallup/South Hill area experience the largest travel time improvements as a result of the SR 167 Extension.

Exhibit 3
Examples of 2030 Afternoon Rush Hour Delay Improvements in Full Build Scenario

Trip Description	Travel Time Without SR 167 Extension (Mins)	Travel Time Improvement With SR 167 Extension (Mins)	Percentage Improvement
Trips To/From Port			
Port of Tacoma to Puyallup	18.2	2.8	15%
Port of Tacoma to Fredrickson	33.0	2.3	7%
Port of Tacoma to Orting	35.7	4.8	13%
Trips To/From Kent Valley			
Puyallup to Tukwila/SeaTac	30.4	2.6	9%
South Hill to Des Moines	32.5	2.9	9%

Source: Perteet Inc., 2006

3.5 Total User Benefits

Exhibit 4 outlines the total discounted user benefits over 30 years from an assumed completion year of 2015 out to a project horizon year of 2045 for this analysis. For the full build scenario, $940 million of user benefits are generated by the project and about half that amount ($450 million) is generated by the partial build scenario. The estimated value of travel time savings in 2015 and 2045 shown in the chart were not discounted so the two values could be reasonably compared. The full build scenario has annual user benefits drop by 32% over 30 years and the partial build scenario has annual benefits drop even more severely by 67%. In both scenarios, the build year travel time savings are much higher than the horizon year savings. This is caused by future growth in trips and congestion outpacing infrastructure construction and gradually eating away at travel time benefits. Exhibit 5 shows how user benefits diminish over time even without discounting for the future value of money.

Exhibit 4
Total User Benefits of the SR 167 Extension

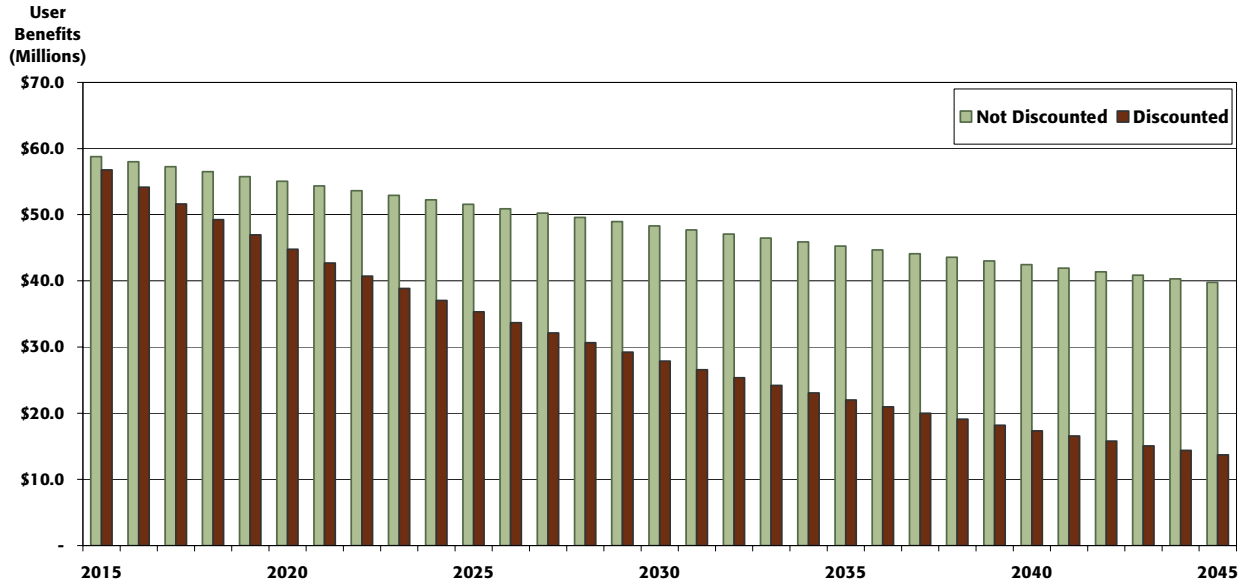
	Full Build Scenario	Partial Build Scenario (Proposal A)
Total Travel Time Savings (Person-hours)		
In Build Year (2015)	13,915	8,571
In Project Horizon Year (2045)	7,019	2,090
Estimated Value of Travel Time Savings (Millions)*		
In Build Year (2015)	$58.8 M	$36.1 M
In Project Horizon Year (2045)	$39.8 M	$11.9 M
Total Discounted User Benefits, 2015-2045 (2006 Dollars)**	**$940 Million**	**$450 Million**

Source: Berk & Associates, 2006

* 2045 benefits not discounted for comparison purposes only

** Net user benefits calculations factor in wage growth (1% over inflation) and use a real discount rate of 3.5%

Exhibit 5
Total User Benefits by Year for the Full Build Scenario



Source: Berk & Associates, 2006

It is important to note that the estimated user benefits shown in Exhibit 4 only encompass a portion of the true user benefits associated with the SR 167 Extension. There are several significant components of total user benefits that are not included in these numbers, including:

- User benefits experienced by users in other parts of the region outside Pierce County and the Kent Valley;
- Additional operational and safety benefits; and
- Additional user benefits beyond the horizon year but within the lifespan of the project.

The next section discusses in detail the user benefits not accounted for in this analysis and provides a useful context within which these user benefits should be considered.

3.6 Analysis and Interpretation of User Benefits

Several factors, including some of the travel model limitations noted in Section 3.2, have restricted user benefit calculations and should be taken into account when evaluating the overall economic impact of the SR 167 project. Listed below are several of these important factors.

A detailed operational model of local traffic impacts was not included in the analysis. The Pierce County travel model used in this analysis is a regional travel model better suited to analyze relative shifts in congestion and travel times as opposed to absolute shifts in travel times. A more detailed operational model of traffic behavior in and around the SR 167 Extension would have produced better estimates of actual travel time savings, which could then have been used to calibrate results from the regional model. This would have resulted in a better overall estimate of likely travel time impacts and user benefits.

Only a portion of the regional transportation network and associated travel time impacts are included in the total user benefits calculation. Travel time changes in Kitsap County, Snohomish County, North and East King County, and Southeast Pierce County were all excluded from this analysis because the travel model was not calibrated to handle these outlying areas. At first glance, these exclusions make sense – why should a project in Pierce County be expected to impact travel times in Snohomish or Kitsap Counties? However, when one considers the regional transportation system and land use patterns as an interconnected system, these exclusions actually cut out a significant portion of the potential user benefits associated with a project like SR 167. By not being able to accurately model land use shifts and travel time savings in other parts of the region, it is likely that total user benefits are being underestimated in this analysis.

Additional operational and safety benefits. As mentioned earlier, total user benefits are comprised of three parts: travel time costs, vehicle operation costs, and safety costs. Only travel time benefits are estimated explicitly in this analysis. Vehicle operation costs, although typically minor in relation to travel time savings, would likely improve marginally due to the congestion relief created by the SR 167 project. Safety costs would also likely improve due to the project. The extension is being built according to modern highway design standards with limited access points and divided lanes to minimize safety risks on the highway. In addition, the SR 167 Extension will remove significant amounts of traffic from River Road, which currently has high accident rates due to congestion and

numerous access points and intersections. Moving traffic from River Road to a modern highway system will reduce accident rates and safety costs. The extension will also allow trucks to arrive and leave the Port of Tacoma through a limited access route and reduce travel on the local street system. This will improve congestion and safety on the local streets considerably.

Additional benefits beyond the 30-year project horizon. User benefits have only been projected and discounted out to a 30-year project horizon. A major highway improvement like the SR 167 Extension can generate user benefits beyond 30 years without need for significant maintenance costs. Although benefits towards the end of this project's lifespan would be heavily discounted, they should be considered as another minor source of benefits.

3.7 Incident-related Impacts on the Variability of Travel Time

SR 167 Provides the Region with a North-South Corridor Complementing I-5

The estimates of mobility improvement decreasing over time described in Exhibit 4 reflect the average delay associated with congestion on overburdened roadways. This average reflects observed traffic conditions on a range of existing roadways nationwide, combining light traffic days, heavy traffic days, and the effects of non-recurring incidents.

Traffic volumes and levels of congestion vary considerably from day to day. Periodic increases in traffic occur due to planned events such as sporting events and festivals. In addition, non-recurring events such as vehicle accidents, vehicle breakdowns, temporary lane closures, or bad weather also contribute substantially to the overall delay.[5] WSDOT estimates that half of all highway delays in Washington State result from non-recurring events.

The proposed extension, particularly in the full build scenario, will improve connectivity between I-5 and SR 167 and make it easier for traffic to shift between the two corridors. If the SR 167 Extension were not available, the impact of non-recurring events could become significantly worse, for two reasons:

1. SR 167 and the extension offer an alternate route to a congested I-5 when incidents occur. Without the extension drivers have few if any freeway alternatives to relieve pressure on the system due to an event or incident, particularly south of SR 18.

2. Non-recurring incidents are more frequent and their delaying effects are more damaging as volumes on a given facility increase. As traffic volume increases over time, more stress will be placed on the I-5 corridor, increasing the frequency and severity of accidents and events.

[5] "Sketch Methods for Estimating Incident-Related Impacts: Task Order No. 21." Federal Highway Administration, Office of Environment and Planning. Prepared by Cambridge Systematics, Inc., Harry Cohen and Science Applications International Corporation. December 1998.

4.0 INDIRECT BENEFITS – ECONOMIC DEVELOPMENT IMPACTS ON PORT OF TACOMA OPERATIONS

4.1 Port of Tacoma Operations

Major Economic Centers: Port of Tacoma and Port of Seattle

The Ports of Tacoma and Seattle are major regional and statewide economic centers. Deep water port activities contribute to the economy by providing employment and income to individuals, tax revenue to local and state governments, and revenue to businesses engaged in handling, shipping, and receiving cargo via the ports. Combined, the Ports of Tacoma and Seattle marine cargo activities directly employ over 19,000 people and are responsible for generating a total of 34,000 jobs – detailed in Exhibit 6. In addition to creating employment, firms engaged in the transport of marine cargo generated $2.9 billion in total revenue with $195 million being spent on local and state government taxes. The jobs created by port activities are high value jobs with annual wage averages ranging between $49,000 (Tacoma) and $50,000 (Seattle). A large percentage of those direct jobs are in the marine services industries where annual wages are substantially higher than the average wage range cited above for all jobs.

Exhibit 6
Current Economic Impacts of the Puget Sound Ports: Marine Cargo

	Port of Seattle	Port of Tacoma	Total
Employment			
Direct	9,681	9,370	19,051
Induced	5,804	4,504	10,308
Indirect	2,707	2,243	4,950
Total	18,192	16,117	34,309
Business Revenue	$1,438,323,000	$1,492,111,000	$2,930,434,000
State and Local Taxes	$104,479,000	$90,655,000	$195,134,000

Source: Port of Tacoma, 2004 Economic Impact Study; Port of Seattle, 2003 Economic Impact Study.

Marine cargo activities at the Ports of Seattle and Tacoma encompass the shipment of containers, grain, breakbulk, forest products, petroleum, and automobiles. The shipment of containerized cargo is responsible for generating the majority of direct jobs and business revenue at the ports. Exhibit 7 shows that containerized cargo accounts for 61% of the 19,000 direct jobs created by port marine cargo activity. At the Port of Seattle, $960 million of the $1.4 billion and $1.26 of the $1.49 billion in direct business revenue at the Port of Tacoma comes from the shipment of containers. The bulk of these jobs and revenue are tied to the shipment of international containers which account for a largest proportion of total direct jobs.

Exhibit 7
Direct Employment from Containerized Cargo

Commodity	Direct Jobs Port of Seattle	Port of Tacoma
Containerized Cargo		
International	3,908	5,664
Domestic	1,011	962
All Other Commodities	4,762	2,744
Total	9,681	9,370

Source: Port of Tacoma, 2004 Economic Impact Study; Port of Seattle, 2003 Economic Impact Study.

4.2 Projected Growth in Containerized Cargo: Port of Tacoma's Importance

Looking forward, the Port of Tacoma's availability of land and potential berthing spaces makes it the key Puget Sound port in terms of the region's capacity to grow and meet the demand for West Coast container traffic. Both the Ports of Seattle and Tacoma are projecting a substantial increase in international containerized cargo over the next two decades. In 2005, both ports handled a combined volume of approximately 4.15 million TEUs (twenty-foot equivalents). Puget Sound container traffic is projected to grow at 6.4% per year from 4.15 million TEUs in 2005 to 14.3 million TEUs in 2025. Exhibit 8 and Exhibit 9 illustrate that the vast majority of that growth is expected to occur at the Port of Tacoma. Of the approximately 10 million TEU increase projected by 2025, the Port of Tacoma is expected to accommodate roughly three quarters of the growth.

Exhibit 8
Project Marine Containerized Cargo Capacity (TEUs)

Port	2005		2025		Share of Growth
Port of Seattle	2,087,929	(50.3%)	4,500,000	(31.5%)	23.8%
Port of Tacoma	2,066,447	(49.7%)	9,806,000	(68.5%)	76.2%
Total	4,154,376		14,306,000		

Source: Port of Tacoma, personal communication and Port Truck Trips in Corridor, Heffron Transportation.

Marine port operations are land intensive and potential container traffic growth is dependent on the capacity to expand landside operations for the handling, storage, and shipping of containers. In 2000, the Ports of Tacoma and Seattle had a relatively equitable amount of land devoted to marine cargo operations (Exhibit 9). However, the Port of Seattle is constrained by the availability of land while the Port of Tacoma has some of the largest available capacity for expansion on the West Coast. In 2000, the Port of Tacoma accounted for 1,335 of the 1,455 acres slotted for expansion between the two ports.

Exhibit 9
Port Planned Expansion Acreage

	Yr 2000	Planned Expansion	Total Planned
Port of Seattle	405	120	525
Port of Tacoma	422	1,335	1,757
Total	827	1,455	2,282

Source: Port of Seattle, Harbor Development Strategy 21, 2001.

The Port of Tacoma handles both domestic and international containerized cargo, and increases on the international side are expected to contribute the most to growth rates (Exhibit 10). By 2025 container traffic is projected to increase to 9.8 million TEUs – growing 8.1% annually. International container cargo is expected to grow 9.2% annually, while domestic container trade is projected to grow by 2.0% per year.

Exhibit 10
Projected Growth in Port of Tacoma Container Traffic

	TEUs	
Containerized Cargo	2005	2025
International	1,551,677	9,037,000
Domestic	514,770	769,000
Total	2,066,447	9,806,000

Source: Port of Tacoma, personal communication.

Economic Value of the Port of Tacoma's Projected Growth

The growth in container volumes has, and will continue to generate substantial amounts of business revenue, jobs, and taxes for Washington State. Exhibit 11 summarizes the statewide economic impacts of projected increases in Port of Tacoma containerized cargo. Annual total statewide economic output is estimated to increase by $3.5 billion (2006$). Exhibit 11 also shows the increased economic activity generated by the Port of Tacoma is estimated to support an additional 79,000 jobs and $1.2 billion (2006$) in annual wage income statewide by 2025. Between 2005 and 2025, the net present value of the total increase in economic activity over all years translates to a value of $30.2 billion (2006$) in economic output with $10.1 billion (2006$) in total wage income.

Exhibit 11
Economic Impact of Projected Containerized Cargo Volumes
(Millions of 2006 dollars)

	2005	2025	Increase
Total Economic Impacts (millions)	$1,798	$5,258	$3,461
Direct economic impacts	$922	$2,696	$1,774
Induced/Indirect economic impacts	$876	$2,563	$1,687
Total Job Impacts	18,449	97,456	79,007
Direct job impacts	7,791	41,153	33,363
Induced/Indirect job impacts	10,659	56,303	45,644
Total Wage Income (millions)	$598	$1,750	$1,152

Source: Berk & Associates, 2006. All dollar amounts are adjusted to 2006.

Future 2025 jobs and business revenue were estimated using the 2004 Port of Tacoma Economic Impact Study, future projections for container traffic, and the Washington State Input/Output Model described in Section 4.5.

Majority of Economic Activity Expected to be Located in Pierce County

The majority of economic activity generated by the containerized cargo business at the Port Tacoma is expected to be located in Pierce County. Exhibit 12 summarizes the economic impacts of projected increases in Port of Tacoma containerized cargo for Pierce County and the rest of Washington State. Pierce County accounts for approximately $2.1 billion of the $3.5 billion projected growth in annual economic output by 2025. The majority of direct jobs (64%), 50,000 of the 79,000 total job growth, and $783 million of the $1.2 billion annual wage income growth is estimated to occur within the County. Between 2005 and 2025, growth in the container industry in Pierce County translates to a net present value of $19.0 billion in economic output over all years, of which, $6.4 billion is in the form of total wage income

Exhibit 12

Pierce County's Share of Growth in Statewide Economic Activity Related to Containerized Cargo

	2005		2025		Total WA	Pierce County's
	Pierce Co.	Total WA	Pierce Co.	Total WA	Increase	Share of Increase
Total Revenue (millions)	$1,137	$1,798	$3,229	$5,258	$3,461	$2,092
Total Job Impacts	11,695	18,449	61,777	97,456	79,007	50,082
Direct	4,952	7,791	26,159	41,153	33,362	21,207
Total Labor Income (millions)	$407	$598	$1,189	$1,750	$1,152	$783

Source: Berk & Associates, 2006. All dollar amounts are adjusted to 2006.

The methodology used to estimate the selected economic impacts for Pierce County shown in Exhibit 12 are described in Section 4.5.

4.3 Economic Value Contingent on Port of Tacoma's Competitiveness for Containers

The ability of the Port of Tacoma to deliver projected economic benefits to the region and the State is critically dependent on the Port's ability to achieve its projections for container volumes, *vis-a-vis* its ability to compete with other North American ports for the forecasted growth in West Coast container traffic.

Containerized cargo is the fastest growing component of waterborne trade and ports compete with each other for their share of that growth. The Ports of Tacoma and Seattle face major competition for market share of marine cargo from other West Coast ports, chiefly from Southern California and Vancouver, British Columbia, but also with East Coast and Gulf Coast ports. The distribution of port-of-entry calls for ocean shippers are dependent on several factors that include:

- Demand from regional population
- Cargo transit time to final destination
- Total cargo transportation costs

Port-of-entry decisions are highly sensitive to these factors. It is estimated that approximately 80% of all port-of-entry decisions are discretionary. The Puget Sound ports have distinct advantages in sailing time from Asian ports and transit times to northern tier cities such as Chicago and New York; however, Southern California has large advantages in rail capacity and a robust freight logistics infrastructure that reduces total transportation costs. Conversely, the Puget Sound ports are hampered by higher average total transportation costs. Southern California ports are the favored destination for many shippers due to its advantages in logistics infrastructure and transit times to major inland destinations. However, this demand has created substantial congestion and shifted container traffic to other west coast ports.

Ports are highly dependent on intermodal transportation to move containerized freight and this emphasizes the importance of infrastructure that connects different modes, especially where modes converge at transfer points, such as port terminals. Consequently, a port's competitive position is not only affected by the condition and performance of each modal system, but also on how the different modes fit together to provide a continuous and complete transportation system.

The efficiency of a freight transportation system is a key factor in a port's competitive position. Shippers and movers of freight focus on obtaining the least cost combination of production inputs. Transit time and total transportation costs are important inputs that factor into a shippers' decision when selecting a port-of-entry.

1. Lower transit times reduce some transportation costs, e.g., drivers' wages for a given trip length, and result in a net lower dollar cost to shippers. Further, as with lower transportation costs, less time for a move extends the "reach" of a port to a larger market area for access to warehouses and distribution centers.

2. Reductions in transit time and/or increases in schedule reliability have significant impacts on the desirability of a port. Increased reliability reduces the requirement of firms to "buffer" inventory

stocks to protect against delivery failure. These gains in terms of time allow firms to manage their inventories and supply chains more efficiently.

4.4 The SR 167 Extension Supports Port of Tacoma's Long-run Growth

In an environment of intense competition for containerized cargo, an efficient freight mobility infrastructure is an important advantage for the Port of Tacoma. If the Port of Tacoma does not have a high-quality transportation system that supports the movement of cargo, especially for the containerized cargo that is not destined for Washington State, shippers will quickly shift their business to other ports. As road and rail congestion in the I-5 corridor increases over the next 20 years, the impact of increasing traffic levels on the quality and reliability of the freight transportation system will be magnified if needed investments in our highways, railroads, and intermodal facilities do not keep pace, resulting in an increase in the cost of moving freight.

Construction of the SR 167 Extension is an essential piece of an integrated transportation system that supports and improves freight movement to and from the Port of Tacoma through more efficient connections with the rail and road systems. Without the SR 167 Extension, the Port of Tacoma (and all Puget Sound ports) would find it more difficult to compete with other U.S. and Canadian ports for the movement of containers.

Rail and transload operations. SR 167 supports the competitiveness of the regional rail system, by providing important connections for the fastest growing segment of its rail operations – transloading. Transloading is the operation where two 40-ft containers are unloaded from a ship and driven to a nearby warehouse by truck and re-loaded into one 53-ft container and driven to a rail yard that is then loaded onto a train. Since rail cars allow up to 53-foot containers, but ships are limited to 40-foot containers, this transload activity allows the railroads to move more total cargo per train than simply loading the two separate 40-foot containers.

Exhibit 13 displays the distribution of containerized cargo that either arrives/departs the Port of Tacoma by rail, transload, or truck. Most of the containers that arrive from international markets are expected to be transported to inland markets via rail. The Port of Tacoma expects that by 2025 75% of all containerized cargo will be intermodal (transported by rail).

Exhibit 13
Modal Distribution of Port of Tacoma Containerized Cargo

	TEUs		
Containerized Cargo	2005	2025	Annual Rate
International			
Rail	1,055,140	6,597,010	9.60%
Rail/Transload	93,101	722,960	10.79%
Truck	403,436	1,717,030	7.51%
Domestic			
Rail	10,295	15,380	2.03%
Truck	504,475	753,620	2.03%
Total	2,066,447	9,806,000	8.10%

Source: Port of Tacoma, personal communication

It is important to note that the capacity of the regional rail system to handle projected growth is an increasing concern. All of the rail traffic generated by the Ports of Tacoma and Seattle move on the I-5 Rail Corridor, as does all of the Amtrak and Sound Transit Commuter Rail passenger traffic. Upgrades to track and signals, as well as changes in operating procedures, are necessary if the corridor is to handle all of the projected freight and passenger traffic. In terms of east/west capacity, it is expected that the Stampede Pass line has the potential to serve as a major intermodal corridor, but would require tunnel improvement and upgraded signals to allow it to handle double-stack trains and a greater number of trains.

The SR 167 Extension would provide a direct link to transload facilities located in warehouses in the immediate vicinity of the Port of Tacoma. Transloading is a time and transportation intensive activity and the SR 167 link would reduce the time needed for a truck to make the trip, thereby reducing the total transportation cost reflected in lower driver wages and vehicle operations per container. These lower total transportation costs support the competitiveness of international container traffic that moves through the Port of Tacoma by rail.

Surface transport and regional distribution centers and warehouses. The SR 167 Extension supports the Port of Tacoma's competitiveness by making regional freight logistics more efficient. The Extension will provide:

- **Increased transportation capacity and a more direct route to meet projected increases in truck traffic resulting from increases in container volumes.** Containerized cargo that arrives through the Ports of Seattle and Tacoma are not trucked directly to a retailer. Both regionally-destined and transload containers are first trucked to a warehouse or distribution center for repackaging, or are trucked directly to a manufacturer. Therefore, truck destinations are influenced by the location of these types of uses throughout the region. Currently, an estimated 44% of regional truck trips generated by the Ports of Seattle and Tacoma are destined for warehouses and distribution centers in the SR 167 corridor in the Green River Valley, Tacoma, and Fife. By 2025, the warehouses in this region are expected to see a 3,210 average daily truck increase to/from the Ports of Tacoma and Seattle with the Port of Tacoma accounting for 82% of that growth.[6]

- **Faster delivery times, more delivery reliability, and efficient land use of warehouse space.** SR 167 improvements will allow local firms to more efficiently manage their inventories in the supply of manufacturers or distribution of retail items. Holding cargo and inventory is costly for firms operating distribution centers and warehouses. Capital must be used to hold it, warehouse or storage space has to be used to store it, and insurance must be carried to cover the risk of loss or damage. For these reasons, inventory and warehousing costs have been increasing relative to transportation costs, and the trend has been to spend more on transportation and realize offsetting reductions in the other logistics costs.

  A distinct competitive advantage for Port of Tacoma is to offer a logistics system where firms rely on faster and timelier delivery of cargo. This allows firms to economize on warehouse space by

[6] "Port Truck Trips in Corridor, Technical Memorandum", Heffron Transportation, Inc., October, 2006: 2-7.

efficiently managing the capacity they have. An associated benefit for the region is the efficient land use of existing and planned warehouse space. Further, with lower travel time costs, less time for a move extends the "reach" of the Port of Tacoma to a larger market area for access to other warehouses and distribution centers that it was not able to attract previously.

4.5 Detailed Methodology and Assumptions Used to Calculate Future Port-Related Economic Impacts

1. **Develop 2004 job per container ratios.** The 2004 Port of Tacoma Economic Impact Study prepared by Martin Associates was used to derive direct job to containerized cargo ratios by job category. Using containerized cargo traffic data for the Port of Tacoma in 2004 and Martin's estimate for direct jobs generated by international and domestic containerized cargo, direct jobs to container ratios were estimated from the shipment of international and domestic containers. The movement of international containers created 4.39 direct jobs per 1,000 TEUs while domestic containers created 1.89 direct jobs per 1,000 TEUs. These ratios are consistent with Martin's estimate of jobs per ton of commodity for container cargo.

2. **Assume that current job per container ratios remain constant in 2005 and 2025.** The 2005 and 2025 direct job estimates are extrapolated from the Port of Tacoma's figures for 2004 container volumes and Martin's estimate of direct jobs. The 2005 and 2025 estimates assume that the labor output needed in the shipment of containers is constant over time. The movement of containers is a labor intensive endeavor involving the trucking, loading, stacking, and processing of individual containers. This assumption about the amount of labor output needed to transport a container underlie the assumption that current job per container ratios should remain relatively constant.

3. **Estimate 2005 and 2025 direct jobs resulting from container traffic.** 2005 and 2025 direct jobs were estimated by applying the calculated jobs per container ratios to the Port of Tacoma's 2005 container data (in TEUs) and its 2025 container projection.

4. **Allocate total direct jobs to Standard Industrial Classification (SIC) job categories.** 2005 and 2025 direct jobs were allocated to SIC job categories by applying Martin's 2004 direct jobs by job category distributions. This was accomplished by: 1) applying known percentages of direct jobs of a certain job category attributed to the transport of container cargo (e.g. surface transportation and terminal employees); and 2) applying a uniform ratio to all other job types reflecting the percentage of all direct jobs that are tied to the movement of containerized cargo.

5. **Estimate 2005 and 2025 economic impacts using the 2004 Washington State Input/Output Model. Direct jobs were used.** The 2004 Washington State Input/Output Model was used to model the 2005 and 2025 economic impacts. 2005 and 2025 direct job estimates were used to create revenue outputs for the model. Total economic output (direct and indirect/induced), total jobs (direct and indirect/induced), and total wages were estimated for 2005 and 2025. All dollar figures were adjusted to 2006 dollars.

6. **Estimate the economic impacts located in Pierce County.** The direct Pierce County jobs were estimated using a direct job ratio of Pierce County to Washington State jobs described in the Martin Associates 2004 Port of Tacoma Economic Impact Study. These ratios were used to

calculate Pierce County's share of the total Washington State economic impacts. A range of total, direct, induced, and indirect impacts were estimated using the following two methods: 1) combining the Pierce County estimated direct jobs impacts and the Department of Revenue's Washington State I/O model; and 2) applying job to economic output ratios derived from the 2004 Martin Study to estimate the share of Pierce County economic impacts. This approach assumes that the economic system described in the 2004 Martin Associates report would be similar to the Port of Tacoma's economic situations in 2005 and 2025. While it is highly plausible that the economic relationship in 2004 (the year of the study) and 2005 are similar, it becomes more difficult to assume that the same characteristics will be evident in 2025. Additionally, the Washington Input/Output Model is used only to approximate the economic impacts of Pierce County since it describes the entire State economy and not a smaller, selected geography. Pierce County's share of the total growth is calculated by subtracting the increase in economic activity in 2005 from 2025 total. The more conservative estimate is used where there is a range of values.

5.0 OTHER INDIRECT IMPACTS

5.1 Urban Center Connectivity in Pierce County

With a population of approximately 200,000, Tacoma is the largest city in Pierce County and is its urban, economic, and legislative center. However, Tacoma lacks key transportation connections with a growing number of urban and suburban centers within the county, particularly to the east. Whereas downtown Seattle is directly served by three major highway systems, downtown Tacoma is only directly served by I-5.

The SR 167 Extension would increase transportation access and network connectivity to many underserved areas. Currently, there are no direct, limited access east/west highways for residents living along the SR 410 corridor in Sumner, Bonney Lake, Buckley, and Orting that provide access to downtown Tacoma. The SR 167 Extension would add additional connectivity and capacity for users of the SR 161 corridor/North Meridian between Puyallup and Tacoma.

The addition of the SR 167 Extension would make Tacoma more accessible to a large portion of County residents. The increased accessibility could bring positive benefits to Pierce County by connecting Tacoma with population bases in these outlying areas. Businesses in Tacoma could draw from a larger labor pool, while housing in the outlying areas would be more accessible to those working in Tacoma, which could spur additional commercial development in the downtown area.

5.2 Land Use Efficiency

The Green River Valley and SR 167 Corridor north of Puyallup is home to many warehouses and distribution centers. Most warehouses and distribution centers operate using just-in-time inventory systems, where goods are shipped from the manufacturer when they are needed on store shelves, rather than being shipped in advance and stored in a warehouse. This system economizes on warehouse space, but relies on a timely and reliable transportation system that allows trucks to easily access distribution centers.

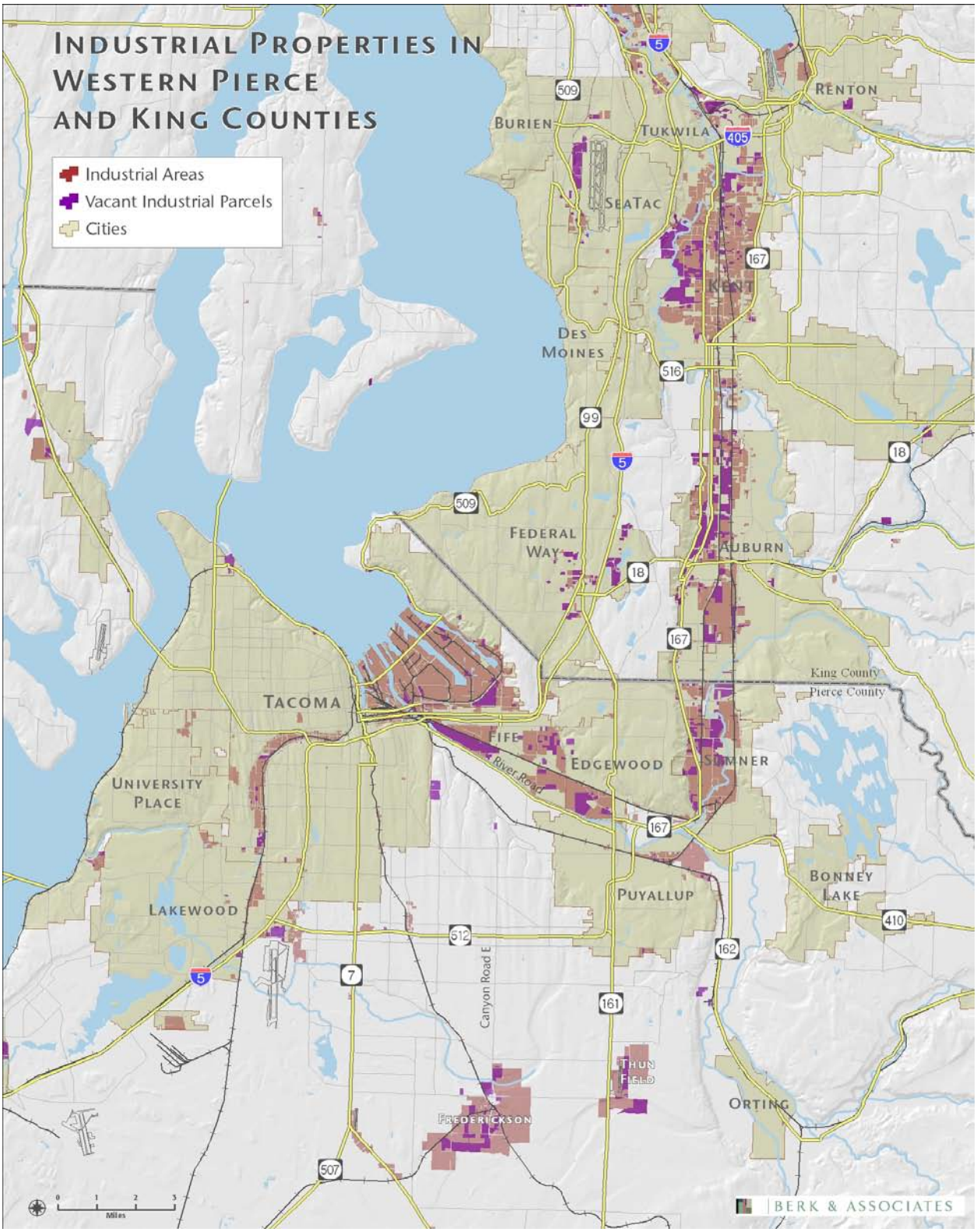
Costco Corporation, a retail wholesaler, operates a distribution center in the City of Sumner and is a foremost example of just-in-time delivery and its effects on the production process. In one eight-hour period 500 trucks deliver goods to the Costco distribution warehouse. In the next eight hours these goods are sorted and organized, and in the third eight-hour period 700 trucks pick up those goods to deliver them to individual Costco stores. This system requires 1,200 trucks to travel in and out of Sumner in one twenty-four hour period to a single distribution center. Trucks must meet their targeted delivery or pick-up time or the entire system is affected. Late trucks disrupt the system, and if they arrive early they must sit and idle on the roadside. The predictability and reliability of the road system is a major factor for just-in-time delivery operations.

The current road network in Pierce County is unreliable, unpredictable and highly congested. Trucks either rely on I-5, which is unpredictable regarding congestion due to accidents and predictably-congested during peak travel times, or they must travel on smaller highways and arterials, which are often more congested than the interstate, and provide other timing obstacles such as traffic lights. When the road system becomes unreliable, truck delivery and pick-up times become more difficult to schedule. To keep the system functioning, companies are forced to use warehouse space, thus – land use – more inefficiently by providing more docking space to accommodate trucks when they arrive, on time or not; or, devote more warehouse space to hold inventory to buffer against missed or late deliveries.

In the greater-Tacoma area, industrially zoned land suitable for warehousing and distribution centers is nearing capacity. Exhibit 14, which displays the locations of vacant industrial parcels in Western Pierce and King Counties, shows that these parcels are becoming scarce. For example, the City of Sumner has indicated that the permits currently in their system fill the remaining capacity available for industrial land uses.

An SR 167 Extension would effectively increase warehouse capacity by allowing a more efficient use of the existing warehouse capacity through the increase of transportation network links, alternative routes, and shorter travel times for all users. This would assist in decreasing congestion and travel times, and increase the reliability of the entire transportation system. The improvement to the predictability and reliability of deliveries and pick ups at warehouses and distribution centers would be realized in fewer docking bays and a smaller inventory buffer.

Exhibit 14



Source: Pierce County Assessor, 2005 and King County Assessor, 2005

5.3 Investment Avoidance

Most arterials and highways in Pierce County, specifically, River Road in Puyallup and SR 99 in Fife were not designed to carry current and projected vehicle volumes and loads. Current tractor trailer traffic to and from the Port of Tacoma typically exceeds designed pavement vehicle loads necessitating more investment in road maintenance and preservation. Construction of the SR 167 Extension partial build and full build would accommodate forecasted traffic and could produce long-term cost savings by responding to the demand for transportation infrastructure through:

1. Alleviating preservation, rehabilitation, and reconstruction costs on existing highways and arterials, and

2. Avoiding major capitol improvements on existing transportation corridors that would be needed to accommodate existing and forecasted traffic.

Reduced preservation costs. As much of the transportation system reaches its design life, the need for rehabilitation and reconstruction of some of the most heavily traveled sections in the Puyallup River Valley is growing. This issue will be exacerbated by forecasted increases in vehicle traffic, especially for forecasted tractor trailer traffic originating or destined for the Port of Tacoma or the warehouse centers that carry heavier vehicle loads and exert more wear on the pavement. Construction of the SR 167 Extension will have higher initial costs, but the use of newer pavements and designs will cost governments and road users less than preserving existing pavements that are not designed to handle current vehicle volumes and loads.

The Washington State Department of Transportation and local jurisdictions spend a substantial amount of resources preserving, rehabilitating, and reconstructing heavily traveled sections of arterials and highways that are accommodating vehicle volumes and loads that exceed the design limitations and result in excessive and accelerated damage to the road surface. Contemporary pavement design is based on procedures recommended by the American Association of State Highway and Transportation Officials. They have longer performance periods and lower overall maintenance costs than roads built in the past. Current pavement design better supports vehicle loads and transfers them to the soil below through layers of construction that are appropriate for the soil foundation and the traffic to be carried; while addressing such variables as environmental conditions, soil drainage, and pavement aging and weathering.

Redundant capital costs. The SR 167 Extension would provide a more efficient allocation of transportation improvements. Vehicle and truck traffic are forecasted to grow in the region and local and state transportation planners will have to accommodate that growth by making improvements to the current transportation infrastructure. Without the SR 167 Extension, major transportation improvements will be needed to accommodate forecasted traffic volumes and loads. As stated in the previous section, the SR 167 Extension supports the efficient use of existing warehouse capacity in the Green River Valley.

5.4 Local and Regional Comprehensive Planning

The uncertainty surrounding construction of the SR 167 Extension could create additional costs stemming from the need to update regional and local growth management plans. The Puget Sound

Regional Council's STEP model and the Pierce County Travel Demand Model allocate forecasts of employment and population for transportation and growth management planning on the assumption that the SR 167 Extension will be a completed project.

If the SR 167 Extension were not built, there would be regional and local planning consequences that would impose additional costs on government. Current allocations of employment and population assume the SR 167 Extension is built and provides the necessary transportation infrastructure support to key business sectors, namely the warehouse and distribution centers in the SR 167 corridor and the cargo shipping businesses at the Port of Tacoma. Without the SR 167 Extension, the timing, pace, and location of future growth in the corridor would be impacted. Regional planning would need to respond to these changes and amend growth management plans to more accurately reflect the regional distribution of employment and population. Subsequently, local governments would need to amend their long-range planning so that they are in compliance.

WORKS CITED

- "Freight Transportation: Improvements and the Economy." Federal Highway Administration, U.S. Department of Transportation, 2002.
- "Harbor Development Strategy 21, Technical Appendix." Port of Seattle, March 2001.
- "Port Truck Trips in Corridor, Technical Memorandum", Heffron Transportation, Inc., October, 2006.
- "Sketch Methods for Estimating Incident-Related Impacts: Task Order No. 21." Federal Highway Administration, Office of Environment and Planning. Prepared by Cambridge Systematics, Inc., Harry Cohen and Science Applications International Corporation. December 1998.
- "The 2004 Economic Impacts of the Port of Tacoma." Martin Associates. July 2005
- "The 2003 Economic Impacts of the Port of Seattle." Martin Associates, January 2005.
- "The Value of Travel Time: Departmental Guidance for Conducting Economic Evaluations." U.S. Department of Transportation. 1997, revised February 2003.
- "User Benefit Analysis for Highways Manual (Redbook)." American Association of State Highway and Transportation Officials. August 2003.

WORKS REFERENCED

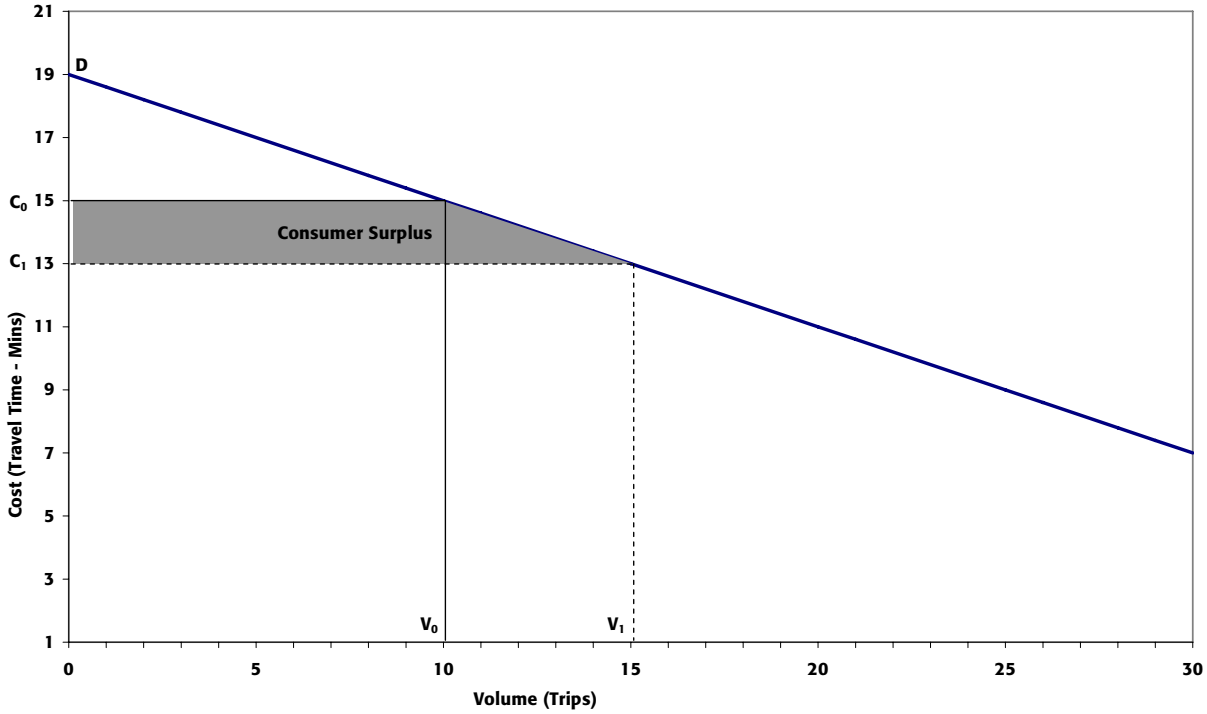
- "Alaskan Way Viaduct and Seawall Replacement Project Economic Assessment." Berk & Associates. May 2006.
- "Benefit-Cost Analysis Methodology Technical Memorandum." Washington State Department of Transportation. Prepared by Parsons Brinckerhoff. November 2004.
- "The Value of Travel-Time: Estimates of the Hourly Value of Time for Vehicles in Oregon 2003." Oregon Department of Transportation, Policy and Economic Analysis Unit. May 2004.

APPENDIX A

Analytical Framework Used to Assess User Benefits

At a fundamental level, travel time user benefits of any given project are calculated by comparing traffic performance without the project (no-build scenario) to traffic performance with the project (build scenario) and quantifying the improvement in performance. Exhibit A-1 provides a graphical representation of how travel time benefits from a transportation improvement can be quantified and represented as "consumer surplus."

Exhibit A-1
Graphic Showing Basic Consumer Surplus Calculation



D = Demand curve. Consumers' willingness to pay for highway services at various quantities of those services

C_0 = Travel time without improvement

C_1 = Travel time with improvement

V_0 = Volume (number of trips) without improvement

V_1 = Volume (number of trips) with improvement

In this conceptual example, the base supply of road services and consumers' demand for those services determines that 10 trips are made (V_0) averaging 15 minutes per trip (C_0). When the road improvement is made, travel times drop and more users are willing to use the road network, resulting in 15 trips being made (V_1) averaging 13 minutes per trip (C_1). The shaded area in the graphic represents the aggregate "consumer surplus" created by the transportation project.

Algebraically, consumer surplus is calculated with the following formula:

Consumer Surplus = $(C_0-C_1)((V_0+V_1)/2)$

For this example, consumer surplus = (15 mins-13mins)((10+15)/2) = 25 minutes of travel time saved

Since the improvement will provide benefits over its useful life, the consumer surplus needs to be estimated on an annual basis starting with the year of construction completion. To do this, the travel time savings are calculated at two points in time and changes in the value of time are factored into the analysis. Since a dollar in twenty years is worth less than a dollar today, the present value of these future benefits is then calculated by assuming a discount rate and bringing all future values to today's value terms. This is a simplified description of user benefits calculations – actual estimates also take into account limitations in the travel model and variation in the types of trips and values of time.