# Washington State

# Amtrak *Cascades* Cross Modal Analysis Technical Report

VOLUME 6


Washington State Department of Transportation

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**Prepared by the Freight Systems Division**
**Washington State Department of Transportation**

February 2006

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**Prepared for the**

## Washington State Department of Transportation

**By**

**Berk & Associates, Inc.**

**in association with**

**The Resource Group Consultants, Inc.**
**Transit Safety Management, Inc.**
**HDR Engineering, Inc.**
**AECOM Consult, Inc.**

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# Chapter One: Introduction

In 1998, the Washington State Department of Transportation (WSDOT) published a report entitled *Economic Analysis for the Intercity Passenger Rail Program for Washington State: 1998-2020.* The report included a cross-modal analysis that compared the different types (modes) of intercity transportation systems and the monetary and societal costs (impacts) of providing each. The transportation modes that were compared were airline travel, automobile travel, and travel by intercity passenger rail. As part of WSDOT's update to its twenty year plan for Amtrak *Cascades* service in Washington, the cost comparisons between these three modes were re-calculated in 2004.

The cross-modal analysis update includes the following elements:

- New passenger rail costs for operations and capital improvements and new ridership projections.
- Updated cost and travel data for highway and air transportation in the Vancouver, BC to Seattle, WA to Portland, OR corridor.
- A literature search to review and validate assumptions regarding indirect and external costs by mode.

Reference materials used for this analysis are presented in **Appendix A**. Supporting calculations performed as part of this analysis are located in the **Appendix B**.

## What makes a cross-modal comparison so difficult?

Overcoming the many substantial differences among rail, highway and air travel is a significant challenge. The most substantial areas of difference include travel markets served, service delivery, the sources of funding, and market maturity.

### Travel Markets Served

Each mode serves different travel markets.

- Commercial airlines serve an intercity function linking larger urban areas.
- Highways serve a number of markets, with most of the demand coming from regional and commuter trips.
- Passenger rail serves intercity demand, including linking the larger urban areas as well as smaller urban areas not served directly by air service and potentially meeting the demand for some regional and even commuter trips.

## Service Delivery

The way in which service is provided also varies significantly among the modes.

- Air service is provided by a combination of private for-profit commercial air carriers and public entities responsible for terminal development and operation.
- Highway trips combine the "free" use of public facilities with privately owned and operated vehicles.
- Passenger rail service is generally provided by public or not-for-profit entities, using privately-owned railroad tracks built primarily for handling freight.

## Source of Funding

The mechanisms and responsibility for paying for the cost of service also varies widely.

- In general, commercial air service is fully supported by users through air fares and airport charges, though significant federal funds have been expended on facilities and the air traffic control system.
- Highway use is also generally supported by user charges including federal and state gas taxes, motor vehicle excise tax (MVET), license fees, and private funding of auto operation, although general tax funds have also been targeted to support this mode, such as the property tax road levy used for county arterials.
- Passenger rail is partially supported by user charges and usually requires the use of general or transportation tax revenues for operating and capital support. In some cases user charges are sufficient to meet operating cost requirements, but seldom adequate to pay the cost of capital. This has been the principal barrier to the re-development of a private passenger rail industry.

## Maturity of the Market

The markets for highway use and air travel are both mature markets and involve well-established transportation choices in the minds of the general public. In contrast, passenger rail in the Pacific Northwest has only recently been restarted as a viable intercity mode and, to a large extent, the general public is in the process of rediscovering train travel when making intercity transportation choices. To date, passenger rail service has been in many ways analogous to a new product entering a competitive market and as such is in the process of building its market share.

## General Approach to the Analysis

When asked to consider the full costs of transportation, most people would readily identify both the private and public expenditures that support each travel mode.[1] Far fewer individuals would consider the important role that travel time[2] and external costs[3] have in determining overall costs. Because these latter elements do not require direct out-of-pocket expenditures by either private or public groups, they are frequently overlooked. However, the hours dedicated to travel represent time lost for either work or leisure, and the external costs associated with air pollution, noise impacts, and accident losses are important policy considerations that should not be ignored.

### What does this analysis measure?

The analysis takes the out-of-pocket expenditures of operations together with the less obvious costs associated with intercity travel, and groups them into three areas. The analysis identifies the three distinct cost components as:

- direct operating costs;
- cost associated with travel time; and
- the cost of externalities.

These elements focus on the direct and indirect annual costs of intercity travel by mode. The final step of the analysis is to add in the capital costs that support the operation of each of the modes.[4]

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[1] *Such expenditures often include the costs associated with maintaining and operating the facility, often referred to as operational costs.*

[2] *Travel time simply refers to the amount of time it takes to get to your destination.*

[3] *External costs refer to the elements of your trip that aren't "out-of-pocket" expenses. These are often invisible expenses usually associated with the human environment, such as the impact to our air and water quality as a result of emissions and run-off from our transportation systems.*

[4] *The approach of separating capital and operating costs will allow for a direct comparison among the modes without the potentially distorting effects of the current capital costs. As passenger rail service is currently a relatively minor element in the intercity travel market, there is substantial investment required to bring it into a competitive position in terms of service frequency and travel time. The other two modes are well established and require less infusion of capital.*

## How do we compare the different modes?

After identifying the elements that will be compared, it is next necessary to identify a measurement that can be used for all modes. Since each mode relies on a different form of travel – highway travel consists of using personal cars and either driving alone or with passengers; airplanes travel in the air and can carry as many as hundreds of passengers; and trains travel on tracks and also carry hundreds of passengers – finding a uniform measurement is critical.

**Exhibit 1-1**
**Calculating Passenger Miles**

**Rail**

Current/Projected Annual Miles Traveled
Existing/Projected Ridership
*Source: Amtrak Cascades Ridership and Revenue Forecasts Technical Paper, 2004*

**Automobile**

Current/Projected Vehicle Miles Traveled *
Average Vehicle Occupancy
(1.4 persons per Vehicle)
*Source: WSDOT, 2001*

**Air**

Current/Projected Trips Between Each City Pair *
Distance Between City Pairs
*Source: FAA Enplanement Projections, 2003*

Economists and transportation planners have agreed that in order to put different modes on "an even playing field", a common measurement of utilization is needed. A passenger mile is determined by taking the total number of passengers (in the plane, train, or in a car) and multiplying that number by the total number of miles traveled. That number of total passenger miles is used to calculate cost per passenger mile – the total component cost (i.e. yearly airport operational costs) is then divided by the yearly total passenger miles. **Exhibit 1-1** highlights the process and data sources for developing passenger miles.

The analysis is presented in "step-wise" fashion that highlights how each of the components affects the relative advantages of each mode.[5] After focusing first on the direct costs associated with out-of-pocket expenses, the analysis proceeds to incorporate the costs associated with travel time, and then adds the external costs estimated for each mode. The final outcome of the analysis is a comparison of all three components among the three modes of intercity travel.

[5] *It is important to note that the analysis is based on the estimated use of the facilities and not on the basis of the facility's total capacity. This is due to the fact that each mode serves different markets and capacity can be defined differently for each mode. Though it could be argued that the availability of unused capacity has some value, it is not likely to be equivalent to the value of meeting actual travel demands.*

# Chapter Two: Comparison of Direct Operating Costs

For this analysis, direct operating costs are defined to include the expenses required to cover the variable costs of travel and the regular maintenance of all facilities associated with each travel mode. Excluded from this component of costs are all capital expenses associated with building or expanding the infrastructure needed for each mode. Below, the operating costs for each mode are first reviewed separately and then included in a general cross-modal comparison.

### Assumptions

This component of total costs is designed to reflect the direct operational and maintenance costs that are associated with each mode of transportation. These are largely costs incurred directly by the user, but also include expenditures for the operation and maintenance of required facilities, both public and private. These costs are sometimes paid directly by the user, but are frequently supported by government subsidies. For example, for rail travel the estimate of direct operational costs includes all required operations and maintenance expenses, not just the portion that is covered by passenger fares. In addition, the costs associated with the preservation and maintenance of Interstate 5, Interstate 405, Interstate 205, State Route 512, and State Route 167 are a component of the direct operating costs for the auto mode of travel. Other operational costs such as insurance, vehicle, maintenance, fuel, etc. are totaled and apportioned on a per passenger mile basis.

### Data Collection

A review of the existing literature provides supporting documentation for some of the less quantifiable cost elements, which, when combined with local mode-specific cost data, provides enough material to establish reasonable upper and lower bounds for each of these components of cost. Specific sources of information can be found in the Bibliography located at the end of this report.

## Highway Direct Operating Costs

The analysis of highway travel costs has three major elements:

- The expenses associated with maintaining existing facilities (roadways);
- The cost of vehicle ownership and operation; and
- The costs of parking.

## Facility Maintenance Costs

The analysis of highway maintenance costs is based on data for the portion of the Interstate 5 corridor that is located in the state of Washington. This includes Interstate 405, Interstate 205, State Route 512, and State Route 167. The data are taken from the recently completed *Washington State System Plan* and cover the period 2003-2022. Maintenance costs include all expenses associated with pavement preservation and general highway upkeep. The *Highway System Plan* presents maintenance and preservation costs in Statewide totals ($9.04 billion in 2001 dollars). The I-5 corridor's share of lane-miles and average daily traffic suggests corridor maintenance and preservation costs of $1.42 billion.

To facilitate analysis of costs on a year-by-year basis, these costs were spread evenly over the twenty year period and escalated to current dollars. The cost of new and rehabilitated facilities is discussed later in the capital investment section.

Passenger miles were then calculated based on the projected number of vehicle miles that will be traveled along the I-5 corridor during the years 2003-2023. Estimates of total vehicle miles were converted to total passenger miles using WSDOT's assumption that occupancy averages 1.4 persons per vehicle for intercity travel along the corridor. Costs per passenger mile were then calculated by dividing the annual cost by passenger miles for each year in the study horizon.

## Vehicle Ownership Costs

The costs of vehicle ownership were taken from the American Automobile Association's (AAA) 2003 publication "Your Driving Costs". The AAA analysis estimates the fully burdened cost of owning and operating several different types of vehicles. Based on an assumption that the automobiles are driven 15,000 miles per year and replaced on a four to six year/60,000 mile cycle, estimates are provided for the costs of fuel, oil, maintenance, tires, insurance, license/registration and capital depreciation. License and registration fees are not included as part of vehicle ownership costs for this study. These funds feed into public investments in roadways, reflected in highway maintenance and expansion expenditures.

For cars driven 15,000 miles per year, these costs range from $0.445 to $0.594 per vehicle mile. The lower end of this cost range corresponds to the cost of operating a compact Chevrolet Cavalier, while the upper end reflects ownership costs for luxury sedans and sport utility vehicles.

Of course, a significant number of car-owners hold their vehicle for more than four years, and the operating cost for these cars could differ from the range noted above. As a car ages, deprecation and insurance costs decline, but

repair and maintenance costs tend to increase. To develop operating cost estimates for older cars would require detailed information about how repair costs change through time, how depreciation affects older cars, and how insurance premiums are adjusted as a car grows older.

Data on these elements of operating costs are not readily available and it was not possible to develop specific cost estimates for older cars. However, the limited information that was found on the subject, suggests that overall operating costs do not decrease significantly through time.

In a study completed by U.S. Fleet leasing, the average annual repair costs associated with operating a vehicle beyond 60,000 miles exceeded thirty-five cents per mile. Comparing this figure with the AAA costs which emphasize newer cars suggests that operations costs for older cars may not differ significantly from newer costs, and that the range of costs developed for AAA may be generally representative of average ownership costs for the overall fleet.

The increased popularity of sport utility vehicles and light trucks led to a weighted average for operating costs using data from the U.S. Department of Transportation, 2001 National Household Travel Survey. According to this study, approximately fifty-five percent of the vehicle registrations in the West are automobiles, nineteen percent are pickups, thirteen percent are sports utility vehicles (SUVs), eight percent are vans and five percent are listed as other, including other trucks, motorcycles and recreational vehicles (RVs). Thus a composite cost was developed using fifty-five percent of the average AAA car costs plus forty-four percent of the average AAA costs for SUVs and minivans. The result is an assumed fleet average of $0.522 per vehicle mile which is escalated at the rate of inflation suggested by the 1997 and 2003 AAA studies (2.7 percent). Note that car costs have been growing at a rate faster than inflation in recent years (1.7 percent during the same period). This average cost per vehicle mile was converted into a cost per passenger mile using an estimate of average vehicle occupancy and added to the cost for facility maintenance.

## Parking Costs

While frequently ignored because it does not always represent an out-of-pocket expense for drivers, parking is an important component of total transportation costs. Even if drivers do not pay directly, parking lots are available because employers and commercial businesses cover the costs associated with land acquisition, paving, maintenance and security.

Estimates from the Puget Sound Regional Council (PSRC) suggest that within the overall Puget Sound region the cost of parking is approximately one billion dollars per year, or approximately four cents in 1995 dollars (6.8 cents in 2003 dollars) per passenger mile based on total annual travel in the area. Including residential parking costs, the figure increases to six cents in 1995 dollars (10.7 cents in 2003 dollars).

The PSRC's focus on the Puget Sound Region and its urban/suburban characteristics might lead one to conclude that this figure might be unrealistically high to be applied to all travel throughout the I-5/I-405 corridor. However, the underlying assumption in the PSRC analysis is based on one additional parking space per vehicle and excludes the cost of providing residential parking. As a result, using this figure to extrapolate to the intercity corridor offers a reasonable estimate of a cost element that is very difficult to quantify.

Previous studies have suggested that costs could range from between two and eight cents per passenger mile, so this represents a conservative estimate of parking costs. For the purposes of this analysis, both high and low scenarios began with the PSRC parking cost. The high estimate then added in residential costs, which were not incorporated into the low cost. The parking costs were then added to operating costs for a total direct cost per passenger mile.

## Air Travel Direct Operating Costs

The operating costs of commercial air travel are broken into two major components:

- The costs of operations and maintenance for the airport facilities; and
- The cost of providing the airline service between city-pairs in the PNWRC.

Separating costs into these components made it possible to identify both the private-sector costs associated with airline operations and the public-sector costs required for airport operations. The city-pairs selected for this analysis were: Seattle, WA to Vancouver, BC; Seattle, WA to Portland, OR; Seattle, WA to Bellingham, WA; and Vancouver, BC to Portland, OR.

### Operations and Maintenance for Airport Facilities

Total airport terminal costs are based on estimates of airport revenues generated by the activities serving the air passenger market, such as parking fees and concession revenues. Since airports recover costs through user charges, including a portion of the cost of capital, it is assumed that airport revenues will be equal to the fully-allocated cost of providing airport facilities and services. Revenues that are not based on passenger activity, such as rental

income from cargo operations, are excluded from the calculation of the passenger cost base.

The passenger cost base is then split into annual operating and capital components by subtracting debt service and cash-financed capital items for each of the airports. The remaining passenger-related operating costs are then divided by the projected number of enplaned passengers to arrive at an annual estimate of operating costs per enplanement.

Airports have invested heavily in enhanced security following the events of September 11, affecting both operations and capital budgets. This report does not delineate these costs, which are captured in airport budgets and capital plans and in higher airline fares. To help fund the Transportation Security Administration and other federal security measures, the federal government imposed a security fee on December 31, 2001 which increased ticket prices by $2.50 per leg, with a maximum fee of $5.00 per one way ticket and $10.00 per roundtrip ticket. The fee was temporarily lifted as part of the $3.1 billion relief package for the airline industry, allowing the airlines to pocket the amount of the fee instead of lowering fares. The fee was reinstated on October 1 2003, and is designed to cover increased federal costs of airport security.

### Sea-Tac International Airport

Sea-Tac Airport revenues are taken from the Port of Seattle 2002 Annual Report. Projections are based on the airport's capital improvement plan.[1] Operating costs include only the costs of operating the expanded facilities.

### Vancouver International Airport

Airport costs for Vancouver International Airport were based on the current annual report and projections of future growth in enplaned passengers. Revenues and operating costs are projected to grow at an annual rate of seven percent, derived from historic financial statements. Airport improvement fees are not adjusted for inflation; this portion of revenues increases at the rate of projected passenger growth.

### Portland International Airport

Portland International Airport cost projections were provided by the Port's Finance Department. Cost, revenue and enplanement projections were available through the year 2024.

[1] *Port of Seattle, 2003*

### Bellingham International Airport

Due to insufficient data regarding airport costs in Bellingham, the terminal cost element was estimated using the average of the other airports in the corridor. While this approach is not ideal, it does allow for a full comparison of all the major air travel markets.

## Cost of Providing Airline Service

The city-to-city airline service (travel) cost is assumed to be equal to the commercial airline airfare. These fares should reflect each airline's operating costs such as the expenses associated with staffing, fuel, food, maintenance, and security, and will also include the cost of capital and airline profit.

Selecting the correct airfare for use in the analysis poses a challenge since the mix of airfares on any particular flight or within a particular corridor is proprietary data that airlines will generally not share for competitive reasons. In addition, these variables are constantly in flux as a result of a number of factors including demand for travel and competition on particular routes. As a result, while airlines would like to achieve certain profitability goals for each route, the reality is that they attempt to optimize profitability throughout the system, balancing equipment utilization, market-share and profitability goals.

To estimate a reasonable average fare for each of the city-pairs in the corridor, a survey of current fares was conducted. A simple weighted-average for each flight was developed based on the following assumptions:

- Business travelers will book at least three days in advance, but will not travel with a Saturday stayover.
- Leisure travelers will book at least three days in advance and will travel with a Saturday stayover.
- The average fare for the flight is based on the estimated split among business and leisure travel and the respective fares for each.

Escalation of airfares is assumed to occur at three percent per year, which implies that competition in the commercial airline industry will result in continued emphasis on low to average fare levels. To avoid double counting, the revenues and fees charged to airlines for the use of airport facilities are subtracted from the reported airfares. These are accounted for in the estimate of airport facility costs and are not be included in this part of the analysis.

Using airfares as a measure of city-to-city travel costs may overstate operating costs, and understate capital costs, because it treats the costs associated with aircraft as an operational rather than a capital expense for the airlines. However, this approach is consistent with our assumption that private vehicle

ownership costs should be considered a portion of operating costs for highway travel.

### Total Costs per Passenger Mile

As described above, total city-to-city travel costs are made up of two components:

- The airport costs at either end of the trip; and
- The one-way airfare between the cities (half the round-trip fare).

The first component captures the costs associated with providing the airport and terminal services that are necessary to make air travel possible. The second portion reflects the actual costs associated with flying the aircraft and operating a private airline, including any profits derived from the service. The per-passenger-mile cost is determined by dividing the total city-to-city cost by the miles of travel.

For cross-modal comparison purposes, a corridor weighted-average is computed based on total travel among the city-pairs within the corridor. Based on statistics from the US Department of Transportation Bureau of Transportation Statistics, approximately fifty percent of all air travel among the cities in the corridor is between Seattle and Portland. As a result, the weighted-average is significantly influenced by the cost of this segment.

## Passenger Rail Direct Operating Costs

The operational costs of the proposed passenger rail program are taken from the *Amtrak Cascades Plan for Washington State Technical Paper: Operating Plan, September 2003*. The costs are based on a program of improvements that will result in four round-trips per day between Vancouver, BC and Seattle, WA (currently one round-trip) and thirteen round-trips per day between Seattle, WA and Portland, OR (currently four round-trips). In addition, travel times will be reduced as a result of facility improvements in the corridor, increasing the competitiveness of the train service relative to the other modes. Seattle, WA to Vancouver, BC transit time is to be reduced by one hour, from approximately four hours to three hours. Seattle, WA to Portland, OR will improve by one hour, from the current three hours and thirty minutes to two-and-a-half hours.

Operating costs, as part of these overall figures include:

- The costs of operations and maintenance for rail facilities and stations; and
- The cost of providing rail service within the corridor.

Ultimately, these operating costs will be covered through ticket revenues. However, at this point in the analysis, it was not important to identify the exact source of operating revenues or to determine what portion of operating costs will be reflected in train fares. For the cross-modal comparison of costs it is only necessary that the estimates of total operating costs fully reflect all anticipated expenditures. Total operating costs, expressed in 2003 dollars, are projected to increase from $20.3 million in 2002 to $83.4 million in 2023.

## Results of Direct Operating Cost Analysis

**Exhibits 2-1** and **2-2** compare the direct operating costs for each mode. These results reveal that on an operating basis, passenger rail service is comparable to both air and highway travel and by the end of the period is actually the lowest of the group. By 2023 rail costs amount to $0.34 per passenger mile, while highway travel is estimated to cost $0.76.

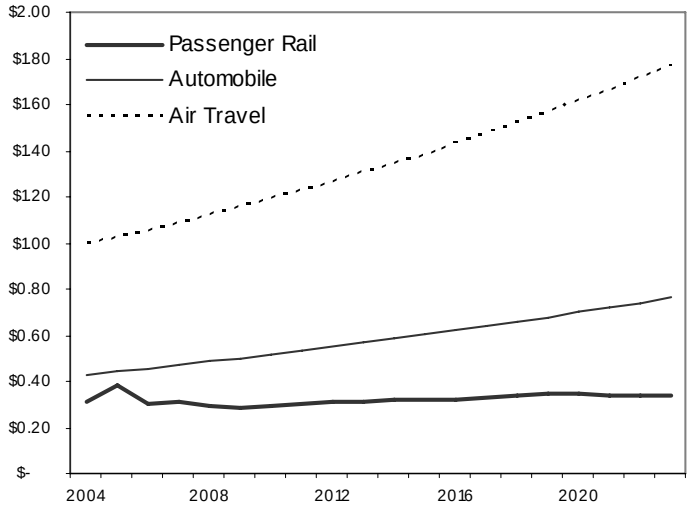
**Exhibit 2-1**
**Comparison of Direct Operating Costs ($ per passenger mile)**

| Year | Automobile | Passenger Rail | Air Travel |
|---|---|---|---|
| 2004 | $0.43 | $0.31 | $1.00 |
| 2008 | $0.49 | $0.29 | $1.12 |
| 2013 | $0.57 | $0.31 | $1.30 |
| 2018 | $0.66 | $0.34 | $1.52 |
| 2023 | $0.76 | $0.34 | $1.77 |

*Source: Berk & Associates, 2004.*

Direct costs exclude costs associated with travel time and externalities.

**Exhibit 2-2**
**Comparison of Direct Operating Costs Graph ($ per passenger mile)**



# Chapter Three: Comparison of Travel Time

In addition to any direct out-of-pocket expenses, travel requires a significant commitment of time. Travel time has an implied cost because time spent in transit represents forgone opportunities for work or leisure. Although some individuals enjoy the process of travel and others are able to work while on the move, most people find that travel time is unproductive and often stressful or uncomfortable. Given that both the quantity and quality of travel time differs across modes, an accurate cross-modal comparison of costs must include a formal analysis of the opportunity cost (amount lost) associated with the time spent traveling.

The challenge posed by including time in the current cost comparison is that qualitative observations about travel time must be translated to quantitative estimates of value.

Economic theory provides some insight into how estimates might be developed. For travel that occurs while on the job, or that directly reduces the hours available for work, economists recognize that an individual's wage rate provides a reasonable basis for measuring the opportunity cost of time. The wage rate reveals how an employer values the productivity of each worker and reflects the value of lost work time. Of course, every hour spent commuting or in other business related travel might not represent an hour that would otherwise be spent at work, so valuation at the full wage rate might not be appropriate.

As a result, to avoid overstating the value of travel time, the opportunity cost of work-related travel is often measured as some fraction of average hourly wage. For this study, the low-cost estimate values work-related time at fifty percent of the wage rate, while the high-cost estimate values work-related time at one hundred percent of the wage rate. Recent study of high occupancy toll (HOT) lanes in Southern California, using revealed preferences to estimate driver's value of time, supports the valuing time at fifty percent of the gross wage rate (Brownstone and Small, 2002).

Gwilliam (1997) performed an extensive review of international studies treating the value of time and recommends the use of the "augmented" wage rate, including "extra costs directly associated with employment of labor (social security taxes, costs of uniform, etc.)." Given the use of wages here as a proxy for how an individual values work and personal time, these additional costs are not included here. While such costs reflect an employer's full costs, they are not typically thought of when an individual considers the value of his or her leisure time, or even how work time is commonly valued.

Other recent studies recommend that premiums be placed on time spent in congestion, due to both the aggravating nature of driving in traffic and uncertainty about arrival times, and "excess travel time," or time spent waiting for transit. The high and low valuations of time used in this study incorporate this range of time value without separately attaching premiums to congested travel or terminal times.

## Developing Time Costs by Mode

Time spent in transit imposes costs on drivers and passengers alike, because travel time represents hours lost from work or leisure. Depending on the mode selected, transit time will imply somewhat different sacrifices in terms of productive or leisure time. Within the existing literature several different methodologies have been proposed for estimating the value of travel time. These results are presented here to compare how different valuation approaches affect the cross-modal comparison of total operating costs.

Using the full wage rate to value the opportunity cost of travel time also assumes that travel time is wholly unproductive, but such an assumption cannot be equally applied to all modes of transportation. Research indicates that time spent in different modes of travel is not valued equally. For example, estimates derived by Waters (1992) for the British Columbia Ministry of Transportation indicate that time spent on a bus or as a passenger in a car pool is generally regarded more favorably than time spent behind the wheel of an automobile. This particular study recommended that the opportunity cost associated with travel as a passenger be assigned an opportunity costs that is only seventy percent of the value associated with being a driver.

The lower opportunity cost associated with being a passenger is linked to the possibility of enhanced productivity and reduced discomfort as compared to driving. Extending these results to air and train travel suggests that the time spent on these modes should also be valued differently than time spent driving. Using the proportions developed for the BC Ministry of Transportation, such an approach is adopted in the current analysis.

In the results presented below, time spent as an airline or rail passenger is assumed to have an opportunity cost equal to seventy percent of that associated with driving an automobile for work-related trips.

Some recent studies (Wardman and others) suggest that the value of time for passengers on higher speed transport modes (air and to some extent rail) should be higher than for passengers traveling by slower modes (here principally highway). The basis for this argument is that individuals who select high speed options evidently value their time more than those who travel by slower modes. This phenomenon is captured in the model in that a

greater proportion of business travelers are expected to travel by air, and – particularly as rail speeds increase – by rail.

## Work Related vs. Leisure Related Travel Time

A significant amount of travel occurs outside of work and is associated with personal errands and other leisure time activities. For this type of travel, the hours spent in transit still have an opportunity cost because they represent time lost to other tasks. Estimates for the value of this time have been developed from studies that compare how individuals make trade-offs between their work and leisure time.

Frequently these studies find a relationship between increasing income levels and increasing values of leisure time. As a result, estimates for the value of leisure-related travel time are also quoted as a fraction of income or wages. The studies by Litman (1997), UCB-ITS (1996), and Apogee (1994) provide a thorough review of such results.

For analyses that make a distinction between work and leisure related travel time, work time is generally assumed to have an opportunity cost that is twice that of leisure related travel. This ratio is used in this analysis for all three intercity travel modes. As noted above, the current analysis also adopts the assumption that time spent traveling as a passenger has an opportunity cost that is lower than time spent as driver. For both work and leisure time, this lower value is used in estimating the opportunity cost of automobile passengers and for all those who travel by rail or air.

## Estimated Opportunity Cost of Travel

Rather than produce a single estimate for the opportunity cost of travel time, the cost estimates used in this analysis establish a range of potential values. This range reflects the varying approaches taken within the existing literature on the subject, and allows one to compare how different valuation methods can influence the overall analysis of transportation costs.

**Exhibit 3-1**, on the following page, summarizes the two sets of assumptions that are currently employed for estimating the opportunity cost of travel time. The estimated wage that underlies both sets of estimates reflects a population-weighted average for the nine counties of Western Washington that contain the I-5/I-405 corridor.

**Exhibit 3-1**
**Cost Estimates for the Value of Travel Time ($ per hour)**

| | Value of Time | Automobile | | Airplane | Rail |
|---|---|---|---|---|---|
| | | Driver | Passenger | | |
| **Low Cost Estimate** | | | | | |
| Work-Related Time | Value = 50% of Wage Rate | $9.31 | $6.52 | $6.32 | $6.32 |
| Leisure Time | Value = 25% of Wage Rate | $6.52 | $3.35 | $3.35 | $3.35 |
| **High Cost Estimate** | | | | | |
| Work-Related Time | Value = 100% of Wage Rate | $18.62 | $13.04 | $13.04 | $13.04 |
| Leisure Time | Value = 50% of Wage Rate | $9.31 | $6.52 | $6.52 | $6.52 |

## Assumptions Used for Travel Time Estimates

Regardless of which cost assumptions are used, the overall impact of travel time on the cross-modal analysis depends on four additional factors. The following presents an overview of these factors.

### Speed of Travel

First, the speed of travel will have a significant role in the total time commitment required for travel by any particular mode. As average speeds change through time (increasing for rail, decreasing for auto, constant for air, as below) the average time cost per passenger mile will also change. For the current analysis, highway speeds were computed as a weighted-average of current urban and rural speeds, where the weights reflect the proportion of vehicle miles traveled in each area.

In projecting future speeds, it was assumed that urban traffic would continue to slow at the current rate of one percent per year, but that rural speeds would remain unchanged into the future. Rail speeds reflect the operation projections contained in the *Amtrak Cascades Operating and Capital Plan Technical Paper, 2004*. Airline flight times are assumed to remain constant over the period of this study, so current flight times are taken as a prediction of future travel times.

## Proportion of Work and Leisure Travel

Estimates of time-related costs are affected by the proportion of work and leisure travel predicted for each mode. Business related travel has a higher opportunity cost than leisure travel. Therefore, as the share of business passengers increases, the average costs per passenger mile also increases. This latter effect will be important for rail, as current operations analysis indicates increased speeds will attract an increasing share of business travelers.

## Terminal Time

The third factor affecting the indirect costs of time spent traveling is the estimated terminal time for each mode. In addition to time spent traveling between cities, there is a necessary time commitment required at either end of a rail or air trip. The *Washington State High Speed Ground Transportation Study* (1992) estimated terminal times for the major airports in the corridor based on allowances in scheduled connecting times, including an allowance for boarding time. These times have been adjusted upwards to reflect slower boarding due to increased security post September 11. The terminal time for rail service was assumed to be a total of eighteen minutes at each end of the trip.

## Time Spent on Intercity Facilities

It is also worth reiterating that the travel time projections that underlie these cost estimates only consider the cost associated with the time spent on the intercity facilities. For example, the time cost calculations for air travel are based on average flight time plus the appropriate terminal time at either end and do not include the estimated time required to/from the airport at either end of the trip.

While a true comparison of the total time cost of any individual trip would also include the time required to access the intercity facilities, quantifying this additional trip segment poses several significant challenges, including:

- *Data requirements*. There is a lack of consistent origin and destination data for all three modes considered in this analysis.
- *Double counting costs.* The time spent accessing Sea-Tac International Airport via I-5 for an airline trip to Portland would already be counted in the highway cost analysis.
- *Internal consistency in modal cost estimates.* The direct costs for each mode are based only on the portion of the trip that takes place on the intercity mode under consideration. Thus to maintain a consistent basis of comparison the indirect costs should be similarly defined.

**Exhibit 3-2**
**Comparison of Travel Time Costs ($ per passenger mile)**

| | Automobile | | Passenger Rail | | Air Travel | |
|---|---|---|---|---|---|---|
| Year | Low Cost Estimate | High Cost Estimate | Low Cost Estimate | High Cost Estimate | Low Cost Estimate | High Cost Estimate |
| 2004 | $0.12 | $0.24 | $0.10 | $0.20 | $0.12 | $0.23 |
| 2008 | $0.14 | $0.28 | $0.11 | $0.22 | $0.13 | $0.26 |
| 2013 | $0.16 | $0.32 | $0.13 | $0.26 | $0.15 | $0.30 |
| 2018 | $0.19 | $0.38 | $0.15 | $0.29 | $0.18 | $0.35 |
| 2023 | $0.23 | $0.45 | $0.15 | $0.30 | $0.21 | $0.41 |

*Source: Berk & Associates, 2003.*

As a result, it was determined that the approach offering the fairest and cleanest point of comparison was to limit the comparison to the intercity segments of each trip. **Exhibit 3-2** highlights how both speed and the mix of passengers will affect the average costs associated with travel time on each mode. These cost estimates have been adjusted to reflect an assumed three percent rate of inflation.

## Methodology

The following steps were used to convert hourly travel time rates by mode into the final estimates of cost per passenger mile:

- Calculate total travel time per passenger, including the time spent at intercity facilities. Travel times reflect the differences in speed among the various modes and how speeds are anticipated to change over the next twenty years.
- Estimate the value of travel time for both business and leisure travel.
- Weight the relative costs of business and leisure according to the share of each
- type of travel that occurs on each mode.
- Divide the total time costs by the mileage associated with each type of trip to convert costs to a per mile basis.

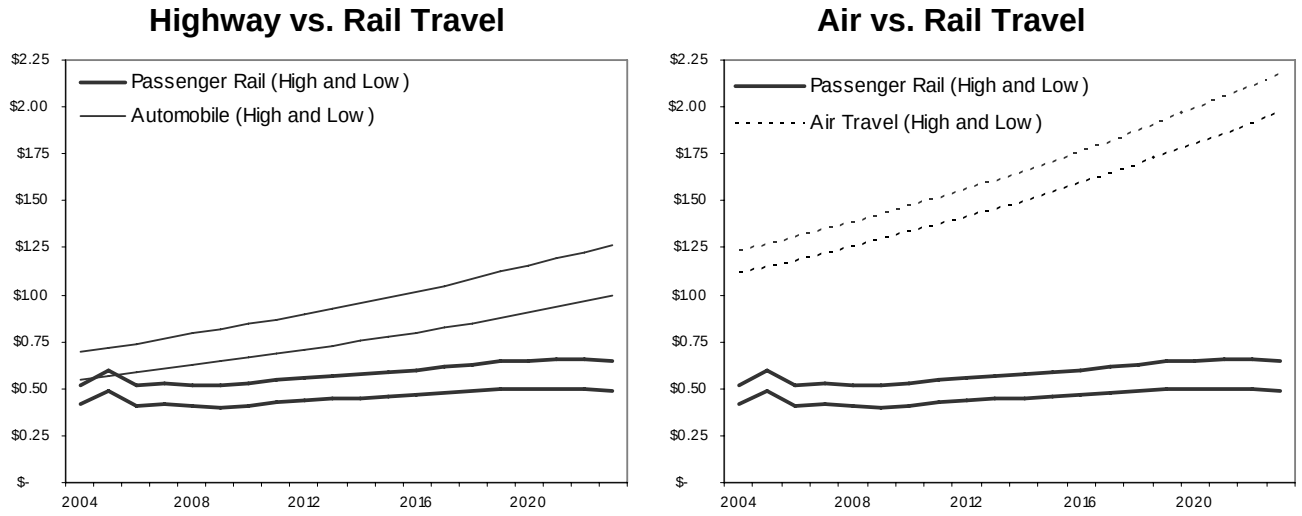
Travel time costs for rail are relatively low when compared to highway travel. This advantage for rail results from the high percentage of total highway travel that occurs during urban commuting hours, when average speeds are low. The time-cost advantage for rail is predicted to increase in the future as highway congestion slows travel speeds while rail service improves.

## Results of Direct Operating Cost Analysis plus Travel Time

Adding time costs to the earlier analysis of direct operating costs per mode results in a slight shift in the rail modal advantage. As highway speeds decrease and rail speeds increase, rail travel emerges as advantageous to both automobile and air travel. Although the cost estimates for auto and rail travel are comparable in the earlier years of analysis, **Exhibit 3-3** demonstrates how costs begin to diverge as rail service is developed.

While travel times are shortest for air, the higher terminal times result in rail travel times gradually moving within the estimated range for air service. **Appendix B** contains full documentation and back-up information for these graphs.

**Exhibit 3-3**
**A Cost Comparison including Direct Operating Costs and Time Costs ($ per passenger mile)**



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# Chapter Four: Comparison of External Costs

The term externality or, "external costs", is used by economists to describe an unintended consequence or indirect effect that is created by some activity. The costs associated with these unintentional actions are not directly charged to any specific individual, but are borne by society as a whole. The negative health impacts associated with air pollution are a classic example of such an externality. Although the travel by air, car, or rail creates air pollution impacts, riders are not charged for their contribution to decreasing air quality.

Many previous studies have focused on examples such as this, and attempted to measure external costs associated with pollution and environmental degradation. These studies point out that excluding such costs from cross-modal comparisons can lead to misleading conclusions, because the magnitude of these costs can be large and their impacts vary from one mode to another.

In comparing external costs across modes, one should recognize that the magnitude of external effects has been changing over time. In recent years, many environmental impacts have been converted to direct costs as environmental legislation has forced users to more fully bear the costs of their activities. For example, automobile-related air pollution has been reduced by legal constraints that have forced automobile manufacturers to equip cars with more sophisticated emission control systems. In this sense, some portion of the costs that were formerly external to the user have been "internalized" and converted to a direct, out-of-pocket expense. This implies that older studies of external costs will tend to overstate the current magnitude of such effects. For this reason, the cost estimates we have drawn from the existing literature generally rely on research conducted within the past few years. In some cases, work done in the early 1990s remains the standard text referenced in the current literature, and so is also relied upon here.

Current literature debates whether or not future emission levels will be greater or less than current levels. The outcome is unclear. Better technology may lead to reduced emissions on individual models, but this may be offset by a mode shift towards larger vehicles. The standard automobiles detailed in the AAA driving costs brochure (which today constitute an estimated fifty-five percent of vehicle registrations in the western United States) score sixes and sevens on an Environmental Protection Agency (EPA) measure of emissions[1], with ten being the best. Larger vehicles included in the AAA study (constituting approximately thirteen percent of vehicles on the roads), such as the Trailblazer or Caravan score between one and four, depending on the

[1] *EPA Green Vehicle Guide: http://www.epa.gov/autoemissions/index.htm*

model of the vehicle. In 1998, standard autos constituted approximately sixty-one percent of vehicles on the road in the western United States, with the remaining thirty-nine percent composed of SUVs, pickups, minivans, and other vehicles. The trend towards larger, more polluting vehicles is clear, and may negate technological advances in individual models.

External costs are not limited to environmental issues. The accidents associated with each type of travel also impose costs that are not fully borne by the user and thus represent another significant externality. Although insurance premiums effectively internalize a portion of accident-related costs, some types of losses are not covered by insurance. Time lost from work is often not recoverable and the pain and suffering of accident victims and their relatives may not be fully compensated. These types of external costs are also included in the current cross-modal comparison.

## Methodology for Developing External Costs

The existing studies of external costs generally adopt a two-step approach toward the difficult task of developing cost estimates for each externality. The first step involves a review of data that describe the link between the use of each transportation mode and the level of air pollution and noise. This link relies on engineering studies of emissions or on statistical data specific to each mode. In the second stage, an economic value or cost must be associated with each externality. Estimates of these costs are derived from direct assessments of damages or by measuring the costs of mitigating potential impacts. This same basic methodology was applied to the current analysis of the external costs associated with air, highway, and rail travel.

Similar to the approach adopted in the analysis of travel time, estimates for external costs are presented as range of values. Reporting external costs with a single point estimate, rather than a range of values, would overstate the precision to which such costs can be measured. The following discussion provides an overview of the existing research in this field and describes the work that underlies the current estimates of external costs. Most previous analyses have been conducted as part of cross-modal analyses of total costs. As a result, estimates were either reported or easily converted to costs per passenger mile. The final estimates of total external cost reflect the individual contribution of the following factors:

- air Pollution,
- noise Pollution,
- water Pollution,
- waste Disposal, and
- accidents.

## Air Pollution

Among the potential environmental impacts, air pollution is generally thought to be associated with the largest external costs. Fossil fuels combustion generates by-products that have both immediate and long-term impacts on the environment and human health. As noted above, measures of the external costs of air pollution rely both on models that predict the level of vehicle emissions and on separate estimates of the costs associated with the resulting levels of air contaminants. The estimates presented here have been developed by integrating the most reliable information on emissions with the best data on costs and damages.

### Emission Levels

Focusing first on emissions, the most frequently cited estimates of automobile emissions were developed by Small and Kazimi (1995) for an academic study of automobile pollution in Southern California. Small and Kazimi's study continues to be referenced in contemporary studies, for example in Ozbay and Bartin (2001) and Anderson and McCullough (2000). Small and Kazimi's figures relied on existing engineering models, but were calibrated to match data on observed levels of air pollution. The engineering models used in their work have served as the basis for previous analyses (Apogee (1994)), but their efforts to adjust the model's results to match observed levels of pollution added to the credibility of their conclusions. Their final results, which are summarized in **Exhibit 4-1** provide the basis for our analysis of automobile emissions.

**Exhibit 4-1**
**Estimates of External Costs ($ per passenger mile)**

| | AUTOMOBILE | AIRPLANE | RAIL |
|---|---|---|---|
| Air Pollution | $0.049-$0.081 | $0.003-$0.004 | $0.016-$0.031 |
| Noise Pollution | $0.001-$0.006 | $0.002-$0.018 | $0.001-$0.005 |
| Water Pollution | Mitigation Included in Direct Costs | Mitigation Included in Direct Cost | Mitigation Included in Direct Costs |
| Solid Waste Disposal | $.001 | N/A | N/A |
| Uninsured Accident Losses | $0.01 | $0.002-$0.003 | $0.001-$0.036 |
| **TOTAL** | **$0.052-$0.089** | **$0.007-$0.026** | **$0.019-$0.071** |

*Source: Berk & Associates, 2004.*

**Exhibit 4-2**
**Emission Rates - Grams per Passenger Mile**

| | AUTOMOBILE | AIRPLANE | RAIL |
|---|---|---|---|
| CO2 | 250 | 160 | 230 |
| Volatile Organic Compounds | 2.68 | .145 | .160 |
| CO | 16.4 | .461 | .600 |
| NOx | .900 | .209 | .900 |
| Particulate Matter | .008 | Not Available | .080 |
| Road Dust | .879 | Not Applicable | Not Applicable |
| SOx | .027 | Not Available | .051 |

*Source: Small and Kazimi (1995), UCB-ITS (1996), NRDC (1993)*

The literature search also produced comparable emission estimates for air and rail travel. The most detailed estimates available for airplane emissions were provided by the University of California's Institute of Transportation Studies (UCB-ITS) 1996 cost analysis for the San-Francisco-Los Angeles-San Diego travel corridor. Emission estimates for rail travel were drawn from the cost analysis completed in 1993 by Miller and Moffet for the National Resources Defense Council (NRDC). To allow for a direct comparison across modes, **Exhibit 4-2** presents emission rates for all three modes on per passenger mile basis.

A critical factor has not been calculated into these emissions factor: the Amtrak *Cascades* program for Washington State will utilize new locomotives that have improved, state-of-the-art computer-controlled fuel injection systems. These locomotives are currently being used in San Diego and have exhibited emission levels below California's tough air quality standards.

These data on emissions were then combined with detailed estimates of the costs associated with direct health impacts and the potential impacts of climate change. These separate effects are described in detail, below.

## Health Impacts Due to Air Pollution

Small and Kazimi (1995) also offers the most compelling analysis of potential health impacts. The results of this work were cited by several studies that followed, including both UCB-ITS (1996) and Litman (1997). Focusing on effects in Southern California, they assessed both the illness (morbidity) and death (mortality) that could be attributed to tailpipe particulate and ozone emissions. The cost estimates they developed reflect the increased expenditures on health care, the value of lost work time, and the number of deaths that can be attributed to each component of vehicle emissions. These results, summarized in **Exhibit 4-3**, were the basis for the cost estimates applied to all travel modes in the current study.

The variation between the low and high cost estimates is driven by differing assumptions about the monetary value of the human lives lost to air pollution. The lower estimate of cost corresponds to a value of $2.1 million per life, while the higher estimate is driven by an assumption that an average human life has a value of $4.3 million.

**Exhibit 4-3**
**Estimated Health Impacts Cost per Gram of Emissions**

| | Low Cost Estimate | High Cost Estimate |
|---|---|---|
| Volatile Organic Compounds | $0.002 | $0.003 |
| NOx | $0.006 | $0.012 |
| Particulate Matter | $0.051 | $0.110 |
| Road Dust | $0.017 | $0.037 |
| SOx | $0.055 | $0.121 |

*Source: Small and Kazimi (1995)*

While it may seem stark in its implications, placing a value on human life is an essential component of measuring the magnitude of external costs. If the increased mortality risks associated with pollution are not quantified, then the full costs of each mode will be systematically understated. Economists have adopted several different approaches to developing an estimate for the value of a life. How much more are construction workers paid to take on more risky job assignments? The tradeoffs made between increased pay and increased risk imply an underlying value of life. Alternatively, survey methods can also be used to develop value estimates that are more representative of the general population.

Fisher's 1991 review of this literature found that these methods reveal that an average human life is valued between $2.1 million and $11.3 million. A 2000 USDOT publication (Addendum to the 1997 Federal Highway Cost Allocation Final Report) states that the Environmental Protection Agency uses a value of $4.8 million to represent the cost of a premature death, based upon a range of $0.6 million to $13.5 million found in twenty-six studies dating back to the mid 1970s. The USDOT uses a value of $2.7 million per premature death based on a 1991 Urban Institute study. The Science Advisory Board advocates basing the value associated with a premature death on the number of life-years lost, resulting in an average value of $2.6 million. Given the range found in published studies, the high cost estimates cited in **Exhibit 4-3** likely represent a rather conservative view on the external costs associated with air pollution.

Based on the emissions data cited above, the cost estimates presented in **Exhibit 4-3** are used to develop estimates of the external health costs attributable to each mode. For example, multiplying the emission rates and associated costs for each component of automobile emissions, one finds that external health impacts fall between twenty-nine cents and fifty-six cents per passenger mile. Although the estimates developed by Small and Kazimi reflect costs in a relatively high-density urban area, they were directly applied to the emissions data reported for each mode. This approach may somewhat overstate costs for travel in rural areas, but the overall results are generally consistent with findings in previous studies.

### Climate Impacts/Global Warming

Beyond their immediate impact on human health, fossil fuel emissions have also been linked to changes in global climate. While global warming is clearly an area of controversy, if human activity is affecting the overall climate, then transportation is clearly a major contributory factor. Fossil fuel emissions are a major source of carbon dioxide and other "green-house" gases. That said, linking emissions to changes in climate and the economic impacts that result from such changes is a nearly impossible task. As a result, attempts to quantify the impact of "greenhouse gases" have focused on the cost of technologies that can be used to reduce emissions. Although they use the same basic methodology, these types of analyses have produced an extremely wide range of potential impacts.

At the lower end of the cost range, the UCB-ITS study relies on a cost estimate of $5.80 per ton of carbon, and the 2000 Full cost of Transportation in the Twin Cities Region study uses low and high estimates of $5.00 and $30.00 per ton respectively. At the upper end, the study completed for the NRDC suggests that costs could reach $82.80 per ton. The EPA's 1997 Federal Highway Cost Allocation Study Final Report notes that "The Intergovernmental Panel on Climate Control has concluded it cannot endorse

any particular range of values for the marginal damage of CO2 emissions on climate change, but noted that published estimates range between $5 and $125 (1990 dollars) per metric ton of carbon emitted." Using the lower range of these alternatives places this study's overall cost estimates within the ranges established by previous research.

### Highway Air Pollution

If global warming costs are viewed conservatively, and the lower cost estimate of these effects is added to the health impacts described above, the potential impacts of air pollution from each mode can be viewed in total. For automobile travel, this estimate falls between $0.031 and $0.058 per passenger mile. This range is consistent with the four cents average suggested by Litman (1997) in his review of the existing literature, and falls at the lower end of the $0.038 to $0.071 range developed in the 1993 NRDC study. Our conclusions are also generally consistent with the $.005 - $0.092 range suggested by Delucchi, et al. (1996) in their extensive analysis of motor vehicle emissions.

### Airplane Air Pollution

For air travel, air pollution costs are estimated to fall between $0.003 and $0.004 per passenger mile. This range is calculated from the emission data cited in **Exhibit 3-4** and the cost estimates summarized in **Exhibit 3-5**. The pollution costs for air travel depend heavily on one's assumptions about the costs related to global warming. If the NRDC's cost estimate of $82.80 per ton is used in the analysis, cost per passenger mile exceeds ten cents. However, the current analysis maintains a more conservative view of the potential costs of global warming. The final range of cost estimates is somewhat higher than the $0.001 per passenger mile estimate developed for the UCB-ITS (1996) study, but this relatively low estimate relies on a extremely conservative view of both health and climate impacts.

### Railroad Air Pollution

Employing the costs estimates noted in **Exhibit 3-5** and the emissions figures in **Exhibit 3-4**, air pollution costs for rail travel range from $0.014 to $0.027 per passenger mile. These estimates fall at the lower end of the $0.016 to $0.041 range that was presented in the NRDC study. A comparison to previous studies is not possible because most focused on some form of electrified rail and did not produce cost estimates for a diesel-powered service.

## Noise Pollution

The available estimates of noise pollution impacts are largely based on studies of how property values are affected by proximity to roads, airports, and train tracks. The impact on property values is taken as a measure of how much individuals are willing to pay to avoid exposure to high levels of noise. By focusing on property values, these studies limit impact estimates to residents

and ignore the effects of noise on other users and other non-resident groups. This implies that the available studies likely understate the overall impact of noise. This understatement applies to all travel modes and should not bias the overall results in favor of any particular mode. One should also note that many of these studies have been conducted in areas where some type of mitigation (insulated windows, noise walls, and berms) has been installed, so the available cost estimates already recognize that some portion of noise impacts have been internalized.

### Highway Noise

Focusing on the external component of noise costs, numerous studies have analyzed the impact of highway traffic. Litman's 1997 review of the existing literature indicates that estimates of external costs range from between $0.001 and $0.013 per passenger mile. This range reflects differences in urban and rural impacts, and variations in implied costs from one region of the country to another. In his final analysis, the author recommends an average value of $0.006 per passenger mile.

The noise estimates derived in the NRDC study range from between $0.001 and $0.002 per passenger mile. In analyzing noise impacts in the San Francisco to Los Angeles to San Diego corridor, the UCB-ITS study developed cost estimates of $0.004 per passenger mile. These results suggest that a range of between $0.001 to $0.006 per passenger mile should reasonably capture the potential for external impacts created by highway noise.

### Airplane Noise

Data on the noise impacts created by air travel were somewhat more difficult to obtain. Although property value analyses have probably been completed for many individual airports, few studies have taken a comprehensive view and attempted to estimate costs on a per passenger mile basis. The UCB-ITS study relied on European and Canadian studies that indicated a range of $0.002 to $0.016 per passenger mile, with an average value of approximately $0.007. The UCB-ITS analysis used this average value, but the results presented here rely on the full $0.002 to $0.016 range. This range of values highlights the true uncertainty that underlies the available estimates.

### Railroad Noise

In estimating the potential impacts one must be careful to distinguish between studies that focus on electrified rail systems and those that attempt to measure the impact of diesel powered passenger service. Cost estimates exist for urban rail systems such as San Francisco's BART system, but the noise generated by an electrified system with frequent service is very different than that created by an infrequent, diesel powered service such as that experienced in the PNWRC.

The only comparable estimates for rail related noise impacts were developed for Apogee's 1994 study of transportation alternatives in the Boston, Massachusetts area. A portion of the Boston rail system is served by diesel powered trains so the estimates derived for this study might shed some light on the potential impact of expanded service within the Pacific Northwest. The cost estimates used in the Apogee study were quite small, ranging from $0.001 to $0.004 per passenger mile. A study of high speed rail options proposed for the Los Angeles to San Francisco Corridor estimated that trains traveling at two hundred and three hundred miles per hour would result in noise pollution costs of $0.004 and $0.007 per passenger mile respectively.[2] While not directly analogous to the trains that travel from Portland, OR to Vancouver, BC, this range provides additional support for the lower range of figures used in this study.

However, given that freight service will remain a significant portion of total track use, this range of estimates may still overstate the noise impacts of passenger rail service.

### Water Pollution

Fuel spills, fluid leaks, and particulate waste from all three modes of travel have the potential to significantly degrade water quality. The potential costs of this pollution depend on how well the source of contamination is controlled and how effectively contaminated water is captured and treated.

In reviewing the data that was used to develop estimates of the capital and operating expenses for each travel mode, it becomes apparent that a large portion of the costs associated with water pollution have already been captured in the analysis of direct costs. Environmental regulations now require that a significant effort be made to prevent run-off from contaminating nearby sources of water. For example, WSDOT's current system plan identifies over ten million dollars in projects designed to control run-off in the I-5 corridor. In addition, Sea-Tac airport has developed an on-site water treatment facility to capture and treat environmentally hazardous materials such as fuel and deicing fluids. Some external water pollution costs probably still exist for each mode, but their impact is likely to be small. Therefore, an explicit monetary estimate of such costs is not included in the current analysis.

### Waste Disposal

All three modes of travel have the potential to create a significant quantity of waste material. Used oil, worn tires, and dead batteries all require some form of disposal or recycling. Most of these disposal costs are absorbed directly by the users of each mode. Airlines must pay for proper disposal of their waste

[2] *The full cost of high-speed rail: an engineering approach, Levinson, Mathieu, Gillen, and Kanafani1 (1997)*

materials and ticket prices reflect these types of operating costs. Likewise, some portion of rail operations costs will reflect the expenditures related to waste disposal and recycling. Automobile owners pay indirectly for disposal costs when they have their car serviced or repaired.

Nonetheless, the waste created by privately owned automobiles are generally thought to be less well managed than those created by airline and rail travel, mostly due the significantly larger number of responsible parties. Some portion of automobile waste is disposed of improperly and sent to municipal landfill facilities that are not designed for such materials.

The only available estimate for the external component of automobile waste disposal costs suggests that the total impacts can be valued at approximately $0.001 per passenger mile (Lee (1995)). The waste disposal costs for air and rail travel are assumed to be fully internalized and, thus captured in the estimates of direct operating costs.

## Accidents

Accidents impose external costs because a significant portion of accident related losses are not covered by the insurance payments that are accounted for in the estimates of direct operating costs. Although insurance will reimburse for material damage (less a deductible) and immediate health care expenses, the costs associated with lost productivity, long-term disability, pain, and grief are not generally covered. The research cited by Litman (1997) suggests that these uncovered losses amount to between twenty-five percent and seventy-five percent of total accident costs.

### Automobile Accidents

Estimating the value of these losses requires detailed data on both the rate of accidents and the costs associated with the uninsured components of accident losses. The existing studies of accident related external costs use slightly different accident data and rely on varying estimates of accident cost. Interestingly, their overall estimates of external accident costs are remarkably similar, amounting to approximately $0.040-$0.045 per passenger mile.

Research completed by the Transportation Research Center at Indiana University (1996) highlights a very simple and direct approach toward estimating external costs. Given separate data on the rate of fatal and non-fatal highway accidents, the researchers made assumptions about the cost associated with each type of accident. Each fatality was assumed to impose an external cost of $1.5 million. Although this estimate of the value of life is somewhat lower than the estimates used in the analysis of pollution costs, it represents only the external portion of the losses associated with each fatality. If insurance companies bear approximately fifty percent of total costs, then $1.5 million in external costs implies a total value of three million dollars.

This latter value is generally consistent with the range of estimates ($2.4-$4.2 million) used in the air pollution analysis.

For non-fatal accidents, the authors assigned a cost estimate of $50,000 to reflect the uninsured component of each automobile-related injury. Assuming that insurance also covers fifty percent of total injury losses, this estimate is consistent with research cited in the NRDC (1993) study that shows individuals are willing to pay approximately $100,000 to avoid a serious injury. These assumptions imply external accident costs of approximately $0.045 per passenger mile.

A more detailed approach was taken in the work completed for the UCB-ITS study of transportation alternatives in California. Using data developed in a 1991 Federal Highway Administration study, the authors tried to separately account for the accident losses associated with health care, lost wages, emergency services, property damage, pain and suffering, and other minor external costs. Their research suggested that these costs amounted to $120,000 for rural crashes and $70,000 for urban incidents. These estimates then imply an overall external cost of $0.040 per passenger mile resulting from automobile accidents.

The range of estimates established by these two studies ($.040-$0.045 per passenger mile) is generally representative of previous research. For example, Litman's qualitative review of the existing literature suggests that external costs range from $0.007 to $0.070 per passenger mile. NRDC's cost analysis suggests a value of $0.033 per passenger mile, but the authors indicated that this is a very conservative estimate of total costs.

A review piece completed by the Office of Technology Assessment indicated that external accident costs might reach to $0.054 per passenger mile, but the authors did not provide a full explanation of how this higher value was established.

### Airplane Accidents

Estimates for the external costs of airline accidents have been developed using the same basic methodologies as those analyzing automobile accidents. Given the availability of data on accident rates for large aircraft and smaller commuter airplanes, the focus of the analysis has been on assigning an appropriate external cost to the predicted number of fatalities and injuries.

In the research completed at Indiana University it was assumed the portion of cost covered by the airline or its insurance company would be the same as that covered by automobile insurance. Applying the same external costs estimates for injuries and fatalities that were used in their analysis of automobile accidents, this implies a total external accident costs of $0.0035 and $0.0002 per passenger mile for commuter and major carrier service, respectively. A

weighted average cost factor was developed using corridor travel statistics provided by the Federal Aviation Administration (FAA) showing total passengers between city-pairs for jet and commuter aircraft. Since the vast majority of travel in the corridor takes place on jets, the average approaches the major carrier service rate.

Using accident statistics from a different year and a somewhat larger estimate for the uninsured losses attributable to each fatality ($2.4 million), the UCB-ITS study concluded that external accident costs could amount to $0.0003 and $0.005 for commuter and large airline service, respectively. This implies a composite cost of $0.003 per passenger mile, if service is evenly divided between commuter and major airline carriers. These two analyses define the overall $0.002 to $0.003 range that is used in the current analysis of external accident costs.

### Railroad Accidents

In developing estimates of the external costs of rail travel, accident data provided directly by Amtrak formed the basis for this analysis. These data were more current and comprehensive than those used in any existing study, so the current cost estimates were calculated directly and do not rely solely on previous research. **Exhibit 4-4** summarizes the information available on the rate of fatalities associated with Amtrak's service. Notice that most fatal railway accidents are associated with rail-crossing incidents and trespassing, and did not involve passengers. Depending on how one accounts for these accidents, external costs can vary significantly.

**Exhibit 4-4**
**Accident Rates for Rail Travel**

| | Fatalities per Million Passenger Miles |
|---|---|
| Amtrak Passenger | 0.0007 |
| Automobile drivers (rail crossing incidents) | 0.0107 |
| Trespassers | 0.0096 |

*Source: Amtrak, 2003.*

Using the costs estimates proposed in the research conducted at Indiana University's Transportation Research Center, the external accident costs of onboard fatalities amount to just $0.001 per passenger mile. Estimates of a similar magnitude were cited in the literature as representing the total external accident costs associated with rail travel (NRDC (1993), Litman (1997)). However, if one adds the costs associated with rail-crossing and trespass accidents, the indirect cost of rail accidents increases to $0.032 per passenger mile.

Given this large range, only onboard and trespasser accidents are included in the high cost range. Therefore, a range of $0.001 to $0.015 per passenger mile is used to summarize the external costs of railroad accidents. It should also be noted that these estimates may somewhat understate actual costs, because the accident data from Amtrak only reflect fatalities and did not include information about serious injury accidents.

## External Cost Estimates by Mode

**Exhibit 4-5** summarizes the range of cost estimates that were used as a base for each external factor considered in the cross-modal cost analysis.

The results presented in this table have been escalated at the rate of inflation and represent current dollar estimates of costs for each year in the planning horizon. Notice that external costs are significantly larger for highway travel than for either rail or air. In 2003, highway costs are estimated to range from seven to nine cents per passenger mile, while rail costs are estimated to be two to seven cents per passenger mile. External cost for air travel amount to just one to three cents per passenger mile. Air pollution and accident costs

**Exhibit 4-5**
**Comparison of External Costs ($ per passenger mile)**

| | Automobile | | Passenger Rail | | Air Travel | |
|---|---|---|---|---|---|---|
| Year | Low Cost Estimate | High Cost Estimate | Low Cost Estimate | High Cost Estimate | Low Cost Estimate | High Cost Estimate |
| 2004 | $0.07 | $0.09 | $0.02 | $0.07 | $0.01 | $0.03 |
| 2008 | $0.08 | $0.11 | $0.02 | $0.08 | $0.01 | $0.03 |
| 2013 | $0.09 | $0.12 | $0.03 | $0.10 | $0.01 | $0.03 |
| 2018 | $0.11 | $0.14 | $0.03 | $0.11 | $0.01 | $0.04 |
| 2023 | $0.12 | $0.17 | $0.03 | $0.13 | $0.01 | $0.05 |

*Source: Berk & Associates, 2004.*

represent the largest share of the external cost associated with highway travel.

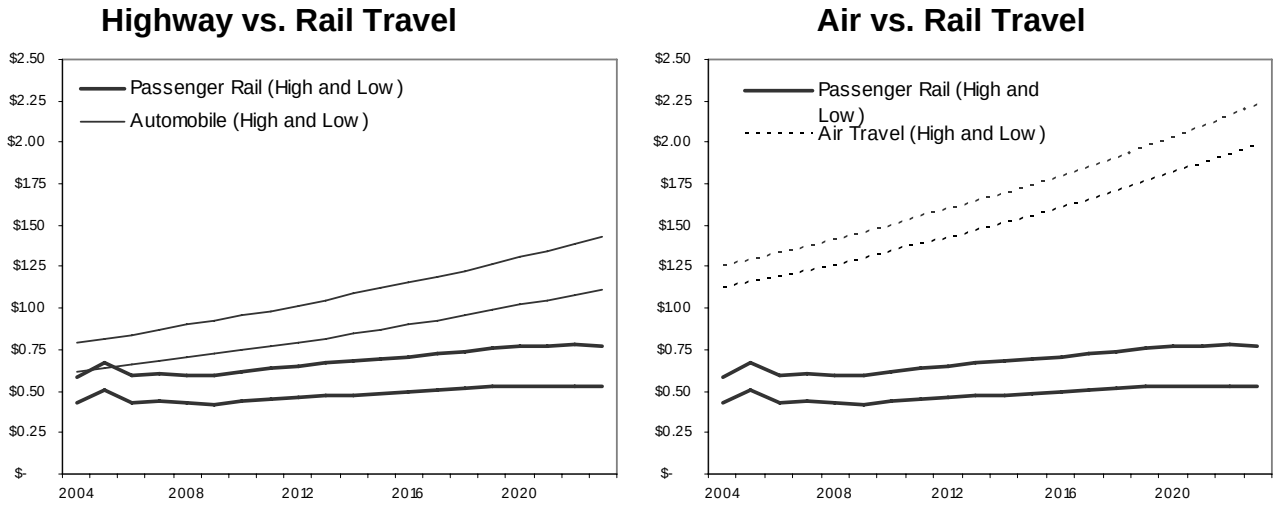
## Results of Adding External Cost to Direct and Time Costs

Returning to the step-wise analysis of full operating costs, external costs can now be added to the previous estimates of direct operating costs and travel time costs. External costs are largest for highway travel, so the cost advantages of rail versus highway travel that were identified earlier are reinforced when externalities are added to the analysis.

**Exhibit 4-6** presents a direct comparison between the full operating costs of highway and rail travel. The pattern of these results matches those observed in the analysis of time costs, but the total magnitude of the cost estimates and the divergence between highway and rail are somewhat larger.

The addition of external costs does not alter the conclusions that air travel is generally a less cost-effective choice for short distance travel in the corridor. External costs are lowest for air travel, so the relative cost advantage for rail over air travel decreases somewhat when externalities are considered.

**Exhibit 4-6**
**A Cost Comparison, including Direct Costs, Travel Time, and Externalities Highway vs. Rail Travel ($ per passenger mile)**



# Chapter Five: Inclusion of Capital Costs

Having reviewed the issues associated with whether to invest in passenger rail, the next major question is how much will it cost? Over the years, estimates have been developed to answer this question. The most recent cost estimates (as of December 2003, in 2003 dollars) call for a $4.9 to $5.4 billion investment in the corridor. However, this cost estimate is for the corridor as a whole – a corridor that includes intercity passenger rail along with freight rail and commuter rail.

Many of the proposed corridor investments will provide significant benefits not only to passenger rail, but to commuter service, and freight traffic as well. (The *Amtrak Cascades Operating and Capital Plan Technical Paper, 2004* provides details and costs of these many projects.)

The $4.9 to $5.4 billion in capital improvements to the Pacific Northwest Rail Corridor will:

- Allow Sound Transit to operate all of the planned peak hour commuter trains between Lakewood and Everett which are projected to carry three million commuters per year
- Accommodate the anticipated growth in freight rail traffic within the corridor;
- Support all planned Amtrak *Cascades* service that is projected to carry three million intercity riders per year.[1]

At the end of the twenty-year period, it is assumed that no major capital requirements will remain for intercity passenger rail service and ticket buying passengers will fund the majority of annual operating costs.

In order to achieve WSDOT's vision of faster and more frequent service, it is imperative that improvements and investments be made throughout the corridor, from Oregon to British Columbia. In addition to the three jurisdictions, other funding partners – the Burlington Northern and Santa Fe Railway, Sound Transit, and Amtrak – will also need to make capital investments in the corridor. However, it should be recognized that given the uncertainties involved in projecting future expenses, total costs can only be broadly estimated.

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[1] *The ridership and revenue projections for Amtrak Cascades service between Portland, Seattle, and Vancouver, BC are included in the Amtrak Cascades Ridership and Revenue Forecasts Technical Paper, 2004.*

**Exhibit 5-1** provides an overview of capital investments required in the corridor over the next twenty years. These investments include track improvements, bridges, safety upgrades, and train equipment.

**Exhibit 5-1**
**Corridor Capital Costs with Passenger Rail Allocation**
**(in millions of 2003 dollars)**

| | 2008/9 | 2023 | TOTAL |
|---|---|---|---|
| Corridor Capital Investments | | | |
| Oregon | $51.6 | $75.3 | $126.9 |
| Washington | $1,221.6 | $3,161.8 | $4,383.5 |
| British Columbia | $85.0 | $452.6 | $537.5 |
| *Total Corridor Capital Investments* | $1,358.2 | $3,689.7 | $5,047.9 |
| Sound Transit Investments | | | |
| | $319.0 | $264.0 | $583.0 |
| *Passenger Rail Total* | $1,039.2 | $3,425.7 | $4,464.9 |
| Miscellaneous Capital Costs | | | |
| Trainsets | $187.5 | $180.0 | $367.5 |
| Land Acquisition | $19.4 | $55.1 | $74.5 |
| Station Improvements | | | |
| *Total Misc. Capital Costs* | $206.9 | $235.1 | $442.0 |
| **Total Passenger Rail Costs** | **$1,246.1** | **$3,660.8** | **$4,906.9** |

*Source: Draft PNWRC Passenger Rail Plan, 2003.*

## Operating Costs

According to the *Amtrak Cascades Operating and Capital Plan*, the total annual cost of providing intercity rail service (operations and maintenance) is projected to range from approximately $20.3 million currently and increase with the level-of-service to $84.6 million at project buildout, excluding the effects of inflation.

**Exhibit 5-2** provides a snapshot of the program's projected performance during representative years throughout the planning horizon. These estimates highlight how the anticipated growth in ridership will build operating revenues, improve the system's farebox recovery, and reduce the

**Exhibit 5-2**
**Estimated Operating Costs and Subsidy (millions of 2003 US dollars)**

| | 2002 | 2008 | 2023 | TOTAL |
|---|---|---|---|---|
| Annual Operating Revenue | $9.2 | $36.5 | $82.3 | $516.9 |
| Annual Operating Costs | $20.3 | $51.5 | $83.4 | $681.5 |
| Subsidy Requirements | -$11.1 | -$15.1 | -$1.1 | -$164.6 |
| Farebox Recovery | 45% | 71% | 99% | 76% |
| Passengers (millions) | .3 | 1.4 | 3.0 | 33.7 |
| Passenger-Miles (millions) | 82.9 | 211.3 | 456.5 | 5,212.7 |
| Average Trip Length (miles) | 254.2 | 149.8 | 152.4 | 154.6 |

required operational subsidy.

Looking forward, operating revenues are expected to jump to approximately seventy percent of operating costs by the year 2008 and increase to nearly one hundred percent by program completion. This results in operating subsidy requirements of approximately $15.0 million per year by 2008, gradually decreasing until all operations costs are expected to be recovered from operating revenues. These estimates are expressed in constant 2003 dollars.

The totals reported in the last column of **Exhibit 5-2** reflect total costs and revenues over the entire twenty-year planning period, based on an extrapolation of the four snapshot years presented in the other columns. During this period, 33.7 million passengers are projected to travel a total of just over five billion passenger miles. The cost and revenue estimates indicate that over this timeframe the program will operate with an average farebox recovery of over seventy-five percent and require just over $164 million in total operational subsidies (2003 present value).

## Subsidy Requirements and Cost Recovery Rate

It is useful to put the subsidy requirements into a policy context. The cost recovery rate measures the percent of operating costs covered by user fees with the balance coming from public subsidy. The estimated cost recovery rate begins at approximately forty-five percent and improves over time until all operating costs are expected to be recovered at project buildout.

The subsidy estimate for the early years of the program is a conservative planning estimate based on current operating experience in the corridor. As such it provides a good basis for decision making regarding the next increment of service improvement. In subsequent years there are projected changes in assumptions, which may or may not be realized, that will have a significant bearing on the size of the subsidy requirements at these levels of

service. As a point of comparison, the current, systemwide farebox recovery rate for Washington State Ferries is approximately seventy-five percent.

## Passenger Rail: Viewed within the Context of the Overall Transportation System

The previous section presented a comparison of the direct, indirect and external costs of the three principal modes of intercity travel in the I-5 corridor between Vancouver, BC and Portland, OR. As was mentioned earlier, the capital costs were explicitly excluded from the analysis. This was done to ensure that the operational characteristics of each mode were not overshadowed by the potentially large investments in capital facilities.

This is particularly true in the current comparison, where the rail system is just beginning the process of investing in facilities and equipment to offer a competitive alternative to driving or flying. Thus, the operational cross modal analysis assumes that each mode will have the necessary capital infrastructure to meet future demands, within some reasonable financial constraint.

The balance of this section will address the relevant capital cost items for each mode and add these to the cross modal analysis of operational costs. The result will be a fully-allocated cost comparison of travel in the corridor.

## Adding Capital Costs to the Cross Modal Comparison

The comparison of capital costs poses a series of complications that are not raised in the analysis of operating costs. Operating costs represent recurring expenses that can be easily identified and tracked through time. Although capital investments may be incurred at a particular point in time, they must also be allocated across time because they have useful lives of thirty years. In addition, facilities support both passenger and freight traffic, so costs must be appropriately divided among all uses. Furthermore, because the current planning horizon is less than twenty years, current expenditure plans may not capture the full capital costs of each mode. The following are additional observations regarding the integration of capital into the overall analysis of cost effectiveness.

Rather then reflecting the inherent advantages of one mode over another, short-term capital investment requirements can be heavily influenced by past investment decisions. If infrastructure and facilities have been allowed to age and deteriorate, significant capital expenditures may be needed in the immediate future. These expenditures could increase the apparent costs of the affected mode of travel, but may not accurately reflect its long-term cost effectiveness.

Required capital investments also reflect differences in the relative maturity of each transportation alternative. As discussed earlier, the markets for both highway use and air travel are mature, and have benefited from a long history of public and private investment. In contrast, the objective of Washington State's Amtrak *Cascades* program is to reintroduce intercity passenger rail as a viable alternative in the I-5 corridor. It will probably take some time to build its market share. If rail travel is to successfully compete with both air and highway travel, public investment may be needed in the short term to build the necessary infrastructure to offer competitive service.

A comparison of planned capital expenditures can be misleading because it does not offer direct insight into the long-term levels of capacity that will be available for each mode. Planned improvements in air and rail facilities might be used to support an expansion of service in the years beyond 2023. The current analysis relies on projections of demand to estimate relative cost effectiveness. However, the availability of unused capacity will have value in the years beyond the current planning horizon and the cost of expanding capacity will also be different for each mode.

Nonetheless, each mode does require a basic infrastructure in order to operate and each will require significant capital investments over then next fifteen to twenty years. To fully compare the costs associated with each mode of travel, the analysis must also account for this aspect of total costs. In the discussion that follows, the treatment of capital costs are identified as well as associated assumptions.

## Estimating Capital Costs

The capital costs included in the analysis all reflect one-time investment expenditures that are planned through the year 2023. Capital expenditures were converted to annualized costs by using a discount factor of 4.5 percent and the assumed useful life of each investment.[2]

The only exception to this approach is for the analysis of air travel. The capital expenditures related to air travel were measured by totaling the debt service payments and cash funded capital improvements that are scheduled to occur through the year 2023.

A simplifying assumption was made about the treatment of the existing infrastructure for each mode. Since the investment decision that is currently

[2]*For example, investing $10 million in a new building would be converted to an annualized cost of $614,000, using a factor of 0.0614, which is determined by amortizing the costs over a useful life of thirty years at 4.5 percent. The 4.5 percent discount rate accounts for the opportunity cost of capital, and is roughly equivalent to the current cost of money for a public entity such as the State of Washington.*

under consideration is how best to address future travel demand needs, the cost of the existing facilities and equipment were considered to be sunk costs and not included in the cost effectiveness analysis. The only exception to this assumption is in the case of the air travel analysis, where the cost of some of the existing capital base is reflected in debt service payments and in the calculation of airport rental charges. This is discussed in more detail in the air travel analysis.

### Highway

Data on planned capital expenditures for the Interstate 5 corridor are taken from the 2001 Washington State Highway System Plan and the 2003 Project List of projects included in the "Nickel Package" (a five-cent gas tax increment approved in 2002 for transportation projects). The capital costs identified in the plans include expenses for projects related to safety enhancements, environmental retrofits, economic initiatives and mobility improvements. In addition, the anticipated costs of retrofitting bridges for seismic integrity have also been included in the capital cost estimates.

In developing an estimate of planned investments in the corridor, projects planned for Interstate 5, Interstate 405, Interstate 205, State Route 167, and State Route 512 were all included in the total. Discussion with WSDOT staff indicated that these would comprise the likely routes for north-south travel over the next twenty years.

The capital expenditures planned for these routes over twenty years total $6.1 billion in current 2003 dollars. These costs were spread evenly over the twenty-year period from 2003 to 2023 and escalated to current dollars under the assumption that inflation will average 3 percent per year. The resulting estimates were then converted to a measure of annualized costs under the assumption that highway improvements have a useful life of thirty years.

Projections for total corridor travel were then used to convert annualized capital investments to a per passenger mile estimate of annualized capital costs. WSDOT staff provided vehicle mile projections for the relevant sections of each highway in the corridor. Using WSDOT's estimate that occupancy averages 1.4 persons per vehicle, these vehicle mile estimates were then converted to projections of total passenger miles.

### Air Travel

Total airport costs are based on an estimate of airport revenues generated by activities that are directly related to the air passenger market. Since airports recover their full costs through user charges, a portion of these revenues are used to cover capital investments. Smaller capital projects are funded directly from retained earnings or grant funding, while the costs of larger projects are

reflected in the airports' annual debt service payments. Rather than annualize costs, as was done with the other modes, estimates of these two sources of financing were taken as a measure of annual capital costs.

Among the relevant airports, annual capital costs vary significantly, but all anticipate significant expansions and major capital investments over the next twenty years:

- At present, SeaTac Airport allocates nearly $100 million per year to capital costs, and with inflation and new capital projects this is expected to grow to nearly $300 million by 2023 (inflation adjusted dollars).
- Vancouver International Airport currently spends $52 million (U.S.) per year to finance capital projects and projections indicate that this could reach $210 million (U.S.) by 2023.
- Portland International Airport's current budget allocates approximately $70 million per year for capital costs. Looking forward, this could increase to more than $80 million over the next ten years before declining slightly as major capital projects are paid off.
- Although specific estimates of annual capital costs were not available for Bellingham International Airport, the Port's current master plan identifies more than $36 million (2003 dollars) in capital improvements that will be needed before 2015.

Capital costs related to enhanced security are not listed separately and are accounted for in airport budgets and increased passenger fares.[3]

Using the percentage of total revenue attributable to passenger travel, capital costs were then allocated to passenger and non-passenger investments. Summing the resulting total annual expenses and removing the effects of inflation, the capital costs associated with passenger travel at the corridor's four major airports are expected to total more than $5.6 billion in 2003 dollars over the twenty-year period from 2003-2023. These costs reflect significant expansions including the addition of new runways at Sea-Tac and Vancouver International Airport.

[3] *This approach is supported by a recent article in the Business Journal of Portland (Port Approves PDX Security Upgrade Contract, September 15, 2003) which describes a $77 million multi-year project "to upgrade [the airport's] explosives screening capabilities." The article states the airport is working under "the assumption it will be reimbursed 100 percent but without assurances of repayment. The Transportation Security Administration has suggested it will reimburse airports for ninety percent of their costs, Schreiber [the PDX manager] said. The airport plans to recover the remaining ten percent from airlines, he said."*

### Passenger Rail

Capital cost estimates for passenger rail were obtained from information provided in the Amtrak Cascades Capital Costs Technical Paper, 2004. This report identifies the capital costs associated with purchasing new trains, improving station facilities, acquiring necessary land, and upgrading the existing track network. Although it is clear that the costs of new trains and upgrading existing stations will be driven exclusively by the passenger rail program, many of the proposed corridor investments will provide significant benefit to passenger rail, commuter service, and freight traffic.

**Exhibit 5-3**
**Comparison of Capital Costs**
**($ per passenger mile)**

| Year | Automobile | Passenger Rail | Air Travel |
|---|---|---|---|
| 2004 | $0.002 | $0.11 | $0.05 |
| 2008 | $0.001 | $0.38 | $0.06 |
| 2013 | $0.001 | $0.40 | $0.06 |
| 2018 | $0.001 | $0.60 | $0.06 |
| 2023 | $0.001 | $0.85 | $0.06 |

*Source: Berk & Associates, 2004.*

The following are major assumptions made in the analysis:

- The period over which the capital costs are amortized varies according to the type of improvement.
- Corridor improvements are assumed to have a useful life of thirty years, buildings thirty years, and equipment twenty years.
- Since land does not depreciate, the land acquisition costs are amortized over ninety-nine years.

## Final Capital Cost Estimates

**Exhibit 5-3** compares the capital cost estimates derived for each mode. When viewed on a passenger mile basis, capital costs differ significantly by mode. Over the current period of study, highway capital costs do not exceed $0.001 per passenger mile, but they reach eighty-five cents per passenger mile for rail. This variation is largely driven by two key factors:

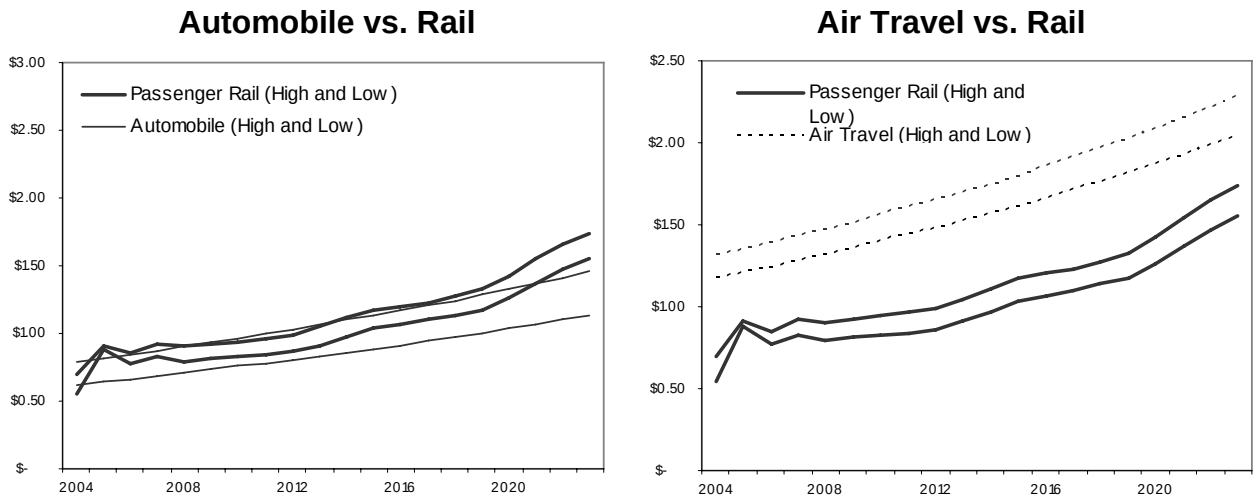
- Differences in projected levels of ridership for each mode; and
- The level of investment in rail and highway are designed to meet different level-of-service (LOS) goals. Total highway capital costs ($6.1 to $7.6 billion) exceed those for rail ($4.86 billion), however, given the 28.3 billion vehicle miles that are projected for the I-5 corridor in 2023, average capital costs per passenger mile are significantly lower for highway travel.

The investment in the rail system will result in significant improvements in the level-of-service, both in terms of frequency of service and reduced travel times. The investments in the highway system will not have a significant impact on the degradation in the overall level-of-service, as average speeds are projected to continue to slow throughout the period. As a result, a significant portion of the cost effectiveness advantage for highway comes at the expense of a significant decrease in the level-of-service.

There is a significant increase in the capital cost per passenger mile for rail in the later period of the analysis. This is due to the fact that there are some very large projects scheduled in the later years of the plan, including: $1 billion for crossings of the Columbia and Fraser Rivers and $1.1 billion for major track improvements and a bypass route.

**Exhibits 5-4** present a comparison of the full cost associated with each mode of travel. The estimates reflect operating costs, travel time, externalities, and capital costs for each of the three modes.

**Exhibit 5-4**
**A Full Cost Comparison of Travel including Direct Costs, Travel Time, Externalities, and Capital Expenditures ($ per passenger mile): 2023**



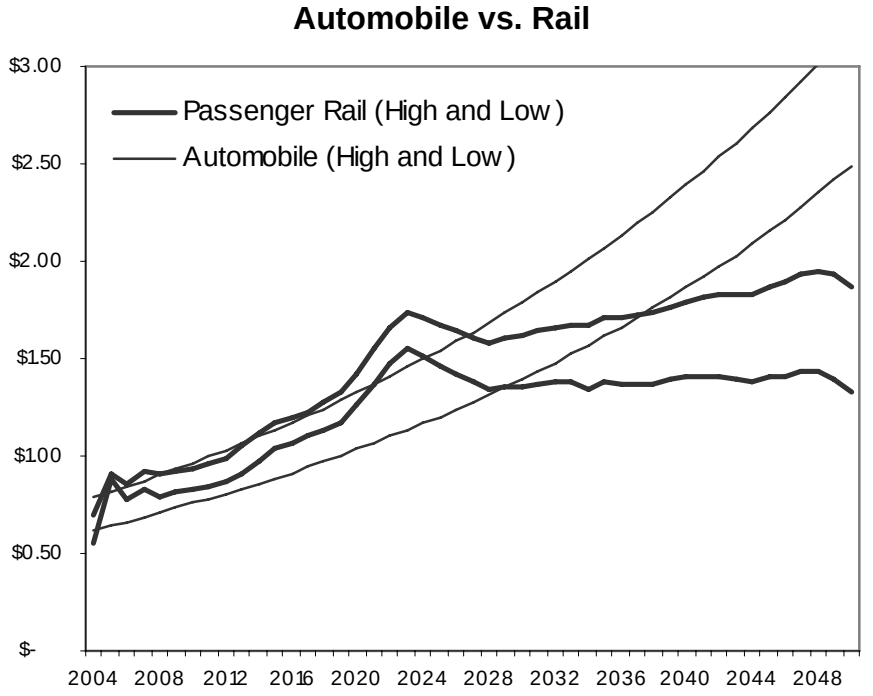

## What happens beyond year 2023?

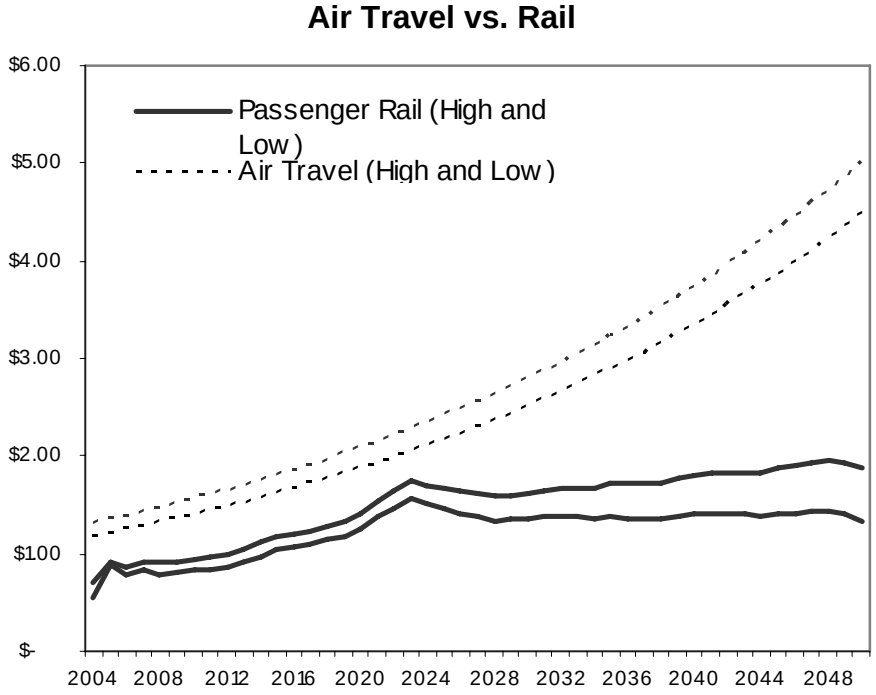
After 2023, all of the improvements identified in the *Amtrak Cascades Operating and Capital Plan* will have been completed and the service objectives will have been met. Therefore, future capital needs are likely to be limited to rehabilitation and maintenance needs, which are far less expensive

than new construction. Because of this, the full cost of travel comparison between modes shows that costs per passenger mile for passenger rail will become relatively constant after 2023, while the total cost per passenger mile for air travel and automobile travel will continue to climb.[4] **Exhibit 5-5** on the following page illustrates this comparison.

[4] In addition, the model used for the cross-modal comparison assumes that the life of a rail corridor capital improvement is thirty years. This assumption is based on industry estimates for high-volume rail lines that are shared by both passenger and freight trains. As part of WSDOT's capital improvement plan for Amtrak *Cascades*, there will be large sections of track that will be used almost exclusively by lighter-weight passenger trains and not subject to the same degree of track wear and tear typically found on a high-volume freight rail line. This will result in a much longer life span for these capital projects than the thirty-year assumption used in this cross-modal analysis, a life span that could reach 100 years with proper maintenance.

**Exhibit 5-5**
**A Full Cost Comparison of Travel including Direct Costs, Travel Time, Externalities, and Capital Expenditures ($ per passenger mile): 2050**



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# Appendices

# Appendix A
# Annotated Bibliography

**Apogee Research (1994):** ***The Costs of Transportation: Final Report.*** **Prepared for the Conservation Law Foundation.**

Focusing on two specific case studies, this study provided a cross-model comparison or urban transportation costs. Although the results of this work did provide some general guidance in our work, the study was designed to address the costs associated with urban transportation, rather than inter-city travel.

**American Automobile Association (2003):** ***Your Driving Costs: 2003 Edition.*** **Prepared with the assistance of Runzheimer International.**

This annual report provided a complete analysis of the direct ownership costs for several makes and models of automobiles. The analysis includes a consideration of purchase costs, regular maintenance, insurance, etc. The results presented in this report provided the basis for estimating the direct costs of automobile ownership.

**Amtrak (1996):** ***Twenty-Fifth Annual Report, Leading the Way into the 21st Century.***

Amtrak's annual report provided summary level information about passenger rail operations. This included some information about accident control programs now being implemented throughout the country.

**Black, William R. and Dean L. Munn, Richard J. Black, Jirong Xie (1996):** ***Model Choices: An Approach to Comparing the Costs of Transportation Alternatives.*** **Transportation Research Center, Indiana University.**

The work of Black et al. was designed to offer a general review of the full costs of transportation and to provide a methodology for comparing costs across different modes. The study includes specific estimates for the individual cost components for each mode, including important elements of direct, indirect, and external costs. These results were used to verify the range of costs that summarize the current analysis. In addition, the author's analysis of accident costs and the value of human life provided the foundation for our analysis of this same issue.

**Brand, Daniel (1996):** ***The Value of Time Savings for Intercity Air and Auto Travelers for Trips Under 500 Miles in the U.S.*** **Prepared by Charles River Associates for the U.S. DOT, Office of the Secretary of Transportation, Panel on the Value of Time for Use in Transportation Investment Evaluation.**

Although the data used in this analysis were drawn from areas outside the Pacific Northwest, the results of this study were used to help verify the value of time estimates used in the current analysis.

**Brownstone, Dave; Small, Kenneth (2002):** ***Valuing Time and Reliability: Assessing the Evidence from Road Pricing Demonstrations.***

This paper reports results from evaluations of two road pricing demonstrations in Southern California, providing insight in how to measure commuters' values of time and reliability.

**Brownstone, David (2002):** ***Drivers Willing-to-Pay to Reduce Travel Time: Evidence from the San Diego I-15 Congestion Pricing Project.***

This paper provided a useful estimation of the true cost of travel delays due to congestion.

**Bureau of Transportation Statistics:** ***TranStats, Table T-100 Domestic Market.***

This data was used to determine the number of passengers flying between various city pairs.

**California Intercity High Speed Rail Commission (1996):** ***High-Speed Rail Summary Report and Action Plan.***

This study provides an analysis of the high speed rail project that has been proposed for the State of California. The work does not include a detailed assessment of full costs, but rather includes information about proposed operations, potential ridership, and projected revenues. This study provided useful background information and a list of valuable references.

**Center for Transportation Studies, University of Minnesota (2000):** ***The Full Cost of Transportation in the Twin Cities Region.***

This approach provided a useful listing of and model for quantifying the full costs associated with transportation, including government costs, internal costs, and external costs.

**Delucchi, Mark A. (1997):** ***The Annualized Social Cost of Motor-Vehicle Use in the U.S. 1990-1991: Summary of Theory, Data, Methods, and Results.*** **Institute of Transportation Studies, University of California Davis. UCD-ITS-RR-96-3.**

As the title indicates, this report provided a thorough review of the external costs associated with automobile transportation. The results of this study and Delucchi's other work (see below) helped establish the range of estimates used in our assessment of the external costs of automobile transportation.

**Delucchi, Mark A.; Murphy, James J.; McCubbin, Donald R. (2002):** ***The Heath and Visibility Cost of Air Pollution: A Comparison of Estimation Methods.*** **Journal of Environmental Management.**

This paper provided a general review of methodologies used to quantify externalized costs related to air pollution.

**Delucchi, Mark A. (1997):** ***Total Cost of Motor vehicle Use. Access,*** **number 8, pp. 7-13.**

Delucchi's work provides a review of the total costs associated with automobile transportation, including an assessment of direct personal costs, air pollution, accidents, parking, etc. These estimates helped establish the range of estimates used in our assessment of the external costs of automobile transportation.

**Economics Research Associates (1996): *Economic Impact and Benefit/Cost of High Speed Rail for California.* Submitted to the California Intercity High Speed Rail C omission, Project no. 11475, Contract no. 75w230.**

This study provided a general review of the methodologies used in assessing the potential costs and benefits of high-speed rail in California.

**Federal Aviation Administration (2002): *Terminal Area Forecasts (TAF)*.**

The 2002 TAF contains historical aviation data and FAA's forecasts for airports around the country. Forecasts cover fiscal years 2002 to 2020. Forecasts include the impact of the September 11, 2001, terrorist attacks.

**Federal Aviation Administration (1997): *Treatment of Values of Passenger Time in Economic Analysis.* U.S. Department of Transportation, Office of Aviation Policy and Plans.**

Following a review of several other studies, the methodology presented in this memorandum formed the foundation for our analysis of the value of travel time.

**Federal Highway Administration (2003): *Trends and Forecasts of Highway Costs.***

This paper described general approaches to quantifying and forecasting highway costs.

**Federal Highway Administration (2003): *Addendum to the 1997 Federal Highway Cost Allocation Study Final Report.***

This addendum to the original 1997 report provided a model for estimating air pollution-related costs of highway use.

**Gannet Fleming (1992): *High Speed Ground Transportation Study.* Report to the Governor, Washington State Legislature, and the Washington State Transportation Commission.**

This detailed analysis of the potential for operating high-speed rail service within the Pacific Northwest provided data essential for our analysis of the rail alternative. In addition, this analysis included information about the factors driving mode choice decisions and the direct and indirect costs associated with other modes.

**Gwilliam, Ken (1997): *Sustainable Transport*. World Bank.**

Gwilliam reviews existing studies which put value on time and external costs of transportation.

**Hare, Patrick (1991): *Trip Reduction and Affordable Housing. Transportation Research Board.***

Hare's work was directly used in the analysis of parking costs. This article includes an estimate that parking represents approximately 10% of the rental costs for a typical apartment.

**IBI Group (1995): *Full Cost Transportation and Cost-Based Pricing Strategies.* Prepared for the Ontario Round Table on Environment Economy.**

While this report focused on estimating transportation costs for Canada, it also provided a review of previous work conducted worldwide. The report included estimates for various

aspects of total cost, but the author's work on the external costs associated with air pollution were of the greatest value for the current study.

**Levinson, David; Gillen, David (1997):** ***The Full Cost of Intercity Highway Transportation***
This paper provides another example of full cost transportation modelling.

**Levinson, David; Gillen, David; Kanafani, Adib (1996):** ***The Social Costs of Intercity Transportation: A Review and Comparison of Air and Highway.***
This paper included a survey of literature measuring social costs of air and car travel. The summary tables provided a useful means of benchmarking what measures other studies had employed.

**Litman, Todd (1997):** ***Transportation Cost Analysis: Techniques, Estimates, and Implications.*** **Victoria Transport Policy Institute.**
This report provided a comprehensive review of previous work in estimating the full costs of transportation. This included a detailed review of the direct, indirect, and external costs associated with train, air and automobile travel. This work directly informed our analysis and provided a range of cost estimates with which to compare our final results.

**Murphy, James; Delucchi, Mark (1998):** ***A Review of the Literature on the Social Costs of Motor Vehicle Use in the United States.*** **Journal of Transportation and Statistics.**
This paper provided a useful summary of thinking done on the social costs related with motor vehicle use.

**Natural Resources Defense Council (1993):** ***The Price of Mobility, Uncovering the Hidden Costs of Transportation.*** **Prepared by Peter Miller and John Miffed.**
Focusing most directly on the external costs associated with accidents, noise, air pollution, water pollution, etc., this analysis provided a thorough cross-modal assessment of total costs. The results of this work helped to establish the range of costs cited in the current study.

**National Highway Traffic Safety Administration (1994):** ***Estimating Crash Costs in State or Local Jurisdictions.*** **Office of Regulatory Analysis Plans and Policy, U.S. Department of Transportation.**
This report provided a detailed analysis of the costs associated with both fatal and serious injury accidents. This includes an assessment of direct property value losses as well as the costs associated with health care and lost wages. These results formed our analysis of accident costs, and specifically the costs associated with automobile transportation.

**National Highway Traffic Safety Administration (1993):** ***Saving Lives and Dollars, Highway Safety Contribution to Health Care Reform and Deficit Reduction.*** **U.S. Department of Transportation.**
This report provided estimates of the direct health care costs associated with automobile injuries and fatalities. The information in this study was used to confirm the results cited in several broader studies of the overall costs associated with transportation accidents.

**New Jersey Department of Transportation (2001):** ***Cost of Transporting People in New Jersey.***

This report provided an example of an evaluation of the full costs of highway transportation.

**Pickrell, Don and Paul Schimek (1998):** ***Trends in Personal Motor Vehicle Ownership and Use; Evidence from the Nationwide Personal Transportation Survey.*** **U.S. Department of Transportation, Volpe Center.**

The Volpe Center's analysis of the age and composition of the current fleet of motor vehicles was used in conjunction with cost estimates provided by the AAA to estimate the average costs of vehicle ownership in the United States.

**Port of Bellingham (2003):** ***Annual Report – 2002*** **and the** ***2003 Corporate Strategic Plan*****.**

These documents provided direct information about current airport revenues and projected future costs.

**Port of Portland (2004):** ***Audited Financial Statements.***

These summary financial reports provided direct information about current airport revenues and projected future costs. When supplemented with more detailed information provided by Port personnel, these data were used to develop estimates for the terminal costs associated with air travel to and from the Portland airport.

**Port of Seattle (1994):** ***Airport Master Plan Update.*** **Prepared for the Port of Seattle by P&D Aviation.**

This report, along with detailed financial projections of the Port's future operations were used to estimate the costs associated with passenger travel through Sea-Tac Airport. This included a separate analysis of on-going operational costs and anticipated capital investments.

**Puget Sound Regional Council (1996):** ***The Costs of Transportation: Expenditures on Surface Transportation in the Central Puget Sound Region for 1995.*** **Prepared with the assistance of the Underhill Company.**

The PSRC's analysis of the relative costs of automobile, public transit, and other modes provided valuable information about the direct and indirect costs of automobile ownership. The reports estimates regarding parking were included in the current analysis, and its general conclusions were used to verify our results regarding the costs of automobile operation.

**Qin, Jiefeng, Jose Weismann, Mark A. Euritt, and Michael Martello (1996):** ***Evaluating the Full Costs of Urban Transportation. Transportation Research Record, 1518.***

This article described a computer model that has been developed to evaluate the full costs of urban transportation. Given its focus on urban, rather than inter-city travel, the model itself was not useful for the current analysis. However, a review of the methodology developed by the authors did provide useful starting point.

**Small, K.A. and C. Kazimi (1995):** ***On the Costs of Air Pollution from Motor Vehicles. Journal of Transport Economics and Policy,*** **vol. 45, pp. 7-32.**

This paper provided a thorough analysis of both emission levels and the social costs associated with these emissions. The results of this study provided the basis for our analysis of the eternality costs associated with air pollution.

**Texas Transportation Institute (1996):** ***Urban Roadway Congestion – 1982-1993, Volume 1: Annual Report.*** **Texas Transportation Institute, Texas A&M University.**

**Texas Transportation Institute (1996):** ***Urban Roadway Congestion – 1982-1993, Volume 2: Methodology and Urbanized Area Data.*** **Texas Transportation Institute, Texas A&M University.**

These two volumes provided an assessment of congestion within urbanized areas, including Seattle and Portland. These results helped to develop projections for average highway speeds in these areas and thus contributed to our analysis of automobile travel times.

**University of California at Berkeley, Institute of Transportation Studies (UCB-ITS) (1996):** ***The Full Cost of Intercity Transportation – A Comparison of High Speed Rail, Air and Highway Transportation in California.*** **Prepared by Levinson, David and David Gillen, Adib Kanafani, and Jean-Michel Mathieu.**

A comparable assessment of the overall costs of different transportation modes, this study provided a review of previous cost estimates as well as an analysis of different research methodologies. Because it included an analysis of rail, air and highway transportation, this work provided a valuable benchmark for our analysis.

**U.S. Congress, Office of Technology Assessment (1994):** ***Saving Energy in U.S. Transportation.***

This study included a review of previous work on estimating the external costs associated with various modes of travel. This review provided some valuable background information and include references to other useful materials.

**US Department of Transportation (2001):** ***National Household Travel Survey.***

Results of this survey were used to estimate the classes vehicle driven by vehicle owners in the Western U.S.

**Vancouver International Airport Authority (1996):** ***Annual Report: 1996.***

This report provided direct information about current airport venues and projected future costs. These data were used to develop estimate for the terminal costs associated with air travel to and from Vancouver, B.C.

**The Victoria Transport Policy Institute.**

The Institute provides an extremely useful compendium of transportation-related literature.

**Wardman, Mark (1996):** ***A Review of Evident on the Value of Travel Time in Great Britain.*** **HETA Division, Department of Transport, Great Britain.**

Wardman's analysis of travel time provided useful review of the different methodologies that have been used to assess the value of travel time. However, the specific estimates presented in his study applied to Great Britain and were not used din the current analysis.

**Washington State Department of Ecology (1993):** ***1992 Washington State Waste Characterization Study.*** **Solid Waste Services Program Publication #93-45.**

The Department of Ecology's review of the waste generated in the State of Washington provided some direct evidence about the volume of waste attributable to automobiles and other modes of transportation.

**Washington State Department of Ecology (1990):** ***Moderate Risk Waste, A Progress Report.*** **Volume 2-1 of the Problem Waste Study.**

This report provided further evidence about the volume of waste attributable to automobiles and other modes of transportation.

**Washington State Department of Transportation (2002):** ***Washington State Highway System Plan, 2003-2022*** **and** ***"Nickel Funding Package" Enacted For Transportation by The 2003 Washington State Legislature.***

This document was useful in capturing anticipated investment in Washington's highways, including maintenance, preservation, and operations.

**Waters, W. (1992):** ***The Value of Time Savings for The Evaluation of Highway Investments in British Columbia.*** **Prepared for the British Columbia Ministry of Transportation and Highways.**

This report included a thorough review of the issues surrounding the valuation of travel time. The author's recommendations regarding the differential valuation of driver's and passenger's travel time were integrated in the current analysis.

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# Appendix B
# Data and Worksheets

# Worksheet 1

**Global Assumptions**

| | |
|---|---|
| **General Inflation** | 3.0% |
| **Land Inflation** | 5.0% |
| **Wage Inflation** | 3.0% |
| **Cost of Capital** | 4.5% |

**Business Travel as % of All Corridor Travel**

| **Highway** | **Highway** | **Air** |
|---|---|---|
| Business | 30% | 73% |
| Non-Business | 70% | 27% |

| **Rail** | **2003** | **2023** |
|---|---|---|
| Business | 30% | 73% |
| Non-Business | 70% | 27% |

| **Travel Time Value as % of Wage** | **Low** | **High** |
|---|---|---|
| Driver - Business | 50% | 100% |
| Passenger - Business | 35% | 70% |
| Driver - Non-Business | 25% | 50% |
| Passenger - Non-Business | 18% | 35% |

**Highway Low and High Assumptions**

| | Current Law* | Low | High |
|---|---|---|---|
| **Percentage of System Plan Funde** | 27.7% | 40.0% | 50.0% |

| | Low | High |
|---|---|---|
| **Parking Costs per vehicle mile** | $ 0.07 | $ 0.10 |

*This percentage excludes the Nickel Package Projects

# Worksheet 2

**INTERCITY RAIL COST-EFFECTIVENESS - LOW SCENARIO**

| **Direct Costs** | | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Capital Costs '03 Dollars** | Total Planned | | | | | | | | | | |
| North Corridor Improvements | $1,904.5 | $.0 | $1.7 | $56.0 | $30.0 | $32.2 | $32.2 | $32.2 | $.0 | $.0 | $.0 |
| South Corrior Improvements | $2,560.4 | $.0 | $132.3 | $173.8 | $176.9 | $210.3 | $80.8 | $80.8 | $.0 | $16.0 | $39.8 |
| Total Improvements | $4,464.9 | $.0 | $134.0 | $229.8 | $206.8 | $242.5 | $113.0 | $113.0 | $.0 | $16.0 | $39.8 |
| Right-of-Way | $74.5 | $.0 | $4.7 | $4.7 | $4.9 | $4.9 | $.3 | $.0 | $.0 | $.0 | $3.2 |
| Rolling Stock Purchases | $397.5 | $.0 | $7.5 | $180.0 | $.0 | $.0 | $.0 | $30.0 | $.0 | $.0 | $.0 |
| **Total Capital Requirements** | **$4,936.9** | **$.0** | **$146.2** | **$414.5** | **$211.7** | **$247.4** | **$113.3** | **$143.0** | **$.0** | **$16.0** | **$43.0** |
| | | | | | | | | | | | |
| **Capital Costs Year of Expenditure Dollars** | | | | | | | | | | | |
| North Corridor Improvements | $3,277.6 | $.0 | $1.8 | $61.2 | $33.7 | $37.3 | $38.4 | $39.6 | $.0 | $.0 | $.0 |
| South Corrior Improvements | $3,720.3 | $.0 | $140.4 | $190.0 | $199.1 | $243.8 | $96.5 | $99.4 | $.0 | $20.9 | $53.5 |
| Total Improvements | $6,997.9 | $.0 | $142.2 | $251.2 | $232.8 | $281.2 | $134.9 | $139.0 | $.0 | $20.9 | $53.5 |
| Right-of-Way | $142.9 | $.0 | $4.9 | $5.1 | $5.7 | $6.0 | $.3 | $.0 | $.0 | $.0 | $5.0 |
| Rolling Stock Purchases | $534.8 | $.0 | $8.0 | $196.7 | $.0 | $.0 | $.0 | $36.9 | $.0 | $.0 | $.0 |
| **Total Capital Requirements** | **$7,675.6** | **$.0** | **$155.0** | **$453.0** | **$238.5** | **$287.1** | **$135.3** | **$175.9** | **$.0** | **$20.9** | **$58.4** |
| | | | | | | | | | | | |
| **Cumulative Annualized Capital Expenditures** | Useful Life (yrs) | | | | | | | | | | |
| Corridor Improvements | 30 | $.0 | $8.7 | $24.1 | $38.4 | $55.7 | $64.0 | $72.5 | $72.5 | $73.8 | $77.1 |
| Land | 99 | $.0 | $.2 | $.5 | $.7 | $1.0 | $1.0 | $1.0 | $1.0 | $1.0 | $1.2 |
| Rolling Stock | 30 | $.0 | $.5 | $12.6 | $12.6 | $12.6 | $12.6 | $14.8 | $14.8 | $14.8 | $14.8 |
| *Less "expired" capital* | | | | | | | | | | | |
| Corridor Improvements | | | | | | | | | | | |
| Land | | | | | | | | | | | |
| Rolling Stock | | | | | | | | | | | |
| **Total Annualized Capital Costs** | | **$.0** | **$9.4** | **$37.2** | **$51.7** | **$69.2** | **$77.5** | **$88.3** | **$88.3** | **$89.6** | **$93.1** |
| **Capital Costs Per Passenger Mile** | | **$ -** | **$ 0.11** | **$ 0.37** | **$ 0.34** | **$ 0.38** | **$ 0.37** | **$ 0.39** | **$ 0.39** | **$ 0.39** | **$ 0.40** |
| | **2002** | | | | | | | | | | |
| **Operating Costs ('03$)** | **$20.3** | **$20.3** | **$24.4** | **$35.8** | **$41.6** | **$48.4** | **$51.5** | **$52.7** | **$52.7** | **$52.9** | **$53.2** |
| **Operating Costs (YOE$)** | | **$20.9** | **$25.8** | **$39.1** | **$46.8** | **$56.1** | **$61.5** | **$64.9** | **$66.8** | **$69.0** | **$71.5** |
| **Total Annualized Costs** | | **$20.9** | **$35.3** | **$76.3** | **$98.5** | **$125.4** | **$139.1** | **$153.2** | **$155.1** | **$158.6** | **$164.7** |
| | | | | | | | | | | | |
| Passenger Estimates (millions) | | 0.3 | 0.3 | 0.5 | 0.9 | 1.1 | 1.4 | 1.5 | 1.5 | 1.5 | 1.5 |
| Passenger Miles (millions) | | 82.9 | 82.9 | 101.3 | 153.5 | 180.1 | 211.3 | 227.3 | 227.3 | 228.3 | 231.0 |
| Trip Length | | 254.25 | 254.25 | 210.42 | 166.45 | 157.02 | 149.82 | 150.15 | 150.15 | 150.17 | 150.22 |
| **Operating Costs per Passenger Mile (YOE$)** | | **$ 0.25** | **$ 0.31** | **$ 0.39** | **$ 0.31** | **$ 0.31** | **$ 0.29** | **$ 0.29** | **$ 0.29** | **$ 0.30** | **$ 0.31** |
| **Total Annualized Cost per Passenger Mile** | | **$ 0.25** | **$ 0.43** | **$ 0.75** | **$ 0.64** | **$ 0.70** | **$ 0.66** | **$ 0.67** | **$ 0.68** | **$ 0.69** | **$ 0.71** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

**INTERCITY RAIL COST-EFFECTIVENESS - LOW SCENARIO**

| Direct Costs | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Capital Costs '03 Dollars** | | | | | | | | | | | |
| North Corridor Improvements | $.0 | $.0 | $.0 | $.0 | $.0 | $36.3 | $36.3 | $284.4 | $451.1 | $456.1 | $456.1 |
| South Corrior Improvements | $157.6 | $205.6 | $227.7 | $70.0 | $70.0 | $83.3 | $104.1 | $104.1 | $209.1 | $209.1 | $209.1 |
| Total Improvements | $157.6 | $205.6 | $227.7 | $70.0 | $70.0 | $119.6 | $140.4 | $388.6 | $660.1 | $665.1 | $665.1 |
| Right-of-Way | $3.2 | $5.0 | $5.0 | $1.8 | $1.8 | $.6 | $.6 | $8.5 | $8.5 | $8.5 | $8.5 |
| Rolling Stock Purchases | $.0 | $.0 | $60.0 | $.0 | $60.0 | $.0 | $.0 | $.0 | $.0 | $.0 | $60.0 |
| **Total Capital Requirements** | **$160.8** | **$210.6** | **$292.6** | **$71.8** | **$131.8** | **$120.3** | **$141.1** | **$397.0** | **$668.6** | **$673.6** | **$733.6** |
| | | | | | | | | | | | |
| **Capital Costs Year of Expenditure Dollars** | | | | | | | | | | | |
| North Corridor Improvements | $.0 | $.0 | $.0 | $.0 | $.0 | $58.3 | $60.0 | $484.2 | $791.0 | $823.7 | $848.4 |
| South Corrior Improvements | $218.2 | $293.1 | $334.3 | $105.9 | $109.1 | $133.7 | $172.1 | $177.3 | $366.6 | $377.6 | $388.9 |
| Total Improvements | $218.2 | $293.1 | $334.3 | $105.9 | $109.1 | $192.0 | $232.1 | $661.5 | $1157.6 | $1201.3 | $1237.3 |
| Right-of-Way | $5.2 | $8.5 | $8.9 | $3.3 | $3.5 | $1.3 | $1.4 | $19.4 | $20.4 | $21.4 | $22.5 |
| Rolling Stock Purchases | $.0 | $.0 | $88.1 | $.0 | $93.5 | $.0 | $.0 | $.0 | $.0 | $.0 | $111.6 |
| **Total Capital Requirements** | **$223.4** | **$301.6** | **$431.3** | **$109.2** | **$206.1** | **$193.3** | **$233.5** | **$680.9** | **$1178.0** | **$1222.7** | **$1371.4** |
| | | | | | | | | | | | |
| **Cumulative Annualized Capital Expenditures** | | | | | | | | | | | |
| Corridor Improvements | $90.5 | $108.5 | $129.0 | $135.5 | $142.2 | $154.0 | $168.2 | $208.8 | $279.9 | $353.7 | $429.6 |
| Land | $1.5 | $1.9 | $2.3 | $2.4 | $2.6 | $2.6 | $2.7 | $3.6 | $4.5 | $5.5 | $6.5 |
| Rolling Stock | $14.8 | $14.8 | $20.2 | $20.2 | $26.0 | $26.0 | $26.0 | $26.0 | $26.0 | $26.0 | $32.8 |
| *Less "expired" capital* | | | | | | | | | | | |
| Corridor Improvements | | | | | | | | | | | |
| Land | | | | | | | | | | | |
| Rolling Stock | | | | | | | | | | | |
| **Total Annualized Capital Costs** | **$106.8** | **$125.2** | **$151.5** | **$158.1** | **$170.7** | **$182.6** | **$196.9** | **$238.4** | **$310.4** | **$385.1** | **$469.0** |
| **Capital Costs Per Passenger Mile** | **$ 0.44** | **$ 0.49** | **$ 0.56** | **$ 0.57** | **$ 0.60** | **$ 0.62** | **$ 0.65** | **$ 0.73** | **$ 0.84** | **$ 0.94** | **$ 1.03** |
| | | | | | | | | | | | |
| **Operating Costs ('03$)** | **$54.6** | **$56.3** | **$58.8** | **$59.4** | **$60.5** | **$61.5** | **$62.7** | **$66.0** | **$71.6** | **$77.2** | **$83.4** |
| **Operating Costs (YOE$)** | **$75.5** | **$80.3** | **$86.3** | **$89.8** | **$94.2** | **$98.7** | **$103.6** | **$112.4** | **$125.6** | **$139.5** | **$155.1** |
| **Total Annualized Costs** | **$182.3** | **$205.5** | **$237.8** | **$248.0** | **$265.0** | **$281.3** | **$300.5** | **$350.8** | **$436.0** | **$524.6** | **$624.1** |
| | | | | | | | | | | | |
| Passenger Estimates (millions) | 1.6 | 1.7 | 1.8 | 1.8 | 1.9 | 1.9 | 2.0 | 2.2 | 2.4 | 2.7 | 3.0 |
| Passenger Miles (millions) | 241.1 | 254.2 | 272.6 | 277.1 | 285.3 | 292.8 | 301.7 | 326.5 | 368.4 | 410.6 | 456.5 |
| Trip Length | 150.40 | 150.62 | 150.89 | 150.95 | 151.05 | 151.15 | 151.25 | 151.50 | 151.86 | 152.14 | 152.40 |
| **Operating Costs per Passenger Mile (YOE$)** | **$ 0.31** | **$ 0.32** | **$ 0.32** | **$ 0.32** | **$ 0.33** | **$ 0.34** | **$ 0.34** | **$ 0.34** | **$ 0.34** | **$ 0.34** | **$ 0.34** |
| **Total Annualized Cost per Passenger Mile** | **$ 0.76** | **$ 0.81** | **$ 0.87** | **$ 0.90** | **$ 0.93** | **$ 0.96** | **$ 1.00** | **$ 1.07** | **$ 1.18** | **$ 1.28** | **$ 1.37** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

**INTERCITY RAIL COST-EFFECTIVENESS - LOW SCENARIO**

| **Indirect Costs** | | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Travel Time (minutes) | | 477 | 477 | 469 | 446 | 434 | 420 | 417 | 413 | 413 | 412 |
| Average Speed (mph) | 338 miles | 43 | 43 | 43 | 46 | 47 | 48 | 49 | 49 | 49 | 49 |
| | | | | | | | | | | | |
| **Time Costs - Business Travelers** | | | | | | | | | | | |
| Business Travel Share of Total | | 30% | 30% | 32% | 38% | 41% | 44% | 45% | 46% | 46% | 46% |
| Total Business Passenger Miles (mil) | | 24.88 | 24.88 | 32.48 | 58.14 | 73.59 | 93.66 | 102.66 | 105.03 | 105.50 | 107.01 |
| Total Business Travel Hours (mil) | | 0.6 | 0.6 | 0.8 | 1.3 | 1.6 | 1.9 | 2.1 | 2.1 | 2.1 | 2.2 |
| Average Hourly Wage Rate | | $ 18.62 | $ 19.18 | $ 19.76 | $ 20.35 | $ 20.96 | $ 21.59 | $ 22.24 | $ 22.90 | $ 23.59 | $ 24.30 |
| Value of Travel Time (% of Wage Rate) | 35% | $ 6.52 | $ 6.71 | $ 6.92 | $ 7.12 | $ 7.34 | $ 7.56 | $ 7.78 | $ 8.02 | $ 8.26 | $ 8.50 |
| **Total Value of Business Travel Time ($ mil)** | | $3.8 | $3.9 | $5.2 | $9.1 | $11.5 | $14.7 | $16.4 | $17.1 | $17.7 | $18.5 |
| | | | | | | | | | | | |
| **Time Costs - Non-Business Travelers** | | | | | | | | | | | |
| Total Non-Business Passenger Miles (mil) | | 58.06 | 58.06 | 68.85 | 95.34 | 106.53 | 117.60 | 124.65 | 122.27 | 122.81 | 123.98 |
| Total Non-Business Travel Hours (mil) | | 1.4 | 1.4 | 1.6 | 2.1 | 2.3 | 2.4 | 2.6 | 2.5 | 2.5 | 2.5 |
| Average Hourly Wage Rate | | $ 18.62 | $ 19.18 | $ 19.76 | $ 20.35 | $ 20.96 | $ 21.59 | $ 22.24 | $ 22.90 | $ 23.59 | $ 24.30 |
| Value of Travel Time (% of Wage Rate) | 18% | $ 3.35 | $ 3.45 | $ 3.56 | $ 3.66 | $ 3.77 | $ 3.89 | $ 4.00 | $ 4.12 | $ 4.25 | $ 4.37 |
| **Total Value of Non-Business Travel Time ($ mil)** | | $4.6 | $4.7 | $5.7 | $7.7 | $8.6 | $9.5 | $10.3 | $10.3 | $10.6 | $11.0 |
| **Total Time Costs ($ mil)** | | $8.4 | $8.6 | $10.9 | $16.8 | $20.1 | $24.1 | $26.7 | $27.4 | $28.3 | $29.5 |
| | | | | | | | | | | | |
| Total Indirect Costs ($ mil) | | $8.4 | $8.6 | $10.9 | $16.8 | $20.1 | $24.1 | $26.7 | $27.4 | $28.3 | $29.5 |
| Annual Passenger Miles | | 82.9 | 82.9 | 101.3 | 153.5 | 180.1 | 211.3 | 227.3 | 227.3 | 228.3 | 231.0 |
| Total Passenger Hours | | 2.0 | 2.0 | 2.3 | 3.4 | 3.9 | 4.4 | 4.7 | 4.6 | 4.6 | 4.7 |
| **Total Indirect Costs per Passenger Mile** | | **$ 0.10** | **$ 0.10** | **$ 0.11** | **$ 0.11** | **$ 0.11** | **$ 0.11** | **$ 0.12** | **$ 0.12** | **$ 0.12** | **$ 0.13** |
| | | | | | | | | | | | |
| **Total Direct + Indirect Costs per Passenger Mile** | | **$ 0.35** | **$ 0.42** | **$ 0.49** | **$ 0.41** | **$ 0.42** | **$ 0.41** | **$ 0.40** | **$ 0.41** | **$ 0.43** | **$ 0.44** |

| **External Costs** | | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Annual Passenger Miles (mil) | | 82.9 | 82.9 | 101.3 | 153.5 | 180.1 | 211.3 | 227.3 | 227.3 | 228.3 | 231.0 |
| | $ per passenger mile **2003** | | | | | | | | | | |
| **Air Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | $ 0.016 | $1.4 | $1.4 | $1.8 | $2.7 | $3.3 | $4.0 | $4.4 | $4.6 | $4.7 | $4.9 |
| **Noise Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | $ 0.001 | $0.1 | $0.1 | $0.1 | $0.2 | $0.2 | $0.3 | $0.3 | $0.3 | $0.3 | $0.3 |
| **Solid Waste Disposal** | | | | | | | | | | | |
| Annual Cost ($ mil) | N/A | | | | | | | | | | |
| **Water Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | N/A | | | | | | | | | | |
| **Accidents** | | | | | | | | | | | |
| Annual Cost ($ mil) | $ 0.001 | $0.1 | $0.1 | $0.1 | $0.2 | $0.3 | $0.3 | $0.3 | $0.3 | $0.4 | $0.4 |
| | | | | | | | | | | | |
| **Total External Costs ($mil)** | | $1.6 | $1.6 | $2.0 | $3.1 | $3.8 | $4.6 | $5.1 | $5.2 | $5.4 | $5.6 |
| **Total External Costs per Passenger Mile** | | $ 0.02 | $ 0.02 | $ 0.02 | $ 0.02 | $ 0.02 | $ 0.02 | $ 0.02 | $ 0.02 | $ 0.02 | $ 0.02 |
| | | | | | | | | | | | |
| **Direct + Indirect + External Costs per Passenger Mile** | | **$ 0.37** | **$ 0.44** | **$ 0.51** | **$ 0.43** | **$ 0.44** | **$ 0.43** | **$ 0.42** | **$ 0.44** | **$ 0.45** | **$ 0.46** |
| | | | | | | | | | | | |
| **Capital + Direct + Indirect + External Costs per Passenger Mile** | | **$ 0.37** | **$ 0.55** | **$ 0.88** | **$ 0.77** | **$ 0.83** | **$ 0.79** | **$ 0.81** | **$ 0.83** | **$ 0.84** | **$ 0.87** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

**INTERCITY RAIL COST-EFFECTIVENESS - LOW SCENARIO**

| **Indirect Costs** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Travel Time (minutes) | 411 | 406 | 400 | 391 | 389 | 386 | 382 | 378 | 366 | 347 | 306 |
| Average Speed (mph) | 49 | 50 | 51 | 52 | 52 | 53 | 53 | 54 | 55 | 58 | 66 |
| | | | | | | | | | | | |
| **Time Costs - Business Travelers** | | | | | | | | | | | |
| Business Travel Share of Total | 47% | 48% | 49% | 52% | 52% | 53% | 54% | 55% | 58% | 63% | 73% |
| Total Business Passenger Miles (mil) | 112.43 | 121.57 | 134.53 | 142.69 | 148.43 | 155.17 | 162.51 | 179.27 | 212.96 | 257.42 | 333.23 |
| Total Business Travel Hours (mil) | 2.3 | 2.4 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.3 | 3.8 | 4.4 | 5.0 |
| Average Hourly Wage Rate | $ 25.03 | $ 25.78 | $ 26.55 | $ 27.35 | $ 28.17 | $ 29.01 | $ 29.88 | $ 30.78 | $ 31.70 | $ 32.66 | $ 33.64 |
| Value of Travel Time (% of Wage Rate) | $ 8.76 | $ 9.02 | $ 9.29 | $ 9.57 | $ 9.86 | $ 10.16 | $ 10.46 | $ 10.77 | $ 11.10 | $ 11.43 | $ 11.77 |
| **Total Value of Business Travel Time ($ mil)** | $20.0 | $22.0 | $24.7 | $26.4 | $28.1 | $30.0 | $32.0 | $36.0 | $42.7 | $50.3 | $59.2 |
| | | | | | | | | | | | |
| **Time Costs - Non-Business Travelers** | | | | | | | | | | | |
| Total Non-Business Passenger Miles (mil) | 128.63 | 132.67 | 138.03 | 134.37 | 136.88 | 137.66 | 139.16 | 147.25 | 155.43 | 153.13 | 123.25 |
| Total Non-Business Travel Hours (mil) | 2.6 | 2.7 | 2.7 | 2.6 | 2.6 | 2.6 | 2.6 | 2.7 | 2.8 | 2.6 | 1.9 |
| Average Hourly Wage Rate | $ 25.03 | $ 25.78 | $ 26.55 | $ 27.35 | $ 28.17 | $ 29.01 | $ 29.88 | $ 30.78 | $ 31.70 | $ 32.66 | $ 33.64 |
| Value of Travel Time (% of Wage Rate) | $ 4.51 | $ 4.64 | $ 4.78 | $ 4.92 | $ 5.07 | $ 5.22 | $ 5.38 | $ 5.54 | $ 5.71 | $ 5.88 | $ 6.05 |
| **Total Value of Non-Business Travel Time ($ mil)** | $11.7 | $12.3 | $13.0 | $12.8 | $13.3 | $13.7 | $14.1 | $15.2 | $16.0 | $15.4 | $11.3 |
| **Total Time Costs ($ mil)** | $31.7 | $34.3 | $37.7 | $39.1 | $41.4 | $43.6 | $46.1 | $51.2 | $58.7 | $65.7 | $70.5 |
| | | | | | | | | | | | |
| Total Indirect Costs ($ mil) | $31.7 | $34.3 | $37.7 | $39.1 | $41.4 | $43.6 | $46.1 | $51.2 | $58.7 | $65.7 | $70.5 |
| Annual Passenger Miles | 241.1 | 254.2 | 272.6 | 277.1 | 285.3 | 292.8 | 301.7 | 326.5 | 368.4 | 410.6 | 456.5 |
| Total Passenger Hours | 4.9 | 5.1 | 5.4 | 5.3 | 5.5 | 5.6 | 5.7 | 6.1 | 6.7 | 7.0 | 6.9 |
| **Total Indirect Costs per Passenger Mile** | **$ 0.13** | **$ 0.13** | **$ 0.14** | **$ 0.14** | **$ 0.15** | **$ 0.15** | **$ 0.15** | **$ 0.16** | **$ 0.16** | **$ 0.16** | **$ 0.15** |
| | | | | | | | | | | | |
| **Total Direct + Indirect Costs per Passenger Mile** | **$ 0.44** | **$ 0.45** | **$ 0.45** | **$ 0.47** | **$ 0.48** | **$ 0.49** | **$ 0.50** | **$ 0.50** | **$ 0.50** | **$ 0.50** | **$ 0.49** |
| | | | | | | | | | | | |
| **External Costs** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** |
| Annual Passenger Miles (mil) | 241.1 | 254.2 | 272.6 | 277.1 | 285.3 | 292.8 | 301.7 | 326.5 | 368.4 | 410.6 | 456.5 |
| $ per pa | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Air Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | $5.3 | $5.7 | $6.3 | $6.6 | $7.0 | $7.5 | $7.9 | $8.8 | $10.2 | $11.8 | $13.5 |
| **Noise Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | $0.4 | $0.4 | $0.4 | $0.5 | $0.5 | $0.5 | $0.5 | $0.6 | $0.7 | $0.8 | $0.9 |
| **Solid Waste Disposal** | | | | | | | | | | | |
| Annual Cost ($ mil) | | | | | | | | | | | |
| **Water Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | | | | | | | | | | | |
| **Accidents** | | | | | | | | | | | |
| Annual Cost ($ mil) | $0.4 | $0.4 | $0.5 | $0.5 | $0.5 | $0.6 | $0.6 | $0.7 | $0.8 | $0.9 | $1.0 |
| | | | | | | | | | | | |
| **Total External Costs ($mil)** | $6.1 | $6.6 | $7.3 | $7.6 | $8.1 | $8.5 | $9.1 | $10.1 | $11.7 | $13.5 | $15.4 |
| **Total External Costs per Passenger Mile** | $ 0.03 | $ 0.03 | $ 0.03 | $ 0.03 | $ 0.03 | $ 0.03 | $ 0.03 | $ 0.03 | $ 0.03 | $ 0.03 | $ 0.03 |
| | | | | | | | | | | | |
| **Direct + Indirect + External Costs per Passenger Mile** | **$ 0.47** | **$ 0.48** | **$ 0.48** | **$ 0.49** | **$ 0.50** | **$ 0.52** | **$ 0.53** | **$ 0.53** | **$ 0.53** | **$ 0.53** | **$ 0.53** |
| | | | | | | | | | | | |
| **Capital + Direct + Indirect + External Costs per Passeng** | **$ 0.91** | **$ 0.97** | **$ 1.04** | **$ 1.06** | **$ 1.10** | **$ 1.14** | **$ 1.18** | **$ 1.26** | **$ 1.37** | **$ 1.47** | **$ 1.56** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

# Worksheet 3

INTERCITY RAIL COST-EFFECTIVENESS ANALYSIS
HIGH SCENARIO

| **Direct Costs** | | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Capital Costs '03 Dollars** | Total Planned | | | | | | | | | | |
| North Corridor Improvements | $1,904.5 | $.0 | $1.7 | $56.0 | $30.0 | $32.2 | $32.2 | $32.2 | $.0 | $.0 | $.0 |
| South Corrior Improvements | $2,560.4 | $.0 | $132.3 | $173.8 | $176.9 | $210.3 | $80.8 | $80.8 | $.0 | $16.0 | $39.8 |
| Total Improvements | $4,464.9 | $.0 | $134.0 | $229.8 | $206.8 | $242.5 | $113.0 | $113.0 | $.0 | $16.0 | $39.8 |
| Right-of-Way | $74.5 | $.0 | $4.7 | $4.7 | $4.9 | $4.9 | $.3 | $.0 | $.0 | $.0 | $3.2 |
| Rolling Stock Purchases | $397.5 | $.0 | $7.5 | $180.0 | $.0 | $.0 | $.0 | $30.0 | $.0 | $.0 | $.0 |
| **Total Capital Requirements** | **$4,936.9** | **$.0** | **$146.2** | **$414.5** | **$211.7** | **$247.4** | **$113.3** | **$143.0** | **$.0** | **$16.0** | **$43.0** |
| | | | | | | | | | | | |
| **Capital Costs Year of Expenditure Dollars** | | | | | | | | | | | |
| North Corridor Improvements | $3,277.6 | $.0 | $1.8 | $61.2 | $33.7 | $37.3 | $38.4 | $39.6 | $.0 | $.0 | $.0 |
| South Corrior Improvements | $3,720.3 | $.0 | $140.4 | $190.0 | $199.1 | $243.8 | $96.5 | $99.4 | $.0 | $20.9 | $53.5 |
| Total Improvements | $6,997.9 | $.0 | $142.2 | $251.2 | $232.8 | $281.2 | $134.9 | $139.0 | $.0 | $20.9 | $53.5 |
| Right-of-Way | $142.9 | $.0 | $4.9 | $5.1 | $5.7 | $6.0 | $.3 | $.0 | $.0 | $.0 | $5.0 |
| Rolling Stock Purchases | $111.6 | | | | $.0 | | $.0 | | | | $.0 |
| **Total Capital Requirements** | **$7,252.4** | **$.0** | **$147.1** | **$256.3** | **$238.5** | **$287.1** | **$135.3** | **$139.0** | **$.0** | **$20.9** | **$58.4** |
| | | | | | | | | | | | |
| **Cumulative Annualized Capital Expenditur** | Useful Life (yrs) | | | | | | | | | | |
| Corridor Improvements | 30 | $.0 | $8.7 | $24.1 | $38.4 | $55.7 | $64.0 | $72.5 | $72.5 | $73.8 | $77.1 |
| Land | 99 | $.0 | $.2 | $.5 | $.7 | $1.0 | $1.0 | $1.0 | $1.0 | $1.0 | $1.2 |
| Rolling Stock | 30 | $.0 | $.0 | $.0 | $.0 | $.0 | $.0 | $.0 | $.0 | $.0 | $.0 |
| *Less "expired" capital* | | | | | | | | | | | |
| Corridor Improvements | | | | | | | | | | | |
| Land | | | | | | | | | | | |
| Rolling Stock | | | | | | | | | | | |
| **Total Annualized Capital Costs** | | **$.0** | **$9.0** | **$24.6** | **$39.2** | **$56.7** | **$65.0** | **$73.5** | **$73.5** | **$74.8** | **$78.3** |
| **Capital Costs Per Passenger Mile** | | **$ -** | **$ 0.11** | **$ 0.24** | **$ 0.26** | **$ 0.31** | **$ 0.31** | **$ 0.32** | **$ 0.32** | **$ 0.33** | **$ 0.34** |
| | **2002** | | | | | | | | | | |
| **Operating Costs ('03$)** | **$20.3** | **$20.3** | **$24.4** | **$35.8** | **$41.6** | **$48.4** | **$51.5** | **$52.7** | **$52.7** | **$52.9** | **$53.2** |
| **Operating Costs (YOE$)** | | **$20.9** | **$25.8** | **$39.1** | **$46.8** | **$56.1** | **$61.5** | **$64.9** | **$66.8** | **$69.0** | **$71.5** |
| **Total Annualized Costs** | | **$20.9** | **$34.8** | **$63.7** | **$86.0** | **$112.8** | **$126.5** | **$138.4** | **$140.3** | **$143.8** | **$149.8** |
| | | | | | | | | | | | |
| Passenger Estimates (millions) | | 0.3 | 0.3 | 0.5 | 0.9 | 1.1 | 1.4 | 1.5 | 1.5 | 1.5 | 1.5 |
| Passenger Miles (millions) | | 82.9 | 82.9 | 101.3 | 153.5 | 180.1 | 211.3 | 227.3 | 227.3 | 228.3 | 231.0 |
| Trip Length | | 254.25 | 254.25 | 210.42 | 166.45 | 157.02 | 149.82 | 150.15 | 150.15 | 150.17 | 150.22 |
| **Operating Costs per Passenger Mile (YOE$)** | | **$ 0.25** | **$ 0.31** | **$ 0.39** | **$ 0.31** | **$ 0.31** | **$ 0.29** | **$ 0.29** | **$ 0.29** | **$ 0.30** | **$ 0.31** |
| **Total Annualized Cost per Passenger Mile** | | **$ 0.25** | **$ 0.42** | **$ 0.63** | **$ 0.56** | **$ 0.63** | **$ 0.60** | **$ 0.61** | **$ 0.62** | **$ 0.63** | **$ 0.65** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY RAIL COST-EFFECTIVENESS ANALYSIS
HIGH SCENARIO

| **Direct Costs** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Capital Costs '03 Dollars** | | | | | | | | | | | |
| North Corridor Improvements | $.0 | $.0 | $.0 | $.0 | $.0 | $36.3 | $36.3 | $284.4 | $451.1 | $456.1 | $456.1 |
| South Corrior Improvements | $157.6 | $205.6 | $227.7 | $70.0 | $70.0 | $83.3 | $104.1 | $104.1 | $209.1 | $209.1 | $209.1 |
| Total Improvements | $157.6 | $205.6 | $227.7 | $70.0 | $70.0 | $119.6 | $140.4 | $388.6 | $660.1 | $665.1 | $665.1 |
| Right-of-Way | $3.2 | $5.0 | $5.0 | $1.8 | $1.8 | $.6 | $.6 | $8.5 | $8.5 | $8.5 | $8.5 |
| Rolling Stock Purchases | $.0 | $.0 | $60.0 | $.0 | $60.0 | $.0 | $.0 | $.0 | $.0 | $.0 | $60.0 |
| **Total Capital Requirements** | **$160.8** | **$210.6** | **$292.6** | **$71.8** | **$131.8** | **$120.3** | **$141.1** | **$397.0** | **$668.6** | **$673.6** | **$733.6** |
| | | | | | | | | | | | |
| **Capital Costs Year of Expenditure Dollars** | | | | | | | | | | | |
| North Corridor Improvements | $.0 | $.0 | $.0 | $.0 | $.0 | $58.3 | $60.0 | $484.2 | $791.0 | $823.7 | $848.4 |
| South Corrior Improvements | $218.2 | $293.1 | $334.3 | $105.9 | $109.1 | $133.7 | $172.1 | $177.3 | $366.6 | $377.6 | $388.9 |
| Total Improvements | $218.2 | $293.1 | $334.3 | $105.9 | $109.1 | $192.0 | $232.1 | $661.5 | $1157.6 | $1201.3 | $1237.3 |
| Right-of-Way | $5.2 | $8.5 | $8.9 | $3.3 | $3.5 | $1.3 | $1.4 | $19.4 | $20.4 | $21.4 | $22.5 |
| Rolling Stock Purchases | | | | $.0 | | | | $.0 | | | $111.6 |
| **Total Capital Requirements** | **$223.4** | **$301.6** | **$343.2** | **$109.2** | **$112.6** | **$193.3** | **$233.5** | **$680.9** | **$1178.0** | **$1222.7** | **$1371.4** |
| | | | | | | | | | | | |
| **Cumulative Annualized Capital Expenditur** | | | | | | | | | | | |
| Corridor Improvements | $90.5 | $108.5 | $129.0 | $135.5 | $142.2 | $154.0 | $168.2 | $208.8 | $279.9 | $353.7 | $429.6 |
| Land | $1.5 | $1.9 | $2.3 | $2.4 | $2.6 | $2.6 | $2.7 | $3.6 | $4.5 | $5.5 | $6.5 |
| Rolling Stock | $.0 | $.0 | $.0 | $.0 | $.0 | $.0 | $.0 | $.0 | $.0 | $.0 | $6.9 |
| *Less "expired" capital* | | | | | | | | | | | |
| Corridor Improvements | | | | | | | | | | | |
| Land | | | | | | | | | | | |
| Rolling Stock | | | | | | | | | | | |
| **Total Annualized Capital Costs** | **$91.9** | **$110.3** | **$131.3** | **$137.9** | **$144.8** | **$156.6** | **$170.9** | **$212.4** | **$284.4** | **$359.1** | **$443.0** |
| **Capital Costs Per Passenger Mile** | **$ 0.38** | **$ 0.43** | **$ 0.48** | **$ 0.50** | **$ 0.51** | **$ 0.53** | **$ 0.57** | **$ 0.65** | **$ 0.77** | **$ 0.87** | **$ 0.97** |
| | | | | | | | | | | | |
| **Operating Costs ('03$)** | **$54.6** | **$56.3** | **$58.8** | **$59.4** | **$60.5** | **$61.5** | **$62.7** | **$66.0** | **$71.6** | **$77.2** | **$83.4** |
| **Operating Costs (YOE$)** | **$75.5** | **$80.3** | **$86.3** | **$89.8** | **$94.2** | **$98.7** | **$103.6** | **$112.4** | **$125.6** | **$139.5** | **$155.1** |
| **Total Annualized Costs** | **$167.5** | **$190.6** | **$217.6** | **$227.7** | **$239.0** | **$255.3** | **$274.5** | **$324.8** | **$410.0** | **$498.7** | **$598.1** |
| | | | | | | | | | | | |
| Passenger Estimates (millions) | 1.6 | 1.7 | 1.8 | 1.8 | 1.9 | 1.9 | 2.0 | 2.2 | 2.4 | 2.7 | 3.0 |
| Passenger Miles (millions) | 241.1 | 254.2 | 272.6 | 277.1 | 285.3 | 292.8 | 301.7 | 326.5 | 368.4 | 410.6 | 456.5 |
| Trip Length | 150.40 | 150.62 | 150.89 | 150.95 | 151.05 | 151.15 | 151.25 | 151.50 | 151.86 | 152.14 | 152.40 |
| **Operating Costs per Passenger Mile (YOE$** | **$ 0.31** | **$ 0.32** | **$ 0.32** | **$ 0.32** | **$ 0.33** | **$ 0.34** | **$ 0.34** | **$ 0.34** | **$ 0.34** | **$ 0.34** | **$ 0.34** |
| **Total Annualized Cost per Passenger Mile** | **$ 0.69** | **$ 0.75** | **$ 0.80** | **$ 0.82** | **$ 0.84** | **$ 0.87** | **$ 0.91** | **$ 0.99** | **$ 1.11** | **$ 1.21** | **$ 1.31** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY RAIL COST-EFFECTIVENESS ANALYSIS
HIGH SCENARIO

| **Indirect Costs** | | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Travel Time (minutes) | | 477 | 477 | 469 | 446 | 434 | 420 | 417 | 413 | 413 | 412 |
| Average Speed (mph) | 338 miles | 43 | 43 | 43 | 46 | 47 | 48 | 49 | 49 | 49 | 49 |
| | | | | | | | | | | | |
| **Time Costs - Business Travelers** | | | | | | | | | | | |
| Business Travel Share of Total | | 30% | 30% | 32% | 38% | 41% | 44% | 45% | 46% | 46% | 46% |
| Total Business Passenger Miles (mil) | | 24.88 | 24.88 | 32.48 | 58.14 | 73.59 | 93.66 | 102.66 | 105.03 | 105.50 | 107.01 |
| Total Business Travel Hours (mil) | | 0.6 | 0.6 | 0.8 | 1.3 | 1.6 | 1.9 | 2.1 | 2.1 | 2.1 | 2.2 |
| Average Hourly Wage Rate | | $ 18.62 | $ 19.18 | $ 19.76 | $ 20.35 | $ 20.96 | $ 21.59 | $ 22.24 | $ 22.90 | $ 23.59 | $ 24.30 |
| Value of Travel Time (% of Wage Rate) | 70% | $ 13.04 | $ 13.43 | $ 13.83 | $ 14.25 | $ 14.67 | $ 15.11 | $ 15.57 | $ 16.03 | $ 16.51 | $ 17.01 |
| **Total Value of Business Travel Time ($ mil)** | | $7.6 | $7.9 | $10.4 | $18.2 | $23.1 | $29.3 | $32.8 | $34.3 | $35.4 | $37.0 |
| | | | | | | | | | | | |
| **Time Costs - Non-Business Travelers** | | | | | | | | | | | |
| Total Non-Business Passenger Miles (mil) | | 58.06 | 58.06 | 68.85 | 95.34 | 106.53 | 117.60 | 124.65 | 122.27 | 122.81 | 123.98 |
| Total Non-Business Travel Hours (mil) | | 1.4 | 1.4 | 1.6 | 2.1 | 2.3 | 2.4 | 2.6 | 2.5 | 2.5 | 2.5 |
| Average Hourly Wage Rate | | $ 18.62 | $ 19.18 | $ 19.76 | $ 20.35 | $ 20.96 | $ 21.59 | $ 22.24 | $ 22.90 | $ 23.59 | $ 24.30 |
| Value of Travel Time (% of Wage Rate) | 35% | $ 6.52 | $ 6.71 | $ 6.92 | $ 7.12 | $ 7.34 | $ 7.56 | $ 7.78 | $ 8.02 | $ 8.26 | $ 8.50 |
| **Total Value of Non-Business Travel Time ($ mil)** | | $8.9 | $9.2 | $11.0 | $14.9 | $16.7 | $18.4 | $19.9 | $19.9 | $20.6 | $21.4 |
| **Total Time Costs ($ mil)** | | $16.5 | $17.0 | $21.4 | $33.1 | $39.8 | $47.7 | $52.8 | $54.2 | $56.1 | $58.4 |
| | | | | | | | | | | | |
| Total Indirect Costs ($ mil) | | $16.5 | $17.0 | $21.4 | $33.1 | $39.8 | $47.7 | $52.8 | $54.2 | $56.1 | $58.4 |
| Annual Passenger Miles | | 82.9 | 82.9 | 101.3 | 153.5 | 180.1 | 211.3 | 227.3 | 227.3 | 228.3 | 231.0 |
| Total Passenger Hours | | 2.0 | 2.0 | 2.3 | 3.4 | 3.9 | 4.4 | 4.7 | 4.6 | 4.6 | 4.7 |
| **Total Indirect Costs per Passenger Mile** | | **$ 0.20** | **$ 0.21** | **$ 0.21** | **$ 0.22** | **$ 0.22** | **$ 0.23** | **$ 0.23** | **$ 0.24** | **$ 0.25** | **$ 0.25** |
| | | | | | | | | | | | |
| **Total Direct + Indirect Costs per Passenger Mile** | | **$ 0.45** | **$ 0.52** | **$ 0.60** | **$ 0.52** | **$ 0.53** | **$ 0.52** | **$ 0.52** | **$ 0.53** | **$ 0.55** | **$ 0.56** |
| | | | | | | | | | | | |
| **External Costs** | | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
| Annual Passenger Miles (mil) | | 82.9 | 82.9 | 101.3 | 153.5 | 180.1 | 211.3 | 227.3 | 227.3 | 228.3 | 231.0 |
| | $ per passenger mile | | | | | | | | | | |
| | **2003** | | | | | | | | | | |
| **Air Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | $ 0.031 | $2.5 | $2.6 | $3.3 | $5.1 | $6.2 | $7.5 | $8.3 | $8.5 | $8.8 | $9.2 |
| **Noise Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | $ 0.005 | $0.4 | $0.4 | $0.5 | $0.8 | $0.9 | $1.1 | $1.2 | $1.3 | $1.3 | $1.4 |
| **Solid Waste Disposal** | | | | | | | | | | | |
| Annual Cost ($ mil) | N/A | | | | | | | | | | |
| **Water Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | N/A | | | | | | | | | | |
| **Accidents** | | | | | | | | | | | |
| Annual Cost ($ mil) | $ 0.036 | $3.0 | $3.1 | $3.9 | $6.1 | $7.3 | $8.9 | $9.8 | $10.1 | $10.5 | $10.9 |
| | | | | | | | | | | | |
| **Total External Costs ($mil)** | | $5.9 | $6.1 | $7.7 | $12.0 | $14.5 | $17.5 | $19.4 | $19.9 | $20.6 | $21.5 |
| **Total External Costs per Passenger Mile** | | $ 0.07 | $ 0.07 | $ 0.08 | $ 0.08 | $ 0.08 | $ 0.08 | $ 0.09 | $ 0.09 | $ 0.09 | $ 0.09 |
| | | | | | | | | | | | |
| **Direct + Indirect + External Costs per Passenger Mile** | | **$ 0.52** | **$ 0.59** | **$ 0.67** | **$ 0.60** | **$ 0.61** | **$ 0.60** | **$ 0.60** | **$ 0.62** | **$ 0.64** | **$ 0.66** |
| | | | | | | | | | | | |
| **Capital + Direct + Indirect + External Costs per Passeng** | | **$ 0.52** | **$ 0.70** | **$ 0.92** | **$ 0.85** | **$ 0.93** | **$ 0.91** | **$ 0.93** | **$ 0.94** | **$ 0.97** | **$ 0.99** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY RAIL COST-EFFECTIVENESS ANALYSIS
HIGH SCENARIO

| **Indirect Costs** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Travel Time (minutes) | 411 | 406 | 400 | 391 | 389 | 386 | 382 | 378 | 366 | 347 | 306 |
| Average Speed (mph) | 49 | 50 | 51 | 52 | 52 | 53 | 53 | 54 | 55 | 58 | 66 |
| | | | | | | | | | | | |
| **Time Costs - Business Travelers** | | | | | | | | | | | |
| Business Travel Share of Total | 47% | 48% | 49% | 52% | 52% | 53% | 54% | 55% | 58% | 63% | 73% |
| Total Business Passenger Miles (mil) | 112.43 | 121.57 | 134.53 | 142.69 | 148.43 | 155.17 | 162.51 | 179.27 | 212.96 | 257.42 | 333.23 |
| Total Business Travel Hours (mil) | 2.3 | 2.4 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.3 | 3.8 | 4.4 | 5.0 |
| Average Hourly Wage Rate | $ 25.03 | $ 25.78 | $ 26.55 | $ 27.35 | $ 28.17 | $ 29.01 | $ 29.88 | $ 30.78 | $ 31.70 | $ 32.66 | $ 33.64 |
| Value of Travel Time (% of Wage Rate) | $ 17.52 | $ 18.05 | $ 18.59 | $ 19.14 | $ 19.72 | $ 20.31 | $ 20.92 | $ 21.55 | $ 22.19 | $ 22.86 | $ 23.55 |
| **Total Value of Business Travel Time ($ mil)** | $39.9 | $43.9 | $49.3 | $52.7 | $56.2 | $59.9 | $64.0 | $72.0 | $85.4 | $100.7 | $118.4 |
| | | | | | | | | | | | |
| **Time Costs - Non-Business Travelers** | | | | | | | | | | | |
| Total Non-Business Passenger Miles (mil) | 128.63 | 132.67 | 138.03 | 134.37 | 136.88 | 137.66 | 139.16 | 147.25 | 155.43 | 153.13 | 123.25 |
| Total Non-Business Travel Hours (mil) | 2.6 | 2.7 | 2.7 | 2.6 | 2.6 | 2.6 | 2.6 | 2.7 | 2.8 | 2.6 | 1.9 |
| Average Hourly Wage Rate | $ 25.03 | $ 25.78 | $ 26.55 | $ 27.35 | $ 28.17 | $ 29.01 | $ 29.88 | $ 30.78 | $ 31.70 | $ 32.66 | $ 33.64 |
| Value of Travel Time (% of Wage Rate) | $ 8.76 | $ 9.02 | $ 9.29 | $ 9.57 | $ 9.86 | $ 10.16 | $ 10.46 | $ 10.77 | $ 11.10 | $ 11.43 | $ 11.77 |
| **Total Value of Non-Business Travel Time ($** | $22.8 | $24.0 | $25.3 | $24.8 | $25.9 | $26.6 | $27.4 | $29.6 | $31.2 | $29.9 | $21.9 |
| **Total Time Costs ($ mil)** | $62.7 | $67.9 | $74.6 | $77.6 | $82.1 | $86.5 | $91.5 | $101.6 | $116.6 | $130.6 | $140.3 |
| | | | | | | | | | | | |
| Total Indirect Costs ($ mil) | $62.7 | $67.9 | $74.6 | $77.6 | $82.1 | $86.5 | $91.5 | $101.6 | $116.6 | $130.6 | $140.3 |
| Annual Passenger Miles | 241.1 | 254.2 | 272.6 | 277.1 | 285.3 | 292.8 | 301.7 | 326.5 | 368.4 | 410.6 | 456.5 |
| Total Passenger Hours | 4.9 | 5.1 | 5.4 | 5.3 | 5.5 | 5.6 | 5.7 | 6.1 | 6.7 | 7.0 | 6.9 |
| **Total Indirect Costs per Passenger Mile** | **$ 0.26** | **$ 0.27** | **$ 0.27** | **$ 0.28** | **$ 0.29** | **$ 0.30** | **$ 0.30** | **$ 0.31** | **$ 0.32** | **$ 0.32** | **$ 0.31** |
| | | | | | | | | | | | |
| **Total Direct + Indirect Costs per Passenge** | **$ 0.57** | **$ 0.58** | **$ 0.59** | **$ 0.60** | **$ 0.62** | **$ 0.63** | **$ 0.65** | **$ 0.66** | **$ 0.66** | **$ 0.66** | **$ 0.65** |
| | | | | | | | | | | | |
| **External Costs** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** |
| Annual Passenger Miles (mil) | 241.1 | 254.2 | 272.6 | 277.1 | 285.3 | 292.8 | 301.7 | 326.5 | 368.4 | 410.6 | 456.5 |
| $ per pa | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Air Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | $9.9 | $10.8 | $11.9 | $12.4 | $13.2 | $13.9 | $14.8 | $16.5 | $19.2 | $22.0 | $25.2 |
| **Noise Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | $1.5 | $1.6 | $1.8 | $1.8 | $2.0 | $2.1 | $2.2 | $2.4 | $2.8 | $3.3 | $3.7 |
| **Solid Waste Disposal** | | | | | | | | | | | |
| Annual Cost ($ mil) | | | | | | | | | | | |
| **Water Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | | | | | | | | | | | |
| **Accidents** | | | | | | | | | | | |
| Annual Cost ($ mil) | $11.7 | $12.7 | $14.1 | $14.7 | $15.6 | $16.5 | $17.5 | $19.5 | $22.7 | $26.1 | $29.9 |
| | | | | | | | | | | | |
| **Total External Costs ($mil)** | $23.1 | $25.1 | $27.7 | $29.0 | $30.8 | $32.5 | $34.5 | $38.5 | $44.7 | $51.3 | $58.8 |
| **Total External Costs per Passenger Mile** | $ 0.10 | $ 0.10 | $ 0.10 | $ 0.10 | $ 0.11 | $ 0.11 | $ 0.11 | $ 0.12 | $ 0.12 | $ 0.13 | $ 0.13 |
| | | | | | | | | | | | |
| **Direct + Indirect + External Costs per Pass** | **$ 0.67** | **$ 0.68** | **$ 0.69** | **$ 0.71** | **$ 0.73** | **$ 0.74** | **$ 0.76** | **$ 0.77** | **$ 0.78** | **$ 0.78** | **$ 0.78** |
| | | | | | | | | | | | |
| **Capital + Direct + Indirect + External Costs** | **$ 1.05** | **$ 1.12** | **$ 1.17** | **$ 1.21** | **$ 1.23** | **$ 1.28** | **$ 1.33** | **$ 1.42** | **$ 1.55** | **$ 1.66** | **$ 1.75** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

# Worksheet 4

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
LOW SCENARIO

| | | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Airline Cost per Enplanement** | | | | | | | | | | | |
| {net pax pass through estimates} | | | | | | | | | | | |
| Vancouver, BC. | | $ 9.63 | $ 9.73 | $ 9.87 | $ 10.06 | $ 10.27 | $ 10.51 | $ 10.77 | $ 11.06 | $ 11.39 | $ 11.75 |
| Sea-Tac International | | $ 11.26 | $ 12.41 | $ 16.11 | $ 17.64 | $ 19.11 | $ 18.85 | $ 18.48 | $ 18.14 | $ 17.82 | $ 17.62 |
| Portland International | | $ 14.08 | $ 13.94 | $ 14.01 | $ 14.00 | $ 13.28 | $ 13.25 | $ 13.00 | $ 13.06 | $ 13.16 | $ 13.23 |
| Bellingham | | $ 9.63 | $ 9.73 | $ 9.87 | $ 10.06 | $ 10.27 | $ 10.51 | $ 10.77 | $ 11.06 | $ 11.39 | $ 11.75 |
| **Terminal Operating Costs per Enplanement** | | | | | | | | | | | |
| Vancouver, BC. | | $ 17.17 | $ 17.32 | $ 17.53 | $ 17.84 | $ 18.18 | $ 18.56 | $ 18.99 | $ 19.47 | $ 20.01 | $ 20.61 |
| Sea-Tac International | | $ 12.69 | $ 13.21 | $ 15.22 | $ 16.10 | $ 17.84 | $ 17.47 | $ 17.17 | $ 17.29 | $ 17.32 | $ 16.91 |
| Portland International | | $ 11.58 | $ 11.45 | $ 11.81 | $ 12.13 | $ 12.44 | $ 12.78 | $ 13.12 | $ 13.48 | $ 13.86 | $ 14.26 |
| Bellingham | | $ 11.58 | $ 11.45 | $ 11.81 | $ 12.13 | $ 12.44 | $ 12.78 | $ 13.12 | $ 13.48 | $ 13.86 | $ 14.26 |
| **Terminal Capital Costs per Enplanement** | | | | | | | | | | | |
| Vancouver, BC. | | $ 5.48 | $ 5.55 | $ 5.63 | $ 5.75 | $ 5.87 | $ 6.02 | $ 6.17 | $ 6.35 | $ 6.54 | $ 6.76 |
| Sea-Tac International | | $ 6.84 | $ 7.11 | $ 8.19 | $ 8.67 | $ 9.61 | $ 9.41 | $ 9.25 | $ 9.31 | $ 9.33 | $ 9.11 |
| Portland International | | $ 11.84 | $ 11.67 | $ 11.51 | $ 11.25 | $ 10.30 | $ 10.00 | $ 9.49 | $ 9.28 | $ 9.08 | $ 8.86 |
| Bellingham | | $ 5.48 | $ 5.55 | $ 5.63 | $ 5.75 | $ 5.87 | $ 6.02 | $ 6.17 | $ 6.35 | $ 6.54 | $ 6.76 |
| **Air Fares** | | | | | | | | | | | |
| Vancouver, BC - Seattle | | $ 136 | $ 140 | $ 144 | $ 148 | $ 153 | $ 157 | $ 162 | $ 167 | $ 172 | $ 177 |
| Seattle - Portland | | $ 139 | $ 143 | $ 147 | $ 151 | $ 156 | $ 161 | $ 165 | $ 170 | $ 175 | $ 181 |
| Vancouver, BC - Portland | | $ 224 | $ 230 | $ 237 | $ 244 | $ 252 | $ 259 | $ 267 | $ 275 | $ 283 | $ 292 |
| Bellingham - Seattle | | $ 122 | $ 125 | $ 129 | $ 133 | $ 137 | $ 141 | $ 145 | $ 149 | $ 154 | $ 159 |
| **Total per Pax Operating Costs** | | | | | | | | | | | |
| Vancouver, BC - Seattle | | $140 | $144 | $147 | $151 | $156 | $160 | $165 | $170 | $176 | $181 |
| Seattle - Portland | | $138 | $142 | $145 | $150 | $155 | $160 | $165 | $170 | $176 | $181 |
| Vancouver, BC - Portland | | $226 | $233 | $240 | $247 | $255 | $263 | $271 | $279 | $288 | $297 |
| Bellingham - Seattle | | $123 | $126 | $129 | $133 | $137 | $141 | $146 | $150 | $155 | $159 |
| **Total Pax Operating Costs per Pax Mile** | Miles | | | | | | | | | | |
| Vancouver, BC - Seattle | 120 | $1.17 | $1.20 | $1.23 | $1.26 | $1.30 | $1.34 | $1.38 | $1.42 | $1.46 | $1.51 |
| Seattle - Portland | 170 | $0.81 | $0.83 | $0.86 | $0.88 | $0.91 | $0.94 | $0.97 | $1.00 | $1.03 | $1.06 |
| Vancouver, BC - Portland | 290 | $0.78 | $0.80 | $0.83 | $0.85 | $0.88 | $0.91 | $0.93 | $0.96 | $0.99 | $1.02 |
| Bellingham - Seattle | 94 | $1.31 | $1.34 | $1.38 | $1.42 | $1.46 | $1.50 | $1.55 | $1.60 | $1.65 | $1.70 |
| **Corridor Weighted Average** | | **$0.97** | **$1.00** | **$1.02** | **$1.05** | **$1.09** | **$1.12** | **$1.16** | **$1.19** | **$1.23** | **$1.27** |
| **Total Pax Capital Costs per Pax Mile** | Demand | | | | | | | | | | |
| Vancouver, BC - Seattle | 28% | 0.05 | 0.05 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.07 | 0.07 | 0.07 |
| Seattle - Portland | 51% | 0.05 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.05 | 0.05 | 0.05 |
| Vancouver, BC - Portland | 8% | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Bellingham - Seattle | 13% | 0.07 | 0.07 | 0.07 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| **Corridor Weighted Average** | **100%** | **$0.05** | **$0.05** | **$0.06** | **$0.06** | **$0.06** | **$0.06** | **$0.06** | **$0.06** | **$0.06** | **$0.06** |
| **Enplanements** | | | | | | | | | | | |
| Vancouver | | 7.9 | 8.4 | 8.9 | 9.4 | 9.8 | 10.3 | 10.8 | 11.3 | 11.7 | 12.2 |
| Seattle | | 13.7 | 14.5 | 15.0 | 15.6 | 16.1 | 16.7 | 17.3 | 17.9 | 18.6 | 19.3 |
| Portland | | 5.9 | 6.3 | 6.5 | 6.7 | 6.9 | 7.2 | 7.4 | 7.6 | 7.9 | 8.1 |
| Total | | 27.6 | 29.3 | 30.4 | 31.7 | 32.9 | 34.2 | 35.5 | 36.8 | 38.2 | 39.5 |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
LOW SCENARIO

| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Airline Cost per Enplanement** | | | | | | | | | | | |
| {net pax pass through estimates} | | | | | | | | | | | |
| Vancouver, BC. | $ 12.15 | $ 12.59 | $ 13.06 | $ 13.58 | $ 14.13 | $ 14.74 | $ 15.39 | $ 16.09 | $ 16.84 | $ 17.65 | $ 18.52 |
| Sea-Tac International | $ 17.37 | $ 17.12 | $ 16.64 | $ 16.69 | $ 16.74 | $ 16.80 | $ 16.85 | $ 16.91 | $ 16.96 | $ 17.01 | $ 17.07 |
| Portland International | $ 13.35 | $ 13.23 | $ 13.06 | $ 13.16 | $ 13.20 | $ 13.38 | $ 12.86 | $ 13.09 | $ 13.35 | $ 13.32 | $ 13.60 |
| Bellingham | $ 12.15 | $ 12.59 | $ 13.06 | $ 13.16 | $ 13.20 | $ 13.38 | $ 12.86 | $ 13.09 | $ 13.35 | $ 13.32 | $ 13.60 |
| **Terminal Operating Costs per Enplanement** | | | | | | | | | | | |
| Vancouver, BC. | $ 21.27 | $ 21.99 | $ 22.78 | $ 23.63 | $ 24.55 | $ 25.55 | $ 26.63 | $ 27.79 | $ 29.04 | $ 30.38 | $ 31.82 |
| Sea-Tac International | $ 16.06 | $ 15.16 | $ 14.15 | $ 16.35 | $ 16.50 | $ 16.66 | $ 16.82 | $ 16.98 | $ 17.14 | $ 17.30 | $ 17.47 |
| Portland International | $ 14.66 | $ 15.07 | $ 15.49 | $ 15.93 | $ 16.37 | $ 16.84 | $ 17.29 | $ 17.78 | $ 18.29 | $ 18.80 | $ 19.34 |
| Bellingham | $ 14.66 | $ 15.07 | $ 14.15 | $ 15.93 | $ 16.37 | $ 16.66 | $ 16.82 | $ 16.98 | $ 17.14 | $ 17.30 | $ 17.47 |
| **Terminal Capital Costs per Enplanement** | | | | | | | | | | | |
| Vancouver, BC. | $ 6.99 | $ 7.25 | $ 7.53 | $ 7.84 | $ 8.17 | $ 8.53 | $ 8.91 | $ 9.33 | $ 9.78 | $ 10.26 | $ 10.77 |
| Sea-Tac International | $ 8.65 | $ 8.16 | $ 7.62 | $ 8.80 | $ 8.89 | $ 8.97 | $ 9.06 | $ 9.14 | $ 9.23 | $ 9.32 | $ 9.41 |
| Portland International | $ 8.67 | $ 8.26 | $ 7.78 | $ 7.56 | $ 7.27 | $ 7.11 | $ 6.29 | $ 6.17 | $ 6.07 | $ 5.70 | $ 5.62 |
| Bellingham | $ 6.99 | $ 7.25 | $ 7.53 | $ 7.56 | $ 7.27 | $ 7.11 | $ 6.29 | $ 6.17 | $ 6.07 | $ 5.70 | $ 5.62 |
| **Air Fares** | | | | | | | | | | | |
| Vancouver, BC - Seattle | $ 182 | $ 188 | $ 193 | $ 199 | $ 205 | $ 211 | $ 217 | $ 224 | $ 231 | $ 238 | $ 245 |
| Seattle - Portland | $ 186 | $ 192 | $ 197 | $ 203 | $ 209 | $ 216 | $ 222 | $ 229 | $ 236 | $ 243 | $ 250 |
| Vancouver, BC - Portland | $ 300 | $ 309 | $ 319 | $ 328 | $ 338 | $ 348 | $ 359 | $ 369 | $ 380 | $ 392 | $ 404 |
| Bellingham - Seattle | $ 163 | $ 168 | $ 173 | $ 178 | $ 184 | $ 189 | $ 195 | $ 201 | $ 207 | $ 213 | $ 219 |
| **Total per Pax Operating Costs** | | | | | | | | | | | |
| Vancouver, BC - Seattle | $186 | $191 | $197 | $204 | $210 | $216 | $223 | $230 | $237 | $244 | $252 |
| Seattle - Portland | $186 | $192 | $197 | $205 | $211 | $217 | $224 | $231 | $238 | $246 | $253 |
| Vancouver, BC - Portland | $306 | $315 | $325 | $335 | $345 | $355 | $366 | $378 | $389 | $401 | $413 |
| Bellingham - Seattle | $164 | $168 | $173 | $180 | $185 | $191 | $197 | $203 | $209 | $215 | $222 |
| **Total Pax Operating Costs per Pax Mile** | | | | | | | | | | | |
| Vancouver, BC - Seattle | $1.55 | $1.59 | $1.64 | $1.70 | $1.75 | $1.80 | $1.86 | $1.92 | $1.97 | $2.03 | $2.10 |
| Seattle - Portland | $1.09 | $1.13 | $1.16 | $1.20 | $1.24 | $1.28 | $1.32 | $1.36 | $1.40 | $1.45 | $1.49 |
| Vancouver, BC - Portland | $1.05 | $1.09 | $1.12 | $1.15 | $1.19 | $1.23 | $1.26 | $1.30 | $1.34 | $1.38 | $1.42 |
| Bellingham - Seattle | $1.74 | $1.79 | $1.84 | $1.91 | $1.97 | $2.03 | $2.10 | $2.16 | $2.22 | $2.29 | $2.36 |
| **Corridor Weighted Average** | **$1.30** | **$1.34** | **$1.38** | **$1.43** | **$1.47** | **$1.52** | **$1.57** | **$1.61** | **$1.66** | **$1.71** | **$1.77** |
| **Total Pax Capital Costs per Pax Mile** | | | | | | | | | | | |
| Vancouver, BC - Seattle | 0.07 | 0.06 | 0.06 | 0.07 | 0.07 | 0.07 | 0.07 | 0.08 | 0.08 | 0.08 | 0.08 |
| Seattle - Portland | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.04 | 0.04 |
| Vancouver, BC - Portland | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Bellingham - Seattle | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| **Corridor Weighted Average** | **$0.06** | **$0.06** | **$0.05** | **$0.06** | **$0.06** | **$0.06** | **$0.06** | **$0.06** | **$0.06** | **$0.06** | **$0.06** |
| **Enplanements** | | | | | | | | | | | |
| Vancouver | 12.6 | 13.1 | 13.5 | 13.9 | 14.3 | 14.7 | 15.1 | 15.5 | 15.9 | 16.3 | 16.6 |
| Seattle | 20.0 | 20.7 | 21.4 | 22.2 | 23.0 | 23.8 | 24.7 | 25.6 | 26.5 | 27.4 | 28.4 |
| Portland | 8.4 | 8.6 | 8.9 | 9.2 | 9.4 | 9.7 | 10.0 | 10.3 | 10.7 | 11.0 | 11.3 |
| Total | 40.9 | 42.3 | 43.8 | 45.3 | 46.8 | 48.3 | 49.8 | 51.4 | 53.0 | 54.7 | 56.4 |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
LOW SCENARIO

| **Vancouver International Airport** | **AAGR** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ($000s) | 50% | | | | | | | | | | |
| **Revenue** | | | | | | | | | | | |
| Landing Fees | 7% | 34,484 | 37,056 | 39,821 | 42,792 | 45,985 | 49,416 | 53,103 | 57,065 | 61,322 | 65,898 |
| Terminal Fees | 7% | 41,965 | 44,903 | 48,046 | 51,409 | 55,008 | 58,859 | 62,979 | 67,387 | 72,104 | 77,152 |
| Concessions | 7% | 43,036 | 46,048 | 49,272 | 52,721 | 56,411 | 60,360 | 64,585 | 69,106 | 73,944 | 79,120 |
| Airport Improvement Fees | 7% | 42,904 | 45,907 | 49,120 | 52,559 | 56,238 | 60,175 | 64,387 | 68,894 | 73,717 | 78,877 |
| Car Parking | 7% | 17,423 | 18,642 | 19,947 | 21,344 | 22,838 | 24,436 | 26,147 | 27,977 | 29,936 | 32,031 |
| Rentals, Fees and Miscellaneous | 7% | 32,434 | 34,704 | 37,133 | 39,733 | 42,514 | 45,490 | 48,674 | 52,081 | 55,727 | 59,628 |
| **Total Revenue** | | 212,245 | 227,261 | 243,340 | 260,558 | 278,994 | 298,735 | 319,875 | 342,511 | 366,750 | 392,705 |
| | | | | | | | | | | | |
| **Airline Revenues** | | 76,449 | 81,959 | 87,867 | 94,202 | 100,993 | 108,274 | 116,081 | 124,452 | 133,427 | 143,049 |
| Non-Airline Revenues | | 135,796 | 145,302 | 155,473 | 166,356 | 178,001 | 190,461 | 203,793 | 218,059 | 233,323 | 249,656 |
| Less Non-Pax Air Revenues | | (32,434) | (34,704) | (37,133) | (39,733) | (42,514) | (45,490) | (48,674) | (52,081) | (55,727) | (59,628) |
| **Total Air Pax Costs** | | 179,811 | 192,557 | 206,207 | 220,825 | 236,480 | 253,246 | 271,201 | 290,429 | 311,022 | 333,077 |
| | | | | | | | | | | | |
| **Capital vs. Operating Costs** | | | | | | | | | | | |
| Total Revenues | | 212,245 | 227,261 | 243,340 | 260,558 | 278,994 | 298,735 | 319,875 | 342,511 | 366,750 | 392,705 |
| Operating Expenditures | 7% | 160,865 | 172,126 | 184,175 | 197,067 | 210,862 | 225,622 | 241,415 | 258,314 | 276,396 | 295,744 |
| Capital Expenditures | | | | | | | | | | | |
| Interest and Financing | | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 |
| Equity Re-Invested | | 30,380 | 34,135 | 38,166 | 42,491 | 47,132 | 52,114 | 57,459 | 63,196 | 69,353 | 75,961 |
| Capital Expenditures | | 51,380 | 55,135 | 59,166 | 63,491 | 68,132 | 73,114 | 78,459 | 84,196 | 90,353 | 96,961 |
| Percent of Costs Allocated to Capital Expenditures | | 24.2% | 24.3% | 24.3% | 24.4% | 24.4% | 24.5% | 24.5% | 24.6% | 24.6% | 24.7% |
| | | | | | | | | | | | |
| **Enplanements + Deplanements (millions)** | | 15.9 | 16.8 | 17.8 | 18.7 | 19.7 | 20.6 | 21.6 | 22.5 | 23.4 | 24.3 |
| **Enplanements (millions)** | | 7.9 | 8.4 | 8.9 | 9.4 | 9.8 | 10.3 | 10.8 | 11.3 | 11.7 | 12.2 |
| | | | | | | | | | | | |
| **Airline Cost per Enplanement** | | $ 9.63 | $ 9.73 | $ 9.87 | $ 10.06 | $ 10.27 | $ 10.51 | $ 10.77 | $ 11.06 | $ 11.39 | $ 11.75 |
| **Total Pax Costs per Enplanement** | | $ 22.66 | $ 22.87 | $ 23.17 | $ 23.58 | $ 24.05 | $ 24.58 | $ 25.16 | $ 25.81 | $ 26.55 | $ 27.37 |
| **Net Pax Costs per Enplanement** | | $ 13.02 | $ 13.13 | $ 13.30 | $ 13.52 | $ 13.78 | $ 14.07 | $ 14.39 | $ 14.75 | $ 15.16 | $ 15.61 |
| **Total Capital Costs per Enplanement** | | $ 5.48 | $ 5.55 | $ 5.63 | $ 5.75 | $ 5.87 | $ 6.02 | $ 6.17 | $ 6.35 | $ 6.54 | $ 6.76 |
| **Total Operating Costs per Enplanement** | | $ 17.17 | $ 17.32 | $ 17.53 | $ 17.84 | $ 18.18 | $ 18.56 | $ 18.99 | $ 19.47 | $ 20.01 | $ 20.61 |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
LOW SCENARIO

| **Vancouver International Airport** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ($000s) | | | | | | | | | | | |
| **Revenue** | | | | | | | | | | | |
| Landing Fees | 70,814 | 76,098 | 81,775 | 87,876 | 94,433 | 101,479 | 109,050 | 117,186 | 125,929 | 135,325 | 145,421 |
| Terminal Fees | 82,552 | 88,331 | 94,514 | 101,130 | 108,209 | 115,784 | 123,889 | 132,561 | 141,840 | 151,769 | 162,393 |
| Concessions | 84,658 | 90,584 | 96,925 | 103,710 | 110,970 | 118,737 | 127,049 | 135,942 | 145,458 | 155,641 | 166,535 |
| Airport Improvement Fees | 84,398 | 90,306 | 96,627 | 103,391 | 110,629 | 118,373 | 126,659 | 135,525 | 145,012 | 155,162 | 166,024 |
| Car Parking | 34,273 | 36,672 | 39,239 | 41,986 | 44,925 | 48,070 | 51,435 | 55,035 | 58,888 | 63,010 | 67,421 |
| Rentals, Fees and Miscellaneous | 63,802 | 68,268 | 73,047 | 78,160 | 83,631 | 89,486 | 95,750 | 102,452 | 109,624 | 117,297 | 125,508 |
| **Total Revenue** | 420,498 | 450,259 | 482,128 | 516,254 | 552,797 | 591,928 | 633,831 | 678,702 | 726,751 | 778,204 | 833,302 |
| | | | | | | | | | | | |
| **Airline Revenues** | 153,366 | 164,429 | 176,289 | 189,007 | 202,642 | 217,262 | 232,939 | 249,747 | 267,769 | 287,094 | 307,814 |
| Non-Airline Revenues | 267,131 | 285,831 | 305,839 | 327,247 | 350,155 | 374,666 | 400,892 | 428,955 | 458,982 | 491,110 | 525,488 |
| Less Non-Pax Air Revenues | (63,802) | (68,268) | (73,047) | (78,160) | (83,631) | (89,486) | (95,750) | (102,452) | (109,624) | (117,297) | (125,508) |
| **Total Air Pax Costs** | 356,696 | 381,991 | 409,081 | 438,094 | 469,166 | 502,442 | 538,081 | 576,250 | 617,127 | 660,907 | 707,794 |
| | | | | | | | | | | | |
| **Capital vs. Operating Costs** | | | | | | | | | | | |
| Total Revenues | 420,498 | 450,259 | 482,128 | 516,254 | 552,797 | 591,928 | 633,831 | 678,702 | 726,751 | 778,204 | 833,302 |
| Operating Expenditures | 316,446 | 338,598 | 362,299 | 387,660 | 414,797 | 443,832 | 474,901 | 508,144 | 543,714 | 581,774 | 622,498 |
| Capital Expenditures | | | | | | | | | | | |
| Interest and Financing | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 |
| Equity Re-Invested | 83,052 | 90,662 | 98,829 | 107,594 | 117,000 | 127,096 | 137,930 | 149,558 | 162,037 | 175,430 | 189,804 |
| Capital Expenditures | 104,052 | 111,662 | 119,829 | 128,594 | 138,000 | 148,096 | 158,930 | 170,558 | 183,037 | 196,430 | 210,804 |
| Percent of Costs Allocated to Capital Expenditures | 24.7% | 24.8% | 24.9% | 24.9% | 25.0% | 25.0% | 25.1% | 25.1% | 25.2% | 25.2% | 25.3% |
| | | | | | | | | | | | |
| **Enplanements + Deplanements (millions)** | 25.2 | 26.1 | 27.0 | 27.8 | 28.7 | 29.5 | 30.3 | 31.1 | 31.8 | 32.5 | 33.2 |
| **Enplanements (millions)** | 12.6 | 13.1 | 13.5 | 13.9 | 14.3 | 14.7 | 15.1 | 15.5 | 15.9 | 16.3 | 16.6 |
| | | | | | | | | | | | |
| **Airline Cost per Enplanement** | $ 12.15 | $ 12.59 | $ 13.06 | $ 13.58 | $ 14.13 | $ 14.74 | $ 15.39 | $ 16.09 | $ 16.84 | $ 17.65 | $ 18.52 |
| **Total Pax Costs per Enplanement** | $ 28.26 | $ 29.24 | $ 30.31 | $ 31.47 | $ 32.72 | $ 34.08 | $ 35.54 | $ 37.12 | $ 38.81 | $ 40.63 | $ 42.59 |
| **Net Pax Costs per Enplanement** | $ 16.11 | $ 16.66 | $ 17.25 | $ 17.89 | $ 18.59 | $ 19.34 | $ 20.15 | $ 21.03 | $ 21.97 | $ 22.98 | $ 24.07 |
| **Total Capital Costs per Enplanement** | $ 6.99 | $ 7.25 | $ 7.53 | $ 7.84 | $ 8.17 | $ 8.53 | $ 8.91 | $ 9.33 | $ 9.78 | $ 10.26 | $ 10.77 |
| **Total Operating Costs per Enplanement** | $ 21.27 | $ 21.99 | $ 22.78 | $ 23.63 | $ 24.55 | $ 25.55 | $ 26.63 | $ 27.79 | $ 29.04 | $ 30.38 | $ 31.82 |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
LOW SCENARIO

| Sea-Tac International Airport | AAGR | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Revenues** | | | | | | | | | | | |
| Total Revenues | 5% | 266,477 | 301,335 | 364,234 | 400,963 | 458,752 | 472,421 | 484,513 | 497,094 | 510,479 | 526,512 |
| Airline Revenues | 4% | 154,322 | 180,076 | 242,320 | 274,835 | 308,414 | 315,250 | 320,116 | 325,504 | 331,299 | 339,322 |
| Non-Airline Revenues | | 112,155 | 121,259 | 121,914 | 126,127 | 150,337 | 157,171 | 164,397 | 171,590 | 179,179 | 187,190 |
| Security Reimbursement | | 3,675 | 0 | 0 | 0 | 0 | | | | | |
| Less: Non-Pax Revenues (% of Non-Airline Rev) | 6% | (2,469) | (6,441) | (12,223) | (15,000) | (15,721) | (22,931) | (26,851) | (19,641) | (15,000) | (25,407) |
| **Total Air Pax Costs** | | 267,683 | 294,894 | 352,012 | 385,963 | 443,031 | 449,490 | 457,663 | 477,453 | 495,479 | 501,104 |
| | | | | | | | | | | | |
| **Capital vs. Operating Costs** | | | | | | | | | | | |
| Total Revenues | | 266,477 | 301,335 | 364,234 | 400,963 | 458,752 | 472,421 | 484,513 | 497,094 | 510,479 | 526,512 |
| Operating Expenditures | 65% | 173,210 | 195,868 | 236,752 | 260,626 | 298,188 | 307,074 | 314,934 | 323,111 | 331,811 | 342,233 |
| Capital Expenditures | | | | | | | | | | | |
| Interest and Financing | | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 |
| Equity Re-Invested | | 66,267 | 78,467 | 100,482 | 113,337 | 133,563 | 138,347 | 142,580 | 146,983 | 151,668 | 157,279 |
| Captial Expenditures | | 93,267 | 105,467 | 127,482 | 140,337 | 160,563 | 165,347 | 169,580 | 173,983 | 178,668 | 184,279 |
| Percent of Costs Allocated to Capital Expenditures | | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% |
| | | | | | | | | | | | |
| **Total Enplanement** | 4% | 13.7 | 14.5 | 15.0 | 15.6 | 16.1 | 16.7 | 17.3 | 17.9 | 18.6 | 19.3 |
| | | | | | | | | | | | |
| **Airline Cost per Enplanement** | | $ 11.26 | $ 12.41 | $ 16.11 | $ 17.64 | $ 19.11 | $ 18.85 | $ 18.48 | $ 18.14 | $ 17.82 | $ 17.62 |
| **Total Pax Costs per Enplanement** | | $ 19.53 | $ 20.32 | $ 23.41 | $ 24.77 | $ 27.45 | $ 26.88 | $ 26.42 | $ 26.60 | $ 26.65 | $ 26.01 |
| **Net Pax Costs per Enplanement** | | $ 8.27 | $ 7.91 | $ 7.29 | $ 7.13 | $ 8.34 | $ 8.03 | $ 7.94 | $ 8.47 | $ 8.83 | $ 8.40 |
| **Total Capital Costs per Enplanement** | | $ 6.84 | $ 7.11 | $ 8.19 | $ 8.67 | $ 9.61 | $ 9.41 | $ 9.25 | $ 9.31 | $ 9.33 | $ 9.11 |
| **Total Operating Costs per Enplanement** | | $ 12.69 | $ 13.21 | $ 15.22 | $ 16.10 | $ 17.84 | $ 17.47 | $ 17.17 | $ 17.29 | $ 17.32 | $ 16.91 |

| Portland International Airport | AAGR | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Revenues** | | | | | | | | | | | |
| Total Revenues | | $146.1 | $155.0 | $160.7 | $166.4 | $167.4 | $173.2 | $177.7 | $184.7 | $192.1 | $199.7 |
| Airline Revenues | | $83.2 | $88.3 | $91.2 | $94.1 | $92.1 | $94.8 | $96.0 | $99.6 | $103.4 | $107.2 |
| Non-Airline Revenues | | $62.4 | $65.9 | $68.7 | $71.5 | $74.4 | $77.6 | $80.8 | $84.3 | $87.8 | $91.6 |
| Security Reimbursement | | | | | | | | | | | |
| Less: Non-Pax Revenues (% of Non-Airline Rev) | | -$7.2 | -$7.8 | -$8.1 | -$8.5 | -$8.9 | -$9.3 | -$9.8 | -$10.3 | -$10.9 | -$11.5 |
| **Total Air Pax Costs** | | $138.5 | $146.5 | $151.9 | $157.1 | $157.7 | $163.0 | $167.0 | $173.5 | $180.3 | $187.3 |
| | | | | | | | | | | | |
| **Capital vs. Operating Costs** | | | | | | | | | | | |
| Total Revenues | | $146.1 | $155.0 | $160.7 | $166.4 | $167.4 | $173.2 | $177.7 | $184.7 | $192.1 | $199.7 |
| Operating Expenditures | | $72.3 | $76.8 | $81.4 | $86.3 | $91.6 | $97.2 | $103.1 | $109.4 | $116.1 | $123.2 |
| Capital Expenditures | | | | | | | | | | | |
| Interest and Financing | | $56.4 | $49.3 | $49.6 | $49.7 | $44.9 | $43.2 | $41.2 | $41.1 | $41.2 | $40.9 |
| Equity Re-Invested | | $17.5 | $28.9 | $29.7 | $30.4 | $30.8 | $32.9 | $33.5 | $34.2 | $34.9 | $35.7 |
| Captial Expenditures | | $73.9 | $78.2 | $79.4 | $80.1 | $75.8 | $76.1 | $74.6 | $75.3 | $76.1 | $76.5 |
| Percent of Costs Allocated to Capital Expenditures | | 50.5% | 50.5% | 49.4% | 48.1% | 45.3% | 43.9% | 42.0% | 40.8% | 39.6% | 38.3% |
| | | | | | | | | | | | |
| **Total Enplanement (PDX forecasts)** | | 5.9 | 6.3 | 6.5 | 6.7 | 6.9 | 7.2 | 7.4 | 7.6 | 7.9 | 8.1 |
| | | | | | | | | | | | |
| **Airline Cost per Enplanement** | | $ 14.08 | $ 13.94 | $ 14.01 | $ 14.00 | $ 13.28 | $ 13.25 | $ 13.00 | $ 13.06 | $ 13.16 | $ 13.23 |
| **Total Pax Costs per Enplanement** | | $ 23.42 | $ 23.12 | $ 23.32 | $ 23.38 | $ 22.74 | $ 22.78 | $ 22.61 | $ 22.76 | $ 22.95 | $ 23.12 |
| **Net Pax Costs per Enplanement** | | $ 9.35 | $ 9.18 | $ 9.31 | $ 9.38 | $ 9.45 | $ 9.53 | $ 9.61 | $ 9.70 | $ 9.79 | $ 9.89 |
| **Total Capital Costs per Enplanement** | | $ 11.84 | $ 11.67 | $ 11.51 | $ 11.25 | $ 10.30 | $ 10.00 | $ 9.49 | $ 9.28 | $ 9.08 | $ 8.86 |
| **Total Operating Costs per Enplanement** | | $ 11.58 | $ 11.45 | $ 11.81 | $ 12.13 | $ 12.44 | $ 12.78 | $ 13.12 | $ 13.48 | $ 13.86 | $ 14.26 |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
LOW SCENARIO

| **Sea-Tac International Airport** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Revenues** | | | | | | | | | | | |
| Total Revenues | 542,251 | 558,480 | 570,354 | 596,514 | 623,874 | 652,489 | 682,416 | 713,717 | 746,452 | 780,690 | 816,497 |
| Airline Revenues | 346,606 | 353,908 | 356,354 | 370,366 | 384,929 | 400,065 | 415,795 | 432,144 | 449,136 | 466,796 | 485,151 |
| Non-Airline Revenues | 195,645 | 204,572 | 213,999 | 226,147 | 238,945 | 252,424 | 266,621 | 281,572 | 297,316 | 313,893 | 331,347 |
| Security Reimbursement | | | | | | | | | | | |
| Less: Non-Pax Revenues (% of Non-Airline Rev) | (49,192) | (76,224) | (104,157) | (38,509) | (40,275) | (42,123) | (44,055) | (46,075) | (48,189) | (50,399) | (52,710) |
| **Total Air Pax Costs** | 493,059 | 482,255 | 466,196 | 558,005 | 583,599 | 610,366 | 638,362 | 667,641 | 698,264 | 730,291 | 763,787 |
| | | | | | | | | | | | |
| **Capital vs. Operating Costs** | | | | | | | | | | | |
| Total Revenues | 542,251 | 558,480 | 570,354 | 596,514 | 623,874 | 652,489 | 682,416 | 713,717 | 746,452 | 780,690 | 816,497 |
| Operating Expenditures | 352,463 | 363,012 | 370,730 | 387,734 | 405,518 | 424,118 | 443,571 | 463,916 | 485,194 | 507,448 | 530,723 |
| Capital Expenditures | | | | | | | | | | | |
| Interest and Financing | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 |
| Equity Re-Invested | 162,788 | 168,468 | 172,624 | 181,780 | 191,356 | 201,371 | 211,846 | 222,801 | 234,258 | 246,241 | 258,774 |
| Captial Expenditures | 189,788 | 195,468 | 199,624 | 208,780 | 218,356 | 228,371 | 238,846 | 249,801 | 261,258 | 273,241 | 285,774 |
| Percent of Costs Allocated to Capital Expenditures | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% |
| | | | | | | | | | | | |
| **Total Enplanement** | 20.0 | 20.7 | 21.4 | 22.2 | 23.0 | 23.8 | 24.7 | 25.6 | 26.5 | 27.4 | 28.4 |
| | | | | | | | | | | | |
| **Airline Cost per Enplanement** | $ 17.37 | $ 17.12 | $ 16.64 | $ 16.69 | $ 16.74 | $ 16.80 | $ 16.85 | $ 16.91 | $ 16.96 | $ 17.01 | $ 17.07 |
| **Total Pax Costs per Enplanement** | $ 24.71 | $ 23.33 | $ 21.77 | $ 25.15 | $ 25.39 | $ 25.63 | $ 25.87 | $ 26.12 | $ 26.37 | $ 26.62 | $ 26.87 |
| **Net Pax Costs per Enplanement** | $ 7.34 | $ 6.21 | $ 5.13 | $ 8.46 | $ 8.64 | $ 8.83 | $ 9.02 | $ 9.21 | $ 9.41 | $ 9.60 | $ 9.80 |
| **Total Capital Costs per Enplanement** | $ 8.65 | $ 8.16 | $ 7.62 | $ 8.80 | $ 8.89 | $ 8.97 | $ 9.06 | $ 9.14 | $ 9.23 | $ 9.32 | $ 9.41 |
| **Total Operating Costs per Enplanement** | $ 16.06 | $ 15.16 | $ 14.15 | $ 16.35 | $ 16.50 | $ 16.66 | $ 16.82 | $ 16.98 | $ 17.14 | $ 17.30 | $ 17.47 |

| **Portland International Airport** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Revenues** | | | | | | | | | | | |
| Total Revenues | $207.9 | $214.6 | $221.1 | $230.2 | $239.3 | $250.1 | $254.4 | $266.7 | $279.9 | $290.6 | $305.4 |
| Airline Revenues | $111.5 | $114.0 | $116.0 | $120.5 | $124.6 | $130.2 | $129.0 | $135.4 | $142.3 | $146.4 | $154.1 |
| Non-Airline Revenues | $95.5 | $99.7 | $104.0 | $108.7 | $113.6 | $118.8 | $124.3 | $130.1 | $136.3 | $142.9 | $149.9 |
| Security Reimbursement | | | | | | | | | | | |
| Less: Non-Pax Revenues (% of Non-Airline Rev) | -$12.1 | -$12.7 | -$13.4 | -$14.2 | -$15.0 | -$15.9 | -$16.8 | -$17.8 | -$18.8 | -$20.0 | -$21.2 |
| **Total Air Pax Costs** | $194.9 | $200.9 | $206.6 | $215.0 | $223.2 | $233.1 | $236.5 | $247.8 | $259.8 | $269.4 | $282.9 |
| | | | | | | | | | | | |
| **Capital vs. Operating Costs** | | | | | | | | | | | |
| Total Revenues | $207.9 | $214.6 | $221.1 | $230.2 | $239.3 | $250.1 | $254.4 | $266.7 | $279.9 | $290.6 | $305.4 |
| Operating Expenditures | $130.7 | $138.7 | $147.1 | $156.1 | $165.7 | $175.8 | $186.6 | $198.0 | $210.1 | $223.0 | $236.6 |
| Capital Expenditures | | | | | | | | | | | |
| Interest and Financing | $40.9 | $39.5 | $37.2 | $36.6 | $34.8 | $34.6 | $28.2 | $28.2 | $28.2 | $23.9 | $24.0 |
| Equity Re-Invested | $36.4 | $36.4 | $36.7 | $37.5 | $38.8 | $39.7 | $39.7 | $40.6 | $41.6 | $43.7 | $44.8 |
| Captial Expenditures | $77.3 | $76.0 | $73.9 | $74.1 | $73.6 | $74.3 | $67.9 | $68.7 | $69.8 | $67.6 | $68.7 |
| Percent of Costs Allocated to Capital Expenditures | 37.2% | 35.4% | 33.4% | 32.2% | 30.8% | 29.7% | 26.7% | 25.8% | 24.9% | 23.3% | 22.5% |
| | | | | | | | | | | | |
| **Total Enplanement (PDX forecasts)** | 8.4 | 8.6 | 8.9 | 9.2 | 9.4 | 9.7 | 10.0 | 10.3 | 10.7 | 11.0 | 11.3 |
| | | | | | | | | | | | |
| **Airline Cost per Enplanement** | $ 13.35 | $ 13.23 | $ 13.06 | $ 13.16 | $ 13.20 | $ 13.38 | $ 12.86 | $ 13.09 | $ 13.35 | $ 13.32 | $ 13.60 |
| **Total Pax Costs per Enplanement** | $ 23.33 | $ 23.33 | $ 23.27 | $ 23.48 | $ 23.65 | $ 23.95 | $ 23.57 | $ 23.96 | $ 24.37 | $ 24.50 | $ 24.96 |
| **Net Pax Costs per Enplanement** | $ 9.99 | $ 10.09 | $ 10.20 | $ 10.32 | $ 10.44 | $ 10.58 | $ 10.71 | $ 10.86 | $ 11.02 | $ 11.18 | $ 11.36 |
| **Total Capital Costs per Enplanement** | $ 8.67 | $ 8.26 | $ 7.78 | $ 7.56 | $ 7.27 | $ 7.11 | $ 6.29 | $ 6.17 | $ 6.07 | $ 5.70 | $ 5.62 |
| **Total Operating Costs per Enplanement** | $ 14.66 | $ 15.07 | $ 15.49 | $ 15.93 | $ 16.37 | $ 16.84 | $ 17.29 | $ 17.78 | $ 18.29 | $ 18.80 | $ 19.34 |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
LOW SCENARIO

| Indirect Costs - Low | | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time costs (by route)** | | | | | | | | | | | |
| **Seattle to Portland** | 170 Miles | | | | | | | | | | |
| Travel Time (Hours) With Terminal Time | | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 |
| Average Hourly Wage Rate | | 18.62 | 19.18 | 19.76 | 20.35 | 20.96 | 21.59 | 22.24 | 22.90 | 23.59 | 24.30 |
| Value of Travel Time for Business Travelers (% of Wage Rate) | 35% | 6.52 | 6.71 | 6.92 | 7.12 | 7.34 | 7.56 | 7.78 | 8.02 | 8.26 | 8.50 |
| Percentage of Business Travelers | 73% | | | | | | | | | | |
| Value of Travel Time for Non-Business Travelers (% of Wage Rate) | 18% | 3.35 | 3.45 | 3.56 | 3.66 | 3.77 | 3.89 | 4.00 | 4.12 | 4.25 | 4.37 |
| Percentage of Non-Business Travelers | 27% | | | | | | | | | | |
| Time Cost per Passenger Mile - Weighted Average | | $ 0.09 | $ 0.09 | $ 0.09 | $ 0.09 | $ 0.10 | $ 0.10 | $ 0.10 | $ 0.11 | $ 0.11 | $ 0.11 |
| **Seattle to Vancouver** | 120 Miles | | | | | | | | | | |
| Travel Time (Hours) With Terminal Time | | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 |
| Average Hourly Wage Rate | | 18.62 | 19.18 | 19.76 | 20.35 | 20.96 | 21.59 | 22.24 | 22.90 | 23.59 | 24.30 |
| Value of Travel Time for Business Travelers (% of Wage Rate) | 35% | 6.52 | 6.71 | 6.92 | 7.12 | 7.34 | 7.56 | 7.78 | 8.02 | 8.26 | 8.50 |
| Percentage of Business Travelers | 73% | | | | | | | | | | |
| Value of Travel Time for Non-Business Travelers (% of Wage Rate) | 18% | 3.35 | 3.45 | 3.56 | 3.66 | 3.77 | 3.89 | 4.00 | 4.12 | 4.25 | 4.37 |
| Percentage of Non-Business Travelers | 27% | | | | | | | | | | |
| Time Cost per Passenger Mile - Weighted Average | | $ 0.13 | $ 0.14 | $ 0.14 | $ 0.15 | $ 0.15 | $ 0.16 | $ 0.16 | $ 0.16 | $ 0.17 | $ 0.17 |
| **Vancouver to Portland** | 290 Miles | | | | | | | | | | |
| Travel Time (Hours) With Terminal Time | | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 |
| Average Hourly Wage Rate | | 18.62 | 19.18 | 19.76 | 20.35 | 20.96 | 21.59 | 22.24 | 22.90 | 23.59 | 24.30 |
| Value of Travel Time for Business Travelers (% of Wage Rate) | 35% | 6.52 | 6.71 | 6.92 | 7.12 | 7.34 | 7.56 | 7.78 | 8.02 | 8.26 | 8.50 |
| Percentage of Business Travelers | 73% | | | | | | | | | | |
| Value of Travel Time for Non-Business Travelers (% of Wage Rate) | 18% | 3.35 | 3.45 | 3.56 | 3.66 | 3.77 | 3.89 | 4.00 | 4.12 | 4.25 | 4.37 |
| Percentage of Non-Business Travelers | 27% | | | | | | | | | | |
| Time Cost per Passenger Mile - Weighted Average | | $ 0.06 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.08 | 0.08 | 0.08 | 0.08 |
| **Seattle to Bellingham** | 94 Miles | | | | | | | | | | |
| Travel Time (Hours) With Terminal Time | | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 |
| Average Hourly Wage Rate | | $ 18.62 | $ 19.18 | $ 19.76 | $ 20.35 | $ 20.96 | $ 21.59 | $ 22.24 | $ 22.90 | $ 23.59 | $ 24.30 |
| Value of Travel Time for Business Travelers (% of Wage Rate) | 35% | $ 6.52 | $ 6.71 | $ 6.92 | $ 7.12 | $ 7.34 | $ 7.56 | $ 7.78 | $ 8.02 | $ 8.26 | $ 8.50 |
| Percentage of Business Travelers | 73% | | | | | | | | | | |
| Value of Travel Time for Non-Business Travelers (% of Wage Rate) | 18% | $ 0.44 | $ 0.44 | $ 0.44 | $ 0.44 | $ 0.44 | $ 0.44 | $ 0.44 | $ 0.44 | $ 0.44 | $ 0.44 |
| Percentage of Non-Business Travelers | 27% | | | | | | | | | | |
| Time Cost per Passenger Mile - Weighted Average | | $ 0.13 | $ 0.13 | $ 0.13 | $ 0.14 | $ 0.14 | $ 0.14 | $ 0.15 | $ 0.15 | $ 0.16 | $ 0.16 |
| **Total Indirect Costs per Passenger Mile** | Miles | | | | | | | | | | |
| Seattle to Portland | 170 | $ 0.09 | $ 0.09 | $ 0.09 | $ 0.09 | $ 0.10 | $ 0.10 | $ 0.10 | $ 0.11 | $ 0.11 | $ 0.11 |
| Seattle to Vancouver | 120 | $ 0.13 | $ 0.14 | $ 0.14 | $ 0.15 | $ 0.15 | $ 0.16 | $ 0.16 | $ 0.16 | $ 0.17 | $ 0.17 |
| Vancouver to Portland | 290 | $ 0.06 | $ 0.07 | $ 0.07 | $ 0.07 | $ 0.07 | $ 0.07 | $ 0.08 | $ 0.08 | $ 0.08 | $ 0.08 |
| Seattle to Bellingham | 94 | $ 0.13 | $ 0.13 | $ 0.13 | $ 0.14 | $ 0.14 | $ 0.14 | $ 0.15 | $ 0.15 | $ 0.16 | $ 0.16 |
| **Weighted Average** | | **$ 0.11** | **$ 0.12** | **$ 0.12** | **$ 0.12** | **$ 0.13** | **$ 0.13** | **$ 0.14** | **$ 0.14** | **$ 0.14** | **$ 0.15** |
| **Indirect + Direct Costs PPM** | | **$ 1.09** | **$ 1.12** | **$ 1.14** | **$ 1.18** | **$ 1.22** | **$ 1.25** | **$ 1.29** | **$ 1.33** | **$ 1.37** | **$ 1.41** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
LOW SCENARIO

| Indirect Costs - Low | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time costs (by route)** | | | | | | | | | | | |
| **Seattle to Portland** | | | | | | | | | | | |
| Travel Time (Hours) With Terminal Time | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 |
| Average Hourly Wage Rate | 25.03 | 25.78 | 26.55 | 27.35 | 28.17 | 29.01 | 29.88 | 30.78 | 31.70 | 32.66 | 33.64 |
| Value of Travel Time for Business Travelers (% of Wage Rate) | 8.76 | 9.02 | 9.29 | 9.57 | 9.86 | 10.16 | 10.46 | 10.77 | 11.10 | 11.43 | 11.77 |
| Percentage of Business Travelers | | | | | | | | | | | |
| Value of Travel Time for Non-Business Travelers (% of Wage Rate) | 4.51 | 4.64 | 4.78 | 4.92 | 5.07 | 5.22 | 5.38 | 5.54 | 5.71 | 5.88 | 6.05 |
| Percentage of Non-Business Travelers | | | | | | | | | | | |
| Time Cost per Passenger Mile - Weighted Average | $ 0.12 | $ 0.12 | $ 0.12 | $ 0.13 | $ 0.13 | $ 0.13 | $ 0.14 | $ 0.14 | $ 0.15 | $ 0.15 | $ 0.16 |
| **Seattle to Vancouver** | | | | | | | | | | | |
| Travel Time (Hours) With Terminal Time | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 |
| Average Hourly Wage Rate | 25.03 | 25.78 | 26.55 | 27.35 | 28.17 | 29.01 | 29.88 | 30.78 | 31.70 | 32.66 | 33.64 |
| Value of Travel Time for Business Travelers (% of Wage Rate) | 8.76 | 9.02 | 9.29 | 9.57 | 9.86 | 10.16 | 10.46 | 10.77 | 11.10 | 11.43 | 11.77 |
| Percentage of Business Travelers | | | | | | | | | | | |
| Value of Travel Time for Non-Business Travelers (% of Wage Rate) | 4.51 | 4.64 | 4.78 | 4.92 | 5.07 | 5.22 | 5.38 | 5.54 | 5.71 | 5.88 | 6.05 |
| Percentage of Non-Business Travelers | | | | | | | | | | | |
| Time Cost per Passenger Mile - Weighted Average | $ 0.18 | $ 0.19 | $ 0.19 | $ 0.20 | $ 0.20 | $ 0.21 | $ 0.21 | $ 0.22 | $ 0.23 | $ 0.23 | $ 0.24 |
| **Vancouver to Portland** | | | | | | | | | | | |
| Travel Time (Hours) With Terminal Time | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 |
| Average Hourly Wage Rate | 25.03 | 25.78 | 26.55 | 27.35 | 28.17 | 29.01 | 29.88 | 30.78 | 31.70 | 32.66 | 33.64 |
| Value of Travel Time for Business Travelers (% of Wage Rate) | 8.76 | 9.02 | 9.29 | 9.57 | 9.86 | 10.16 | 10.46 | 10.77 | 11.10 | 11.43 | 11.77 |
| Percentage of Business Travelers | | | | | | | | | | | |
| Value of Travel Time for Non-Business Travelers (% of Wage Rate) | 4.51 | 4.64 | 4.78 | 4.92 | 5.07 | 5.22 | 5.38 | 5.54 | 5.71 | 5.88 | 6.05 |
| Percentage of Non-Business Travelers | | | | | | | | | | | |
| Time Cost per Passenger Mile - Weighted Average | 0.09 | 0.09 | 0.09 | 0.09 | 0.10 | 0.10 | 0.10 | 0.10 | 0.11 | 0.11 | 0.11 |
| **Seattle to Bellingham** | | | | | | | | | | | |
| Travel Time (Hours) With Terminal Time | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 |
| Average Hourly Wage Rate | $ 25.03 | $ 25.78 | $ 26.55 | $ 27.35 | $ 28.17 | $ 29.01 | $ 29.88 | $ 30.78 | $ 31.70 | $ 32.66 | $ 33.64 |
| Value of Travel Time for Business Travelers (% of Wage Rate) | $ 8.76 | $ 9.02 | $ 9.29 | $ 9.57 | $ 9.86 | $ 10.16 | $ 10.46 | $ 10.77 | $ 11.10 | $ 11.43 | $ 11.77 |
| Percentage of Business Travelers | | | | | | | | | | | |
| Value of Travel Time for Non-Business Travelers (% of Wage Rate) | $ 0.44 | $ 0.44 | $ 0.44 | $ 0.44 | $ 0.44 | $ 0.44 | $ 0.44 | $ 0.44 | $ 0.44 | $ 0.44 | $ 0.44 |
| Percentage of Non-Business Travelers | | | | | | | | | | | |
| Time Cost per Passenger Mile - Weighted Average | $ 0.17 | $ 0.17 | $ 0.18 | $ 0.18 | $ 0.19 | $ 0.19 | $ 0.20 | $ 0.21 | $ 0.21 | $ 0.22 | $ 0.22 |
| **Total Indirect Costs per Passenger Mile** | | | | | | | | | | | |
| Seattle to Portland | $ 0.12 | $ 0.12 | $ 0.12 | $ 0.13 | $ 0.13 | $ 0.13 | $ 0.14 | $ 0.14 | $ 0.15 | $ 0.15 | $ 0.16 |
| Seattle to Vancouver | $ 0.18 | $ 0.19 | $ 0.19 | $ 0.20 | $ 0.20 | $ 0.21 | $ 0.21 | $ 0.22 | $ 0.23 | $ 0.23 | $ 0.24 |
| Vancouver to Portland | $ 0.09 | $ 0.09 | $ 0.09 | $ 0.09 | $ 0.10 | $ 0.10 | $ 0.10 | $ 0.10 | $ 0.11 | $ 0.11 | $ 0.11 |
| Seattle to Bellingham | $ 0.17 | $ 0.17 | $ 0.18 | $ 0.18 | $ 0.19 | $ 0.19 | $ 0.20 | $ 0.21 | $ 0.21 | $ 0.22 | $ 0.22 |
| **Weighted Average** | **$ 0.15** | **$ 0.16** | **$ 0.16** | **$ 0.17** | **$ 0.17** | **$ 0.18** | **$ 0.18** | **$ 0.19** | **$ 0.19** | **$ 0.20** | **$ 0.21** |
| **Indirect + Direct Costs PPM** | **$ 1.46** | **$ 1.50** | **$ 1.54** | **$ 1.60** | **$ 1.65** | **$ 1.70** | **$ 1.75** | **$ 1.80** | **$ 1.86** | **$ 1.91** | **$ 1.97** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
LOW SCENARIO

| External Costs | | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cost per passenger mile | | | | | | | | | | |
| External Costs - Low | 2003 | | | | | | | | | | |
| Air Pollution | $ 0.0029 | $ 0.0029 | $ 0.0030 | $ 0.0031 | $ 0.0032 | $ 0.0033 | $ 0.0034 | $ 0.0035 | $ 0.0036 | $ 0.0037 | $ 0.0038 |
| Noise Pollution | $ 0.0023 | $ 0.0023 | $ 0.0023 | $ 0.0024 | $ 0.0025 | $ 0.0025 | $ 0.0026 | $ 0.0027 | $ 0.0028 | $ 0.0029 | $ 0.0030 |
| Solid Waste Disposal | N/A | | | | | | | | | | |
| Water Pollution | N/A | | | | | | | | | | |
| Accidents | $ 0.0021 | $ 0.0021 | $ 0.0021 | $ 0.0022 | $ 0.0023 | $ 0.0023 | $ 0.0024 | $ 0.0025 | $ 0.0025 | $ 0.0026 | $ 0.0027 |
| **Total External Costs per Passenger Mile** | **$0.006** | **$0.007** | **$0.007** | **$0.008** | **$0.008** | **$0.008** | **$0.008** | **$0.009** | **$0.009** | **$0.009** | **$0.009** |
| **External + Indirect + Direct Costs PPM** | | **$ 1.09** | **$ 1.12** | **$ 1.15** | **$ 1.19** | **$ 1.22** | **$ 1.26** | **$ 1.30** | **$ 1.34** | **$ 1.38** | **$ 1.42** |
| **Capital + Direct + Indirect + External Costs PPM** | | **$ 1.15** | **$ 1.18** | **$ 1.21** | **$ 1.24** | **$ 1.28** | **$ 1.32** | **$ 1.36** | **$ 1.40** | **$ 1.44** | **$ 1.48** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
LOW SCENARIO

| External Costs | | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cost per pass | | | | | | | | | | | |
| External Costs - Low | | | | | | | | | | | | |
| Air Pollution | | $ 0.0040 | $ 0.0041 | $ 0.0042 | $ 0.0043 | $ 0.0045 | $ 0.0046 | $ 0.0047 | $ 0.0049 | $ 0.0050 | $ 0.0052 | $ 0.0053 |
| Noise Pollution | | $ 0.0030 | $ 0.0031 | $ 0.0032 | $ 0.0033 | $ 0.0034 | $ 0.0035 | $ 0.0036 | $ 0.0037 | $ 0.0039 | $ 0.0040 | $ 0.0041 |
| Solid Waste Disposal | | | | | | | | | | | | |
| Water Pollution | | | | | | | | | | | | |
| Accidents | | $ 0.0028 | $ 0.0029 | $ 0.0029 | $ 0.0030 | $ 0.0031 | $ 0.0032 | $ 0.0033 | $ 0.0034 | $ 0.0035 | $ 0.0036 | $ 0.0037 |
| **Total External Costs per Passenger Mile** | | **$0.010** | **$0.010** | **$0.010** | **$0.011** | **$0.011** | **$0.011** | **$0.012** | **$0.012** | **$0.012** | **$0.013** | **$0.013** |
| **External + Indirect + Direct Costs PPM** | | **$ 1.46** | **$ 1.51** | **$ 1.55** | **$ 1.61** | **$ 1.66** | **$ 1.71** | **$ 1.76** | **$ 1.81** | **$ 1.87** | **$ 1.93** | **$ 1.98** |
| **Capital + Direct + Indirect + External Costs PPM** | | **$ 1.52** | **$ 1.56** | **$ 1.60** | **$ 1.66** | **$ 1.71** | **$ 1.76** | **$ 1.82** | **$ 1.87** | **$ 1.93** | **$ 1.98** | **$ 2.04** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

# Worksheet 5

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
HIGH SCENARIO

| | | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Airline Cost per Enplanement** | | | | | | | | | | | |
| {net pax pass through estimates} | | | | | | | | | | | |
| Vancouver, BC. | | $ 9.63 | $ 9.73 | $ 9.87 | $ 10.06 | $ 10.27 | $ 10.51 | $ 10.77 | $ 11.06 | $ 11.39 | $ 11.75 |
| Sea-Tac International | | $ 11.26 | $ 12.41 | $ 16.11 | $ 17.64 | $ 19.11 | $ 18.85 | $ 18.48 | $ 18.14 | $ 17.82 | $ 17.62 |
| Portland International | | $ 14.08 | $ 13.94 | $ 14.01 | $ 14.00 | $ 13.28 | $ 13.25 | $ 13.00 | $ 13.06 | $ 13.16 | $ 13.23 |
| Bellingham | | $ 9.63 | $ 9.73 | $ 9.87 | $ 10.06 | $ 10.27 | $ 10.51 | $ 10.77 | $ 11.06 | $ 11.39 | $ 11.75 |
| **Terminal Operating Costs per Enplanement** | | | | | | | | | | | |
| Vancouver, BC. | | $ 17.17 | $ 17.32 | $ 17.53 | $ 17.84 | $ 18.18 | $ 18.56 | $ 18.99 | $ 19.47 | $ 20.01 | $ 20.61 |
| Sea-Tac International | | $ 12.69 | $ 13.21 | $ 15.22 | $ 16.10 | $ 17.84 | $ 17.47 | $ 17.17 | $ 17.29 | $ 17.32 | $ 16.91 |
| Portland International | | $ 11.58 | $ 11.45 | $ 11.81 | $ 12.13 | $ 12.44 | $ 12.78 | $ 13.12 | $ 13.48 | $ 13.86 | $ 14.26 |
| Bellingham | | $ 11.58 | $ 11.45 | $ 11.81 | $ 12.13 | $ 12.44 | $ 12.78 | $ 13.12 | $ 13.48 | $ 13.86 | $ 14.26 |
| **Terminal Capital Costs per Enplanement** | | | | | | | | | | | |
| Vancouver, BC. | | $ 5.48 | $ 5.55 | $ 5.63 | $ 5.75 | $ 5.87 | $ 6.02 | $ 6.17 | $ 6.35 | $ 6.54 | $ 6.76 |
| Sea-Tac International | | $ 6.84 | $ 7.11 | $ 8.19 | $ 8.67 | $ 9.61 | $ 9.41 | $ 9.25 | $ 9.31 | $ 9.33 | $ 9.11 |
| Portland International | | $ 11.84 | $ 11.67 | $ 11.51 | $ 11.25 | $ 10.30 | $ 10.00 | $ 9.49 | $ 9.28 | $ 9.08 | $ 8.86 |
| Bellingham | | $ 5.48 | $ 5.55 | $ 5.63 | $ 5.75 | $ 5.87 | $ 6.02 | $ 6.17 | $ 6.35 | $ 6.54 | $ 6.76 |
| **Air Fares** | | | | | | | | | | | |
| Vancouver, BC - Seattle | | $ 136 | $ 140 | $ 144 | $ 148 | $ 153 | $ 157 | $ 162 | $ 167 | $ 172 | $ 177 |
| Seattle - Portland | | $ 139 | $ 143 | $ 147 | $ 151 | $ 156 | $ 161 | $ 165 | $ 170 | $ 175 | $ 181 |
| Vancouver, BC - Portland | | $ 224 | $ 230 | $ 237 | $ 244 | $ 252 | $ 259 | $ 267 | $ 275 | $ 283 | $ 292 |
| Bellingham - Seattle | | $ 122 | $ 125 | $ 129 | $ 133 | $ 137 | $ 141 | $ 145 | $ 149 | $ 154 | $ 159 |
| **Total per Pax Operating Costs** | | | | | | | | | | | |
| Vancouver, BC - Seattle | | $140 | $144 | $147 | $151 | $156 | $160 | $165 | $170 | $176 | $181 |
| Seattle - Portland | | $138 | $142 | $145 | $150 | $155 | $160 | $165 | $170 | $176 | $181 |
| Vancouver, BC - Portland | | $226 | $233 | $240 | $247 | $255 | $263 | $271 | $279 | $288 | $297 |
| Bellingham - Seattle | | $123 | $126 | $129 | $133 | $137 | $141 | $146 | $150 | $155 | $159 |
| **Total Pax Operating Costs per Pax Mile** | Miles | | | | | | | | | | |
| Vancouver, BC - Seattle | 120 | $1.17 | $1.20 | $1.23 | $1.26 | $1.30 | $1.34 | $1.38 | $1.42 | $1.46 | $1.51 |
| Seattle - Portland | 170 | $0.81 | $0.83 | $0.86 | $0.88 | $0.91 | $0.94 | $0.97 | $1.00 | $1.03 | $1.06 |
| Vancouver, BC - Portland | 290 | $0.78 | $0.80 | $0.83 | $0.85 | $0.88 | $0.91 | $0.93 | $0.96 | $0.99 | $1.02 |
| Bellingham - Seattle | 94 | $1.31 | $1.34 | $1.38 | $1.42 | $1.46 | $1.50 | $1.55 | $1.60 | $1.65 | $1.70 |
| **Corridor Weighted Average** | | **$0.97** | **$1.00** | **$1.02** | **$1.05** | **$1.09** | **$1.12** | **$1.16** | **$1.19** | **$1.23** | **$1.27** |
| **Total Pax Capital Costs per Pax Mile** | Demand | | | | | | | | | | |
| Vancouver, BC - Seattle | 28% | 0.05 | 0.05 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.07 | 0.07 | 0.07 |
| Seattle - Portland | 51% | 0.05 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.05 | 0.05 | 0.05 |
| Vancouver, BC - Portland | 8% | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Bellingham - Seattle | 13% | 0.07 | 0.07 | 0.07 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| **Corridor Weighted Average** | **100%** | **$0.05** | **$0.05** | **$0.06** | **$0.06** | **$0.06** | **$0.06** | **$0.06** | **$0.06** | **$0.06** | **$0.06** |
| **Enplanements** | | | | | | | | | | | |
| Vancouver | | 7.9 | 8.4 | 8.9 | 9.4 | 9.8 | 10.3 | 10.8 | 11.3 | 11.7 | 12.2 |
| Seattle | | 13.7 | 14.5 | 15.0 | 15.6 | 16.1 | 16.7 | 17.3 | 17.9 | 18.6 | 19.3 |
| Portland | | 5.9 | 6.3 | 6.5 | 6.7 | 6.9 | 7.2 | 7.4 | 7.6 | 7.9 | 8.1 |
| Total | | 27.6 | 29.3 | 30.4 | 31.7 | 32.9 | 34.2 | 35.5 | 36.8 | 38.2 | 39.5 |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
HIGH SCENARIO

| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Airline Cost per Enplanement** | | | | | | | | | | | |
| {net pax pass through estimates} | | | | | | | | | | | |
| Vancouver, BC. | $ 12.15 | $ 12.59 | $ 13.06 | $ 13.58 | $ 14.13 | $ 14.74 | $ 15.39 | $ 16.09 | $ 16.84 | $ 17.65 | $ 18.52 |
| Sea-Tac International | $ 17.37 | $ 17.12 | $ 16.64 | $ 16.69 | $ 16.74 | $ 16.80 | $ 16.85 | $ 16.91 | $ 16.96 | $ 17.01 | $ 17.07 |
| Portland International | $ 13.35 | $ 13.23 | $ 13.06 | $ 13.16 | $ 13.20 | $ 13.38 | $ 12.86 | $ 13.09 | $ 13.35 | $ 13.32 | $ 13.60 |
| Bellingham | $ 12.15 | $ 12.59 | $ 13.06 | $ 13.16 | $ 13.20 | $ 13.38 | $ 12.86 | $ 13.09 | $ 13.35 | $ 13.32 | $ 13.60 |
| **Terminal Operating Costs per Enplanement** | | | | | | | | | | | |
| Vancouver, BC. | $ 21.27 | $ 21.99 | $ 22.78 | $ 23.63 | $ 24.55 | $ 25.55 | $ 26.63 | $ 27.79 | $ 29.04 | $ 30.38 | $ 31.82 |
| Sea-Tac International | $ 16.06 | $ 15.16 | $ 14.15 | $ 16.35 | $ 16.50 | $ 16.66 | $ 16.82 | $ 16.98 | $ 17.14 | $ 17.30 | $ 17.47 |
| Portland International | $ 14.66 | $ 15.07 | $ 15.49 | $ 15.93 | $ 16.37 | $ 16.84 | $ 17.29 | $ 17.78 | $ 18.29 | $ 18.80 | $ 19.34 |
| Bellingham | $ 14.66 | $ 15.07 | $ 14.15 | $ 15.93 | $ 16.37 | $ 16.66 | $ 16.82 | $ 16.98 | $ 17.14 | $ 17.30 | $ 17.47 |
| **Terminal Capital Costs per Enplanement** | | | | | | | | | | | |
| Vancouver, BC. | $ 6.99 | $ 7.25 | $ 7.53 | $ 7.84 | $ 8.17 | $ 8.53 | $ 8.91 | $ 9.33 | $ 9.78 | $ 10.26 | $ 10.77 |
| Sea-Tac International | $ 8.65 | $ 8.16 | $ 7.62 | $ 8.80 | $ 8.89 | $ 8.97 | $ 9.06 | $ 9.14 | $ 9.23 | $ 9.32 | $ 9.41 |
| Portland International | $ 8.67 | $ 8.26 | $ 7.78 | $ 7.56 | $ 7.27 | $ 7.11 | $ 6.29 | $ 6.17 | $ 6.07 | $ 5.70 | $ 5.62 |
| Bellingham | $ 6.99 | $ 7.25 | $ 7.53 | $ 7.56 | $ 7.27 | $ 7.11 | $ 6.29 | $ 6.17 | $ 6.07 | $ 5.70 | $ 5.62 |
| **Air Fares** | | | | | | | | | | | |
| Vancouver, BC - Seattle | $ 182 | $ 188 | $ 193 | $ 199 | $ 205 | $ 211 | $ 217 | $ 224 | $ 231 | $ 238 | $ 245 |
| Seattle - Portland | $ 186 | $ 192 | $ 197 | $ 203 | $ 209 | $ 216 | $ 222 | $ 229 | $ 236 | $ 243 | $ 250 |
| Vancouver, BC - Portland | $ 300 | $ 309 | $ 319 | $ 328 | $ 338 | $ 348 | $ 359 | $ 369 | $ 380 | $ 392 | $ 404 |
| Bellingham - Seattle | $ 163 | $ 168 | $ 173 | $ 178 | $ 184 | $ 189 | $ 195 | $ 201 | $ 207 | $ 213 | $ 219 |
| **Total per Pax Operating Costs** | | | | | | | | | | | |
| Vancouver, BC - Seattle | $186 | $191 | $197 | $204 | $210 | $216 | $223 | $230 | $237 | $244 | $252 |
| Seattle - Portland | $186 | $192 | $197 | $205 | $211 | $217 | $224 | $231 | $238 | $246 | $253 |
| Vancouver, BC - Portland | $306 | $315 | $325 | $335 | $345 | $355 | $366 | $378 | $389 | $401 | $413 |
| Bellingham - Seattle | $164 | $168 | $173 | $180 | $185 | $191 | $197 | $203 | $209 | $215 | $222 |
| **Total Pax Operating Costs per Pax Mile** | | | | | | | | | | | |
| Vancouver, BC - Seattle | $1.55 | $1.59 | $1.64 | $1.70 | $1.75 | $1.80 | $1.86 | $1.92 | $1.97 | $2.03 | $2.10 |
| Seattle - Portland | $1.09 | $1.13 | $1.16 | $1.20 | $1.24 | $1.28 | $1.32 | $1.36 | $1.40 | $1.45 | $1.49 |
| Vancouver, BC - Portland | $1.05 | $1.09 | $1.12 | $1.15 | $1.19 | $1.23 | $1.26 | $1.30 | $1.34 | $1.38 | $1.42 |
| Bellingham - Seattle | $1.74 | $1.79 | $1.84 | $1.91 | $1.97 | $2.03 | $2.10 | $2.16 | $2.22 | $2.29 | $2.36 |
| **Corridor Weighted Average** | **$1.30** | **$1.34** | **$1.38** | **$1.43** | **$1.47** | **$1.52** | **$1.57** | **$1.61** | **$1.66** | **$1.71** | **$1.77** |
| **Total Pax Capital Costs per Pax Mile** | | | | | | | | | | | |
| Vancouver, BC - Seattle | 0.07 | 0.06 | 0.06 | 0.07 | 0.07 | 0.07 | 0.07 | 0.08 | 0.08 | 0.08 | 0.08 |
| Seattle - Portland | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.04 | 0.04 |
| Vancouver, BC - Portland | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Bellingham - Seattle | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.09 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| **Corridor Weighted Average** | **$0.06** | **$0.06** | **$0.05** | **$0.06** | **$0.06** | **$0.06** | **$0.06** | **$0.06** | **$0.06** | **$0.06** | **$0.06** |
| **Enplanements** | | | | | | | | | | | |
| Vancouver | 12.6 | 13.1 | 13.5 | 13.9 | 14.3 | 14.7 | 15.1 | 15.5 | 15.9 | 16.3 | 16.6 |
| Seattle | 20.0 | 20.7 | 21.4 | 22.2 | 23.0 | 23.8 | 24.7 | 25.6 | 26.5 | 27.4 | 28.4 |
| Portland | 8.4 | 8.6 | 8.9 | 9.2 | 9.4 | 9.7 | 10.0 | 10.3 | 10.7 | 11.0 | 11.3 |
| Total | 40.9 | 42.3 | 43.8 | 45.3 | 46.8 | 48.3 | 49.8 | 51.4 | 53.0 | 54.7 | 56.4 |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
HIGH SCENARIO

| **Vancouver International Airport** | **AAGR** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ($000s) | 50% | | | | | | | | | | |
| **Revenue** | | | | | | | | | | | |
| Landing Fees | 7% | 34,484 | 37,056 | 39,821 | 42,792 | 45,985 | 49,416 | 53,103 | 57,065 | 61,322 | 65,898 |
| Terminal Fees | 7% | 41,965 | 44,903 | 48,046 | 51,409 | 55,008 | 58,859 | 62,979 | 67,387 | 72,104 | 77,152 |
| Concessions | 7% | 43,036 | 46,048 | 49,272 | 52,721 | 56,411 | 60,360 | 64,585 | 69,106 | 73,944 | 79,120 |
| Airport Improvement Fees | 7% | 42,904 | 45,907 | 49,120 | 52,559 | 56,238 | 60,175 | 64,387 | 68,894 | 73,717 | 78,877 |
| Car Parking | 7% | 17,423 | 18,642 | 19,947 | 21,344 | 22,838 | 24,436 | 26,147 | 27,977 | 29,936 | 32,031 |
| Rentals, Fees and Miscellaneous | 7% | 32,434 | 34,704 | 37,133 | 39,733 | 42,514 | 45,490 | 48,674 | 52,081 | 55,727 | 59,628 |
| **Total Revenue** | | 212,245 | 227,261 | 243,340 | 260,558 | 278,994 | 298,735 | 319,875 | 342,511 | 366,750 | 392,705 |
| | | | | | | | | | | | |
| **Airline Revenues** | | 76,449 | 81,959 | 87,867 | 94,202 | 100,993 | 108,274 | 116,081 | 124,452 | 133,427 | 143,049 |
| Non-Airline Revenues | | 135,796 | 145,302 | 155,473 | 166,356 | 178,001 | 190,461 | 203,793 | 218,059 | 233,323 | 249,656 |
| Less Non-Pax Air Revenues | | (32,434) | (34,704) | (37,133) | (39,733) | (42,514) | (45,490) | (48,674) | (52,081) | (55,727) | (59,628) |
| **Total Air Pax Costs** | | 179,811 | 192,557 | 206,207 | 220,825 | 236,480 | 253,246 | 271,201 | 290,429 | 311,022 | 333,077 |
| | | | | | | | | | | | |
| **Capital vs. Operating Costs** | | | | | | | | | | | |
| Total Revenues | | 212,245 | 227,261 | 243,340 | 260,558 | 278,994 | 298,735 | 319,875 | 342,511 | 366,750 | 392,705 |
| Operating Expenditures | 7% | 160,865 | 172,126 | 184,175 | 197,067 | 210,862 | 225,622 | 241,415 | 258,314 | 276,396 | 295,744 |
| Capital Expenditures | | | | | | | | | | | |
| Interest and Financing | | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 |
| Equity Re-Invested | | 30,380 | 34,135 | 38,166 | 42,491 | 47,132 | 52,114 | 57,459 | 63,196 | 69,353 | 75,961 |
| Capital Expenditures | | 51,380 | 55,135 | 59,166 | 63,491 | 68,132 | 73,114 | 78,459 | 84,196 | 90,353 | 96,961 |
| Percent of Costs Allocated to Capital Expenditures | | 24.2% | 24.3% | 24.3% | 24.4% | 24.4% | 24.5% | 24.5% | 24.6% | 24.6% | 24.7% |
| | | | | | | | | | | | |
| **Enplanements + Deplanements (millions)** | | 15.9 | 16.8 | 17.8 | 18.7 | 19.7 | 20.6 | 21.6 | 22.5 | 23.4 | 24.3 |
| **Enplanements (millions)** | | 7.9 | 8.4 | 8.9 | 9.4 | 9.8 | 10.3 | 10.8 | 11.3 | 11.7 | 12.2 |
| | | | | | | | | | | | |
| **Airline Cost per Enplanement** | | $ 9.63 | $ 9.73 | $ 9.87 | $ 10.06 | $ 10.27 | $ 10.51 | $ 10.77 | $ 11.06 | $ 11.39 | $ 11.75 |
| **Total Pax Costs per Enplanement** | | $ 22.66 | $ 22.87 | $ 23.17 | $ 23.58 | $ 24.05 | $ 24.58 | $ 25.16 | $ 25.81 | $ 26.55 | $ 27.37 |
| **Net Pax Costs per Enplanement** | | $ 13.02 | $ 13.13 | $ 13.30 | $ 13.52 | $ 13.78 | $ 14.07 | $ 14.39 | $ 14.75 | $ 15.16 | $ 15.61 |
| **Total Capital Costs per Enplanement** | | $ 5.48 | $ 5.55 | $ 5.63 | $ 5.75 | $ 5.87 | $ 6.02 | $ 6.17 | $ 6.35 | $ 6.54 | $ 6.76 |
| **Total Operating Costs per Enplanement** | | $ 17.17 | $ 17.32 | $ 17.53 | $ 17.84 | $ 18.18 | $ 18.56 | $ 18.99 | $ 19.47 | $ 20.01 | $ 20.61 |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
HIGH SCENARIO

| **Vancouver International Airport** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ($000s) | | | | | | | | | | | |
| **Revenue** | | | | | | | | | | | |
| Landing Fees | 70,814 | 76,098 | 81,775 | 87,876 | 94,433 | 101,479 | 109,050 | 117,186 | 125,929 | 135,325 | 145,421 |
| Terminal Fees | 82,552 | 88,331 | 94,514 | 101,130 | 108,209 | 115,784 | 123,889 | 132,561 | 141,840 | 151,769 | 162,393 |
| Concessions | 84,658 | 90,584 | 96,925 | 103,710 | 110,970 | 118,737 | 127,049 | 135,942 | 145,458 | 155,641 | 166,535 |
| Airport Improvement Fees | 84,398 | 90,306 | 96,627 | 103,391 | 110,629 | 118,373 | 126,659 | 135,525 | 145,012 | 155,162 | 166,024 |
| Car Parking | 34,273 | 36,672 | 39,239 | 41,986 | 44,925 | 48,070 | 51,435 | 55,035 | 58,888 | 63,010 | 67,421 |
| Rentals, Fees and Miscellaneous | 63,802 | 68,268 | 73,047 | 78,160 | 83,631 | 89,486 | 95,750 | 102,452 | 109,624 | 117,297 | 125,508 |
| **Total Revenue** | 420,498 | 450,259 | 482,128 | 516,254 | 552,797 | 591,928 | 633,831 | 678,702 | 726,751 | 778,204 | 833,302 |
| | | | | | | | | | | | |
| **Airline Revenues** | 153,366 | 164,429 | 176,289 | 189,007 | 202,642 | 217,262 | 232,939 | 249,747 | 267,769 | 287,094 | 307,814 |
| Non-Airline Revenues | 267,131 | 285,831 | 305,839 | 327,247 | 350,155 | 374,666 | 400,892 | 428,955 | 458,982 | 491,110 | 525,488 |
| Less Non-Pax Air Revenues | (63,802) | (68,268) | (73,047) | (78,160) | (83,631) | (89,486) | (95,750) | (102,452) | (109,624) | (117,297) | (125,508) |
| **Total Air Pax Costs** | 356,696 | 381,991 | 409,081 | 438,094 | 469,166 | 502,442 | 538,081 | 576,250 | 617,127 | 660,907 | 707,794 |
| | | | | | | | | | | | |
| **Capital vs. Operating Costs** | | | | | | | | | | | |
| Total Revenues | 420,498 | 450,259 | 482,128 | 516,254 | 552,797 | 591,928 | 633,831 | 678,702 | 726,751 | 778,204 | 833,302 |
| Operating Expenditures | 316,446 | 338,598 | 362,299 | 387,660 | 414,797 | 443,832 | 474,901 | 508,144 | 543,714 | 581,774 | 622,498 |
| Capital Expenditures | | | | | | | | | | | |
| Interest and Financing | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 | 21,000 |
| Equity Re-Invested | 83,052 | 90,662 | 98,829 | 107,594 | 117,000 | 127,096 | 137,930 | 149,558 | 162,037 | 175,430 | 189,804 |
| Capital Expenditures | 104,052 | 111,662 | 119,829 | 128,594 | 138,000 | 148,096 | 158,930 | 170,558 | 183,037 | 196,430 | 210,804 |
| Percent of Costs Allocated to Capital Expenditure | 24.7% | 24.8% | 24.9% | 24.9% | 25.0% | 25.0% | 25.1% | 25.1% | 25.2% | 25.2% | 25.3% |
| | | | | | | | | | | | |
| **Enplanements + Deplanements (millions)** | 25.2 | 26.1 | 27.0 | 27.8 | 28.7 | 29.5 | 30.3 | 31.1 | 31.8 | 32.5 | 33.2 |
| **Enplanements (millions)** | 12.6 | 13.1 | 13.5 | 13.9 | 14.3 | 14.7 | 15.1 | 15.5 | 15.9 | 16.3 | 16.6 |
| | | | | | | | | | | | |
| **Airline Cost per Enplanement** | $ 12.15 | $ 12.59 | $ 13.06 | $ 13.58 | $ 14.13 | $ 14.74 | $ 15.39 | $ 16.09 | $ 16.84 | $ 17.65 | $ 18.52 |
| **Total Pax Costs per Enplanement** | $ 28.26 | $ 29.24 | $ 30.31 | $ 31.47 | $ 32.72 | $ 34.08 | $ 35.54 | $ 37.12 | $ 38.81 | $ 40.63 | $ 42.59 |
| **Net Pax Costs per Enplanement** | $ 16.11 | $ 16.66 | $ 17.25 | $ 17.89 | $ 18.59 | $ 19.34 | $ 20.15 | $ 21.03 | $ 21.97 | $ 22.98 | $ 24.07 |
| **Total Capital Costs per Enplanement** | $ 6.99 | $ 7.25 | $ 7.53 | $ 7.84 | $ 8.17 | $ 8.53 | $ 8.91 | $ 9.33 | $ 9.78 | $ 10.26 | $ 10.77 |
| **Total Operating Costs per Enplanement** | $ 21.27 | $ 21.99 | $ 22.78 | $ 23.63 | $ 24.55 | $ 25.55 | $ 26.63 | $ 27.79 | $ 29.04 | $ 30.38 | $ 31.82 |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
HIGH SCENARIO

| Sea-Tac International Airport | AAGR | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Revenues** | | | | | | | | | | | |
| Total Revenues | 5% | 266,477 | 301,335 | 364,234 | 400,963 | 458,752 | 472,421 | 484,513 | 497,094 | 510,479 | 526,512 |
| Airline Revenues | 4% | 154,322 | 180,076 | 242,320 | 274,835 | 308,414 | 315,250 | 320,116 | 325,504 | 331,299 | 339,322 |
| Non-Airline Revenues | | 112,155 | 121,259 | 121,914 | 126,127 | 150,337 | 157,171 | 164,397 | 171,590 | 179,179 | 187,190 |
| Security Reimbursement | | 3,675 | 0 | 0 | 0 | 0 | | | | | |
| Less: Non-Pax Revenues (% of Non-Airline Rev) | 6% | (2,469) | (6,441) | (12,223) | (15,000) | (15,721) | (22,931) | (26,851) | (19,641) | (15,000) | (25,407) |
| **Total Air Pax Costs** | | 267,683 | 294,894 | 352,012 | 385,963 | 443,031 | 449,490 | 457,663 | 477,453 | 495,479 | 501,104 |
| | | | | | | | | | | | |
| **Capital vs. Operating Costs** | | | | | | | | | | | |
| Total Revenues | | 266,477 | 301,335 | 364,234 | 400,963 | 458,752 | 472,421 | 484,513 | 497,094 | 510,479 | 526,512 |
| Operating Expenditures | 65% | 173,210 | 195,868 | 236,752 | 260,626 | 298,188 | 307,074 | 314,934 | 323,111 | 331,811 | 342,233 |
| Capital Expenditures | | | | | | | | | | | |
| Interest and Financing | | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 |
| Equity Re-Invested | | 66,267 | 78,467 | 100,482 | 113,337 | 133,563 | 138,347 | 142,580 | 146,983 | 151,668 | 157,279 |
| Captial Expenditures | | 93,267 | 105,467 | 127,482 | 140,337 | 160,563 | 165,347 | 169,580 | 173,983 | 178,668 | 184,279 |
| Percent of Costs Allocated to Capital Expenditures | | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% |
| | | | | | | | | | | | |
| **Total Enplanement** | 4% | 13.7 | 14.5 | 15.0 | 15.6 | 16.1 | 16.7 | 17.3 | 17.9 | 18.6 | 19.3 |
| | | | | | | | | | | | |
| **Airline Cost per Enplanement** | | $ 11.26 | $ 12.41 | $ 16.11 | $ 17.64 | $ 19.11 | $ 18.85 | $ 18.48 | $ 18.14 | $ 17.82 | $ 17.62 |
| **Total Pax Costs per Enplanement** | | $ 19.53 | $ 20.32 | $ 23.41 | $ 24.77 | $ 27.45 | $ 26.88 | $ 26.42 | $ 26.60 | $ 26.65 | $ 26.01 |
| **Net Pax Costs per Enplanement** | | $ 8.27 | $ 7.91 | $ 7.29 | $ 7.13 | $ 8.34 | $ 8.03 | $ 7.94 | $ 8.47 | $ 8.83 | $ 8.40 |
| **Total Capital Costs per Enplanement** | | $ 6.84 | $ 7.11 | $ 8.19 | $ 8.67 | $ 9.61 | $ 9.41 | $ 9.25 | $ 9.31 | $ 9.33 | $ 9.11 |
| **Total Operating Costs per Enplanement** | | $ 12.69 | $ 13.21 | $ 15.22 | $ 16.10 | $ 17.84 | $ 17.47 | $ 17.17 | $ 17.29 | $ 17.32 | $ 16.91 |

| Portland International Airport | AAGR | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Revenues** | | | | | | | | | | | |
| Total Revenues | | $146.1 | $155.0 | $160.7 | $166.4 | $167.4 | $173.2 | $177.7 | $184.7 | $192.1 | $199.7 |
| Airline Revenues | | $83.2 | $88.3 | $91.2 | $94.1 | $92.1 | $94.8 | $96.0 | $99.6 | $103.4 | $107.2 |
| Non-Airline Revenues | | $62.4 | $65.9 | $68.7 | $71.5 | $74.4 | $77.6 | $80.8 | $84.3 | $87.8 | $91.6 |
| Security Reimbursement | | | | | | | | | | | |
| Less: Non-Pax Revenues (% of Non-Airline Rev) | | -$7.2 | -$7.8 | -$8.1 | -$8.5 | -$8.9 | -$9.3 | -$9.8 | -$10.3 | -$10.9 | -$11.5 |
| **Total Air Pax Costs** | | $138.5 | $146.5 | $151.9 | $157.1 | $157.7 | $163.0 | $167.0 | $173.5 | $180.3 | $187.3 |
| | | | | | | | | | | | |
| **Capital vs. Operating Costs** | | | | | | | | | | | |
| Total Revenues | | $146.1 | $155.0 | $160.7 | $166.4 | $167.4 | $173.2 | $177.7 | $184.7 | $192.1 | $199.7 |
| Operating Expenditures | | $72.3 | $76.8 | $81.4 | $86.3 | $91.6 | $97.2 | $103.1 | $109.4 | $116.1 | $123.2 |
| Capital Expenditures | | | | | | | | | | | |
| Interest and Financing | | $56.4 | $49.3 | $49.6 | $49.7 | $44.9 | $43.2 | $41.2 | $41.1 | $41.2 | $40.9 |
| Equity Re-Invested | | $17.5 | $28.9 | $29.7 | $30.4 | $30.8 | $32.9 | $33.5 | $34.2 | $34.9 | $35.7 |
| Captial Expenditures | | $73.9 | $78.2 | $79.4 | $80.1 | $75.8 | $76.1 | $74.6 | $75.3 | $76.1 | $76.5 |
| Percent of Costs Allocated to Capital Expenditures | | 50.5% | 50.5% | 49.4% | 48.1% | 45.3% | 43.9% | 42.0% | 40.8% | 39.6% | 38.3% |
| | | | | | | | | | | | |
| **Total Enplanement (PDX forecasts)** | | 5.9 | 6.3 | 6.5 | 6.7 | 6.9 | 7.2 | 7.4 | 7.6 | 7.9 | 8.1 |
| | | | | | | | | | | | |
| **Airline Cost per Enplanement** | | $ 14.08 | $ 13.94 | $ 14.01 | $ 14.00 | $ 13.28 | $ 13.25 | $ 13.00 | $ 13.06 | $ 13.16 | $ 13.23 |
| **Total Pax Costs per Enplanement** | | $ 23.42 | $ 23.12 | $ 23.32 | $ 23.38 | $ 22.74 | $ 22.78 | $ 22.61 | $ 22.76 | $ 22.95 | $ 23.12 |
| **Net Pax Costs per Enplanement** | | $ 9.35 | $ 9.18 | $ 9.31 | $ 9.38 | $ 9.45 | $ 9.53 | $ 9.61 | $ 9.70 | $ 9.79 | $ 9.89 |
| **Total Capital Costs per Enplanement** | | $ 11.84 | $ 11.67 | $ 11.51 | $ 11.25 | $ 10.30 | $ 10.00 | $ 9.49 | $ 9.28 | $ 9.08 | $ 8.86 |
| **Total Operating Costs per Enplanement** | | $ 11.58 | $ 11.45 | $ 11.81 | $ 12.13 | $ 12.44 | $ 12.78 | $ 13.12 | $ 13.48 | $ 13.86 | $ 14.26 |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
HIGH SCENARIO

| Sea-Tac International Airport | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Revenues** | | | | | | | | | | | |
| Total Revenues | 542,251 | 558,480 | 570,354 | 596,514 | 623,874 | 652,489 | 682,416 | 713,717 | 746,452 | 780,690 | 816,497 |
| Airline Revenues | 346,606 | 353,908 | 356,354 | 370,366 | 384,929 | 400,065 | 415,795 | 432,144 | 449,136 | 466,796 | 485,151 |
| Non-Airline Revenues | 195,645 | 204,572 | 213,999 | 226,147 | 238,945 | 252,424 | 266,621 | 281,572 | 297,316 | 313,893 | 331,347 |
| Security Reimbursement | | | | | | | | | | | |
| Less: Non-Pax Revenues (% of Non-Airline Rev) | (49,192) | (76,224) | (104,157) | (38,509) | (40,275) | (42,123) | (44,055) | (46,075) | (48,189) | (50,399) | (52,710) |
| **Total Air Pax Costs** | 493,059 | 482,255 | 466,196 | 558,005 | 583,599 | 610,366 | 638,362 | 667,641 | 698,264 | 730,291 | 763,787 |
| | | | | | | | | | | | |
| **Capital vs. Operating Costs** | | | | | | | | | | | |
| Total Revenues | 542,251 | 558,480 | 570,354 | 596,514 | 623,874 | 652,489 | 682,416 | 713,717 | 746,452 | 780,690 | 816,497 |
| Operating Expenditures | 352,463 | 363,012 | 370,730 | 387,734 | 405,518 | 424,118 | 443,571 | 463,916 | 485,194 | 507,448 | 530,723 |
| Capital Expenditures | | | | | | | | | | | |
| Interest and Financing | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 | 27,000 |
| Equity Re-Invested | 162,788 | 168,468 | 172,624 | 181,780 | 191,356 | 201,371 | 211,846 | 222,801 | 234,258 | 246,241 | 258,774 |
| Captial Expenditures | 189,788 | 195,468 | 199,624 | 208,780 | 218,356 | 228,371 | 238,846 | 249,801 | 261,258 | 273,241 | 285,774 |
| Percent of Costs Allocated to Capital Expenditure | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% | 35.0% |
| | | | | | | | | | | | |
| **Total Enplanement** | 20.0 | 20.7 | 21.4 | 22.2 | 23.0 | 23.8 | 24.7 | 25.6 | 26.5 | 27.4 | 28.4 |
| | | | | | | | | | | | |
| **Airline Cost per Enplanement** | $ 17.37 | $ 17.12 | $ 16.64 | $ 16.69 | $ 16.74 | $ 16.80 | $ 16.85 | $ 16.91 | $ 16.96 | $ 17.01 | $ 17.07 |
| **Total Pax Costs per Enplanement** | $ 24.71 | $ 23.33 | $ 21.77 | $ 25.15 | $ 25.39 | $ 25.63 | $ 25.87 | $ 26.12 | $ 26.37 | $ 26.62 | $ 26.87 |
| **Net Pax Costs per Enplanement** | $ 7.34 | $ 6.21 | $ 5.13 | $ 8.46 | $ 8.64 | $ 8.83 | $ 9.02 | $ 9.21 | $ 9.41 | $ 9.60 | $ 9.80 |
| **Total Capital Costs per Enplanement** | $ 8.65 | $ 8.16 | $ 7.62 | $ 8.80 | $ 8.89 | $ 8.97 | $ 9.06 | $ 9.14 | $ 9.23 | $ 9.32 | $ 9.41 |
| **Total Operating Costs per Enplanement** | $ 16.06 | $ 15.16 | $ 14.15 | $ 16.35 | $ 16.50 | $ 16.66 | $ 16.82 | $ 16.98 | $ 17.14 | $ 17.30 | $ 17.47 |

| Portland International Airport | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Revenues** | | | | | | | | | | | |
| Total Revenues | $207.9 | $214.6 | $221.1 | $230.2 | $239.3 | $250.1 | $254.4 | $266.7 | $279.9 | $290.6 | $305.4 |
| Airline Revenues | $111.5 | $114.0 | $116.0 | $120.5 | $124.6 | $130.2 | $129.0 | $135.4 | $142.3 | $146.4 | $154.1 |
| Non-Airline Revenues | $95.5 | $99.7 | $104.0 | $108.7 | $113.6 | $118.8 | $124.3 | $130.1 | $136.3 | $142.9 | $149.9 |
| Security Reimbursement | | | | | | | | | | | |
| Less: Non-Pax Revenues (% of Non-Airline Rev) | -$12.1 | -$12.7 | -$13.4 | -$14.2 | -$15.0 | -$15.9 | -$16.8 | -$17.8 | -$18.8 | -$20.0 | -$21.2 |
| **Total Air Pax Costs** | $194.9 | $200.9 | $206.6 | $215.0 | $223.2 | $233.1 | $236.5 | $247.8 | $259.8 | $269.4 | $282.9 |
| | | | | | | | | | | | |
| **Capital vs. Operating Costs** | | | | | | | | | | | |
| Total Revenues | $207.9 | $214.6 | $221.1 | $230.2 | $239.3 | $250.1 | $254.4 | $266.7 | $279.9 | $290.6 | $305.4 |
| Operating Expenditures | $130.7 | $138.7 | $147.1 | $156.1 | $165.7 | $175.8 | $186.6 | $198.0 | $210.1 | $223.0 | $236.6 |
| Capital Expenditures | | | | | | | | | | | |
| Interest and Financing | $40.9 | $39.5 | $37.2 | $36.6 | $34.8 | $34.6 | $28.2 | $28.2 | $28.2 | $23.9 | $24.0 |
| Equity Re-Invested | $36.4 | $36.4 | $36.7 | $37.5 | $38.8 | $39.7 | $39.7 | $40.6 | $41.6 | $43.7 | $44.8 |
| Captial Expenditures | $77.3 | $76.0 | $73.9 | $74.1 | $73.6 | $74.3 | $67.9 | $68.7 | $69.8 | $67.6 | $68.7 |
| Percent of Costs Allocated to Capital Expenditure | 37.2% | 35.4% | 33.4% | 32.2% | 30.8% | 29.7% | 26.7% | 25.8% | 24.9% | 23.3% | 22.5% |
| | | | | | | | | | | | |
| **Total Enplanement (PDX forecasts)** | 8.4 | 8.6 | 8.9 | 9.2 | 9.4 | 9.7 | 10.0 | 10.3 | 10.7 | 11.0 | 11.3 |
| | | | | | | | | | | | |
| **Airline Cost per Enplanement** | $ 13.35 | $ 13.23 | $ 13.06 | $ 13.16 | $ 13.20 | $ 13.38 | $ 12.86 | $ 13.09 | $ 13.35 | $ 13.32 | $ 13.60 |
| **Total Pax Costs per Enplanement** | $ 23.33 | $ 23.33 | $ 23.27 | $ 23.48 | $ 23.65 | $ 23.95 | $ 23.57 | $ 23.96 | $ 24.37 | $ 24.50 | $ 24.96 |
| **Net Pax Costs per Enplanement** | $ 9.99 | $ 10.09 | $ 10.20 | $ 10.32 | $ 10.44 | $ 10.58 | $ 10.71 | $ 10.86 | $ 11.02 | $ 11.18 | $ 11.36 |
| **Total Capital Costs per Enplanement** | $ 8.67 | $ 8.26 | $ 7.78 | $ 7.56 | $ 7.27 | $ 7.11 | $ 6.29 | $ 6.17 | $ 6.07 | $ 5.70 | $ 5.62 |
| **Total Operating Costs per Enplanement** | $ 14.66 | $ 15.07 | $ 15.49 | $ 15.93 | $ 16.37 | $ 16.84 | $ 17.29 | $ 17.78 | $ 18.29 | $ 18.80 | $ 19.34 |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
HIGH SCENARIO

| Indirect Costs - High | | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time costs (by route)** | | | | | | | | | | | |
| **Seattle to Portland** | 170 Miles | | | | | | | | | | |
| Travel Time (Hours) With Terminal Time | | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 |
| Average Hourly Wage Rate | | 18.62 | 19.18 | 19.76 | 20.35 | 20.96 | 21.59 | 22.24 | 22.90 | 23.59 | 24.30 |
| Value of Travel Time for Business Travelers (% | 70% | 13.04 | 13.43 | 13.83 | 14.25 | 14.67 | 15.11 | 15.57 | 16.03 | 16.51 | 17.01 |
| Percentage of Business Travelers | 73% | | | | | | | | | | |
| Value of Travel Time for Non-Business Travelers | 35% | 6.52 | 6.71 | 6.92 | 7.12 | 7.34 | 7.56 | 7.78 | 8.02 | 8.26 | 8.50 |
| Percentage of Non-Business Travelers | 27% | | | | | | | | | | |
| Time Cost per Passenger Mile - Weighted Average | | $ 0.17 | $ 0.18 | $ 0.18 | $ 0.19 | $ 0.19 | $ 0.20 | $ 0.20 | $ 0.21 | $ 0.22 | $ 0.22 |
| **Seattle to Vancouver** | 120 Miles | | | | | | | | | | |
| Travel Time (Hours) With Terminal Time | | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 |
| Average Hourly Wage Rate | | 18.62 | 19.18 | 19.76 | 20.35 | 20.96 | 21.59 | 22.24 | 22.90 | 23.59 | 24.30 |
| Value of Travel Time for Business Travelers (% | 35% | 13.04 | 13.43 | 13.83 | 14.25 | 14.67 | 15.11 | 15.57 | 16.03 | 16.51 | 17.01 |
| Percentage of Business Travelers | 73% | | | | | | | | | | |
| Value of Travel Time for Non-Business Travelers | 18% | 6.52 | 6.71 | 6.92 | 7.12 | 7.34 | 7.56 | 7.78 | 8.02 | 8.26 | 8.50 |
| Percentage of Non-Business Travelers | 27% | | | | | | | | | | |
| Time Cost per Passenger Mile - Weighted Average | | $ 0.27 | $ 0.27 | $ 0.28 | $ 0.29 | $ 0.30 | $ 0.31 | $ 0.32 | $ 0.33 | $ 0.34 | $ 0.35 |
| **Vancouver to Portland** | 290 Miles | | | | | | | | | | |
| Travel Time (Hours) With Terminal Time | | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 |
| Average Hourly Wage Rate | | 18.62 | 19.18 | 19.76 | 20.35 | 20.96 | 21.59 | 22.24 | 22.90 | 23.59 | 24.30 |
| Value of Travel Time for Business Travelers (% | 70% | 13.04 | 13.43 | 13.83 | 14.25 | 14.67 | 15.11 | 15.57 | 16.03 | 16.51 | 17.01 |
| Percentage of Business Travelers | 73% | | | | | | | | | | |
| Value of Travel Time for Non-Business Travelers | 35% | 6.52 | 6.71 | 6.92 | 7.12 | 7.34 | 7.56 | 7.78 | 8.02 | 8.26 | 8.50 |
| Percentage of Non-Business Travelers | 27% | | | | | | | | | | |
| Time Cost per Passenger Mile - Weighted Average | | $ 0.13 | 0.13 | 0.13 | 0.14 | 0.14 | 0.15 | 0.15 | 0.16 | 0.16 | 0.16 |
| **Seattle to Bellingham** | 94 Miles | | | | | | | | | | |
| Travel Time (Hours) With Terminal Time | | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 |
| Average Hourly Wage Rate | | $ 18.62 | $ 19.18 | $ 19.76 | $ 20.35 | $ 20.96 | $ 21.59 | $ 22.24 | $ 22.90 | $ 23.59 | $ 24.30 |
| Value of Travel Time for Business Travelers (% | 70% | $ 13.04 | $ 13.43 | $ 13.83 | $ 14.25 | $ 14.67 | $ 15.11 | $ 15.57 | $ 16.03 | $ 16.51 | $ 17.01 |
| Percentage of Business Travelers | 73% | | | | | | | | | | |
| Value of Travel Time for Non-Business Travelers | 35% | $ 0.85 | $ 0.85 | $ 0.85 | $ 0.85 | $ 0.85 | $ 0.85 | $ 0.85 | $ 0.85 | $ 0.85 | $ 0.85 |
| Percentage of Non-Business Travelers | 27% | | | | | | | | | | |
| Time Cost per Passenger Mile - Weighted Average | | $ 0.25 | $ 0.26 | $ 0.27 | $ 0.27 | $ 0.28 | $ 0.29 | $ 0.30 | $ 0.31 | $ 0.32 | $ 0.33 |
| **Total Indirect Costs per Passenger Mile** | Miles | | | | | | | | | | |
| Seattle to Portland | 170 | $ 0.17 | $ 0.18 | $ 0.18 | $ 0.19 | $ 0.19 | $ 0.20 | $ 0.20 | $ 0.21 | $ 0.22 | $ 0.22 |
| Seattle to Vancouver | 120 | $ 0.27 | $ 0.27 | $ 0.28 | $ 0.29 | $ 0.30 | $ 0.31 | $ 0.32 | $ 0.33 | $ 0.34 | $ 0.35 |
| Vancouver to Portland | 290 | $ 0.13 | $ 0.13 | $ 0.13 | $ 0.14 | $ 0.14 | $ 0.15 | $ 0.15 | $ 0.16 | $ 0.16 | $ 0.16 |
| Seattle to Bellingham | 94 | $ 0.25 | $ 0.26 | $ 0.27 | $ 0.27 | $ 0.28 | $ 0.29 | $ 0.30 | $ 0.31 | $ 0.32 | $ 0.33 |
| **Weighted Average** | | **$ 0.23** | **$ 0.23** | **$ 0.24** | **$ 0.25** | **$ 0.25** | **$ 0.26** | **$ 0.27** | **$ 0.28** | **$ 0.29** | **$ 0.30** |
| **Indirect + Direct Costs PPM** | | **$ 1.20** | **$ 1.23** | **$ 1.26** | **$ 1.30** | **$ 1.34** | **$ 1.38** | **$ 1.43** | **$ 1.47** | **$ 1.52** | **$ 1.56** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
HIGH SCENARIO

| Indirect Costs - High | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time costs (by route)** | | | | | | | | | | | |
| **Seattle to Portland** | | | | | | | | | | | |
| Travel Time (Hours) With Terminal Time | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 | 2.58 |
| Average Hourly Wage Rate | 25.03 | 25.78 | 26.55 | 27.35 | 28.17 | 29.01 | 29.88 | 30.78 | 31.70 | 32.66 | 33.64 |
| Value of Travel Time for Business Travelers (% c | 17.52 | 18.05 | 18.59 | 19.14 | 19.72 | 20.31 | 20.92 | 21.55 | 22.19 | 22.86 | 23.55 |
| Percentage of Business Travelers | | | | | | | | | | | |
| Value of Travel Time for Non-Business Travelers | 8.76 | 9.02 | 9.29 | 9.57 | 9.86 | 10.16 | 10.46 | 10.77 | 11.10 | 11.43 | 11.77 |
| Percentage of Non-Business Travelers | | | | | | | | | | | |
| Time Cost per Passenger Mile - Weighted Avera( | $ 0.23 | $ 0.24 | $ 0.24 | $ 0.25 | $ 0.26 | $ 0.27 | $ 0.27 | $ 0.28 | $ 0.29 | $ 0.30 | $ 0.31 |
| **Seattle to Vancouver** | | | | | | | | | | | |
| Travel Time (Hours) With Terminal Time | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 |
| Average Hourly Wage Rate | 25.03 | 25.78 | 26.55 | 27.35 | 28.17 | 29.01 | 29.88 | 30.78 | 31.70 | 32.66 | 33.64 |
| Value of Travel Time for Business Travelers (% c | 17.52 | 18.05 | 18.59 | 19.14 | 19.72 | 20.31 | 20.92 | 21.55 | 22.19 | 22.86 | 23.55 |
| Percentage of Business Travelers | | | | | | | | | | | |
| Value of Travel Time for Non-Business Travelers | 8.76 | 9.02 | 9.29 | 9.57 | 9.86 | 10.16 | 10.46 | 10.77 | 11.10 | 11.43 | 11.77 |
| Percentage of Non-Business Travelers | | | | | | | | | | | |
| Time Cost per Passenger Mile - Weighted Avera( | $ 0.36 | $ 0.37 | $ 0.38 | $ 0.39 | $ 0.40 | $ 0.41 | $ 0.43 | $ 0.44 | $ 0.45 | $ 0.47 | $ 0.48 |
| **Vancouver to Portland** | | | | | | | | | | | |
| Travel Time (Hours) With Terminal Time | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 |
| Average Hourly Wage Rate | 25.03 | 25.78 | 26.55 | 27.35 | 28.17 | 29.01 | 29.88 | 30.78 | 31.70 | 32.66 | 33.64 |
| Value of Travel Time for Business Travelers (% c | 17.52 | 18.05 | 18.59 | 19.14 | 19.72 | 20.31 | 20.92 | 21.55 | 22.19 | 22.86 | 23.55 |
| Percentage of Business Travelers | | | | | | | | | | | |
| Value of Travel Time for Non-Business Travelers | 8.76 | 9.02 | 9.29 | 9.57 | 9.86 | 10.16 | 10.46 | 10.77 | 11.10 | 11.43 | 11.77 |
| Percentage of Non-Business Travelers | | | | | | | | | | | |
| Time Cost per Passenger Mile - Weighted Avera( | 0.17 | 0.17 | 0.18 | 0.19 | 0.19 | 0.20 | 0.20 | 0.21 | 0.22 | 0.22 | 0.23 |
| **Seattle to Bellingham** | | | | | | | | | | | |
| Travel Time (Hours) With Terminal Time | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 | 2.42 |
| Average Hourly Wage Rate | $ 25.03 | $ 25.78 | $ 26.55 | $ 27.35 | $ 28.17 | $ 29.01 | $ 29.88 | $ 30.78 | $ 31.70 | $ 32.66 | $ 33.64 |
| Value of Travel Time for Business Travelers (% c | $ 17.52 | $ 18.05 | $ 18.59 | $ 19.14 | $ 19.72 | $ 20.31 | $ 20.92 | $ 21.55 | $ 22.19 | $ 22.86 | $ 23.55 |
| Percentage of Business Travelers | | | | | | | | | | | |
| Value of Travel Time for Non-Business Travelers | $ 0.85 | $ 0.85 | $ 0.85 | $ 0.85 | $ 0.85 | $ 0.85 | $ 0.85 | $ 0.85 | $ 0.85 | $ 0.85 | $ 0.85 |
| Percentage of Non-Business Travelers | | | | | | | | | | | |
| Time Cost per Passenger Mile - Weighted Avera( | $ 0.33 | $ 0.34 | $ 0.35 | $ 0.37 | $ 0.38 | $ 0.39 | $ 0.40 | $ 0.41 | $ 0.42 | $ 0.43 | $ 0.45 |
| **Total Indirect Costs per Passenger Mile** | | | | | | | | | | | |
| Seattle to Portland | $ 0.23 | $ 0.24 | $ 0.24 | $ 0.25 | $ 0.26 | $ 0.27 | $ 0.27 | $ 0.28 | $ 0.29 | $ 0.30 | $ 0.31 |
| Seattle to Vancouver | $ 0.36 | $ 0.37 | $ 0.38 | $ 0.39 | $ 0.40 | $ 0.41 | $ 0.43 | $ 0.44 | $ 0.45 | $ 0.47 | $ 0.48 |
| Vancouver to Portland | $ 0.17 | $ 0.17 | $ 0.18 | $ 0.19 | $ 0.19 | $ 0.20 | $ 0.20 | $ 0.21 | $ 0.22 | $ 0.22 | $ 0.23 |
| Seattle to Bellingham | $ 0.33 | $ 0.34 | $ 0.35 | $ 0.37 | $ 0.38 | $ 0.39 | $ 0.40 | $ 0.41 | $ 0.42 | $ 0.43 | $ 0.45 |
| **Weighted Average** | **$ 0.30** | **$ 0.31** | **$ 0.32** | **$ 0.33** | **$ 0.34** | **$ 0.35** | **$ 0.36** | **$ 0.37** | **$ 0.39** | **$ 0.40** | **$ 0.41** |
| **Indirect + Direct Costs PPM** | **$ 1.61** | **$ 1.65** | **$ 1.70** | **$ 1.76** | **$ 1.82** | **$ 1.87** | **$ 1.93** | **$ 1.99** | **$ 2.05** | **$ 2.11** | **$ 2.17** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
HIGH SCENARIO

| External Costs | | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cost per passenger mile | | | | | | | | | | |
| External Costs - High | 2003 | | | | | | | | | | |
| Air Pollution | $ 0.0044 | $ 0.0044 | $ 0.0045 | $ 0.0046 | $ 0.0048 | $ 0.0049 | $ 0.0051 | $ 0.0052 | $ 0.0054 | $ 0.0055 | $ 0.0057 |
| Noise Pollution | $ 0.0181 | $ 0.0181 | $ 0.0187 | $ 0.0192 | $ 0.0198 | $ 0.0204 | $ 0.0210 | $ 0.0216 | $ 0.0223 | $ 0.0229 | $ 0.0236 |
| Solid Waste Disposal | N/A | | | | | | | | | | |
| Water Pollution | N/A | | | | | | | | | | |
| Accidents | $ 0.0032 | $ 0.0032 | $ 0.0032 | $ 0.0033 | $ 0.0034 | $ 0.0036 | $ 0.0037 | $ 0.0038 | $ 0.0039 | $ 0.0040 | $ 0.0041 |
| **Total External Costs per Passenger Mile** | **$0.006** | **$0.026** | **$0.026** | **$0.027** | **$0.028** | **$0.029** | **$0.030** | **$0.031** | **$0.032** | **$0.032** | **$0.033** |
| **External + Indirect + Direct Costs PPM** | | **$ 1.22** | **$ 1.26** | **$ 1.29** | **$ 1.33** | **$ 1.37** | **$ 1.41** | **$ 1.46** | **$ 1.50** | **$ 1.55** | **$ 1.59** |
| **Capital + Direct + Indirect + External Costs PPM** | | **$ 1.28** | **$ 1.31** | **$ 1.35** | **$ 1.39** | **$ 1.43** | **$ 1.47** | **$ 1.52** | **$ 1.56** | **$ 1.61** | **$ 1.65** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AIR TRAVEL COST-EFFECTIVENESS
HIGH SCENARIO

| External Costs | | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cost per pass | | | | | | | | | | | |
| External Costs - High | | | | | | | | | | | | |
| Air Pollution | | $ 0.0059 | $ 0.0060 | $ 0.0062 | $ 0.0064 | $ 0.0066 | $ 0.0068 | $ 0.0070 | $ 0.0072 | $ 0.0074 | $ 0.0077 | $ 0.0079 |
| Noise Pollution | | $ 0.0243 | $ 0.0251 | $ 0.0258 | $ 0.0266 | $ 0.0274 | $ 0.0282 | $ 0.0291 | $ 0.0299 | $ 0.0308 | $ 0.0318 | $ 0.0327 |
| Solid Waste Disposal | | | | | | | | | | | | |
| Water Pollution | | | | | | | | | | | | |
| Accidents | | $ 0.0042 | $ 0.0044 | $ 0.0045 | $ 0.0046 | $ 0.0048 | $ 0.0049 | $ 0.0051 | $ 0.0052 | $ 0.0054 | $ 0.0055 | $ 0.0057 |
| **Total External Costs per Passenger Mile** | | **$0.034** | **$0.035** | **$0.037** | **$0.038** | **$0.039** | **$0.040** | **$0.041** | **$0.042** | **$0.044** | **$0.045** | **$0.046** |
| **External + Indirect + Direct Costs PPM** | | **$ 1.64** | **$ 1.69** | **$ 1.74** | **$ 1.80** | **$ 1.85** | **$ 1.91** | **$ 1.97** | **$ 2.03** | **$ 2.09** | **$ 2.16** | **$ 2.22** |
| **Capital + Direct + Indirect + External Costs PP** | | **$ 1.70** | **$ 1.74** | **$ 1.79** | **$ 1.86** | **$ 1.91** | **$ 1.97** | **$ 2.03** | **$ 2.09** | **$ 2.15** | **$ 2.21** | **$ 2.28** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

# Worksheet 6

INTERCITY AUTO TRAVEL COST-EFFECTIVENESS ANALYSIS
LOW SCENARIO

| | | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Capital Investments (03$; millions)** | Totals | | | | | | | | | | |
| Mobility Investments | 5,830.78 | 291.54 | 291.54 | 291.54 | 291.54 | 291.54 | 291.54 | 291.54 | 291.54 | 291.54 | 291.54 |
| Safety Investments | 0.15 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Environmental Retrofit Investments | 258.70 | 12.93 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 |
| Economic Initiatives | 8.71 | 0.44 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Stormwater | 13.84 | 0.69 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Total Capital Improvements (const$) | 6,112.18 | 305.61 | 292.25 | 292.25 | 292.25 | 292.25 | 292.25 | 292.25 | 292.25 | 292.25 | 292.25 |
| | | | | | | | | | | | |
| **Captial Investments (Year of Expenditure $s)** | | | | | | | | | | | |
| Mobility Investments | | 291.54 | 300.29 | 309.29 | 318.57 | 328.13 | 337.97 | 348.11 | 358.56 | 369.31 | 380.39 |
| Safety Investments | | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Environmental Retrofit Investments | | 13.72 | 0.67 | 0.69 | 0.71 | 0.73 | 0.75 | 0.77 | 0.80 | 0.82 | 0.84 |
| Economic Initiatives | | 0.46 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Stormwater | | 0.73 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 |
| Total Capital Improvements | | 306.47 | 301.02 | 310.05 | 319.35 | 328.93 | 338.80 | 348.96 | 359.43 | 370.21 | 381.32 |
| | | | | | | | | | | | |
| **Cumulative Annualized Expenditures** | | | | | | | | | | | |
| Mobility Investments | 30 yrs | $17.90 | $36.33 | $55.32 | $74.88 | $95.02 | $115.77 | $137.14 | $159.16 | $181.83 | $205.18 |
| Safety Investments | | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.01 |
| Environmental Retrofit Investments | | $0.84 | $0.88 | $0.93 | $0.97 | $1.01 | $1.06 | $1.11 | $1.16 | $1.21 | $1.26 |
| Economic Initiatives | | $0.03 | $0.03 | $0.03 | $0.03 | $0.03 | $0.04 | $0.04 | $0.04 | $0.04 | $0.04 |
| Stormwater | | $0.05 | $0.05 | $0.05 | $0.05 | $0.05 | $0.06 | $0.06 | $0.06 | $0.06 | $0.07 |
| *Less "expired" capital* | | | | | | | | | | | |
| Mobility Investments | | | | | | | | | | | |
| Safety Investments | | | | | | | | | | | |
| Environmental Retrofit Investments | | | | | | | | | | | |
| Economic Initiatives | | | | | | | | | | | |
| Stormwater | | | | | | | | | | | |
| Total Capital Improvements | | $18.81 | $37.29 | $56.33 | $75.93 | $96.13 | $116.93 | $138.35 | $160.42 | $183.14 | $206.55 |
| | | | | | | | | | | | |
| Annual Passenger Miles (millions) | | 18,100.0 | 18,510.6 | 18,930.6 | 19,360.0 | 19,799.2 | 20,248.4 | 20,707.8 | 21,177.6 | 21,658.1 | 22,149.5 |
| **Capital Costs per Passenger Mile** | | **$ 0.001** | **$ 0.002** | **$ 0.003** | **$ 0.004** | **$ 0.005** | **$ 0.006** | **$ 0.007** | **$ 0.008** | **$ 0.008** | **$ 0.009** |
| | | | | | | | | | | | |
| **Operations Inflated** | 20-yr allocation | | | | | | | | | | |
| Highway Maintenance | 600.66 | $ 31.86 | $ 32.82 | $ 33.80 | $ 34.82 | $ 35.86 | $ 36.94 | $ 38.04 | $ 39.19 | $ 40.36 | $ 41.57 |
| Pavement Preservation | 815.40 | $ 43.25 | $ 44.55 | $ 45.89 | $ 47.26 | $ 48.68 | $ 50.14 | $ 51.65 | $ 53.20 | $ 54.79 | $ 56.44 |
| Total Operations - Inflated $ | | $ 75.11 | $ 77.37 | $ 79.69 | $ 82.08 | $ 84.54 | $ 87.08 | $ 89.69 | $ 92.38 | $ 95.15 | $ 98.01 |
| Annual Passenger Miles | | 18,100.0 | 18,510.6 | 18,930.6 | 19,360.0 | 19,799.2 | 20,248.4 | 20,707.8 | 21,177.6 | 21,658.1 | 22,149.5 |
| **Operating Costs Per Passenger Mile** | | **$ 0.004** | **$ 0.004** | **$ 0.004** | **$ 0.004** | **$ 0.004** | **$ 0.004** | **$ 0.004** | **$ 0.004** | **$ 0.004** | **$ 0.004** |
| **Total Annualized Facility Costs** | | **$ 93.9** | **$ 114.7** | **$ 136.0** | **$ 158.0** | **$ 180.7** | **$ 204.0** | **$ 228.0** | **$ 252.8** | **$ 278.3** | **$ 304.6** |
| | | | | | | | | | | | |
| **Total WSDOT Costs Per Passenger Mile** | | **$ 0.005** | **$ 0.006** | **$ 0.007** | **$ 0.008** | **$ 0.009** | **$ 0.010** | **$ 0.011** | **$ 0.012** | **$ 0.013** | **$ 0.014** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AUTO TRAVEL COST-EFFECTIVENESS ANALYSIS
LOW SCENARIO

| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Capital Investments (03$; millions)** | | | | | | | | | | | |
| Mobility Investments | 291.54 | 291.54 | 291.54 | 291.54 | 291.54 | 291.54 | 291.54 | 291.54 | 291.54 | 291.54 | 291.54 |
| Safety Investments | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Environmental Retrofit Investments | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 |
| Economic Initiatives | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Stormwater | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Total Capital Improvements (const$) | 292.25 | 292.25 | 292.25 | 292.25 | 292.25 | 292.25 | 292.25 | 292.25 | 292.25 | 292.25 | 292.25 |
| | | | | | | | | | | | |
| **Captial Investments (Year of Expenditure $s** | | | | | | | | | | | |
| Mobility Investments | 391.80 | 403.56 | 415.66 | 428.13 | 440.98 | 454.21 | 467.83 | 481.87 | 496.33 | 511.22 | 526.55 |
| Safety Investments | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Environmental Retrofit Investments | 0.87 | 0.90 | 0.92 | 0.95 | 0.98 | 1.01 | 1.04 | 1.07 | 1.10 | 1.13 | 1.17 |
| Economic Initiatives | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 |
| Stormwater | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| Total Capital Improvements | 392.76 | 404.54 | 416.68 | 429.18 | 442.05 | 455.32 | 468.97 | 483.04 | 497.54 | 512.46 | 527.84 |
| | | | | | | | | | | | |
| **Cumulative Annualized Expenditures** | | | | | | | | | | | |
| Mobility Investments | $229.23 | $254.01 | $279.53 | $305.81 | $332.88 | $360.77 | $389.49 | $419.07 | $449.54 | $480.93 | $513.25 |
| Safety Investments | $0.01 | $0.01 | $0.01 | $0.01 | $0.01 | $0.01 | $0.01 | $0.01 | $0.01 | $0.01 | $0.01 |
| Environmental Retrofit Investments | $1.31 | $1.37 | $1.42 | $1.48 | $1.54 | $1.60 | $1.67 | $1.73 | $1.80 | $1.87 | $1.94 |
| Economic Initiatives | $0.04 | $0.05 | $0.05 | $0.05 | $0.05 | $0.05 | $0.06 | $0.06 | $0.06 | $0.06 | $0.07 |
| Stormwater | $0.07 | $0.07 | $0.08 | $0.08 | $0.08 | $0.09 | $0.09 | $0.09 | $0.10 | $0.10 | $0.10 |
| *Less "expired" capital* | | | | | | | | | | | |
| Mobility Investments | | | | | | | | | | | |
| Safety Investments | | | | | | | | | | | |
| Environmental Retrofit Investments | | | | | | | | | | | |
| Economic Initiatives | | | | | | | | | | | |
| Stormwater | | | | | | | | | | | |
| Total Capital Improvements | $230.67 | $255.50 | $281.08 | $307.43 | $334.57 | $362.52 | $391.31 | $420.97 | $451.51 | $482.97 | $515.38 |
| | | | | | | | | | | | |
| Annual Passenger Miles (millions) | 22,652.0 | 23,166.0 | 23,691.6 | 24,229.1 | 24,778.9 | 25,341.1 | 25,916.1 | 26,504.1 | 27,105.5 | 27,720.6 | 28,349.6 |
| **Capital Costs per Passenger Mile** | **$ 0.010** | **$ 0.011** | **$ 0.012** | **$ 0.013** | **$ 0.014** | **$ 0.014** | **$ 0.015** | **$ 0.016** | **$ 0.017** | **$ 0.017** | **$ 0.018** |
| | | | | | | | | | | | |
| **Operations Inflated** | | | | | | | | | | | |
| Highway Maintenance | $ 42.82 | $ 44.10 | $ 45.43 | $ 46.79 | $ 48.19 | $ 49.64 | $ 51.13 | $ 52.66 | $ 54.24 | $ 55.87 | $ 57.55 |
| Pavement Preservation | $ 58.13 | $ 59.87 | $ 61.67 | $ 63.52 | $ 65.42 | $ 67.39 | $ 69.41 | $ 71.49 | $ 73.64 | $ 75.84 | $ 78.12 |
| Total Operations - Inflated $ | $ 100.95 | $ 103.98 | $ 107.10 | $ 110.31 | $ 113.62 | $ 117.03 | $ 120.54 | $ 124.15 | $ 127.88 | $ 131.71 | $ 135.67 |
| Annual Passenger Miles | 22,652.0 | 23,166.0 | 23,691.6 | 24,229.1 | 24,778.9 | 25,341.1 | 25,916.1 | 26,504.1 | 27,105.5 | 27,720.6 | 28,349.6 |
| **Operating Costs Per Passenger Mile** | **$ 0.004** | **$ 0.004** | **$ 0.005** | **$ 0.005** | **$ 0.005** | **$ 0.005** | **$ 0.005** | **$ 0.005** | **$ 0.005** | **$ 0.005** | **$ 0.005** |
| **Total Annualized Facility Costs** | **$ 331.6** | **$ 359.5** | **$ 388.2** | **$ 417.7** | **$ 448.2** | **$ 479.5** | **$ 511.8** | **$ 545.1** | **$ 579.4** | **$ 614.7** | **$ 651.0** |
| | | | | | | | | | | | |
| **Total WSDOT Costs Per Passenger Mile** | **$ 0.015** | **$ 0.016** | **$ 0.016** | **$ 0.017** | **$ 0.018** | **$ 0.019** | **$ 0.020** | **$ 0.021** | **$ 0.021** | **$ 0.022** | **$ 0.023** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AUTO TRAVEL COST-EFFECTIVENESS ANALYSIS
LOW SCENARIO

| **Direct Costs** | | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily Vehicle Miles (millions) | | 35.42 | 36.22 | 37.05 | 37.89 | 38.75 | 39.63 | 40.52 | 41.44 | 42.38 | 43.35 |
| Annual Vehicle Miles (millions) | | 12,928.6 | 13,221.9 | 13,521.8 | 13,828.6 | 14,142.3 | 14,463.2 | 14,791.3 | 15,126.9 | 15,470.1 | 15,821.1 |
| Ownership/Operations Cost Per Mile | | $ 0.51 | $ 0.52 | $ 0.54 | $ 0.55 | $ 0.57 | $ 0.59 | $ 0.60 | $ 0.62 | $ 0.64 | $ 0.66 |
| Parking (Cost Per Mile) | 12% | $ 0.07 | $ 0.07 | $ 0.07 | $ 0.07 | $ 0.08 | $ 0.08 | $ 0.08 | $ 0.08 | $ 0.09 | $ 0.09 |
| Total Vehicle Costs | | $ 0.57 | $ 0.59 | $ 0.61 | $ 0.63 | $ 0.65 | $ 0.67 | $ 0.69 | $ 0.71 | $ 0.73 | $ 0.75 |
| Annual Passenger Miles (millions) | | 18,100.0 | 18,510.6 | 18,930.6 | 19,360.0 | 19,799.2 | 20,248.4 | 20,707.8 | 21,177.6 | 21,658.1 | 22,149.5 |
| **Vehicle Cost Per Passenger Mile** | | **$ 0.41** | **$ 0.42** | **$ 0.43** | **$ 0.45** | **$ 0.46** | **$ 0.48** | **$ 0.49** | **$ 0.50** | **$ 0.52** | **$ 0.53** |
| **Total Direct Operating Costs** | | **$ 0.42** | **$ 0.43** | **$ 0.44** | **$ 0.46** | **$ 0.47** | **$ 0.49** | **$ 0.50** | **$ 0.52** | **$ 0.53** | **$ 0.55** |
| **Total Annualized Costs PPM** | | **$ 0.42** | **$ 0.43** | **$ 0.44** | **$ 0.46** | **$ 0.48** | **$ 0.49** | **$ 0.51** | **$ 0.52** | **$ 0.54** | **$ 0.56** |

| **Indirect Costs - Low** | | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time costs** | | | | | | | | | | | |
| Annual Vehicle Miles (millions) | | 12,928.6 | 13,221.9 | 13,521.8 | 13,828.6 | 14,142.3 | 14,463.2 | 14,791.3 | 15,126.9 | 15,470.1 | 15,821.1 |
| Average Speed (mph) | | 47 | 47 | 47 | 47 | 47 | 46 | 46 | 46 | 46 | 46 |
| Annual Vehicle Hours (millions) | | 275.1 | 281.3 | 287.7 | 294.2 | 300.9 | 314.4 | 321.5 | 328.8 | 336.3 | 343.9 |
| **Business-Related Travel** | 30% of total | | | | | | | | | | |
| Total Driver Hours (millions) | | 82.5 | 84.4 | 86.3 | 88.3 | 90.3 | 94.3 | 96.5 | 98.7 | 100.9 | 103.2 |
| Average Wage | | $ 18.62 | $ 19.18 | $ 19.76 | $ 20.35 | $ 20.96 | $ 21.59 | $ 22.24 | $ 22.90 | $ 23.59 | $ 24.30 |
| Value Per Hour of Travel Time (% of Wage Ra | 50% | $ 9.31 | $ 9.59 | $ 9.88 | $ 10.18 | $ 10.48 | $ 10.79 | $ 11.12 | $ 11.45 | $ 11.80 | $ 12.15 |
| Total Value of Drivers' Time ($ mil) | | $ 768.4 | $ 809.4 | $ 852.6 | $ 898.1 | $ 946.1 | $ 1,018.2 | $ 1,072.6 | $ 1,129.8 | $ 1,190.1 | $ 1,253.6 |
| Total Passenger Hours | | 33.01 | 33.76 | 34.52 | 35.31 | 36.11 | 37.73 | 38.59 | 39.46 | 40.36 | 41.27 |
| Average Wage | | $ 18.62 | $ 19.18 | $ 19.76 | $ 20.35 | $ 20.96 | $ 21.59 | $ 22.24 | $ 22.90 | $ 23.59 | $ 24.30 |
| Value Per Hour of Travel Time (% of Wage Ra | 35% | $ 6.52 | $ 6.71 | $ 6.92 | $ 7.12 | $ 7.34 | $ 7.56 | $ 7.78 | $ 8.02 | $ 8.26 | $ 8.50 |
| Total Value of Passengers' Time ($ mil) | | $ 215.2 | $ 226.6 | $ 238.7 | $ 251.5 | $ 264.9 | $ 285.1 | $ 300.3 | $ 316.3 | $ 333.2 | $ 351.0 |
| **Total Business-Related Time Costs** | | **$ 983.6** | **$ 1,036.1** | **$ 1,091.4** | **$ 1,149.6** | **$ 1,211.0** | **$ 1,303.3** | **$ 1,372.9** | **$ 1,446.1** | **$ 1,523.3** | **$ 1,604.6** |
| **Non-Business-Related Travel** | 70% of total | | | | | | | | | | |
| Value of drivers' time: | | | | | | | | | | | |
| Total Driver Hours (millions) | | 192.55 | 196.92 | 201.39 | 205.96 | 210.63 | 220.09 | 225.08 | 230.19 | 235.41 | 240.76 |
| Average Wage | | $ 18.62 | $ 19.18 | $ 19.76 | $ 20.35 | $ 20.96 | $ 21.59 | $ 22.24 | $ 22.90 | $ 23.59 | $ 24.30 |
| Value Per Hour of Travel Time (% of Wage Ra | 25% | $ 4.66 | $ 4.80 | $ 4.94 | $ 5.09 | $ 5.24 | $ 5.40 | $ 5.56 | $ 5.73 | $ 5.90 | $ 6.07 |
| Total Value of Drivers' Time ($ mil) | | $ 896.5 | $ 944.3 | $ 994.7 | $ 1,047.8 | $ 1,103.7 | $ 1,187.9 | $ 1,251.3 | $ 1,318.1 | $ 1,388.4 | $ 1,462.5 |
| Total Passenger Hours | | 77.0 | 78.8 | 80.6 | 82.4 | 84.3 | 88.0 | 90.0 | 92.1 | 94.2 | 96.3 |
| Average Wage | | $ 18.62 | $ 19.18 | $ 19.76 | $ 20.35 | $ 20.96 | $ 21.59 | $ 22.24 | $ 22.90 | $ 23.59 | $ 24.30 |
| Value Per Hour of Travel Time (% of Wage Ra | 18% | $ 3.35 | $ 3.45 | $ 3.56 | $ 3.66 | $ 3.77 | $ 3.89 | $ 4.00 | $ 4.12 | $ 4.25 | $ 4.37 |
| Total Value of Passengers' Time ($ mil) | | $ 258.2 | $ 272.0 | $ 286.5 | $ 301.8 | $ 317.9 | $ 342.1 | $ 360.4 | $ 379.6 | $ 399.9 | $ 421.2 |
| **Total Non-Business-Related Time Costs** | | **$ 1,154.7** | **$ 1,216.3** | **$ 1,281.2** | **$ 1,349.6** | **$ 1,421.6** | **$ 1,530.0** | **$ 1,611.7** | **$ 1,697.7** | **$ 1,788.3** | **$ 1,883.8** |
| **Total Time Costs ($ mil)** | | **$ 2,138.3** | **$ 2,252.4** | **$ 2,372.6** | **$ 2,499.2** | **$ 2,632.6** | **$ 2,833.4** | **$ 2,984.6** | **$ 3,143.8** | **$ 3,311.6** | **$ 3,488.4** |
| Annual Vehicle Miles | | 12,928.6 | 13,221.9 | 13,521.8 | 13,828.6 | 14,142.3 | 14,463.2 | 14,791.3 | 15,126.9 | 15,470.1 | 15,821.1 |
| Total Indirect Costs | | $ 2,138.3 | $ 2,252.4 | $ 2,372.6 | $ 2,499.2 | $ 2,632.6 | $ 2,833.4 | $ 2,984.6 | $ 3,143.8 | $ 3,311.6 | $ 3,488.4 |
| Annual Passenger Miles | | 18,100.0 | 18,510.6 | 18,930.6 | 19,360.0 | 19,799.2 | 20,248.4 | 20,707.8 | 21,177.6 | 21,658.1 | 22,149.5 |
| **Total Indirect Costs Per Passenger Mile** | | **$ 0.12** | **$ 0.12** | **$ 0.13** | **$ 0.13** | **$ 0.13** | **$ 0.14** | **$ 0.14** | **$ 0.15** | **$ 0.15** | **$ 0.16** |
| **Indirect + Direct Costs PPM** | | **$ 0.53** | **$ 0.55** | **$ 0.57** | **$ 0.59** | **$ 0.60** | **$ 0.63** | **$ 0.64** | **$ 0.66** | **$ 0.68** | **$ 0.71** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AUTO TRAVEL COST-EFFECTIVENESS ANALYSIS
LOW SCENARIO

| **Direct Costs** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily Vehicle Miles (millions) | 44.33 | 45.33 | 46.36 | 47.42 | 48.49 | 49.59 | 50.72 | 51.87 | 53.04 | 54.25 | 55.48 |
| Annual Vehicle Miles (millions) | 16,180.0 | 16,547.1 | 16,922.6 | 17,306.5 | 17,699.2 | 18,100.8 | 18,511.5 | 18,931.5 | 19,361.1 | 19,800.4 | 20,249.7 |
| Ownership/Operations Cost Per Mile | $ 0.68 | $ 0.70 | $ 0.72 | $ 0.74 | $ 0.77 | $ 0.79 | $ 0.81 | $ 0.84 | $ 0.86 | $ 0.89 | $ 0.91 |
| Parking (Cost Per Mile) | $ 0.09 | $ 0.09 | $ 0.10 | $ 0.10 | $ 0.10 | $ 0.11 | $ 0.11 | $ 0.11 | $ 0.12 | $ 0.12 | $ 0.12 |
| Total Vehicle Costs | $ 0.77 | $ 0.79 | $ 0.82 | $ 0.84 | $ 0.87 | $ 0.89 | $ 0.92 | $ 0.95 | $ 0.98 | $ 1.01 | $ 1.04 |
| Annual Passenger Miles (millions) | 22,652.0 | 23,166.0 | 23,691.6 | 24,229.1 | 24,778.9 | 25,341.1 | 25,916.1 | 26,504.1 | 27,105.5 | 27,720.6 | 28,349.6 |
| **Vehicle Cost Per Passenger Mile** | **$ 0.55** | **$ 0.57** | **$ 0.58** | **$ 0.60** | **$ 0.62** | **$ 0.64** | **$ 0.66** | **$ 0.68** | **$ 0.70** | **$ 0.72** | **$ 0.74** |
| **Total Direct Operating Costs** | **$ 0.57** | **$ 0.58** | **$ 0.60** | **$ 0.62** | **$ 0.64** | **$ 0.66** | **$ 0.68** | **$ 0.70** | **$ 0.72** | **$ 0.74** | **$ 0.76** |
| **Total Annualized Costs PPM** | **$ 0.58** | **$ 0.59** | **$ 0.61** | **$ 0.63** | **$ 0.65** | **$ 0.67** | **$ 0.69** | **$ 0.71** | **$ 0.74** | **$ 0.76** | **$ 0.78** |

| **Indirect Costs - Low** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time costs** | | | | | | | | | | | |
| Annual Vehicle Miles (millions) | 16,180.0 | 16,547.1 | 16,922.6 | 17,306.5 | 17,699.2 | 18,100.8 | 18,511.5 | 18,931.5 | 19,361.1 | 19,800.4 | 20,249.7 |
| Average Speed (mph) | 46 | 45 | 45 | 45 | 45 | 45 | 44 | 44 | 44 | 44 | 44 |
| Annual Vehicle Hours (millions) | 351.7 | 367.7 | 376.1 | 384.6 | 393.3 | 402.2 | 420.7 | 430.3 | 440.0 | 450.0 | 460.2 |
| **Business-Related Travel** | | | | | | | | | | | |
| Total Driver Hours (millions) | 105.5 | 110.3 | 112.8 | 115.4 | 118.0 | 120.7 | 126.2 | 129.1 | 132.0 | 135.0 | 138.1 |
| Average Wage | $ 25.03 | $ 25.78 | $ 26.55 | $ 27.35 | $ 28.17 | $ 29.01 | $ 29.88 | $ 30.78 | $ 31.70 | $ 32.66 | $ 33.64 |
| Value Per Hour of Travel Time (% of Wage Ra | $ 12.51 | $ 12.89 | $ 13.28 | $ 13.67 | $ 14.08 | $ 14.51 | $ 14.94 | $ 15.39 | $ 15.85 | $ 16.33 | $ 16.82 |
| Total Value of Drivers' Time ($ mil) | $ 1,320.5 | $ 1,421.9 | $ 1,497.8 | $ 1,577.7 | $ 1,661.9 | $ 1,750.6 | $ 1,886.0 | $ 1,986.6 | $ 2,092.6 | $ 2,204.3 | $ 2,322.0 |
| Total Passenger Hours | 42.21 | 44.13 | 45.13 | 46.15 | 47.20 | 48.27 | 50.49 | 51.63 | 52.80 | 54.00 | 55.23 |
| Average Wage | $ 25.03 | $ 25.78 | $ 26.55 | $ 27.35 | $ 28.17 | $ 29.01 | $ 29.88 | $ 30.78 | $ 31.70 | $ 32.66 | $ 33.64 |
| Value Per Hour of Travel Time (% of Wage Ra | $ 8.76 | $ 9.02 | $ 9.29 | $ 9.57 | $ 9.86 | $ 10.16 | $ 10.46 | $ 10.77 | $ 11.10 | $ 11.43 | $ 11.77 |
| Total Value of Passengers' Time ($ mil) | $ 369.7 | $ 398.1 | $ 419.4 | $ 441.8 | $ 465.3 | $ 490.2 | $ 528.1 | $ 556.3 | $ 585.9 | $ 617.2 | $ 650.2 |
| **Total Business-Related Time Costs** | **$ 1,690.3** | **$ 1,820.0** | **$ 1,917.2** | **$ 2,019.5** | **$ 2,127.3** | **$ 2,240.8** | **$ 2,414.0** | **$ 2,542.9** | **$ 2,678.6** | **$ 2,821.5** | **$ 2,972.1** |
| **Non-Business-Related Travel** | | | | | | | | | | | |
| Value of drivers' time: | | | | | | | | | | | |
| Total Driver Hours (millions) | 246.22 | 257.40 | 263.24 | 269.21 | 275.32 | 281.57 | 294.50 | 301.18 | 308.02 | 315.01 | 322.15 |
| Average Wage | $ 25.03 | $ 25.78 | $ 26.55 | $ 27.35 | $ 28.17 | $ 29.01 | $ 29.88 | $ 30.78 | $ 31.70 | $ 32.66 | $ 33.64 |
| Value Per Hour of Travel Time (% of Wage Ra | $ 6.26 | $ 6.44 | $ 6.64 | $ 6.84 | $ 7.04 | $ 7.25 | $ 7.47 | $ 7.70 | $ 7.93 | $ 8.16 | $ 8.41 |
| Total Value of Drivers' Time ($ mil) | $ 1,540.6 | $ 1,658.9 | $ 1,747.4 | $ 1,840.7 | $ 1,938.9 | $ 2,042.4 | $ 2,200.3 | $ 2,317.7 | $ 2,441.4 | $ 2,571.7 | $ 2,709.0 |
| Total Passenger Hours | 98.5 | 103.0 | 105.3 | 107.7 | 110.1 | 112.6 | 117.8 | 120.5 | 123.2 | 126.0 | 128.9 |
| Average Wage | $ 25.03 | $ 25.78 | $ 26.55 | $ 27.35 | $ 28.17 | $ 29.01 | $ 29.88 | $ 30.78 | $ 31.70 | $ 32.66 | $ 33.64 |
| Value Per Hour of Travel Time (% of Wage Ra | $ 4.51 | $ 4.64 | $ 4.78 | $ 4.92 | $ 5.07 | $ 5.22 | $ 5.38 | $ 5.54 | $ 5.71 | $ 5.88 | $ 6.05 |
| Total Value of Passengers' Time ($ mil) | $ 443.7 | $ 477.8 | $ 503.3 | $ 530.1 | $ 558.4 | $ 588.2 | $ 633.7 | $ 667.5 | $ 703.1 | $ 740.7 | $ 780.2 |
| **Total Non-Business-Related Time Costs** | **$ 1,984.3** | **$ 2,136.6** | **$ 2,250.7** | **$ 2,370.8** | **$ 2,497.3** | **$ 2,630.6** | **$ 2,834.0** | **$ 2,985.2** | **$ 3,144.5** | **$ 3,312.4** | **$ 3,489.2** |
| **Total Time Costs ($ mil)** | **$ 3,674.5** | **$ 3,956.7** | **$ 4,167.8** | **$ 4,390.3** | **$ 4,624.6** | **$ 4,871.4** | **$ 5,248.0** | **$ 5,528.1** | **$ 5,823.1** | **$ 6,133.9** | **$ 6,461.3** |
| Annual Vehicle Miles | 16,180.0 | 16,547.1 | 16,922.6 | 17,306.5 | 17,699.2 | 18,100.8 | 18,511.5 | 18,931.5 | 19,361.1 | 19,800.4 | 20,249.7 |
| Total Indirect Costs | $ 3,674.5 | $ 3,956.7 | $ 4,167.8 | $ 4,390.3 | $ 4,624.6 | $ 4,871.4 | $ 5,248.0 | $ 5,528.1 | $ 5,823.1 | $ 6,133.9 | $ 6,461.3 |
| Annual Passenger Miles | 22,652.0 | 23,166.0 | 23,691.6 | 24,229.1 | 24,778.9 | 25,341.1 | 25,916.1 | 26,504.1 | 27,105.5 | 27,720.6 | 28,349.6 |
| **Total Indirect Costs Per Passenger Mile** | **$ 0.16** | **$ 0.17** | **$ 0.18** | **$ 0.18** | **$ 0.19** | **$ 0.19** | **$ 0.20** | **$ 0.21** | **$ 0.21** | **$ 0.22** | **$ 0.23** |
| **Indirect + Direct Costs PPM** | **$ 0.73** | **$ 0.75** | **$ 0.78** | **$ 0.80** | **$ 0.82** | **$ 0.85** | **$ 0.88** | **$ 0.91** | **$ 0.93** | **$ 0.96** | **$ 0.99** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AUTO TRAVEL COST-EFFECTIVENESS ANALYSIS
LOW SCENARIO

| **External Costs** | | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Annual Vehicle Miles (mil) | | 12,928.6 | 13,221.9 | 13,521.8 | 13,828.6 | 14,142.3 | 14,463.2 | 14,791.3 | 15,126.9 | 15,470.1 | 15,821.1 |
| | Cost per vehicle mile | | | | | | | | | | |
| **Air Pollution** | **2003** | | | | | | | | | | |
| Annual Cost ($ mil) | $ 0.049 | $ 635.0 | $ 668.9 | $ 704.6 | $ 742.2 | $ 781.8 | $ 823.5 | $ 867.5 | $ 913.8 | $ 962.5 | $ 1,013.9 |
| **Noise Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | $ 0.001 | $ 14.6 | $ 15.4 | $ 16.2 | $ 17.1 | $ 18.0 | $ 19.0 | $ 20.0 | $ 21.1 | $ 22.2 | $ 23.4 |
| **Solid Waste Disposal** | | | | | | | | | | | |
| Annual Cost ($ mil) | $ 0.001 | $ 14.6 | $ 15.4 | $ 16.2 | $ 17.1 | $ 18.0 | $ 19.0 | $ 20.0 | $ 21.1 | $ 22.2 | $ 23.4 |
| **Water Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | | | | | | | | | | | |
| **Accidents** | | | | | | | | | | | |
| Annual Cost ($ mil) | $ 0.045 | $ 585.3 | $ 616.5 | $ 649.4 | $ 684.1 | $ 720.6 | $ 759.0 | $ 799.5 | $ 842.2 | $ 887.1 | $ 934.5 |
| **Total External Costs ($ mil)** | | $ 1,249.5 | $ 1,316.2 | $ 1,386.5 | $ 1,460.4 | $ 1,538.4 | $ 1,620.5 | $ 1,707.0 | $ 1,798.1 | $ 1,894.0 | $ 1,995.1 |
| Annual Passenger Miles | | 18,100.0 | 18,510.6 | 18,930.6 | 19,360.0 | 19,799.2 | 20,248.4 | 20,707.8 | 21,177.6 | 21,658.1 | 22,149.5 |
| **Total External Costs Per Passenger Mile** | | $ 0.07 | $ 0.07 | $ 0.07 | $ 0.08 | $ 0.08 | $ 0.08 | $ 0.08 | $ 0.08 | $ 0.09 | $ 0.09 |
| **External + Indirect + Direct Costs PPM** | | **$ 0.60** | **$ 0.62** | **$ 0.64** | **$ 0.66** | **$ 0.68** | **$ 0.71** | **$ 0.73** | **$ 0.75** | **$ 0.77** | **$ 0.80** |
| **Capital + Direct + Indirect + External costs ppm** | | **$ 0.60** | **$ 0.62** | **$ 0.64** | **$ 0.66** | **$ 0.69** | **$ 0.71** | **$ 0.73** | **$ 0.76** | **$ 0.78** | **$ 0.81** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AUTO TRAVEL COST-EFFECTIVENESS ANALYSIS
LOW SCENARIO

| External Costs | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Annual Vehicle Miles (mil) | 16,180.0 | 16,547.1 | 16,922.6 | 17,306.5 | 17,699.2 | 18,100.8 | 18,511.5 | 18,931.5 | 19,361.1 | 19,800.4 | 20,249.7 |
| **Air Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | $ 1,068.0 | $ 1,125.0 | $ 1,185.1 | $ 1,248.3 | $ 1,314.9 | $ 1,385.1 | $ 1,459.0 | $ 1,536.9 | $ 1,618.9 | $ 1,705.3 | $ 1,796.4 |
| **Noise Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | $ 24.6 | $ 25.9 | $ 27.3 | $ 28.8 | $ 30.3 | $ 31.9 | $ 33.6 | $ 35.4 | $ 37.3 | $ 39.3 | $ 41.4 |
| **Solid Waste Disposal** | | | | | | | | | | | |
| Annual Cost ($ mil) | $ 24.6 | $ 25.9 | $ 27.3 | $ 28.8 | $ 30.3 | $ 31.9 | $ 33.6 | $ 35.4 | $ 37.3 | $ 39.3 | $ 41.4 |
| **Water Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | | | | | | | | | | | |
| **Accidents** | | | | | | | | | | | |
| Annual Cost ($ mil) | $ 984.4 | $ 1,036.9 | $ 1,092.2 | $ 1,150.5 | $ 1,211.9 | $ 1,276.6 | $ 1,344.7 | $ 1,416.5 | $ 1,492.1 | $ 1,571.7 | $ 1,655.6 |
| **Total External Costs ($ mil)** | $ 2,101.6 | $ 2,213.8 | $ 2,331.9 | $ 2,456.4 | $ 2,587.4 | $ 2,725.5 | $ 2,871.0 | $ 3,024.2 | $ 3,185.6 | $ 3,355.7 | $ 3,534.8 |
| Annual Passenger Miles | 22,652.0 | 23,166.0 | 23,691.6 | 24,229.1 | 24,778.9 | 25,341.1 | 25,916.1 | 26,504.1 | 27,105.5 | 27,720.6 | 28,349.6 |
| **Total External Costs Per Passenger Mile** | $ 0.09 | $ 0.10 | $ 0.10 | $ 0.10 | $ 0.10 | $ 0.11 | $ 0.11 | $ 0.11 | $ 0.12 | $ 0.12 | $ 0.12 |
| **External + Indirect + Direct Costs PPM** | **$ 0.82** | **$ 0.85** | **$ 0.88** | **$ 0.90** | **$ 0.93** | **$ 0.96** | **$ 0.99** | **$ 1.02** | **$ 1.05** | **$ 1.08** | **$ 1.12** |
| **Capital + Direct + Indirect + External costs p** | **$ 0.83** | **$ 0.86** | **$ 0.89** | **$ 0.91** | **$ 0.94** | **$ 0.97** | **$ 1.01** | **$ 1.04** | **$ 1.07** | **$ 1.10** | **$ 1.13** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

# Worksheet 7

INTERCITY AUTO COST-EFFECTIVENESS ANALYSIS
HIGH SCENARIO

| | | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Capital Investments (03$; millions)** | | | | | | | | | | | |
| Mobility Investments | 7,288.48 | 364.42 | 364.42 | 364.42 | 364.42 | 364.42 | 364.42 | 364.42 | 364.42 | 364.42 | 364.42 |
| Safety Investments | 0.19 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Environmental Retrofit In | 323.37 | 16.17 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 |
| Economic Initiatives | 10.89 | 0.54 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Stormwater | 17.30 | 0.87 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| Total Capital Improveme | 7,640.23 | 382.01 | 365.31 | 365.31 | 365.31 | 365.31 | 365.31 | 365.31 | 365.31 | 365.31 | 365.31 |
| | | | | | | | | | | | |
| **Captial Investments (Year of Expenditure $s)** | | | | | | | | | | | |
| Mobility Investments | | 364 | 375 | 387 | 398 | 410 | 422 | 435 | 448 | 462 | 475 |
| Safety Investments | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Environmental Retrofit Investments | | 17 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Economic Initiatives | | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Stormwater | | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Capital Improvements | | 383 | 376 | 388 | 399 | 411 | 423 | 436 | 449 | 463 | 477 |
| | | | | | | | | | | | |
| **Cumulative Annualized Expenditures** | | | | | | | | | | | |
| Mobility Inve 30 yrs | | $22.37 | $45.42 | $69.15 | $93.60 | $118.78 | $144.71 | $171.43 | $198.94 | $227.28 | $256.48 |
| Safety Investments | | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.01 | $0.01 | $0.01 |
| Environmental Retrofit Investments | | $1.05 | $1.10 | $1.16 | $1.21 | $1.27 | $1.32 | $1.38 | $1.44 | $1.51 | $1.57 |
| Economic Initiatives | | $0.04 | $0.04 | $0.04 | $0.04 | $0.04 | $0.04 | $0.05 | $0.05 | $0.05 | $0.05 |
| Stormwater | | $0.06 | $0.06 | $0.06 | $0.06 | $0.07 | $0.07 | $0.07 | $0.08 | $0.08 | $0.08 |
| *Less "expired" capital* | | | | | | | | | | | |
| Mobility Investments | | | | | | | | | | | |
| Safety Investments | | | | | | | | | | | |
| Environmental Retrofit Investments | | | | | | | | | | | |
| Economic Initiatives | | | | | | | | | | | |
| Stormwater | | | | | | | | | | | |
| Total Capital Improvements | | $23.52 | $46.62 | $70.41 | $94.92 | $120.16 | $146.16 | $172.94 | $200.52 | $228.93 | $258.19 |
| | | | | | | | | | | | |
| Annual Passenger Miles (millions) | | 18,100.0 | 18,510.6 | 18,930.6 | 19,360.0 | 19,799.2 | 20,248.4 | 20,707.8 | 21,177.6 | 21,658.1 | 22,149.5 |
| **Capital Costs per Passenger Mile** | | **$ 0.001** | **$ 0.003** | **$ 0.004** | **$ 0.005** | **$ 0.006** | **$ 0.007** | **$ 0.008** | **$ 0.009** | **$ 0.011** | **$ 0.012** |
| | | | | | | | | | | | |
| **Operations** 20-yr allocation | | | | | | | | | | | |
| Highway Ma 600.66 | | $ 31.86 | $ 32.82 | $ 33.80 | $ 34.82 | $ 35.86 | $ 36.94 | $ 38.04 | $ 39.19 | $ 40.36 | $ 41.57 |
| Pavement P 815.40 | | $ 43.25 | $ 44.55 | $ 45.89 | $ 47.26 | $ 48.68 | $ 50.14 | $ 51.65 | $ 53.20 | $ 54.79 | $ 56.44 |
| Total Operations - Inflated $ | | $ 75.11 | $ 77.37 | $ 79.69 | $ 82.08 | $ 84.54 | $ 87.08 | $ 89.69 | $ 92.38 | $ 95.15 | $ 98.01 |
| Annual Passenger Miles | | 18,100.0 | 18,510.6 | 18,930.6 | 19,360.0 | 19,799.2 | 20,248.4 | 20,707.8 | 21,177.6 | 21,658.1 | 22,149.5 |
| **Operating Costs Per Passenger Mil** | | **$ 0.004** | **$ 0.004** | **$ 0.004** | **$ 0.004** | **$ 0.004** | **$ 0.004** | **$ 0.004** | **$ 0.004** | **$ 0.004** | **$ 0.004** |
| **Total Annualized Facility Costs** | | **$ 98.6** | **$ 124.0** | **$ 150.1** | **$ 177.0** | **$ 204.7** | **$ 233.2** | **$ 262.6** | **$ 292.9** | **$ 324.1** | **$ 356.2** |
| | | | | | | | | | | | |
| **Total WSDOT Costs Per Passenger** | | **$ 0.005** | **$ 0.007** | **$ 0.008** | **$ 0.009** | **$ 0.010** | **$ 0.012** | **$ 0.013** | **$ 0.014** | **$ 0.015** | **$ 0.016** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AUTO COST-EFFECTIVENESS ANALYSIS
HIGH SCENARIO

| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Capital Inve** | | | | | | | | | | | |
| Mobility Inve | 364.42 | 364.42 | 364.42 | 364.42 | 364.42 | 364.42 | 364.42 | 364.42 | 364.42 | 364.42 | 364.42 |
| Safety Inves | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Environment | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 |
| Economic In | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Stormwater | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| Total Capital | 365.31 | 365.31 | 365.31 | 365.31 | 365.31 | 365.31 | 365.31 | 365.31 | 365.31 | 365.31 | 365.31 |
| | | | | | | | | | | | |
| **Captial Inve** | | | | | | | | | | | |
| Mobility Inve | 490 | 504 | 520 | 535 | 551 | 568 | 585 | 602 | 620 | 639 | 658 |
| Safety Inves | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Environment | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Economic In | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Stormwater | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Capital | 491 | 506 | 521 | 536 | 553 | 569 | 586 | 604 | 622 | 641 | 660 |
| | | | | | | | | | | | |
| **Cumulative** | | | | | | | | | | | |
| Mobility Inve | $286.54 | $317.51 | $349.41 | $382.26 | $416.10 | $450.96 | $486.86 | $523.84 | $561.93 | $601.16 | $641.57 |
| Safety Inves | $0.01 | $0.01 | $0.01 | $0.01 | $0.01 | $0.01 | $0.01 | $0.01 | $0.01 | $0.02 | $0.02 |
| Environment | $1.64 | $1.71 | $1.78 | $1.85 | $1.93 | $2.00 | $2.08 | $2.17 | $2.25 | $2.34 | $2.43 |
| Economic In | $0.06 | $0.06 | $0.06 | $0.06 | $0.06 | $0.07 | $0.07 | $0.07 | $0.08 | $0.08 | $0.08 |
| Stormwater | $0.09 | $0.09 | $0.10 | $0.10 | $0.10 | $0.11 | $0.11 | $0.12 | $0.12 | $0.13 | $0.13 |
| *Less "expire* | | | | | | | | | | | |
| Mobility Inve | | | | | | | | | | | |
| Safety Inves | | | | | | | | | | | |
| Environment | | | | | | | | | | | |
| Economic In | | | | | | | | | | | |
| Stormwater | | | | | | | | | | | |
| Total Capital | $288.33 | $319.38 | $351.35 | $384.29 | $418.21 | $453.15 | $489.14 | $526.21 | $564.39 | $603.71 | $644.22 |
| | | | | | | | | | | | |
| Annual Pass | 22,652.0 | 23,166.0 | 23,691.6 | 24,229.1 | 24,778.9 | 25,341.1 | 25,916.1 | 26,504.1 | 27,105.5 | 27,720.6 | 28,349.6 |
| **Capital Cos** | **$ 0.013** | **$ 0.014** | **$ 0.015** | **$ 0.016** | **$ 0.017** | **$ 0.018** | **$ 0.019** | **$ 0.020** | **$ 0.021** | **$ 0.022** | **$ 0.023** |
| | | | | | | | | | | | |
| **Operations** | | | | | | | | | | | |
| Highway Ma | $ 42.82 | $ 44.10 | $ 45.43 | $ 46.79 | $ 48.19 | $ 49.64 | $ 51.13 | $ 52.66 | $ 54.24 | $ 55.87 | $ 57.55 |
| Pavement P | $ 58.13 | $ 59.87 | $ 61.67 | $ 63.52 | $ 65.42 | $ 67.39 | $ 69.41 | $ 71.49 | $ 73.64 | $ 75.84 | $ 78.12 |
| Total Operat | $ 100.95 | $ 103.98 | $ 107.10 | $ 110.31 | $ 113.62 | $ 117.03 | $ 120.54 | $ 124.15 | $ 127.88 | $ 131.71 | $ 135.67 |
| Annual Pass | 22,652.0 | 23,166.0 | 23,691.6 | 24,229.1 | 24,778.9 | 25,341.1 | 25,916.1 | 26,504.1 | 27,105.5 | 27,720.6 | 28,349.6 |
| **Operating C** | **$ 0.004** | **$ 0.004** | **$ 0.005** | **$ 0.005** | **$ 0.005** | **$ 0.005** | **$ 0.005** | **$ 0.005** | **$ 0.005** | **$ 0.005** | **$ 0.005** |
| **Total Annua** | **$ 389.3** | **$ 423.4** | **$ 458.4** | **$ 494.6** | **$ 531.8** | **$ 570.2** | **$ 609.7** | **$ 650.4** | **$ 692.3** | **$ 735.4** | **$ 779.9** |
| | | | | | | | | | | | |
| **Total WSDC** | **$ 0.017** | **$ 0.018** | **$ 0.019** | **$ 0.020** | **$ 0.021** | **$ 0.023** | **$ 0.024** | **$ 0.025** | **$ 0.026** | **$ 0.027** | **$ 0.028** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AUTO COST-EFFECTIVENESS ANALYSIS
HIGH SCENARIO

| **Direct Costs** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|---|---|---|---|---|
| Daily Vehicle Miles (millions) | 35.42 | 36.22 | 37.05 | 37.89 | 38.75 | 39.63 | 40.52 | 41.44 | 42.38 | 43.35 |
| Annual Vehicle Miles (millions) | 12,928.6 | 13,221.9 | 13,521.8 | 13,828.6 | 14,142.3 | 14,463.2 | 14,791.3 | 15,126.9 | 15,470.1 | 15,821.1 |
| Ownership/Operations Cost Per Mile | $ 0.51 | $ 0.52 | $ 0.54 | $ 0.55 | $ 0.57 | $ 0.59 | $ 0.60 | $ 0.62 | $ 0.64 | $ 0.66 |
| Parking (Cost Per Mile) 17% | $ 0.10 | $ 0.10 | $ 0.11 | $ 0.11 | $ 0.11 | $ 0.12 | $ 0.12 | $ 0.13 | $ 0.13 | $ 0.13 |
| Total Vehicle Costs | $ 0.61 | $ 0.63 | $ 0.64 | $ 0.66 | $ 0.68 | $ 0.70 | $ 0.73 | $ 0.75 | $ 0.77 | $ 0.79 |
| Annual Passenger Miles (millions) | 18,100.0 | 18,510.6 | 18,930.6 | 19,360.0 | 19,799.2 | 20,248.4 | 20,707.8 | 21,177.6 | 21,658.1 | 22,149.5 |
| **Vehicle Cost Per Passenger Mile** | **$ 0.43** | **$ 0.45** | **$ 0.46** | **$ 0.47** | **$ 0.49** | **$ 0.50** | **$ 0.52** | **$ 0.53** | **$ 0.55** | **$ 0.57** |
| **Total Direct Operating Costs** | **$ 0.44** | **$ 0.45** | **$ 0.47** | **$ 0.48** | **$ 0.50** | **$ 0.51** | **$ 0.53** | **$ 0.55** | **$ 0.56** | **$ 0.58** |
| **Total Annualized Costs PPM** | **$ 0.44** | **$ 0.46** | **$ 0.47** | **$ 0.49** | **$ 0.50** | **$ 0.52** | **$ 0.54** | **$ 0.56** | **$ 0.58** | **$ 0.59** |

| **Indirect Costs - High** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Time costs** | | | | | | | | | | |
| Annual Vehicle Miles (millions) | 12,928.6 | 13,221.9 | 13,521.8 | 13,828.6 | 14,142.3 | 14,463.2 | 14,791.3 | 15,126.9 | 15,470.1 | 15,821.1 |
| Average Speed (mph) | 47 | 47 | 47 | 47 | 47 | 46 | 46 | 46 | 46 | 46 |
| Annual Vehicle Hours (millions) | 275.1 | 281.3 | 287.7 | 294.2 | 300.9 | 314.4 | 321.5 | 328.8 | 336.3 | 343.9 |
| **Business-R** 30% of total | | | | | | | | | | |
| Total Driver Hours (millions) | 82.5 | 84.4 | 86.3 | 88.3 | 90.3 | 94.3 | 96.5 | 98.7 | 100.9 | 103.2 |
| Average Wage | $ 18.62 | $ 19.18 | $ 19.76 | $ 20.35 | $ 20.96 | $ 21.59 | $ 22.24 | $ 22.90 | $ 23.59 | $ 24.30 |
| Value Per H 100% | $ 18.62 | $ 19.18 | $ 19.76 | $ 20.35 | $ 20.96 | $ 21.59 | $ 22.24 | $ 22.90 | $ 23.59 | $ 24.30 |
| Total Value of Drivers' Time ($ mil) | $ 1,536.8 | $ 1,618.9 | $ 1,705.3 | $ 1,796.3 | $ 1,892.1 | $ 2,036.4 | $ 2,145.1 | $ 2,259.6 | $ 2,380.2 | $ 2,507.2 |
| Total Passenger Hours | 33.01 | 33.76 | 34.52 | 35.31 | 36.11 | 37.73 | 38.59 | 39.46 | 40.36 | 41.27 |
| Average Wage | $ 18.62 | $ 19.18 | $ 19.76 | $ 20.35 | $ 20.96 | $ 21.59 | $ 22.24 | $ 22.90 | $ 23.59 | $ 24.30 |
| Value Per H 70% | $ 13.04 | $ 13.43 | $ 13.83 | $ 14.25 | $ 14.67 | $ 15.11 | $ 15.57 | $ 16.03 | $ 16.51 | $ 17.01 |
| Total Value of Passengers' Time ($ m | $ 430.3 | $ 453.3 | $ 477.5 | $ 503.0 | $ 529.8 | $ 570.2 | $ 600.6 | $ 632.7 | $ 666.5 | $ 702.0 |
| **Total Business-Related Time Costs** | **$ 1,967.2** | **$ 2,072.1** | **$ 2,182.7** | **$ 2,299.2** | **$ 2,421.9** | **$ 2,606.6** | **$ 2,745.7** | **$ 2,892.3** | **$ 3,046.6** | **$ 3,209.2** |
| **Non-Busine** 70% of total | | | | | | | | | | |
| Value of drivers' time: | | | | | | | | | | |
| Total Driver Hours (millions) | 192.55 | 196.92 | 201.39 | 205.96 | 210.63 | 220.09 | 225.08 | 230.19 | 235.41 | 240.76 |
| Average Wage | $ 18.62 | $ 19.18 | $ 19.76 | $ 20.35 | $ 20.96 | $ 21.59 | $ 22.24 | $ 22.90 | $ 23.59 | $ 24.30 |
| Value Per H 50% | $ 9.31 | $ 9.59 | $ 9.88 | $ 10.18 | $ 10.48 | $ 10.79 | $ 11.12 | $ 11.45 | $ 11.80 | $ 12.15 |
| Total Value of Drivers' Time ($ mil) | $ 1,793.0 | $ 1,888.7 | $ 1,989.5 | $ 2,095.6 | $ 2,207.5 | $ 2,375.8 | $ 2,502.6 | $ 2,636.2 | $ 2,776.9 | $ 2,925.1 |
| Total Passenger Hours | 77.0 | 78.8 | 80.6 | 82.4 | 84.3 | 88.0 | 90.0 | 92.1 | 94.2 | 96.3 |
| Average Wage | $ 18.62 | $ 19.18 | $ 19.76 | $ 20.35 | $ 20.96 | $ 21.59 | $ 22.24 | $ 22.90 | $ 23.59 | $ 24.30 |
| Value Per H 35% | $ 6.52 | $ 6.71 | $ 6.92 | $ 7.12 | $ 7.34 | $ 7.56 | $ 7.78 | $ 8.02 | $ 8.26 | $ 8.50 |
| Total Value of Passengers' Time ($ m | $ 502.0 | $ 528.8 | $ 557.1 | $ 586.8 | $ 618.1 | $ 665.2 | $ 700.7 | $ 738.1 | $ 777.5 | $ 819.0 |
| **Total Non-Business-Related Time C** | **$ 2,295.0** | **$ 2,417.5** | **$ 2,546.5** | **$ 2,682.4** | **$ 2,825.6** | **$ 3,041.1** | **$ 3,203.4** | **$ 3,374.3** | **$ 3,554.4** | **$ 3,744.1** |
| **Total Time Costs ($ mil)** | **$ 4,262.2** | **$ 4,489.6** | **$ 4,729.2** | **$ 4,981.6** | **$ 5,247.5** | **$ 5,647.7** | **$ 5,949.1** | **$ 6,266.6** | **$ 6,601.0** | **$ 6,953.3** |
| Annual Vehicle Miles | 12,928.6 | 13,221.9 | 13,521.8 | 13,828.6 | 14,142.3 | 14,463.2 | 14,791.3 | 15,126.9 | 15,470.1 | 15,821.1 |
| Total Indirect Costs | $ 4,262.2 | $ 4,489.6 | $ 4,729.2 | $ 4,981.6 | $ 5,247.5 | $ 5,647.7 | $ 5,949.1 | $ 6,266.6 | $ 6,601.0 | $ 6,953.3 |
| Annual Passenger Miles | 18,100.0 | 18,510.6 | 18,930.6 | 19,360.0 | 19,799.2 | 20,248.4 | 20,707.8 | 21,177.6 | 21,658.1 | 22,149.5 |
| **Total Indirect Costs Per Passenger** | **$ 0.24** | **$ 0.24** | **$ 0.25** | **$ 0.26** | **$ 0.27** | **$ 0.28** | **$ 0.29** | **$ 0.30** | **$ 0.30** | **$ 0.31** |
| **Indirect + Direct Costs PPM** | **$ 0.68** | **$ 0.70** | **$ 0.72** | **$ 0.74** | **$ 0.76** | **$ 0.79** | **$ 0.82** | **$ 0.84** | **$ 0.87** | **$ 0.90** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AUTO COST-EFFECTIVENESS ANALYSIS
HIGH SCENARIO

| **Direct Cost** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily Vehicle | 44.33 | 45.33 | 46.36 | 47.42 | 48.49 | 49.59 | 50.72 | 51.87 | 53.04 | 54.25 | 55.48 |
| Annual Vehi | 16,180.0 | 16,547.1 | 16,922.6 | 17,306.5 | 17,699.2 | 18,100.8 | 18,511.5 | 18,931.5 | 19,361.1 | 19,800.4 | 20,249.7 |
| Ownership/C | $ 0.68 | $ 0.70 | $ 0.72 | $ 0.74 | $ 0.77 | $ 0.79 | $ 0.81 | $ 0.84 | $ 0.86 | $ 0.89 | $ 0.91 |
| Parking (Cos | $ 0.14 | $ 0.14 | $ 0.15 | $ 0.15 | $ 0.15 | $ 0.16 | $ 0.16 | $ 0.17 | $ 0.17 | $ 0.18 | $ 0.18 |
| Total Vehicle | $ 0.82 | $ 0.84 | $ 0.87 | $ 0.89 | $ 0.92 | $ 0.95 | $ 0.98 | $ 1.00 | $ 1.03 | $ 1.07 | $ 1.10 |
| Annual Pass | 22,652.0 | 23,166.0 | 23,691.6 | 24,229.1 | 24,778.9 | 25,341.1 | 25,916.1 | 26,504.1 | 27,105.5 | 27,720.6 | 28,349.6 |
| **Vehicle Co** | **$ 0.58** | **$ 0.60** | **$ 0.62** | **$ 0.64** | **$ 0.66** | **$ 0.68** | **$ 0.70** | **$ 0.72** | **$ 0.74** | **$ 0.76** | **$ 0.78** |
| **Total Direc** | **$ 0.60** | **$ 0.62** | **$ 0.64** | **$ 0.66** | **$ 0.68** | **$ 0.70** | **$ 0.72** | **$ 0.74** | **$ 0.76** | **$ 0.79** | **$ 0.81** |
| **Total Annu** | **$ 0.61** | **$ 0.63** | **$ 0.65** | **$ 0.67** | **$ 0.69** | **$ 0.72** | **$ 0.74** | **$ 0.76** | **$ 0.79** | **$ 0.81** | **$ 0.83** |

| **Indirect Co** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time costs** | | | | | | | | | | | |
| Annual Vehi | 16,180.0 | 16,547.1 | 16,922.6 | 17,306.5 | 17,699.2 | 18,100.8 | 18,511.5 | 18,931.5 | 19,361.1 | 19,800.4 | 20,249.7 |
| Average Spe | 46 | 45 | 45 | 45 | 45 | 45 | 44 | 44 | 44 | 44 | 44 |
| Annual Vehi | 351.7 | 367.7 | 376.1 | 384.6 | 393.3 | 402.2 | 420.7 | 430.3 | 440.0 | 450.0 | 460.2 |
| **Business-R** | | | | | | | | | | | |
| Total Driver | 105.5 | 110.3 | 112.8 | 115.4 | 118.0 | 120.7 | 126.2 | 129.1 | 132.0 | 135.0 | 138.1 |
| Average Wa | $ 25.03 | $ 25.78 | $ 26.55 | $ 27.35 | $ 28.17 | $ 29.01 | $ 29.88 | $ 30.78 | $ 31.70 | $ 32.66 | $ 33.64 |
| Value Per H | $ 25.03 | $ 25.78 | $ 26.55 | $ 27.35 | $ 28.17 | $ 29.01 | $ 29.88 | $ 30.78 | $ 31.70 | $ 32.66 | $ 33.64 |
| Total Value | $ 2,641.0 | $ 2,843.8 | $ 2,995.6 | $ 3,155.4 | $ 3,323.8 | $ 3,501.2 | $ 3,771.9 | $ 3,973.2 | $ 4,185.3 | $ 4,408.7 | $ 4,644.0 |
| Total Passer | 42.21 | 44.13 | 45.13 | 46.15 | 47.20 | 48.27 | 50.49 | 51.63 | 52.80 | 54.00 | 55.23 |
| Average Wa | $ 25.03 | $ 25.78 | $ 26.55 | $ 27.35 | $ 28.17 | $ 29.01 | $ 29.88 | $ 30.78 | $ 31.70 | $ 32.66 | $ 33.64 |
| Value Per H | $ 17.52 | $ 18.05 | $ 18.59 | $ 19.14 | $ 19.72 | $ 20.31 | $ 20.92 | $ 21.55 | $ 22.19 | $ 22.86 | $ 23.55 |
| Total Value | $ 739.5 | $ 796.3 | $ 838.8 | $ 883.5 | $ 930.7 | $ 980.3 | $ 1,056.1 | $ 1,112.5 | $ 1,171.9 | $ 1,234.4 | $ 1,300.3 |
| **Total Busin** | **$ 3,380.5** | **$ 3,640.0** | **$ 3,834.3** | **$ 4,039.0** | **$ 4,254.5** | **$ 4,481.6** | **$ 4,828.1** | **$ 5,085.7** | **$ 5,357.2** | **$ 5,643.1** | **$ 5,944.3** |
| **Non-Busine** | | | | | | | | | | | |
| Value of driv | | | | | | | | | | | |
| Total Driver | 246.22 | 257.40 | 263.24 | 269.21 | 275.32 | 281.57 | 294.50 | 301.18 | 308.02 | 315.01 | 322.15 |
| Average Wa | $ 25.03 | $ 25.78 | $ 26.55 | $ 27.35 | $ 28.17 | $ 29.01 | $ 29.88 | $ 30.78 | $ 31.70 | $ 32.66 | $ 33.64 |
| Value Per H | $ 12.51 | $ 12.89 | $ 13.28 | $ 13.67 | $ 14.08 | $ 14.51 | $ 14.94 | $ 15.39 | $ 15.85 | $ 16.33 | $ 16.82 |
| Total Value | $ 3,081.2 | $ 3,317.8 | $ 3,494.8 | $ 3,681.3 | $ 3,877.8 | $ 4,084.8 | $ 4,400.6 | $ 4,635.4 | $ 4,882.8 | $ 5,143.4 | $ 5,418.0 |
| Total Passer | 98.5 | 103.0 | 105.3 | 107.7 | 110.1 | 112.6 | 117.8 | 120.5 | 123.2 | 126.0 | 128.9 |
| Average Wa | $ 25.03 | $ 25.78 | $ 26.55 | $ 27.35 | $ 28.17 | $ 29.01 | $ 29.88 | $ 30.78 | $ 31.70 | $ 32.66 | $ 33.64 |
| Value Per H | $ 8.76 | $ 9.02 | $ 9.29 | $ 9.57 | $ 9.86 | $ 10.16 | $ 10.46 | $ 10.77 | $ 11.10 | $ 11.43 | $ 11.77 |
| Total Value | $ 862.7 | $ 929.0 | $ 978.5 | $ 1,030.8 | $ 1,085.8 | $ 1,143.7 | $ 1,232.2 | $ 1,297.9 | $ 1,367.2 | $ 1,440.2 | $ 1,517.0 |
| **Total Non-B** | **$ 3,943.9** | **$ 4,246.7** | **$ 4,473.4** | **$ 4,712.1** | **$ 4,963.6** | **$ 5,228.5** | **$ 5,632.7** | **$ 5,933.4** | **$ 6,250.0** | **$ 6,583.6** | **$ 6,935.0** |
| **Total Time** | **$ 7,324.4** | **$ 7,886.8** | **$ 8,307.7** | **$ 8,751.1** | **$ 9,218.1** | **$ 9,710.1** | **$10,460.8** | **$11,019.1** | **$11,607.2** | **$12,226.7** | **$12,879.2** |
| Annual Vehi | 16,180.0 | 16,547.1 | 16,922.6 | 17,306.5 | 17,699.2 | 18,100.8 | 18,511.5 | 18,931.5 | 19,361.1 | 19,800.4 | 20,249.7 |
| Total Indirec | $ 7,324.4 | $ 7,886.8 | $ 8,307.7 | $ 8,751.1 | $ 9,218.1 | $ 9,710.1 | $10,460.8 | $11,019.1 | $11,607.2 | $12,226.7 | $12,879.2 |
| Annual Pass | 22,652.0 | 23,166.0 | 23,691.6 | 24,229.1 | 24,778.9 | 25,341.1 | 25,916.1 | 26,504.1 | 27,105.5 | 27,720.6 | 28,349.6 |
| **Total Indire** | **$ 0.32** | **$ 0.34** | **$ 0.35** | **$ 0.36** | **$ 0.37** | **$ 0.38** | **$ 0.40** | **$ 0.42** | **$ 0.43** | **$ 0.44** | **$ 0.45** |
| **Indirect + D** | **$ 0.92** | **$ 0.96** | **$ 0.99** | **$ 1.02** | **$ 1.05** | **$ 1.08** | **$ 1.12** | **$ 1.16** | **$ 1.19** | **$ 1.23** | **$ 1.27** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AUTO COST-EFFECTIVENESS ANALYSIS
HIGH SCENARIO

| **External Costs** | | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Annual Vehicle Miles (mil) | | 12,928.6 | 13,221.9 | 13,521.8 | 13,828.6 | 14,142.3 | 14,463.2 | 14,791.3 | 15,126.9 | 15,470.1 | 15,821.1 |
| | Cost per vehicle mile | | | | | | | | | | |
| **Air Pollutio** | **2003** | | | | | | | | | | |
| Annual Cost | $ 0.081 | $ 1,049.8 | $ 1,105.8 | $ 1,164.8 | $ 1,227.0 | $ 1,292.5 | $ 1,361.5 | $ 1,434.1 | $ 1,510.7 | $ 1,591.3 | $ 1,676.2 |
| **Noise Pollution** | | | | | | | | | | | |
| Annual Cost | $ 0.006 | $ 77.6 | $ 81.7 | $ 86.1 | $ 90.7 | $ 95.5 | $ 100.6 | $ 106.0 | $ 111.6 | $ 117.6 | $ 123.9 |
| **Solid Waste Disposal** | | | | | | | | | | | |
| Annual Cost | $ 0.001 | $ 12.9 | $ 13.6 | $ 14.3 | $ 15.1 | $ 15.9 | $ 16.8 | $ 17.7 | $ 18.6 | $ 19.6 | $ 20.6 |
| **Water Pollution** | | | | | | | | | | | |
| Annual Cost ($ mil) | | | | | | | | | | | |
| **Accidents** | | | | | | | | | | | |
| Annual Cost | $ 0.040 | $ 517.1 | $ 544.7 | $ 573.8 | $ 604.4 | $ 636.7 | $ 670.7 | $ 706.5 | $ 744.2 | $ 783.9 | $ 825.7 |
| **Total External Costs ($ mil)** | | $ 1,657.4 | $ 1,745.9 | $ 1,839.1 | $ 1,937.2 | $ 2,040.6 | $ 2,149.5 | $ 2,264.2 | $ 2,385.1 | $ 2,512.3 | $ 2,646.4 |
| Annual Passenger Miles | | 18,100.0 | 18,510.6 | 18,930.6 | 19,360.0 | 19,799.2 | 20,248.4 | 20,707.8 | 21,177.6 | 21,658.1 | 22,149.5 |
| **Total External Costs Per Passenge** | | $ 0.09 | $ 0.09 | $ 0.10 | $ 0.10 | $ 0.10 | $ 0.11 | $ 0.11 | $ 0.11 | $ 0.12 | $ 0.12 |
| **External + Indirect + Direct Costs P** | | **$ 0.77** | **$ 0.79** | **$ 0.82** | **$ 0.84** | **$ 0.87** | **$ 0.90** | **$ 0.93** | **$ 0.96** | **$ 0.99** | **$ 1.02** |
| **Capital + Direct + Indirect + Externa** | | **$ 0.77** | **$ 0.79** | **$ 0.82** | **$ 0.85** | **$ 0.87** | **$ 0.91** | **$ 0.94** | **$ 0.97** | **$ 1.00** | **$ 1.03** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

INTERCITY AUTO COST-EFFECTIVENESS ANALYSIS
HIGH SCENARIO

| External Co | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Annual Vehi | 16,180.0 | 16,547.1 | 16,922.6 | 17,306.5 | 17,699.2 | 18,100.8 | 18,511.5 | 18,931.5 | 19,361.1 | 19,800.4 | 20,249.7 |
| **Air Pollutio** | | | | | | | | | | | |
| Annual Cost | $ 1,765.7 | $ 1,859.9 | $ 1,959.2 | $ 2,063.7 | $ 2,173.9 | $ 2,289.9 | $ 2,412.1 | $ 2,540.8 | $ 2,676.4 | $ 2,819.3 | $ 2,969.7 |
| **Noise Pollu** | | | | | | | | | | | |
| Annual Cost | $ 130.5 | $ 137.4 | $ 144.8 | $ 152.5 | $ 160.6 | $ 169.2 | $ 178.2 | $ 187.7 | $ 197.8 | $ 208.3 | $ 219.4 |
| **Solid Waste** | | | | | | | | | | | |
| Annual Cost | $ 21.7 | $ 22.9 | $ 24.1 | $ 25.4 | $ 26.8 | $ 28.2 | $ 29.7 | $ 31.3 | $ 33.0 | $ 34.7 | $ 36.6 |
| **Water Pollu** | | | | | | | | | | | |
| Annual Cost | | | | | | | | | | | |
| **Accidents** | | | | | | | | | | | |
| Annual Cost | $ 869.8 | $ 916.2 | $ 965.1 | $ 1,016.6 | $ 1,070.9 | $ 1,128.0 | $ 1,188.2 | $ 1,251.6 | $ 1,318.4 | $ 1,388.8 | $ 1,462.9 |
| **Total Extern** | $ 2,787.7 | $ 2,936.4 | $ 3,093.1 | $ 3,258.2 | $ 3,432.1 | $ 3,615.3 | $ 3,808.2 | $ 4,011.5 | $ 4,225.6 | $ 4,451.1 | $ 4,688.7 |
| Annual Pass | 22,652.0 | 23,166.0 | 23,691.6 | 24,229.1 | 24,778.9 | 25,341.1 | 25,916.1 | 26,504.1 | 27,105.5 | 27,720.6 | 28,349.6 |
| **Total Extern** | $ 0.12 | $ 0.13 | $ 0.13 | $ 0.13 | $ 0.14 | $ 0.14 | $ 0.15 | $ 0.15 | $ 0.16 | $ 0.16 | $ 0.17 |
| **External + In** | **$ 1.05** | **$ 1.09** | **$ 1.12** | **$ 1.15** | **$ 1.19** | **$ 1.22** | **$ 1.27** | **$ 1.31** | **$ 1.35** | **$ 1.39** | **$ 1.43** |
| **Capital + Di** | **$ 1.06** | **$ 1.10** | **$ 1.13** | **$ 1.17** | **$ 1.21** | **$ 1.24** | **$ 1.29** | **$ 1.33** | **$ 1.37** | **$ 1.41** | **$ 1.45** |

Notes: Dark shaded cells indicate key assumptions supported by literature review.
Light shaded cells indicate data provided by transit agencies.

# Worksheet 8

**Passengers flying between city pairs, 2002**

| Origin | Destination | 2002 All months | % of Total |
|---|---|---|---|
| PDX | SEA | 238,834 | 23.1% |
| SEA | PDX | 291,352 | 28.1% |
| | | | |
| PDX | BLI | 698 | 0.1% |
| BLI | PDX | 1,393 | 0.1% |
| | | | |
| PDX | YVR | 39,337 | 3.8% |
| YVR | PDX | 40,678 | 3.9% |
| | | | |
| SEA | BLI | 64,520 | 6.2% |
| BLI | SEA | 65,328 | 6.3% |
| | | | |
| SEA | YVR | 147,900 | 14.3% |
| YVR | SEA | 145,893 | 14.1% |
| | | | |
| YVR | BLI | NA | NA |
| BLI | YVR | NA | NA |
| | | | |
| | | **1,035,933** | **100.0%** |

Source: TranStats, Bureau of Transportation Statistics - Table T-100

Airport Codes:
YVR - Vancouver BC
BLI - Bellingham WA
SEA - Seattle-Tacoma WA
PDX - Portland OR

# Worksheet 9

**CONSOLIDATED STATEMENTS OF FINANCIAL POSITION**

in thousands of US dollars years ended December 31, 2002 and 2001
USD=.06472 CAD

| ASSETS | 2002 | 2001 |
|---|---|---|
| Current assets: | | |
| Cash and short-term investments | $ 28,065.98 | $ 25,471.54 |
| Marketable securities | $ 18,362.36 | $ 7,355.60 |
| Accounts receivable | $ 18,357.18 | $ 10,023.30 |
| Other receivables | $ 581.64 | $ 1,548.08 |
| Current portion of net investment in lease | $ 57.72 | $ - |
| Other current assets | $ 1,774.52 | $ 1,420.80 |
| | $ 67,199.40 | $ 45,819.32 |
| Net investment in lease | $ 8,270.24 | $ - |
| Long-term receivables | $ 2,908.20 | $ 1,893.66 |
| Deferred financing costs and other charges | $ 3,020.68 | $ 2,335.44 |
| Investments | $ 5,075.66 | $ 5,444.92 |
| Capital assets | $ 568,779.54 | $ 541,809.50 |
| Future income taxes | $ 584.60 | $ - |
| Intangible interest in airport lease | $ 10,003.32 | $ - |
| | $ 665,841.64 | $ 597,302.84 |
| LIABILITIES AND NET ASSETS | | |
| Current liabilities: | | |
| Bank indebtedness | $ - | $ 629.74 |
| Accounts payable and accrued liabilities | $ 23,133.14 | $ 24,101.80 |
| Current portion of long-term debt | $ 472.12 | $ - |
| Other current liabilities | $ 615.68 | $ - |
| | $ 24,220.94 | $ 24,731.54 |
| Long-term debt: | | |
| Long-term debt | $ 4,164.72 | $ - |
| Debentures | $ 222,000.00 | $ 222,000.00 |
| Deferred government subsidy | $ 4,832.94 | $ - |
| | $ 230,997.66 | $ 222,000.00 |
| Non-controlling interest | $ 28,103.72 | $ 882.82 |
| Net assets: | | |
| Invested in capital assets | $ 346,779.54 | $ 319,809.50 |
| Unrestricted net assets | $ 35,739.78 | $ 29,878.98 |
| | $ 665,841.64 | $ 597,302.84 |

## CONSOLIDATED STATEMENTS OF OPERATIONS

in thousands of US dollars years ended December 31, 2002 and 2001
USD=.06472 CAD

| | 2002 | 2001 |
|---|---|---|
| Revenue: | | |
| Landing fees | $ 32,089.36 | $ 29,229.26 |
| Terminal fees | $ 39,220.00 | $ 36,455.36 |
| Concessions | $ 40,220.48 | $ 53,689.96 |
| Airport improvement fees | $ 40,096.90 | $ 40,058.42 |
| Car parking | $ 16,282.96 | $ 16,563.42 |
| Rentals, fees and miscellaneous | $ 30,311.88 | $ 29,645.88 |
| | $ 198,221.58 | $ 205,642.30 |
| Expenses: | | |
| Salaries, wages and benefits | $ 23,700.72 | $ 22,133.40 |
| Materials, supplies and services | $ 38,475.56 | $ 39,046.84 |
| Payment in lieu of taxes, insurance and other | $ 11,939.90 | $ 11,342.72 |
| Depreciation and amortization | $ 27,195.00 | $ 24,237.96 |
| | $ 101,311.18 | $ 96,760.92 |
| | $ 96,910.40 | $ 108,881.38 |
| Other expenses: | | |
| Ground lease | $ 49,030.18 | $ 50,181.62 |
| Interest and financing charges | $ 16,049.86 | $ 15,810.10 |
| Other | | |
| Total other expenses | $ 65,080.04 | $ 65,991.72 |
| Excess of revenue over expenditures before undernoted items and income taxes | $ 23,554.47 | $ 31,738.35 |
| Non-controlling interest | $ (1,132.94) | $ 76.96 |
| Gain on deemed disposition of shares | $ 4,255.74 | $ 3,187.92 |
| Write off of deferred development costs | $ (371.48) | $ - |
| Excess of revenue over expenditures before income taxes | $ 26,305.79 | $ 35,003.23 |
| Income taxes | $ 1,750.84 | $ 119.14 |
| Excess of revenue over expenditures | $ 24,554.95 | $ 34,884.09 |
| Net assets, beginning of year | $ 349,688.48 | $ 303,653.08 |
| Net assets, end of year | $ 374,243.43 | $ 338,537.17 |

## CONSOLIDATED STATEMENTS OF CHANGES IN NET ASSETS

| | Invested in capital assets | Unrestricted |
|---|---|---|
| Balance, beginning of year | $ 319,809.50 | $ 29,878.98 |
| Excess (deficiency) of revenue over expenditures | $ (26,762.10) | $ 59,592.94 |
| Capital assets additions (net) | $ 53,732.14 | $ (53,732.14) |
| Balance, end of year | $ 346,779.54 | $ 35,739.78 |

| | 2002 | 2001 |
|---|---|---|
| Balance, beginning of year | $ 258,769.48 | $ 303,653.08 |
| Excess (deficiency) of revenue over expenditures | $ 24,294.82 | $ 46,035.40 |
| Capital assets additions (net) | $ - | $ - |
| Balance, end of year | $ 283,064.30 | $ 349,688.48 |

**CONSOLIDATED STATEMENTS OF CASH FLOWS**

in thousands of US dollars years ended December 31, 2002 and 2001
USD=.06472 CAD

| Operations: | 2001 | 2002 |
|---|---|---|
| Excess of revenue over expenditures | $ 32,830.84 | $ 46,035.40 |
| Items not involving cash: | $ - | $ - |
| Depreciation and amortization | $ 27,195.00 | $ 24,237.96 |
| Gain on sale of capital assets | $ (0.74) | $ (3.70) |
| Write off of capital assets | $ 152.44 | $ - |
| Write off of deferred development costs | $ 330.04 | $ - |
| Gain on deemed disposition of shares | $ (4,255.74) | $ (3,187.92) |
| Non-controlling interest | $ 1,132.94 | $ (76.96) |
| Future income tax | $ (381.10) | $ - |
| Changes in non-cash operating working | $ - | $ - |
| Accounts receivable | $ (3,571.24) | $ 464.72 |
| Other receivables | $ 966.44 | $ (703.00) |
| Other current assets | $ (353.72) | $ 418.10 |
| Accounts payable and accrued liabilities | $ (6,836.86) | $ (3,511.30) |
| | $ 47,208.30 | $ 63,673.30 |
| Investments: | | |
| Decrease in investments | $ - | $ 40.70 |
| Decrease (increase) in marketable securities | $ (11,006.76) | $ 16,541.96 |
| Net investment in lease | $ (8,327.96) | $ - |
| Increase in deferred financing costs and | $ (674.14) | $ (623.08) |
| Additions of capital assets | $ (40,532.76) | $ (72,501.50) |
| Proceeds on disposal of capital assets | $ 14.06 | $ 105.82 |
| Proceeds on deemed disposition of shares, | $ - | $ - |
| net of issuance costs | $ 25,520.38 | $ 4,147.70 |
| Distributions to non-controlling interest | $ (715.58) | $ - |
| Investment in TradePort | $ (7,476.96) | $ - |
| | $ (43,199.72) | $ (52,288.40) |
| Financing: | | |
| Decrease in bank indebtedness | $ (629.74) | $ (828.80) |
| Increase in long-term receivables | $ (1,014.54) | $ (2,041.66) |
| Decrease in long-term debt | $ 230.14 | $ (102.86) |
| | $ (1,414.14) | $ (2,973.32) |
| Increase in cash | $ 1,919.89 | $ 6,224.57 |
| Cash, beginning of year | $ 25,471.54 | $ 17,059.96 |
| Cash, end of year | $ 27,391.43 | $ 23,284.53 |
| Supplementary information: | | |
| Interest expense paid | $ 15,759.04 | $ 15,508.18 |
| Interest income received | $ 740.74 | $ 1,726.42 |
| Income taxes paid | $ 1,320.16 | $ 133.20 |

Cash is defined as cash and short-term investments. See accompanying notes to the consolidated financial statements.

# Worksheet 10

Portland International Airport
Financial Data


| | Estimate* 2003 | Proj 2004 | Proj 2005 |
|---|---|---|---|
| **Enplanements** | 6,139,480 | 6,336,500 | 6,511,209 |
| **O&M Expense Projections** | | | |
| Airfield | $4,370,254 | $4,593,973 | $4,816,919 |
| Terminal | 10,849,904 | 11,650,047 | 12,411,843 |
| Ground Transp. | 9,797,300 | 10,388,874 | 11,007,314 |
| Air Cargo/Aircraft maint. | 609,525 | 646,096 | 684,862 |
| Other Aviation | 290,626 | 308,064 | 326,548 |
| Non-aviation | 1,057,979 | 1,121,458 | 1,188,745 |
| Operations | 1,099,563 | 1,166,671 | 1,235,186 |
| Maintenance | 8,688,724 | 9,222,730 | 9,759,489 |
| Systems & services | 3,516,036 | 3,726,998 | 3,950,618 |
| ARFF | 4,376,725 | 4,643,774 | 4,916,580 |
| Police | 4,385,894 | 4,625,922 | 4,933,776 |
| Administration | 23,271,362 | 24,676,004 | 26,145,618 |
| **Total** | **$72,258,483** | **$76,770,612** | **$81,377,497** |
| **NON-AIRLINE REVENUES** | | | |
| Airfield | $984,475 | $990,909 | $1,005,945 |
| Terminal | 8,485,739 | 9,185,220 | 9,563,130 |
| Ground Transportation | 43,454,400 | 45,365,328 | 47,292,665 |
| Air cargo/aircraft maintenance | 4,606,588 | 4,947,029 | 5,274,223 |
| Other aviation | 3,176,504 | 3,385,769 | 3,547,306 |
| Non-aviation | 1,447,168 | 1,526,975 | 1,525,242 |
| Other (Administration, Police,ARFF etc.) | 501,000 | 501,000 | 501,000 |
| **Total** | **$62,410,050** | **$65,902,230** | **$68,709,511** |
| **AIRLINE REVENUES** | | | |
| Signatory landing fees | $25,122,792 | $26,764,621 | $28,205,400 |
| Non-sig landing fees | 577,309 | 805,994 | 594,049 |
| Signatory term rentals | 50,857,475 | 53,297,049 | 55,199,661 |
| Non-sig term rentals | | 0 | 0 |
| Apron fees | 563,592 | 580,500 | 597,915 |
| Loading bridge payments | 1,585,612 | 1,332,836 | 1,365,823 |
| Conveyor systems | 1,553,482 | 1,993,532 | 1,710,830 |
| Port gate rentals | 1,754,765 | 1,806,195 | 1,861,989 |
| Airline TI's | 1,967,413 | 1,759,923 | 1,700,558 |
| **Total airline costs** | **$83,231,767** | **$88,340,649** | **$91,236,224** |
| Total operating revenues | $145,374,264 | $154,242,879 | $159,945,734 |
| Interest income | 752,709 | 775,000 | 795,213 |
| **Total revenues** | **$146,124,004** | **$155,017,879** | **$160,740,947** |
| **Less non-air pax pass throughs** | | | |
| Interest income | $752,709 | $775,000 | $795,213 |
| Air cargo/aircraft maintenance | $4,606,588 | $4,947,029 | $5,274,223 |
| Non-aviation | $1,447,168 | $1,526,975 | $1,525,242 |
| Other (Administration, Police,ARFF etc.) | $501,000 | $501,000 | $501,000 |
| Total non-air pax costs | $7,164,241 | $7,750,004 | $8,095,677 |
| **Net passenger costs** | **$139,078,928** | **$147,267,875** | **$152,645,270** |
| **Capital vs. operating costs** | | | |
| Operating expenses (less debt service) | $72,258,483 | $76,770,612 | $81,377,497 |
| Capital Expenditures | | | |
| Debt Service | $56,350,534 | $49,346,523 | $49,630,122 |
| Debt Service Coverage | $16,905,160 | $14,803,957 | $14,889,037 |
| **Airline cost per enplanement** | $13.56 | $13.94 | $14.01 |

Portland International Airport
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| | Proj 2006 | Proj 2007 | Proj 2008 |
|---|---|---|---|
| **Enplanements** | 6,719,567 | 6,934,594 | 7,156,501 |
| **O&M Expense Projections** | | | |
| Airfield | $5,057,765 | $5,310,653 | $5,576,186 |
| Terminal | 13,280,672 | 14,210,319 | 15,205,041 |
| Ground Transp. | 11,667,753 | 12,367,818 | 13,109,887 |
| Air Cargo/Aircraft maint. | 725,953 | 769,511 | 815,681 |
| Other Aviation | 346,141 | 366,909 | 388,924 |
| Non-aviation | 1,260,070 | 1,335,674 | 1,415,815 |
| Operations | 1,309,297 | 1,387,855 | 1,471,126 |
| Maintenance | 10,345,059 | 10,965,762 | 11,623,708 |
| Systems & services | 4,187,655 | 4,438,914 | 4,705,249 |
| ARFF | 5,211,574 | 5,524,269 | 5,855,725 |
| Police | 5,229,802 | 5,543,591 | 5,876,206 |
| Administration | 27,714,355 | 29,377,216 | 31,139,849 |
| **Total** | **$86,336,096** | **$91,598,491** | **$97,183,397** |
| **NON-AIRLINE REVENUES** | | | |
| Airfield | $1,013,468 | $1,021,215 | $1,036,608 |
| Terminal | 9,940,972 | 10,341,802 | 10,767,680 |
| Ground Transportation | 49,177,418 | 51,144,675 | 53,198,823 |
| Air cargo/aircraft maintenance | 5,624,458 | 5,999,367 | 6,400,697 |
| Other aviation | 3,714,114 | 3,890,803 | 4,078,016 |
| Non-aviation | 1,559,523 | 1,535,482 | 1,570,561 |
| Other (Administration, Police,ARFF etc.) | 501,000 | 501,000 | 501,000 |
| **Total** | **$71,530,953** | **$74,434,343** | **$77,553,385** |
| **AIRLINE REVENUES** | | | |
| Signatory landing fees | $29,164,689 | $28,473,040 | $29,374,420 |
| Non-sig landing fees | 612,934 | 597,114 | 614,695 |
| Signatory term rentals | 57,547,341 | 56,298,649 | 58,156,285 |
| Non-sig term rentals | 0 | 0 | 0 |
| Apron fees | 615,852 | 634,328 | 653,358 |
| Loading bridge payments | 1,374,856 | 1,365,072 | 1,204,962 |
| Conveyor systems | 1,215,533 | 1,190,563 | 1,197,333 |
| Port gate rentals | 1,918,514 | 1,976,757 | 2,036,768 |
| Airline TI's | 1,623,335 | 1,590,464 | 1,584,495 |
| **Total airline costs** | **$94,073,055** | **$92,125,987** | **$94,822,316** |
| Total operating revenues | $165,604,009 | $166,560,331 | $172,375,701 |
| Interest income | 816,031 | 837,475 | 859,562 |
| **Total revenues** | **$166,420,040** | **$167,397,806** | **$173,235,262** |
| **Less non-air pax pass throughs** | | | |
| Interest income | $816,031 | $837,475 | $859,562 |
| Air cargo/aircraft maintenance | $5,624,458 | $5,999,367 | $6,400,697 |
| Non-aviation | $1,559,523 | $1,535,482 | $1,570,561 |
| Other (Administration, Police,ARFF etc.) | $501,000 | $501,000 | $501,000 |
| Total non-air pax costs | $8,501,013 | $8,873,323 | $9,331,819 |
| **Net passenger costs** | **$157,919,027** | **$158,524,483** | **$163,903,443** |
| **Capital vs. operating costs** | | | |
| Operating expenses (less debt service) | $86,336,096 | $91,598,491 | $97,183,397 |
| Capital Expenditures | | | |
| Debt Service | $49,656,720 | $44,949,873 | $43,157,233 |
| Debt Service Coverage | $14,897,016 | $13,484,962 | $12,947,170 |
| **Airline cost per enplanement** | $14.00 | $13.28 | $13.25 |

Portland International Airport
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| | Proj 2009 | Proj 2010 | Proj 2011 |
|---|---|---|---|
| **Enplanements** | 7,385,509 | 7,621,845 | 7,858,122 |
| **O&M Expense Projections** | | | |
| Airfield | $5,854,995 | $6,147,745 | $6,455,132 |
| Terminal | 16,269,394 | 17,408,252 | 18,626,829 |
| Ground Transp. | 13,896,480 | 14,730,269 | 15,614,085 |
| Air Cargo/Aircraft maint. | 864,622 | 916,500 | 971,489 |
| Other Aviation | 412,259 | 436,995 | 463,214 |
| Non-aviation | 1,500,764 | 1,590,810 | 1,686,258 |
| Operations | 1,559,394 | 1,652,957 | 1,752,135 |
| Maintenance | 12,321,130 | 13,060,398 | 13,844,022 |
| Systems & services | 4,987,564 | 5,286,818 | 5,604,027 |
| ARFF | 6,207,069 | 6,579,493 | 6,974,262 |
| Police | 6,228,778 | 6,602,505 | 6,998,655 |
| Administration | 33,008,240 | 34,988,734 | 37,088,058 |
| **Total** | **$103,110,690** | **$109,401,475** | **$116,078,169** |
| **NON-AIRLINE REVENUES** | | | |
| Airfield | $1,044,823 | $1,053,281 | $1,069,410 |
| Terminal | 11,220,898 | 11,704,008 | 12,211,024 |
| Ground Transportation | 55,344,574 | 57,586,999 | 59,878,404 |
| Air cargo/aircraft maintenance | 6,830,321 | 7,290,245 | 7,782,616 |
| Other aviation | 4,276,440 | 4,486,805 | 4,708,224 |
| Non-aviation | 1,611,324 | 1,640,018 | 1,672,860 |
| Other (Administration, Police,ARFF etc.) | 501,000 | 501,000 | 501,000 |
| **Total** | **$80,829,380** | **$84,262,357** | **$87,823,538** |
| **AIRLINE REVENUES** | | | |
| Signatory landing fees | $29,621,701 | $30,823,598 | $32,090,635 |
| Non-sig landing fees | 618,539 | 642,254 | 664,339 |
| Signatory term rentals | 59,095,212 | 61,468,173 | 63,974,185 |
| Non-sig term rentals | 0 | 0 | 0 |
| Apron fees | 672,959 | 693,147 | 713,942 |
| Loading bridge payments | 1,131,527 | 1,012,752 | 953,872 |
| Conveyor systems | 1,189,290 | 1,193,404 | 1,203,750 |
| Port gate rentals | 2,098,603 | 2,162,316 | 2,227,575 |
| Airline TI's | 1,579,753 | 1,560,049 | 1,560,049 |
| **Total airline costs** | **$96,007,584** | **$99,555,693** | **$103,388,346** |
| Total operating revenues | $176,836,963 | $183,818,051 | $191,211,884 |
| Interest income | 882,311 | 905,743 | 929,878 |
| **Total revenues** | **$177,719,274** | **$184,723,793** | **$192,141,762** |
| **Less non-air pax pass throughs** | | | |
| Interest income | $882,311 | $905,743 | $929,878 |
| Air cargo/aircraft maintenance | $6,830,321 | $7,290,245 | $7,782,616 |
| Non-aviation | $1,611,324 | $1,640,018 | $1,672,860 |
| Other (Administration, Police,ARFF etc.) | $501,000 | $501,000 | $501,000 |
| Total non-air pax costs | $9,824,956 | $10,337,005 | $10,886,354 |
| **Net passenger costs** | **$167,894,318** | **$174,386,788** | **$181,255,408** |
| **Capital vs. operating costs** | | | |
| Operating expenses (less debt service) | $103,110,690 | $109,401,475 | $116,078,169 |
| Capital Expenditures | | | |
| Debt Service | $41,157,416 | $41,138,778 | $41,164,742 |
| Debt Service Coverage | $12,347,225 | $12,341,634 | $12,349,423 |
| **Airline cost per enplanement** | $13.00 | $13.06 | $13.16 |

Portland International Airport
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| | Proj 2012 | Proj 2013 | Proj 2014 |
|---|---|---|---|
| **Enplanements** | 8,101,724 | 8,352,877 | 8,611,817 |
| **O&M Expense Projections** | | | |
| Airfield | $6,777,889 | $7,116,783 | $7,472,622 |
| Terminal | 19,930,707 | 21,325,857 | 22,818,667 |
| Ground Transp. | 16,550,930 | 17,543,986 | 18,596,625 |
| Air Cargo/Aircraft maint. | 1,029,779 | 1,091,566 | 1,157,060 |
| Other Aviation | 491,007 | 520,468 | 551,696 |
| Non-aviation | 1,787,434 | 1,894,680 | 2,008,360 |
| Operations | 1,857,263 | 1,968,698 | 2,086,820 |
| Maintenance | 14,674,663 | 15,555,143 | 16,488,452 |
| Systems & services | 5,940,269 | 6,296,685 | 6,674,486 |
| ARFF | 7,392,718 | 7,836,281 | 8,306,458 |
| Police | 7,418,575 | 7,863,689 | 8,335,510 |
| Administration | 39,313,342 | 41,672,142 | 44,172,471 |
| **Total** | **$123,164,576** | **$130,685,978** | **$138,669,228** |
| **NON-AIRLINE REVENUES** | | | |
| Airfield | $1,078,146 | $1,087,134 | $1,104,251 |
| Terminal | 12,753,405 | 13,334,684 | 13,958,809 |
| Ground Transportation | 62,273,663 | 64,778,915 | 67,400,823 |
| Air cargo/aircraft maintenance | 8,309,735 | 8,874,065 | 9,478,245 |
| Other aviation | 4,943,099 | 5,192,317 | 5,456,829 |
| Non-aviation | 1,698,472 | 1,718,071 | 1,752,698 |
| Other (Administration, Police,ARFF etc.) | 501,000 | 501,000 | 501,000 |
| **Total** | **$91,557,521** | **$95,486,187** | **$99,652,655** |
| **AIRLINE REVENUES** | | | |
| Signatory landing fees | $33,392,465 | $34,807,773 | $35,482,646 |
| Non-sig landing fees | 686,826 | 711,313 | 720,422 |
| Signatory term rentals | 67,197,695 | 70,665,207 | 72,503,419 |
| Non-sig term rentals | 0 | 0 | 0 |
| Apron fees | 735,360 | 757,421 | 780,143 |
| Loading bridge payments | 961,407 | 918,319 | 784,626 |
| Conveyor systems | 646,718 | 398,038 | 409,343 |
| Port gate rentals | 2,294,804 | 2,364,063 | 2,435,412 |
| Airline TI's | 1,266,265 | 854,969 | 854,969 |
| **Total airline costs** | **$107,181,541** | **$111,477,102** | **$113,970,979** |
| Total operating revenues | $198,739,061 | $206,963,289 | $213,623,634 |
| Interest income | 954,736 | 980,341 | 1,006,714 |
| **Total revenues** | **$199,693,798** | **$207,943,629** | **$214,630,348** |
| **Less non-air pax pass throughs** | | | |
| Interest income | $954,736 | $980,341 | $1,006,714 |
| Air cargo/aircraft maintenance | $8,309,735 | $8,874,065 | $9,478,245 |
| Non-aviation | $1,698,472 | $1,718,071 | $1,752,698 |
| Other (Administration, Police,ARFF etc.) | $501,000 | $501,000 | $501,000 |
| Total non-air pax costs | $11,463,944 | $12,073,477 | $12,738,657 |
| **Net passenger costs** | **$188,229,854** | **$195,870,152** | **$201,891,691** |
| **Capital vs. operating costs** | | | |
| Operating expenses (less debt service) | $123,164,576 | $130,685,978 | $138,669,228 |
| Capital Expenditures | | | |
| Debt Service | $40,859,605 | $40,854,249 | $39,544,435 |
| Debt Service Coverage | $12,257,881 | $12,256,275 | $11,863,331 |
| **Airline cost per enplanement** | $13.23 | $13.35 | $13.23 |

Portland International Airport
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| | Proj 2015 | Proj 2016 | Proj 2017 |
|---|---|---|---|
| **Enplanements** | 8,878,783 | 9,154,025 | 9,437,800 |
| **O&M Expense Projections** | | | |
| Airfield | $7,846,253 | $8,238,566 | $8,650,494 |
| Terminal | 24,415,974 | 26,125,092 | 27,953,848 |
| Ground Transp. | 19,712,423 | 20,895,168 | 22,148,879 |
| Air Cargo/Aircraft maint. | 1,226,483 | 1,300,072 | 1,378,076 |
| Other Aviation | 584,797 | 619,885 | 657,078 |
| Non-aviation | 2,128,862 | 2,256,594 | 2,391,989 |
| Operations | 2,212,030 | 2,344,751 | 2,485,436 |
| Maintenance | 17,477,759 | 18,526,425 | 19,638,010 |
| Systems & services | 7,074,955 | 7,499,452 | 7,949,419 |
| ARFF | 8,804,845 | 9,333,136 | 9,893,124 |
| Police | 8,835,641 | 9,365,780 | 9,927,726 |
| Administration | 46,822,819 | 49,632,188 | 52,610,120 |
| **Total** | **$147,142,842** | **$156,137,110** | **$165,684,201** |
| **NON-AIRLINE REVENUES** | | | |
| Airfield | $1,113,768 | $1,123,561 | $1,133,638 |
| Terminal | 14,630,208 | 15,353,844 | 16,135,286 |
| Ground Transportation | 70,146,635 | 73,024,250 | 76,042,300 |
| Air cargo/aircraft maintenance | 10,125,100 | 10,817,656 | 11,559,155 |
| Other aviation | 5,737,648 | 6,035,860 | 6,352,623 |
| Non-aviation | 1,788,072 | 1,821,553 | 1,856,076 |
| Other (Administration, Police,ARFF etc.) | 501,000 | 501,000 | 501,000 |
| **Total** | **$104,042,431** | **$108,677,724** | **$113,580,079** |
| **AIRLINE REVENUES** | | | |
| Signatory landing fees | $36,230,638 | $37,745,981 | $39,303,872 |
| Non-sig landing fees | 730,858 | 756,508 | 782,643 |
| Signatory term rentals | 73,658,760 | 76,494,709 | 79,081,849 |
| Non-sig term rentals | 0 | 0 | 0 |
| Apron fees | 803,548 | 827,654 | 852,484 |
| Loading bridge payments | 768,324 | 780,464 | 609,836 |
| Conveyor systems | 420,988 | 432,982 | 445,335 |
| Port gate rentals | 2,508,914 | 2,584,635 | 2,662,642 |
| Airline TI's | 854,969 | 854,969 | 854,969 |
| **Total airline costs** | **$115,976,999** | **$120,477,902** | **$124,593,630** |
| Total operating revenues | $220,019,429 | $229,155,626 | $238,173,708 |
| Interest income | 1,033,878 | 1,061,856 | 1,090,675 |
| **Total revenues** | **$221,053,307** | **$230,217,482** | **$239,264,383** |
| **Less non-air pax pass throughs** | | | |
| Interest income | $1,033,878 | $1,061,856 | $1,090,675 |
| Air cargo/aircraft maintenance | $10,125,100 | $10,817,656 | $11,559,155 |
| Non-aviation | $1,788,072 | $1,821,553 | $1,856,076 |
| Other (Administration, Police,ARFF etc.) | $501,000 | $501,000 | $501,000 |
| Total non-air pax costs | $13,448,050 | $14,202,066 | $15,006,906 |
| **Net passenger costs** | **$207,605,257** | **$216,015,417** | **$224,257,477** |
| **Capital vs. operating costs** | | | |
| Operating expenses (less debt service) | $147,142,842 | $156,137,110 | $165,684,201 |
| Capital Expenditures | | | |
| Debt Service | $37,215,136 | $36,602,967 | $34,816,598 |
| Debt Service Coverage | $11,164,541 | $10,980,890 | $10,444,979 |
| **Airline cost per enplanement** | $13.06 | $13.16 | $13.20 |

# Worksheet 11

| **Business Purpose** | Auto | Air | Total |
|---|---|---|---|
| Portland Metro, OR | | | |
| Pierce County | 238,400 | 0 | 238,400 |
| King/Kitsap Counties | 623,300 | 166,200 | 789,500 |
| Snohomish/Island Counties | 55,600 | 36,900 | 92,500 |
| Skagit/San Juan/Whatcom Counties | 33,700 | 7,500 | 41,200 |
| Greater Vancouver, BC | 79,300 | 8,600 | 87,900 |
| Clark/Cowlitz/Skamania Co | | | |
| Pierce County | 143,400 | 0 | 143,400 |
| King/Kitsap Counties | 263,900 | 8,800 | 272,700 |
| Snohomish/Island Counties | 45,100 | 6,800 | 51,900 |
| Skagit/San Juan/Whatcom Counties | 12,800 | 0 | 12,800 |
| Greater Vancouver, BC | 6,900 | 0 | 6,900 |
| Thurston County | | | |
| Pierce County | 5,878,900 | 0 | 5,878,900 |
| King/Kitsap Counties | 3,012,500 | 0 | 3,012,500 |
| Snohomish/Island Counties | 254,800 | 0 | 254,800 |
| Skagit/San Juan/Whatcom Counties | 72,300 | 0 | 72,300 |
| Greater Vancouver, BC | 4,600 | 1,900 | 6,500 |
| Pierce County | | | |
| Skagit/San Juan/Whatcom Counties | 74,700 | 1,600 | 76,300 |
| Greater Vancouver, BC | 3,400 | 0 | 3,400 |
| King/Kitsap Counties | | | |
| Skagit/San Juan/Whatcom Counties | 589,100 | 11,700 | 600,800 |
| Greater Vancouver, BC | 186,600 | 9,100 | 195,700 |
| Snohomish County | | | |
| Skagit/San Juan/Whatcom Counties | 443,400 | 4,600 | 448,000 |
| Greater Vancouver, BC | 33,600 | 3,200 | 36,800 |
| Skagit/San Juan Counties | | | |
| Whatcom County | 934,100 | 0 | 934,100 |
| Greater Vancouver, BC | 18,600 | 0 | 18,600 |
| Other North-South Markets | 1,322,700 | 0 | 1,322,700 |

| **Non-Business Purpose** | Auto | Air | Total |
|---|---|---|---|
| Portland Metro, OR | | | |
| Pierce County | 563,300 | 0 | 563,300 |
| King/Kitsap Counties | 2,018,200 | 37,500 | 2,055,700 |
| Snohomish/Island Counties | 373,200 | 7,900 | 381,100 |
| Skagit/San Juan/Whatcom Counties | 252,500 | 11,600 | 264,100 |
| Greater Vancouver, BC | 167,000 | 8,300 | 175,300 |
| Clark/Cowlitz/Skamania Co | | | |
| Pierce County | 511,400 | 0 | 511,400 |
| King/Kitsap Counties | 1,011,000 | 3,900 | 1,014,900 |
| Snohomish/Island Counties | 171,000 | 0 | 171,000 |
| Skagit/San Juan/Whatcom Counties | 105,900 | 0 | 105,900 |
| Greater Vancouver, BC | 9,700 | 0 | 9,700 |
| Thurston County | | | |
| Pierce County | 9,207,600 | 0 | 9,207,600 |
| King/Kitsap Counties | 4,472,900 | 0 | 4,472,900 |
| Snohomish/Island Counties | 441,300 | 0 | 441,300 |
| Skagit/San Juan/Whatcom Counties | 199,100 | 0 | 199,100 |
| Greater Vancouver, BC | 27,200 | 0 | 27,200 |
| Pierce County | | | |
| Skagit/San Juan/Whatcom Counties | 282,700 | 0 | 282,700 |
| Greater Vancouver, BC | 222,300 | 0 | 222,300 |
| King/Kitsap Counties | | | |
| Skagit/San Juan/Whatcom Counties | 1,669,200 | 2,200 | 1,671,400 |
| Greater Vancouver, BC | 1,314,500 | 23,200 | 1,337,700 |
| Snohomish County | | | |
| Skagit/San Juan/Whatcom Counties | 1,043,800 | 1,300 | 1,045,100 |
| Greater Vancouver, BC | 380,400 | 5,300 | 385,700 |
| Skagit/San Juan Counties | | | |
| Whatcom Counties | 2,821,400 | 0 | 2,821,400 |
| Greater Vancouver, BC | 398,500 | 0 | 398,500 |
| Other North-South Markets | 6,009,600 | 0 | 6,009,600 |

| **All Purposes** | Auto | Air | Total |
|---|---|---|---|
| Portland Metro, OR | | | |
| Pierce County | 801,700 | 0 | 801,700 |
| King/Kitsap Counties | 2,641,500 | 203,700 | 2,845,200 |
| Snohomish/Island Counties | 428,800 | 44,800 | 473,600 |
| Skagit/San Juan/Whatcom Counties | 286,200 | 19,100 | 305,300 |
| Greater Vancouver, BC | 246,300 | 16,900 | 263,200 |
| Clark/Cowlitz/Skamania Co | | | |
| Pierce County | 654,800 | 0 | 654,800 |
| King/Kitsap Counties | 1,274,900 | 12,700 | 1,287,600 |
| Snohomish/Island Counties | 216,100 | 6,800 | 222,900 |
| Skagit/San Juan/Whatcom Counties | 118,700 | 0 | 118,700 |
| Greater Vancouver, BC | 16,600 | 0 | 16,600 |
| Thurston County | | | |
| Pierce County | 15,086,500 | 0 | 15,086,500 |
| King/Kitsap Counties | 7,485,400 | 0 | 7,485,400 |
| Snohomish/Island Counties | 696,100 | 0 | 696,100 |
| Skagit/San Juan/Whatcom Counties | 271,400 | 0 | 271,400 |
| Greater Vancouver, BC | 31,800 | 1,900 | 33,700 |
| Pierce County | | | |
| Skagit/San Juan/Whatcom Counties | 357,400 | 1,600 | 359,000 |
| Greater Vancouver, BC | 225,700 | 0 | 225,700 |
| King/Kitsap Counties | | | |
| Skagit/San Juan/Whatcom Counties | 2,258,300 | 13,900 | 2,272,200 |
| Greater Vancouver, BC | 1,501,100 | 32,300 | 1,533,400 |
| Snohomish County | | | |
| Skagit/San Juan/Whatcom Counties | 1,487,200 | 5,900 | 1,493,100 |
| Greater Vancouver, BC | 414,000 | 8,500 | 422,500 |
| Skagit/San Juan Counties | | | |
| Whatcom Counties | 3,755,500 | 0 | 3,755,500 |
| Greater Vancouver, BC | 417,100 | 0 | 417,100 |
| Other North-South Markets | 7,332,300 | 0 | 7,332,300 |

| **Summary** | Auto | Air | Total |
|---|---|---|---|
| Business | 14,331,700 | 266,900 | 14,598,600 |
| Nonbusiness | 33,673,700 | 101,200 | 33,774,900 |
| Total | 48,005,400 | 368,100 | 48,373,500 |

| | Auto | Air | Total |
|---|---|---|---|
| Business | 30% | 73% | 30% |
| Nonbusiness | 70% | 27% | 70% |
| Total | 100% | 100% | 100% |

# Worksheet 12

Wage and Other Income Data

| County | Population[1] | Percentage of Corridor Population | Annual Wage[2] | Monthly Wage | Additional Income Data: Earnings (2000 Census) Annual | Additional Income Data: Earnings (2000 Census) Monthly | Additional Income Data: Earnings (place of work - BEA 2000) |
|---|---|---|---|---|---|---|---|
| Whatcom County | 174,500 | 4.2% | $27,724 | $2,310 | | | 2,526,038,000 |
| Skagit County | 106,700 | 2.6% | $27,420 | $2,285 | | | 1,713,095,000 |
| Snohomish County | 637,500 | 15.2% | $36,390 | $3,032 | | | |
| King County | 1,779,300 | 42.5% | $47,187 | $3,932 | 68,908 | 5,742 | |
| Pierce County | 733,700 | 17.5% | $31,263 | $2,605 | | | |
| Thurston County | 214,800 | 5.1% | $32,771 | $2,731 | | | |
| Lewis County | 70,400 | 1.7% | $26,957 | $2,246 | | | 906,606,000 |
| Cowlitz County | 94,900 | 2.3% | $31,069 | $2,589 | | | $1,511,830,000 |
| Clark County | 372,300 | 8.9% | $33,124 | $2,760 | 56,280 | 4,690 | |
| | **4,184,100** | **100.0%** | | | | | |
| | | | **Weighted Average Monthly Wage** | **$3,228** | | 2,859 | |
| | | | **Hourly wage (assumes full-time employment)** | **$18.62** | | $16.50 | |

1 Office of Financial Management
2 Annual Average Covered Wages (2001); Employment Security Department, LMEA

Annual Average Covered Wages
(ESD, LMEA) 2001

Census: Earnings is defined as the algebraic sum of wage or salary income and net income from self-employment. Earnings represent the amount of income received regularly before deductions for personal income taxes, Social Security, bond purchases, union dues, Medicare deductions, etc.

# Worksheet 13

Air Travel Times

| | Arrival to flight | Flight time | Land to exit | Minutes | Hours |
|---|---|---|---|---|---|
| Seattle-Portland | 75 | 50 | 30 | 155 | 2.58 |
| Seattle-Vancouver | 75 | 50 | 45 | 170 | 2.83 |
| Portland-Vancouver | 75 | 75 | 45 | 195 | 3.25 |
| Bellingham-Seattle | 75 | 40 | 30 | 145 | 2.42 |

# Worksheet 14

Average Vehicle Occupancy
and
Highway Speed

Vehicle occupancy: Email from Pat Whittaker (forwarded by Kirk Frederickson 9/10)

For benefit cost analysis WSDOT uses
1.3 occupants for autos in urban areas during the peak period and
1.1 occupants per auto for urban off peak and rural areas.

PSRC does an occupancy survey every few years and may have more information.

Average Vehicle Occupancy
1.4

| | Length | % Total |
|---|---|---|
| I-5 | 276.62 | 77.4% |
| I-205 | 10.57 | 3.0% |
| I-405 | 30.3 | 8.5% |
| SR-167 | 27.72 | 7.8% |
| SR-512 | 12.06 | 3.4% |
| | 357.27 | 100.0% |

**Washington State Annual Speed Report - CY 2002**

| Federal speed site number | Hwy. | Vehs Observed | Avg. Speed |
|---|---|---|---|
| 5 | I-5 | 1,241,962 | 64.3 |
| 15 | I-5 | 1,936,487 | 57.7 |
| 58 | I-5 | 863,997 | 68.9 |
| 64 | I-5 | 727,319 | 70.0 |
| 65 | I-5 | 568,860 | 68.4 |
| 66 | I-5 | 2,328,074 | 60.3 |
| 67 | I-5 | 2,252,968 | 60.7 |
| 68 | I-5 | Construction | |
| 69 | I-5 | 2,362,972 | 57.6 |
| 69 | I-5 | | |
| 70 | I-5 | 2,160,256 | 59.2 |
| 70 | I-5 | | |
| 71 | I-5 | 498,996 | 66.5 |
| | | | |
| | | | |
| 36 | I-205 | 374,202 | 69.0 |
| | | | |
| | | | |
| 13 | I-405 | Construction | |

| | Avg. Speed | % total |
|---|---|---|
| I-5 | 63.4 | 77.4% |
| I-205 | 69.0 | 3.0% |
| I-405 | unknown | 8.5% |
| SR-167 | unknown | 7.8% |
| SR-512 | unknown | 3.4% |

# Worksheet 15

| **Vehicle Ownership in the Western U.S.** | |
|---|---|
| Automobile/car/station wagon | 55% |
| Pickup | 19% |
| Sports Utility Vehicles | 13% |
| Van | 8% |
| Other | 5% |

Source: U.S. DOT, 2001 National Household Travel Survey (http://nhts.ornl.gov/2001/index.shtml)

**Automobile/car/station wagon - Represent 55% of Total Vehicles**

| | **Cavalier** | **Tarus** | **Grand Marquis** | **Average** |
|---|---|---|---|---|
| **Operating Costs (gas, oil, maintenance, tires)** | 1,725 | 1,950 | 2,220 | 1,965 |
| **Ownership Costs** | | | | |
| Insurance | $1,181 | $1,075 | $1,050 | $1,102 |
| Depreciation and finance charge | $3,605 | $4,444 | $5,397 | $4,482 |
| **Total Operating Costs** | $4,786 | $5,519 | $6,447 | $5,584 |
| **Total Costs** | $6,511 | $7,469 | $8,667 | $7,549 |
| **Total Miles** | 15,000 | 15,000 | 15,000 | 15,000 |
| **Cost per Mile** | $0.434 | $0.498 | $0.578 | $0.503 |
| **Excluded costs to avoid double counting highway** | | | | |
| License, registration, taxes | $167 | $206 | $242 | $205 |

**Vans, SUVs, Pickup Trucks, Other trucks, RVs, Motorcycles - Represent 45% of Total Vehicles**

| | **Trailblazer** | **Caravan** | **Average** |
|---|---|---|---|
| **Operating Costs (gas, oil, maintenance, tires)** | 2,025 | 1,890 | 1,958 |
| **Ownership Costs** | | | |
| Insurance | $950 | $873 | $912 |
| Depreciation and finance charge | $5,153 | $4,527 | $4,840 |
| **Total Operating Costs** | $6,103 | $5,400 | $5,752 |
| **Total Costs** | $8,128 | $7,290 | $7,709 |
| **Total Miles** | 15,000 | 15,000 | 15,000 |
| **Cost per Mile** | $0.542 | $0.486 | $0.514 |
| **Excluded costs to avoid double counting highway** | | | |
| License, registration, taxes | $289 | $259 | $274 |

| **Weighted Average Cost per Mile per Vehicle** | $0.506 |
|---|---|

Source: Your Driving Costs, American Automobile Association, 2003

*Notes:*
*Ownership costs are based on a 4-year/60,000-mile retention cycle*
*Insurance: Comprehensive insurance ($250 deductible); Collision insurance ($500 deductible); Bodily injury and property damage ($100,000, $300,000, $50,000)*
*Depreciation based on 15,000 driving miles annually*
*Financing charges based on 20% down; loan at 7.5% for four years*

# Worksheet 16

| Route | 2002 | 2022 | Rate of Increase |
|---|---|---|---|
| SR 5 | 26,469,332 | 41,574,879 | 2.3% |
| SR 167 | 2,141,454 | 3,237,417 | 2.1% |
| SR 205 | 822,332 | 1,315,725 | 2.4% |
| SR 405 | 4,360,882 | 6,824,568 | 2.3% |
| SR 512 | 841,000 | 1,295,132 | 2.2% |
| **Total** | 34,635,000 | 54,247,721 | |

Source:
2002 and 2022 Pat Whittaker
Highway Performance Monitoring System
Functional Classification
GIS Liaison, WSDOT Transportation Data Office
by way of Kirk Frederickson (email 9/10/03)
other years calculated based on implied rate of increase

**Daily Vehicles Miles (in millions)**

| Route | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|
| SR 5 | 26.47 | 27.07 | 27.69 | 28.32 | 28.97 | 29.63 | 30.31 | 31.00 |
| SR 167 | 2.14 | 2.19 | 2.23 | 2.28 | 2.33 | 2.37 | 2.42 | 2.47 |
| SR 205 | 0.82 | 0.84 | 0.86 | 0.88 | 0.90 | 0.92 | 0.95 | 0.97 |
| SR 405 | 4.36 | 4.46 | 4.56 | 4.66 | 4.77 | 4.88 | 4.99 | 5.10 |
| SR 512 | 0.84 | 0.86 | 0.88 | 0.90 | 0.92 | 0.94 | 0.96 | 0.98 |
| **Total** | **34.64** | **35.42** | **36.22** | **37.05** | **37.89** | **38.75** | **39.63** | **40.52** |

| Route | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|
| SR 5 | 31.71 | 32.43 | 33.17 | 33.93 | 34.71 | 35.50 | 36.31 | 37.14 |
| SR 167 | 2.53 | 2.58 | 2.63 | 2.69 | 2.74 | 2.80 | 2.86 | 2.92 |
| SR 205 | 0.99 | 1.02 | 1.04 | 1.06 | 1.09 | 1.12 | 1.14 | 1.17 |
| SR 405 | 5.22 | 5.33 | 5.46 | 5.58 | 5.71 | 5.83 | 5.97 | 6.10 |
| SR 512 | 1.00 | 1.02 | 1.04 | 1.07 | 1.09 | 1.11 | 1.14 | 1.16 |
| **Total** | **41.44** | **42.38** | **43.35** | **44.33** | **45.33** | **46.36** | **47.42** | **48.49** |

| Route | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| SR 5 | 37.99 | 38.85 | 39.74 | 40.65 | 41.57 | 42.52 |
| SR 167 | 2.98 | 3.04 | 3.11 | 3.17 | 3.24 | 3.31 |
| SR 205 | 1.20 | 1.23 | 1.26 | 1.29 | 1.32 | 1.35 |
| SR 405 | 6.24 | 6.38 | 6.53 | 6.67 | 6.82 | 6.98 |
| SR 512 | 1.19 | 1.21 | 1.24 | 1.27 | 1.30 | 1.32 |
| **Total** | **49.59** | **50.72** | **51.87** | **53.04** | **54.25** | **55.48** |

# Worksheet 17

| | 2001 Dollars | | | 2003 Dollars | |
|---|---|---|---|---|---|
| **I-5 CORRIDOR** | **low** | **high** | percent of system-wide need | **low** | **high** |
| Mobility | 11,679.25 | 15,801.10 | 95.4% | 12,390.52 | 16,763.39 |
| Safety | 0.30 | 0.40 | 0.0% | 0.32 | 0.42 |
| Economic Vitality | 518.19 | 701.05 | 4.2% | 549.75 | 743.74 |
| Environmental | 17.58 | 23.48 | 0.1% | 18.65 | 24.91 |
| Stormwater | 27.69 | 37.54 | 0.2% | 29.38 | 39.83 |
| | 12,243.01 | 16,563.57 | | 12,988.61 | 17,572.29 |
| | 21.4% | 28.9% | | | |

| | | | | Assumed Funded | |
|---|---|---|---|---|---|
| | | | **Avg** | **Low** | **High** |
| From 1998 report - for comparision purposes | | | 14,577 | 5,830.8 | 7,288.5 |
| Mobility investments | $2,098.69 | 92% | 0 | 0.1 | 0.2 |
| Safety investments | $142.90 | 6% | 647 | 258.7 | 323.4 |
| Environmental retrofit investments | $10.88 | 0% | 22 | 8.7 | 10.9 |
| Economic initiatives | $24.32 | 1% | 35 | 13.8 | 17.3 |
| Total capital improvements (const$) | $2,276.79 | | 15,280 | 6,112.2 | 7,640.2 |

15,280.45 average of low and high

**26.7% of system wide need**

Proportions established using 2001 dollars then used in calculation with 2003 dollars

(average of low and high - all figures in millions of 2001 dollars)

| | | | | |
|---|---|---|---|---|
| Total system-wide need: | 57,300.00 | % of System-Wide Need | | |
| Current-law projected revenues: | 12,800.00 | 22.3% | | |
| Plus Nickel Package Infusion | 3,082.40 | 5.4% | | |
| Shortfall | 41,417.60 | 27.7% | 40.0% | Assumed funded - Low Assumption |
| | | | 50.0% | Assumed funded - High Assumption |

**FUNDING SCENARIOS**

| | Low | High | Avg. | |
|---|---|---|---|---|
| Fully funded | 12,988.61 | 17,572.29 | 15,280.45 | |
| No additional funding (at 23% of fully funded) | 2,901.47 | 3,925.40 | 3,413.43 | |
| | | | 26.7% | of Current-law projected revenue |

| | | Millions of 2001$ | | |
|---|---|---|---|---|
| | | | Statewide System Plan (03-22) (p. 16) | |
| | | Statebudget | Corridor allocation | 18% |
| Maintenance | | $3,337 | $601 | Assumed |
| Preservation | | | | |
| Pavement (P1) | | $4,530 | $815 | |
| Structures (P2) | | $1,704 | $307 | |
| Other Facilities (P3) | | $2,518 | $453 | |
| | | | **$1,416** | |
| | | Statewide LaneMiles | 9041.34 | |
| I-5 Corridor L | 967.88 | | | |
| Corridor share | 0.1070505 | | | |

**071404 1240**
**Still need something on the statewide lane miles figure**

| | |
|---|---|
| ADT (millions) | |
| Statewide | 150.073 |
| I-5 Corridor | 34.635 |
| Corridor share | 0.23078768 |

## Annual Mileage and Travel Information

The following mileage and travel information is based on data collected annually for Highway

### 2002 DVMT Information

31-Jul-03

| Jurisdiction Level | Centerline Miles | | Lane Miles | | Daily Vehicle Miles Traveled (1,000s) | |
|---|---|---|---|---|---|---|
| State Total [1] | 7,052.74 | 8.60% | 18,286.75 | 10.70% | 86,263 | 57.90% |
| (Interstate) | 763.67 | 0.90% | 3,940.75 | 2.30% | 41,948 | 28.10% |
| City | 15,273.61 | 18.60% | 32,463.86 | 19.00% | 38,257 | 25.20% |
| County | 40,383.49 | 49.10% | 81,545.66 | 47.60% | 23,930 | 15.80% |
| Other [2] | 19,469.77 | 23.70% | 38,939.66 | 22.70% | 1,623 | 1.10% |
| Total | 82,179.62 | 100% | 171,235.93 | 100% | 150,073 | 100% |

http://www.wsdot.wa.gov/mapsdata/tdo/annualmileage.htm

# Worksheet 18

Nickel Package Statewide Mobility Projects

**Projects Summary**

**Totals** **$3,082.40** **in year 2003$**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2003 | $34.00 | 2004 | $57.20 | 2005 | $3.60 | 2006 | $49.70 |
| 2003 | $23.30 | 2004 | $0.20 | 2005 | $3.00 | 2006 | $13.50 |
| 2003 | $0.10 | 2004 | $7.40 | 2005 | $55.10 | 2006 | $177.00 |
| 2003 | $0.40 | 2004 | $15.00 | 2005 | $12.70 | 2006 | $9.60 |
| 2003 | $3.30 | 2004 | $25.50 | 2005 | $10.00 | 2006 | $0.60 |
| 2003 | $1.80 | 2004 | $39.60 | 2005 | $0.80 | 2006 | $1.00 |
| 2003 | $13.40 | 2004 | $5.10 | 2005 | $55.80 | 2006 | $2.40 |
| 2003 | $9.50 | 2004 | $8.00 | 2005 | $1.30 | 2006 | $0.60 |
| 2003 | $90.50 | 2004 | $11.00 | 2005 | $93.00 | 2006 | $35.00 |
| 2003 | $19.40 | 2004 | $15.20 | 2005 | $91.90 | 2006 | $63.30 |
| 2003 | $0.70 | 2004 | $0.70 | 2005 | $25.50 | 2006 | $6.00 |
| 2003 | $34.20 | 2004 | $15.90 | 2005 | $26.40 | 2006 | $15.00 |
| 2003 | $108.30 | 2004 | $12.00 | 2005 | $28.50 | 2006 | $76.50 |
| 2003 | $0.30 | 2004 | $0.80 | 2005 | $35.00 | 2006 | $7.50 |
| | | 2004 | $1.00 | | | 2006 | $2.20 |
| | | 2004 | $10.00 | | | 2006 | $7.70 |
| | | 2004 | $20.00 | | | 2006 | $2.40 |
| | | 2004 | $35.50 | | | 2006 | $12.20 |
| | | 2004 | $15.10 | | | 2006 | $0.60 |
| | | | | | | 2006 | $1.30 |
| | | | | | | 2006 | $5.00 |
| | | | | | | 2006 | $0.70 |
| | | | | | | 2006 | $1.00 |
| 2007 | $0.30 | 2008 | $1.10 | 2009 | $0.40 | 2010 | $41.60 |
| 2007 | $25.40 | 2008 | $3.40 | 2009 | $1.90 | 2010 | $89.10 |
| 2007 | $0.80 | 2008 | $5.00 | 2009 | $15.20 | | |
| 2007 | $2.90 | 2008 | $102.30 | 2009 | $3.90 | | |
| 2007 | $485.10 | 2008 | $1.90 | 2009 | $33.60 | | |
| 2007 | $14.80 | 2008 | $22.00 | 2009 | $108.70 | 2011 | $40.00 |
| 2007 | $71.40 | 2008 | $238.70 | 2009 | $7.10 | 2011 | $37.30 |
| 2007 | $0.70 | 2008 | $80.70 | | | | |
| 2007 | $5.00 | | | | | | |
| 2007 | $1.10 | | | | | | |
| 2007 | $73.20 | | | | | | |

# Worksheet 19

**The 2002 TAF contains historical aviation activity data and FAA's forecasts for 474 airports receiving FAA and contract tower services. This database also includes projections for 2,895 other airports in the National Plan of Integrated Airport Systems. The forecasts, covering fiscal years 2002 – 2020 project activity of four major U.S. air traffic system users: air carriers, commuters/air taxi, general aviation, and the military as well as passenger enplanements. The FAA uses these forecasts to meet its budget and planning needs. Airport sponsors, state and local aviation authorities, other in the aviation industry, and the public are welcome to use these data.**

**These forecasts include the impact of the terrorists' events of September 11, 2001 and the recent economic downturn. However, these projections do not fully reflect the ongoing structural changes occurring within the aviation industry or the war in Iraq.**

**FAA has revised its forecasts for three airports: Pittsburgh International (PIT), Dallas Love (DAL), and John F. Kennedy International (JFK). These revisions were made on July 29, 2003.**

***The Terminal Area Forecast System*** is the official forecast of aviation activity at FAA facilities. This includes FAA-towered airports, federally-contracted towered airports, nonfederal towered airports, and many non-towered airports.

***Detailed forecasts are developed for the major users of the NationalAviation System***:

- large air carriers
- air taxi/commuters
- general aviation, and military

These forecasts have been prepared to meet the budget and planning needs of the constituent units of the FAA and to provide information which can be used by state and local authorities, the aviation industry, and the general public.

Terminal Area Forecast Estmiates (Aviation)
2 of 4

| SeaTac | | air carrier | commuter | total enplanements | | | | |
|---|---|---|---|---|---|---|---|---|
| year | scenario | ac | commuter | t_enpl | g_ac | g_commuter | g_t_enpl | itn_ac |
| 1992 | 0 | 8,120,436 | 899,275 | 9,019,711 | 0 | 0 | 0 | 194776 |
| 1993 | 0 | 8,275,882 | 983,054 | 9,258,936 | 1.91 | 9.32 | 2.65 | 197955 |
| 1994 | 0 | 9,067,584 | 1,148,436 | 10,216,020 | 9.57 | 16.82 | 10.34 | 208259 |
| 1995 | 0 | 9,908,575 | 1,280,065 | 11,188,640 | 9.27 | 11.46 | 9.52 | 223295 |
| 1996 | 0 | 10,487,597 | 1,281,314 | 11,768,911 | 5.84 | 0.1 | 5.19 | 238421 |
| 1997 | 0 | 10,763,476 | 1,302,929 | 12,066,405 | 2.63 | 1.69 | 2.53 | 240979 |
| 1998 | 0 | 11,141,894 | 1,325,609 | 12,467,503 | 3.52 | 1.74 | 3.32 | 255680 |
| 1999 | 0 | 11,795,944 | 1,894,042 | 13,689,986 | 5.87 | 42.88 | 9.81 | 267926 |
| 2000 | 0 | 12,204,115 | 1,649,184 | 13,853,299 | 3.46 | -12.93 | 1.19 | 276041 |
| 2001 | 0 | 12,051,460 | 1,553,008 | 13,604,468 | -1.25 | -5.83 | -1.8 | 236326 |
| 2002 | 1 | 11,283,129 | 1,287,443 | 12,570,572 | -6.38 | -17.1 | -7.6 | 217352 |
| 2003 | 1 | 11,090,997 | 1,235,945 | 12,326,942 | -1.7 | -4 | -1.94 | 215178 |
| 2004 | 1 | 11,472,822 | 1,321,966 | 12,794,788 | 3.44 | 6.96 | 3.8 | 220844 |
| 2005 | 1 | 11,853,539 | 1,407,988 | 13,261,527 | 3.32 | 6.51 | 3.65 | 226510 |
| 2006 | 1 | 12,233,726 | 1,494,010 | 13,727,736 | 3.21 | 6.11 | 3.52 | 232176 |
| 2007 | 1 | 12,613,796 | 1,580,032 | 14,193,828 | 3.11 | 5.76 | 3.4 | 237842 |
| 2008 | 1 | 12,993,194 | 1,666,053 | 14,659,247 | 3.01 | 5.44 | 3.28 | 243508 |
| 2009 | 1 | 13,375,474 | 1,752,075 | 15,127,549 | 2.94 | 5.16 | 3.19 | 249175 |
| 2010 | 1 | 13,759,005 | 1,838,097 | 15,597,102 | 2.87 | 4.91 | 3.1 | 254841 |
| 2011 | 1 | 14,140,379 | 1,924,119 | 16,064,498 | 2.77 | 4.68 | 3 | 260507 |
| 2012 | 1 | 14,523,706 | 2,010,140 | 16,533,846 | 2.71 | 4.47 | 2.92 | 266173 |
| 2013 | 1 | 14,907,826 | 2,096,162 | 17,003,988 | 2.64 | 4.28 | 2.84 | 271839 |
| 2014 | 1 | 15,293,703 | 2,182,184 | 17,475,887 | 2.59 | 4.1 | 2.78 | 277505 |
| 2015 | 1 | 15,679,582 | 2,268,206 | 17,947,788 | 2.52 | 3.94 | 2.7 | 283172 |
| 2016 | 1 | 16,062,418 | 2,354,227 | 18,416,645 | 2.44 | 3.79 | 2.61 | 288838 |
| 2017 | 1 | 16,446,778 | 2,440,249 | 18,887,027 | 2.39 | 3.65 | 2.55 | 294504 |
| 2018 | 1 | 16,832,087 | 2,526,271 | 19,358,358 | 2.34 | 3.53 | 2.5 | 300170 |
| 2019 | 1 | 17,219,660 | 2,612,293 | 19,831,953 | 2.3 | 3.41 | 2.45 | 305836 |
| 2020 | 1 | 17,606,590 | 2,698,315 | 20,304,905 | 2.25 | 3.29 | 2.38 | 311503 |

Portland air carrier commuter total enplanements

| year | scenario | ac | commuter | t_enpl | g_ac | g_commuter | g_t_enpl | itn_ac |
|---|---|---|---|---|---|---|---|---|
| 1992 | 0 | 3,174,445 | 470,273 | 3,644,718 | 0 | 0 | 0 | 89014 |
| 1993 | 0 | 3,545,270 | 551,748 | 4,097,018 | 11.68 | 17.33 | 12.41 | 93202 |
| 1994 | 0 | 4,116,084 | 675,933 | 4,792,017 | 16.1 | 22.51 | 16.96 | 98959 |
| 1995 | 0 | 4,660,289 | 794,053 | 5,454,342 | 13.22 | 17.48 | 13.82 | 112625 |
| 1996 | 0 | 5,234,104 | 841,706 | 6,075,810 | 12.31 | 6 | 11.39 | 119872 |
| 1997 | 0 | 5,468,483 | 866,396 | 6,334,879 | 4.48 | 2.93 | 4.26 | 124392 |
| 1998 | 0 | 5,394,747 | 901,808 | 6,296,555 | -1.35 | 4.09 | -0.6 | 116652 |
| 1999 | 0 | 5,634,889 | 1,087,009 | 6,721,898 | 4.45 | 20.54 | 6.76 | 144680 |
| 2000 | 0 | 5,753,975 | 976,537 | 6,730,512 | 2.11 | -10.16 | 0.13 | 154091 |
| 2001 | 0 | 5,493,756 | 944,877 | 6,438,633 | -4.52 | -3.24 | -4.34 | 145836 |
| 2002 | 1 | 5,076,162 | 894,798 | 5,970,960 | -7.6 | -5.3 | -7.26 | 122407 |
| 2003 | 1 | 4,906,849 | 1,004,858 | 5,911,707 | -3.34 | 12.3 | -0.99 | 119346 |
| 2004 | 1 | 5,052,281 | 1,035,690 | 6,087,971 | 2.96 | 3.07 | 2.98 | 122320 |
| 2005 | 1 | 5,197,713 | 1,066,522 | 6,264,235 | 2.88 | 2.98 | 2.9 | 125294 |
| 2006 | 1 | 5,343,145 | 1,097,354 | 6,440,499 | 2.8 | 2.89 | 2.81 | 128268 |
| 2007 | 1 | 5,488,577 | 1,128,186 | 6,616,763 | 2.72 | 2.81 | 2.74 | 131242 |
| 2008 | 1 | 5,634,009 | 1,159,018 | 6,793,027 | 2.65 | 2.73 | 2.66 | 134216 |
| 2009 | 1 | 5,779,442 | 1,189,850 | 6,969,292 | 2.58 | 2.66 | 2.59 | 137190 |
| 2010 | 1 | 5,924,874 | 1,220,682 | 7,145,556 | 2.52 | 2.59 | 2.53 | 140164 |
| 2011 | 1 | 6,070,306 | 1,251,514 | 7,321,820 | 2.45 | 2.53 | 2.47 | 143138 |
| 2012 | 1 | 6,215,738 | 1,282,346 | 7,498,084 | 2.4 | 2.46 | 2.41 | 146112 |
| 2013 | 1 | 6,361,170 | 1,313,178 | 7,674,348 | 2.34 | 2.4 | 2.35 | 149086 |
| 2014 | 1 | 6,506,602 | 1,344,010 | 7,850,612 | 2.29 | 2.35 | 2.3 | 152060 |
| 2015 | 1 | 6,652,035 | 1,374,842 | 8,026,877 | 2.24 | 2.29 | 2.25 | 155034 |
| 2016 | 1 | 6,797,467 | 1,405,674 | 8,203,141 | 2.19 | 2.24 | 2.2 | 158008 |
| 2017 | 1 | 6,942,899 | 1,436,506 | 8,379,405 | 2.14 | 2.19 | 2.15 | 160982 |
| 2018 | 1 | 7,088,331 | 1,467,338 | 8,555,669 | 2.09 | 2.15 | 2.1 | 163956 |
| 2019 | 1 | 7,233,763 | 1,498,170 | 8,731,933 | 2.05 | 2.1 | 2.06 | 166930 |
| 2020 | 1 | 7,379,196 | 1,529,002 | 8,908,198 | 2.01 | 2.06 | 2.02 | 169904 |

| Bellingham | | air carrier | commuter | total enplanements | | | | |
|---|---|---|---|---|---|---|---|---|
| year | scenario | ac | commuter | t_enpl | g_ac | g_commuter | g_t_enpl | itn_ac |
| 1992 | 0 | 42,729 | 76,142 | 118,871 | 0 | 0 | 0 | 1469 |
| 1993 | 0 | 46,459 | 105,259 | 151,718 | 8.73 | 38.24 | 27.63 | 1083 |
| 1994 | 0 | 25,125 | 108,506 | 133,631 | -45.92 | 3.08 | -11.92 | 813 |
| 1995 | 0 | 22,015 | 104,022 | 126,037 | -12.38 | -4.13 | -5.68 | 1026 |
| 1996 | 0 | 28,178 | 94,887 | 123,065 | 27.99 | -8.78 | -2.36 | 671 |
| 1997 | 0 | 24,433 | 87,125 | 111,558 | -13.29 | -8.18 | -9.35 | 705 |
| 1998 | 0 | 9,732 | 84,352 | 94,084 | -60.17 | -3.18 | -15.66 | 402 |
| 1999 | 0 | 2,711 | 90,165 | 92,876 | -72.14 | 6.89 | -1.28 | 137 |
| 2000 | 0 | 19,737 | 92,208 | 111,945 | 628.03 | 2.27 | 20.53 | 510 |
| 2001 | 0 | 8,817 | 94,433 | 103,250 | -55.33 | 2.41 | -7.77 | 308 |
| 2002 | 1 | 8,817 | 50,114 | 58,931 | 0 | -46.93 | -42.92 | 146 |
| 2003 | 1 | 8,817 | 50,114 | 58,931 | 0 | 0 | 0 | 194 |
| 2004 | 1 | 8,817 | 51,062 | 59,879 | 0 | 1.89 | 1.61 | 194 |
| 2005 | 1 | 8,817 | 52,010 | 60,827 | 0 | 1.86 | 1.58 | 194 |
| 2006 | 1 | 8,817 | 52,958 | 61,775 | 0 | 1.82 | 1.56 | 194 |
| 2007 | 1 | 8,817 | 53,907 | 62,724 | 0 | 1.79 | 1.54 | 194 |
| 2008 | 1 | 8,817 | 54,855 | 63,672 | 0 | 1.76 | 1.51 | 194 |
| 2009 | 1 | 8,817 | 55,804 | 64,621 | 0 | 1.73 | 1.49 | 194 |
| 2010 | 1 | 8,817 | 56,752 | 65,569 | 0 | 1.7 | 1.47 | 194 |
| 2011 | 1 | 8,817 | 57,701 | 66,518 | 0 | 1.67 | 1.45 | 194 |
| 2012 | 1 | 8,817 | 58,649 | 67,466 | 0 | 1.64 | 1.43 | 194 |
| 2013 | 1 | 8,817 | 59,597 | 68,414 | 0 | 1.62 | 1.41 | 194 |
| 2014 | 1 | 8,817 | 60,546 | 69,363 | 0 | 1.59 | 1.39 | 194 |
| 2015 | 1 | 8,817 | 61,494 | 70,311 | 0 | 1.57 | 1.37 | 194 |
| 2016 | 1 | 8,817 | 62,443 | 71,260 | 0 | 1.54 | 1.35 | 194 |
| 2017 | 1 | 8,817 | 63,391 | 72,208 | 0 | 1.52 | 1.33 | 194 |
| 2018 | 1 | 8,817 | 64,340 | 73,157 | 0 | 1.5 | 1.31 | 194 |
| 2019 | 1 | 8,817 | 65,288 | 74,105 | 0 | 1.47 | 1.3 | 194 |
| 2020 | 1 | 8,817 | 66,237 | 75,054 | 0 | 1.45 | 1.28 | 194 |

# Worksheet 20

**Port of Seattle 2003 Budget Summary**
**(in thousands)**

| OPERATING BUDGET | Aviation |
|---|---|
| Operating Revenues | 228,078 |
| Security Reimbursement | 3,675 |
| **Total Operating Revenues** | **231,753** |
| | |
| Operating and Maintenance Expense | 106,243 |
| Corporate Administrative Expense | 14,260 |
| Security Costs | 4,823 |
| Law Enforcement Costs | 17,844 |
| General Contingency | 0 |
| **Total Operating Expense** | **143,170** |
| | |
| **Net Operating Income before Depreciation** | **88,583** |
| | |
| Depreciation | 55,744 |
| **Net Operating Income after Depreciation** | **32,839** |
| | |
| Revenue Bond Interest Expense | -32,463 |
| Interest Income | 4,930 |
| Other Non-Op Income (Expense) | -2,757 |
| **Income (loss) Before Governmental Revenue/Expense** | **2,549** |
| | |
| Ad Valorem Tax Levy Revenue | 0 |
| Grants and Donations | 45,703 |
| Passenger Facility Charges & related Investment Income | 56,771 |
| PFC Bond Interest & Amortization | -2,753 |
| G.O. Bond Interest & Amortization | 0 |
| Public Asset Expense | 0 |
| **Revenue Over Expense** | **102,270** |
| | |
| Capital Budget | |
| Total Committed | 607,389 |

**Port of Seattle 2003 Budget Summary**
**(in thousands)**

| | Notes | Budget 2002 | Approved Budget | 2004 | Forecast 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|
| Operating Budget | | | | | | | |
| Airline Revenue | | 110,456 | 126,032 | 159,089 | 243,483 | 281,766 | 319,493 |
| Non-Airline Revenue | | 103,021 | 102,046 | 109,917 | 118,718 | 127,608 | 136,918 |
| Security Reimbursement | | 0 | 3,675 | 0 | 0 | 0 | 0 |
| **Total Operating Revenues** | | **213,477** | **231,753** | **269,006** | **362,201** | **409,374** | **456,411** |
| | | | | | | | |
| Operating and Maintenance Expense | | 96,282 | | 129,409 | 146,441 | 159,711 | 174,192 |
| Corporate Administrative Expense | 1 | 14,796 | | 29,506 | 30,833 | 32,221 | 33,672 |
| Security Costs | | 2,559 | | 0 | 0 | 0 | 0 |
| Law Enforcement Costs | | 18,550 | | 0 | 0 | 0 | 0 |
| **Total Operating Expense** | | **132,187** | **0** | **158,915** | **177,274** | **191,932** | **207,864** |
| | | | | | | | |
| **Net Operating Income Before Depreciation** | | **81,290** | **231,753** | **110,091** | **184,927** | **217,442** | **248,547** |
| | | | | | | | |
| Total Depreciation Expense | | 51,678 | | | | | |
| **Net Operating Income After Depreciation** | | **29,612** | **231,753** | | | | |
| | | | | | | | |
| **Committed Capital Budget** | 2 | **495,310** | **607,389** | **482,160** | **413,545** | **131,134** | **64,971** |

1) Consists of remaining Corporate costs to be allocated to Lines of Business after direct charges have been coded to LOB's and Divisions or other costs allocated to Divisions. Most costs are allocated using a formula based on Expenses and employees. For

**Port of Seattle Capital Budget (in thousands)**

| | Budget 2002[2] | Est. Act 2002 [3] | 2003 | 2004 | 2005 | 2006 | 2007 | 2008-2012 | Total 2003-2012 |
|---|---|---|---|---|---|---|---|---|---|
| Committed Projects | | | | | | | | | |
| Airfield | 185,364 | 88,295 | 78,519 | 180,602 | 216,855 | 70,220 | 32,498 | 0 | **578,694** |
| Aviation Properties | 0 | 1,022 | 272 | 250 | 350 | 641 | 0 | 0 | **1,513** |
| Landslide | 23,633 | 16,057 | 20,290 | 10,639 | 2,000 | 0 | 0 | 0 | **32,929** |
| Air Terminal | 212,230 | 232,306 | 291,732 | 104,429 | 29,746 | 5,393 | 0 | 0 | **431,300** |
| Aviation Infrastructure Systems | 58,095 | 82,994 | 73,219 | 76,668 | 68,177 | 33,966 | 10,892 | 271 | **263,193** |
| Airfield Security | 0 | 17,620 | 93,165 | 28,415 | 0 | 0 | 0 | 0 | **121,580** |
| Community Relations | 0 | 14,525 | 26,165 | 24,574 | 32,670 | 35,067 | 21,581 | 82,028 | **222,085** |
| Aviation F&B (Division-wide) | 15,988 | 1,732 | 24,027 | 56,583 | 63,747 | -14,153 | 0 | 1,193 | **131,397** |
| **Aviation Division** | **495,310** | **454,551** | **607,389** | **482,160** | **413,545** | **131,134** | **64,971** | **83,492** | **1,782,691** |

[2] The Budget 2002 column lists amounts from the 2002 Business Plan/Budget established in October 2001. In many cases these vary from the Approved Budget amounts established in the beginning of 2002 against which estimated actuals are tracked. [3] Estimated Actual 2002 represent six months of actual spending and six months of projected spending.

# Worksheet 21

| | 2002 | 2001 | 2000 |
|---|---|---|---|
| Security grants | 4,972 | 0 | 0 |

**Financial information by division for years ended December 31 (in thousands)**

| **Airport Only** | **2002** | **2001** | **2000** |
|---|---|---|---|
| Revenue | 219,034 | 220,192 | 206,916 |
| Operations, maintenance, and environmental expenses | 114,494 | 114,468 | 116,535 |
| Earthquake repair expense—net | -1,394 | 1,516 | 13,810 |
| Administration | 30,963 | 26,834 | 0 |
| Total operating expenses before depreciation | **144,063** | **142,818** | **130,345** |
| Net operating income before depreciation | 74,970 | 77,374 | 76,571 |
| Depreciation | 51,799 | 47,840 | 44,979 |
| Operating income | **23,171** | **29,534** | **31,592** |
| Revenue and capital appreciation bond interest expense | -27,033 | -24,500 | -25,308 |
| Interest income | 14,511 | 11,876 | 9,191 |
| Other nonoperating (expense) income | -1,591 | -5,677 | -10,727 |
| (Loss) income before governmental revenue (expense) | **9,058** | **11,233** | **4,748** |
| | | | |
| Ad valorem tax levy revenue | 0 | 0 | 0 |
| Grants and donations | 16,349 | 20,597 | 6,031 |
| Passenger facility charges revenue and related interest incom | 53,675 | 43,961 | 44,978 |
| Passenger facility charges revenue bond interest expense | -3,121 | -2,323 | -1,007 |
| General obligation bond interest expense—net | 0 | 0 | 0 |
| Public assets expense | 0 | 0 | 0 |
| | | | |
| Revenue over expense | **75,961** | **73,468** | **54,750** |
| | | | |
| Identifiable fixed assets | 1,398,004 | 1,252,301 | 1,134,561 |
| Other identifiable assets | 1,421,290 | 1,432,644 | 1,075,068 |
| Identifiable assets | **2,819,294** | **2,684,945** | **2,209,629** |
| | | | |
| Capital expenditures | 455,717 | 391,822 | 292,059 |
| | | | |
| Total long-term debt, including current maturities | 1,757,440 | 1,740,116 | 1,350,981 |

# Worksheet 22

SeaTac Annual Financial Summary
1 of 3

| | Budget 2002 | Forecast 2003 | Forecast 2004 | Forecast 2005 | Forecast 2006 |
|---|---|---|---|---|---|
| Revenues | | | | | |
| Landing Fees | 71,467,938 | 60,478,438 | 68,139,495 | 86,322,540 | 98,253,808 |
| Terminal Rents | 37,490,220 | 92,239,479 | 110,260,744 | 154,245,905 | 174,751,408 |
| Other Airline | 1,534,800 | 1,603,866 | 1,676,040 | 1,751,462 | 1,830,278 |
| Total Airline | 110,492,958 | 154,321,783 | 180,076,279 | 242,319,907 | 274,835,493 |
| Non Airline | 103,185,460 | 112,155,015 | 121,258,914 | 121,914,437 | 126,127,158 |
| Total Revenue | 213,678,418 | 266,476,799 | 301,335,193 | 364,234,344 | 400,962,651 |
| Total Operating Expense | 132,388,531 | 148,339,451 | 157,642,845 | 169,218,853 | 182,291,594 |
| Net Operating Income | 81,289,887 | 118,137,348 | 143,692,348 | 195,015,491 | 218,671,057 |
| Non-Operating Income | 690,000 | 246,895 | 644,146 | 1,222,251 | 1,500,000 |
| Available for Debt Service | 81,979,887 | 118,384,243 | 144,336,494 | 196,237,743 | 220,171,057 |
| Total Debt Service | 60,466,234 | 80,590,465 | 96,372,157 | 133,523,888 | 150,908,328 |
| Net After Debt Service | 21,513,653 | 37,793,778 | 47,964,338 | 62,713,855 | 69,262,728 |
| Financial Indicators | | | | | |
| Airline CPE | 8.70 | 11.26 | 12.41 | 16.11 | 17.64 |
| Landing Fee | 3.44 | 2.86 | 3.07 | 3.78 | 4.19 |
| Airline Revenue/Total Revenue | 51.7% | 57.9% | 59.8% | 66.5% | 68.5% |
| Non Airline Revenue Growth | -7.8% | 8.7% | 8.1% | 0.5% | 3.5% |
| Total Airport Coverage | 1.36 | 1.47 | 1.50 | 1.47 | 1.46 |
| Debt Per Enplanement | 111.61 | 130.99 | 148.52 | 153.61 | 147.04 |
| Total Debt Outstanding | 1,417,850,775 | 1,795,463,371 | 2,155,887,112 | 2,309,985,766 | 2,290,779,596 |
| Landing Fee Credit | | 13,752,618 | 13,790,602 | 2,628,105 | 451,327 |
| Cumulative % of CIP Funded with Debt | 60.0% | 65.9% | 67.3% | 66.1% | 63.3% |
| Fund Balances | | | | | |
| ADF | 11,459,653 | 31,483,431 | 50,000,000 | 50,000,000 | 54,806,399 |
| PFC | 26,672,202 | - | - | - | - |
| Traffic Assumptions | | | | | |
| Enplanements | 12,703,270 | 13,706,828 | 14,515,531 | 15,038,090 | 15,579,462 |
| Enplanment Growth Rate | -4.3% | 7.9% | 5.9% | 3.6% | 3.6% |
| Landed Weight | 19,913,000 | 21,171,502 | 22,170,796 | 22,809,315 | 23,466,224 |
| Landed Weight Growth Rate | | 6.3% | 4.7% | 2.9% | 2.9% |
| CIP Summary | | | | | |
| Phase 1 | 457,978,000 | 513,890,000 | 328,795,000 | 209,908,000 | 57,634,000 |
| Phase 2 | 50,159,000 | 143,218,000 | 181,476,000 | 169,931,000 | 78,141,000 |
| Phase 3 | 3,543,000 | 14,792,000 | 1,000,000 | 200,000 | 5,000,000 |
| Total | 511,680,000 | 671,900,000 | 511,271,000 | 380,039,000 | 140,775,000 |

SeaTac Annual Financial Summary
2 of 3

| | Forecast 2007 | Forecast 2008 | Forecast 2009 | Forecast 2010 | Forecast 2011 |
|---|---|---|---|---|---|
| Revenues | | | | | |
| Landing Fees | 120,904,018 | 124,392,212 | 126,042,778 | 127,391,721 | 129,925,170 |
| Terminal Rents | 185,597,442 | 188,859,493 | 191,984,937 | 195,929,579 | 199,093,158 |
| Other Airline | 1,912,640 | 1,998,709 | 2,088,651 | 2,182,640 | 2,280,859 |
| Total Airline | 308,414,100 | 315,250,414 | 320,116,365 | 325,503,940 | 331,299,186 |
| Non Airline | 150,337,401 | 157,170,522 | 164,397,025 | 171,589,825 | 179,179,486 |
| Total Revenue | 458,751,502 | 472,420,936 | 484,513,390 | 497,093,765 | 510,478,673 |
| Total Operating Expense | 193,794,687 | 203,087,036 | 211,551,855 | 220,748,806 | 230,364,378 |
| Net Operating Income | 264,956,814 | 269,333,900 | 272,961,535 | 276,344,959 | 280,114,295 |
| Non-Operating Income | 1,572,096 | 2,293,110 | 2,685,070 | 1,964,056 | 1,500,000 |
| Available for Debt Service | 266,528,910 | 271,627,010 | 275,646,605 | 278,309,015 | 281,614,295 |
| Total Debt Service | 189,114,705 | 189,725,542 | 188,707,113 | 188,076,138 | 191,007,550 |
| Net After Debt Service | 77,414,206 | 81,901,468 | 86,939,493 | 90,232,877 | 90,606,745 |
| Financial Indicators | | | | | |
| Airline CPE | 19.11 | 18.85 | 18.48 | 18.14 | 17.82 |
| Landing Fee | 5.01 | 5.01 | 4.93 | 4.85 | 4.80 |
| Airline Revenue/Total Revenue | 67.2% | 66.7% | 66.1% | 65.5% | 64.9% |
| Non Airline Revenue Growth | 19.2% | 4.5% | 4.6% | 4.4% | 4.4% |
| Total Airport Coverage | 1.41 | 1.43 | 1.46 | 1.48 | 1.47 |
| Debt Per Enplanement | 138.53 | 129.91 | 124.44 | 116.14 | 107.97 |
| Total Debt Outstanding | 2,235,870,702 | 2,172,287,440 | 2,155,666,724 | 2,084,350,190 | 2,007,460,160 |
| Landing Fee Credit | - | - | - | - | - |
| Cumulative % of CIP Funded with Debt | 61.6% | 58.9% | 56.7% | 54.6% | 53.9% |
| Fund Balances | | | | | |
| ADF | 98,067,605 | 80,937,073 | 50,000,000 | 50,000,000 | 119,381,745 |
| PFC | 30,455,274 | 74,917,433 | 123,551,462 | 176,612,019 | 226,749,724 |
| Traffic Assumptions | | | | | |
| Enplanements | 16,140,322 | 16,721,374 | 17,323,343 | 17,946,984 | 18,593,075 |
| Enplanment Growth Rate | 3.6% | 3.6% | 3.6% | 3.6% | 3.6% |
| Landed Weight | 24,142,051 | 24,837,342 | 25,552,657 | 26,288,574 | 27,045,685 |
| Landed Weight Growth Rate | 2.9% | 2.9% | 2.9% | 2.9% | 2.9% |
| CIP Summary | | | | | |
| Phase 1 | 18,593,000 | 9,240,000 | 9,121,000 | 8,642,000 | 12,617,000 |
| Phase 2 | 25,910,000 | 18,448,000 | 19,001,000 | 19,571,000 | 20,158,000 |
| Phase 3 | 15,000,000 | 80,000,000 | 143,000,000 | 71,117,000 | - |
| Total | 59,503,000 | 107,688,000 | 171,122,000 | 99,330,000 | 32,775,000 |

Phase 1 (+ Noise)
Phase 2
Phase 3
Total

SeaTac Annual Financial Summary
3 of 3

| | Forecast 2012 | Forecast 2013 | Forecast 2014 | Forecast 2015 | Average Annual |
|---|---|---|---|---|---|
| Revenues | | | | | |
| Landing Fees | 133,324,149 | 136,439,335 | 139,578,679 | 140,877,256 | |
| Terminal Rents | 203,614,408 | 207,676,129 | 211,726,205 | 212,757,248 | |
| Other Airline | 2,383,497 | 2,490,755 | 2,602,839 | 2,719,967 | |
| Total Airline | 339,322,054 | 346,606,219 | 353,907,722 | 356,354,471 | |
| Non Airline | 187,189,503 | 195,644,831 | 204,571,974 | 213,999,091 | |
| Total Revenue | 526,511,557 | 542,251,050 | 558,479,696 | 570,353,562 | |
| Total Operating Expense | 240,418,424 | 250,931,813 | 261,926,484 | 273,425,509 | |
| Net Operating Income | 286,093,133 | 291,319,236 | 296,553,212 | 296,928,053 | 235,100,805 |
| Non-Operating Income | 2,540,726 | 4,919,178 | 7,622,433 | 10,415,709 | |
| Available for Debt Service | 288,633,859 | 296,238,414 | 304,175,645 | 307,343,762 | |
| Total Debt Service | 192,254,146 | 192,229,142 | 191,811,496 | 184,558,843 | |
| Net After Debt Service | 96,379,713 | 104,009,272 | 112,364,149 | 122,784,919 | |
| Financial Indicators | | | | | |
| Airline CPE | 17.62 | 17.37 | 17.12 | 16.64 | |
| Landing Fee | 4.79 | 4.77 | 4.74 | 4.65 | |
| Airline Revenue/Total Revenue | 64.4% | 63.9% | 63.4% | 62.5% | |
| Non Airline Revenue Growth | 4.5% | 4.5% | 4.6% | 4.6% | |
| Total Airport Coverage | 1.50 | 1.54 | 1.59 | 1.67 | |
| Debt Per Enplanement | 99.95 | 92.11 | 84.84 | 77.88 | |
| Total Debt Outstanding | 1,925,190,842 | 1,838,168,065 | 1,753,998,821 | 1,667,994,223 | |
| Landing Fee Credit | - | - | - | - | |
| Cumulative % of CIP Funded with Debt | 53.8% | 53.5% | 53.2% | 53.2% | |
| Fund Balances | | | | | |
| ADF | 208,563,458 | 299,598,731 | 394,781,880 | 517,566,799 | |
| PFC | 292,021,753 | 362,666,471 | 438,988,156 | 521,325,494 | |
| Traffic Assumptions | | | | | |
| Enplanements | 19,262,426 | 19,955,873 | 20,674,284 | 21,418,559 | |
| Enplanment Growth Rate | 3.6% | 3.6% | 3.6% | 3.6% | |
| Landed Weight | 27,824,601 | 28,625,949 | 29,450,376 | 30,298,547 | |
| Landed Weight Growth Rate | 2.9% | 2.9% | 2.9% | 2.9% | |
| CIP Summary | | | | | |
| Phase 1 | - | - | - | - | |
| Phase 2 | 7,198,000 | 12,974,000 | 17,181,000 | - | |
| Phase 3 | - | - | - | - | |
| Total | 7,198,000 | 12,974,000 | 17,181,000 | - | |

| Pre-2001 | 2001 - 2015 | 2016 - 2018 | Total CIP |
|---|---|---|---|
| 735,345,000 | 1,970,079,000 | - | 2,705,424,000 |
| 36,886,000 | 805,451,000 | - | 842,337,000 |
| 3,674,000 | 338,751,000 | - | 342,425,000 |
| 775,905,000 | 3,114,281,000 | | 3,890,186,000 |

# Worksheet 23

Vancouver BC Overall Flight Projections
(Source: John)
Overall includes Domestic, International, and Transport

| 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|
| 6.1% | 5.7% | 5.2% | 5.0% | 4.8% | 4.6% | 4.4% | 4.1% | 3.9% | 3.7% |

| 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|
| 3.5% | 3.3% | 3.2% | 3.0% | 2.8% | 2.7% | 2.5% | 2.4% | 2.3% | 2.2% |

# Worksheet 24

## Total Enplaned and Deplaned Revenue Passengers (thousands) - Vancouver

| | Domestic | Transborder | Other International | Majors | Regional / Local | Charter | Total | Change from Previous | 3 Year Average Change |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 5,048 | 1,576 | 455 | 6,492 | 96 | 491 | 7,079 | | |
| 1981 | 5,068 | 1,600 | 463 | 6,509 | 85 | 537 | 7,131 | 0.7% | |
| 1982 | 4,438 | 1,463 | 459 | 5,548 | 150 | 661 | 6,360 | -10.8% | |
| 1983 | 4,353 | 1,474 | 544 | 5,498 | 225 | 648 | 6,371 | 0.2% | -3.3% |
| 1984 | 4,662 | 1,572 | 536 | 5,739 | 448 | 582 | 6,770 | 6.3% | -1.5% |
| 1985 | 4,937 | 1,528 | 553 | 5,750 | 601 | 668 | 7,018 | 3.7% | 3.4% |
| 1986 | 5,838 | 1,950 | 627 | 6,928 | 974 | 513 | 8,415 | 19.9% | 9.9% |
| 1987 | 5,298 | 1,839 | 687 | 6,332 | 1,098 | 394 | 7,824 | -7.0% | 5.5% |
| 1988 | 6,046 | 1,956 | 838 | 6,920 | 1,550 | 370 | 8,840 | 13.0% | 8.6% |
| 1989 | 6,053 | 2,138 | 953 | 6,878 | 1,822 | 443 | 9,144 | 3.4% | 3.1% |
| 1990 | 6,043 | 2,383 | 1,119 | 6,988 | 1,991 | 565 | 9,545 | 4.4% | 6.9% |
| 1991 | 5,571 | 2,166 | 1,259 | 6,614 | 1,815 | 567 | 8,996 | -5.8% | 0.7% |
| 1992 | 5,657 | 2,293 | 1,500 | 6,995 | 1,811 | 644 | 9,450 | 5.0% | 1.2% |
| 1993 | 5,494 | 2,448 | 1,737 | 6,967 | 1,922 | 790 | 9,679 | 2.4% | 0.6% |
| 1994 | 5,748 | 2,508 | 1,950 | 7,840 | 1,320 | 1,045 | 10,206 | 5.4% | 4.3% |
| 1995 | 6,135 | 2,854 | 2,118 | 8,678 | 1,263 | 1,166 | 11,107 | 8.8% | 5.6% |
| 1996 | 7,079 | 3,447 | 2,564 | 11,008 | 1,143 | 939 | 13,090 | 17.9% | 10.7% |
| 1997 | 7,423 | 3,727 | 2,891 | 11,973 | 1,008 | 1,061 | 14,041 | 7.3% | 11.3% |
| 1998 | 7,828 | 4,107 | 2,957 | 12,600 | 1,354 | 938 | 14,892 | 6.1% | 10.4% |
| 1999 | 8,063 | 4,006 | 3,067 | 13,034 | 1,204 | 899 | 15,136 | 1.6% | 5.0% |

Note: 1999 data subject to revision due to carriers' late filing; Enplaned and deplaned passengers;

Effective in 1994, Time Air data is reported in the major scheduled airlines data instead of in the regional/local scheduled airlines data.

Updated Nov. 30, 2000

Source: Statistics Canada, Air Carrier Statements 2, 4 & 6 - Oct. 2000

15 Year Average Change 5.8%

## Tickets Sold in Canada by Major Airport (thousands)

| | Toronto | **Vancouver** | Dorval | Calgary | Ottawa | Mirabel | Halifax | Winnipeg | Edmonton Intl |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 14,528 | **7,079** | 6,287 | 4,237 | 1,950 | 1,409 | 1,510 | 2,414 | 2,441 |
| 1985 | 15,839 | **7,019** | 5,545 | 3,910 | 2,272 | 1,716 | 1,754 | 2,150 | 2,002 |
| 1990 | 20,424 | **9,544** | 6,435 | 4,614 | 2,698 | 2,496 | 2,527 | 2,254 | 2,015 |
| 1991 | 18,495 | **8,996** | 5,590 | 4,574 | 2,421 | 2,255 | 2,292 | 2,073 | 1,810 |
| 1992 | 19,124 | **9,450** | 5,564 | 4,675 | 2,498 | 2,428 | 2,310 | 2,142 | 1,791 |
| 1993 | 19,282 | **9,679** | 5,593 | 4,591 | 2,377 | 2,259 | 2,253 | 2,081 | 1,521 |
| 1994 | 19,556 | **10,206** | 5,568 | 4,747 | 2,344 | 2,299 | 2,259 | 2,149 | 1,508 |
| 1995 | 20,909 | **11,107** | 5,729 | 5,291 | 2,458 | 2,376 | 2,338 | 2,299 | 1,777 |
| 1996 | 22,669 | **13,090** | 6,142 | 6,662 | 2,763 | 2,392 | 2,462 | 2,830 | 2,897 |
| 1997 | 24,808 | **14,041** | 6,592 | 7,284 | 2,997 | 2,104 | 2,624 | 3,130 | 3,628 |
| 1998 | 25,561 | **14,892** | 7,858 | 7,826 | 2,940 | 1,157 | 2,609 | 2,685 | 3,770 |
| 1999 | 26,690 | **15,137** | 8,188 | 8,102 | 3,210 | 1,218 | 2,893 | 2,748 | 3,829 |

Note: 1999 data subject to revision due to carriers' late reporting; Data is for all services;
Enplaned and deplaned passengers
Updated Nov. 29, 2000
Source: Statistics Canada, Air Carrier Statements St. 2, 4 & 6 - Oct. 2000

## Aircraft Movements by Major Airport

| | Toronto LBPIA | Vancouver | Calgary | Dorval | Ottawa | Winnipeg | Halifax | Edmonton Int'l | Mirabel |
|---|---|---|---|---|---|---|---|---|---|
| 1990 | 353,848 | 317,464 | 206,677 | 197,460 | 136,738 | 114,451 | 92,759 | 62,958 | 47,804 |
| 1991 | 322,287 | 288,106 | 205,086 | 197,392 | 126,879 | 104,475 | 87,540 | 56,482 | 47,453 |
| 1992 | 327,526 | 289,904 | 200,686 | 197,460 | 122,848 | 104,481 | 90,920 | 55,051 | 46,397 |
| 1993 | 305,352 | 289,090 | 197,919 | 188,771 | 114,901 | 102,518 | 90,801 | 50,293 | 42,986 |
| 1994 | 307,023 | 301,163 | 202,699 | 191,800 | 116,578 | 114,313 | 96,505 | 52,741 | 47,998 |
| 1995 | 341,957 | 311,451 | 213,644 | 198,227 | 122,339 | 122,050 | 104,278 | 60,945 | 48,740 |
| 1996 | 372,309 | 329,961 | 221,320 | 202,221 | 124,230 | 126,234 | 97,726 | 86,334 | 49,481 |
| 1997 | 395,637 | 342,552 | 224,561 | 195,043 | 122,546 | 130,172 | 101,962 | 103,130 | 47,198 |
| 1998 | 420,846 | 368,675 | 245,985 | 209,173 | 136,028 | 126,893 | 104,686 | 110,140 | 41,556 |
| 1999 | 424,846 | 369,126 | 253,761 | 221,282 | 141,780 | 135,215 | 103,408 | 105,204 | 41,160 |

Note: Itinerant aircraft movements at airports with Air Traffic Control Towers
Updated Jan. 2, 2001
Source: Statistics Canada/Transport Canada, TP577 - May 2000

# Worksheet 25

AE Com Rpt; Exec Summ; p. ii; Summary of Forecasts

| Alternative | Total Riders | Total Revenue | Passenger Miles | Train Miles | Revenue/ Train Mile | Revenue/ Pass Mi |
|---|---|---|---|---|---|---|
| Existing (actual) | 659,100 | $14,900,000 | 99,481,000 | 1,000,100 | $14.90 | $0.15 |
| 2008 Build | 1,488,100 | $34,280,000 | 225,460,000 | 1,835,220 | $18.68 | $0.15 |
| 2023 Build | 3,191,500 | $74,568,000 | 493,930,000 | 2,492,220 | $29.92 | $0.15 |
| 2023 Rev A | 3,397,800 | $79,064,000 | 520,804,000 | 2,606,100 | $30.34 | $0.15 |
| 2023 Rev A- Scott Rd | 3,488,900 | $80,985,000 | 531,800,000 | 2,533,100 | $31.97 | $0.15 |
| 2008 Fare Increase | 1,316,500 | $37,391,000 | 199,997,000 | 1,835,220 | $20.37 | $0.19 |
| 2023 Fare Increase | 2,858,700 | $97,645,000 | 440,225,000 | 2,606,100 | $37.47 | $0.22 |

| | |
|---|---|
| Revenue per Rider | $22.61 |

P. 10 of AE Com report

| | | FY 2002 Actual (Unlinked Trips) | | | FY 02 Estimated (Linked Trips) | | |
|---|---|---|---|---|---|---|---|
| | | **Riders** | **Pas Mi** | **Revenue** | **Riders** | **Pas Mi** | **Revenue** |
| Vancouver | NW Washington | 18,500 | 1,765,000 | $322,000 | 17,800 | 1,695,000 | $310,000 |
| Vancouver | Seattle | 76,000 | 11,646,000 | $1,978,000 | 76,700 | 11,746,000 | $1,995,000 |
| Vancouver | SW Washington | 0 | 0 | $0 | 0 | 0 | $0 |
| Vancouver | Portland | 0 | 0 | $0 | 0 | 0 | $0 |
| Vancouver | Central Oregon | 0 | 0 | $9 | 0 | 0 | $0 |
| NW Washington | NW Washington | 1,900 | 99,000 | $21,000 | 1,800 | 97,000 | $20,000 |
| NW Washington | Seattle | 53,700 | 4,582,000 | $771,000 | 52,900 | 4,500,000 | $757,000 |
| NW Washington | SW Washington | 0 | 0 | $0 | 2,900 | 382,000 | $57,000 |
| NW Washington | Portland | 0 | 0 | $0 | 2,800 | 679,000 | $91,000 |
| NW Washington | Central Oregon | 0 | 0 | $0 | 1,400 | 446,000 | $58,000 |
| Seattle | Seattle | 2,800 | 50,000 | $18,000 | 2,900 | 51,000 | $18,000 |
| Seattle | SW Washington | 39,200 | 3,496,000 | $595,000 | 38,100 | 3,406,000 | $580,000 |
| Seattle | Portland | 243,400 | 44,830,000 | $6,654,000 | 240,500 | 44,302,000 | $6,576,000 |
| Seattle | Central Oregon | 40,200 | 11,127,000 | $1,415,000 | 41,200 | 11,402,000 | $1,450,000 |
| SW Washington | SW Washington | 7,500 | 467,000 | $85,000 | 7,500 | 467,000 | $85,000 |
| SW Washington | Portland | 87,000 | 11,353,000 | $1,687,000 | 87,000 | 11,352,000 | $1,687,000 |
| SW Washington | Central Oregon | 14,400 | 3,057,000 | $404,000 | 14,400 | 3,055,000 | $404,000 |
| Portland | Portland | 1,500 | 15,000 | $9,000 | 1,500 | 15,000 | $9,000 |
| Portland | Central Oregon | 67,900 | 6,687,000 | $898,000 | 67,400 | 6,637,000 | $891,000 |
| Central Oregon | Central Oregon | 5,200 | 308,000 | $42,000 | 5,100 | 306,000 | $42,000 |
| Total | | 659,100 | 99,481,000 | $14,900,000 | 661,900 | 100,538,000 | $15,031,000 |
| Washington Corridor | | 490,100 | 79,061,000 | 11,650,000 | 493,400 | 80,139,000 | 11,783,000 |

P. 10 of AE Com report

| | | FY 08 Build Estimate (Linked Trips) | | | FY 23 Build Estimate (Linked Trips) | | |
|---|---|---|---|---|---|---|---|
| | | **Riders** | **Pas Mi** | **Revenue** | **Riders** | **Pas Mi** | **Revenue** |
| Vancouver | NW Washington | 49,000 | 4,638,000 | $850,000 | 142,600 | 13,227,000 | $2,441,000 |
| Vancouver | Seattle | 241,800 | 37,308,000 | $6,270,000 | 559,700 | 86,730,000 | $14,482,000 |
| Vancouver | SW Washington | 1,400 | 289,000 | $40,000 | 4,100 | 848,000 | $116,000 |
| Vancouver | Portland | 1,500 | 494,000 | $64,000 | 3,900 | 1,321,000 | $170,000 |
| Vancouver | Central Oregon | 200 | 77,000 | $10,000 | 400 | 161,000 | $20,000 |
| NW Washington | NW Washington | 3,800 | 202,000 | $43,000 | 7,500 | 404,000 | $85,000 |
| NW Washington | Seattle | 123,500 | 10,810,000 | $1,807,000 | 235,900 | 21,356,000 | $3,547,000 |
| NW Washington | SW Washington | 34,000 | 4,319,000 | $655,000 | 65,000 | 8,570,000 | $1,288,000 |
| NW Washington | Portland | 19,900 | 4,755,000 | $639,000 | 44,200 | 10,602,000 | $1,425,000 |
| NW Washington | Central Oregon | 2,900 | 947,000 | $122,000 | 15,600 | 5,188,000 | $669,000 |
| Seattle | Seattle | 5,500 | 116,000 | $37,000 | 6,700 | 143,000 | $46,000 |
| Seattle | SW Washington | 104,400 | 9,646,000 | $1,620,000 | 201,600 | 19,059,000 | $3,179,000 |
| Seattle | Portland | 556,700 | 102,758,000 | $15,222,000 | 1,102,400 | 203,980,000 | $30,158,000 |
| Seattle | Central Oregon | 46,500 | 12,906,000 | $1,643,000 | 145,500 | 40,829,000 | $5,221,000 |
| SW Washington | SW Washington | 18,700 | 1,189,000 | $216,000 | 33,700 | 2,188,000 | $399,000 |
| SW Washington | Portland | 186,300 | 24,688,000 | $3,651,000 | 380,500 | 50,691,000 | $7,481,000 |
| SW Washington | Central Oregon | 14,000 | 3,006,000 | $398,000 | 46,000 | 9,841,000 | $1,301,000 |
| Portland | Portland | 2,200 | 22,000 | $14,000 | 3,400 | 34,000 | $22,000 |
| Portland | Central Oregon | 70,700 | 6,972,000 | $936,000 | 181,500 | 18,047,000 | $2,423,000 |
| Central Oregon | Central Oregon | 5,300 | 317,000 | $43,000 | 11,400 | 709,000 | $95,000 |
| Total | | 1,488,100 | 225,460,000 | $34,280,000 | 3,191,500 | 493,930,000 | $74,568,000 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Washington Corridor | | 1,116,200 | 175,342,000 | 26,053,000 | 2,284,600 | 372,851,000 | 54,799,000 |

**Exhibit 7: Alternatives Summary**

| | | | | | | Fare Sensitivity A | |
|---|---|---|---|---|---|---|---|
| | 2002 Base | 2008 Build | 2023 Build | 2023 RevA | 2023 RevA-Scott Rd | 2008 Build (23% Fare Inc) | 2023 Build (46% Fare Inc) |
| **Frequency (Rnd Trip/Day)** | | | | | | | |
| Seattle – Portland | 4 | 8 | 13 | 14 | 14 | 8 | 13 |
| Seattle- Vancouver, BC | 1 | 3 | 4 | 5 | 5 | 3 | 4 |
| Vancouver, BC – Portland | 0 | 2 | 3 | 4 | 4 | 2 | 3 |
| **Travel Time (minutes)** | | | | | | | |
| Seattle – Portland | 222 | 195 | 147 | 150 | 150 | 195 | 147 |
| Seattle- Vancouver, BC | 235 | 205 | 165 | 156 | 136 | 205 | 165 |
| Vancouver, BC – Portland | - | 400 | 331 | 322 | 302 | 400 | 331 |
| **Fares** | | | | | | | |
| Seattle – Portland | $28 | $28 | $28 | $28 | $28 | $34 | $40 |
| Seattle- Vancouver, BC | $26 | $26 | $26 | $26 | $26 | $32 | $38 |
| Vancouver, BC – Portland | - | $44 | $44 | $44 | $44 | $54 | $64 |

| | | | |
|---|---|---|---|
| Terminal Lag Times (both ends) | 20 | 20 | 20 |

**Exhibit 5: Existing Travel Market Size Estimates**

| Estimated 2002 Travel Market Size | | | | | | |
|---|---|---|---|---|---|---|
| Major Travel Markets | | Business | Non-Business | Total | % Business | |
| Seattle | Portland | 1,440,638 | 5,018,949 | 6,459,587 | 22% | 17,943 |
| Seattle | Vancouver | 203,449 | 1,248,331 | 1,451,780 | 14% | 4,033 |
| Vancouver | Portland | 14,287 | 111,234 | 125,521 | 11% | 349 |
| | | 1,658,374 | 6,378,514 | 8,036,888 | 21% | |

| nalysis |
| --- |
| 2023 RevA (46% Fare Inc) |
| |
| 14 |
| 5 |
| 4 |
| |
| 150 |
| 156 |
| 322 |
| |
| $40 |
| $38 |
| $64 |

# Worksheet 26

**Exhibit 4-2: System Summary, Operating Costs Technical Paper, September 2003**

## System Summary

### Portland - Seattle

| | 2002 | 2008 | 2008 Increase | 2023 | 2023A | 2023A Scott | 2023A Increase |
|---|---|---|---|---|---|---|---|
| Revenue | $5,557,372 | $25,283,666 | $28,004,190 | $55,139,041 | $55,897,581 | $55,924,579 | $69,468,734 |
| Expense | $13,765,092 | $38,819,981 | $38,442,163 | $61,867,986 | $62,047,049 | $62,050,948 | $60,911,471 |
| **Balance** | ($8,207,720) | ($13,536,315) | ($10,437,973) | ($6,728,945) | ($6,149,468) | ($6,126,369) | $8,557,263 |
| Passengers | 221,605 | 992,000 | 885,400 | 2,049,600 | 2,080,200 | 2,081,300 | 1,759,800 |
| (Per Passenger) | ($37.04) | ($13.65) | ($11.79) | ($16.32) | ($5.70) | ($4.81) | $6.27 |
| Passenger Miles | 64,343,789 | 153,767,841 | 137,699,933 | 323,984,427 | 327,479,232 | 327,652,835 | 278,985,145 |
| Per Passenger Mile | ($0.13) | ($0.09) | ($0.08) | ($0.02) | ($0.02) | ($0.02) | $0.03 |

### Seattle - Vancouver

| | 2002 | 2008 | 2008 Increase | 2023 | 2023A | 2023A Scott | 2023A Increase |
|---|---|---|---|---|---|---|---|
| Revenue | $3,674,693 | $11,169,139 | $11,857,473 | $27,118,696 | $30,219,482 | $32,402,254 | $36,863,324 |
| Expense | $6,564,187 | $12,712,471 | $12,382,962 | $21,520,374 | $24,100,265 | $24,557,163 | $22,994,880 |
| Balance | ($2,889,494) | ($1,543,332) | ($525,489) | $5,598,322 | $6,119,217 | $7,845,091 | $13,868,443 |
| Passengers | 104,596 | 478,000 | 412,300 | 1,078,900 | 1,272,700 | 1,363,800 | 1,052,300 |
| (Per Passenger) | ($27.63) | ($3.23) | ($1.27) | $5.19 | $4.81 | $5.75 | $13.18 |
| Passenger Miles | 18,592,737 | 57,492,253 | 49,624,949 | 132,490,740 | 156,398,017 | 167,218,868 | 130,742,048 |
| Per Passenger Mile | ($0.16) | ($0.03) | ($0.01) | $0.04 | $0.04 | $0.05 | $0.11 |

### Combined

| | 2002 | 2008 | 2008 Increase | 2023 | 2023A | 2023A Scott | 2023A Increase |
|---|---|---|---|---|---|---|---|
| Revenue | $9,232,065 | $36,452,805 | $39,861,663 | $82,257,737 | $86,117,063 | $88,326,833 | $106,332,057 |
| Expense | $20,329,279 | $51,532,452 | $50,825,126 | $83,388,360 | $86,147,314 | $86,608,111 | $83,906,352 |
| Balance | ($11,097,214) | ($15,079,646) | ($10,963,463) | ($1,130,623) | ($30,251) | $1,718,722 | $22,425,706 |
| Passengers | 326,201 | 1,410,100 | 1,246,900 | 2,995,300 | 3,203,900 | 3,295,000 | 2,696,900 |
| (Per Passenger) | ($34.02) | ($10.69) | ($8.79) | ($0.38) | ($0.01) | $0.52 | $8.32 |
| Passenger Miles | 82,936,526 | 211,260,094 | 187,324,882 | 456,475,167 | 483,877,249 | 494,871,703 | 409,727,193 |
| Per Passenger Mile | ($0.13) | ($0.07) | ($0.06) | $0.00 | $0.00 | $0.00 | $0.05 |

| | | | |
|---|---|---|---|
| Rolling stock maintenance | | | |
| Trains added since '02 | | - | - |
| Maintenance per train | | $ 1,200,000 | $ 1,200,000 |
| Rolling stock maintenance | | $ - | $ - |
| Exp w/ new maintenance | $20,329,279 | $ 51,532,452 | $ 83,388,360 |

**Exhibit 4-2: System Summary, Operating Costs Technical Paper, September 2003**

## Per Train

### Portland - Seattle

| | 2002 | 2008 | 2008 Increase | 2023 | 2023A | 2023A Scott | 2023A Increase |
|---|---|---|---|---|---|---|---|
| Revenue | $1,389,343 | $1,580,229 | $1,750,262 | $2,120,732 | $1,996,342 | $1,997,306 | $2,481,026 |
| Expense | $3,441,273 | $2,426,249 | $2,402,635 | $2,379,538 | $2,594,264 | $2,594,404 | $2,553,708 |
| **Balance** | **($2,051,930)** | **($846,020)** | **($652,373)** | **($258,806)** | **($597,922)** | **($597,097)** | **($72,682)** |
| Passengers | 55,401 | 62,000 | 55,338 | 78,831 | 74,293 | 74,332 | 62,850 |
| (Per Passenger) | ($37.04) | ($13.65) | ($11.79) | ($1.75) | ($2.33) | ($2.87) | ($0.35) |
| Passenger Miles | 16,085,947 | 9,610,490 | 8,606,246 | 12,460,940 | 11,695,687 | 11,701,887 | 9,963,755 |
| Per Passenger Mile | ($0.13) | ($0.09) | ($0.08) | ($0.02) | ($0.05) | ($0.05) | ($0.01) |

### Seattle - Vancouver

| | 2002 | 2008 | 2008 Increase | 2023 | 2023A | 2023A Scott | 2023A Increase |
|---|---|---|---|---|---|---|---|
| Revenue | $1,837,346 | $1,861,523 | $1,976,245 | $3,389,837 | $3,021,948 | $3,240,225 | $3,686,332 |
| Expense | $3,282,094 | $2,118,745 | $2,063,827 | $2,690,047 | $2,680,023 | $2,725,713 | $2,569,485 |
| Balance | ($1,444,747) | ($257,222) | ($87,582) | $699,790 | $341,925 | $514,512 | $1,116,847 |
| Passengers | 52,298 | 165,333 | 147,567 | 256,200 | 208,020 | 208,130 | 175,980 |
| (Per Passenger) | ($27.63) | ($1.56) | ($0.59) | $2.73 | $1.64 | $2.47 | $6.35 |
| Passenger Miles | 4,648,184 | 3,593,266 | 3,101,559 | 5,095,798 | 5,585,643 | 5,972,102 | 4,669,359 |
| Per Passenger Mile | ($0.31) | ($0.07) | ($0.03) | $0.14 | $0.06 | $0.09 | $0.24 |

# Worksheet 27

| In service | Timetable | New Trainsets* | Cost (in Million) | Trainsets in Service | Remarks |
|---|---|---|---|---|---|
| 2004 | A | 1 | $7,500,000 | 5 | Acquisition in November 2003 of only one Talgo trainset (no locomotives) formerly leased for use in Amtrak Cascades service |
| 2005 | B | 6 | $180,000,000 | 6 | Complete replacement of all Amtrak Cascades equipment |
| 2009 | C | 1 | $30,000,000 | 7 | |
| 2015 | D | 2 | $60,000,000 | 9 | |
| 2017 | E | 2 | $60,000,000 | 11 | |
| 2023 | F | 2 | $60,000,000 | 13 | Timetable F revision A requires one less trainset than Timetable F (See Appendix I) |

(Revision A)
Total Equipment (Timetables A through F)
$397.50 12
Total Equipment (Timetables A through F Revision A)
$367.50 13

**Dollars: 2002**

Locomotives
Trainsets

# Worksheet 28

**Appendix B**
**Capital Costs Based on Proposed Year of Construction**

## Seattle to Vancouver, BC

| Project/Land | Base Year $ | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|
| **2005 (Timetable A and B)** | | | | | | | | | |
| Ballard Crossover | **$5,000,000** | $ 5,150,000.00 | $ 5,304,500.00 | | | | | | |
| PA Junction Curve Realignment | **$4,102,408** | $ 4,225,480.24 | $ 4,352,244.65 | | | | | | |
| Delta Yard Storage Tracks | **$16,569,064** | $ 17,066,135.92 | $ 17,578,120.00 | | | | | | |
| Stanwood Siding | **$9,787,896** | $ 10,081,532.88 | $ 10,383,978.87 | | | | | | |
| Bellingham GP Curve | **$1,997,592** | $ 2,057,519.76 | $ 2,119,245.35 | | | | | | |
| Mt. Vernon Siding | **$8,037,909** | $ 8,279,046.27 | $ 8,527,417.66 | | | | | | |
| Willingdon Junction | **$14,684,800** | $ 15,125,344.00 | $ 15,579,104.32 | | | | | | |
| CN Junction | **$3,563,817** | $ 3,670,731.51 | $ 3,780,853.46 | | | | | | |
| Colebrook Siding | **$11,268,748** | $ 11,606,810.44 | $ 11,955,014.75 | | | | | | |
| **2009 (Timetable C, D, and E)** | | | | | | | | | |
| Sound Transit | **$180,000,000** | $ 185,400,000.00 | $ 190,962,000.00 | $ 196,690,860.00 | $ 202,591,585.80 | $ 208,669,333.37 | $ 214,929,413.38 | | |
| Bow to Samish Siding Extension | **$15,385,122** | $ 15,846,675.66 | $ 16,322,075.93 | $ 16,811,738.21 | $ 17,316,090.35 | $ 17,835,573.06 | $ 18,370,640.26 | | |
| Bellingham Siding Extension | **$28,319,354** | $ 29,168,934.62 | $ 30,044,002.66 | $ 30,945,322.74 | $ 31,873,682.42 | $ 32,829,892.89 | $ 33,814,789.68 | | |
| Ballard Bridge Speed | **$10,000,000** | $ 10,300,000.00 | $ 10,609,000.00 | $ 10,927,270.00 | $ 11,255,088.10 | $ 11,592,740.74 | $ 11,940,522.97 | | |
| Vancouver BC | | | | | | | | | |
| *Alternative 1:* | | | | | | | | | |
| Still Creek to CN Junction | **$12,884,086** | $ 13,270,608.58 | $ 13,668,726.84 | $ 14,078,788.64 | $ 14,501,152.30 | $ 14,936,186.87 | $ 15,384,272.48 | | |
| Vancouver Terminal Control | **$6,721,120** | $ 6,922,753.60 | $ 7,130,436.21 | $ 7,344,349.29 | $ 7,564,679.77 | $ 7,791,620.17 | $ 8,025,368.77 | | |
| Sperling to Willington Junction | **$10,353,909** | $ 10,664,526.27 | $ 10,984,462.06 | $ 11,313,995.92 | $ 11,653,415.80 | $ 12,003,018.27 | $ 12,363,108.82 | | |
| Brunette to Piper Siding | **$25,521,605** | $ 26,287,253.15 | $ 27,075,870.74 | $ 27,888,146.87 | $ 28,724,791.27 | $ 29,586,535.01 | $ 30,474,131.06 | | |
| *Alterantive 2:* | | | | | | | | | |
| Scott Road Station | **$75,000,000** | $ 77,250,000.00 | $ 79,567,500.00 | $ 81,954,525.00 | $ 84,413,160.75 | $ 86,945,555.57 | $ 89,553,922.24 | | |
| **2023 (Timetable F)** | | | | | | | | | |
| Marysville to Mt. Vernon | **$277,162,285** | $ 285,477,153.55 | $ 294,041,468.16 | $ 302,862,712.20 | $ 311,948,593.57 | $ 321,307,051.37 | $ 330,946,262.92 | $ 340,874,650.80 | $ 351,100,890.33 |
| Burlington to Bellingham | **$217,852,072** | $ 224,387,634.16 | $ 231,119,263.18 | $ 238,052,841.08 | $ 245,194,426.31 | $ 252,550,259.10 | $ 260,126,766.88 | $ 267,930,569.88 | $ 275,968,486.98 |
| Bellingham to Blaine | **$124,773,220** | $ 128,516,416.60 | $ 132,371,909.10 | $ 136,343,066.37 | $ 140,433,358.36 | $ 144,646,359.11 | $ 148,985,749.89 | $ 153,455,322.38 | $ 158,058,982.05 |
| Everett Junction | **$9,921,785** | $ 10,219,438.55 | $ 10,526,021.71 | $ 10,841,802.36 | $ 11,167,056.43 | $ 11,502,068.12 | $ 11,847,130.16 | $ 12,202,544.07 | $ 12,568,620.39 |
| Advanced Signal (US) | **$138,000,000** | $ 142,140,000.00 | $ 146,404,200.00 | $ 150,796,326.00 | $ 155,320,215.78 | $ 159,979,822.25 | $ 164,779,216.92 | $ 169,722,593.43 | $ 174,814,271.23 |
| Advanced Signal (BC) | **$60,000,000** | $ 61,800,000.00 | $ 63,654,000.00 | $ 65,563,620.00 | $ 67,530,528.60 | $ 69,556,444.46 | $ 71,643,137.79 | $ 73,792,431.93 | $ 76,006,204.88 |
| White Rock Bypass | **$312,624,585** | $ 322,003,322.55 | $ 331,663,422.23 | $ 341,613,324.89 | $ 351,861,724.64 | $ 362,417,576.38 | $ 373,290,103.67 | $ 384,488,806.78 | $ 396,023,470.98 |
| Colebrook to Brownsville | **$79,926,112** | $ 82,323,895.36 | $ 84,793,612.22 | $ 87,337,420.59 | $ 89,957,543.21 | $ 92,656,269.50 | $ 95,435,957.59 | $ 98,299,036.31 | $ 101,248,007.40 |
| Fraser River Bridge | **$500,000,000** | $ 515,000,000.00 | $ 530,450,000.00 | $ 546,363,500.00 | $ 562,754,405.00 | $ 579,637,037.15 | $ 597,026,148.26 | $ 614,936,932.71 | $ 633,385,040.69 |

**NOTES:**
**Shaded boxes indicate projects done by other jurisdiction or agency**
**Some projects did not have a ROW component and therefore was not included in calculations**
**Improvements were inflated by 3% compounded annually. This is based on WSDOT standard inflation numbers.**

**Appendix B**
**Capital Costs Based on Proposed Year of Construction**

## Seattle to Vancouver, BC

| Project/Land | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| **2005 (Timetable A and B)** | | | | | | | | | |
| Ballard Crossover | | | | | | | | | |
| PA Junction Curve Realignment | | | | | | | | | |
| Delta Yard Storage Tracks | | | | | | | | | |
| Stanwood Siding | | | | | | | | | |
| Bellingham GP Curve | | | | | | | | | |
| Mt. Vernon Siding | | | | | | | | | |
| Willingdon Junction | | | | | | | | | |
| CN Junction | | | | | | | | | |
| Colebrook Siding | | | | | | | | | |
| **2009 (Timetable C, D, and E)** | | | | | | | | | |
| Sound Transit | | | | | | | | | |
| Bow to Samish Siding Extension | | | | | | | | | |
| Bellingham Siding Extension | | | | | | | | | |
| Ballard Bridge Speed | | | | | | | | | |
| Vancouver BC | | | | | | | | | |
| *Alternative 1:* | | | | | | | | | |
| Still Creek to CN Junction | | | | | | | | | |
| Vancouver Terminal Control | | | | | | | | | |
| Sperling to Willington Junction | | | | | | | | | |
| Brunette to Piper Siding | | | | | | | | | |
| *Alterantive 2:* | | | | | | | | | |
| Scott Road Station | | | | | | | | | |
| **2023 (Timetable F)** | | | | | | | | | |
| Marysville to Mt. Vernon | $ 361,633,917.04 | $ 372,482,934.55 | $ 383,657,422.58 | $ 395,167,145.26 | $ 407,022,159.62 | $ 419,232,824.41 | $ 431,809,809.14 | $ 444,764,103.41 | $ 458,107,026.52 |
| Burlington to Bellingham | $ 284,247,541.59 | $ 292,774,967.83 | $ 301,558,216.87 | $ 310,604,963.38 | $ 319,923,112.28 | $ 329,520,805.65 | $ 339,406,429.81 | $ 349,588,622.71 | $ 360,076,281.39 |
| Bellingham to Blaine | $ 162,800,751.52 | $ 167,684,774.06 | $ 172,715,317.28 | $ 177,896,776.80 | $ 183,233,680.11 | $ 188,730,690.51 | $ 194,392,611.22 | $ 200,224,389.56 | $ 206,231,121.25 |
| Everett Junction | $ 12,945,679.00 | $ 13,334,049.37 | $ 13,734,070.86 | $ 14,146,092.98 | $ 14,570,475.77 | $ 15,007,590.04 | $ 15,457,817.74 | $ 15,921,552.28 | $ 16,399,198.85 |
| Advanced Signal (US) | $ 180,058,699.37 | $ 185,460,460.35 | $ 191,024,274.16 | $ 196,755,002.38 | $ 202,657,652.46 | $ 208,737,382.03 | $ 214,999,503.49 | $ 221,449,488.60 | $ 228,092,973.25 |
| Advanced Signal (BC) | $ 78,286,391.03 | $ 80,634,982.76 | $ 83,054,032.24 | $ 85,545,653.21 | $ 88,112,022.81 | $ 90,755,383.49 | $ 93,478,045.00 | $ 96,282,386.35 | $ 99,170,857.94 |
| White Rock Bypass | $ 407,904,175.11 | $ 420,141,300.37 | $ 432,745,539.38 | $ 445,727,905.56 | $ 459,099,742.73 | $ 472,872,735.01 | $ 487,058,917.06 | $ 501,670,684.57 | $ 516,720,805.11 |
| Colebrook to Brownsville | $ 104,285,447.63 | $ 107,414,011.05 | $ 110,636,431.39 | $ 113,955,524.33 | $ 117,374,190.06 | $ 120,895,415.76 | $ 124,522,278.23 | $ 128,257,946.58 | $ 132,105,684.98 |
| Fraser River Bridge | $ 652,386,591.91 | $ 671,958,189.67 | $ 692,116,935.36 | $ 712,880,443.42 | $ 734,266,856.73 | $ 756,294,862.43 | $ 778,983,708.30 | $ 802,353,219.55 | $ 826,423,816.14 |

**NOTES:**
**Shaded boxes indicate projects done by other jurisdiction or agency**
**Some projects did not have a ROW component and therefore was not included in calculations**
**Improvements were inflated by 3% compounded annually. This is based on WSDOT standard inflation numbers.**

## Costs based on Proposed Year of Construction

## Seattle to Vancouver, BC

| Project/Land | 2021 | 2022 | 2023 |
|---|---|---|---|
| **2005 (Timetable A and B)** | | | |
| Ballard Crossover | | | |
| PA Junction Curve Realignment | | | |
| Delta Yard Storage Tracks | | | |
| Stanwood Siding | | | |
| Bellingham GP Curve | | | |
| Mt. Vernon Siding | | | |
| Willingdon Junction | | | |
| CN Junction | | | |
| Colebrook Siding | | | |
| **2009 (Timetable C, D, and E)** | | | |
| Sound Transit | | | |
| Bow to Samish Siding Extension | | | |
| Bellingham Siding Extension | | | |
| Ballard Bridge Speed | | | |
| Vancouver BC | | | |
| *Alternative 1:* | | | |
| Still Creek to CN Junction | | | |
| Vancouver Terminal Control | | | |
| Sperling to Willington Junction | | | |
| Brunette to Piper Siding | | | |
| *Alterantive 2:* | | | |
| Scott Road Station | | | |
| **2023 (Timetable F)** | | | |
| Marysville to Mt. Vernon | $ 471,850,237.31 | $ 486,005,744.43 | $ 500,585,916.77 |
| Burlington to Bellingham | $ 370,878,569.83 | $ 382,004,926.93 | $ 393,465,074.74 |
| Bellingham to Blaine | $ 212,418,054.89 | $ 218,790,596.53 | $ 225,354,314.43 |
| Everett Junction | $ 16,891,174.81 | $ 17,397,910.05 | $ 17,919,847.36 |
| Advanced Signal (US) | $ 234,935,762.45 | $ 241,983,835.32 | $ 249,243,350.38 |
| Advanced Signal (BC) | $ 102,145,983.67 | $ 105,210,363.18 | $ 108,366,674.08 |
| White Rock Bypass | $ 532,222,429.26 | $ 548,189,102.14 | $ 564,634,775.20 |
| Colebrook to Brownsville | $ 136,068,855.53 | $ 140,150,921.19 | $ 144,355,448.83 |
| Fraser River Bridge | $ 851,216,530.62 | $ 876,753,026.54 | $ 903,055,617.33 |

**NOTES:**
**Shaded boxes indicate projects done by other jurisdiction or agency**
**Some projects did not have a ROW component and therefore was not included in calculations**
**Improvements were inflated by 3% compounded annually. This is based on WSDOT standard inflation numbers.**

# Worksheet 29

**Appendix B**
**Capital Costs Based on Proposed Year of Construction**

## Seattle to Portland, OR

| Project/Land | Base Year $ | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **2005 (Timetable A)** | | | | | | | | | | | |
| Felida Crossover | **$2,200,000** | 2266000 | $ 2,333,980.00 | | | | | | | | |
| Woodland Crossover | **$2,800,000** | 2884000 | $ 2,970,520.00 | | | | | | | | |
| Titlow Crossover | **$4,000,000** | 4120000 | $ 4,243,600.00 | | | | | | | | |
| Ruston Crossover | **$3,500,000** | 3605000 | $ 3,713,150.00 | | | | | | | | |
| Sound Transit | **$264,000,000** | 271920000 | $ 280,077,600.00 | | | | | | | | |
| **2007 (Timetable B)** | | | | | | | | | | | |
| Vancouver Rail Project | **$68,793,340** | $ 70,857,140.20 | $ 72,982,854.41 | $ 75,172,340.04 | $ 77,427,510.24 | | | | | | |
| Kelso-Martin's Bluff Rail Project | **$394,906,903** | $ 406,754,110.09 | $ 418,956,733.39 | $ 431,525,435.39 | $ 444,471,198.46 | | | | | | |
| Centennial Crossovers | **$3,443,586** | $ 3,546,893.58 | $ 3,653,300.39 | $ 3,762,899.40 | $ 3,875,786.38 | | | | | | |
| Winlock Crossover | **$3,370,162** | $ 3,471,266.86 | $ 3,575,404.87 | $ 3,682,667.01 | $ 3,793,147.02 | | | | | | |
| Ketron Crossover | **$3,370,162** | $ 3,471,266.86 | $ 3,575,404.87 | $ 3,682,667.01 | $ 3,793,147.02 | | | | | | |
| Tenino Crossover | **$3,370,162** | $ 3,471,266.86 | $ 3,575,404.87 | $ 3,682,667.01 | $ 3,793,147.02 | | | | | | |
| North Portland Junction to Kenton | **$51,600,000** | $ 53,148,000.00 | $ 54,742,440.00 | $ 56,384,713.20 | $ 58,076,254.60 | | | | | | |
| **2009 (Timetable C)** | | | | | | | | | | | |
| Pt. Defiance Bypass | **$232,568,793** | $ 239,545,856.79 | $ 246,732,232.49 | $ 254,134,199.47 | $ 261,758,225.45 | $ 269,610,972.22 | $ 277,699,301.38 | | | | |
| Reservation Third Main | **$25,700,157** | $ 26,471,161.71 | $ 27,265,296.56 | $ 28,083,255.46 | $ 28,925,753.12 | $ 29,793,525.72 | $ 30,687,331.49 | | | | |
| Centralia Steam Plant | **$16,618,201** | $ 17,116,747.03 | $ 17,630,249.44 | $ 18,159,156.92 | $ 18,703,931.63 | $ 19,265,049.58 | $ 19,843,001.07 | | | | |
| Woodland Siding | **$16,308,480** | $ 16,797,734.40 | $ 17,301,666.43 | $ 17,820,716.42 | $ 18,355,337.92 | $ 18,905,998.06 | $ 19,473,178.00 | | | | |
| China Creek Crossover | **$1,685,081** | $ 1,735,633.43 | $ 1,787,702.43 | $ 1,841,333.51 | $ 1,896,573.51 | $ 1,953,470.72 | $ 2,012,074.84 | | | | |
| Sound Transit | **$139,000,000** | $ 143,170,000.00 | $ 147,465,100.00 | $ 151,889,053.00 | $ 156,445,724.59 | $ 161,139,096.33 | $ 165,973,269.22 | | | | |
| Auburn South Third Main | **$41,777,008** | $ 43,030,318.24 | $ 44,321,227.79 | $ 45,650,864.62 | $ 47,020,390.56 | $ 48,431,002.28 | $ 49,883,932.34 | | | | |
| **2015 (Timetable D)** | | | | | | | | | | | |
| Winlock to Chehalis Third Main | **$95,115,236** | $ 97,968,693.08 | $ 100,907,753.87 | $ 103,934,986.49 | $ 107,053,036.08 | $ 110,264,627.17 | $ 113,572,565.98 | $ 116,979,742.96 | $ 120,489,135.25 | $ 124,103,809.31 | $ 127,826,923.59 |
| Chehalis Siding | **$10,267,979** | $ 10,576,018.37 | $ 10,893,298.92 | $ 11,220,097.89 | $ 11,556,700.83 | $ 11,903,401.85 | $ 12,260,503.91 | $ 12,628,319.02 | $ 13,007,168.59 | $ 13,397,383.65 | $ 13,799,305.16 |
| King Street Station | **$80,000,000** | $ 82,400,000.00 | $ 84,872,000.00 | $ 87,418,160.00 | $ 90,040,704.80 | $ 92,741,925.94 | $ 95,524,183.72 | $ 98,389,909.23 | $ 101,341,606.51 | $ 104,381,854.71 | $ 107,513,310.35 |
| East St. Johns Siding/Main Track | **$49,703,716** | $ 51,194,827.48 | $ 52,730,672.30 | $ 54,312,592.47 | $ 55,941,970.25 | $ 57,620,229.36 | $ 59,348,836.24 | $ 61,129,301.32 | $ 62,963,180.36 | $ 64,852,075.77 | $ 66,797,638.05 |
| Lake Yard North Leads | **$19,511,620** | $ 20,096,968.60 | $ 20,699,877.66 | $ 21,320,873.99 | $ 21,960,500.21 | $ 22,619,315.21 | $ 23,297,894.67 | $ 23,996,831.51 | $ 24,716,736.46 | $ 25,458,238.55 | $ 26,221,985.71 |
| Portland Union Station | **$6,089,493** | $ 6,272,177.79 | $ 6,460,343.12 | $ 6,654,153.42 | $ 6,853,778.02 | $ 7,059,391.36 | $ 7,271,173.10 | $ 7,489,308.29 | $ 7,713,987.54 | $ 7,945,407.17 | $ 8,183,769.38 |
| Advanced Signal System | **$268,000,000** | $ 276,040,000.00 | $ 284,321,200.00 | $ 292,850,836.00 | $ 301,636,361.08 | $ 310,685,451.91 | $ 320,006,015.47 | $ 329,606,195.93 | $ 339,494,381.81 | $ 349,679,213.27 | $ 360,169,589.66 |
| **2017 (Timetable E)** | | | | | | | | | | | |
| Chehalis to Hannaford Third Main | **$66,169,982** | $ 68,155,081.46 | $ 70,199,733.90 | $ 72,305,725.92 | $ 74,474,897.70 | $ 76,709,144.63 | $ 79,010,418.97 | $ 81,380,731.54 | $ 83,822,153.48 | $ 86,336,818.09 | $ 88,926,922.63 |
| Ostrander to Winlock 3rd/4th Main | **$191,833,863** | $ 197,588,878.89 | $ 203,516,545.26 | $ 209,622,041.61 | $ 215,910,702.86 | $ 222,388,023.95 | $ 229,059,664.67 | $ 235,931,454.61 | $ 243,009,398.25 | $ 250,299,680.19 | $ 257,808,670.60 |
| **2023 (Timetable F)** | | | | | | | | | | | |
| Felida to MP 114 Third Main | **$103,965,785** | $ 107,084,758.55 | $ 110,297,301.31 | $ 113,606,220.35 | $ 117,014,406.96 | $ 120,524,839.16 | $ 124,140,584.34 | $ 127,864,801.87 | $ 131,700,745.93 | $ 135,651,768.30 | $ 139,721,321.35 |
| Hannaford to Nisqually Third Main | **$314,778,491** | $ 324,221,845.73 | $ 333,948,501.10 | $ 343,966,956.13 | $ 354,285,964.82 | $ 364,914,543.76 | $ 375,861,980.08 | $ 387,137,839.48 | $ 398,751,974.66 | $ 410,714,533.90 | $ 423,035,969.92 |
| Columbia River Bridge | **$500,000,000** | $ 515,000,000.00 | $ 530,450,000.00 | $ 546,363,500.00 | $ 562,754,405.00 | $ 579,637,037.15 | $ 597,026,148.26 | $ 614,936,932.71 | $ 633,385,040.69 | $ 652,386,591.91 | $ 671,958,189.67 |

**NOTES:**
**Shaded boxes indicate projects done by other jurisdiction or agency**
**Some projects did not have a ROW component and therefore was not included in calculations**
**Improvements were inflated by 3% compounded annually. This is based on WSDOT standard inflation numbers.**

**Appendix B**
**Capital Costs Based on Proposed Year of Construction**

## Seattle to Portland, OR

| Project/Land | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|
| **2005 (Timetable A)** | | | | | | | | | | |
| Felida Crossover | | | | | | | | | | |
| Woodland Crossover | | | | | | | | | | |
| Titlow Crossover | | | | | | | | | | |
| Ruston Crossover | | | | | | | | | | |
| Sound Transit | | | | | | | | | | |
| | | | | | | | | | | |
| **2007 (Timetable B)** | | | | | | | | | | |
| Vancouver Rail Project | | | | | | | | | | |
| Kelso-Martin's Bluff Rail Project | | | | | | | | | | |
| Centennial Crossovers | | | | | | | | | | |
| Winlock Crossover | | | | | | | | | | |
| Ketron Crossover | | | | | | | | | | |
| Tenino Crossover | | | | | | | | | | |
| North Portland Junction to Kenton | | | | | | | | | | |
| | | | | | | | | | | |
| **2009 (Timetable C)** | | | | | | | | | | |
| Pt. Defiance Bypass | | | | | | | | | | |
| Reservation Third Main | | | | | | | | | | |
| Centralia Steam Plant | | | | | | | | | | |
| Woodland Siding | | | | | | | | | | |
| China Creek Crossover | | | | | | | | | | |
| Sound Transit | | | | | | | | | | |
| Auburn South Third Main | | | | | | | | | | |
| | | | | | | | | | | |
| **2015 (Timetable D)** | | | | | | | | | | |
| Winlock to Chehalis Third Main | $ 131,661,731.29 | $ 135,611,583.23 | | | | | | | | |
| Chehalis Siding | $ 14,213,284.32 | $ 14,639,682.85 | | | | | | | | |
| King Street Station | $ 110,738,709.66 | $ 114,060,870.95 | | | | | | | | |
| East St. Johns Siding/Main Track | $ 68,801,567.19 | $ 70,865,614.20 | | | | | | | | |
| Lake Yard North Leads | $ 27,008,645.28 | $ 27,818,904.64 | | | | | | | | |
| Portland Union Station | $ 8,429,282.47 | $ 8,682,160.94 | | | | | | | | |
| Advanced Signal System | $ 370,974,677.35 | $ 382,103,917.67 | | | | | | | | |
| | | | | | | | | | | |
| **2017 (Timetable E)** | | | | | | | | | | |
| Chehalis to Hannaford Third Main | $ 91,594,730.31 | $ 94,342,572.22 | $ 97,172,849.39 | $ 100,088,034.87 | | | | | | |
| Ostrander to Winlock 3rd/4th Main | $ 265,542,930.72 | $ 273,509,218.64 | $ 281,714,495.20 | $ 290,165,930.05 | | | | | | |
| | | | | | | | | | | |
| **2023 (Timetable F)** | | | | | | | | | | |
| Felida to MP 114 Third Main | $ 143,912,960.99 | $ 148,230,349.82 | $ 152,677,260.32 | $ 157,257,578.13 | $ 161,975,305.47 | $ 166,834,564.64 | $ 171,839,601.57 | $ 176,994,789.62 | $ 182,304,633.31 | $ 187,773,772.31 |
| Hannaford to Nisqually Third Main | $ 435,727,049.02 | $ 448,798,860.49 | $ 462,262,826.30 | $ 476,130,711.09 | $ 490,414,632.42 | $ 505,127,071.40 | $ 520,280,883.54 | $ 535,889,310.05 | $ 551,965,989.35 | $ 568,524,969.03 |
| Columbia River Bridge | $ 692,116,935.36 | $ 712,880,443.42 | $ 734,266,856.73 | $ 756,294,862.43 | $ 778,983,708.30 | $ 802,353,219.55 | $ 826,423,816.14 | $ 851,216,530.62 | $ 876,753,026.54 | $ 903,055,617.33 |

**NOTES:**
**Shaded boxes indicate projects done by other jurisdiction or agency**
**Some projects did not have a ROW component and therefore was not included in calculations**
**Improvements were inflated by 3% compounded annually. This is based on WSDOT standard inflation numbers.**