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DATE: October 12, 2017
TO: David Saint John, King County Parks and Jenny Bailey, Parametrix
FROM: Matthew Kitchen and Erik Rundell
SUBJECT: Eastside Rail Corridor Trail Wilburton Segment Benefit-Cost Analysis

1 Executive Summary

ECONorthwest quantified the economic benefits of the proposed Wilburton segment of the Eastside Rail Corridor trail in Bellevue, Washington. Given the available data, the types of benefits eligible for inclusion in the TIGER grant application that ECONorthwest is able to quantify and include in this analysis are:

- Change in recreational value,
- Change in auto use,
- Change in auto crashes,
- Change in user delay, and
- Change in land values.

In addition, there are also likely economic benefits that the analysis was unable to quantify. These include bike and pedestrian safety improvements and benefits to nearby businesses. These benefits are qualitatively discussed in Section 3.

The analysis evaluated a Base Case scenario and three different alternative scenarios to assess how much the quantified benefits vary with changes in a couple of key assumptions. Each scenario is summarized below.

- **Base Case scenario:** This scenario is based on the assumptions discussed in later sections. This includes the number of new bike and pedestrian trip cited, a recreation trip value of $10 per trip, and the mean land value premium.
- **High Recreation Value scenario:** This scenario assumes the value of a recreation trip is $22 per trip instead of $10 per trip assumed in the Base Case. All other assumptions are the same.
- **Low Land Value Premium scenario:** This scenario assumes the land value premium is a value one standard deviation below the mean for all impacted properties within one mile of the project site. All other assumptions are the same.
- **Mixed Scenario:** This scenario assumes both the higher $22 per trip recreation value and the lower land value premium. All other assumptions are the same.

The Base Case scenario has net quantified economic benefits of $7.5 million for a benefit-cost ratio of 1.30 assuming a seven percent discount rate. Using a three percent discount rate the net quantified economic benefits are $29.4 million.

Exhibit 1. Present Value of Net Benefits and Benefit-Cost Ratio, 2019-2058 (2017$)

	Base Case		High Rec Value		Low Land Premium		Mixed Scenario	
Net Present Values	7% Discount Rate	3% Discount Rate	7% Discount Rate	3% Discount Rate	7% Discount Rate	3% Discount Rate	7% Discount Rate	3% Discount Rate
Total Costs	$ (24,720,810)	$ (27,455,266)	$(24,720,810)	$ (27,455,266)	$ (24,720,810)	$ (27,455,266)	$ (24,720,810)	$ (27,455,266)
Total Benefits	$ 32,233,189	$ 56,856,805	$ 53,647,784	$ 99,590,291	$ 27,201,055	$ 50,996,255	$ 48,615,650	$ 93,729,741
Net Economic Benefits	$ 7,512,378	$ 29,401,539	$ 28,926,974	$ 72,135,025	$ 2,480,245	$ 23,540,989	$ 23,894,840	$ 66,274,474
Benefit Cost Ratio	1.30	2.07	2.17	3.63	1.10	1.86	1.97	3.41

The alternative scenarios range from a low of $2.5 million under the low land value premium scenario to $72.1 million under the high recreation value scenario. The sensitivity analysis indicates changes in the assumptions and discount rate used can sizably affect the net economic benefits of the project, mostly in a positive direction. Adding the unquantified safety and potential additional commercial land value premium benefits to the quantified benefits would also increase the benefit-cost ratio under each scenario.

2 Overview

This memorandum summarizes ECONorthwest's analysis of the economic benefits of the construction of the Wilburton segment of the Eastside Rail Corridor in the City of Bellevue. This analysis is in support of King County Department of Natural Resources and Parks' application for a Transportation Investment Generating Economic Recovery (TIGER) grant from the U.S. Department of Transportation.

2.1 Project Summary

The Wilburton Center Segment of the Eastside Rail Corridor trail is a proposed 2.64-mile mixed-use trail utilizing the old railbed and right-of-way through the City of Bellevue. The project will build a new 12-foot wide paved multi-use trail within the corridor. The south end of the trail starts at Interstate-90 and runs north, crosses Interstate-405, and ends at NE 8th Street. This segment would connect the Interstate-90/Mountain to Sound Greenway Trail in the south with the Lake Washington Loop Trail. The trail would include the renovation of an existing wooden railroad trestle and the construction of a new crossing over I-405 funded by the Washington State Department of Transportation.

The Wilburton commercial area is located across I-405 from downtown Bellevue, and it is anticipated to realize significant redevelopment in the future. The area is currently composed of low-scale retail uses and auto dealers. The Sound Transit's Link light-rail expansion to Redmond will include a new station in Wilburton, which is expected in 2023. In anticipation of the Eastside Rail Corridor trail and light-rail stations, the City of Bellevue is currently conducting a planning process to rezone the area for higher-density trail- and transit-oriented residential and commercial uses. The City of Bellevue is also in the planning process for the Grand Connection that will create a new bicycle and pedestrian connection over I-405 to better connect downtown and to the Eastside Rail Corridor.

Exhibit 2. Wilburton Center Segment Location

Source: Eastside Rail Corridor Master Plan

2.2 Approach and Methods

ECONorthwest's overall approach to the benefit-cost analysis is to first monetize the annual economic benefits of completing the project, summing these annual benefits over 40 years, and then discounting them to present value. The analysis then compares these calculated benefits

with the present value of the identified costs (both one-time construction costs and ongoing operation and maintenance costs) of the project to determine the net economic benefits.

Economic benefits of the project include benefits to the users of the project and benefits to the broader public when the project is complete. ECONorthwest used multiple approaches to estimate these benefits. To monetize most of the economic benefits, ECONorthwest based our analysis on the National Cooperative Highway Research Program (NCHRP) Report 552. This report, based on transportation research on the topic, provides formulas and assumptions for calculating benefits related to recreation, safety, health, mobility, decreased auto use, and user delay[1].

In addition, ECONorthwest analyzed the impact of completing the project on residential land values. The estimated increase in land value is based on analysis ECONorthwest conducted looking at the sales prices of residential properties in relation to their distance to mixed-use trails throughout King County.

Given the available data, the types of benefits eligible for inclusion in the TIGER grant application that ECONorthwest is able to quantify and include in this analysis are:

- Change in recreational value,
- Change in auto use,
- Change in auto crashes,
- Change in user delay, and
- Change in land values.

Safety benefits from a potential reduction in crashes and/or injuries are not monetized because of the lack of data. Data on past pedestrian and bicyclist injuries in the general area of the project is available. However, analysis or assumptions about the potential reduction in injuries is not available. As a result, the analysis is not able to calculate the net change in crashes and injuries directly related to the project. These benefits are qualitatively addressed as part of this analysis later in this memorandum.

Demand Estimates

The methods for calculating benefits related to recreation, decreased auto use, and user delay start with determining the daily number of bike and pedestrian trips using the new trail when it is complete. The NCHRP Report outlines a method to estimate demand for bike trips using the population within 800, 1600, and 2400 meters of the facility. This method then applies a number of assumptions about the share of current and future commute and other (non-commute) bike trips. For this analysis, population estimates are based on 2015 American Community Survey 1-

[1] http://www.pedbikeinfo.org/bikecost/docs/Translating%20Demand%20and%20Benefits%20Research%20into%20Guidelines.pdf

year estimates for Census Block Groups that intersected with the corresponding distance buffers from the proposed project. Using this method, an estimated 4,555 people live within 2400 meters of the Wilburton segment of the trail.

ECONorthwest then used the formulas and assumptions in the NCHRP Report and the local bike commute share (1.0%) to estimate the total number of commute and non-commute bike trips. due to the construction of the trail. These assumptions resulted in an assumed 51 new daily bike trips, six of which are commute trips.

To estimate the demand for pedestrian trips, ECONorthwest use the same population figures and most of the same assumptions used for the bike estimates. The pedestrian estimates did use a different and higher mode share for pedestrian trips compared to bike trips. This higher pedestrian trip share is based on current user counts on the completed interim section of the Eastside Rail Corridor trail in Kirkland. Average daily pedestrian counts on this segment of trail are 8.8 times more than average daily bicyclist counts. ECONorthwest assumed this ratio would be the same for the new trail project. These assumptions resulted in an assumed 300 new daily pedestrian trips, 50 of which are commute trips.

To account for future growth, ECONorthwest used population projection figures from the Puget Sound Regional Council's (PSRC) Land Use Vision model. The model outputs provide growth projections by Forecast Analysis Zone (FAZ) for the entire region from 2015 to 2040. These growth projections were then allocated to the project vicinity based on development expectations outlined in a ULI report on the Wilburton Commercial Area[2]. ECONorthwest determined the average annual population growth rate from 2015 to 2040 for the study area within which the project is located to be 2.3 percent. The analysis then used this growth factor to increase the number of new bicycle and pedestrian trips for each year through 2058.

The specific methods for calculating recreational value, decrease in auto use, and user delay using the demand estimates as well as land value increases are provided in more detail below.

Recreation Value

To estimate annual recreation benefits, ECONorthwest multiplied assumptions about the net value of recreation activities by the estimated annual number of new non-commuter bike (45 average daily trips starting in 2019) and pedestrian trips (250 average daily trips starting in 2019). The NCHRP Report assumed a net value of $10 per trip. Other research has shown a value as high as $22 per trip[3]. This analysis used both assumptions to test the sensitivity of the benefits calculations.

[2]https://planning.bellevuewa.gov/UserFiles/Servers/Server_4779004/File/pdf/PCD/BellevueWA_PanelReport_web.pdf

[3] Estimating the economic value and impacts of recreational trails: a case study of the Virginia Creeper Rail Trail, Bowker, 2007

https://www.srs.fs.usda.gov/pubs/ja/ja_bowker008.pdf

Safety

Infrastructure that separates motorized from bike use can decrease the risk of injury to cyclists. For this analysis, King County provided the number of total crashes to establish a baseline of cyclist injuries near the study area. Based on the 2012-2017 data provided to ECONorthwest, no vehicle-bicycle collisions occurred in areas attributable to the segment in question. To capture the potential avoided costs from the multiuse path near the highway, ECONorthwest calculated the avoided safety costs associated with reduced VMT for those new cyclists expected to convert from driving to biking or walking. Accidents avoided were estimated using accident rates for fatalities per million vehicle miles travelled in urban areas in Washington State, and a relationship between fatalities and other accidents (injury and property damage only) developed for the AASHTO User Benefit Analysis Handbook.

The U.S. Department of Transportation provides guidance that the value of statistical life (VSL) for 2013 should be calculated at $9,100,000. For property damage only (PDO) crashes, the NHSA calculates the monetized value at $3,206 in 2010 dollars. The VSL and PDO values were scaled to 2016 dollars using conversion factors from the Bureau of Labor Statistics. The resulting values in 2016 dollars were $9,375,394 for VSL and $3,816 for PDO.

Exhibit 3. Improved Safety Benefits

Discount Rate	Bellevue
7%	$76,174
3%	$147,360

Source: ECONorthwest.

Exhibit 3 indicates the net present value in 2017 dollars for the 40 years after construction (2019-2058) for the recommended discount rate of three percent and the alternative rate of seven percent. The calculated benefits remain the same across the various scenarios used in the sensitivity analysis.

Decrease Auto Use

Benefits-related decreased auto use are assumed to result from auto commuters transitioning to bike and walk commutes. To determine the annual benefit of this reduction in auto use, the analysis converted the daily commute trip estimate to an annual total. The analysis then multiplied the total annual trips by an assumed commute trip length and the congestion and pollution savings per mile. The assumed trip length was 5.8 miles, based on the average trip length from PSRC's 2015 household travel survey. Congestion and pollution savings per mile are based on a 2004 value of $0.13 per mile, which was inflated to 2017 dollars. The $0.13 estimate is cited in the NCHRP Report and is based on research in Barnes' Minnesota Department of Transportation Report, 2004-2050. To calculate the annual benefit from decreased auto use, ECONorthwest assumed five new trips per week, for 47 weeks.

User Delay

Benefits related to reductions in user delay are determined using the perceived time savings from traveling on a bike trail. This perceived time savings is based on research by Portland State

University on the impacts of bike boulevards and paths on perceived distance[4]. The research found that travel on a bike path has the equivalent benefit to the user as decreasing route distance by 26 percent.

To calculate the value of this decrease, ECONorthwest estimated the total annual number of bike commute hours using the number of net new bike commute trips, an assumed bike commute trip length of 1.5 miles, and an average speed of 10 miles per hour. The analysis then calculated the perceived number of hours saved and the value of those time savings using value of time of $13.10 per hour.

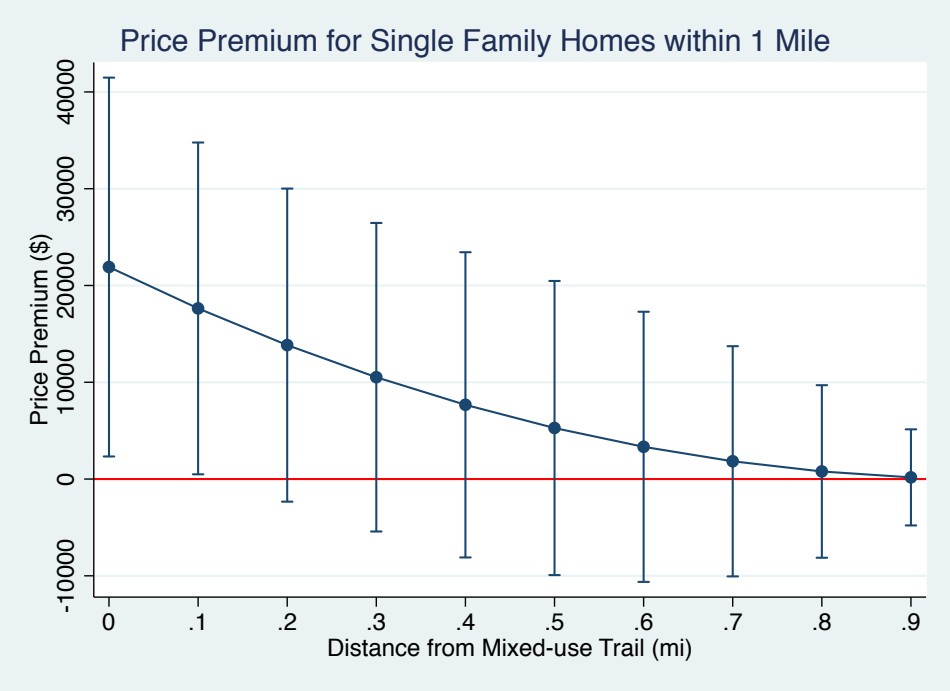
Land Value Increase

To determine the increase in land value related to proximity to the proposed project, ECONorthwest developed an econometric model to isolate the land value premium related to the distance a single-family house or condominium is from a mixed-use trail facility. In addition to trail proximity, this analysis controlled for structural differences in houses (lot size, number of bedrooms, etc.) and geographic characteristics (driving distance to Seattle central business district, zoning, waterfront property/frontage, etc.).

The results of the econometric model provided a mean land value premium for single-family and condominium properties based on the distance from the facility. Exhibit 4 and Exhibit 5 show the mean values for single-family homes and condominiums and the variance around the mean values. ECONorthwest applied the mean value to all single-family and condominium parcels within one mile of the facility based on their straight-line distance to the facility. The sum of the land value premium for all impacted parcels is the one-time increase in land value that can be attributed to the completion of the project.

[4] Bicycle Route Choice Developed Using Revealed Preference GPS Data; Broach, Gliebe, Dill; 2010 http://ppms.trec.pdx.edu/media/project_files/TRB2011_Bicycle%20route%20choice%20model%20developed%20using%20revealed%20preference%20GPS%20data.pdf

Exhibit 4. Price Premium for Single-family Homes and Proximity to Mixed-Use Trails



Source: ECONorthwest

Exhibit 5. Price Premium for Condominiums and Proximity to Mixed-Use Trails

Source: ECONorthwest

2.3 Assumptions

Exhibit 6. NCHRP Report Demand and Benefit Calculations and Assumptions

Demand	
Daily existing bicycle commuters trips (D1) =	Ri * C * 0.004
Residents in each buffer (Ri) =	Varies
Commute Share (C) =	1.0%
Eligible population =	40.0%
Total daily adult cyclists trips (noncommuter) (D2) =	Ri * Ti * 0.8
Residents in each buffer (Ri) =	Varies
Commute Share (C) =	1.0%
T (low) =	C
T (medium) =	0.4%+1.2C
T (high) =	0.6% + 3C
Total daily child cycle trips (noncommuter) (D3) =	Ri * 0.2 * 0.05
New Commuter trips (D4) =	D1 * Li
New adult cyclists (D5) =	D2 * Li
New child cyclists (D6) =	D3 * Li
L (800 m) =	0.51
L (1600 m) =	0.44
L (2400 m) =	0.15
Benefits	
Recreation Benefit =	(D5 + D6 - D4) * V * 365
Value of benefit per day (V) =	$10
Days per year =	365
Decreased Auto Use Benefit =	D4 * L * S * 47 * 5
Length of Commute (L) =	5.8
Savings per mile, 2016$ (S) =	$0.17
Weeks per year =	47
Days per week =	5

Source: National Cooperative Highway Research Program (NCHRP) Report 552: Guidelines for Analysis of Investments in Bicycle Facilities

3 Assessment Benefits and Costs

3.1 Economic Benefits

Exhibit 7 summarizes the present value of the quantified benefits. In addition to the base case scenario, ECONorthwest conducted a sensitivity analysis to assess how much the quantified benefits vary with changes in key assumptions. Each scenario is summarized below.

- **Base Case scenario:** This scenario is based on the assumptions discussed in the sections above. This includes the number of new bike and pedestrian trip cited, a recreation trip value of $10 per trip, and the mean land value premium.
- **High Recreation Value scenario:** This scenario assumes the value of a recreation trip is $22 per trip instead of $10 per trip assumed in the Base Case. All other assumptions are the same.
- **Low Land Value Premium scenario:** This scenario assumes the land value premium is a value one standard deviation below the mean for all impacted properties within one mile of the project site. All other assumptions are the same.
- **Mixed Scenario:** This scenario assumes both the higher $22 per trip recreation value and the lower land value premium. All other assumptions are the same.

Total quantified benefits for the Base Case are $32.2 million assuming a seven percent discount rate and $56.8 million assuming a three percent discount rate. Under the different scenarios the quantified benefits range from $27.2 million to $53.6 million assuming a seven percent discount rate and $51.0 million to $99.6 million assuming a three percent discount rate.

Exhibit 7. Present Value of Total Monetized Quantified Benefits, 2019-2058 (2017$)

	Base Case		High Rec Value		Low Land Premium		Mixed Scenario	
Net Present Values	7% Discount Rate	3% Discount Rate	7% Discount Rate	3% Discount Rate	7% Discount Rate	3% Discount Rate	7% Discount Rate	3% Discount Rate
Bike Recreation Benefits	$ 2,731,721	$ 5,451,234	$ 6,009,787	$ 11,992,715	$ 2,731,721	$ 5,451,234	$ 6,009,787	$ 11,992,715
Walk Recreation Benefits	$ 15,113,775	$ 30,160,004	$ 33,250,305	$ 66,352,009	$ 15,113,775	$ 30,160,004	$ 33,250,305	$ 66,352,009
Safety Benefits	$ 98,805	$ 197,169	$ 98,805	$ 197,169	$ 98,805	$ 197,169	$ 98,805	$ 197,169
Decreased Auto Use Benefits	$ 204,467	$ 417,330	$ 204,467	$ 417,330	$ 204,467	$ 417,330	$ 204,467	$ 417,330
User Delay Benefits	$ 5,088,421	$ 10,154,101	$ 5,088,421	$ 10,154,101	$ 5,088,421	$ 10,154,101	$ 5,088,421	$ 10,154,101
Operating Expense Benefits	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Property Value Premium	$ 8,995,999	$ 10,476,968	$ 8,995,999	$ 10,476,968	$ 3,963,865	$ 4,616,417	$ 3,963,865	$ 4,616,417
Total Benefits	**$ 32,233,189**	**$ 56,856,805**	**$ 53,647,784**	**$ 99,590,291**	**$ 27,201,055**	**$ 50,996,255**	**$ 48,615,650**	**$ 93,729,741**

Unquantified Economic Benefits

In addition to the quantified benefits, there are economic benefits that the analysis was not able to quantify because of a lack of suitable data. The primary benefits not quantified include improved safety benefits for existing bike and walk trips, and the value of trail access to nearby employers and commercial uses.

An improved trail can provide an opportunity to walk and bike free from the risk of sharing roads and intersections with auto users. In cases where existing bike and walk trips relocate from mixed traffic to the trail, the risk of vehicle related accidents will drop to near zero. Quantifying this benefit requires some understanding of the exiting accident risk associated with the present routes for those bike and walk trips that are amenable to switching to trail use. Unfortunately, accident data was not sufficient to allow for the estimation of these local risk conditions. The safety benefits to existing bike and walk trips, however, would still be realized as a result of project completion.

Proximity and access to a mixed-use trail with a bicycle and pedestrian bridge would have positive economic benefits for commercial uses and employers near the trail. As with the increase in residential land values (estimated above), these benefits would be capitalized in the value of a property based on proximity to the bridge. ECONorthwest conducted the same econometric analysis for office uses near the trail as it did for single-family homes and condominiums. This analysis provided support for the theory that commercial properties closer to mixed-use trails enjoy a land value premium. The results, however, were not statistically significant. As a result, we did not quantify commercial land value premiums for this analysis.

However, there likely will be benefits to commercial land uses that are not being captured in this analysis. The mixed use trail and bridge will make it easier for employees and patrons to access local businesses without a car and not have to find or pay for parking, which lowers their transportation costs. A trail also serves as an amenity valued by employees and patrons of nearby businesses. As a result, some businesses may be willing to pay more to own property or lease space near the trail in order to attract employees and patrons. Unlike gains to residential land, these gains may come with offsetting losses to other properties that do not enjoy trail access. But if commercial uses near the trail realize worker productivity gains or facilitate consumer behavior not otherwise practical there can be net gains to commercial enterprises from the trail improvement.

3.2 Project Costs

Exhibit 8 summarizes the estimated project costs. Construction is assumed to take place in 2019. Construction costs total $24.7 million assuming a seven percent discount rate and $27.4 million assuming a three percent discount rate. The analysis also assumes ongoing annual maintenance costs through 2058.

Exhibit 8. Present Value of Estimated Project Costs (2017$)

Net Present Values	7% Discount Rate	3% Discount Rate
Construction Costs	$(24,571,205)	$(27,150,738)
Maintenance Costs	$ (153,721)	$ (309,082)
Total Costs	**$(24,720,810)**	**$(27,455,266)**

4 Summary

Exhibit 9 compares the total project costs and quantified benefits for the Base Case and three alternative scenarios. The Base Case scenario has net quantified economic benefits of $7.5 million for a benefit-cost ratio of 1.30 assuming a seven percent discount rate. Using a three percent discount rate the net quantified economic benefits are $29.4 million.

Exhibit 9. Present Value of Net Benefits and Benefit-Cost Ratio, 2019-2058 (2017$)

	Base Case		High Rec Value		Low Land Premium		Mixed Scenario	
Net Present Values	7% Discount Rate	3% Discount Rate	7% Discount Rate	3% Discount Rate	7% Discount Rate	3% Discount Rate	7% Discount Rate	3% Discount Rate
Total Costs	$ (24,720,810)	$ (27,455,266)	$(24,720,810)	$ (27,455,266)	$ (24,720,810)	$ (27,455,266)	$ (24,720,810)	$ (27,455,266)
Total Benefits	$ 32,233,189	$ 56,856,805	$ 53,647,784	$ 99,590,291	$ 27,201,055	$ 50,996,255	$ 48,615,650	$ 93,729,741
Net Economic Benefits	$ 7,512,378	$ 29,401,539	$ 28,926,974	$ 72,135,025	$ 2,480,245	$ 23,540,989	$ 23,894,840	$ 66,274,474
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The alternative scenarios range from a low of $2.5 million under the low land value premium scenario to $72.1 million under the high recreation value scenario. The sensitivity analysis indicates that changes in the assumptions and discount rate used can sizably affect the net economic benefits of the project, mostly in a positive direction. Adding the unquantified safety and potential additional commercial land value premium benefits to the quantified benefits would also increase the benefit-cost ratio under each scenario.