

Appendix A Benefit Cost Analysis

Lewis Street Overcrossing, Pasco, WA

Background

The Lewis Street Overpass Project is an existing undercrossing of the BNSF Railyard in Pasco, Washington. Constructed in 1937 with few modifications or modernizations, the structure is in poor condition and the design is obsolete. Lewis Street is a key east-west connection in the City for transit, schools, social services (for more than 60% of financially disadvantaged Latino population), emergency services, and freight and goods movement.

The current undercrossing requires constant maintenance to keep aging concrete in place. In time and with no replacement, the structure will no longer be passable requiring substantial out of distance travel for all modes currently using the undercrossing. The City, with support from the region, State and other stakeholders have prioritized replacement of the undercrossing with an overcrossing structure that would provide greater flexibility and capacity.

Benefit-Cost Project Matrix

The following is the standard project matrix that summarizes the benefit-cost analysis.

Current Status/Baseline & Problem to be solved	Change to Baseline / Alternatives	Type of Impacts	Population Affected by Impacts	Economic Benefit	Summary of Results	Page Reference in BCA
<p>Existing structurally impaired and functionally obsolete undercrossing of BNSF mainline yard.</p> <p>Failure threatens R1 railroad yard (overcrossing) on a Freight Economic Corridor.</p> <p>Pedestrian, bicycle and ADA passage severely impaired.</p> <p>Impaired access between socially and economically linked neighborhoods.</p> <p>Potential loss of current state funding due to shortfall.</p>	<p>Proposed: Construct new arterial and non-motorized bridge over rail yard providing safe access to downtown Pasco.</p> <p>Alternatives: 1. Major maintenance to prevent structural failure of sidewalks, but no improvement to non-motorized access. 2. Reconstruct undercrossing at higher cost with increased disruption to freight rail.</p>	<p>Provide premium pedestrian, bicycle and ADA access.</p> <p>Reduced VMT and travel time due to undercrossing closure.</p> <p>Reduced emissions.</p> <p>Improved emergency vehicle access and lower service costs.</p> <p>Restore crumbling infrastructure. Reduced maintenance costs.</p>	<p>Pasco is the largest city in an economically distressed county</p> <ul style="list-style-type: none"> >20% above state avg. unemployment) Hispanic/Latino population 4 times statewide avg. Avg. wage is 36% below statewide avg. <p>- Project connects minority and low-income neighborhoods to CBD. - Truck and rail freight traffic benefits from the project. Other arterial routes have frequent rail interruption. - Benefits commute and other auto trips, including school buses, transit, emergency vehicles. Other arterial routes have frequent rail interruption. - Project will provide bicycle crossing of the rail yard for local and intercity bicycling (directly accesses the non-motorized route to SE Washington).</p>	<p>State of good repair (SOGR)</p> <p>Project supports planned CBD revitalization Prevents interruption of mainline rail traffic. Produces time savings and increased safety for all users.</p>	<p>\$1.25 Million in state of good repair</p> <p>\$14.5 Million in travel time and operating cost savings for drivers</p> <p>\$1.00 Million in livability benefit for increased ped/bike mode share</p> <p>\$1.00 Million In reduced emissions</p> <p>\$25.9 Million in safety and public service benefits</p> <p>\$43.7 Million in total benefits</p> <p>\$23.1 Million in Net Present Value benefit</p>	<p>BC Ratio of 2.12 Refer to www.Pasco-WA.gov/906/Lewis-Street-Overpass</p>

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Benefit-Cost Analysis Spreadsheet

The Benefit-Cost Analysis (BCA) was analyzed using an Excel spreadsheet named “Copy of Lewis Overpass BCA Notes (2017_07).TIGER7%DIScountn.xlsx”. This documentation explains the calculations on each spreadsheet tab, the premise of the benefits being calculated, and the sources for information used in the BCA.

Tab “Summary”

This spreadsheet shows the summary of all costs and benefits in 2015 dollars, adjusted to reflect present values. Project costs are listed first, then benefits (State of Good Repair, Economic Competitiveness, Livability, Environmental Sustainability, and Safety).

- Total Benefits = \$43,674,375
- Total Costs = \$20,562,743
- Net Present Value = \$23,111,632
- Benefit/Cost Ratio = 2.1

Tab “A-Project Costs”

This spreadsheet shows the yearly stream of project costs. Design and construction of the project would occur between 2016 and 2021. After construction is complete, costs associated with preservation and maintenance would occur on a three-year basis with costs escalating slowly over the life of the project. The project life was assumed to be 50 years, so life-cycle costs were calculated until year 2070. Discount rate was assumed to be 7 percent.

Sources:

- a. Project costs provided by City of Pasco (April 2016)
- b. *TIGER and FASTLANE BCA Resource Guide (updated March 1, 2016)*.
- c. <https://www.transportation.gov/fastlanegrants/bca-resource-guide> (accessed April 1, 2016)
- d. *TIGER and INFRA BCA Resource Guide (updated July, 2017)*

Tab “B-Alt Project Costs”

This spreadsheet shows the yearly stream of costs of the alternate project, or the scenario most likely to occur if the proposed project is not built as anticipated. The present value of these alternative project costs reflects the State of Good Repair benefits.

The premise of the alternative project is that escalating maintenance will occur on the existing underpass structure until sidewall deterioration requires complete closure of underpass. When the underpass is closed, there would be construction costs required to fill the underpass and make the railroad crossing structurally sound. This construction cost is also included in the proposed project costs. While the exact year of the closure is not known, for the purposes of this analysis it assumed that the existing underpass will continue to be used for 10 more years and close in year 2026. Maintenance costs are based on expenses on the underpass over the past 5 years.

Discount rate was assumed to be 7 percent.

Sources:

- a. Project costs provided by City of Pasco (April 2016).
- b. *TIGER and FASTLANE BCA Resource Guide (updated March 1, 2016)*.
- c. <https://www.transportation.gov/fastlanegrants/bca-resource-guide> (accessed April 1, 2016)
- d. *TIGER and INFRA BCA Resource Guide (updated July, 2017)*

Tab “C-Emissions”

This spreadsheet shows the yearly stream of benefits associated with a reduction in emissions. The present value of these benefits reflects the Environmental Sustainability benefits.

The premise of the analysis is that when the underpass is closed, there will be an increase in the number of vehicle-miles-traveled (VMT). The *Lewis Street Overpass Project Transportation Discipline Report* showed that closing the underpass would increase VMT by 820 in the PM peak hour in 2035 compared to No Action. This calculation was extrapolated out to a daily and annual basis based on the factors listed below. The yearly stream of VMT was converted to emissions benefits for CO₂, VOCs, NO_x, and PM.

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- Number workdays in a year = 250
- PM to Daily trips conversion factor = 11.5
- Annual traffic growth in City of Pasco = 1.9 percent
- Metric tons of CO₂ per gallon of gasoline = 0.008887
- Miles per gallon (all vehicle types) = 17.5
- VOCs, NO_x, and PM grams per mile based on EPA Emission Facts 2008
- Benefit dollars per metric ton of emission based on BCA Resource Guide 2016

Discount rate was assumed to be 7 percent for CO₂ emission benefits.

Discount rate was assumed to be 7 percent for VOC, NO_x, and PM emission benefits.

Sources:

- Lewis Street Overpass Project Transportation Discipline Report* (CH2M Hill, Dec 2011)
- NCHRP 716 Travel Demand Forecasting: Parameters and Techniques* (TRB, 2012)
- 2011-2032 Regional Transportation Plan for Tri-Cities Metropolitan Area* (Benton-Franklin Council of Governments, May 2012)
- EPA 2015. <https://www.epa.gov/energy/ghg-equivalencies-calculator-calculations-and-references> (accessed April 13, 2016)
- FHWA 2011 Highway Statistics.
<http://www.fhwa.dot.gov/policyinformation/statistics/2011/vm1.cfm> (accessed April 13, 2016)
- EPA Emissions Facts 2008. <https://www3.epa.gov/otaq/consumer/420f08024.pdf> (accessed April 13, 2016)
- TIGER and FASTLANE BCA Resource Guide (updated March 1, 2016)*.
<https://www.transportation.gov/fastlanegrants/bca-resource-guide> (accessed April 1, 2016)
- TIGER and INFRA BCA Resource Guide (updated July, 2017)*

Tab “D-Operating Costs”

This spreadsheet shows the yearly stream of benefits associated with a reduction in operating costs. The present value of these benefits reflects the Economic Competitiveness benefits.

The premise of the analysis is that when the underpass is closed, there will be an increase in the number of vehicle-miles-traveled (VMT). The *Lewis Street Overpass Project Transportation Discipline Report* showed that closing the underpass would increase VMT by 820 in the PM peak hour in 2035 compared to No Action. This analysis uses the same assumptions shown in Tab “C-Emissions” for the yearly stream of VMT reduction. The operating cost was assumed to be 40 cents per mile based on *TIGER and INFRA BCA Resource Guide (updated July, 2017)*.

Discount rate was assumed to be 7 percent.

Sources:

- Lewis Street Overpass Project Transportation Discipline Report* (CH2M Hill, Dec 2011)
- AAA 2015, <http://publicaffairsresources.aaa.biz/resources/yourdrivingcosts/index.html> (Accessed April 13, 2016)
- TIGER and FASTLANE BCA Resource Guide (updated March 1, 2016)*.
<https://www.transportation.gov/fastlanegrants/bca-resource-guide> (accessed April 1, 2016)
- TIGER and INFRA BCA Resource Guide (updated July, 2017)*

Tab “E-Travel Times”

This spreadsheet shows the yearly stream of benefits associated with a reduction in travel times. The present value of these benefits reflects the Economic Competitiveness benefits.

The premise of the analysis is that when the underpass is closed, there will be an increase in the number of vehicle-hours-traveled (VHT). The *Lewis Street Overpass Project Transportation Discipline Report* showed that closing the underpass would increase VHT by 24 in the PM peak hour in 2035 compared to No Action. This calculation was extrapolated out to a daily and annual basis based on the factors listed below. The yearly stream of VHT was converted to travel time benefits. This includes impacts related to truck trips that would have to divert after closure (though some trucks are already diverting due to low clearances).

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- Number workdays in a year = 250
- PM to Daily trips conversion factor = 11.5
- Annual traffic growth in City of Pasco = 1.9 percent
- Value of Time = \$13.6 per hour per BCA Resource Guide 2017
- Discount rate was assumed to be 7 percent.

Sources:

- a. *Lewis Street Overpass Project Transportation Discipline Report* (CH2M Hill, Dec 2011)
- b. *NCHRP 716 Travel Demand Forecasting: Parameters and Techniques* (TRB, 2012)
- c. *2011-2032 Regional Transportation Plan for Tri-Cities Metropolitan Area* (Benton-Franklin Council of Governments, May 2012)
- d. *TIGER and FASTLANE BCA Resource Guide* (updated March 1, 2016).
<https://www.transportation.gov/fastlanegrants/bca-resource-guide> (accessed April 1, 2016)
- e. *TIGER and INFRA BCA Resource Guide* (updated July, 2017)

Tab “F-Emergency Services”

This spreadsheet shows the yearly stream of benefits associated with a reduction in emergency services costs. The present value of these benefits reflects the Safety benefits.

The premise of the analysis is that when the underpass is closed, there will be a need for an additional fire station due to increased response times. The existing fire station that serves downtown Pasco is on the east side of the underpass structure, whereas the downtown is on the west side. The alternative routes include mostly at-grade crossings which routinely have major crossing delays due to very long and slow trains. Given the increased service response times, and risks associated with train blockages, another fire station would be required in the downtown area. The City of Pasco currently has three fire stations, and adding a fourth station would require an estimated 30 percent increase in their annual operating budget. These costs include both fire protection and ambulatory services.

This benefit is also meant to highlight all the other public services that would be impacted by the underpass closure. Police response times and community services costs would all increase. While not monetized here, the scale of public safety and community benefits (including the minority/ low-income community service providers) could be similar to these emergency services.

- Annual operating cost of new station = \$3,100,784
- Cost of new station = \$3,700,000

Discount rate was assumed to be 7 percent.

Sources:

- a. Annual operating costs from City of Pasco 2015
- b. Tri-City Herald, Sep 2014. <http://www.tri-cityherald.com/news/local/article32197494.html> (Accessed April 13, 2016)
- c. Local NBC News <http://www.nbcrightnow.com/story/5081936/new-pasco-airport-fire-station> (Accessed April 13, 2016)
- d. *TIGER and FASTLANE BCA Resource Guide* (updated March 1, 2016).
<https://www.transportation.gov/fastlanegrants/bca-resource-guide> (accessed April 1, 2016)
- e. *TIGER and INFRA BCA Resource Guide* (updated July, 2017)

Tab “G-Crash Reduction”

This spreadsheet shows the yearly stream of benefits associated with a reduction in crashes. The present value of these benefits reflects the Safety benefits.

The premise of the analysis is that when the underpass is closed, there will be an increase in the number of vehicle-miles-traveled (VMT). The *Lewis Street Overpass Project Transportation Discipline Report* showed that closing the underpass would increase VMT by 820 in the PM peak hour in 2035 compared to No Action. This calculation was extrapolated out to a daily and annual basis based on the factors listed below. The yearly stream of VMT was converted to increased accidents based on the yearly rate of collisions in Franklin County. The costs associated with the crashes were based on values in the BCA Resource Guide weighted by the types of accidents recorded (fatal, injury, etc.) in the City of Pasco.

- Number workdays in a year = 250
- PM to Daily trips conversion factor = 11.5
- Annual traffic growth in City of Pasco = 1.9 percent

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- Countywide collision rate in Franklin County = 139.3 per 100 million vehicle miles
- Average vehicles per collision = 1.71
- Percent type of collisions in City of Pasco based on Washington State 2013 data.
- Cost of accidents based on BCA Resource Guide 2016
- Average cost for each accident in City of Pasco = \$103,760
- Discount rate was assumed to be 7 percent.

Sources:

- a. *Lewis Street Overpass Project Transportation Discipline Report* (CH2M Hill, Dec 2011)
- b. *NCHRP 716 Travel Demand Forecasting: Parameters and Techniques* (TRB, 2012)
- c. *2011-2032 Regional Transportation Plan for Tri-Cities Metropolitan Area* (Benton-Franklin Council of Governments, May 2012)
- d. *2013 Washington State Annual Collision Summary* (WSDOT, 2014)
- e. *TIGER and FASTLANE BCA Resource Guide* (updated March 1, 2016).
<https://www.transportation.gov/fastlanegrants/bca-resource-guide> (accessed April 1, 2016)
- f. *TIGER and INFRA BCA Resource Guide* (updated July, 2017)

Tab “H-Employment Impacts”

This spreadsheet shows the job-creation benefits associated with project. However, the BCA Resource Guide 2016 instructs that these benefits not be included in the benefit-cost analysis calculations. The following is provided for reference only.

- For every \$1 billion spent on highway investment, 13,000 jobs would be created or supported.
- Based on this factor, the Lewis Street project would generate 438 jobs based on the project cost.

Sources:

- a. FHWA 2016 <http://www.fhwa.dot.gov/policy/otps/pubs/impacts/> (accessed April 13, 2016)
- b. *TIGER and FASTLANE BCA Resource Guide* (updated March 1, 2016).
<https://www.transportation.gov/fastlanegrants/bca-resource-guide> (accessed April 1, 2016)
- c. *TIGER and INFRA BCA Resource Guide* (updated July, 2017)

Tab “I-Livability”

This spreadsheet shows the yearly stream of benefits associated with a mode shift from vehicles to walking and bicycling. The present value of these benefits reflects the Livability benefits. The premise of the analysis is that virtually no walking and bicycle trips currently travel through the underpass due to safety and lack of ADA-compliant facilities. When the new overpass is constructed, with new pedestrian and bicycle facilities, there will be a shift in travel modes (vehicle to non-vehicle) consistent with journey-to-work mode shares documented for Pasco in the Census data sets. With the mode shift comes health benefits, as well as emission reductions and operating cost savings due to reduced VMT.

- Percent of commute walk trips in Pasco ZIP code = 1.28%
- Percent of commute bicycle trips in Pasco ZIP code = 0.20%
- Percent of commute trips from total trips = 21%
- Walk commute trip length = 0.5 miles
- Bicycle commute trip length = 3 miles
- 2035 PM Peak Hour volumes on bridge = 1,600
- PM to Daily trips conversion factor = 11.5
- Number of work days in a year = 250 days
- Annual traffic growth in City of Pasco = 1.9 percent
- Health benefits of active transportation = \$10 per day per person (NCHRP 552)
- Emission assumptions same as Tab “C-Emissions”
- Discount rate was assumed to be 3 percent for CO2 emission benefits.
- Discount rate was assumed to be 7 percent for other benefits.

Sources:

- a. American Community Survey 5-year data sets (US Census, 2014)
- b. *NCHRP 365 Travel Estimation Techniques for Urban Planning* (TRB, 1998)

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- c. *Lewis Street Overpass Project Transportation Discipline Report* (CH2M Hill, Dec 2011)
- d. *2011-2032 Regional Transportation Plan for Tri-Cities Metropolitan Area* (Benton-Franklin Council of Governments, May 2012)
- e. *NCHRP Report 552 Guidelines for Analysis of Investments in Bicycle Facilities* (TRB, 2006)
- f. *TIGER and FASTLANE BCA Resource Guide* (updated March 1, 2016).
<https://www.transportation.gov/fastlanegrants/bca-resource-guide> (accessed April 1, 2016)
- g. *TIGER and INFRA BCA Resource Guide* (updated July, 2017)