

Wenatchee Apple Capital Loop BCA Analysis

**FY 2021 INFRA
Discretionary Grant
Program**
Benefit-Cost Analysis

March 2021

Completing the APPLE CAPITAL LOOP

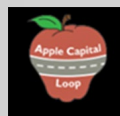


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Section I. BCA SUMMARY

I.A. OVERVIEW

The BCA methodology used in this analysis is consistent with the U.S. Department of Transportation, *Benefit-Cost Analysis Guidance for Discretionary Grant Programs*, February 2021. The detailed cost and benefit assumptions are provided in this BCA Appendix, and have been prepared by an independent professional accountant and economist with input from City staff and consulting engineers. This document is Appendix A-1 to *Completing the Apple Capital Loop 2021 INFRA Grant Application*. The reader is referred to the project narrative, Appendix D for budget and scheduling information, Appendix E for detailed technical feasibility and Appendix I for details about the Traffic Simulation Modeling used in this analysis.

Note: Based on USDOT feedback from the FY19 application, the City has taken a very conservative approach to the BCA to represent the minimum values through assumptions of low population growth and resulting traffic volume growth rates in the regional traffic model. Additionally, the regional traffic model tends to underpredicts travel time savings near system failure and does not capture travel time savings due to reduced occurrence of accidents which is particularly important associated with Segments 1 and 2.



Project Partners:



Exhibit I-1 BCA Overview Full BUILD Scenario

Project Matrix for Apple Capital Loop Project							
Current Status/ Base line (No Build) & Problem to be Addressed	Change to Baseline/ Alternatives	National Goal	Type of Impacts	Population Affected by Impacts	Societal Benefit	Summary of Results (\$2019)	Tab in Spreadsheet
<p>The Wenatchee Valley is one of only 8 communities of its size that does not have an Interstate Highway. Currently, Freight and Citizen Mobility is impeded by the capacity limitation of the Apple Capital Loop Road network.</p>	<p>The Project will bring increased functionality to the Apple Capital Loop. All Project Segments will be constructed under this Scenario:</p> <p>Segment #1: SR 285-North Wenatchee Ave Improvement Segment #2: Confluence Parkway and South End Bike/ Ped Access Segment #3: Cascade Interchange Segment #4: Sunset Highway / SR28 Widening</p> <p>This segment improves the Mobility, Economic Vitality and Safety of the Valley</p>	Freight Mobility, Congestion Reduction & System Reliability	Reduced Travel Time	Truck Drivers, Transit Drivers, Light Vehicle Drivers	Monetized value of reduced travel time costs	Estimated \$978 million in travel time valued is saved	Travel Time Savings Travel Time Savings at RR
		Economic Competitiveness	Improved efficiency in the movement of freight and people	Freight Shippers, Road Users	Monetized value of reduced operational costs to shippers and the public	Estimated \$15 million operational costs savings due to reduction in congestion	Vehicle Op. Cost Savings
		Economic Competitiveness	Incremental Property Value Increase due to access into landlock properties	Local populations	Monetized value of incremental Property Value Increase	No increase in Property Value to land locked Property with access added has been included	Property Value Analysis
		Safety	Reduced potential fatalities on highways and RR crossings	General public	Monetized value of the reduction of potential fatalities on roadways due to use of roundabouts and medium to separate lanes, closure of 2 at-grade crossings.	Estimated \$148 million of reduced fatalities and severe injuries from safety improvements implemented on the roads and removal of at-grade rr crossing	Collision Reduction
		Safety	Improved evacuation routes	Local Populations	Monetized value of lives saved with Confluence Pkwy completed and both lanes used as an outbound evacuation route	An additional evacuation route is built in Seg 2	Emergency Response Savings
		Environmental Sustainability	Reduced pollutant emissions	Local, state, region and national populations	Monetized value of emission reductions due to reduced idling by all vehicles	Estimated \$29 million in reduced emissions	Emission Savings
		Infrastructure Condition	Ensure O&M is done annually per schedule	Local, state, region and national populations	Monetized value of O & M annual costs to ensure good state of repair	\$7.4 million identified in Life-cycle costs	Life Cycle

The results of the BCA indicate a very conservative benefit cost ratio of 1.8:1 when analyzed with a combined 7% for non-CO₂ benefits and costs and a 3% discount rate for CO₂ Emissions over 20 years post-project construction. All dollar values presented in this BCA are based on 2019 dollars. Benefits accrue to congestion reduction/ mobility, wildfire evacuation, economic competitiveness, safety, and environmental sustainability categories. Exhibit I-2 provides a broad overview of the benefit and cost categories and their key components.

Qualitative benefits are also included in Section III.B of this analysis. The benefit includes reduction of the likelihood of high consequence events associated with railroad vehicle conflict and wildfire disaster events, freight impacts specific to the fresh fruit industry, environmental benefits, economic development and vitality, emergency response in terms of ambulance transport to the region's hospital from outlying rural communities, and quality of life.

I.A.1. No-Build Scenario

Presently, the roadways which constitute the Apple Capital Loop are constrained by outdated intersection treatments, poor access management, at-grade rail freight crossing and heavily congested peak and off-peak travel times, and only two bridges in and out of the City of Wenatchee which has approximately 50% of the urban area population in the area. These transportation issues are limiting the regional economy and resulting in measurable accident/safety issues on segments of the Apple Capital Loop. In spite of these constraints, the economy of the greater Wenatchee area is forecasted to continue to grow by creating family-wage jobs within this rural agricultural-dependent export-oriented region. It is forecasted by US Census that the population in the area will increase at a rate of 3.7 percent per year over the next ten years compared to a US national annual rate of 3.4 percent. This high forecasted rate is understandable as steady growth in the Seattle Metropolitan area is pushing an increase in migration to the Valley. To be more conservative, our growth projections have programed in at a lower regional population growth rate of approximately 1.7 percent. Although, for the purposes of this model growth rates are projected at an even lower rate. The traffic model includes population growth of only 1.0% and traffic volume growth rate of slightly less than 1%.

I.A.2. Build Scenario

Apple Capital Loop INFRA funding will leverage, local and WA state funds. The combined capital funding will construct four specific improvements in transportation capacity, safety and freight mobility projects throughout the project area. The Project improvements locations are along the Apple Capital Loop which consists of two cities (Wenatchee and East Wenatchee) and two counties (Chelan and Douglas counties). Detailed BCA assumptions are provided with the supporting spreadsheets found in Section III: Project Benefits. Proposed improvements include a network of projects broken down into the following segments (See Exhibit II-1):

- **Segment 1** will address safety and mobility along State Route 285 / North Wenatchee Ave by installing medians, enhancing access to local businesses, providing active signal priority for transit, installation of roundabouts, and replacing an at-grade rail crossing with an underpass.
- **Segment 2** is construction of Confluence Parkway, an unrestricted 2-lane bypass (SR 285) which will address freight, transit, and traffic delays in the North Wenatchee area and improve emergency vehicle access to the citizens of the region. This bypass connects the center of the city with the existing US2/97A interchange creating a very efficient connection to the existing Columbia River bridge in the northern area of the valley. This will provide a third access point to the city saving lives during fire evacuation events that occurred as recently as 2015. These improvements will also include a railroad

grade separation, walking and biking trail components which will increase multimodal access along the Columbia River, including a pedestrian and bicycle access between the cities of Wenatchee and East Wenatchee through the construction of the South End bicycle and pedestrian bridge, connecting our most at-risk populations and lowest income neighborhoods to a non-motorized trail system, recreational activities, and commercial centers on both sides of the Columbia River.

- **Segment 3** is construction of a new interchange on US Highway 2/97, which will serve to provide access to a future North End development within an Opportunity Zone on the northeast side of the loop, consisting of 280 acres of developable property which are currently landlocked. This planned development is crucial to further economic expansion of the region as the nexus of topography and transportation connections on the site are uniquely suited for high intensity employment and residential uses. Construction of this interchange will prevent additional delay on the highway system resulting from traffic generated by this new intense center of economic activity.
- **Segment 4** will widen an existing 2-lane road to 4 lanes with medians, and U-turns to a vital 2.5-mile section of State Route 28 (Sunset Highway) in East Wenatchee, which will facilitate increased freight movement critically important to the region's established and growing fruit industry. Twenty-one percent of the local employment is agriculture based.

Exhibit I-2: Traffic Volume Projections for 2045 under Build Scenario



Bandwidth map illustrating traffic growth under full build conditions

I.A.3. BCA Model Development

An Excel spreadsheet-based BCA model was developed for the purpose of this analysis. The model utilizes available data provided by the Apple Capital Loop Stakeholders, project specific data elements, and nationally accepted parameters. Many of the national parameters were provided by the United States Department of Transportation (USDOT) specifically for the purposes of Discretionary Grant applications such as FY2021 INFRA.

I.A.4. Changes from FY20 INFRA Application

1. A Benefit Cost Analysis has been developed for the Full Build Scenario and a separate analysis was built for each Segment. This analysis shows the independent utility of the segments, but also shows that the Full Build Scenario surpasses the additive results of the four segments. This should be expected as the full Apple Capital Loop will be much more efficient and reliable with all four segments completed. In addition, the City recognizes that our request for \$140 million is substantial, and believes the project merits full award. However, given the independent utility of project segments, the overall project can be phased to accommodate a partial award, while still accomplishing USDOT goals for the INFRA program and satisfying the non-federal match and societal benefit requirements. Thus, a Benefit Cost Analysis was developed for each Funding Option. As noted in item 2 below, the Traffic Study developed in early 2020 for the FY20 Application did not model Seg 2A and 2B separately. Thus, for BCAs reflection funding options that do not have both sub-segments in the first phase, the congestion savings may be slightly overstated. Even with this notation, all three funding options are cost effective with a BCR exceeding 2:1

Exhibit I-3: Phasing and Partial Funding Options

Funding Request Options	Future Eligible	INFRA Request	Secured Match	Requested Match	Match Percent	BCA
Full Funding Request:	\$262,836,098	\$140,414,116	\$90,497,782	\$31,924,20	46.5%	1.85
Apple Capital Loop Network of Projects Funding Options						
Funding Option A:	\$179,609,738	\$102,111,956	\$77,497,782	\$0	43.1%	2.50
#1 SR 285/North Wenatchee Avenue #2A Confluence Parkway South #2C South End Bike/Ped Access #4 SR 28 / Sunset Highway Widening						
Funding Option B:	\$148,085,538	\$70,587,756	\$77,497,782	\$0	52.3%	3.09
#1A SR 285/North Wenatchee Avenue #1C US2/Easy Street Roundabout #2A Confluence Parkway South #2C South End Bike/Ped Access #4 SR 28 / Sunset Highway Widening						
Funding Option C:	\$118,521,982	\$41,524,200	\$76,997,782	\$0	65.0%	2.55
#1A SR 285/North Wenatchee Avenue #1B McKittrick St/BNSF Underpass #1C US2/Easy Street Roundabout #2C South End Bike/Ped Access #4 SR 28 / Sunset Highway Widening						

Section II.

2. An updated Traffic Simulation referred to as the Chelan-Douglas Transportation Council (CDTC) Travel Demand Model was developed and in for the FY20 Application and run specifically for each Segment and each Travel Time Corridor as outlined in Appendix I CDTC Travel Demand Model Summary. This model remains the basis for this analysis.

The CDTC Model was developed to provide a solid technical basis for evaluating transportation system needs in coordination with long-term planning for Wenatchee, East Wenatchee, and nearby urban areas. The CDTC Model was built using Visum software (Version 18.02) and is consistent with local and regional growth plans within the region. The scope of the model is the Wenatchee Valley areas of Chelan and Douglas Counties, from Monitor to the west and Rock Island to the east (approximately 15 miles wide and 15 miles tall). The boundaries are based on U.S. Census geography in the area.

The CDTC Model has a base year of 2016 and a forecast horizon year of 2045. The 2016 year is based on the year of the latest available land use for the area at time of model development. The model trip assignment represents the PM peak hour period (one-hour volume) between 4 p.m. and 6 p.m. on a typical weekday. The model has a total of 237 Transportation Analysis Zones (TAZs). The 2016 CDTC Model has 521 lane miles coded that represent expressways, arterials, collectors, and local streets. Trip generation is based on population and employment inputs, which are converted to daily trips, then converted to peak hour trips by time-of-day factors. The model network includes both link capacities and intersection movement capacities to evaluate delays and congested travel times. Auto, truck, and transit modes are represented in the trip assignments.

For purposes of the INFRA grant application, it is worth noting that the rate of population growth built into the travel demand model of approximately 1 percent, while based on official city and county growth estimates established in 2016, are well below the actual current rate of annual population increase since that time. According to Washington State Office of Financial Management the actual rate of population growth from 2015-2019 has averaged 1.4 percent per year. As a result, it is likely that the travel demand model represents a conservative forecast of future traffic volumes and corridor travel times, potentially under-estimating the travel delay benefits of the project.

Using this conservative travel model the results of the Full Build Scenario has dropped from 3:61 in FY 19 INFRA Application to 1.7 in FY20 in this analysis primarily due to the very conservative delay calculations resulting from the 2016 baseline data. Currently, we are experiencing delays that surpass the model's projected 2028 delay factors. Based upon this conservative approach it is believed that the BCA modeling should receive a highly confident ranking as to the cost effectiveness of the federal investment into the Project.

3. Based upon discussions with USDOT staff, the City has removed all Property Value increases in the FY21 BCA to ensure that this is not a point of concern. In prior analysis, Property Value increases were included in Segment 1 and 3. With the increase in factors in the February BCA Guidance especially the increased CO₂ Damage Costs, less the Property Values Increase, the BCA for the Full Build Scenario increased slightly to 1.8 compared to FY20.

The main body of this memo describes the Full Build Scenario. A short summary of each Segment's and Funding Option BCAs can be found in Section V as well as the individual Segment BCA spreadsheets have been submitted with the INFRA FY21 Application for review.

II.A.1. Organization of the BCA Memorandum

Section II provides a description of each of the network of project segments including maps to provide context for the BCA consistent with the INFRA grant narrative.

Section III describes the inputs and results of each of the Benefit components of the BCA model. The project specific inputs include items such as freight forecasts, project capital and operating costs, life-cycle costs, annual benefits, and residual value of the project's assets at the end of this analysis. National modeling parameters include emission rates, crash rates, unit operating costs, values of time, average trip lengths, fuel efficiency and monetization factors for all classes of benefits. This section displays the results of each benefit and cost category. A discussion of qualitative benefits that are difficult to quantify is also included in this section.

Section IV describes the capital cost components of the BCA model.

Section V summarizes the results of the BCA and the resulting BCA ratio.

Attachment

Attachment I: Traffic Analysis Summary Memo

II.B. BCA SUMMARY

The following Matrix displays the Current Status (No-Build), the Alternative (Build) Scenario. For each of the six National Goals, the type of impact is identified, followed by the population affected and the societal benefit type, and the results of the impact.

Exhibit II-1 summarizes the results of the Benefit Cost calculations by INFRA Benefit Category

Exhibit II-1: BCA Results (20-year analysis)

Benefit-Cost Analysis Summary- Full Project- All Segments				
Long-term Outcomes	Societal Benefits	Inputs	Impacts	Discounted Value (@7%/3%)
Freight Mobility/ Congestion Reduction	Reductions in travel times within the project area for auto, trucks and transit riders	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group.	32 million hours of travel time delay reductions	\$275,916,584
	Reduction in travel times due to closure of at-grade crossings	Daily vehicles crossing time minutes delayed time probability of being blocked by train	7,500 hours of travel time delay reductions at RR Crossings	\$73,200
Economic Competitiveness	Reduction in Vehicle Operating Costs within the project area for autos, trucks, and transit	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group.	32 million gallons of fuel saved from reduced idling	\$4,196,915
Economic Competitiveness	Enhanced access is expected to leverage new private investment in two specific development locations	Master planned development type (SF) less existing property values (County Assessor tax lot data) investments	No Property Value Increase has been included for Increased development in 2 specific area includes: 14.5 acres at North Wenatchee subarea and land surrounding Cascade Interchange	\$0
Safety	Reduced fatalities and accidents from improvements to intersections which will result in reduced average crash rates	Crash data from Washington State Department of Transportation, crash reduction rates for various elements included in project (roundabouts, medians, etc.) provided by NHTSA	664 accidents prevented with improvements completed, saving an estimated 956 injuries	\$45,536,603
Safety-Emergency Response	Reduced fatalities from the ability to use Confluence Pkwy as evacuation route	Lives saved from Risk of Wildfire due to improved evacuation route	The full project includes the implementation of Confluence Pkwy as an evacuation route	\$12,097,325
Environmental Sustainability	Reductions of emissions associated with congestion (emissions from idling cars)	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group, idling vehicle emission rates provided by EPA	Significant reduction in VOC, THC, CO ₂ , NOx with 330,000 MT saved in CO ₂	\$14,507,802
Public Benefits				\$352,328,428
Less Life-Cycle Costs				(\$1,531,518)
Plus Residual				\$30,192,800
Total Benefits				\$380,989,710
Total Costs				(\$205,497,408)
NPV				\$175,492,302
Benefit-Cost Ratio				1.85

Source: see supporting tables and appendices.

Total Benefits at 0 percent discount rate equal \$1.4 billion, with Total Costs projected to be \$287 million. The Net Present Value (NPV) in \$2019 (at 0 percent) is estimated to be \$1.1 billion, for a Benefit Cost Ratio (BCR) of 4.90. When discounted at a combined 7 percent / 3 percent, total Benefits are estimated to be \$381 million, total Costs equal \$205 million, generating a NPV of \$175 million and a BCR of 1.85.

Exhibit II-2: Benefit Cost Summary

**Benefit Cost Analysis of Wenatchee Apple Loop Road INFRA FY21 Application- Full Build Out
Project Benefit and Cost Analysis Summary (20-year analysis)**

Category	Zero Discount Rate*	Combined Discount Rate @7%/3%
Congestion Reduction and Freight Mobility		
Reduced Travel Time	\$ 979,094,813	\$ 275,989,784
Economic Competitiveness		
Vehicle Operating Savings	\$ 14,897,328	\$ 4,196,915
Property Value Increase (one time only)	\$ -	\$ -
Safety		
Reduced Accident Costs	\$ 148,367,206	\$ 45,536,603
Emergency Response Savings	\$ 39,240,000	\$ 12,097,325
Environmental Sustainability		
Vehicle Delay-Related Emission Cost Reductions based upon Vehicle Delay Reduction	\$ 28,733,842	\$ 14,507,802
Project Benefit and Cost Analysis Summary (20-year analysis)		
Public Benefits	\$ 1,210,333,189	\$ 352,328,428
Life-Cycle Costs	\$ (7,455,641)	\$ (1,531,518)
Residual Value	\$ 200,747,047	\$ 30,192,800
Totals		
Total Benefits	\$ 1,403,624,595	\$ 380,989,710
Total Cost of Project	\$ (286,642,564)	\$ (205,497,408)
Net Present Value	\$ 1,116,982,032	\$ 175,492,302
Benefit-Cost Ratio	4.90	1.85
<i>* These values are expressed in constant 2019 dollar amounts</i>		

II.C. ANNUAL RESULTS WITH THE COMPLETION OF THE BUILD SCENARIO

Exhibit II-3: Total Annual Project Cashflow

NPV Summary															
Calendar Yr.	Project Yr.	Discount Factor 7%	Discount Factor 3%	Capital Costs	Total Public Non-CO ₂ Benefits	CO ₂ Benefits	Total Public Benefits	Life Cycle Costs	Residual Value	Undiscounted Net Benefits (2019\$)	Discounted Non-CO ₂ Benefits (7%)	CO ₂ Benefits NPV @3%	Combined Discounted Benefits	Discounted Total Capital Costs (7%)	NPV @7%/3%
2017	-2	1.042		(\$9,301,570)										(\$9,301,570)	(\$9,301,570)
2018	-1	1.018		(\$1,820,564)										(\$1,788,549)	(\$1,788,549)
2019	0	1.000	1.000	(\$2,599,662)										(\$2,599,662)	(\$2,599,662)
2020	1	1.070	1.030	(\$5,319,943)										(\$4,971,909)	(\$4,971,909)
2021	2	1.145	1.061	(\$10,848,493)										(\$9,475,494)	(\$9,475,494)
2022	3	1.225	1.093	(\$17,249,482)										(\$14,080,716)	(\$14,080,716)
2023	4	1.311	1.126	(\$39,813,330)										(\$30,373,399)	(\$30,373,399)
2024	5	1.403	1.159	(\$57,676,934)										(\$41,122,857)	(\$41,122,857)
2025	6	1.501	1.194	(\$86,027,321)	\$215,025		\$215,025	\$248,100		\$463,125	\$308,600	\$0	\$308,600	(\$57,323,636)	(\$57,015,037)
2026	7	1.606	1.230	(\$46,039,591)	\$1,000,482		\$1,000,482	(\$10,380)		\$990,102	\$616,586	\$0	\$616,586	(\$28,671,143)	(\$28,054,558)
2027	8	1.718	1.267	(\$9,945,674)	\$1,012,244		\$1,012,244	\$411,735		\$1,423,979	\$828,769	\$0	\$828,769	(\$5,788,473)	(\$4,959,704)
2028	9	1.838	1.305		\$41,819,549	\$643,676	\$42,463,225	(\$93,018)		\$42,370,208	\$22,696,469	\$493,324	\$23,189,792	\$0	\$23,189,792
2029	10	1.967	1.344		\$43,243,434	\$681,733	\$43,925,167	(\$93,018)		\$43,832,150	\$21,935,484	\$507,273	\$22,442,757	\$0	\$22,442,757
2030	11	2.105	1.384		\$44,725,195	\$721,841	\$45,447,036	(\$93,018)		\$45,354,019	\$21,204,426	\$521,473	\$21,725,899	\$0	\$21,725,899
2031	12	2.252	1.426		\$46,263,481	\$764,104	\$47,027,585	(\$127,338)		\$46,900,247	\$20,484,999	\$535,927	\$21,020,926	\$0	\$21,020,926
2032	13	2.410	1.469		\$47,863,580	\$808,632	\$48,672,211	(\$93,018)		\$48,579,194	\$19,823,085	\$550,639	\$20,373,724	\$0	\$20,373,724
2033	14	2.579	1.513		\$49,528,038	\$855,539	\$50,383,577	(\$93,018)		\$50,290,560	\$19,171,753	\$565,612	\$19,737,366	\$0	\$19,737,366
2034	15	2.759	1.558		\$51,259,506	\$918,871	\$52,178,376	(\$197,785)		\$51,980,592	\$18,507,118	\$589,788	\$19,096,906	\$0	\$19,096,906
2035	16	2.952	1.605		\$53,060,745	\$971,485	\$54,032,230	(\$93,018)		\$53,939,212	\$17,942,002	\$605,397	\$18,547,399	\$0	\$18,547,399
2036	17	3.159	1.653		\$54,934,630	\$1,026,884	\$55,961,514	(\$1,326,437)		\$54,635,077	\$16,970,981	\$621,282	\$17,592,263	\$0	\$17,592,263
2037	18	3.380	1.702		\$56,884,156	\$1,085,208	\$57,969,364	(\$1,043,178)		\$56,926,187	\$16,521,331	\$637,446	\$17,158,776	\$0	\$17,158,776
2038	19	3.617	1.754		\$58,912,441	\$1,146,606	\$60,059,046	(\$93,018)		\$59,966,029	\$16,264,061	\$653,893	\$16,917,954	\$0	\$16,917,954
2039	20	3.870	1.806		\$61,022,733	\$1,211,230	\$62,233,963	(\$116,418)		\$62,117,545	\$15,739,349	\$670,629	\$16,409,978	\$0	\$16,409,978
2040	21	4.141	1.860		\$63,218,414	\$1,279,244	\$64,497,658	(\$252,858)		\$64,244,801	\$15,207,006	\$687,657	\$15,894,663	\$0	\$15,894,663
2041	22	4.430	1.916		\$65,503,007	\$1,350,818	\$66,853,825	(\$127,338)		\$66,726,488	\$14,756,149	\$704,982	\$15,461,131	\$0	\$15,461,131
2042	23	4.741	1.974		\$67,880,180	\$1,445,402	\$69,325,583	(\$93,018)		\$69,232,565	\$14,299,491	\$732,373	\$15,031,864	\$0	\$15,031,864
2043	24	5.072	2.033		\$70,353,754	\$1,525,439	\$71,879,193	(\$93,018)		\$71,786,176	\$13,851,667	\$750,415	\$14,602,082	\$0	\$14,602,082
2044	25	5.427	2.094		\$72,927,709	\$1,609,630	\$74,537,338	\$156,983		\$74,694,321	\$13,465,794	\$768,768	\$14,234,562	\$0	\$14,234,562
2045	26	5.807	2.157		\$75,606,187	\$1,698,182	\$77,304,369	(\$93,018)		\$77,211,351	\$13,003,027	\$787,429	\$13,790,465	\$0	\$13,790,465
2046	27	6.214	2.221		\$78,393,505	\$1,791,313	\$80,184,817	(\$2,997,377)		\$77,187,440	\$12,133,527	\$806,429	\$12,939,956	\$0	\$12,939,956
2047	28	6.649	2.288		\$81,294,157	\$1,875,202	\$83,169,359	(\$1,143,178)	\$200,747,047	\$82,773,228	\$42,247,685	\$819,607	\$43,067,292	\$0	\$43,067,292
		Total		(\$286,642,564)	\$1,186,922,151	\$23,411,038	\$1,210,333,189	(\$7,455,641)	\$200,747,047	\$1,403,624,595	\$367,979,357	\$13,010,353	\$380,989,710	(\$205,497,408)	\$175,492,302
		B/C Ratio													1.85

Exhibit II-3 displays the annual cashflows of the Project over the analysis period. The Net Present Value at 7 percent / 3 percent discount rates is \$175 million generating a Benefit Cost Ratio of 1.85.

Section III. PROJECT DESCRIPTION

The Wenatchee valley urban area is a regional center providing important services to upwards of 200,000 people who live within driving distance in rural communities in North Central Washington. The demand on the city's transportation infrastructure is growing due to increasing pressure from both residents and citizens from the region that the city serves. Today, people and businesses frequenting the city arrive from British Columbia to the north, Spokane to the east, Seattle and the Puget Sound to the west, and Yakima, Richland, Kennewick and Pasco to the south.

Exhibit III-1 Wenatchee Valley – Urbanized Area (Population Approx. 70,000)

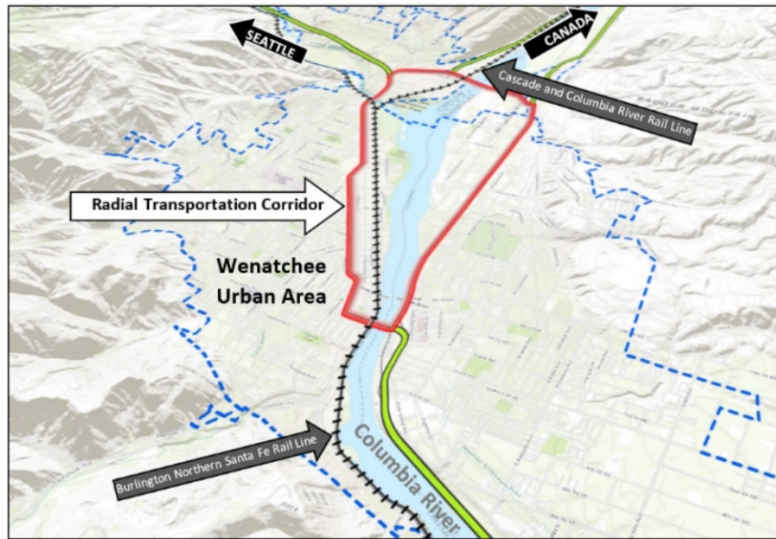


Exhibit III-1 shows the unique radial transportation pattern largely forced on Wenatchee because of mountainous topography. Our future economic success lies in improving this critical corridor within the geographic constraints. This project also addresses increasing rail traffic along the BNSF Seattle-Chicago mainline. Exhibit III-2 reflects 2045 employment growth projections distributed across the urbanized area, demonstrating how the Loop connects employment centers with residential areas. The Apple Capital Loop Project includes four project segments that will complete the radial road network around the Wenatchee Valley. Exhibit II-3 displays the loop and the location of the four projects.

Exhibit III-2: 2045 Employment Forecast

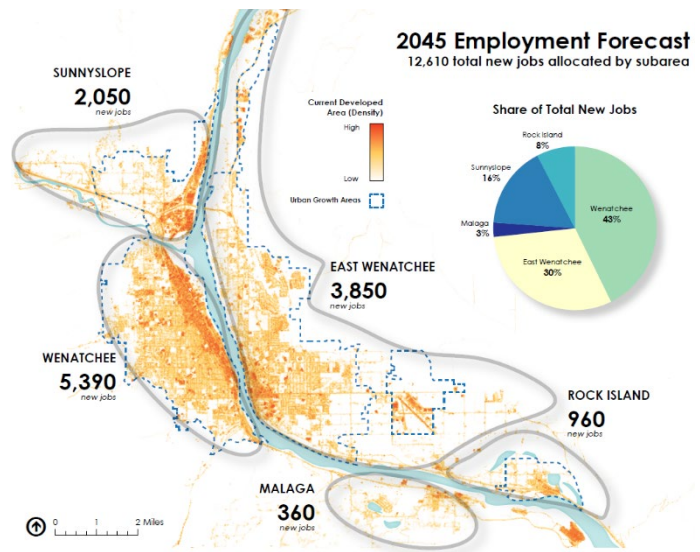
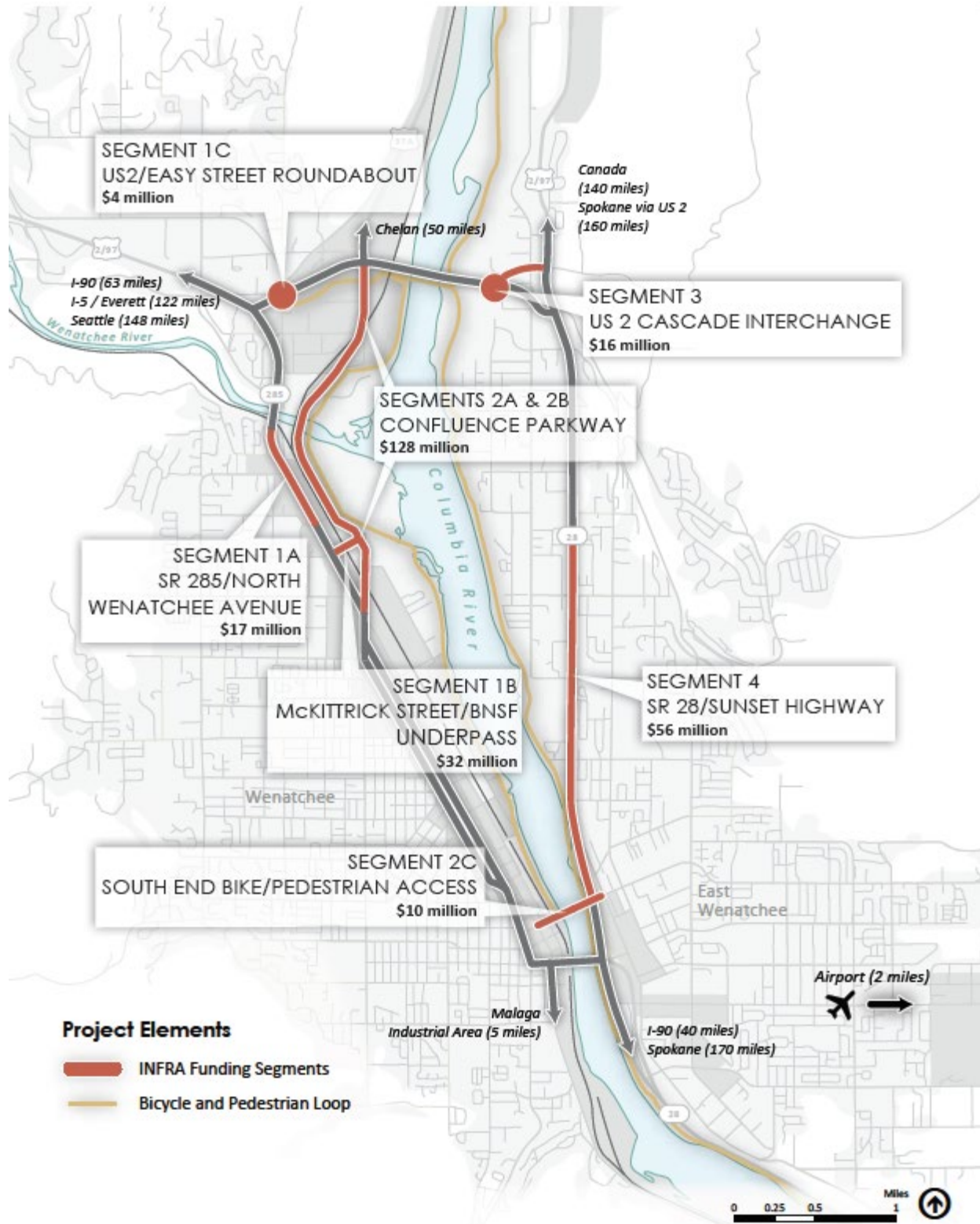


Exhibit III-3: Apple Capital Loop Map



Segment #1 – North Wenatchee Ave. (SR 285) McKittrick RR Underpass, & US2/Easy St Roundabout

North Wenatchee Avenue (SR285) is a NHFN principal arterial and a critical urban freight corridor. This 5-lane segment of the corridor carries 40,000 vehicles per day as measured at the North Wenatchee River bridge. Historically, it experiences the highest number of accidents and is the greatest bottleneck along the Loop. It is the route people must use to get to/from their jobs both in and outside the city.

North Wenatchee Avenue doubles as a primary business as well as the key segment of the loop moving freight and connecting large numbers of people to jobs. Our region’s most at risk neighborhoods in south Wenatchee must use North Wenatchee Avenue to reach the large fruit processing and distribution employers north of the city.

Improvements to this segment of the loop include installation of adaptive and coordinated traffic signals, increasing turn radii, installing U-Turns, replacing sections of the two-way center left turn lane with raised medians, improving pedestrian safety, and improving business access. These changes will significantly benefit freight mobility in and out of the city and allow predictable mobility for citizens and businesses. Modernizing this corridor will create a safer and more reliable travel while enhancing the North Wenatchee Business District (this important district generates more than 30% of local tax revenues for the City of Wenatchee). Utilizing ITS through adaptive signal priority will improve on-time bus service for over 250 Link Transit buses serving this corridor each day. Link transit is experiencing additional operating costs and lost opportunity due to the delay in this corridor for both local routes as well as intercity commuter routes connecting employment centers to outlying communities.

Exhibit III-4: North Wenatchee Avenue Improvement Area



Exhibit III-5: Adaptive Signals



McKittrick Street Underpass -- McKittrick Street is a major arterial connecting to North Wenatchee Avenue from residential neighborhoods and the developing waterfront district, A railroad underpass will be constructed to eliminate train-traffic delays and improve safety for all modes of travel. The underpass will replace and eliminate an existing at-grade crossing at Hawley Street (#065840P) and remove road-rail conflicts with approximately 24 trains per day (one every hour). The existing crossing at Hawley Street experiences traffic backups across the tracks caused by queuing from the signal at Wenatchee Avenue, creating great risk of severe train/vehicle collisions. Train traffic on this Class 1 BNSF route connecting Amtrak passengers and Puget

Exhibit III-6: McKittrick Street Underpass



Sound marine ports to Chicago is anticipated to increase 16 percent to about 28 trains per day (1.2 per hour) by 2035¹. Each train takes 3-5 minutes to clear the crossing, causing backups on each side of the tracks.

The underpass provides a connection to Confluence Parkway (Segment 2) which will act as a bypass to SR 285/North Wenatchee Avenue. The need for this underpass was identified as a priority in the 2004 adopted Waterfront Subarea Plan to address increase in development potential of the waterfront. It will assist in moving freight and is expected to leverage an estimated \$240 million in private investment in the redevelopment of the area destroyed by the 2015 Sleepy Hollow wildfires as identified in the [North Wenatchee Master Plan](#).

Exhibit III-7: New US 2- No. Wenatchee Roundabout

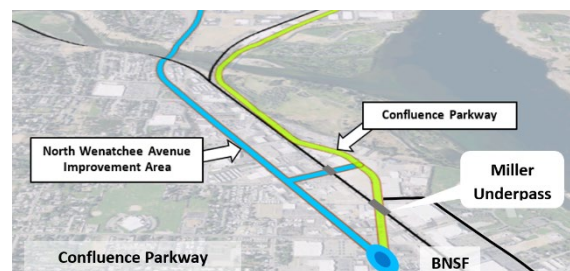
New Roundabout at Easy Street – US 2 Intersection - All traffic to and from the region, including East Wenatchee, Chelan, Entiat, and other areas north of Wenatchee, converge at the US2-Easy Street intersection. This intersection provides access to the Old's Station industrial/commercial area, which has the capacity to double in economic intensity and trip generation. It is one of the primary areas remaining in the city with land available for growth. The Chelan County Public Utility District is locating a new consolidated campus in Olds Station from which over 400 employees and service vehicles will serve Chelan County and two hydroelectric dams. Currently about 1,200 trucks pass through the intersection each day. This number increases significantly during peak harvest periods. The project will replace the signalized intersection with a roundabout to improve traffic flow and increase capacity. The roundabout will include enhanced pedestrian/ bicycle access across US 2 and new transit stops to better serve the US Forest Service district headquarters. The roundabout emerged as the practical design solution through a value engineering study that evaluated costs compared to a traditional grade separated intersection (saving an estimated \$45 million).



Segment #2 - Confluence Parkway (By-pass to SR 285 North Wenatchee Ave)

It is the solution to congestion on SR 285 / North Wenatchee Avenue. Confluence Parkway is a 2.3-mile bypass of North Wenatchee Avenue (SR 285) for freight, transit and passenger vehicles moving to and from the city center and residential areas. This new segment of the Loop will provide relief from the current 5-lane North Wenatchee Avenue bottleneck, which is fed by 10 lanes of highway capacity from the north, and 10 lanes of arterial from the Wenatchee central business district to the South. Upon completion, Confluence Parkway will work in tandem with North Wenatchee Avenue to eliminate congestion on the worst pinch point on the Loop by increasing north-south capacity from 40,000 vehicles per day on

Exhibit III-8: Confluence Parkway



¹ WPPA 2017 Marine Cargo Forecast

North Wenatchee Avenue to a total capacity of both roadways to approximately 63,000 vehicles per day, a 60% increase. In addition, Confluence Parkway is designed as an emergency evacuation corridor by converting both lanes outbound. This evacuation capacity is paramount for wildfire evacuations. During the 2015 Sleepy Hollow Wildfire disaster, North Wenatchee Avenue was blocked during an evacuation event.

The Confluence Parkway is a new corridor that is recognized in the Washington State Freight Plan. This new bypass of the North Wenatchee Avenue commercial corridor will facilitate freight mobility between US 2/97 and the Wenatchee waterfront and central business district. The Confluence Parkway will separate through traffic, including freight trucks and commuter buses, from the heavy commercial traffic along North Wenatchee Avenue (SR 285). This will greatly enhance freight mobility and safety in the northern part of the City of Wenatchee.

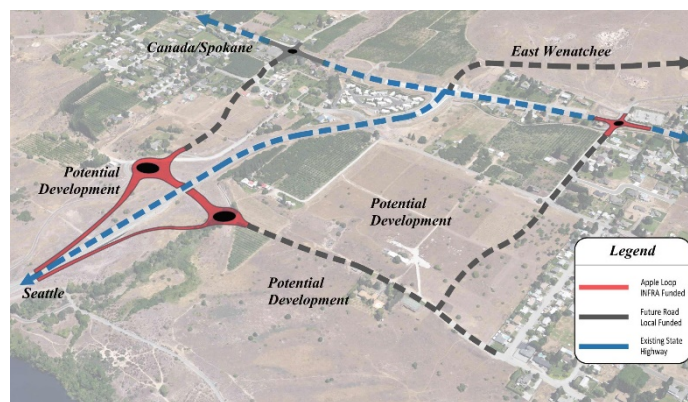
A key element of the Confluence Parkway is the Miller Underpass at the south end of the corridor which will eliminate an existing BNSF mainline at-grade crossing (#065839V). This underpass will allow for safe, unrestricted movement of capacity of 20,000 vehicles per day and will work in tandem with the new McKittrick Street grade separation as Confluence Parkway's southerly connection to SR 285.

The Confluence Parkway includes a key element of the non-motorized Apple Capital Loop trail. Built in 1994, the Apple Capital Loop trail system is an important non-motorized transportation corridor serving thousands of commuter and recreational users each year. Parallel to the highway Loop, the trail functions as a hub and spoke system for cyclists and pedestrians. South Wenatchee is currently cut off from accessing the Loop Trail by the BNSF rail main line. This area is home to 30% of the city's population, most of whom are disadvantaged economically. The Apple Capital Loop project includes construction of a non-motorized railroad overpass to complete trail loop access and eliminate the BNSF rail corridor as a mobility barrier. This nonmotorized connection benefits the highway Loop by providing separated access for pedestrians and cyclists and improving options for non-motorized travel between employment centers as well as recreational destinations along the Columbia River waterfront.

Segment #3 - Cascade Interchange & SR 28/35th Roundabout

This project segment will provide US 2 access into Wenatchi Landing, a 280-acre greenfield Mixed Use/ Commercial Development waiting for highway access, located on undeveloped land in the northeast corner of the Apple Capital Loop and within the East Wenatchee Urban Growth Area boundary. "Wenatchi Landing" derives its name from the traditional cultural spelling of "Wenatchee". This is the largest and last greenfield available for development in the Valley. The North End Master Plan anticipates an additional \$44 million in road and utility investments from public and private contributions to support \$200 Million in economic development through private investment. The Port and County anticipate utilizing tax increment financing tools to accelerate development of the adjacent non-INFRA infrastructure. The City of East Wenatchee and Douglas County have adopted a Planned Action Ordinance in anticipation of the project moving forward.

Exhibit III-9: Cascade Interchange & SR 28/ 35th Roundabout



The project will construct on/off ramps from US 2 (part of the NHS) and utilize an existing overpass to create a unique half-diamond grade separated interchange with local arterial roads serving as the other half of the interchange. This option emerged from the practical solutions review of the original full-diamond interchange and works equally well to meet the safety and operational demands of the Wenatchi Landing development. To access the Wenatchi Landing from SR28 and US 2, the project includes roundabouts at 35th Street NW. These improvements ensure the coming development will not create interruption of US2 and SR 28 at these critical locations on the Loop.

Note: For the purposes of this model, little to no growth is assumed to occur without the interchange being built. This causes a negative impact to the system when the interchange is added based on the addition of trips. This project is heavy economic development project yielding great opportunity for planned growth and minimal impact on the system with the construction of an interchange. If growth were to occur without the interchange, this area of the system would quickly fail due a point load of increased traffic volume at 35th St and SR 28.

Segment #4 - Sunset Highway (SR 28) Widening

This corridor segment serves the highest volumes of truck traffic on the Apple Capital Loop at 12 percent of AADT. This project will enhance safety and mobility on SR 28 in East Wenatchee from 9th Street to Hadley Street. SR 28 is a NHS route. SR 28 Sunset Highway is a T-1 freight route with over 10 million tons of freight moved per year. Freight traffic cannot use SR 285 to bypass this section of the Loop because Wenatchee's downtown business district to the south of Confluence Parkway is a challenging route for trucks. Residential growth, congestion and safety concerns on this important freight corridor resulted in a NEPA decision by WSDOT to widen this segment of the Loop.



This project widens the existing highway to four lanes with non-motorized accessibility and improved channelization at intersections. These changes will allow this segment of the Loop to serve a projected capacity of 35,000 vehicles per day, improving freight movement and mobility on this vital urban corridor.



Section IV. PROJECT BENEFITS

This section describes the key assumptions, calculations and results of each of the project benefit categories.

Each discrete benefit category and its components addresses needs along the Apple Capital Loop. The existing conditions of the project area are detailed below. In addition to the below descriptions, the methodology used to determine the value of each benefit component is detailed below to provide a narrative summary of assumptions and metrics used in the BCA.

IV.A. SUMMARY OF DETAILED BENEFITS

Exhibit IV-1: Detailed Benefits by Year

Summary of Benefits																	
Calendar Year	Project Year	7% Discount Factor	Mobility/ Congestion Relief		Economic Vitality		Safety		Environmental		Total Public Benefits	Life Cycle Costs	Residual Value	Undiscounted Benefits (\$2019)	Discounted Non CO2 Benefits (7%)	Discounted CO2 Benefits (3%)	Total Discounted Benefits
			Travel Time Savings (TTS)	Travel Time Savings (TTS) at closed grade crossings	Vehicle Operating Cost Savings	Incremental Property Value Increase upon Access	Safety Benefits	Emergency Response Savings	Non- CO2 Environmental Benefits	CO2 Environmental Benefits							
2017																	
2018																	
2019	0	1.000															
2020	1	1.070															\$0
2021	2	1.145															\$0
2022	3	1.225															\$0
2023	4	1.311															\$0
2024	5	1.403															\$0
2025	6	1.501		\$0			\$215,025	\$0			\$215,025	\$248,100	\$463,125	\$308,600	\$0.00	\$308,600	
2026	7	1.606		\$0			\$1,000,482	\$0			\$1,000,482	(\$10,380)	\$990,102	\$616,586	\$0.00	\$616,586	
2027	8	1.718		\$9,591			\$1,002,653	\$0			\$1,012,244	\$411,735	\$1,423,979	\$828,769	\$0.00	\$828,769	
2028	9	1.838	\$32,473,943	\$10,181	\$492,815		\$6,709,229	\$1,962,000	\$171,381	\$643,676	\$42,463,225	(\$93,018)	\$42,370,208	\$22,696,469	\$493,324	\$23,189,792	
2029	10	1.967	\$33,808,742	\$10,283	\$513,234		\$6,768,488	\$1,962,000	\$180,687	\$681,733	\$43,925,167	(\$93,018)	\$43,832,150	\$21,935,484	\$507,273	\$22,442,757	
2030	11	2.105	\$35,198,819	\$10,386	\$534,500		\$6,828,340	\$1,962,000	\$191,150	\$721,841	\$45,447,036	(\$93,018)	\$45,354,019	\$21,204,426	\$521,473	\$21,725,899	
2031	12	2.252	\$36,646,467	\$10,490	\$556,648		\$6,888,791	\$1,962,000	\$199,086	\$764,104	\$47,027,585	(\$127,338)	\$46,900,247	\$20,484,999	\$535,927	\$21,020,926	
2032	13	2.410	\$38,154,074	\$10,594	\$579,716		\$6,949,845	\$1,962,000	\$207,350	\$808,632	\$48,672,211	(\$93,018)	\$48,579,194	\$19,823,085	\$550,639	\$20,373,724	
2033	14	2.579	\$39,724,128	\$10,700	\$603,741		\$7,011,511	\$1,962,000	\$215,957	\$855,539	\$50,383,577	(\$93,018)	\$50,290,560	\$19,171,753	\$565,612	\$19,737,366	
2034	15	2.759	\$41,359,221	\$10,807	\$628,763		\$7,073,793	\$1,962,000	\$224,922	\$918,871	\$52,178,376	(\$197,785)	\$51,980,592	\$18,507,118	\$589,788	\$19,096,906	
2035	16	2.952	\$43,062,050	\$10,916	\$654,823		\$7,136,698	\$1,962,000	\$234,259	\$971,485	\$54,032,230	(\$93,018)	\$53,939,212	\$17,942,002	\$605,397	\$18,547,399	
2036	17	3.159	\$44,835,426	\$11,025	\$681,964		\$7,200,232	\$1,962,000	\$243,984	\$1,026,884	\$55,961,514	(\$1,326,437)	\$54,635,077	\$16,970,981	\$621,282	\$17,592,263	
2037	18	3.380	\$46,682,276	\$11,135	\$710,232		\$7,264,401	\$1,962,000	\$254,112	\$1,085,208	\$57,969,364	(\$1,043,178)	\$56,926,187	\$16,521,331	\$637,446	\$17,158,776	
2038	19	3.617	\$48,605,649	\$11,246	\$739,673		\$7,329,212	\$1,962,000	\$264,661	\$1,146,606	\$60,059,046	(\$93,018)	\$59,966,029	\$16,264,061	\$653,893	\$16,917,954	
2039	20	3.870	\$50,608,721	\$11,359	\$770,335		\$7,394,671	\$1,962,000	\$275,647	\$1,211,230	\$62,233,963	(\$116,418)	\$62,117,545	\$15,739,349	\$670,629	\$16,409,978	
2040	21	4.141	\$52,694,797	\$11,472	\$802,270		\$7,460,785	\$1,962,000	\$287,090	\$1,279,244	\$64,497,658	(\$252,858)	\$64,244,801	\$15,207,006	\$687,657	\$15,894,663	
2041	22	4.430	\$54,867,323	\$11,587	\$835,530		\$7,527,559	\$1,962,000	\$299,008	\$1,350,818	\$66,853,825	(\$127,338)	\$66,726,488	\$14,756,149	\$704,982	\$15,461,131	
2042	23	4.741	\$57,129,885	\$11,703	\$870,171		\$7,595,002	\$1,962,000	\$311,420	\$1,445,402	\$69,325,583	(\$93,018)	\$69,232,565	\$14,299,491	\$732,373	\$15,031,864	
2043	24	5.072	\$59,486,219	\$11,820	\$906,249		\$7,663,119	\$1,962,000	\$324,348	\$1,525,439	\$71,879,193	(\$93,018)	\$71,786,176	\$13,851,667	\$750,415	\$14,602,082	
2044	25	5.427	\$61,940,218	\$11,938	\$943,824		\$7,731,917	\$1,962,000	\$337,812	\$1,609,630	\$74,537,338	\$156,983	\$74,694,321	\$13,465,794	\$768,768	\$14,234,562	
2045	26	5.807	\$64,495,933	\$12,058	\$982,958		\$7,801,403	\$1,962,000	\$351,835	\$1,698,182	\$77,304,369	(\$93,018)	\$77,211,351	\$13,003,027	\$787,438	\$13,790,465	
2046	27	6.214	\$67,157,585	\$12,178	\$1,023,717		\$7,871,584	\$1,962,000	\$366,441	\$1,791,313	\$80,184,817	(\$2,997,377)	\$77,187,440	\$12,133,527	\$806,429	\$12,939,956	
2047	28	6.649	\$69,929,571	\$12,300	\$1,066,167		\$7,942,467	\$1,962,000	\$381,652	\$1,875,202	\$83,169,359	(\$1,143,178)	\$82,026,181	\$11,143,178	\$819,607	\$12,467,292	
			Total	\$978,861,044	\$233,769	\$14,897,328	\$0	\$148,367,206	\$39,240,000	\$5,322,804	\$23,411,038	\$1,210,333,189	\$7,485,641	\$200,747,047	\$1,403,624,595	\$367,979,357	\$380,989,710

Exhibit III-1 displays the annual benefits of the Project. This Project generates \$1.2 billion in public benefits, has an estimated Life-cycle cost of \$7.4 million and a residual value of \$200 million over the analysis period. Total Project Benefits are estimated to exceed \$1.4 billion in \$2019.

IV.A.1. Improved Mobility by Reducing Passenger Vehicle and Truck Delay

According to traffic modeling forecasts prepared by Transpo Group traffic engineers, travel time improvements will occur for the entire project area. The BCA results include average annual daily trip (AADT) counts for 2016, and projections for 2028 and 2045. Assumptions for traffic volume allocations for vehicles are based upon the regional Chelan-Douglas Transportation Council (CDTC) Travel Demand Model and information provided by independent traffic engineers in conjunction with this project.

Hours of Delay Calculations:

Given that this project adds elements which will be new to the transportation network, AADT figures for the “build” scenario were used to project vehicle trips for both the build and no-build scenarios. Travel times for the Peak Period (3pm to 6pm) were applied to the AADT figures of each vehicle type (Personal, Trucks, and Transit) in order to illustrate the difference in travel times in each scenario. To determine the benefit value of travel time savings, the model multiplies the AADT figures by percentage share of truck and car traffic plus adds the number of transit buses to determine total trip counts for each direction of travel.

Transpo Group used their transportation model to forecast estimated delays in 2028 at four travel time corridors for the No-Build and the Build scenarios:

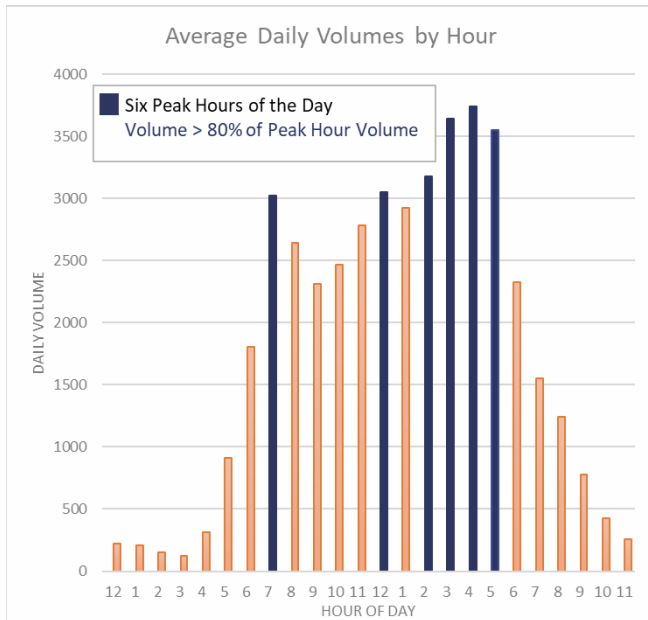
- Wenatchee Avenue/Miller Street - US2/Easy Street
- Wenatchee Avenue/Miller Street to Euclid Avenue/US2 EB Ramp
- Wenatchee Avenue/Miller Street to Empire Avenue/35th Street
- SR 28: Sunset Hwy (US 2 to Valley Mall Pkwy)

Transit travel reductions were estimated based upon using these four corridors to determine total peak-hour travel time in each direction for the build and no-build scenarios. The travel delay difference in minutes was calculated between the 2028 baseline and 2028 Build to determine peak-hour delay in minutes. Total projected delay minutes were allocated per vehicle type which was then converted into Hours Saved for the Build scenario.

The Travel Time Corridor Delay figures were derived from the Regional Travel Demand Model for the “full build” scenario and each project segment, at the Year 2028 (first full year of operation after project opening) and at the model’s 2045 forecast horizon year. For each of the build segment scenarios, projections were made at years 2028 and 2045. The total Travel Time Corridor Delay was compared to the No-build, or “Baseline” scenario to capture the benefit of the project in terms of reduced minutes of travel time delay per day for each corridor. Total minutes reduced delayed were converted in to Daily Hours of Delay Saved. Travel Delay projections can be found in Table1 in CDTC Travel Demand Model in Appendix I.

The next step was to calculate the peak period for the Apple Capital Loop. The Valley does not experience a normal am and pm peak, but instead experiences multiple hours per day at peak traffic levels. Using the actual hourly volumes, in 2016, a model was developed to estimate the six highest travel hours within the day. Exhibit III-2 below displays the average hourly daily volumes. Using the chart, the hours of 7am, noon and the period from 2 pm to 6pm was chosen as the peak period for this analysis. The hours chosen are those hours that exceeded 80 percent of peak. To ensure a conservative approach to calculating peak period delay this peak hour volume was multiplied to 4.5 to recognize the volume curve during these six highest volume hours.

Exhibit IV-2: Average Daily Volumes by Hour



Source: 2016 Actual Average Vehicles per Hour

Next, Daily Hours of Travel Time Saved were multiplied by 365 (days per year) to convert to Annual Hours Saved for Autos and Trucks. Transit was multiple by 260 weekdays, since an estimated number of buses were used versus AADT.

Hours Cost per Vehicle Type Calculations:

For Autos and Trucks, the hourly time value per vehicle type was calculate by multiplying the Average Vehicle Occupancy rates provided by USDOT by hourly value of time savings provided by USDOT (\$17.90 all-purpose hourly value in the case of passenger vehicle figures) producing a travel Time Value per Hour for Autos to equal \$29.89/ hour and \$30.8/ hour for the Truck driver values.

For Transit, average passenger counts were used the passenger occupancy rate for Transit. The average number of passengers (16) was multiplied by the all-purpose hour rate in vehicle rate of \$17.90/ hour was then added to the Bus Driver rate of \$31.70 to get the Transit Travel Time Value per hour of \$318.10 per Transit Bus. The resulting metric is the value of time savings for peak-hour travel.

Exhibit IV-3: Assumption Table for Travel Time Saving- Road

Assumption	Value	Unit	Source:
Annual Traffic Growth Rate	1.0%	percent	USDOT suggested rate below 1.7% in debrief July 2018, conservatively 1% has been used which is greatly below past experience of 4% per year.
	2028		
Hours of Delay Saved- Autos	1,007,705	hours	Transpo Traffic Analysis
Hours of Delay Saved- Trucks	62,657	hours	Transpo Traffic Analysis
Hours of Delay Saved- Transit Buses	1,323	hours	Link Transit / Transpo Traffic Analysis
Hourly Costs			
All purpose hourly In-Vehicle Travel	\$ 17.90	per hour	USDOT BCA Guidance Dec 2020 Table A-3
Average Vehicle Occupancy	1.67	Passenger vehicle	USDOT BCA Guidance Dec 2020 Table A-4
Average In-Vehicle Cost	\$ 29.89	per hour	Calculated
Hours of Delay Saved- Truck Drivers	\$ 30.80	per hour	USDOT BCA Guidance Dec 2020 Table A-3
Hours of Delay Saved- Transit Bus Driver	\$ 31.70	per hour	USDOT BCA Guidance Dec 2020 Table A-3
Hours of Delay Saved per Bus (Driver + passengers)	\$ 318.10	per hour	Calculated based upon Link T transit data
Average number of passengers on Bus	16	passengers	Link T transit data
Number of Days per year- Autos and Trucks	365	days	Transpo Traffic Analysis
Number of Days per year- Transit	260	days	Link T transit data

Travel Time Savings (Peak Hour) per Vehicle					
Travel Time Corridor	Direction	Build vs No Build		Units	Source
Wenatchee Ave. Miller St - US2/Easy St	Both		(6.4)	minutes per vehicle	Transpo Group Independent Analysis (Available in Appendix I)
Wenatchee Ave./Miller St to Euclid Ave/US2 EB Ramp	Both		(8.4)		
Wenatchee Ave/Miller St to Empire Ave/35th St *	Both		0.9		
SR 28:Sunset Hwy. US 2 to Valley Mall Pkwy	Both		(2.6)		
Notes:	The delays detailed above by Travel Time Corridor were calculated using the Transpo Group travel analysis using the conservative traffic model derived from the Regional Travel Demand Model which has set the land use growth factor to 1 percent. The delays displayed above for 2028 No-build are far below what is experienced today in 2020. But in order to remain true to the regional forecast the derived delay values were used as displayed below.				

Travel Time Volume (Peak 6 Hour)					
Travel Time Corridor	Direction	Build vs No Build		Units	Source
		Peak Hour	Peak 6 hrs		
Wenatchee Ave.	Both	4305	14,828	per hour	Transpo Group Independent Analysis (Available in Appendix I)
Wenatchee Ave./Miller St. to	Both	0	6,638	per hour	
Wenatchee Ave/Miller St. to	Both	1728	6,795	per hour	
SR 28:Sunset Hwy.	Both	1860	12,083	per hour	
Total		7893	40,343		

Exhibit IV-4: Travel Time Data by Travel Time Corridor

Travel Time Corridors		Dir		Scenarios (PM Peak Hour Model CONGESTED Travel Times in minutes)					2028 Full Build
				2016 Existing	2028 Baseline	Segment 1 2028 N Wenatchee Ave	Segment 2 2028 Confluence Pkwy	Segment 3 2028 Wentachi Landing IC	
Wenatchee Ave, Miller Street to US 2/Easy St		SB	7.1	9.5	8.8	6.4	9.7	9.1	6.0
		NB	7.0	8.6	7.8	6.1	8.6	8.3	5.7
		Total	14.1	18.1	16.6	12.5	18.3	17.4	11.7
		Minutes Saved vs Baseline			1.5	5.6	-0.2	0.7	6.4
		Volume @ Wenatchee River Bridge			4,305	3,165	4,255	4,160	3,295
		Total Daily Hours Reduced Congestion*			108	295	-14	49	351
					Peak Hour:	39,283	107,821	-5,177	17,715
					4.5 Peak Hour + 80% Shoulder Hours:	176,774	485,195	-23,296	79,716
									128,285
									577,284
Shortest Route, Wenatchee Ave/Miller St to Euclid Ave/US 2 EB Ramp		SB	8.4	10.8	10.0	6.2	11.0	10.3	6.0
in full build it is confluence		NB	7.9	9.5	8.6	6.2	9.5	9.2	5.9
		Total	16.3	20.3	18.6	12.4	20.5	19.5	11.9
		Minutes Saved vs Baseline			1.7	7.9	-0.2	0.8	8.4
		Combined Volume @ SR285 and Confluence Pkwy Wenatchee River Bridges			4,305	4,720	4,255	4,160	4,770
		Total Daily Hours Reduced Congestion*			122	621	-14	55	668
					Peak Hour:	44,521	226,835	-5,177	20,245
					Peak Hour + 80% Shoulder Hours:	200,344	1,020,759	-23,296	91,104
									243,747
									1,096,862
US 2/Easy St to SR 28/19th St NE		SB	7.1	7.7	7.7	7.8	8.2	8.2	8.6
		NB	7.3	8.3	8.3	8.5	8.1	8.5	8.3
		Total	14.4	16.0	16.0	16.3	16.3	16.7	16.9
		Minutes Saved vs Baseline			0.0	-0.3	-0.3	-0.7	-0.9
		Averaged Volume @ US 2 east and west of Wenatchi Landing Ramps			1,728	1,838	1,423	1,720	1,510
		Total Daily Hours Reduced Congestion*			0	-9	-7	-20	-23
					Peak Hour:	0	-3,353	-2,596	-7,324
					Peak Hour + 80% Shoulder Hours:	0	-15,090	-11,682	-32,960
									-8,267
									-37,203
Sunset Hwy, US 2 to Valley Mall Pkwy		SB	7.4	9.0	9.0	8.7	9.3	7.3	7.6
		NB	7.1	8.5	8.3	8.3	8.7	7.1	7.3
		Total	14.5	17.5	17.3	17.0	18.0	14.4	14.9
		Minutes Saved vs Baseline			0.2	0.5	-0.5	3.1	2.6
		Volume @ SR28 South of 19th Street			1,860	1,835	1,850	2,905	2,685
		Total Daily Hours Reduced Congestion*			6	15	-15	150	116
					Peak Hour:	2,263	5,581	-5,627	54,783
					Peak Hour + 80% Shoulder Hours:	10,184	25,117	-25,322	246,526
									42,468
									191,105

Measured as the peak traffic hour plus additional hours that operate at 80% of peak hour volume or greater; delay at 80% is represented as 50% of peak hour delay.

Total Minutes Saved Per Corridor -Full Build:	1.7	13.7	-1.0	3.1	16.5
	Peak Hour:	41,546	336,884	(13,400)	65,174
	4.50 Peak Hour + 80% Shoulder Hours:	186,958	1,515,980	(60,300)	293,282
					1,828,048

Exhibit IV-5: Travel Time Saving -Roadway

Travel Time Savings based upon reduction of delays									
Year	Annual Traffic during Peak six hours for Autos and Trucks	Hours of Delay Saved- Autos	Hours of Delays Saved- Trucks	Hours of Delays Saved- Transit	Total Hours of Delay Saved	Travel Time Savings - Autos	Travel Times Savings - Trucks	Travel Time Savings - Transit	Total Travel Time Saved
				1.0%		\$ 29.89	\$ 30.80	\$ 318.10	
2018								driver + passengers	
2019									0
2020									0
2021									0
2022									0
2023									0
2024									0
2025									0
2026									0
2027									0
2028	14,725,013	1,007,705	62,657	1,323	1,071,685	\$ 30,123,333	\$ 1,929,843	\$ 420,767	\$ 32,473,943
2029	14,872,263	1,049,537	65,258	1,336	1,116,131	\$ 31,373,813	\$ 2,009,955	\$ 424,974	\$ 33,808,742
2030	15,020,985	1,093,105	67,967	1,349	1,162,422	\$ 32,676,203	\$ 2,093,392	\$ 429,224	\$ 35,198,819
2031	15,171,195	1,138,482	70,789	1,363	1,210,634	\$ 34,032,657	\$ 2,180,293	\$ 433,516	\$ 36,646,467
2032	15,322,907	1,185,743	73,727	1,376	1,260,847	\$ 35,445,421	\$ 2,270,801	\$ 437,852	\$ 38,154,074
2033	15,476,136	1,234,966	76,788	1,390	1,313,144	\$ 36,916,831	\$ 2,365,067	\$ 442,230	\$ 39,724,128
2034	15,630,897	1,286,232	79,976	1,404	1,367,611	\$ 38,449,323	\$ 2,463,246	\$ 446,652	\$ 41,359,221
2035	15,787,206	1,339,626	83,295	1,418	1,424,339	\$ 40,045,431	\$ 2,565,500	\$ 451,119	\$ 43,062,050
2036	15,945,079	1,395,236	86,753	1,432	1,483,422	\$ 41,707,797	\$ 2,671,999	\$ 455,630	\$ 44,835,426
2037	16,104,529	1,453,155	90,355	1,447	1,544,956	\$ 43,439,171	\$ 2,782,919	\$ 460,186	\$ 46,682,276
2038	16,265,575	1,513,479	94,105	1,461	1,609,045	\$ 45,242,418	\$ 2,898,443	\$ 464,788	\$ 48,605,649
2039	16,428,230	1,576,306	98,012	1,476	1,675,794	\$ 47,120,521	\$ 3,018,764	\$ 469,436	\$ 50,608,721
2040	16,592,513	1,641,742	102,080	1,491	1,745,313	\$ 49,076,588	\$ 3,144,079	\$ 474,131	\$ 52,694,797
2041	16,758,438	1,709,894	106,318	1,505	1,817,717	\$ 51,113,855	\$ 3,274,595	\$ 478,872	\$ 54,867,323
2042	16,926,022	1,780,875	110,732	1,520	1,893,127	\$ 53,235,694	\$ 3,410,530	\$ 483,661	\$ 57,129,885
2043	17,095,282	1,854,803	115,328	1,536	1,971,666	\$ 55,445,614	\$ 3,552,108	\$ 488,497	\$ 59,486,219
2044	17,266,235	1,931,799	120,116	1,551	2,053,466	\$ 57,747,272	\$ 3,699,564	\$ 493,382	\$ 61,940,218
2045	17,438,898	2,011,992	125,102	1,567	2,138,660	\$ 60,144,477	\$ 3,853,140	\$ 498,316	\$ 64,495,933
2046	17,613,287	2,095,514	130,295	1,582	2,227,391	\$ 62,641,194	\$ 4,013,091	\$ 503,299	\$ 67,157,585
2047	17,789,419	2,182,503	135,704	1,598	2,319,805	\$ 65,241,556	\$ 4,179,683	\$ 508,332	\$ 69,929,571
Total	324,230,109	30,482,694	1,895,358	29,126	32,407,177	\$911,219,167	\$58,377,013	\$9,264,865	\$ 978,861,044

A total of 32 million hours saved by each roadway users times their respective hourly value results in \$978 million before discounting in the value of Travel Time saved on the Roads with the completion of this Project.

IV.A.2. Travel Time Savings- RR Crossings

There will be two Class 1 railroad at-grade crossing closed with the completion of this Project.

The model calculates the Travel Time Saved by closing the two at-grade crossing by multiplying the estimated AADT by the estimated probability that the crossing will be closed based upon current train volume to determine the number of hours of delay. Total Hours of Delay per vehicle type was calculated using the modal splits at these two locations (88% of AADT is autos, with 12% Trucks based upon the FRA crossing inventory reports for these two crossings). No bus routes currently use this crossing because of the unpredictability of delay caused by trains. Once Hours of Delay are calculated by vehicle type, the delay is multiplied time the hourly time value of the respective vehicle type. Total Travel Value Savings is the result of adding the individual Travel Value Saving by vehicle type together.

Exhibit IV-6: Assumptions for Travel Time Savings at Railroad Crossings

Assumption	Value	Unit	Source:
Annual Traffic Growth Rate	1.0%	percent	USDOT suggested rate in debrief July 2018
AADT at Crossings	2000	AADT 2017	USDOT FRA Crossing Inventory/ City of Wenatchee
Estimated Crossing Delay	3	minutes per crossing	BNSF
Number of Crossings	2	crossings	City of Wenatchee
Grade Separation Project In Service			
	2027		
Hours of Delay Saved- Autos	284	hours	Transpo Traffic Analysis
Hours of Delay Saved- Trucks	39	hours	Transpo Traffic Analysis
Hours of Delay Saved- Transit Buses	\$ -	hours	Link Transit/ Transpo Traffic Analysis -buses do not go to waterfront because of delays
Hourly Costs			
All purpose hourly In-Vehicle Travel	\$ 17.90	per hour	USDOT BCA Guidance Dec 2020 Table A-3
Average Vehicle Occupancy	1.67	Passenger vehicle	USDOT BCA Guidance Dec 2020 Table A-4
Average In-Vehicle Cost	\$ 29.89	per hour	Calculated
Hours of Delay Saved- Truck Driver	\$ 30.80	per hour	USDOT BCA Guidance Dec 2020 Table A-3
Hours of Delay Saved- Transit Bus Driver	\$ 31.70	per hour	USDOT BCA Guidance Dec 2020 Table A-3
Hours of Delay Saved per Bus (Driver + passengers	0		Calculated based upon Link Transit data
Average number of passengers on Bus	0	passengers	Link Transit data

Note that due to the number of trains running on through these railroad crossing, Link Transit does not route any of their buses through these crossings. Thus, there are no hours saved by the Transit Buses in this specific benefit calculation.

Exhibit IV-7: Travel Time Value Saved with the Closing of two at-grade rail crossings

Travel Time Savings based upon reduction of delays at 2 Grade Xings												
Year	Traffic Growth Rate	AADT	Probability of train xings closure	Total Crossing Delay in Minutes	Hours of Delay Saved- Autos	Hours of Delays Saved- Trucks	Hours of Delays Saved- Transit	Total Hours of Delay Saved	Travel Time Savings - Autos	Travel Times Savings - Trucks	Travel Time Savings - Transit	Total Travel Time Saved
	1.0%	2,000	0.42%	6.00	88.0%	12.0%			\$ 29.89	\$ 30.80	\$ 318.10	
2018		2,020			270	37						
2019		2,040			273	37						
2020		2,061			276	38						
2021		2,081			279	38						
2022		2,102			281	38						
2023		2,123			284	39						
2024		2,144			287	39						
2025		2,166			290	40						
2026		2,187			293	40						
2027		2,209			296	40		336	\$8,410	\$1,182	\$0	\$9,591
2028		2,231			299	41		339	\$8,927	\$1,254	\$0	\$10,181
2029		2,254			302	41	-	343	\$9,016	\$1,267	\$0	\$10,283
2030		2,276			305	42	-	346	\$9,106	\$1,279	\$0	\$10,386
2031		2,299			308	42	-	350	\$9,197	\$1,292	\$0	\$10,490
2032		2,322			311	42	-	353	\$9,289	\$1,305	\$0	\$10,594
2033		2,345			314	43	-	357	\$9,382	\$1,318	\$0	\$10,700
2034		2,369			317	43	-	360	\$9,476	\$1,331	\$0	\$10,807
2035		2,392			320	44	-	364	\$9,571	\$1,345	\$0	\$10,916
2036		2,416			323	44	-	367	\$9,667	\$1,358	\$0	\$11,025
2037		2,440			327	45	-	371	\$9,763	\$1,372	\$0	\$11,135
2038		2,465			330	45	-	375	\$9,861	\$1,385	\$0	\$11,246
2039		2,489			333	45	-	379	\$9,959	\$1,399	\$0	\$11,359
2040		2,514			337	46	-	382	\$10,059	\$1,413	\$0	\$11,472
2041		2,539			340	46	-	386	\$10,160	\$1,427	\$0	\$11,587
2042		2,565			343	47	-	390	\$10,261	\$1,442	\$0	\$11,703
2043		2,591			347	47	-	394	\$10,364	\$1,456	\$0	\$11,820
2044		2,616			350	48	-	398	\$10,467	\$1,471	\$0	\$11,938
2045		2,643			354	48	-	402	\$10,572	\$1,485	\$0	\$12,058
2046		2,669			357	49	-	406	\$10,678	\$1,500	\$0	\$12,178
2047		2,696			361	49	-	410	\$10,785	\$1,515	\$0	\$12,300
Total Saving					6,575	897	-	7,472	\$196,561	\$27,617	-	\$233,769

It is estimated that a Total of \$0.2 million will be saved in Travel Time Value with the closing of the two at-grade crossings.

IV.A.3. Economic Vitality

IV.A.3.a Vehicle Operating Cost Savings

Vehicle Operating Cost Savings is calculated upon the number of hours of delay by type of vehicle multiplied by the gallons of fuel consumed over the hours of delays times the average fuel price per gallon. Traditionally, Vehicle Operating Cost Savings would be based upon ton-miles traveled. For this Project, the vehicles are not converting from one mode to another so vehicle ton miles and cost per ton mile is an inappropriate measure of operating cost calculations. Nor is the recommended Vehicle Operating Cost per mile as detailed in Table A-5 of the USDOT Benefit-Cost Analysis Guidance for Discretionary Grant Applications, February 2021 an appropriate factor for this Project. Since the Project will reduce congestion/ sitting in traffic i.e. vehicle idling, fuel usage is a better factor to use in calculation the change in operating costs of a vehicle for this BCA.

For Link Transit, the analysis tried to monetize the Operating Cost Savings of the peak time routes, which were considered primarily the Commuter Routes which are longer routes serving employment centers outside downtown Wenatchee. The Commuter Routes are served with buses that use fuel versus the local routes that are all electric. It should be noted that congestion or traffic delays in the no-build scenario will result in the need to place additional buses into operation along the route in order to maintain existing schedules and on-time reliability. The need for additional buses added to the routes during peak congestion periods have not been included in this analysis as studies have not been completed that would provide the correct factors for use in this Analysis.

Exhibit IV-8: Assumptions for Calculating Vehicle Operating Cost Savings

Assumption	Value	Unit	Source:
Annual Traffic Growth Rate	1.0%	percent	USDOT suggested rate in debrief July 2018
Hours of Delay by Vehicle Type			
Hours of Delay by Vehicle Type	2028		
Hours of Delay Saved- Autos	1,007,705	hours	Transpo Traffic Analysis
Hours of Delay Saved- Trucks	62,657	hours	Transpo Traffic Analysis
Hours of Delay Saved- Transit Buses	1,323	hours	Link Transit/ Transpo Traffic Analysis
Operating Cost per Vehicle Fuel Only			
Autos- Gasoline - All Grades	\$ 3.2280	per Gallon	Average Fuel Prices 2/17/20, Westcoast https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_r50_w.htm
Commercial Vehicles	\$ 3.4680	per Gallon	
Buses	\$ 3.4680	per Gallon	
Operating Costs per hour:			
Light Duty Vehicles	\$ 0.43	per hour	Source: USDOT 2021 BCA Guidance Table A-5
Commercial Vehicles	\$ 0.93	per hour	
Gallons of fuel saved			
Autos- Gasoline - All Grades	1.0	per hour	https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_r50_w.htm
Commercial Vehicles	1.0	per hour	
Buses	1.0	per hour	
Travel Time Savings (Peak Hour) per Vehicle Build vs No			
Travel Time Corridor	Build	Units	Source
Wenatchee Ave. Miller St - US2/Easy St	(6.4)	minutes per vehicle	Transpo Group Independent Analysis (Available in Appendix)
Wenatchee Ave./Miller St. to Euclid Ave/US2 EB Ramp	(8.4)		
US 2/ Easy St to SR 28/19 St NE	0.9		
SR 28:Sunset Hwy. US 2 to Valley Mall Pkwy	(2.6)		

Exhibit IV-9: Vehicle Operating Cost Savings based upon reduced Fuel usage due to reduction of delay

Vehicle Operating Cost Savings based upon Gallons of Fuel Saved from Reduction of Delay											
Year	Hours of Delay Saved - Autos	Hours of Delays Saved - Trucks	Hours of Delays Saved - Transit	Gallons of fuel Saved - Auto	Gallons of fuel Saved - Trucks	Gallons of fuel Saved - Transit	Total Gallons of Fuel Saved	Operating Cost Saved - Autos	Operating Cost Saved - Trucks	Operating Cost Saved - Transit	Total Operating Costs Saved (expressed as fuel saved from reduced idling)
			1.0%	1.0	1.0	1.0		\$ 0.430	\$ 0.930	\$ 0.930	
2028	1,007,705	62,657	1,323	1,007,705	62,657	1,323	1,071,685	\$433,313	\$58,271	\$1,230	\$492,815
2029	1,049,537	65,258	1,336	1,049,537	65,258	1,336	1,116,131	\$451,301	\$60,690	\$1,242	\$513,234
2030	1,093,105	67,967	1,349	1,093,105	67,967	1,349	1,162,422	\$470,035	\$63,210	\$1,255	\$534,500
2031	1,138,482	70,789	1,363	1,138,482	70,789	1,363	1,210,634	\$489,547	\$65,834	\$1,267	\$556,648
2032	1,185,743	73,727	1,376	1,185,743	73,727	1,376	1,260,847	\$509,870	\$68,566	\$1,280	\$579,716
2033	1,234,966	76,788	1,390	1,234,966	76,788	1,390	1,313,144	\$531,035	\$71,413	\$1,293	\$603,741
2034	1,286,232	79,976	1,404	1,286,232	79,976	1,404	1,367,611	\$553,080	\$74,377	\$1,306	\$628,763
2035	1,339,626	83,295	1,418	1,339,626	83,295	1,418	1,424,339	\$576,039	\$77,465	\$1,319	\$654,823
2036	1,395,236	86,753	1,432	1,395,236	86,753	1,432	1,483,422	\$599,952	\$80,680	\$1,332	\$681,964
2037	1,453,155	90,355	1,447	1,453,155	90,355	1,447	1,544,956	\$624,857	\$84,030	\$1,345	\$710,232
2038	1,513,479	94,105	1,461	1,513,479	94,105	1,461	1,609,045	\$650,796	\$87,518	\$1,359	\$739,673
2039	1,576,306	98,012	1,476	1,576,306	98,012	1,476	1,675,794	\$677,812	\$91,151	\$1,372	\$770,335
2040	1,641,742	102,080	1,491	1,641,742	102,080	1,491	1,745,313	\$705,949	\$94,935	\$1,386	\$802,270
2041	1,709,894	106,318	1,505	1,709,894	106,318	1,505	1,817,717	\$735,254	\$98,876	\$1,400	\$835,530
2042	1,780,875	110,732	1,520	1,780,875	110,732	1,520	1,893,127	\$765,776	\$102,980	\$1,414	\$870,171
2043	1,854,803	115,328	1,536	1,854,803	115,328	1,536	1,971,666	\$797,565	\$107,255	\$1,428	\$906,249
2044	1,931,799	120,116	1,551	1,931,799	120,116	1,551	2,053,466	\$830,674	\$111,708	\$1,442	\$943,824
2045	2,011,992	125,102	1,567	2,011,992	125,102	1,567	2,138,660	\$865,157	\$116,345	\$1,457	\$982,958
2046	2,095,514	130,295	1,582	2,095,514	130,295	1,582	2,227,391	\$901,071	\$121,175	\$1,471	\$1,023,717
2047	2,182,503	135,704	1,598	2,182,503	135,704	1,598	2,319,805	\$938,476	\$126,205	\$1,486	\$1,066,167
Total	30,482,694	1,895,358	29,126	30,482,694	1,895,358	29,126	32,407,177	\$34,331,660	\$66,767,963	\$27,087	\$14,897,328

The results of the model estimate \$14 million will be saved in operating costs under the Build Scenario from the reduction of 32 million gallons of fuel used under the No-Build Scenario due traffic congestion when the Project is implemented.

IV.A.4. Incremental Property Value Increase

The Apple Capital Loop project provides two key access improvements creating a one-time value increase in property values. The two improvements include a new interchange on US 2 and a Class 1 railroad underpass adjacent to SR 285, which both open up land that did not have access necessary to support the land use regulations and the development planned for the area. Those segments are segment 1B – McKittrick RR Underpass and segment 3A – Cascade Interchange.

As noted above this analysis has removed the Incremental Property Value Increase calculations in the FY21 BCA model..

IV.A.5. Safety Benefits

IV.A.5.a Accident Cost Reduction

Intersection-Related Accident Reductions

Intersection-related accident (health) cost reductions are a function of safety improvements made at four intersections in the project corridor. The intersections at SR 28 and 9th, SR28 and 19th, SR 28 and 35th as well as at US 2 and Easy Street will be converted from stop control to roundabouts. These conversions are expected to mitigate the frequency of traffic collisions at these intersections. Washington State Department of Transportation data on traffic accidents at these intersections from 2006 to 2016 were analyzed to determine the frequency with which crashes have occurred historically. In the debrief in July 2018, USDOT provided the City data on roundabout conversions which recommended using a 19% reduction in incidents when a large intersection is converted to a roundabout.

To determine the value of the reduction in these crashes, valuation figures provided by the USDOT BCA Guidelines and probability figures provided by the NHTSA are averaged to determine a probability-based all-purpose injury accident cost. The number of crashes reduced because of the intersection conversions are multiplied by this all-purpose crash cost factor of \$197,600.

Median Improvement-Related Accident Reductions

The installation of medians along SR 28 and SR 285 are expected to reduce the instances of injury and property damage crashes along those corridors. Washington State Department of Transportation data on traffic accidents at these intersections from 2006 to 2016 were analyzed to determine the frequency with which crashes have occurred historically. Accidents along these corridors were further filtered based on accident type (i.e. opposite direction crashes, left turn crashes, etc.) to identify crashes which would not have happened were a median installed. These numbers were then divided by 11 in order to annualize the number of accidents over the 11-year accident data timeframe.

In order to determine benefits derived from these improvements and resulting crash reductions, this BCA determined percentage occurrence of each type of crash (instances of KABCO-classified crash types as well as “property damage only” crashes) for the build and no-build scenarios. The percentage likelihood of each crash type was multiplied by the costs associated with each type of crash as detailed in the BCA guidance packet provided by USDOT. This created an average “crash cost” for each of the build and no-build scenarios. These average costs were multiplied by the projected annual number of crashes in each of the build and no-build scenarios to determine total cost of crashes in a given year.

Rail Crossing-Related Accident Reductions

Two at-grade rail crossings will be replaced with underpasses in conjunction with this project which will translate to a reduced frequency of vehicle or pedestrian related rail crossing accidents. Predictive collision figures were developed using the **Federal Railroad Administration's Accident Prediction System** in order to determine how many pedestrians may be hit by trains annually. The crossing at Miller Street is expected to generate 0.056957 collisions annually while the Hawley Street intersection was expected to have 0.014904 accidents annually. It was assumed that since trains at these crossings were moving at 65 MPH each of these collisions would result in the death of the occupants of a vehicle or a pedestrian involved. These annualized figures were multiplied by USDOT's value of a statistical life figure of \$10.9 million to determine annual cost avoidance in the build scenario.

Exhibit IV-10: Assumptions for Safety Analysis of Road and Rail Crossing Improvements

Assumptions	Alternative 1: Base Case: No Grant, Apple Capital Loop Improvements not Constructed		Alternative 2: Build out-INFRA Grant Awarded, Apple Capital Loop Improvements Constructed		Reduction in accidents (Savings) with Proj. Completed	Reduction of injuries	Calculations
	11 year Average	Year in Service					
Annual Injury and Fatality Crashes:							
SR 26- Seg 4	3.09	2028	3.09	0.00	0.00	0.00	Removal of suicide lane = elimination of left turns into traffic
SR 265 Seg 1	21.36	2028	0.00	21.36	30.76	30.76	Removal of suicide lane = elimination of left turns into traffic
SR 26 & 9th Intersection Seg 4	3.82	2028	3.09	0.00	0.00	0.00	Installation of Roundabout = reduction of accidents at intersection
SR 26 and 19th Intersection Seg 4	4.18	2028	3.39	0.79	1.14	1.14	Installation of Roundabout = reduction of accidents at intersection
SR 26 and 35th Intersection Seg 4	0.45	2028	0.37	0.09	0.12	0.12	Installation of Roundabout = reduction of accidents at intersection
US 2 & Easy St. Seg 1	5.73	2025	4.64	1.09	1.57	1.57	Installation of Roundabout = reduction of accidents at intersection
Miller and BNSF Railroad Seg 2A	0.06	2027	0.05	0.01	0.01	0.01	Removal of at-grade crossing
Hawley and BNSF Railroad Seg 1B	0.01	2026	0.00	0.01	0.02	0.02	Removal of at-grade crossing
Total Annual Accidents	38.71		14.63	23.35		33.63	
Economic Value of Intersection-Based Injury and Fatality Crashes							
SR 26		2028	\$0	\$0			Number of Accidents Reduced * Av. Cost per Accident
SR 265	\$4,221,455	2028	\$0	\$4,221,455			Number of Accidents Reduced * Av. Cost per Accident
SR 26 & 9th Intersection		2028	\$0	\$0			Number of Accidents Reduced * Av. Cost per Accident
SR 26 and 19th Intersection		2028	\$0	\$0			Number of Accidents Reduced * Av. Cost per Accident
SR 26 and 35th Intersection		2028	\$0	\$0			Number of Accidents Reduced * Av. Cost per Accident
US 2 & Easy St.	\$1,131,709	2025	\$916,684	\$215,025			Number of Accidents Reduced * Av. Cost per Accident
Miller and BNSF Railroad Seg 2A		2027		\$0			Crossing Predictive Collision ratio * Cost per Fatality
Hawley and BNSF Railroad 1B	\$162,475	2026	\$0	\$162,475			Crossing Predictive Collision ratio * Cost per Fatality
Total Annual Savings from Hwy	\$5,515,639		\$916,684	\$4,598,955			

Assumptions	Assumption Value	Unit	Sources
Number of injuries per accident	1.44	per fatal crash	USDOT 2020 BCA Guidance Table A-1: Value of Reduced Fatalities and Injuries
Number of fatalities per fatal crash	1.09	per accident	

Reduction of Predictive Railroad Fatalities at Crossings Being Eliminated (Annually)		
Rail Crossing	Predictive Rail Fatality Annual Rate	Source
Miller #065839V	0.056957	U.S. DOT-Crossing inventory information as of 2/27/2021
Hawley #0658409P	0.014906	
Total Reduction of Predictive Rate with 2 RR crossing Closures	0.071863	

Exhibit IV-11: Safety Analysis of Road and Rail Crossing Improvements

Safety Analysis												
Year	Traffic Growth Rate	#Accidents at Intersections where roundabout will be installed	% Reduction of accidents when Roundabout installed	# of accidents reduced with installation of roundabouts	# Accidents from use of suicide lanes	# Accidents reduced by removing suicide lane	Total Accidents Reduced	Total number of Injuries reduced	# Fatality Accidents reduced with closing of 2 at-grade RR crossing	# Fatality Accidents reduced with closing of 2 at-grade RR crossings	# Injuries reduced *Average cost per Hwy Accident	Total Accident Prevention Savings
	1.0%		19%					1.44	0.07	\$ 10,900,000	\$197,600	
2018		14.18			24.45							
2019	1.0%	14.32			24.70							
2020	1.0%	14.47			24.95		0.00	0.00			\$0	\$0
2021	1.0%	14.61			25.20		0.00	0.00			\$0	\$0
2022	1.0%	14.76			25.45		0.00	0.00			\$0	\$0
2023	1.0%	14.91			25.70		0.00	0.00		\$0	\$0	\$0
2024	1.0%	15.05			25.96		0.00	0.00		\$0	\$0	\$0
2025	1.0%	15.20		1.09	26.22		1.09	1.57		\$0	\$215,025	\$215,025
2026	1.0%	15.36		1.10	26.48		1.10	1.58	0.07	\$783,307	\$217,175	\$1,000,482
2027	1.0%	15.51		1.11	26.75		1.11	1.60	0.07	\$783,307	\$219,347	\$1,002,653
2028	1.0%	15.67		2.98	27.01	27.01	29.99	43.18	0.07	\$783,307	\$5,925,923	\$6,709,229
2029	1.0%	15.82		3.01	27.28	27.28	30.29	43.62	0.07	\$783,307	\$5,985,182	\$6,768,488
2030	1.0%	15.98		3.04	27.56	27.56	30.59	44.05	0.07	\$783,307	\$6,045,034	\$6,828,340
2031	1.0%	16.14		3.07	27.83	27.83	30.90	44.49	0.07	\$783,307	\$6,105,484	\$6,888,791
2032	1.0%	16.30		3.10	28.11	28.11	31.21	44.94	0.07	\$783,307	\$6,166,539	\$6,949,845
2033	1.0%	16.46		3.13	28.39	28.39	31.52	45.39	0.07	\$783,307	\$6,228,204	\$7,011,511
2034	1.0%	16.63		3.16	28.67	28.67	31.83	45.84	0.07	\$783,307	\$6,290,486	\$7,073,793
2035	1.0%	16.80		3.19	28.96	28.96	32.15	46.30	0.07	\$783,307	\$6,353,391	\$7,136,698
2036	1.0%	16.96		3.22	29.25	29.25	32.47	46.76	0.07	\$783,307	\$6,416,925	\$7,200,232
2037	1.0%	17.13		3.26	29.54	29.54	32.80	47.23	0.07	\$783,307	\$6,481,094	\$7,264,401
2038	1.0%	17.30		3.29	29.84	29.84	33.13	47.70	0.07	\$783,307	\$6,545,905	\$7,329,212
2039	1.0%	17.48		3.32	30.14	30.14	33.46	48.18	0.07	\$783,307	\$6,611,364	\$7,394,671
2040	1.0%	17.65		3.35	30.44	30.44	33.79	48.66	0.07	\$783,307	\$6,677,478	\$7,460,785
2041	1.0%	17.83		3.39	30.74	30.74	34.13	49.15	0.07	\$783,307	\$6,744,253	\$7,527,559
2042	1.0%	18.01		3.42	31.05	31.05	34.47	49.64	0.07	\$783,307	\$6,811,695	\$7,595,002
2043	1.0%	18.19		3.46	31.36	31.36	34.82	50.14	0.07	\$783,307	\$6,879,812	\$7,663,119
2044	1.0%	18.37		3.49	31.67	31.67	35.17	50.64	0.07	\$783,307	\$6,948,610	\$7,731,917
2045	1.0%	18.55		3.53	31.99	31.99	35.52	51.14	0.07	\$783,307	\$7,018,096	\$7,801,403
2046	1.0%	18.74		3.56	32.31	32.31	35.87	51.66	0.07	\$783,307	\$7,088,277	\$7,871,584
2047	1.0%	18.93		3.60	32.63	32.63	36.23	52.17	0.07	\$783,307	\$7,159,160	\$7,942,467
Total Saving				68.84	801.50	594.80	663.64	955.64	1.58	\$17,232,747	\$131,134,458	\$148,367,206

Estimates for reduction of fatalities at this crossing is estimated at \$17 million. The model estimates reduction of accidents from the new safety improvements along the roadways to save a total of 664 accidents equaling \$131 million. Total accidents prevented are estimated to exceed \$148 million.

IV.A.5.b Emergency Response- Evacuation Risk Savings

Methodology of Estimating reduced risk of live loss from Wildfires due to limited evacuation routes

The City of Wenatchee developed the following wildfire evacuation benefit analysis based on recent experience with wildland/urban-interface fire disasters: the 1992 Castlerock Wildfire and the 2015 Sleepy Hollow Wildfire. This analysis was developed with supporting information and cooperation with partners such as Chelan County Fire District No.1, the Wenatchee Police Department, and US Forest Service. City staff also reviewed fatality rates from the recent Paradise and Talus wildfires in California. Wenatchee's location in the foothills of the Cascade Mountain Range has similarity to the Wildfire Urban Interface regime in those two California disasters

Wildland Urban interface fire evacuation and loss of life models have not been developed and standardized nationally. Therefore, the following simplified model for estimating loss of life is based on the following key assumptions, which were developed based on research.

Principle Modeling Assumptions:

- Wildland Urban Interface Fire Disasters overwhelm emergency services thus evacuation is the primary way to minimize loss of life. Local evacuation education is based on the "Ready Set Go" public education program.
- Evacuation notice is provided through "Reverse 911" systems and by radio. Door-to-door evacuation is not adequate given the onset of wildfire disasters happens in a matter of minutes and hours.
- Loss of life occurs through direct exposure to fire either inside structures, on foot, or inside vehicles while trying to escape. Loss of life also occurs through indirect effects such as heart attacks.
- The probability of loss of life is increased based on exposure time during a disaster. According to experience with the recent CA fires, most loss of life occurs in the first hours of the event. For this model, 7 hours is estimated as the critical time where loss of life is most likely.
- The probability of a disaster is related to the return frequency of wild fires. The US Forest Service estimates the return interval for wildfires in Wenatchee is approximately 3 years. The city is estimating that the return interval for disaster-scale fires is approximately 20 years based on a 1992 and 2015 fire disaster.
- Evacuation for this model utilized an evacuation model entitled "[Real Time Evacuation Planning Model](#)" (RTEPM).

The **Real time evacuation Planning Model (RtePM, or "Route -P-M")** estimates the time required for evacuating vehicles to clear a user-defined area for a variety of evacuation scenarios.

The number and speed of evacuating vehicles are determined by user-assigned or modified variables, such as the time of day when an evacuation starts, evacuation rate, the population's participation rate, and the number of people per vehicle, using parameters provided within the model.

Independent verification and validation testing was conducted on RtePM for a variety of scenarios by DDL Omni Engineering. Testing determined that RtePM provides sufficiently accurate estimates of vehicle evacuation times to support its use for emergency management planning under the conditions modeled.

- The fatality rate is calculated based on the number of deaths per 1,000 evacuees per hour. This rate is estimated based on a 6-hour evacuation period from the notice of first evacuation.
- Evacuation Scenarios depend on the availability and reliability of evacuation routes. Often evacuation routes become clogged or conflict with emergency vehicles trying to support the fire fighting and

emergency effort. This was exactly the case for the 2015 Sleepy Hollow Fire in which North Wenatchee Avenue became gridlocked.

- Embers cast from burning structures travel from 1 to 2 miles with prevailing 25-35 mph winds.

Wenatchee's wildfire risk is high. Recently, a research paper was developed quantifying risk of exposure to wildfires in the Pacific Northwest entitled "[Exposure of Human Communities to Wildfire in the Pacific Northwest](#)" in which Wenatchee ranked 5th from the top of greatest exposure based on population and the return frequency of wildfire. In addition, the Chelan County Community Wildfire Protection Plan includes Zone E for Wenatchee and identifies the surrounding wildlands as a high risk for wildfire. As shown in the maps below.

Exhibit IV-12: Pacific Northwest Exposure

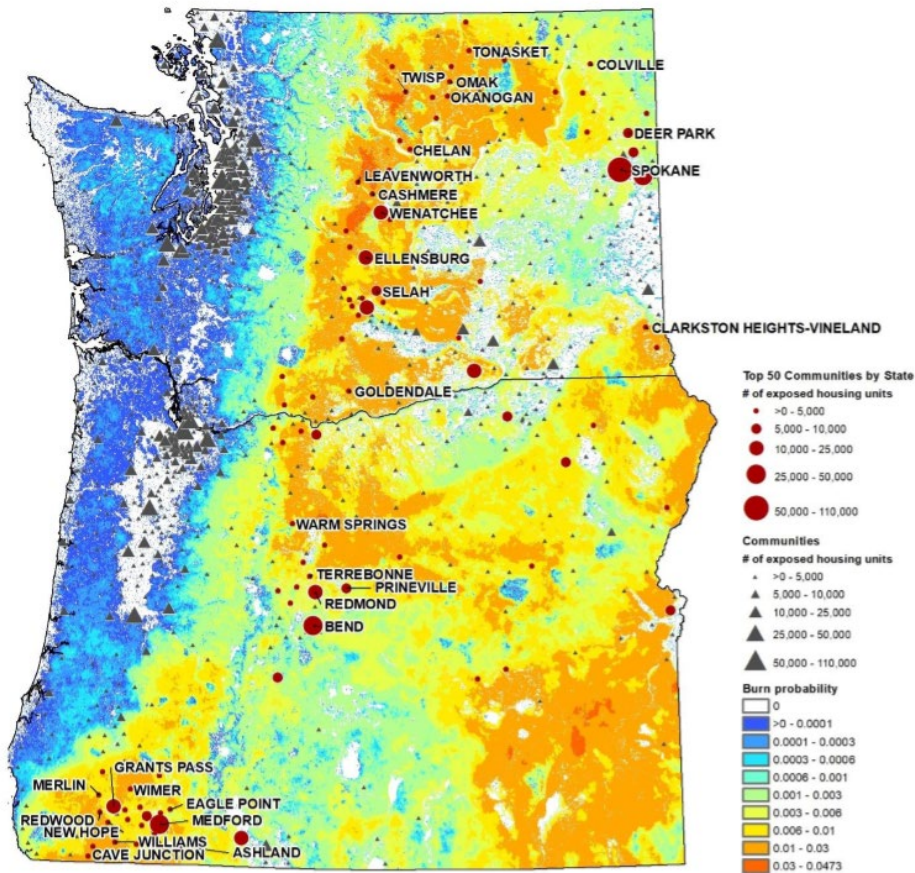
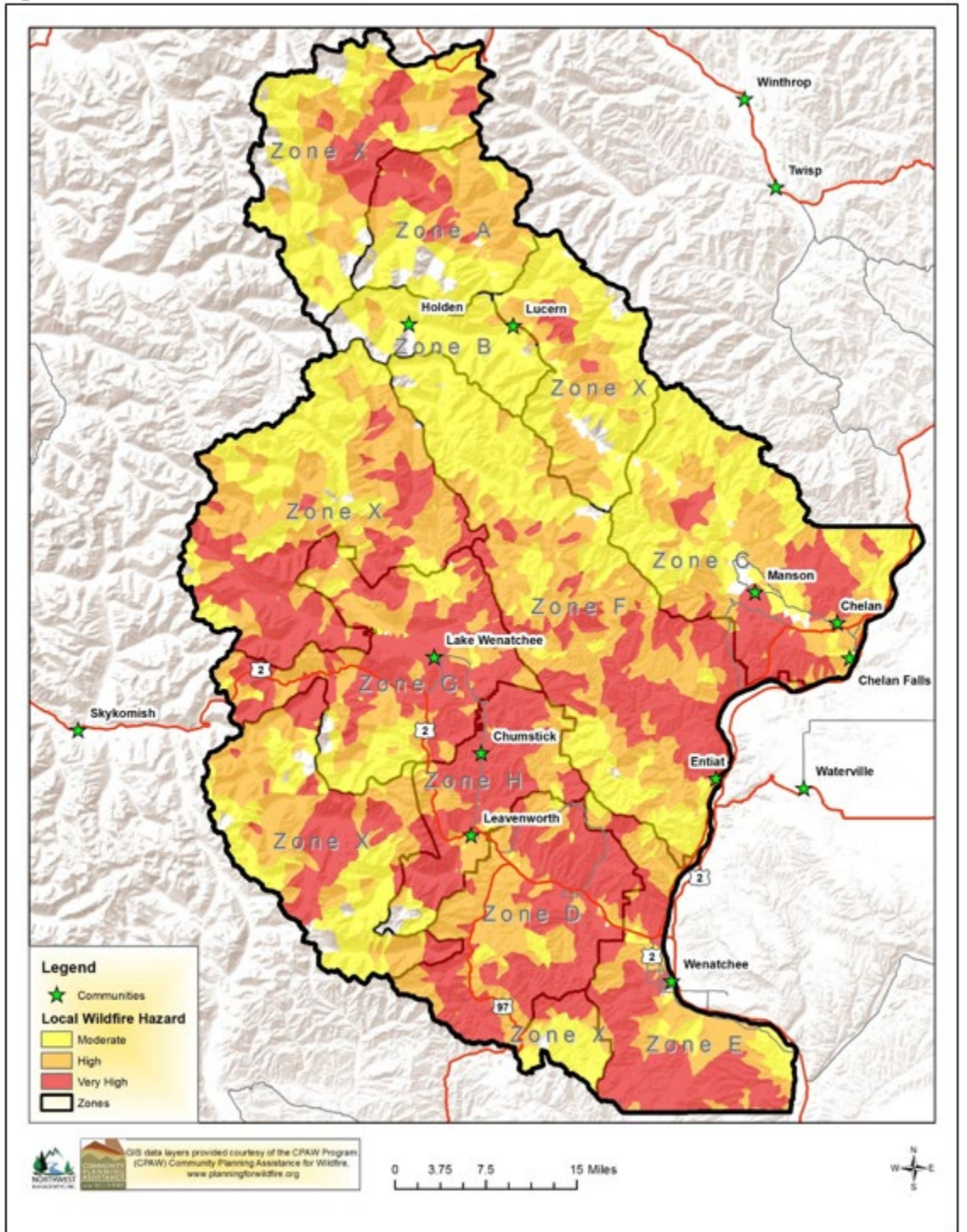


Figure 1. Annual burn probability across the states of Washington and Oregon and exposed human communities in each state. The 50 most-exposed communities in each state are mapped in dark red. The most-exposed communities tend to be in areas with the highest annual burn probabilities based on the FSim modeling results.

Source: "[Exposure of Human Communities to Wildfire in the Pacific Northwest](#)"

Figure 4.8. Local Level Wildfire Risk



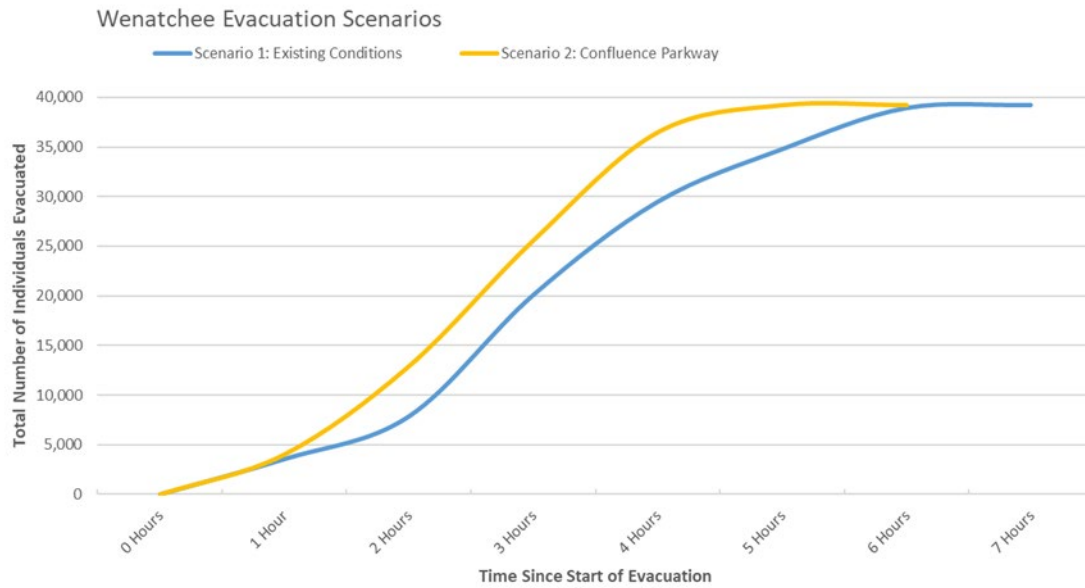
Source: Chelan County Community Wildfire Protection Plan

Specific Model Assumptions and Input Data:

- Evacuation Period: 6 hours. This is based on the Sleepy Hollow Fires in Wenatchee and the recent Paradise fires.
- Disaster Causing Wildfire Event Return Interval: 20 years or an annual probability of 0.05.
- Evacuation Population: 39,236. This estimate is based on the census tract population directly in the line of prevailing winds associated with a wildfire event. Both the 1992 and 2015 Wildfire events in Wenatchee provide historical context for impacts to this population base.
- Fatality Rate: 0.158 fatalities per hour per 1,000 people called to evacuate. This rate was determined based on an average of the Paradise, CA fire loss of life in which 57 people died within 6 hours with a total evacuation population of 52,000 people and the North Costa, CA fire in which an estimated 40 fatalities occurred within 6 hours with approximately 50,000 people evacuated. Note this data required some interpretation.
- Analysis 1: Assumed that Confluence Parkway operates as two lanes out of town. This analysis also assumed that the North Wenatchee River Bridge and the George Sellar Bridges were operating unrestricted. The results of this analysis are included in the BCA as the least severe scenario.
- Analysis 2: Assumed that Confluence Parkway operates as a two lanes out of town. This analysis assumed that the North Wenatchee River Bridge was blocked as was the case for approximately 3 hours during the 2015 Sleepy Hollow Fire.

The less severe scenario (Analysis 1) estimates that the use of Confluence Parkway as a two-lane evacuation route in addition to North Wenatchee Avenue would decrease lives from 15.9 to 12.3 or 3.6 lives saved per wildfire event compared to the no build option. Exhibit III-19 shows the improved results per hour of evacuation when Confluence Parkway is available.

Exhibit IV-14: Results of RTEPM Evacuation Mode Analysis 1



	Without CFP (6.5 Hours)					Scenario 2: CFP One-Way (5.2 Hours)				
	Vehicles	People	People Remaining	Fatalies/hr	Cum. Fatalities	Vehicles	People	People Remaining	Fatalies/hr	Cum. Fatalities
0 Hours	0	0				0	0			
1 Hour	1,427	3,567	35,669	5.64	5.64	1,613	4,032	35,204	5.56	5.56
2 Hours	3,144	7,859	31,377	4.96	10.59	5,170	12,924	26,312	4.16	9.72
3 Hours	8,039	20,096	19,140	3.02	13.62	10,239	25,596	13,640	2.16	11.88
4 Hours	11,793	29,481	9,755	1.54	15.16	14,600	36,498	2,738	0.43	12.31
5 Hours	13,913	34,781	4,455	0.70	15.86	15,691	39,226	10	0.00	12.31
6 Hours	15,573	38,931	305	0.05	15.91	15,695	39,236	0	0.00	12.31
7 Hours	15,695	39,236	0	0.00	15.91					12.31

Exhibit IV-15: Assumptions for Reduced Risk of Fatalities during a Wildfire

Assumptions	Assumption Value	Unit	Source
Estimated Fatalities without Confluence Parkways as an evacuation route	15.9	Fatalities	Calculations based upon California fire history See Detailed Analysis Worksheet
Estimated Fatalities with Confluence Parkways as an evacuation route-(both lanes outbound)	12.3	Fatalities	
Net lives Saved	3.6		
Annual Risk rate	5%	Risk per year of Wildfire that needs full evacuation	Wenatchee Wildfire Historical data
Value of Fatality Saved	\$10,900,000	Each life saved	USDOT BCA Guidance Feb 2021 Table A-1

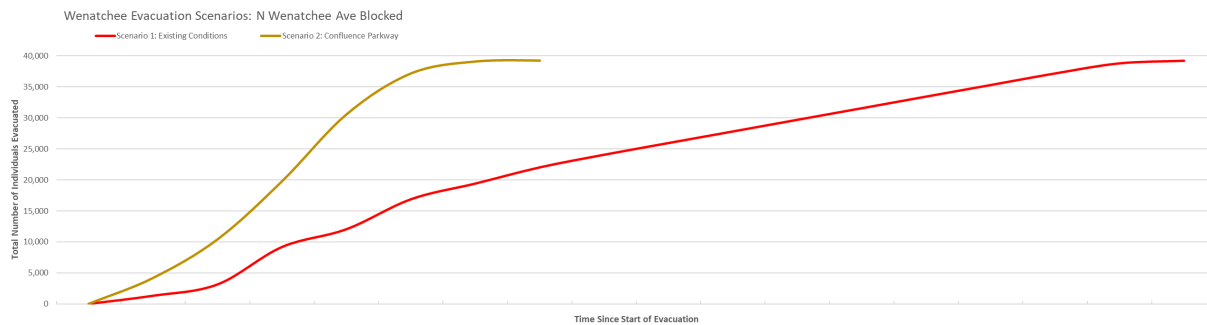
Exhibit IV-16: Wildfire Evacuation Fatalities Savings- Analysis 1

Wildfire Evacuation Fatalities Savings					
Calendar Year	Project Year	No-Build Condition Projected Fatalities	Build Condition Projected Fatalities	Reduced Fatalities with Project	Annual Savings
		Without Confluence Pkwy	With Confluence Pkwy		
2018					
2019					
2020					
2021					
2022					
2023					
2024					
2025					
2026					
2027					
2028	8	0.80	0.62	0.18	\$1,962,000
2029	9	0.80	0.62	0.18	\$1,962,000
2030	10	0.80	0.62	0.18	\$1,962,000
2031	11	0.80	0.62	0.18	\$1,962,000
2032	12	0.80	0.62	0.18	\$1,962,000
2033	13	0.80	0.62	0.18	\$1,962,000
2034	14	0.80	0.62	0.18	\$1,962,000
2035	15	0.80	0.62	0.18	\$1,962,000
2036	16	0.80	0.62	0.18	\$1,962,000
2037	17	0.80	0.62	0.18	\$1,962,000
2038	18	0.80	0.62	0.18	\$1,962,000
2039	19	0.80	0.62	0.18	\$1,962,000
2040	20	0.80	0.62	0.18	\$1,962,000
2041	21	0.80	0.62	0.18	\$1,962,000
2042	22	0.80	0.62	0.18	\$1,962,000
2043	23	0.80	0.62	0.18	\$1,962,000
2044	24	0.80	0.62	0.18	\$1,962,000
2045	25	0.80	0.62	0.18	\$1,962,000
2046	26	0.80	0.62	0.18	\$1,962,000
2047	27	0.80	0.62	0.18	\$1,962,000
		15.90	12.30	3.6	\$39,240,000

Based upon the modeling for evacuation it was determined that the completion of the Apple Capital Loop is projected to save approximately 4 lives during the analysis period for a total savings of \$39 million.

Analysis 2 was run to represent a more severe scenario. Under this scenario, North Wenatchee Avenue is blocked, and evacuation occurs via the SR 285 George Sellar Bridge plus the new Confluence Parkway as a two lane out evacuation route. Under this analysis an estimated 30.1 lives are lost during the evacuation period under the no-build scenario. This is compared to a loss of 14.9 lives lost under with Confluence Parkway, a savings of 15.2 lives. The following tables illustrate the difference.

Exhibit IV-17: Results of RTEPM Evacuation Mode Analysis 2



	Scenario 1: Without CFP (6.5 Hours)					Scenario 2: CFP One-Way (5.2 Hours)				
	Vehicles	People	People Remaining	Fatalies/hr	Cum. Fatalities	Vehicles	People	People Remaining	Fatalies/hr	Cum. Fatalities
0 Hours	0	0				0	0			
1 Hour	525	1,312	37,924	5.99	5.99	1,675	4,187	35,049	5.54	5.54
2 Hours	1,256	3,139	36,097	5.70	11.70	4,165	10,412	28,824	4.55	10.09
3 Hours	3,673	9,182	30,054	4.75	16.45	7,908	19,769	19,467	3.08	13.17
4 Hours	4,817	12,042	27,194	4.30	20.74	12,221	30,551	8,685	1.37	14.54
5 Hours	6,753	16,881	22,355	3.53	24.27	14,862	37,153	2,083	0.33	14.87
6 Hours	7,766	19,414	19,822	3.13	27.41	15,633	39,081	155	0.02	14.89
7 Hours	8,812	22,029	17,207	2.72	30.13	15,695	39,236			14.89

IV.A.6. Conclusion:

Utilizing Analysis 1 as a less aggressive estimate of life savings, the benefit is based on 3.6 lives saved per event or 0.18 lives saved per year rather than Analysis 2 in which 15.3 lives are saved per event or 0.76 lives per year. The calculated benefit under Analysis 1 is a societal benefit of 3.6 lives equaling \$39 million saved over the benefit analysis period when Confluence Parkway is opened in 2025 and both lanes can be use in the outbound direction to evacuate people out of harm's way.

IV.A.7. Emission Reductions from Delayed Passenger Vehicles and Trucks

With a significant reduction in travel times, the pollutants being emitted from idling vehicles will be measurably reduced as well.

To determine the extent of this benefit, the BCA utilizes assumptions published by the Environmental Protection Agency (EPA) entitled “Idling Vehicle Emissions for Passenger Cars, Light-Duty Trucks, and Heavy -Duty Trucks” (cited in Bibliography) which details grams of select pollutants emitted on a per-hour basis for cars and trucks. In order to ensure a conservative estimate, the BCA used figures for smaller vehicles (Light-Duty Gasoline Fueled Vehicles (up to 6,000 GVW) for cars and Light-Duty Diesel Trucks (up to 8,500 GVW) for trucks). Multiplying these rates by travel time savings figures generated in the Reduced Passenger Vehicle and Truck Delay section, the BCA quantifies reductions in emissions. The reduction figure was divided by 907,185 to convert grams to short tons and multiplied by the recommended monetized values of emissions provided by USDOT to determine the value of the reductions in emissions. To model this benefit, the value of reduced emissions was calculated for each year of forecasted travel.

Exhibit IV-18: Assumptions used in Emission Calculations

Monetized Values for Select Emissions					
Pollutant	Damage Costs (\$2017/ Short Ton)	Inflation to (\$2017)	Cost per Short Ton	Cost per Gram	Source
VOC	\$2,000	1	\$2,000	0.0021000	USDOT 2018 BCA Guidance Table A-6
THC	N/A	1	N/A		
CO ₂	*	1	\$0		
NO _x	\$8,300	1	\$8,300	0.0086000	
SO ₂	\$48,900	1	\$48,900	0.0501000	
Particulate Matter	\$377,800	1	\$377,800	0.3873000	

Conversion Factor	
Grams to Short Tons	907,185
Short Tons per Metric Ton	1.1015

Monetized Values for Social Cost of Carbon (SCC)				
Year	(\$2017/ MT)		Cost per Short Ton	Source
2017	\$1.00		\$0.00	USDOT 2021 BCA Guidance Table A-7
2018	\$1.00		\$0.00	
2019	\$1.00		\$0.00	
2020	\$1.00		\$40,400.00	
2021	\$1.00		\$41,300.00	
2022	\$1.00		\$42,100.00	
2023	\$1.00		\$43,000.00	
2024	\$1.00		\$43,900.00	
2025	\$1.00		\$44,900.00	
2026	\$1.00		\$45,500.00	
2027	\$1.00		\$46,200.00	
2028	\$1.00		\$46,900.00	
2029	\$1.00		\$47,600.00	
2030	\$1.00		\$48,200.00	
2031	\$1.00		\$48,200.00	
2032	\$1.00		\$48,200.00	
2033	\$1.00		\$48,200.00	
2034	\$1.00		\$48,200.00	
2035	\$2.00		\$48,200.00	
2036	\$2.00		\$48,200.00	
2037	\$2.00		\$48,200.00	
2038	\$2.00		\$48,200.00	
2039	\$2.00		\$48,200.00	
2040	\$2.00		\$48,200.00	
2041	\$2.00		\$48,200.00	
2042	\$2.00		\$48,200.00	
2043	\$2.00		\$48,200.00	
2044	\$2.00		\$48,200.00	
2045	\$2.00		\$48,200.00	
2046	\$2.00		\$48,200.00	
2047	\$2.00		\$48,200.00	
2048	\$2.00		\$48,200.00	
2049	\$2.00		\$48,200.00	
2050	\$2.00		\$48,200.00	

Exhibit IV-19: Total Emissions Saved

Emissions Saved																
Year	Traffic Growth Rate	Hours of Delay Saved-Autos	Hours of Delay Saved Trucks	VOC grams Saved based upon grams per hour-Autos	VOC grams Saved based upon grams per hour-Trucks	Total Savings of VOC based upon grams	NOx Savings based upon grams per hour-Autos	NOx Savings based upon grams per hour-Trucks	Total Savings of NOx	PM _{2.5} grams Saved by Trucks	Total Savings of PM _{2.5}	Emissions Saved before SCC	Gallons of Fuel Saved	CO ₂ Saved (MT)	Social Cost of Carbon (SCC)	Total Emissions Saved
	1.0%			2,683	4,218		3,515	42,345		1.21				0.01018 MT/ Gal Diesel		
2028		1,007,705	62,657	2,703,673	264,288	\$ -	3,542,084	2,653,221	\$ 108,418	75,878	\$ 62,964	\$ 171,381	1,071,685	10,910	\$ 643,676	\$ 815,057
2029		1,049,537	65,258	2,815,908	275,259	\$ -	3,689,123	2,763,362	\$ 114,209	79,028	\$ 66,478	\$ 180,687	1,116,131	11,362	\$ 681,733	\$ 862,420
2030		1,093,105	67,967	2,932,802	286,686	\$ -	3,842,266	2,878,074	\$ 120,966	82,308	\$ 70,184	\$ 191,150	1,162,422	11,833	\$ 721,841	\$ 912,991
2031		1,138,482	70,789	3,054,549	298,587	\$ -	4,001,766	2,997,549	\$ 125,988	85,725	\$ 73,098	\$ 199,086	1,210,634	12,324	\$ 764,104	\$ 963,189
2032		1,185,743	73,727	3,181,349	310,982	\$ -	4,167,887	3,121,983	\$ 131,218	89,284	\$ 76,132	\$ 207,350	1,260,847	12,835	\$ 808,632	\$ 1,015,982
2033		1,234,966	76,788	3,313,413	323,891	\$ -	4,340,905	3,251,583	\$ 136,665	92,990	\$ 79,293	\$ 215,957	1,313,144	13,368	\$ 855,539	\$ 1,071,497
2034		1,286,232	79,976	3,450,960	337,337	\$ -	4,521,104	3,386,563	\$ 142,338	96,850	\$ 82,584	\$ 224,922	1,367,611	13,922	\$ 918,871	\$ 1,143,793
2035		1,339,626	83,295	3,594,216	351,340	\$ -	4,708,784	3,527,146	\$ 148,247	100,871	\$ 86,013	\$ 234,259	1,424,339	14,500	\$ 971,485	\$ 1,205,744
2036		1,395,236	86,753	3,743,419	365,925	\$ -	4,904,255	3,673,565	\$ 154,401	105,058	\$ 89,583	\$ 243,984	1,483,422	15,101	\$ 1,026,884	\$ 1,270,868
2037		1,453,155	90,355	3,898,816	381,115	\$ -	5,107,841	3,826,062	\$ 160,810	109,419	\$ 93,302	\$ 254,112	1,544,956	15,728	\$ 1,085,208	\$ 1,339,320
2038		1,513,479	94,105	4,060,663	396,936	\$ -	5,319,878	3,984,889	\$ 167,486	113,962	\$ 97,175	\$ 264,661	1,609,045	16,380	\$ 1,146,606	\$ 1,411,266
2039		1,576,306	98,012	4,229,230	413,414	\$ -	5,540,716	4,150,310	\$ 174,438	118,692	\$ 101,209	\$ 275,647	1,675,794	17,060	\$ 1,211,230	\$ 1,486,878
2040		1,641,742	102,080	4,404,793	430,575	\$ -	5,770,722	4,322,598	\$ 181,680	123,619	\$ 105,410	\$ 287,090	1,745,313	17,767	\$ 1,279,244	\$ 1,566,335
2041		1,709,894	106,318	4,587,645	448,449	\$ -	6,010,277	4,502,037	\$ 189,222	128,751	\$ 109,786	\$ 299,008	1,817,717	18,504	\$ 1,350,818	\$ 1,649,826
2042		1,780,875	110,732	4,778,087	467,066	\$ -	6,259,775	4,688,926	\$ 197,077	134,096	\$ 114,344	\$ 311,420	1,893,127	19,272	\$ 1,445,402	\$ 1,756,823
2043		1,854,803	115,328	4,976,435	486,454	\$ -	6,519,631	4,883,572	\$ 205,258	139,662	\$ 119,090	\$ 324,348	1,971,666	20,072	\$ 1,525,439	\$ 1,849,787
2044		1,931,799	120,116	5,183,017	506,648	\$ -	6,790,274	5,086,299	\$ 213,778	145,460	\$ 124,034	\$ 337,812	2,053,466	20,904	\$ 1,609,630	\$ 1,947,442
2045		2,011,992	125,102	5,398,175	527,680	\$ -	7,072,152	5,297,442	\$ 222,653	151,498	\$ 129,183	\$ 351,835	2,138,660	21,772	\$ 1,698,182	\$ 2,050,017
2046		2,095,514	130,295	5,622,264	549,585	\$ -	7,365,731	5,517,349	\$ 231,895	157,787	\$ 134,545	\$ 366,441	2,227,391	22,675	\$ 1,791,313	\$ 2,157,753
2047		2,182,503	135,704	5,855,655	572,399	\$ -	7,671,497	5,746,385	\$ 241,522	164,338	\$ 140,131	\$ 381,652	2,319,805	23,440	\$ 1,875,202	\$ 2,256,854
Total Saving		30,482,694	1,895,358	81,785,068	7,994,618	\$ -	107,146,669	80,258,915	\$ 3,368,267	2,295,278	\$ 1,954,537	\$ 5,322,804	32,407,177	329,729	23,411,038	\$ 28,733,842
Total MT saved				82	8		107	80		2.3						

It is estimated that Total Emissions will be reduced by 107 ST of NOx, 2.3 ST of Particulate Matter and 329,700 MT of CO₂ for a Total Emission savings of \$28 million over the analysis period.

IV.B. QUALITATIVE BENEFITS

Qualitative benefits include reduction of the likelihood of high consequence events associated with railroad vehicle conflict and wildfire disaster events, freight impacts specific to the fresh fruit industry, environmental benefits, economic development and vitality, expanded public transportation, emergency response in terms of ambulance transport to the region's hospital from outlying rural communities, and quality of life.

IV.B.1. Reduction of Likelihood of High Consequence

USDOT requests in the Notice of Funding Availability that factors that reduce the likelihood of high consequence events be brought forward. Since these types of events, often classified as disasters, are difficult to quantify, the following discussion provides three improvements in this project that lessen the likelihood of a high cost high consequence event.

The first is the provision for a third access in and out of the city of Wenatchee which also doubles as an efficient evacuation route as described above in the wildfire example (Section II.A.5.b). That section quantified the value of evacuation for a wildfire event in terms of lives saved. However, it does not capture the cost of insurance losses, business disruption, and loss of employment. For example, the Sleepy Hollow Fires in 2015 resulted in over \$300 Million in direct damages for insurance recovery. In addition, over 400 workers lost work for several weeks in the middle of cherry harvest. Furthermore, insurance payouts for disasters related to wildfire are on the rise with the Camp wildfire in California resulting in \$16.5 billion in losses. The social impacts to loss of homes during a natural disaster is hard to quantify. It is also noted that the BNSF mainline was out of service for over two weeks while repairs were made to the RR tracks following the Sleepy Hollow Fires. Finally, the Sleepy Hollow fires caused evacuations due to the burning of chemical warehouses in which Methyl Bromide tanks were compromised.

The second and third elements of this project that reduce the risk of events with high consequences is associated with replacing two at-grade rail crossings with two grade separated underpasses. The quantitative analysis above does not account for the potential for delays to the Seattle Chicago BNSF Mainline due to accidents or an accident caused derailment. Furthermore, this segment of the Seattle Chicago line is used to ship back empty oil tanker rail cars from the west coast ports. Maintaining operation of the BNSF mainline has a direct cost impact to BNSF and their freight shipments. In addition, rail safety is critical in an urban environment where hazardous substances could threaten urban populations.

IV.B.2. Fresh Fruit Freight Impacts

The Apple Capital Loop serves the Wenatchee Valley, known as the Apple Capital of the World. This title is earned through the innovation of the fresh fruit market, beginning with bringing irrigated agriculture to this arid climate perfect for growing of fruit at the turn of the century; the development of refrigerated rail shipping to all over the United States via the Great Northern Railroad; the development of controlled atmosphere storage in which fruit ripening is slowed to allow fresh apples to be consumed throughout the year; the invention of new varieties of apples enjoyed by consumers today; the perfection of a burgeoning organic market; and highly innovative fruit processing advancements. As a result, fresh fruit industry has expanded throughout central Washington. On an average year, now \$1 billion in value of fruit enters the

Exhibit IV-20: Automated Fruit Sorter



Wenatchee Valley to be stored and packed and the \$1 billion in value of fruit is shipped out to all corners of the United States and overseas.

In a recent interview with Stemilt Growers, one of the large fruit companies in Wenatchee, it was estimated that approximately 200,000 boxes of apples are shipped out daily. This represents 4,000 tons per day. Since trucks are rarely full of only one product, 200 to 400 refrigerated semi-trucks enter and leave this valley daily just to support the fresh fruit industry. Trucking around fruit is complicated during harvest when inbound trucks and outbound trucks occupy the same space. To improve freight efficiency, Stemilt has developed an automated truck distribution warehouse in which over 12,000 pallets of fruit are stacked and sorted by robots. This system delivers the correct pallet to the forklift driver according to the specific destination of the truck. This innovative system greatly improves efficiency and decreases truck standby time. Typically, a truck will be loaded inside of two hours. This new facility will also serve as a cross-dock facility to mix goods to reduce the number of partial loads.

Exhibit IV-21: Stemilt Fruit Distribution Facility, Wenatchee, WA



The importance of the Apple Capital Loop to these industries is critical. Stemilt indicated that much of the fruit enters and exits the valley via SR 28. Many of the fruit warehouses are located along the Northerly edge of the Apple Capital Loop. A large percentage of the employees who work at these warehouses live in South Wenatchee at the southern edge of the Loop. Stemilt recognizes that congestion along Segment #1 (North Wenatchee / SR 285), will push traffic onto SR 28 and make it more challenging for employees to get to and from work. Stemilt has issued a letter of support as Confluence Parkway will maintain and improve capacity for employee and city traffic which will help keep SR 28 open and functioning well for freight. This recognition of the holistic picture of the Loop is important and is widely recognized by business, the public and transportation agencies.

A free-flowing freight network is critical to the fresh fruit industry, especially as it relates to highly perishable products such as cherries. During cherry season, fruit growers send fruit to the warehouses during 90+ degree weather. Congestion greatly impacts the farm to market element of this industry.

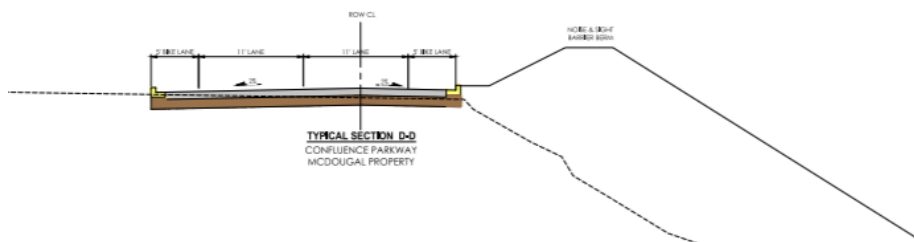
Finally, the cost of freight across the United States is skyrocketing. Stemilt cited that presently it costs approximately \$9,000 to ship refrigerated fruit across the United States to the East Coast. It is approximately half that cost to ship that same fruit via ship from South America. These costs impact the competitiveness within the United States associated with competition from the South American fruit market industry.

IV.B.3. Environmental Benefits (Noise, Wetland,

Environmental benefits are hard to quantify but will most certainly be noticed by the public. As part of the NEPA process, mitigation measures are expected to offset impacts and provide enhancements to the environment. A sampling of the environmental benefits includes the following:

- Noise mitigation will be required for the project to protect the park, wetlands, non-motorized trail, and natural area resources. These mitigation measures will also address existing noise levels cause by the BNSF mainline and the adjoining commercial and industrial areas. Berms and sound walls will reduce overall noise levels and provide a visual barrier. Notice the picture here shows the trail directly adjacent to the BNSF Mainline. Confluence Parkway (Segment 2) will relocate the trail away from the tracks and provide separation as shown in the cross section.

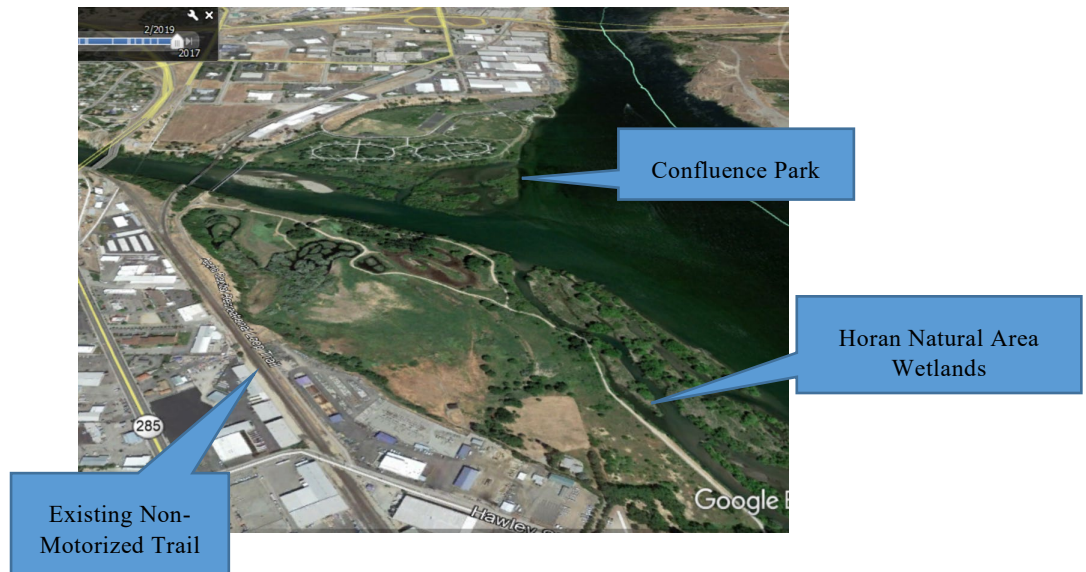
Exhibit IV-22: Pathway near BNSF Rail line



- Wetland mitigation is anticipated with the project and will be further defined as part of the NEPA process. Presently, a number of constructed wetlands in the Horan Natural Area near Confluence Parkway are drying up. As part of the mitigations, rewatering the wetlands is expected. There are opportunities to perform stormwater treatments to support enhanced biologic activity in this area. In general, wetland restoration can lead to carbon sequestration (burial) in the soil, but it takes a long time (>50 years) to recover to "natural" conditions, and most systems don't recover full soil carbon because soils take so long to develop. Nonetheless, most studies see an increase in carbon content with restoration, meaning that the wetland is moving in the right direction. Secondly, it is typically more successful to "rewet" or "restore" a wetland that used to exist as opposed to trying to create one where it did not exist. "A synthesis of soil carbon and nitrogen recovery after wetland restoration and creation in the United States", Lingfei Yu, Yao Huang, Feifei Sun & Wenjuan Sun, Scientific Reports August

2017; and “Fifty-five years of soil development in restored freshwater depressional wetlands”, Katherine Ballantine and Rebecca Schneider Department of Natural Resources, Cornell University, Ithaca, New York 14853 USA.

Exhibit IV-23: Overview of Confluence Park



- In addition to the carbon benefits of re-watering the wetlands, habitat will be restored for this recognized area of bird watching. Birding has become a source of tourism for local areas well as joy for people who enjoy spending time in the natural environment. The Horan area is in need of restoration to improve habitat for native birds and plants.
- The city would like to honor the history of this place by learning and understanding the cultural significance of the Wenatchi area. The Wenatchi/P'Squosa band is now part of the Colville Confederated Tribes and the Yakama Nations. This project offers the opportunity to provide cultural and historical interpretation of the area.
- This project will also replace an existing pedestrian bridge across the Wenatchee River that is substandard structurally and in terms of width. The new roadway bridge will include pedestrian facilities to replace the existing bridge. This will allow the removal of piers from the River.

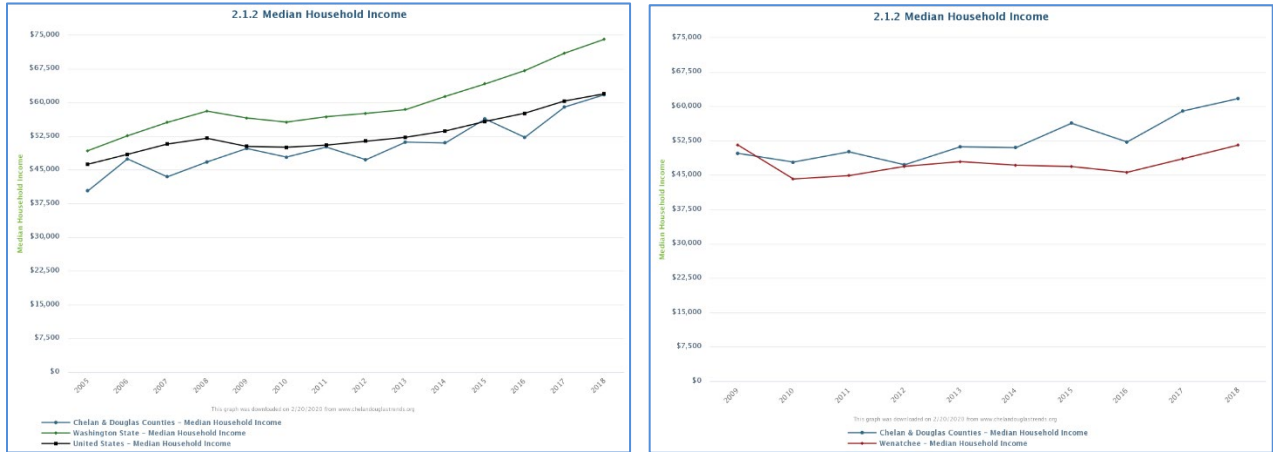
Other environmental benefits will result in terms of wildlife and the human experience in this natural area in the middle of the city. The natural area needs quite a bit of work and thus mitigation measures are abound. This is having the effect of bringing interested parties to the table during the NEPA process. The reader is referred to the Technical Feasibility Analysis for greater detail on the NEPA process. It is noted that the city is excited to go through the NEPA process to make sure that our community is enhanced from an environmental impacts' standpoint.

IV.B.4. Economic Development Benefits (Social Benefit)

This project enabled two economic development strategies which are not allowed in the quantitative BCA given they are transfer benefits. This is understandable from a quantitative analysis standpoint. However, economic development is critical to this rural community given the poverty levels and the ability to sustain vital infrastructure. Rural Eastern Washington falls far below the state average in terms of household income levels

as shown in the following figures with Wenatchee’s 2018 median income at \$51,561 compared median income level of \$74,073 and \$61,937 of the state and nation respectively. This is largely due to the dominant job sector being agriculture. This data and other economic data are available on the [Chelan Douglas Trends website](#).

Exhibit IV-24: Historical Economic Data



The region’s economic development focus is to incent diversity in the regional and local economy to facilitate and elevate a more stable economic basis. Given the region’s proximity to the Seattle Metropolitan area, there is opportunity to spread the tech economy eastward across the Cascade Mountains to the Wenatchee Valley. In addition, housing shortages are at a crisis level like many urban areas in the Nation. Two economic development efforts are underway to help improve economic prosperity for the region. These areas are included the North Wenatchee Master Plan which is made possible with the McKittrick railroad underpass (Segment 1B) and the Wenatchi Landing which is made possible with the Cascade – US2/97 Interchange (Segment 3A). Initial property value increases are considered “stock” increases are included above in section III.A.4.b and c. The following section provides a summary of the economic development impact.

The North Wenatchee Master Plan was developed in an economic recovery response to the Sleepy Hollow wildfires. The [master plan](#), the [North Wenatchee Site Development Analysis](#), and the [North Wenatchee Market Study](#) identify \$234 Million in private investment leveraged by \$37 Million in public infrastructure investment. These studies illustrate a higher and better use for the property which has outlived its industrial uses with antiquated fruit warehouses. These warehouses have been rebuilt in the Valley on industrial property.

Exhibit IV-25: Master Plan Development by Use

Pad	Year Constructed	SF/units	Extension (2016 real \$)
<i>Use</i>			
Hotel	2020	50,000	\$ 16,150,000
Retail/Commercial	2020	100,000	\$ 23,350,000
Light Industrial	2020	15,000	\$ 1,975,000
Retail/Commercial	2025	25,000	\$ 8,150,000
Flex Office	2025	120,000	\$ 15,750,000
Office	2025	50,000	\$ 12,500,000
Light Industrial	2030	125,000	\$ 8,500,000
Residential	2025	850	\$ 148,275,000
		Totals	\$ 234,650,000

Exhibit IV-26: North Wenatchee Master Plan – Redevelopment Plan



- The ratio of public to private investment is approximately 1:6 which yields a sustainable development pattern. The direct annual tax impact is calculated based on \$240 Million assessed value at \$12 per \$1,000 plus 8.4% sales tax on \$24 million in retail sales is estimated at \$4.8 Million per year at buildout. This tax revenue is critical sustaining infrastructure O&M as well as providing urban services.
- Wenatchi Landing is a largely vacant area located within the City of East Wenatchee Urban Growth Area. The area is one of the few areas where open “greenfield” development potential exists in the Wenatchee Valley given the topographical constraints. The Wenatchi Landing accesses the highway system via Cascade Avenue which is currently an at-grade intersection restricted to right in right out. The underpass to be funded will open up the property for development according to the [Northend](#)

[Study](#). The Northend Study anticipates \$44.7 Million in public investment to leverage direct private investment of \$374 Million.

Exhibit IV-27: View of Wenatchi Landing from the Columbia River



The return on public investment is substantial, especially when all of the direct and indirect benefits are calculated. A [financial model](#) was prepared for this development which details investment ratios of at least 1:9 in direct impact. The same financial model provides tax benefit estimates of \$8.5 Million annually.

Exhibit IV-28: Return on Public Investment in Wenatchi Landing

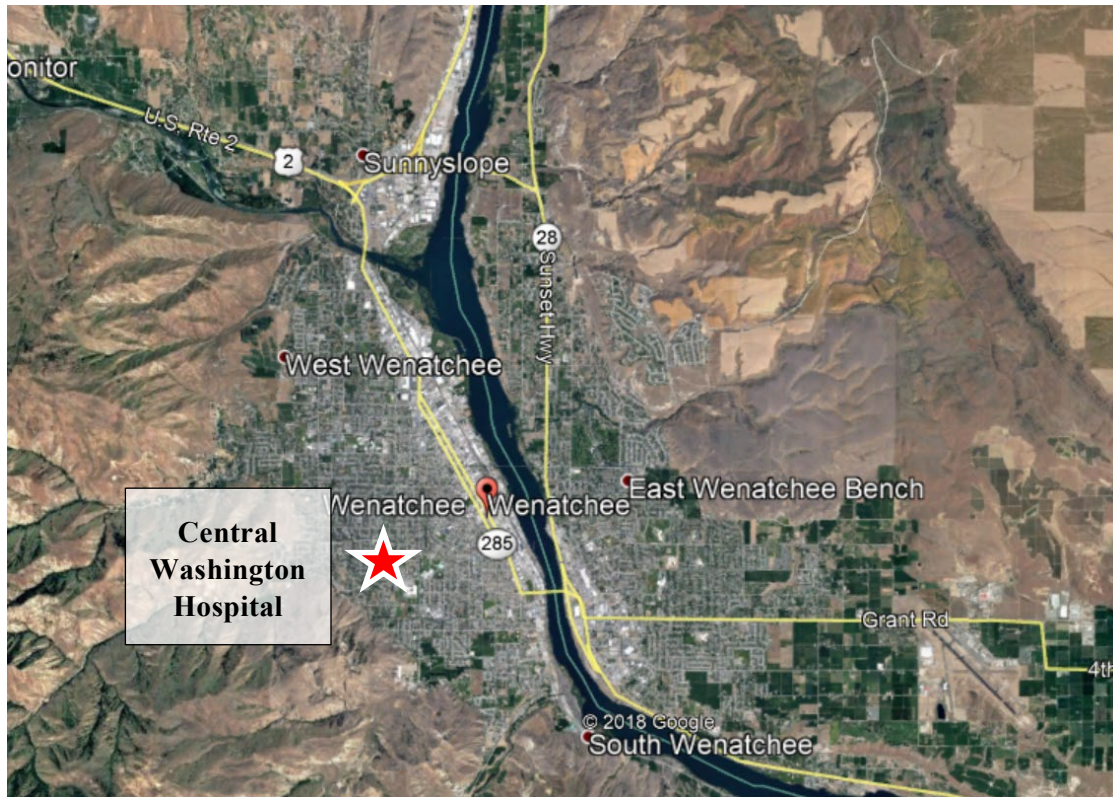
Return on Public Investment	50%	75%	100%
Economic and Fiscal Benefits			
Direct Benefits (Local)	\$215,391,407	\$313,554,678	\$412,512,484
Secondary Benefits (Regional)	\$84,727,913	\$121,852,526	\$159,389,909
Total Benefits	\$300,119,320	\$435,407,204	\$571,902,394
Net Public Facility Costs	(\$23,633,000)	(\$13,647,000)	(\$3,661,000)
Economic Return on Public Investment			
Direct Benefit Per \$1 of Public Investment	\$9.11	\$22.98	\$112.68
Direct and Secondary Benefit Per \$1 of Public Investment	\$12.70	\$31.90	\$156.21
<i>Note: analysis assumes North End remains in unincorporated Douglas County. * Development program includes stadium and soccer fields added in year 10. Dollars are shown in discounted 2017 amounts.</i>			
Source: analysis by FCS GROUP			

Both of these development areas represent proactive planning to accommodate the region's population growth populations as mandated by the State of Washington.

IV.B.5. Emergency Response (Ambulance vs. Life Flight)

Quantifying the difference in emergency response costs between the no-build and build scenarios is included in the travel time savings. However, there are other costs that emergency service providers experience given the hospital and emergency room for the region is located in the city of Wenatchee. Wenatchee's hospital serves as a regional trauma center for a 90-mile radius. This means that transport times are careful considerations for medical emergencies. The delay due to congestion may drive additional helicopter deliveries. Qualitatively speaking, the medical industry should expect increased operational costs and life lost risk increasing as congestion increases. The Apple Capital Loop project not only provides an additional access point to the City, but also provides unrestricted flow bypassing North Wenatchee Avenue (SR 285).

Exhibit IV-29: Location of Central Washington Hospital in Wenatchee, WA



IV.B.6. Quality of Life

The city and partners are taking a holistic view to this project as inspired by NEPA. This view is one of which not only will transportation improvements be made; the project will serve as a proxy to improve the quality of life in this valley holistically. The following quality of life improvements will occur with the Apple Capital Loop project.

- Improved Recreational Opportunities: Confluence Parkway (Segment 2) will relocate the loop non-motorized trail to a better alignment as described above. Currently the trail parallels the BNSF mainline. This portion of the trail is not a pleasant experience which is ironic given the Horan Natural area is adjacent to the trail as well. Relocation of the trail into the natural area will be a huge improvement over existing conditions in addition to shielding noise from the RR tracks.
- Improved Recreation Access: Numerous potential mitigation measures opportunities exist. Some of these are expected with the project whether it be trail extensions, new trailheads, interpretive landings and signing, and potentially new water access to the Wenatchee River. Other opportunities are likely to arise out of the NEPA process.
- New housing: Both the North Wenatchee Plan and Wenatchi Landing offer the opportunity to develop housing types that do not currently exist in the valley and are more widely desired based on demographics. Low maintenance housing with urban amenities provide more living choices.
- The North Wenatchee Avenue (Segment 1) improvements will provide aesthetic enhancements to the entrance to Wenatchee and the business district. This work will raise the standard for Wenatchee

thereby encouraging investment in business properties and improving the experience for residents and visitors alike.

- Improving the walkability of a community is essential for healthy communities and encourages non-motorized transportation alternatives. All of the projects in the Loop improve walkability and non-motorized transportation.
- South Wenatchee is our lowest income area of the region. The community has requested simple investments including lighting and sidewalks in the [South Wenatchee Action Plan](#). The pedestrian bridge (Segment 2) provides access to the loop trail which is currently cut off by the BNSF mainline. This project will improve the environment in South Wenatchee providing equal opportunity as the rest of the Loop. This investment is a focused effort to address environmental justice.

Major focus for the INFRA program is connecting residences with employment centers. Reduced commute times and ease of access have tremendous impacts on households and family activities. Poverty analyses are increasingly recognizing the impacts on families based on long commute times causing parents to be less present. In addition, the cost of transportation is increasingly recognized as a cost of living that disproportionately hurts low income households. This project ensures that the transportation network stays functional and viable to minimize these social impacts.

- USDOT rewards application of Innovation and yet the benefits the very nature that they have yet to be proven. In this small urban area situated in rural Washington, much innovation has occurred through our transit authority, Link Transit, in the testing and deployment of battery-operated electric buses. Link transit also now has one of the only inductive charging stations up and operational as well as a functioning electric fleet. This effort to test and prove buses through Federal Grants is a notable example of innovation providing benefit to the entire nation. This project has the opportunity to utilize this innovative technology with further deployment.
- Finally, the environmental section of this qualitative discussion provides for environmental enhancements. The impact of environmental enhancements has a positive impact on quality of life in terms of healthy living environments. As an example, the Wenatchee Valley suffers from air inversions in the winter months and thus pollution from vehicles sets in the atmosphere. Electrification of the bus fleet and push for electric vehicles is made possible by efficient transportation systems.

Exhibit IV-30: LINK Electric Bus



Out of all of these qualitative benefits, the most telling factor is the level of public support for this project. The city and project partners have received almost 100% positive feedback. It is this holistic approach that brings people together and strengthens a community. This social capital is often measured in terms of resilience. Social capital is what holds a community together in times of distress and helps a community move forward to deal with challenges whether it is wildfire, changing demographics, or changing growth patterns. Wenatchee and its partners have a responsibility to not only the citizens who live in the Valley, but to the entire North Central Washington region.

Section V. PROJECT COSTS

This Section identifies the basis of the capital cost estimates used in the BCA.

V.A. CONSTRUCTION COSTS

The capital costs associated with the completion of the Apple Capital projects are estimated to be \$286 million including previously incurred costs. All costs are in \$2019. These costs are based upon construction cost estimated prepared by each projects Engineering Staff.

Exhibit V-1: Project Cost Summary

Project Schedule- Capital Costs- Full Project		
Calendar Yr.	Project Yr.	Amount \$2019
2017 (prior)		\$ 9,301,570
2018	0	\$ 1,820,564
2019	1	\$ 2,599,662
2020	2	\$ 5,319,943
2021	3	\$ 10,848,493
2022	4	\$ 17,249,482
2023	5	\$ 39,813,330
2024	6	\$ 57,676,934
2025	7	\$ 86,027,321
2026	8	\$ 46,039,591
2027	9	\$ 9,945,674
2028	10	
2029	11	
2030	12	
2031	13	
2032	14	
2033	15	
2034	16	
2035	17	
2036	18	
2037	19	
2038	20	
2039	21	
2040	22	
2041	23	
2042	24	
2043	25	
2044	26	
2045	27	
2046	28	
2047	29	
Total		\$ 286,642,564

Exhibit V-2: Project Cost Matrix Summary by Segment

Projects Costs by Sub-Project														Added 2017 and 2018 escalation to	
Sub-Project	Prior Costs 2017-2021					Future Eligible Costs 2022-2027							Total		
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027				
#1 North Wenatchee															
1A - North Wenatchee Avenue	\$42,387	\$355,025	\$171,110	\$390,140	\$484,018	\$847,816	\$4,247,499	\$6,508,572	\$3,732,152	\$1,084,884	\$372,674	\$18,236,277	\$8,148	\$18,244,425	
1B - McKittrick RR Underpass	\$377,818	\$1,323,039	\$955,289	\$1,419,080	\$2,907,794	\$1,500,000	\$5,546,000	\$15,000,000	\$9,478,200			\$38,507,220	\$39,664	\$38,546,884	
1C - US-2 Roundabout			\$3,031	\$276,959	\$372,915	\$48,400	\$3,296,451	\$1,002,245				\$5,000,001	\$0	\$5,000,001	
Total	\$420,205	\$1,678,064	\$1,129,430	\$2,086,179	\$3,764,727	\$2,396,216	\$13,089,950	\$22,510,817	\$13,210,352	\$1,084,884	\$372,674	\$61,743,498	\$47,812	\$61,791,310	
#2 Confluence Parkway															
2A - Miller Underpass and CP Phase 1 (Hawley St - South)			\$50,000	\$200,000	\$500,000	\$2,250,000	\$6,000,000	\$6,388,428	\$31,000,000	\$15,449,328		\$61,837,756	\$0	\$61,837,756	
2B - Confluence Parkway Phase 2 (Hawley St - North)	\$570,000		\$638,071	\$700,000	\$500,000	\$1,727,901	\$9,189,400	\$9,165,628	\$25,400,000	\$16,805,675	\$4,573,000	\$69,269,675	\$24,111	\$69,293,786	
2C - South Wenatchee Ped Bridge	\$50,000				\$0	\$800,000	\$4,600,000	\$4,600,000				\$10,050,000	\$2,115	\$10,052,115	
Total	\$620,000	\$0	\$688,071	\$900,000	\$1,000,000	\$4,777,901	\$19,789,400	\$20,154,056	\$56,400,000	\$32,255,003	\$4,573,000	\$141,157,431	\$26,226	\$141,183,657	
#3 Cascade Interchange															
3A - Hwy Interchange	\$264,082	\$139,257	\$474,039	\$0	\$0	\$741,601	\$600,216	\$7,306,266	\$5,016,969	\$2,699,704		\$17,242,134	\$13,663	\$17,255,797	
3B - US2 /SR 28 Roundabouts (35th and 38th)	\$0	\$0	\$0	\$0	\$0	\$0						\$0	\$0	\$0	
Total	\$264,082	\$139,257	\$474,039	\$0	\$0	\$741,601	\$600,216	\$7,306,266	\$5,016,969	\$2,699,704	\$0	\$17,242,134	\$13,663	\$17,255,797	
#4 Sunset Highway															
	\$7,619,794	\$3,243	\$308,122	\$2,333,764	\$6,083,766	\$9,333,764	\$6,333,764	\$7,705,795	\$11,400,000	\$10,000,000	\$5,000,000	\$66,122,012	\$322,375	\$66,444,387	
	\$8,924,081	\$1,820,564	\$2,599,662	\$5,319,943	\$10,848,493	\$17,249,482	\$39,813,330	\$57,676,934	\$86,027,321	\$46,039,591	\$9,945,674	\$286,265,075	\$410,077	\$286,675,152	
Escalation rate to 2019	1.0423	1.0179													
	9,301,570	1,853,152										410,077			
Cost Grand Total	\$9,301,570	\$1,820,564	\$2,599,662	\$5,319,943	\$10,848,493	\$17,249,482	\$39,813,330	\$57,676,934	\$86,027,321	\$46,039,591	\$9,945,674	\$286,675,152			

Total prior incurred costs for Prior costs-2019 total \$11.1 million after escalation to \$2019. It is estimated that Project costs for 2019-2021 will be approximately \$19 million. Future eligible costs have been based upon preliminary designs for each section for each year for an estimated total of future eligible costs of \$262 million. Total costs are estimated to be \$286 million.

Exhibit V-3: Project Schedule

Sub-project	Planning Complete	Environmental Review	P.E. (% Complete)	ROW Complete	Const. Start	Const. End
1A – N. Wenatchee Ave	✓	CE – Jul '21	10% Design	Dec '22	Q2 '23	Q4 '27
1B – McKittrick Underpass	✓	CE – Jul '21	20% Design	Complete	Q1 '24	Q4 '26
1C – US2 Roundabout	✓	CE – Jul '21	30% Design	Dec '21	Q4 '21	Q4 '23
2A – Confluence Pkwy - S	✓	EA – Mar '22	20% Design	Jan '23	Q3 '23	Q4 '25
2B – Confluence Pkwy – N	✓	EA – Mar '22	20% Design	Jan '23	Q3 '24	Q4 '26
2C – South End Bike/ Ped Access	✓	CE – Jun '22	10% Design	Jan '24	Q1 '24	Q1 '25
3 – Cascade Interchange	✓	EIS Complete	10% Design	Complete	Q2 '24	Q4 '26
4 – SR 28 Widening	✓	EIS Complete	10% Design	Dec '25	Q1 '24	Q4 '27

This project schedule illustrates the expenditure of funds over time.

V.B. LIFE CYCLE COSTS

Life Cycle costs have been examined in detail. A schedule by project by asset type has been developed and can be found in Appendix H: Life-Cycle Costs.

Exhibit V-4: Life-Cycle Cost Summary

Project Schedule- Life Cycle Costs		
Calendar Yr.	Project Yr.	Amount \$2019
2017 (prior)	0	
2018	0	
2019	1	
2020	2	\$ -
2021	3	\$ -
2022	4	\$ -
2023	5	\$ -
2024	6	\$ -
2025	7	\$ (248,100)
2026	8	\$ 10,380
2027	9	\$ (411,735)
2028	10	\$ 93,018
2029	11	\$ 93,018
2030	12	\$ 93,018
2031	13	\$ 127,338
2032	14	\$ 93,018
2033	15	\$ 93,018
2034	16	\$ 197,785
2035	17	\$ 93,018
2036	18	\$ 1,326,437
2037	19	\$ 1,043,178
2038	20	\$ 93,018
2039	21	\$ 116,418
2040	22	\$ 252,858
2041	23	\$ 127,338
2042	24	\$ 93,018
2043	25	\$ 93,018
2044	26	\$ (156,983)
2045	27	\$ 93,018
2046	28	\$ 2,997,377
2047	29	\$ 1,143,178
Total		\$ 7,455,641

Total life cycle costs are anticipated to be \$7.4 million during the analysis period.

V.C. RESIDUAL VALUE OF RIGHT-OF-WAY AND CAPITAL INVESTMENT

In accordance with BCA Guidelines, the BCA quantifies the residual value of the capital expenses associated with this project. The residual value of the project accounts for the residual value of the right of way acquired for the project and the residual value of the capital cost investment separately. The value of the right of way (ROW) acquired will not decrease in value over time since it will not deteriorate, therefore, the cost of ROW in 2019 dollars is not depreciated in future years.

The residual value of the capital portion of the project was analyzed to determine the general category of the capital investment (culverts, signals, sidewalk etc.). These general categories and their associated costs are summarized and a percentage of the remaining budget (less right of way, design etc.) is identified for each. The capital portion of the project is discounted by 7% annual to determine its net present value.

Exhibit V-5: Assumptions for the Calculations of Residual Value

Residual Value Analysis				
Component	Value (2019)	Residual Value (End of Analysis)	Life of Asset	Remaining Life
ROW	\$40,536,866	\$40,536,866		
Remaining Construction Value	\$85,856,177	\$28,618,726	30	10
Bridges	\$160,282,109	\$128,225,687	100	80
Capitalize Maintenance		\$3,365,769		
Total	\$286,675,152	\$200,747,047		
Total Residual Value		\$200,747,047		

It is expected that right of way investments included in the Apple Capital Loop Project will have a permanent value that equated to the original purchase price. Capital investments in roadway improvements are anticipated to have an average 30-year life and bridges are anticipated to have a 100-year life. Hence at the remaining lives for the two asset classes are 30 and 100 years respectfully. For a total estimated Residual Value of \$200 million in Year 2047. This depreciate schedule for non-bridge assets has been decreased from an average of 50 year in the FY19 analysis to 30 years in this analysis to be conservative on the residual value.

Residual Capital Maint		
Seg 1		\$211,000
Seg 2		\$2,198,726
Seg 3		\$116,883
Seg 4		\$839,160
		\$3,365,769

Residual Capital Maintenance was also calculated on any capital maintenance project that extended the life of the asset.

Full Cost	Full Cost	Bridges	Remaining Costs	ROW	Remaining CN Cost
Segment 1	\$ 61,791,310	\$35,216,880	\$26,574,430	\$ 4,718,438	\$ 21,855,992
Segment 2	\$ 141,183,657	\$125,065,229	\$16,118,428	\$ 16,118,428	\$ -
Segment 3	\$ 17,255,797	0	\$17,255,797	\$ 700,000	\$ 16,555,797
Segment 4	\$ 66,444,387	0	\$66,444,387	\$ 19,000,000	\$ 47,444,387
	\$ 286,675,152	\$ 160,282,109	\$126,393,043	\$ 40,536,866	\$ 85,856,177

Section VI. BENEFIT COST SUMMARY

A favorable Benefit- Cost Ratio is one that exceeds 1.0, indicating that the 28-year analysis of the benefits, life-cycle costs and residual value of the asset exceed the capital costs expended during that same time period. As Exhibit V-1 shows, the Project when Non-CO₂ Benefits discounted at 7 percent and CO₂ benefits are discounted at 3 percent, generates \$362 million in public benefits before life-cycle costs of \$1.5 million and a residual value of \$30.2 million, for a total benefit of \$381 million. Project costs are \$205 million when discounted at 7 percent.

The Benefit Cost Ratio is estimated to be 1.85 with a Net Present Value of \$175 million. Freight Mobility and Congestion Relief accounts for 75 percent of the total societal benefit with \$276 million in travel time value savings. Economic Competitiveness is estimate at \$4 million (1 percent) based upon operating savings produced from the fuel saving generated from the reduction in idling. Safety Benefits is estimated at a combined \$57 million accounting for approximately 16 percent of the benefits, with Savings in Emission at \$14 million accounts for less than 4 percent of the total societal benefits.

Exhibit VI-1: Selection Criteria Summary

Benefit-Cost Analysis Summary- Full Project- All Segments				
Long-term Outcomes	Societal Benefits	Inputs	Impacts	Discounted Value (@7%/3%)
Freight Mobility/ Congestion Reduction	Reductions in travel times within the project area for auto, trucks and transit riders	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group.	32 million hours of travel time delay reductions	\$275,916,584
	Reduction in travel times due to closure of at-grade crossings	Daily vehicles crossing time minutes delayed time probability of being blocked by train	7,500 hours of travel time delay reductions at RR Crossings	\$73,200
Economic Competitiveness	Reduction in Vehicle Operating Costs within the project area for autos, trucks, and transit	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group.	32 million gallons of fuel saved from reduced idling	\$4,196,915
Economic Competitiveness	Enhanced access is expected to leverage new private investment in two specific development locations	Master planned development type (SF) less existing property values (County Assessor tax lot data) investments	No Property Value Increase has been included for increased development in 2 specific area includes: 14.5 acres at North Wenatchee subarea and land surrounding Cascade Interchange	\$0
Safety	Reduced fatalities and accidents from improvements to intersections which will result in reduced average crash rates	Crash data from Washington State Department of Transportation, crash reduction rates for various elements included in project (roundabouts, medians, etc.) provided by NHTSA	664 accidents prevented with improvements completed, saving an estimated 956 injuries	\$45,536,603
Safety-Emergency Response	Reduced fatalities from the ability to use Confluence Pkwy as evacuation route	Lives saved from Risk of Wildfire due to improved evacuation route	The full project includes the implementation of Confluence Pkwy as an evacuation route	\$12,097,325
Environmental Sustainability	Reductions of emissions associated with congestion (emissions from idling cars)	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group, idling vehicle emission rates provided by EPA	Significant reduction in VOC, THC, CO ₂ , NOx with 330,000 MT saved in CO ₂	\$14,507,802
Public Benefits				\$352,328,428
Less Life-Cycle Costs				(\$1,531,518)
Plus Residual				\$30,192,800
Total Benefits				\$380,989,710
Total Costs				(\$205,497,408)
NPV				\$175,492,302
Benefit-Cost Ratio				1.85

VI.A. SENSITIVITY OF THE MODEL

A sensitivity analysis was run on the annual growth rate, and the asset life of the bridges.

Exhibit VI-2: Sensitivity Results

Sensitivity Analysis	Annual Average Traffic Volume Growth Rate		NPV	BCR
Annual Traffic Growth Rate	1.00%		\$175,492,302	1.85
	3.00%		\$248,986,316	2.21
	2.00%		\$209,852,578	2.02
	1.70%		\$199,074,275	1.97
	0.5%		\$159,898,727	1.78

1.00% Change growth rate here to test sensitivity to growth rate
 Annual increase in corridor travel delay
 1.00% Full Loop Official Forecast Annual Growth Rate from Transpo
 3.12% Resulting Annual Increase in Travel Delay, Full Loop
 32.05% Constant relationship ratio of volume/delay for Sensitivity Testing

Annual Traffic Growth = 1.0%		Asset Life		NPV	BCR
Asset life- years - per policy					
Bridges		100			
Other Constructed Assets		30			
				\$175,492,302	1.85

Asset Life at 40 years for Bridges to test sensitivity		Asset Life		NPV	BCR
Bridges		40			
Other Constructed Assets		30			
				\$168,260,267	1.82

The model is set up to allow the reviewer to change the growth rate on the BCA Summary Tab using the green highlighted box to the right. A summary of the rates run are displayed above in Exhibit VI-2. As shown the model is not very sensitive to the change in annual growth rate. When tested, the model is very sensitive to change in delay time as would be expected. Given the regional traffic model tends to under predicts travel time savings at system failure, increasing the travel times would drive the BCA considerably higher making the results shown here extra conservative.

Exhibit VI-3: Full Build and Segment BCA Summaries

Category	Full Build 2028		Segment1		Segment 2		Segment 3		Segment 4	
	Zero Discount Rate*	Discount Rate @7%	Zero Discount Rate*	Discount Rate @7%	Zero Discount Rate*	Discount Rate @7%	Zero Discount Rate*	Discount Rate @7%	Zero Discount Rate*	Discount Rate @7%
Congestion Reduction and Freight Mobility										
Reduced Travel Time	\$ 872,832,932	\$ 246,052,653	\$ 154,434,737	\$ 43,546,812	\$ 685,640,607	\$ 193,284,547	\$ (49,897,273)	\$ (14,067,531)	\$ 251,070,300	\$ 70,762,568
Economic Competitiveness										
Vehicle Operating Savings	\$ 14,189,364	\$ 3,997,509	\$ 2,494,527	\$ 702,789	\$ 11,068,704	\$ 3,118,366	\$ (827,400)	\$ (233,108)	\$ 4,201,255	\$ 1,183,568
Property Value Increase (one time only)	\$ 13,001,128	\$ 10,299,360	\$ 5,869,246	\$ 4,477,619	\$ -	\$ -	\$ 7,131,883	\$ 5,821,741	\$ -	\$ -
Safety										
Reduced Accident Costs	\$ 132,791,450	\$ 42,041,442	\$ 99,267,710	\$ 30,509,706	\$ 12,635,760	\$ 4,808,056	\$ -	\$ -	\$ 14,564,471	\$ 4,473,451
Emergency Response Savings	\$ 39,744,000	\$ 13,887,787	\$ -	\$ 0	\$ 39,744,000	\$ 13,887,787	\$ -	\$ -	\$ -	\$ -
Environmental Sustainability										
Vehicle Delay-Related Emission Cost Reductions based upon Vehicle Delay Reduction	\$ 3,302,790	\$ 924,625	\$ 563,567	\$ 157,738	\$ 2,468,596	\$ 690,873	\$ (218,299)	\$ (61,166)	\$ 1,142,799	\$ 320,263
Project Benefit and Cost Analysis Summary (20-year analysis)										
Public Benefits	\$ 1,075,861,664	\$ 317,203,376	\$ 262,629,787	\$ 79,394,664	\$ 751,557,667	\$ 215,789,629	\$ (43,811,089)	\$ (8,540,064)	\$ 270,978,825	\$ 76,739,850
Life-Cycle Costs	\$ (7,810,345)	\$ (1,627,000)	\$ (396,847)	\$ (22,594)	\$ (3,994,085)	\$ (729,636)	\$ (1,026,673)	\$ (270,720)	\$ (2,392,740)	\$ (604,050)
Residual Value	\$ 190,354,347	\$ 28,629,715	\$ 40,375,750	\$ 6,072,602	\$ 108,037,050	\$ 16,249,011	\$ 6,333,076	\$ 952,509	\$ 35,608,472	\$ 5,355,593
Totals										
Total Benefits	\$ 1,258,405,666	\$ 344,206,091	\$ 302,608,690	\$ 85,444,672	\$ 855,600,632	\$ 231,309,004	\$ (38,504,686)	\$ (7,858,275)	\$ 304,194,557	\$ 81,491,393
Total Cost of Project	\$ (273,578,553)	\$ (203,839,151)	\$ (61,753,741)	\$ (46,432,959)	\$ (128,268,299)	\$ (94,223,682)	\$ (17,248,578)	\$ (12,891,443)	\$ (66,307,935)	\$ (50,291,066)
Net Present Value	\$ 984,827,113	\$ 140,366,940	\$ 240,854,949	\$ 39,011,713	\$ 727,332,333	\$ 137,085,322	\$ (55,753,264)	\$ (20,749,718)	\$ 237,886,622	\$ 31,200,327
Benefit-Cost Ratio	4.60	1.69	4.90	1.84	6.67	2.45	-2.23	-0.61	4.59	1.62

See Section II, for detailed descriptions of each Segment.

VI.B. BCA RESULTS FOR SEGMENT 1

Exhibit VI-4: Segment 1: Benefit Cost Analysis

Benefit Cost Analysis of Wenatchee Apple Loop Road INFRA FY21 Application- Segment 1 Only Project Benefit and Cost Analysis Summary (20-year analysis)

Category	Zero Discount Rate*	Combined Discount Rate @7%/3%
Congestion Reduction and Freight Mobility		
Reduced Travel Time	\$ 171,363,132	\$ 48,312,406
Economic Competitiveness		
Vehicle Operating Savings	\$ 2,591,995	\$ 730,241
Property Value Increase (one time only)	\$ -	\$ -
Safety		
Reduced Accident Costs	\$ 112,180,066	\$ 34,180,565
Emergency Response Savings	\$ -	\$ -
Environmental Sustainability		
Vehicle Delay-Related Emission Cost Reductions based upon Vehicle Delay Reduction	\$ 4,474,067	\$ 2,238,728
Project Benefit and Cost Analysis Summary (20-year analysis)		
Public Benefits	\$ 290,609,260	\$ 85,461,941
Life-Cycle Costs	\$ (383,867)	\$ (25,986)
Residual Value	\$ 40,388,273	\$ 6,074,486
Totals		
Total Benefits	\$ 330,613,665	\$ 91,510,441
Total Cost of Project	\$ (61,791,310)	\$ (46,171,274)
Net Present Value	\$ 268,822,355	\$ 45,339,167
Benefit-Cost Ratio	5.35	1.98
* These values are expressed in constant 2019 dollar amounts		

Segment 1 is the most congested travel corridor, but the improvements only incrementally change the operation of the corridor. Thus, when discounted, generates \$48 million in Travel Time Savings, \$0.7 million in operating cost savings from reduced idling. Accidents are reduced by \$34 million and \$2 million of emissions are saved with the completion of Segment 1. Total Benefits are estimated to be \$91 million including life cycle costs of \$0.02 million and a Residual Value of \$6.1 million. Total Segment costs are estimated to be \$46.2 million. Generating a Net Present Value of \$45.3 million and a BCR of 1.98.

Exhibit VI-5: Segment 1 Benefit Cost Analysis Summary

Benefit-Cost Analysis Summary- Segment 1 Only				
Long-term Outcomes	Societal Benefits	Inputs	Impacts	Discounted Value (@7%/3%)
Freight Mobility/ Congestion Reduction	Reductions in travel times within the project area for auto, trucks and transit riders	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group.	5.7 million hours of travel time delay reductions	\$48,275,807
	Reduction in travel times due to closure of at-grade crossings	Daily vehicles crossing time minutes delayed time probability of being blocked by train	3,736 hours of travel time delay reductions at RR Crossings	\$36,600
Economic Competitiveness	Reduction in Vehicle Operating Costs within the project area for autos, trucks, and transit	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group.	5.7 million gallons of fuel saved from reduced idling	\$730,241
Economic Competitiveness	Enhanced access is expected to leverage new private investment in two specific development locations	Master planned development type (SF) less existing property values (County Assessor tax lot data) investments	Increased development in 1 specific area includes: 14.5 acres at North Wenatchee subarea	\$0
Safety	Reduced fatalities and accidents from improvements to intersections which will result in reduced average crash rates	Crash data from Washington State Department of Transportation, crash reduction rates for various elements included in project (roundabouts, medians, etc.) provided by NHTSA	550 accidents prevented with improvements completed, saving an estimated 792 injuries	\$34,180,565
Safety-Emergency Response	Reduced fatalities from the ability to use Confluence Pkwy as evacuation route	Lives saved from Risk of Wildfire due to improved evacuation route	Seg 1 does not include the implementation of Confluence Pkwy as an evacuation route	\$0
Environmental Sustainability	Reductions of emissions associated with congestion (emissions from idling cars)	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group, idling vehicle emission rates provided by EPA	Significant reduction in VOC, THC, CO2, NOx with 57,600 MT saved in CO2	\$2,238,728
Public Benefits				\$85,461,941
Less Life-Cycle Costs				(\$25,986)
Plus Residual				\$6,074,486
Total Benefits				\$91,510,441
Total Costs				(\$46,171,274)
NPV				\$45,339,167
Benefit-Cost Ratio				1.98

VI.C. BCA RESULTS FOR SEGMENT 2

Exhibit VI-6: Segment 2 Benefit Cost Analysis

Benefit Cost Analysis of Wenatchee Apple Loop Road INFRA FY21 Application- Segment 2 Only Project Benefit and Cost Analysis Summary (20-year analysis)

Category	Zero Discount Rate*	Combined Discount Rate @7%/3%
Congestion Reduction and Freight Mobility		
Reduced Travel Time	\$ 761,024,506	\$ 214,530,994
Economic Competitiveness		
Vehicle Operating Savings	\$ 11,504,407	\$ 3,241,083
Property Value Increase (one time only)	\$ -	\$ -
Safety		
Reduced Accident Costs	\$ 13,037,457	\$ 4,189,259
Emergency Response Savings	\$ 39,240,000	\$ 12,097,325
Environmental Sustainability		
Vehicle Delay-Related Emission Cost Reductions based upon Vehicle Delay Reduction	\$ 19,823,422	\$ 9,935,250
Project Benefit and Cost Analysis Summary (20-year analysis)		
Public Benefits	\$ 844,629,792	\$ 243,993,911
Life-Cycle Costs	\$ (3,923,680)	\$ (686,946)
Residual Value	\$ 118,369,337	\$ 17,803,010
Totals		
Total Benefits	\$ 959,075,448	\$ 261,109,975
Total Cost of Project	\$ (141,183,657)	\$ (96,745,873)
Net Present Value	\$ 817,891,791	\$ 164,364,102
Benefit-Cost Ratio	6.79	2.70
* These values are expressed in constant 2019 dollar amounts		

When discounted, Segment 2 generates Congestion Reduction and Freight Mobility by reducing Travel Time by \$214 million. This new bypass to the Segment 1 corridor not only reduces travel time on Segment 1 but also adds significant unrestricted free flow capacity to the system in and out of the city. The addition of Segment 2 offers the greatest traffic benefit to the loop. Economic Competitiveness is supported by a reduction of operating costs of \$3.2 million due to reduced fuel usage. Safety is estimated to be improved by \$16.3 million due to reduced accident costs due to the removal of an at-grade rail crossing and the completion of this segment which provides the community with an addition evacuation route in case of emergency. Vehicle emissions are estimated to be decrease by \$9.9 million due to reduced fuel usage from reduced traffic congestion. Total Public Benefits are estimated to exceed \$244 million. Life cycle costs are estimated to be \$0.7 million with a Residual Value in year 2047 of \$17.8 million. Total Benefits are calculated to be \$261.1

million; Segment Project Costs are estimated to be \$96.7 million generating a Net Present Value of \$164.4million or a BCR of 2.70.

Exhibit VI-7: Segment 2 Benefit Cost Analysis Summary

Benefit-Cost Analysis Summary- Segment 2 Only					
Long-term Outcomes	Societal Benefits	Inputs	Impacts	Value (\$2019)	Discounted Value (@7%/3%)
Freight Mobility/ Congestion Reduction	Reductions in travel times within the project area for auto, trucks and transit riders	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group.	25 million hours of travel time delay reductions	\$760,790,737	\$214,457,794
	Reduction in travel times due to closure of at-grade crossings	Daily vehicles crossing time minutes delayed time probability of being blocked by train	7,500 hours of travel time delay reductions at a RR Crossing	\$233,769	\$73,200
Economic Competitiveness	Reduction in Vehicle Operating Costs within the project area for autos, trucks, and transit	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group.	25 million gallons of fuel saved from reduced idling	\$11,504,407	\$3,241,083
Economic Competitiveness	Enhanced access is expected to leverage new private investment in two specific development locations	Master planned development type (SF) less existing property values (County Assessor tax lot data) investments	No new specific Development Planned for this Segment	\$0	\$0
Safety	Reduced fatalities and accidents from improvements to intersections which will result in reduced average crash rates	Crash data from Washington State Department of Transportation, crash reduction rates for various elements included in project (roundabouts, medians, etc.) provided by NHTSA	1 accident prevented at 1 RR crossing with improvements completed	\$13,037,457	\$4,189,259
Safety-Emergency Response	Reduced fatalities from the ability to use Confluence Pkwy as evacuation route	Lives saved from Risk of Wildfire due to improved evacuation route	Seg 2 includes the implementation of Confluence Pkwy as an evacuation route	\$39,240,000	\$12,097,325
Environmental Sustainability	Reductions of emissions associated with congestion (emissions from idling cars)	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group, idling vehicle emission rates provided by EPA	Significant reduction in CO ₂ , NOx with 256,000 MT saved in CO ₂	\$19,823,422	\$9,935,250
Public Benefits				\$844,629,792	\$243,993,911
Less Life-Cycle Costs				(3,923,680)	(\$686,946)
Plus Residual				118,369,337	\$17,803,010
Total Benefits				959,075,448	\$261,109,975
Total Costs				(141,183,657)	(\$96,745,873)
NPV				\$817,891,791	\$164,364,102
Benefit-Cost Ratio				6.79	2.70

VI.D. BCA RESULTS FOR SEGMENT 3

Exhibit VI-8: Segment 3 Benefit Cost Analysis

Benefit Cost Analysis of Wenatchee Apple Loop Road INFRA FY21 Application- Segment 3 Only Project Benefit and Cost Analysis Summary (20-year analysis)

Category	Zero Discount Rate*	Combined Discount Rate @7%/3%
Congestion Reduction and Freight Mobility		
Reduced Travel Time	\$ (55,331,876)	\$ (15,599,673)
Economic Competitiveness		
Vehicle Operating Savings	\$ (856,779)	\$ (241,382)
Property Value Increase (one time only)	\$ -	\$ -
Safety		
Reduced Accident Costs	\$ -	\$ -
Emergency Response Savings	\$ -	\$ -
Environmental Sustainability		
Vehicle Delay-Related Emission Cost Reductions based upon Vehicle Delay Reduction	\$ (1,514,302)	\$ (742,170)
Project Benefit and Cost Analysis Summary (20-year analysis)		
Public Benefits	\$ (57,702,958)	\$ (16,583,225)
Life-Cycle Costs	\$ (789,374)	\$ (197,594)
Residual Value	\$ 6,429,599	\$ 967,026
Totals		
Total Benefits	\$ (52,062,732)	\$ (15,813,793)
Total Cost of Project	\$ (17,255,797)	\$ (12,185,343)
Net Present Value	\$ (69,318,530)	\$ (27,999,136)
Benefit-Cost Ratio	-3.02	-1.30
* These values are expressed in constant 2019 dollar amounts		

Segment 3 is a new Cascade Interchange that will provide access into the Wenatchi Landing which anticipates development of 171 acres as a mixed-use development on currently vacant land.

Since there is not an interchange nor development at this location, the Traffic model calculates that new activity that generates traffic will have a negative effect on the road network. This outcome is rooted in the assumption that no growth will occur without the addition of an interchange. If this assumption is wrong and growth does occur, the BCA would increase significantly due to congestion causes at the only access point to the loop at 35th Street. Thus, the BCA for this Segment is negative. If this Segment were being evaluated as a stand-alone project, the traffic counters would be placed at a different location and account for current volumes and projected land use changes in a very different way. That being said, the current traffic modeling indicates that this interchange will be a burden on the network. Thus, generating addition delay of \$15.6 million in Travel Time Delay, increased vehicle operating cost of \$0.2 million. Total Public Benefits are estimated at \$16.6

million with a life-cycle cost of \$0.2 million and a Residual Value of \$1 million. Generating Total Benefits of (\$15.8 million) and Project Costs of \$12.2 million. Net Present Value for this Segment as calculated using the Traffic Model is (\$28 million) or a -1.3 BCR

Exhibit VI-9: Segment 3 Benefit Cost Analysis Summary

Benefit-Cost Analysis Summary- Segment 3 Only					
Long-term Outcomes	Societal Benefits	Inputs	Impacts	Value (\$2019)	Discounted Value (@7%/3%)
Freight Mobility/ Congestion Reduction	Reductions in travel times within the project area for auto, trucks and transit riders	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group.	(1.8) million hours of travel time delay reductions	(55,331,876)	(15,599,673)
	Reduction in travel times due to closure of at-grade crossings	Daily vehicles crossing time minutes delayed time probability of being blocked by train	0 hours of travel time delay reductions at RR Crossings	0	0
Economic Competitiveness	Reduction in Vehicle Operating Costs within the project area for autos, trucks, and transit	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group.	(1.8) million gallons of fuel saved from reduced idling	(856,779)	(241,382)
Economic Competitiveness	Enhanced access is expected to leverage new private investment in two specific development locations	Master planned development type (SF) less existing property values (County Assessor tax lot data) investments	No Property Value has been included for Increased development	0	0
Safety	Reduced fatalities and accidents from improvements to intersections which will result in reduced average crash rates	Crash data from Washington State Department of Transportation, crash reduction rates for various elements included in project (roundabouts, medians, etc.) provided by NHTSA	0 accidents prevented with improvements completed, saving an estimated 0 injuries	0	0
Safety-Emergency Response	Reduced fatalities from the ability to use Confluence Pkwy as evacuation route	Lives saved from Risk of Wildfire due to improved evacuation route	Seg 3 does not include the implementation of Confluence Pkwy as an evacuation route	0	0
Environmental Sustainability	Reductions of emissions associated with congestion (emissions from idling cars)	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group, idling vehicle emission rates provided by EPA	No Significant reduction in CO ₂ , NOx saved	(1,514,302)	(742,170)
Public Benefits				(57,702,958)	(16,583,225)
Less Life-Cycle Costs				(789,374)	(\$197,594)
Plus Residual				6,429,599	\$967,026
Total Benefits				(52,062,732)	(\$15,813,793)
Total Costs				(17,255,797)	(\$12,185,343)
NPV				(\$69,318,530)	(\$27,999,136)
Benefit-Cost Ratio				-3.02	-1.30

VI.E. BCA RESULTS FOR SEGMENT 4

Exhibit VI-10: Segment 4 Benefit Cost Summary

Benefit Cost Analysis of Wenatchee Apple Loop Road INFRA FY21 Application- Segment 4 Only Project Benefit and Cost Analysis Summary (20-year analysis)

Category	Zero Discount Rate*	Combined Discount Rate @7%/3%
Congestion Reduction and Freight Mobility		
Reduced Travel Time	\$ 278,374,356	\$ 78,457,936
Economic Competitiveness		
Vehicle Operating Savings	\$ 4,347,552	\$ 1,224,774
Property Value Increase (one time only)	\$ -	\$ -
Safety		
Reduced Accident Costs	\$ 16,349,698	\$ 4,943,607
Emergency Response Savings	\$ -	\$ -
Environmental Sustainability		
Vehicle Delay-Related Emission Cost Reductions based upon Vehicle Delay Reduction	\$ 7,725,921	\$ 3,770,105
Project Benefit and Cost Analysis Summary (20-year analysis)		
Public Benefits	\$ 306,797,526	\$ 88,396,422
Life-Cycle Costs	\$ (2,358,720)	\$ (584,250)
Residual Value	\$ 35,653,956	\$ 5,362,434
Totals		
Total Benefits	\$ 340,092,762	\$ 93,174,606
Total Cost of Project	\$ (66,444,387)	\$ (50,427,461)
Net Present Value	\$ 273,648,375	\$ 42,747,146
Benefit-Cost Ratio	5.12	1.85
* These values are expressed in constant 2019 dollar amounts		

Segment 4 improves the east side to the Apple Capital Loop along US 28. Details of the improvement can be found in Section II above and in the Technical Reports. These improvements are anticipated to reduce Travel Time along that section of the Apple Capital Loop by \$78.5 million. Operating Cost are estimated to be decreased by over \$1.2 million due to reduced congestion and idling. Accidents will be reduced with the removal of the suicide lane allowing left turns into on-coming traffic. Estimate savings from reduction of accidents is \$4.9 million during the analysis period. Reduction of delays are estimated to reduce Emissions by \$3.8 million. Total Public Benefits are estimated to exceed \$88.4 million. Life-cycle Cost are estimated to be \$0.6 million and Residual Value in 2047 estimated to be \$5.4 million. Total Benefits should exceed \$93.2 million. Based upon Project Costs of \$50.4 million, this Section should generate a Net Present Value of \$42.7 million or a BCR of 1.85.

Exhibit VI-11: Benefit Cost Analysis Summary

Benefit-Cost Analysis Summary- Segment 4 Only					
Long-term Outcomes	Societal Benefits	Inputs	Impacts	Value (\$2019)	Discounted Value (@7%/3%)
Freight Mobility/ Congestion Reduction	Reductions in travel times within the project area for auto, trucks and transit riders	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group.	9.2 million hours of travel time delay reductions	\$278,374,356	\$78,457,936
	Reduction in travel times due to closure of at-grade crossings	Daily vehicles crossing time minutes delayed time probability of being blocked by train	0 hours of travel time delay reductions at RR Crossings - No RR Crossings on Seg 4	\$0	\$0
Economic Competitiveness	Reduction in Vehicle Operating Costs within the project area for autos, trucks, and transit	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group.	9.2 million gallons of fuel saved from reduced idling	\$4,347,552	\$1,224,774
Economic Competitiveness	Enhanced access is expected to leverage new private investment in two specific development locations	Master planned development type (SF) less existing property values (County Assessor tax lot data) investments	No new specific Development Planned for this Segment	\$0	\$0
Safety	Reduced fatalities and accidents from improvements to intersections which will result in reduced average crash rates	Crash data from Washington State Department of Transportation, crash reduction rates for various elements included in project (roundabouts, medians, etc.) provided by NHTSA	83 accidents prevented with improvements completed, saving an estimated 119 injuries	\$16,349,698	\$4,943,607
Safety-Emergency Response	Reduced fatalities from the ability to use Confluence Pkwy as evacuation route	Lives saved from Risk of Wildfire due to improved evacuation route	Only Seg 2 includes the implementation of Confluence Pkwy as an evacuation route	\$0	\$0
Environmental Sustainability	Reductions of emissions associated with congestion (emissions from idling cars)	Average Annual Daily Trip (AADT) and travel time figures provided by Transpo group, idling vehicle emission rates provided by EPA	Significant reduction in CO ₂ , NOx with 93,800 MT saved in CO ₂	\$7,725,921	\$3,770,105
Public Benefits				\$306,797,526	\$88,396,422
Less Life-Cycle Costs				(2,358,720)	(\$584,250)
Plus Residual				35,653,956	\$5,362,434
Total Benefits				340,092,762	\$93,174,606
Total Costs				(66,444,387)	(\$50,427,461)
NPV				\$273,648,375	\$42,747,146
Benefit-Cost Ratio				5.12	1.85

VI.F. BCA RESULTS FOR FUNDING OPTIONS

Combinations of Segments were also calculated for reference. All have a BCR exceed 1. These combinations are additive and thus are only an estimate of the BCA. The traffic model redistributes trips with various combinations of improvements. However, this table provides a good indication of the benefits realized when combinations of segments are constructed. This table is developed to aid USDOT in looking at partial funding options should limited funding be available. The reader is referred to Appendix D and F for more detail.

Exhibit VI-12: Combination of Segments

Summary of Project Phasing Funding Options (Partial Funding Options)

Funding Group	Component Description	Future Eligible	Total Project	INFRA Request	Secured Match	Requested Match	Non-Fed Match	BCA
Full Request	Apple Capital Loop Network of Project Components	\$ 179,609,738	\$ 199,753,264	\$ 140,414,116	\$ 90,497,782	\$31,924,200	46.5%	1.85
A:	#1: No. Wenatchee Ave, #2A: Confluence Parkway South, #2C: South End Bike/ Ped Access Connector and #4: Sunset Highway/ SR28 Widening	\$ 179,609,738	\$ 199,753,264	\$ 102,111,956	\$ 77,497,782	\$0	43.1%	2.51
B:	#1A: North Wenatchee Avenue #1C: US 2/Easy St Roundabout #2A: Confluence Parkway South, #2C: South End Bike/ Ped Access Connector and #4:Sunset Highway/ SR28 Widening	\$148,085,538	\$161,246,044	\$70,587,756	\$77,497,782	\$0	52.3%	3.09
C:	#1: No. Wenatchee Ave, #2C: South End Bike/ Ped Access Bridge and #4 Sunset Highway/ SR28 Widening	\$ 118,521,982	\$ 137,915,508	\$ 41,524,200	\$ 76,997,782	\$0	65.0%	2.55

MEMORANDUM

Date: February 24, 2020 **TG:** 1.17239.00

To: Jeff Wilkens, CDTC

From: Brent Turley, Transpo Group

Subject: CDTC Travel Demand Model: INFRA Grant Analysis Documentation

The purpose of this memorandum is to provide the documentation on how the Chelan-Douglas Transportation Council (CDTC) Travel Demand Model was used in the Benefit-Cost Analysis (BCA) for the 2020 INFRA Grant Application.

Background

The CDTC Model was developed to provide a solid technical basis for evaluating transportation system needs in coordination with long-term planning for Wenatchee, East Wenatchee, and nearby urban areas. The CDTC Model was built using Visum software (Version 18.02) and is consistent with local and regional growth plans within the region. The scope of the model is the Wenatchee Valley areas of Chelan and Douglas Counties, from Monitor to the west and Rock Island to the east (approximately 15 miles wide and 15 miles tall). The boundaries are based on U.S. Census geography in the area.

The CDTC Model has a base year of 2016 and a forecast horizon year of 2045. The 2016 year is based on the year of the latest available land use for the area at time of model development. The model trip assignment represents the PM peak hour period (one-hour volume) between 4 p.m. and 6 p.m. on a typical weekday. The model has a total of 237 Transportation Analysis Zones (TAZs). The 2016 CDTC Model has 521 lane miles coded that represent expressways, arterials, collectors, and local streets. Trip generation is based on population and employment inputs, which are converted to daily trips, then converted to peak hour trips by time-of-day factors. The model network includes both link capacities and intersection movement capacities to evaluate delays and congested travel times. Auto, truck, and transit modes are represented in the trip assignments.

For purposes of the INFRA grant application, it is worth noting that the rate of population growth built into the travel demand model of approximately 1 percent, while based on official city and county growth estimates established in 2016, are well below the actual current rate of annual population increase since that time. According to Washington State Office of Financial Management the actual rate of population growth from 2015-2019 has averaged 1.4 percent per year. As a result, it is likely that the travel demand model represents a conservative forecast of future traffic volumes and corridor travel times, potentially under-estimating the travel delay benefits of the project.

2016 Existing Model

The CDTC 2016 Existing Model represents the base year model that was used for calibration. This model represents one bookend of how the model changes over time, with the other bookend being the Baseline 2045 Model.

2045 Baseline Model

The CDTC 2045 Baseline Model includes added land use growth and external trip growth as compared to the 2016 Existing Model, consistent with *Transportation 2040*, the long-range transportation plan for the region. In addition, several funded and committed network improvements projects are assumed in the 2045 Baseline Model (compared to the 2016 Model), including:

- Add signal to McKittrick Street/ Wenatchee Avenue intersection
- Add roundabout to Springwater Avenue/ Western Avenue intersection
- Add roundabout to Red Apple Road/ Miller Street intersection
- Add signal to 9th Street NE/ Valley Mall Parkway intersection
- Add 35th Street NW Extension, between NW Cascade Avenue and NW Empire Avenue

In addition, the 2045 Baseline land use in the area was conservatively adjusted to reflect 50 percent of build out of the Wenatchi Landing Development Plan. This provides a common land use for comparison between all the 2045 scenarios.

2028 Baseline Model

To assist in the INFRA BCA analysis, a 2028 interim horizon year baseline model was created to represent year of opening of the planned projects. This 2028 Baseline Model is the same as the 2045 Baseline model except land use growth and external zone traffic volumes were adjusted to reflect 2028 conditions. The 2028 Baseline Model network structure is coded the same as the 2045 Baseline Model network.

INFRA Model Analysis Scenarios

The following five model scenarios were developed as part of the INFRA Grant BCA analysis. Each scenario, representing project segments of the Apple Capital Loop project, was evaluated for two horizon years, 2028 and 2045.

North Wenatchee Avenue Scenario

This scenario is the same as the Baseline Model scenario, but revised to include the North Wenatchee Avenue project. In the model, this includes increased roadway and intersection movement capacities to reflect better access management, signal improvements, and “Phase 1” frontage road at Maiden Lane and Horse Lake Road.

Confluence Parkway Scenario

This scenario is the same as the Baseline Model scenario, but revised to include the Confluence Parkway project. In the model this included network changes as documented in the *Confluence Parkway Transportation Discipline Report*, (October 2019).

Wenatchi Landing Interchange Scenario

This scenario is the same as the Baseline Model scenario, but revised to include the proposed network design for Wenatchi Landing Development Plan. The most prominent network elements of

this plan is a new half interchange at US 2, and removed direct intersection access at Cascade Avenue. A new roundabout at SR 28/35th Street NW is also included in this scenario.

Sunset Highway Scenario

This scenario is the same as the Baseline Model scenario, but revised to include the widening of Sunset Highway (SR 28) between 9th Street NE and 23rd Street NE to four lanes with median and left-turn pockets.

Full Build Scenario

This scenario is the same as the Baseline Model scenario, but revised to reflect all of the above scenarios combined.

Scenario Metrics

The following metrics were compiled for 2016 Existing, 2028 Baseline, 2045 Baseline, and all analysis scenarios as described above.

Travel Time Corridors and Delay

The following corridors were used to evaluate travel time benefits. Travel times were compiled for each direction of travel, for the PM peak hour time period. Maps of the segments are shown in Attachment 1.

1. **Between Wenatchee Avenue/Miller Street and US 2/Easy Street intersections.** This is meant to capture travel time changes relative to the North Wenatchee Avenue project.
2. **Shortest Route: Wenatchee Avenue/Miller Street to US 2 EB Ramp intersection at Euclid Ave.** This is meant to capture travel time changes relative to the Confluence Parkway project. The shortest route was used, meaning for some scenarios it may be using the North Wenatchee Avenue corridor and other scenarios it may be Confluence Parkway corridor.
3. **US 2/ Easy Street intersection to SR 28/ 19th Street NE intersection.** This is meant to capture travel time changes relative to the Wenatchi Landing project.
4. **SR28 Sunset Highway: US2 to Valley Mall Parkway.** This is meant to capture travel time changes relative to the Sunset Highway Widening project.

Traffic Volumes

Traffic volume forecasts were developed to understand the number of users that would benefit from the planned improvements. The forecasts were post-processed using the difference method, which is calculating the trip growth between existing and future year model outputs and adding that to existing counts. Post-processing volumes is an industry best practice.

The following locations were forecasted:

- North Wenatchee Avenue at the Wenatchee River Bridge
- Confluence Parkway at the Wenatchee River Bridge
- US 2, west of the future Wenatchi Landing Interchange
- US 2, east of the future Wenatchi Landing Interchange
- SR 28, south of 19th Street NE

Scenario Results

The summary of scenario results are shown in Tables 1 and 2, for 2028 and 2045 conditions, respectively.

Travel time corridor delay and volume metrics were derived from the CDTC Regional Model for all scenarios, including the 2028 horizon year (first full year of operation after project opening) and the 2045 horizon year (official forecast year for long-range CDTC planning). For each of the scenarios, the total corridor delay was compared to the Baseline (No Build) scenario to capture the benefit of the project in terms of reduced minutes of travel time delay. These figures were then translated into total hours of reduced delay over the full year.

The PM peak one-hour delay results (representing one day) were converted into annual delay impacts in two steps. First, the one-hour delay was multiplied by 365 to reflect annual delay based on one-hour congestion per day. While at first glance this may appear incorrect to include weekends in this calculation, this is actually a proxy for the many hours of congestion on weekends during peak summer recreational and fall fruit harvest periods. Second, the one-hour peak period was expanded to include an additional 5 hours where observed traffic volume currently operates at 80 percent of the peak hour or greater. To reflect the non-linear relationship between traffic volume and travel delay, a factor was applied to the non-peak hours that indexed 80 percent of peak traffic volume as equivalent to 50 percent of the amount of delay in the peak hour. With these factors applied, the 6 actual hours were factored down to an equivalent of 4.5 hours per day experiencing delay. Figure 1 represents average daily traffic on North Wenatchee Avenue where WSDOT has a permanent traffic recorder that provides an accurate daily distribution of volumes.

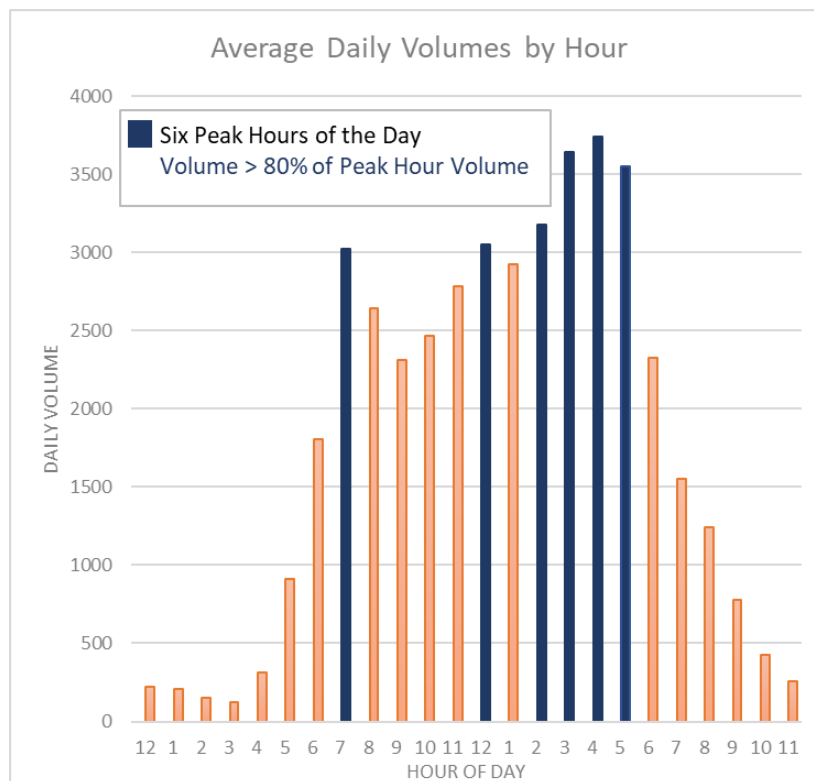


Figure 1 – Hourly Volumes at North Wenatchee Avenue

The results shown in Tables 1 and 2 were used in the calculating BCA metrics on a year-by-year basis. Using the total number for Hours of Reduced Delay produced by the travel demand model for year 2028 and year 2045, the resulting growth rate curve is 3.12 percent per year, which was used to interpolate the per-year Hours of Reduced Delay between 2028 and 2045, and then to extrapolate the model results out to year 2048 for a full 20 year total of Hours of Reduced Delay for the full project and each project segment.

Due to constrained corridors the year-by-year growth in traffic delays is higher than travel volume growth. The calibrated CDTC Model identifies a 1.0 percent annual traffic volume growth rate when measured from the 2016 Model Calibration year out to 2045. The relatively low growth rate in the model (lower than the rate of population growth) is due to reaching the capacity of the study corridors and no alternate or parallel corridors to accommodate additional trips. The model is forced to truncate trip lengths and therefore paints a picture of forecasted travel demand that is lower than what actually exists. Using the traffic model's low 1.0 percent rate of volume growth (1.7 percent volume growth used in previous INFRA applications), the resulting increase in travel delay on the highly capacity-constrained project corridors is higher at a straight-line 3.12 percent per year (the delay growth rate would probably be better represented as a curve instead of a straight line, lower in the early years and higher in the latter years, but without proper data the BCA calculation assumes a straight-line growth rate in order to keep the results directly tied to the travel demand model output).

Full BCA calculations are not included in this memorandum.

Table 1. Travel Time Metrics: 2028 Model Scenarios

Travel Time Corridor	2016 Existing	2028 Model Scenarios					
		Baseline	N Wen. Ave	Conf. Pkwy	Wenatchi Land. IC	Sunset Hwy	Full Build
<i>Wenatchee Ave, Miller Street to US 2/Easy St</i>							
SB Travel Time (minutes)	7.1	9.5	8.8	6.4	9.7	9.1	6
NB Travel Time (minutes)	7.0	8.6	7.8	6.1	8.6	8.3	5.7
Combined Travel Time (minutes)	14.1	18.1	16.6	12.5	18.3	17.4	11.7
Minutes Saved vs Baseline			1.5	5.6	-0.2	0.7	6.4
Volume @ Wenatchee River Bridge			4,305	3,165	4,255	4,160	3,295
Hours Reduced Congestion (1 day)			108	295	-14	49	351
Peak Hour			39,283	107,821	-5,177	17,715	128,285
Peak Hour + 80% Shoulder Hours ¹			176,774	485,195	-23,296	79,716	577,284
<i>Shortest Route, Wenatchee Ave/Miller St to Euclid Ave/US 2 EB Ramp</i>							
SB Travel Time (minutes)	8.4	10.8	10.0	6.2	11.0	10.3	6.0
NB Travel Time (minutes)	7.9	9.5	8.6	6.2	9.5	9.2	5.9
Combined Travel Time (minutes)	16.3	20.3	18.6	12.4	20.5	19.5	11.9
Minutes Saved vs Baseline			1.7	7.9	-0.2	0.8	8.4
Combined Volume @ Wenatchee River Bridges			4,305	4,720	4,255	4,160	4,770
Hours Reduced Congestion (1 day)			122	621	-14	55	207
Peak Hour			44,521	226,835	-5,177	20,245	75,373
Peak Hour + 80% Shoulder Hours ¹			200,344	1,020,759	-23,296	91,104	339,176
<i>US 2/Easy St to SR 28/19th St NE</i>							
SB Travel Time (minutes)	7.1	7.7	7.7	7.8	8.2	8.2	8.6
NB Travel Time (minutes)	7.3	8.3	8.3	8.5	8.1	8.5	8.3
Combined Travel Time (minutes)	14.4	16.0	16.0	16.3	16.3	16.7	16.9
Minutes Saved vs Baseline			0	-0.3	-0.3	-0.7	-0.9
Average Volume @ US 2 near Wenatchi IC			1,728	1,838	1,423	1,720	1,510
Hours Reduced Congestion (1 day)			0	-9	-7	-20	-23
Peak Hour			0	-3,353	-2,596	-7,324	-8,267
Peak Hour + 80% Shoulder Hours ¹			0	-15,090	-11,682	-32,960	-37,203
<i>Sunset Hwy, US 2 to Valley Mall Pkwy</i>							
SB Travel Time (minutes)	7.4	9.0	9.0	8.7	9.3	7.3	7.6
NB Travel Time (minutes)	7.1	8.5	8.3	8.3	8.7	7.1	7.3
Combined Travel Time (minutes)	14.5	17.5	17.3	17.0	18.0	14.4	14.9
Minutes Saved vs Baseline			0.2	0.5	-0.5	3.1	2.6
Volume @ SR 28 south of 19th Street			1,860	1,835	1,850	2,905	2,685
Hours Reduced Congestion (1 day)			6	15	-15	150	116
Peak Hour			2,263	5,581	-5,627	54,783	42,468
Peak Hour + 80% Shoulder Hours ¹			10,184	25,117	-25,322	246,526	191,105

1. Measured as the peak traffic hour plus additional hours that operate at 80% of peak hour volume or greater; delay at 80% is represented as 50% of peak hour delay.

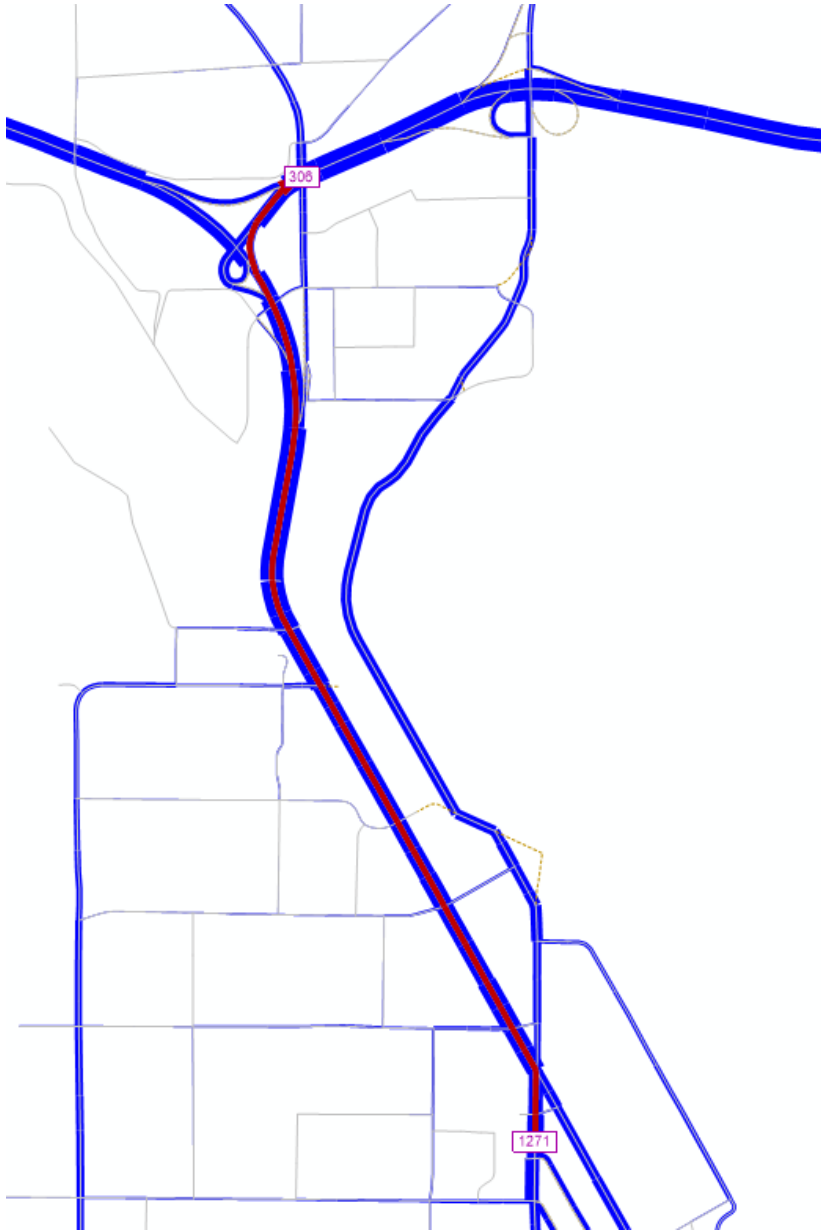
Table 2. Travel Time Metrics: 2045 Model Scenarios

Travel Time Corridor	2016 Existing	2045 Model Scenarios					
		Baseline	N Wen. Ave	Conf. Pkwy	Wenatchi Land. IC	Sunset Hwy	Full Build
<i>Wenatchee Ave, Miller Street to US 2/Easy St</i>							
SB Travel Time (minutes)	7.1	12.8	11.9	8.0	13.1	12.0	7.4
NB Travel Time (minutes)	7.0	11.0	9.9	7.4	11.1	10.6	6.7
Combined Travel Time (minutes)	14.1	23.8	21.8	15.4	24.2	22.6	14.1
Minutes Saved vs Baseline			2.0	8.4	-0.4	1.2	9.7
Volume @ Wenatchee River Bridge			4,895	3,730	4,845	4,725	3,865
Hours Reduced Congestion (1 day)			163	522	-32	94	625
Peak Hour			59,556	190,603	-11,790	34,493	228,067
Peak Hour + 80% Shoulder Hours ¹			268,001	857,714	-53,053	155,216	1,026,302
<i>Shortest Route, Wenatchee Ave/Miller St to Euclid Ave/US 2 EB Ramp</i>							
SB Travel Time (minutes)	8.4	14.0	13.2	7.8	14.3	13.3	7.4
NB Travel Time (minutes)	7.9	12.0	10.8	7.5	12.1	11.6	6.9
Combined Travel Time (minutes)	16.3	26.0	24.0	15.3	26.4	24.9	14.3
Minutes Saved vs Baseline			2.0	10.7	-0.4	1.1	11.7
Combined Volume @ Wenatchee River Bridges			4,895	5,530	4,845	4,725	5,605
Hours Reduced Congestion (1 day)			163	986	-32	87	1,093
Peak Hour			59,556	359,957	-11,790	31,618	398,936
Peak Hour + 80% Shoulder Hours ¹			268,001	1,619,806	-53,053	142,282	1,795,211
<i>US 2/Easy St to SR 28/19th St NE</i>							
SB Travel Time (minutes)	7.1	9.4	9.5	9.9	9.6	10.0	10.5
NB Travel Time (minutes)	7.3	9.8	9.8	10.3	9.1	10.1	9.6
Combined Travel Time (minutes)	14.4	19.2	19.3	20.2	18.7	20.1	20.1
Minutes Saved vs Baseline			-0.1	-1.0	0.5	-0.9	-0.9
Average Volume @ US 2 near Wenatchi IC			2,135	2,265	1,775	2,113	1,909
Hours Reduced Congestion (1 day)			-4	-38	15	-32	-29
Peak Hour			-1,299	-13,779	5,399	-11,566	-10,450
Peak Hour + 80% Shoulder Hours ¹			-5,845	-62,004	24,295	-52,047	-47,027
<i>Sunset Hwy, US 2 to Valley Mall Pkwy</i>							
SB Travel Time (minutes)	7.4	10.8	10.7	10.2	11.0	8.3	8.4
NB Travel Time (minutes)	7.1	10.3	10.1	10.1	10.3	8.4	8.4
Combined Travel Time (minutes)	14.5	21.1	20.8	20.3	21.3	16.7	16.8
Minutes Saved vs Baseline			0.3	0.8	-0.2	4.4	4.3
Volume @ SR 28 south of 19th Street			1,960	1,930	1,955	3,260	3,065
Hours Reduced Congestion (1 day)			10	26	-7	239	220
Peak Hour			3,577	9,393	-2,379	87,259	80,175
Peak Hour + 80% Shoulder Hours ¹			16,097	42,267	-10,704	392,667	360,789

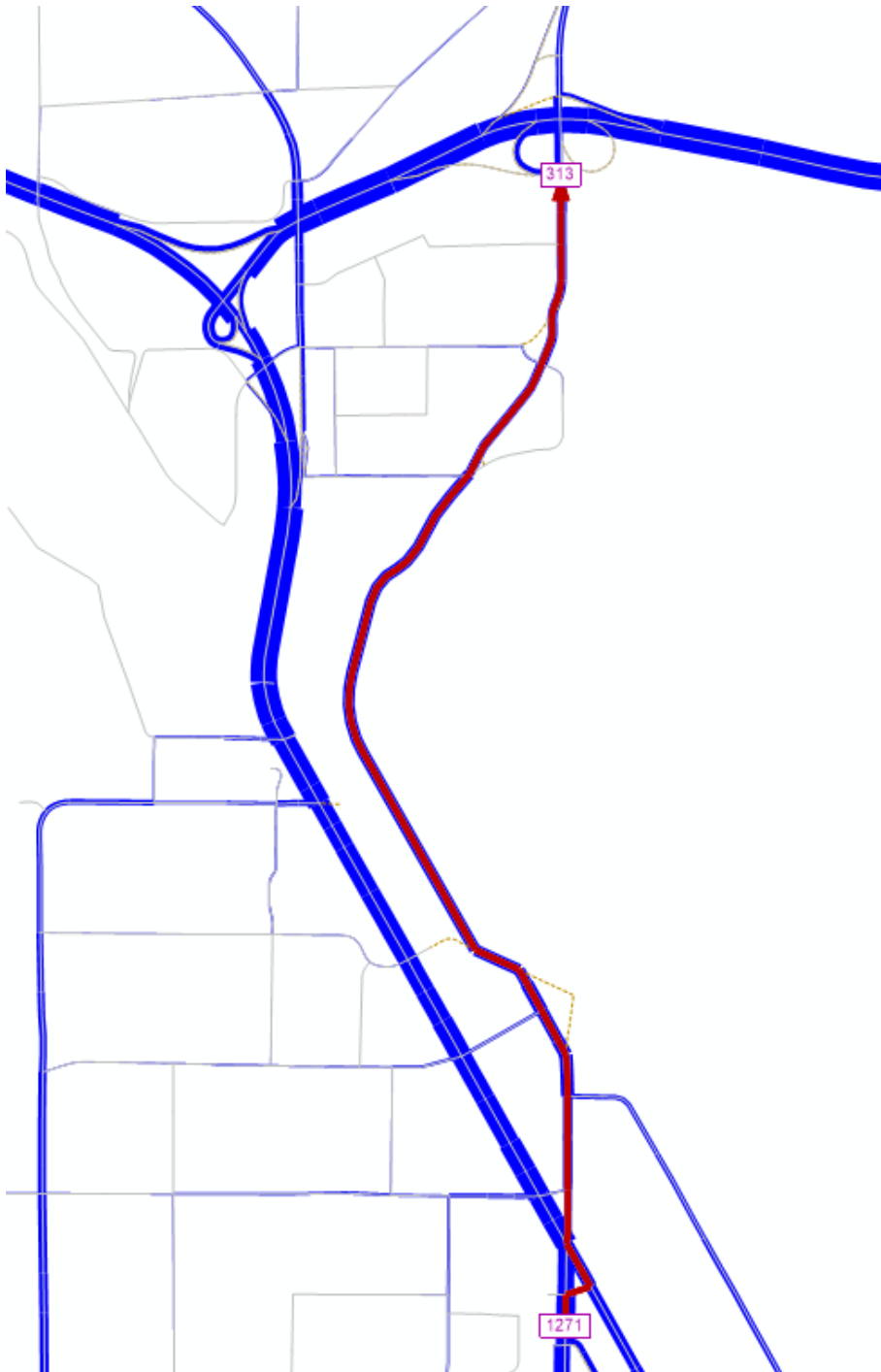
1. Measured as the peak traffic hour plus additional hours that operate at 80% of peak hour volume or greater; delay at 80% is represented as 50% of peak hour delay.

Attachment 1: Travel Time Segments

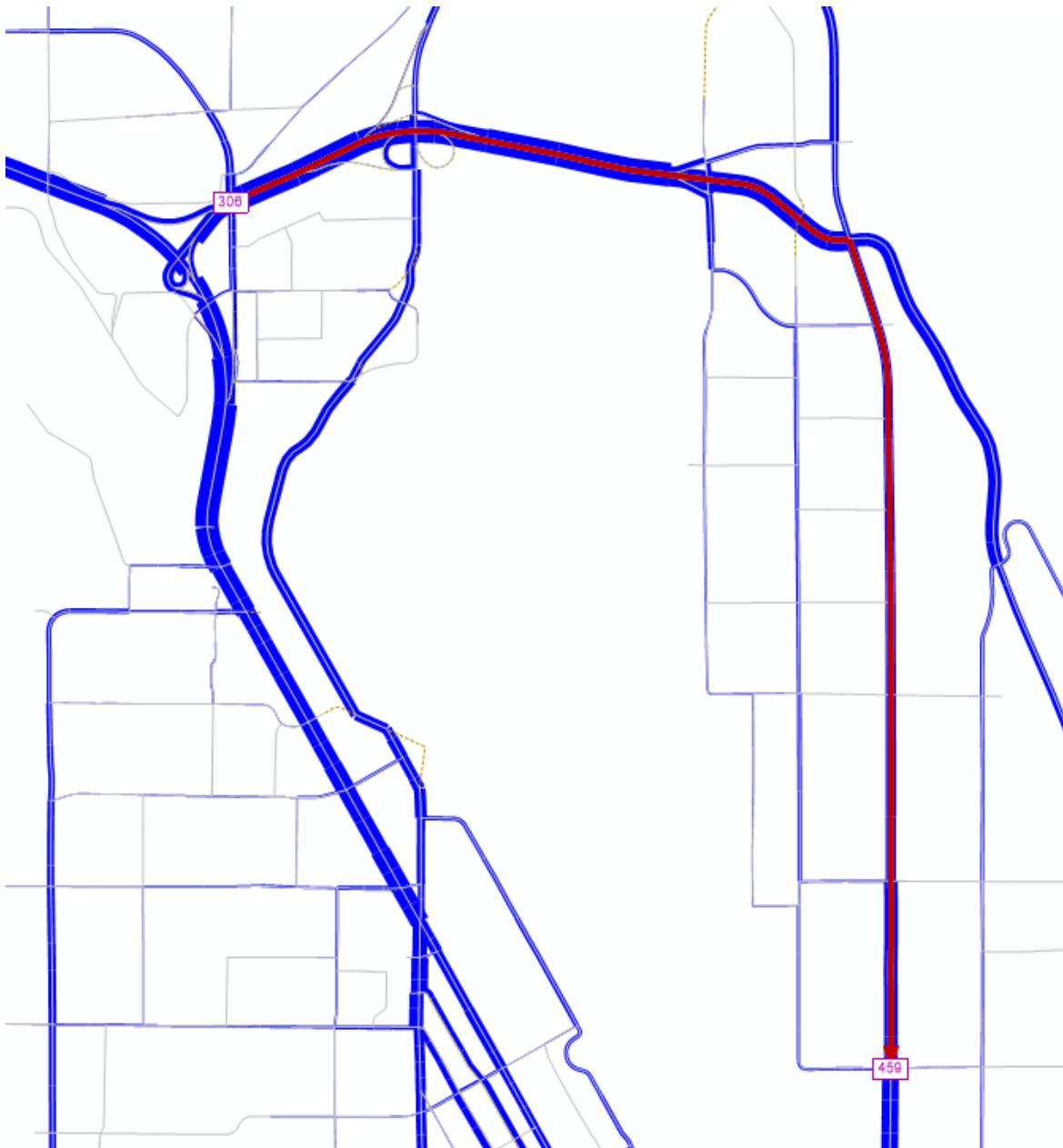
Between Wenatchee Avenue/Miller Street and US 2/Easy Street intersections.



Shortest Route: Wenatchee Avenue/Miller Street to US 2 EB Ramp intersection at Euclid Ave.



US 2/ Easy Street intersection to SR 28/ 19th Street NE intersection.



SR28 Sunset Highway: US2 to Valley Mall Parkway

