Pierce County, Washington

Canyon Road East

Freight Corridor Improvement

Final

Benefit-Cost Analysis

November 30, 2018

SKILLINGS CONNOLLY

Pierce County

Contents

SECTION A. BENEFIT COST ANALYSIS SUMMARY

Background

Over the years, Pierce County has made substantial improvements to the Canyon Road East Freight Corridor. There remains a section of this Corridor that Pierce County is planning to address with this project, namely the section from existing Canyon Road East in the vicinity of Pioneer Way East across the Puyallup River valley and the Puyallup River connecting to 70th Avenue East in the City of Fife. Completion of the Canyon Road East Corridor will further advance the National Highway System (NHS) by providing the missing link and connecting the Port of Tacoma Regional Manufacturing / Industrial Center (RMIC), the Fife Industrial Center and the Frederickson Manufacturing / Industrial Center (MIC).

Purpose

The purpose of this Benefit Cost Analysis is to quantify the benefits and costs associated with this project, evaluate the value and viability of the project, and help position Piece County to competitively apply for future grant funding.

Methodology

The Benefit Cost Analysis (BCA) methodology used in this analysis is consistent with the U.S. Department of Transportation, Office of the Secretary, *"Benefit-Cost Analysis Guidance for Discretionary Grant Programs"*, June 2018. The detailed cost and benefit assumptions are provided in this BCA and have been prepared by independent professional engineers and economists. **Table A.1** provides a summary of criteria, goals, inputs and impacts of the proposed project.

Table A. 1 BCA Overview

Criteria	Description	Inputs	Impacts	Value 2018$ (millions)	Discounted Value (7%) (millions)
Congestion Reduction & Freight Mobility	Reductions in travel times within the project area for vehicles and trucks	Average daily trip (ADT) and travel time figures provided by DKS Associates.	8,924 Hours of Travel Time reductions upon completion annually	$ 891.81	$ 153.49
Safety	Reduced fatalities and accidents from improvements to intersections which will result in reduced average crash rates	Crash Data provided by Pierce County and BNSF	Reduction of: 3 Fatalities and 30 Injuries	$ 51.21	$ 9.53
Operating Costs	Reduction of fuel consumption	Value of fuel consumption savings		$ 68.83	$ 13.48
Environmental Sustainability	Reductions of emissions associated with congestion	Idle and running emissions, and monetized emission values		$ 9.71	$ 2.55
Residual Value	Project Value for the project life estimated at 50 years minus benefit derived for the 30-year analysis period.	Project budget breakdown	Life cycle value of project	$ 73.49	$ 5.62

The results of the BCA indicate a benefit cost ratio of 6.0 without discount and 1.7 when analyzed with a 7% discount rate over 30 years. The 30-year analysis period has been selected as a blend of the expected life of various transportation infrastructure elements. Some of the components, such as structures and bridges have a longer expected life and have been included in the residual value benefit calculation. Other elements such as pavement and roadway substructure will experience a shorter functional life. The transportation industry uses a 30-year life cycle as representative of major transportation projects, such as the Canyon Road East Freight Corridor.

Benefits accrue to congestion reduction and freight mobility, safety, operating cost savings, and environmental sustainability. **Table A.2**. provides a broad overview of the benefit and cost categories and their key components.

Table A.2. BCA Results (30 – year analysis)

Category	Zero Discount Rate *	Discount Rate @7%
Congestion Reduction and Freight Mobility		
Reduced Vehicle Travel Time Benefit	$891,806,657	$153,486,880
Safety		
Accident Related Cost Reductions Benefit	$51,209,600	$9,528,837
Motorist Operating Costs		
Reduced Motorist Operating Cost Benefit	$68,831,615	$13,478,562
Environmental Sustainability		
Reduced Emissions Benefit	$9,712,031	$2,548,374
Residual Value		
Elimination/deferral of roadway preservation investment	$73,491,600	$5,618,937
Totals		
Total Benefits	$ 1,095,051,503	$ 184,661,590
Total Project Costs	$ 184,126,610	$ 110,215,386
Benefit / Cost	6	1.7
Benefit – Cost	$ 910,924,893	$ 74,446,204

*Source: See supporting tables and appendices.

SECTION B. PROJECT BENEFITS

Each discrete benefit category and its components address needs along the Canyon Road East Freight Corridor Improvement Project. The existing conditions of the project area are detailed below along with the improvements proposed in the project area should sufficient funding be allocated to the project. Project benefits have primarily been developed by a comparison of the No-build vs Build scenarios. In addition to the descriptions below, the methodology used to determine the value of each benefit component is identified to provide a narrative summary for assumptions and metrics used in the BCA.

B.1. NO-BUILD SCENARIO

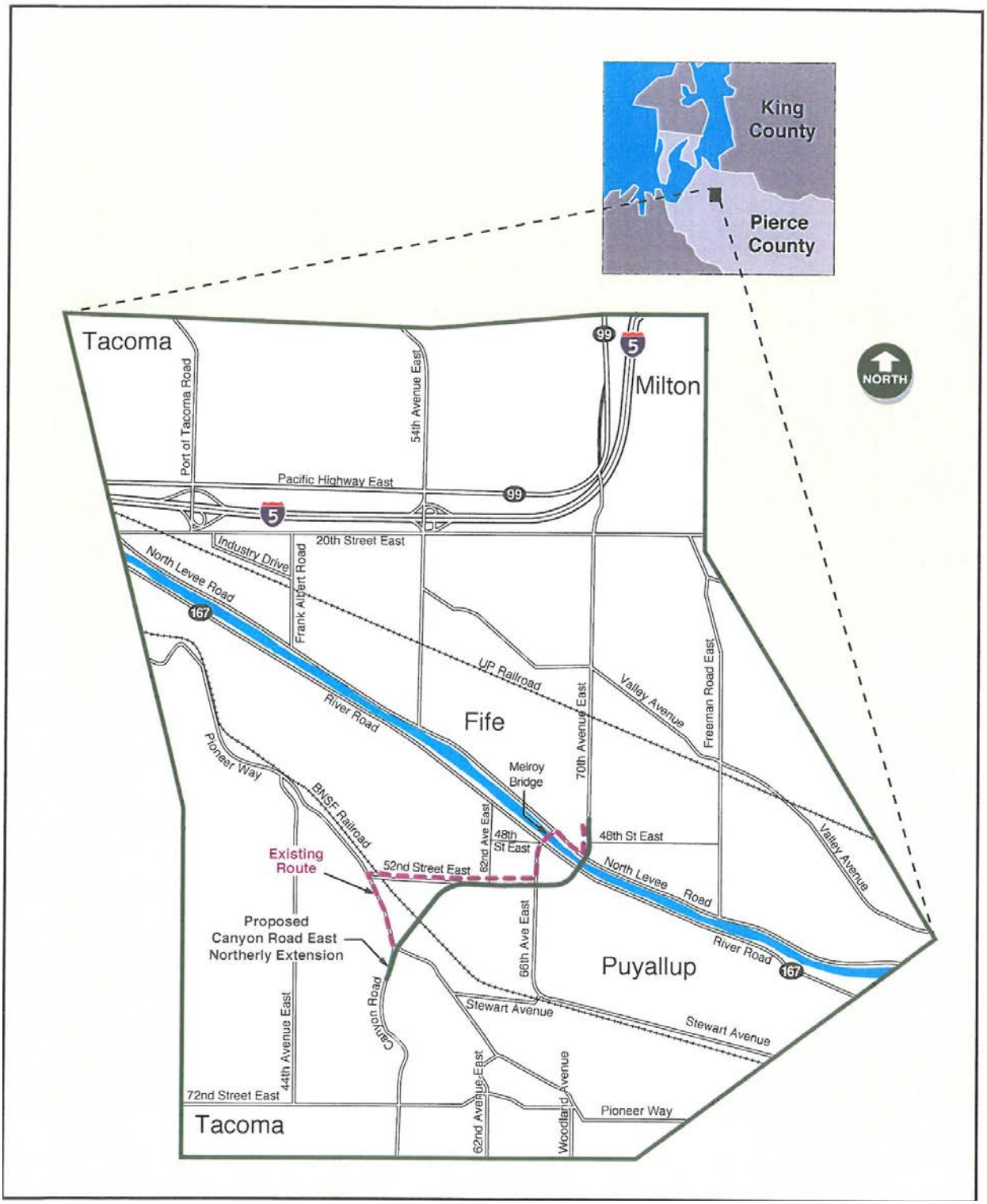
Presently, the route connecting the corridor from the intersection of Canyon Road East and Pioneer Way East in Puyallup, WA to 70th Avenue East in Fife, WA is constrained by narrow circuitous roads with narrow to non-existent shoulders, an at-grade BNSF railroad mainline crossing, outdated intersection treatments and congested travel times during both peak and off-peak periods. In addition, the existing Milroy Bridge over the Puyallup River is extremely narrow and functionally obsolete. The Milroy Bridge was built in 1931 with a 308-ft span and a 20-ft curb-to-curb deck width. A seven-feet wide timber plank sidewalk exists on the east side. Construction of new bridge over the Puyallup River is necessary to improve the transportation of freight across the region. These transportation issues are limiting the safety and reliability of the corridor impacting the regional economy.

Exhibit B.1 shows the circuitous alignment in contrast to the proposed alignment of the Canyon Road East Freight Corridor Extension. **Exhibit B.1A** shows a close up view of the freight corridor proposed features. A more extensive description of the existing route can be found in **Appendix B**.

B.2. BUILD SCENARIO

Over the years, Pierce County has made substantial improvements to two corridors south of State Highway SR 512, in the Frederickson Manufacturing Industrial Center (MIC) area: 176th Street East Corridor and Canyon Road East Corridor. Pierce County is now focusing on improvements to the north of State Highway SR 512 to further advance the National Highway System (NHS) roadway serving the Port of Tacoma RMIC, the Fife Industrial Center, the Frederickson MIC and providing improved access to a number of other industrial, transportation and manufacturing facilities in Pierce County and King County.

The Canyon Road East Freight Corridor improvement would leverage grant funding with local and Washington State funds to complete the final missing link of the Canyon Road East Freight Corridor connecting the Port of Tacoma, a major deep-water port in the Puget Sound region, to key MICs. The corridor also serves as access to a number of significant freight nodes within Pierce and King counties including the Fife Industrial Center, SeaTac Airport, the Renton Boeing plant, the Duwamish and Kent Valley MICs, the Redmond industrial area and a distribution center near Preston, WA on I-90, comprising a very large geographical freight service area.



Source: Berger/Abam Engineers, Corridor Design Report

Exhibit B.1 Canyon Road East Freight Corridor Improvements
Existing and Proposed Routes

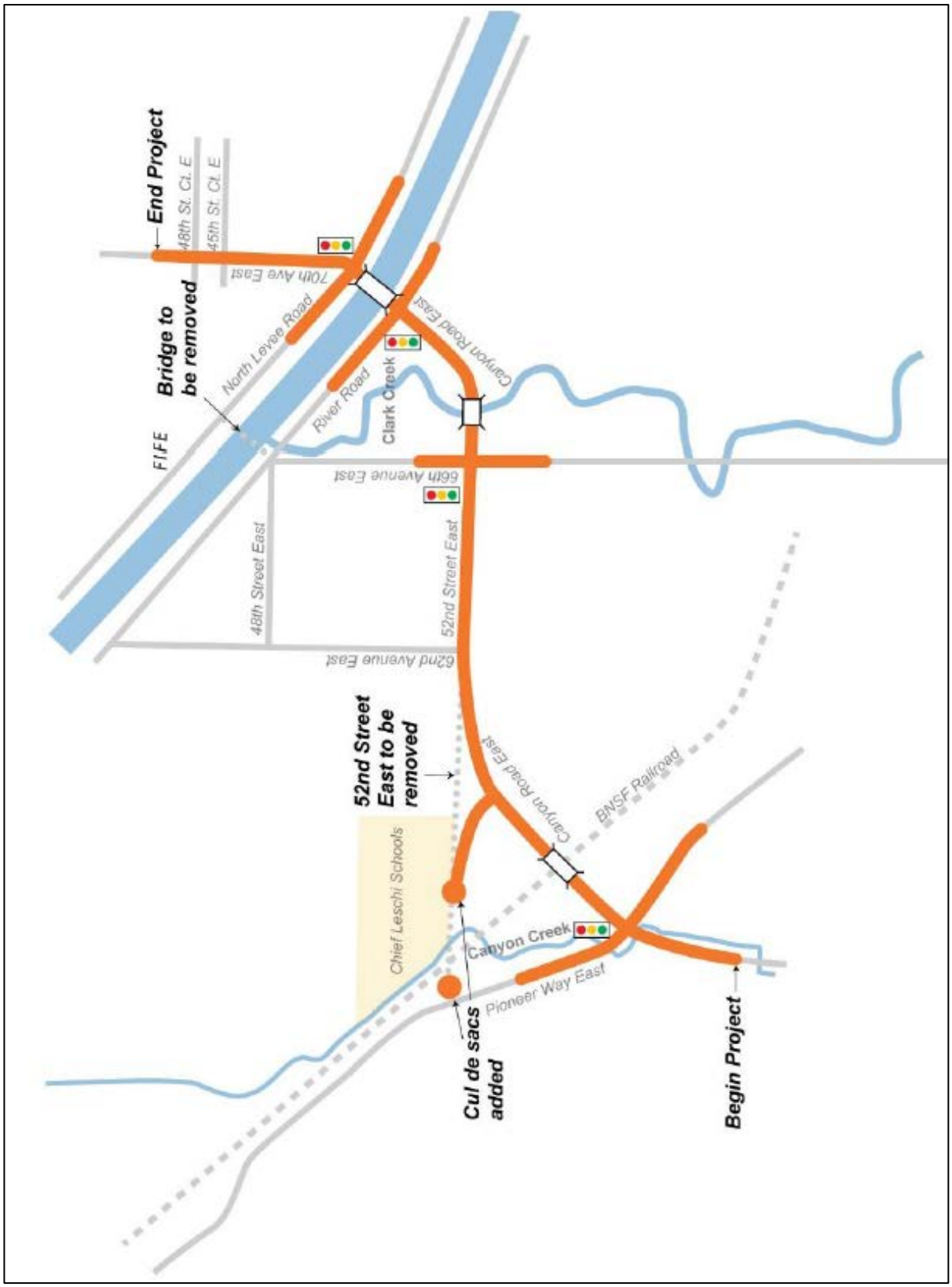
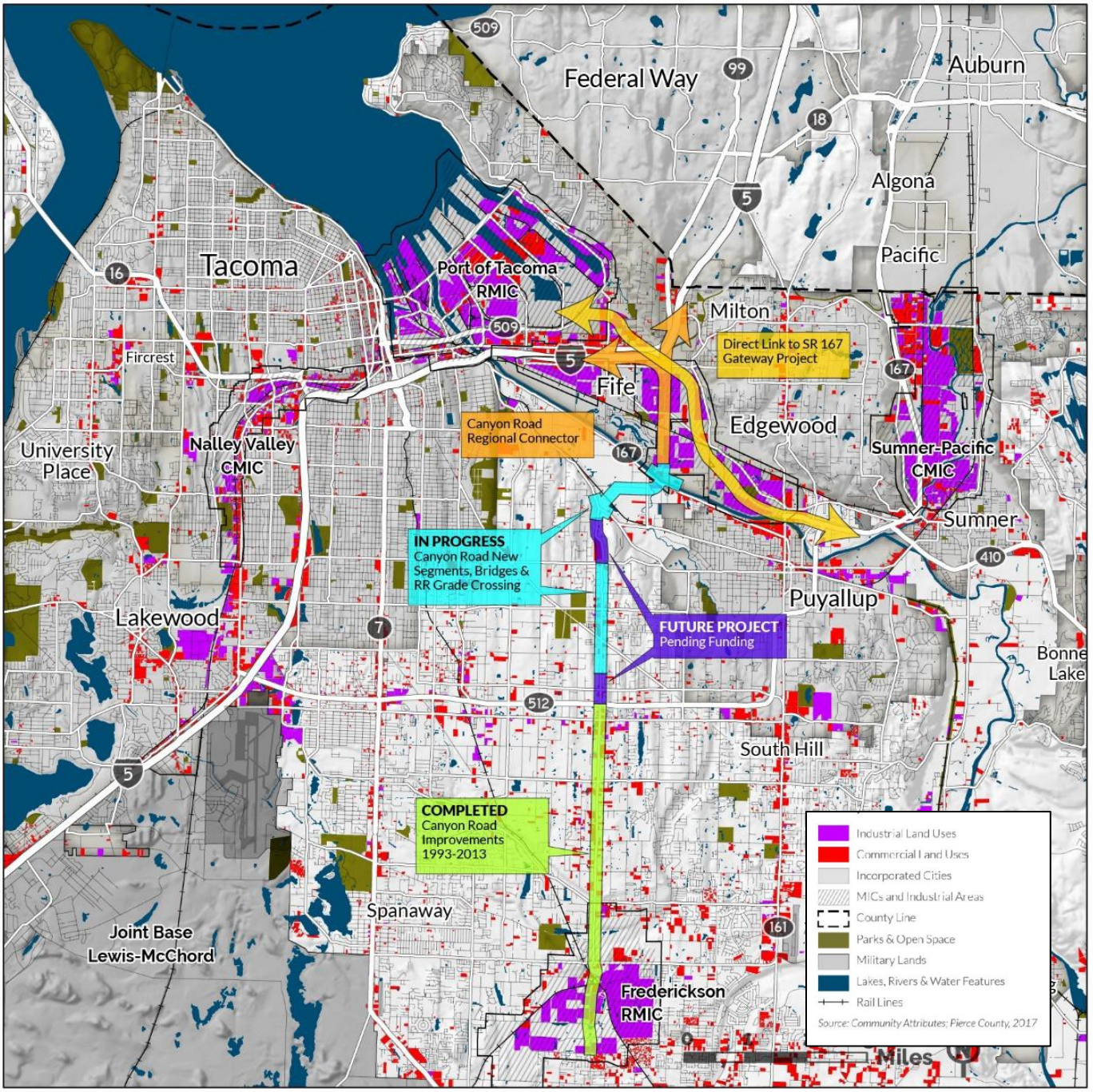


Exhibit B.1A Proposed Canyon Road East Freight Corridor Improvements

The Canyon Road East northerly extension is planned to promote a more direct connection across the Puyallup River Valley for access to Interstate 5 (I-5), State Highways SR 167 and SR 18, Interstate 90 (I-90) and to points of destination such as the cities of Fife and Puyallup, and the Port of Tacoma (**See Exhibit B.2**).



Source: Community Attributes, Pierce County 2018

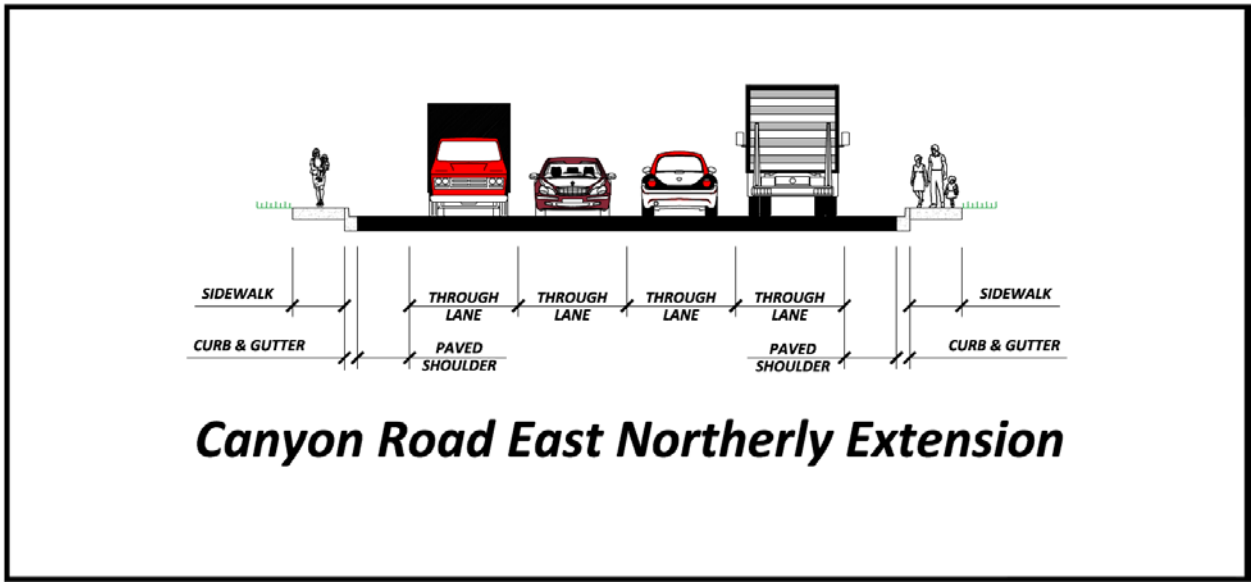
Exhibit B.2. Canyon Road East Freight Corridor Improvements – Overview
Frederickson MIC to Port of Tacoma RMIC

The area along the freight corridor has experienced rapid development, increased traffic volumes and modal conflicts between vehicles, trains, pedestrians, and bicyclists. The proposed project addresses the need for improved freight mobility and increased options for multimodal transportation by:

- Increasing safety and mobility along the proposed freight corridor with the installation of a new four-lane facility, with turn lanes at intersections. The existing route consists of several local streets with multiple intersections and variable roadway and shoulder widths. Some of the intersections are signalized and some are not. This results in multiple slowdowns or stops which is an impact to through freight operations. The improvements will include a roadway section width of 77-feet to back of sidewalks, including curb, gutters, shoulders, and sidewalks on each side (**Exhibit B.3**). Major signalized intersections will also include 12-foot left turn lanes. Safety is improved by providing wider travel lanes, wider shoulders adding to improved clear zone, and improved vehicle operations or Level of Service (LOS) throughout the corridor.

- The project will include the construction of three major bridges and the removal of one existing functionally obsolete bridge. The existing narrow (20 feet curb to curb) Milroy bridge over the Puyallup River will be removed and a new structure will be constructed over the Puyallup River on new alignment connecting to 70th Avenue East in the City of Fife.

- The grade separation of the BNSF railroad mainline tracks will eliminate an existing at-grade crossing, improving safety as well as eliminating delays and associated fuel consumption and emissions relative to idle time at the existing crossing. The crossing currently experiences 46 freight trains, averaging 1 mile in length daily. In addition, there are 8 Amtrak Passenger Trains and 26 Sound Transit Sounder Passenger Commute Trains daily. Freight trains travel at 50 MPH and passenger trains operate at 65 MPH.



Source: Pierce County, Economic Analysis

Exhibit B.3. Proposed Roadway Cross-section

Puyallup River Bridge Crossing

SR 167 (River Road)/66th Avenue East/Milroy Bridge (continuation of 66th Avenue East)/48th Street East forms a five-legged intersection (**Exhibit B.4.**). The approach lanes on the Milroy Bridge and on 66th Avenue East are only 9.5 feet and 9 feet wide, respectively. The 48th Street East approach utilizes approximately 11 feet of the 18-foot-wide roadway to serve all permitted movements from a single lane. The narrow bridge deck leads to decreased mobility as well as decreased safety for users. In addition, Levee Road experiences decreased safety due to the narrow 20-feet wide bridge deck without shoulders. The absence of shoulders on this roadway causes increased vehicle crashes, especially for larger vehicles/trucks.

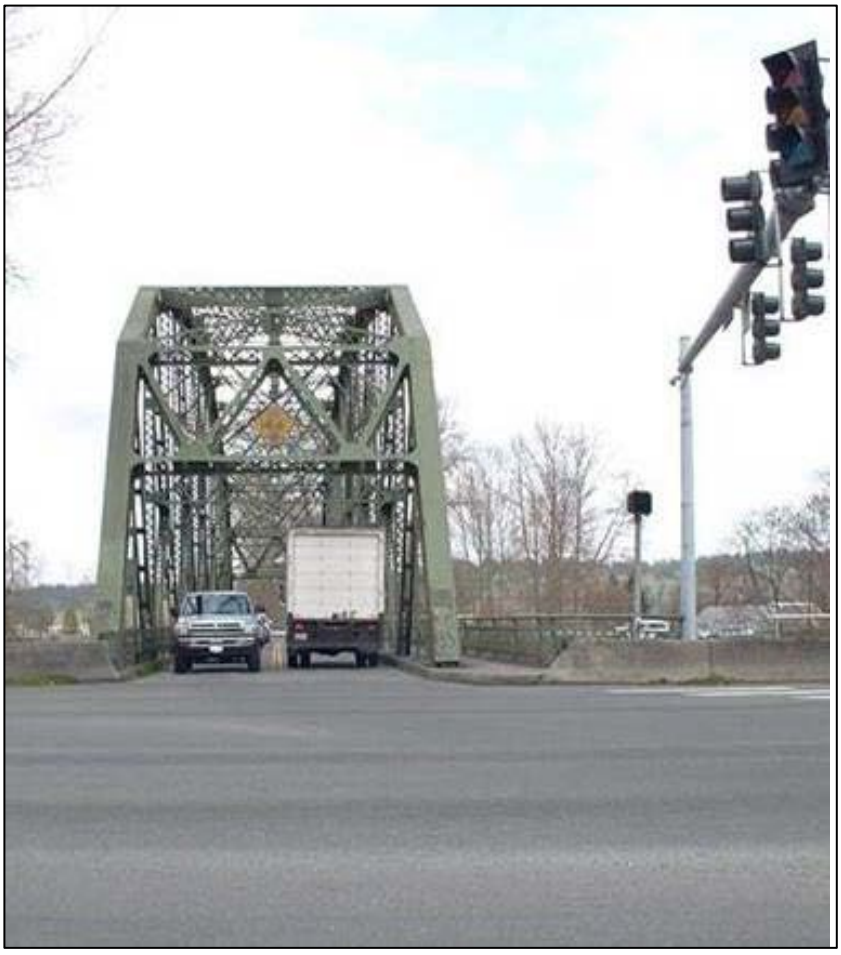
The new bridge on new alignment will accommodate as many as 6 traffic lanes, sidewalks and a multipurpose trail separated from the travel lanes with a barrier and railing, see **Exhibit B.4A** and **B.4B.** The profile will also provide clearance above the 100-year flood plain elevation. Safety will be significantly improved by the construction of the wider, higher capacity bridge. Travel time will also be reduced by the direct connection over the Puyallup River to 70th Avenue in the City of Fife.

Exhibit B.4. Canyon Road East Freight Corridor Improvement
Intersection at Milroy Bridge

Exhibit B.4A. Visualization of proposed new bridge

Source: Pierce County, Economic Analysis

Exhibit B.4B. Existing Milroy Bridge



Source: Pierce County, Economic Analysis

Table B.1 Existing and Proposed Road Characteristics along Project Corridor

Road Characteristics			
Location	**Characteristic**	**Existing**	**Proposed Roadway (Major Arterial)**
Canyon Road East	Lane Width	11 ft Lanes Each Direction	11 ft Inside Lane 14 ft Outside Lane Each Direction
	Sidewalks/Shoulders	1.5 ft Paved Shoulders	6 ft Each Side
	Turn Lane	None	At intersections
	Overall Roadway Width	25 ft to back of shoulder	77 ft to back of sidewalk
BNSF Overcrossing Bridge	Railroad Grade Separation	None	1,114 ft multi-span structure
Milroy Bridge	Bridge	Existing Bridge, Built in 1931, 308 ft span, 20 ft curb-to-curb deck width. 7 ft timber plank sidewalk on the east side.	To be removed
Puyallup River Bridge	Bridge	None	360-foot main span, width varies by option from 59 ft. to 103 ft.
Clarks Creek Bridge	Bridge	None	97 ft single span, 77 ft wide, 4 through Lanes
North Levee Road	Lane Width	12 ft Lanes Each Direction	No change proposed
	Sidewalks/Shoulders	2 ft. Gravel Shoulders	No change proposed
52nd Street East	Lane Width	12 ft	New intersection with Canyon Rd East
	Sidewalks/Shoulders	1 to 3 ft. paved shoulders	
48th Street East	Lane Width	One 10-ftlane in each direction with nominal shoulders	No change proposed
45th Street Ct. East	Roadway Width	34 ft. curb to curb. One lane in each direction with a left turn lane at 70th Avenue E.	No change proposed

Source: Berger/Abam, Design Report 2004

Summary of Freight Corridor Improvements

In addition to the characteristics of the existing route, improvements to the corridor are also summarized in **Table B.1.** The proposed improvements include increased lane widths, addition of much needed sidewalks and shoulders, a railroad grade separation, removal of an existing narrow bridge over the Puyallup River, and a second bridge over Clarks Creek. The additional bridge over Clarks Creek will provide four lanes of through traffic providing a wider roadway section with improved safety.

Completion of this final section of the Canyon Road East Freight Corridor improvement will significantly reduce the time required to traverse the Puyallup River Valley and the Puyallup River. This final planned development is viewed as crucial to the continued economic growth of the region as it increases the mobility of freight across the Puyallup River and improves the connection between major freight activity centers.

Benefits of the Proposed Canyon Road Freight Corridor Improvement

Benefits associated with the Canyon Road East Freight Corridor Improvement project were accrued from congestion reduction an freight mobility improvement, operational safety improvement, improved environmental sustainability, and infrastructure residual value.

1. Congestion reduction and freight mobility

According to traffic modeling forecasts, travel time improvements will occur along the entire route. In addition, travel time improvements will also be experienced by the traffic currently using the southern portions of Canyon Road that have already been improved, providing enhanced vehicle and truck travel times throughout the Canyon Road corridor. Due to these improvements freight mobility will be greatly enhanced.

To determine this benefit, this BCA uses the projected ADT figures at the time of project completion. To determine total vehicle delay, three types of vehicle delay were considered. Vehicle delay caused by:

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- Freight train,
- Passenger train and
- Distance travelled (average distance of freight corridor).

Each delay in hours was multiplied by occupancy figures provided by USDOT to determine peak-hour person hours saved in the build vs. no build case. Next, hours of delay for vehicles (autos, buses and trucks) was multiplied by 365 (days per year) to convert to annual hours saved and multiplied by hourly value of time provided by USDOT (all-purpose hourly value in the case of passenger vehicle figures, bus driver values for bus driver time savings and truck driver values for truck time savings). The Total Vehicle Delay Cost for automobiles, buses and trucks was determined by adding yearly (30-year analysis) delay costs to arrive at a yearly base case total for the build and no-build cases.

Benefit savings were calculated by subtracting the “Build Case” values from the “No-build Case” values.

2. Safety Benefit

Safety benefit was determined by an examination of the accident history. Two primary causes of accidents were identified:

1. At grade rail crossing related pedestrian and vehicle accidents, and
2. intersection related accidents.

Assuming the elimination of the accidents related to the at grade railroad crossing to be removed and accidents related to intersections that will be removed or bypassed by the new route, utilizing the accident related formula provided by USDOT, the accident reduction was determined. The combination of these two values was used to determine the expected number of fatalities, injuries and property-damage-only accidents to determine the total safety benefit.

Rail Crossing-Related Pedestrian and Vehicle Accident Reductions

Removal of the BNSF at-grade crossing will eliminate both vehicle and pedestrian crashes at the crossing. The at-grade railroad crossing will be removed and 53rd Ave will be terminated with a cul-de-sac. Burlington Northern Santa Fe (BNSF) railroad crash data at this crossing was analyzed to determine the frequency with which crashes have occurred historically.

In addition, the safety benefit attributed to the rail-crossing elimination was calculated using the USDOT's "Accident Prediction Model". Using this model, the rail grade crossing related expected accidents per year (for the 52nd Street East crossing) was determined. The related percentage of fatal crashes and injury related crashes for 52nd Street East crossing as the average of percentages of fatal and non-fatal crashes on rail-road crossings in the State of Washington for the past six years was calculated. Using the USDOT figure and the Washington state figure for expected rail grade crossing accidents the expected rail grade crossing related fatalities and injuries per year was determined.

Intersection- Related Accident Reduction

Vehicle crash cost reductions are a function of safety improvements made throughout the project corridor. The improved roadway section provides wider lanes, new or wider shoulder widths enhancing the available clear zone and providing more consistent operating speeds benefiting the overall Level of Service. In addition, the removal or elimination of several intersections was assumed to eliminate those intersection related crashes.

To determine the value of the reduction of intersection-related crashes the expected number of fatalities, injuries, and property-damage-only accidents was determined. The expected cost per year associated with all accidents was then calculated.

The expected cost per year for all types of roadway accidents combined with the expected cost of railroad grade crossing accidents for all years (2027 – 2056) was then determined for both the build and no-build case.

Total safety related benefits were calculated by subtracting the total "Build Case" accident related cost from the "No-build Case" accident related cost.

3. Operational Cost Savings

Operational cost savings are derived from the reduction of fuel consumption as a result of the improved operational characteristics of the proposed freight corridor when compared to the operations of the existing circuitous route.
Fuel consumption for automobiles, buses and trucks was determined for vehicles at idle and economies of consumption by improved operating speeds throughout the corridor was calculated based on an internet search of national industry research data. Argonne national laboratory and the Department of Energy were sources utilized.

Fuel prices were estimated for 2018 from data derived from data published by US EIA Annual Energy Outlook 2018 and projected annually for the 30-year study period. The total fuel cost for all vehicles was calculated for the No-build and Build scenarios and the benefit value was determined by subtracting the Build cost from the No-build cost.

4. 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.

This BCA categorizes emissions into two categories, SO_2 emissions and non-SO_2 emissions. Non- SO_2 emissions include Volatile Organic Compounds (VOC), Nitrogen Oxides (NO_x) and Particulate Matter (PM). To determine the extent of the emission reduction, this BCA utilizes assumptions published by U.S. Department of Transportation as outlined in the Benefit-Cost Analysis Guidance for Discretionary Grant Programs published in 2018. Multiplying these rates by total fuel consumed (all vehicles in gallon/year) generated the cost of emissions. These values were converted to ton/year. A yearly cost/ton was then calculated for both SO_2 and non-SO_2 emissions. The expected emissions costs were then calculated for the life of the project to determine the expected emissions cost for both the build and no-build case.

Total emissions related benefits were calculated by subtracting the total “Build Case” emissions from the “No-build Case” emissions cost.

5. Residual Value – Elimination/Deferral of Roadway Preservation Investment

In accordance with BCA Guidelines, this BCA quantifies the residual value of the capital expenses associated with this project. The following formula was used to calculate residual value:

RV= ((U-Y) x (Project Cost) / U

RV = Residual Value
U = Useful Service Life of Project
Y = Years of Analysis Period Project Operation

The residual value was determined by subtracting the project cost for the 30-year analysis period from the useful service life of the project (assumed to be 50 years.) The Project Cost was then divided by number of years of useful service (50 years). These two values were then multiplied to arrive at the residual value.

6. Secondary Benefits of the Proposed Canyon Road Freight Corridor Improvement

The Canyon Road East Freight Corridor Improvement will generate benefits which are more difficult to precisely quantify than those already identified. Such improvements include:

- Project construction generated jobs
- With the introduction of continuous sidewalks some vehicle trips will be replaced with pedestrian trips.
- Improved Emergency Medical Response times
- Enhanced access to regional development areas such as Fredrickson, Port of Tacoma, Fife, and Puyallup which will promote development and provide new business and new employment opportunities.

Although recognized these benefits have not been quantified in this BCA due to their more generic social nature.

Regional Freight Related Industry Benefits

Constructing the Canyon Road East Freight Corridor will increase accessibility and improve the marketability of nearby strategic Industrial Centers, resulting in increased private investment. A determent to full utilization of available freight related industry and development of available property for freight related uses has been attributed to the lack of dependable freight delivery routes. The Canyon Road East Freight Corridor travels through largely unincorporated residential areas, connecting industrial and manufacturing uses to the higher concentration of uses to the north and south. The corridor serves miscellaneous retail centers as well with several significant manufacturing and industrial concentrations south of SR 512. This BCA focuses on 2 specific subareas exhibiting unusual capability of expanding freight related business improvements:

- Fife Industrial Area
- Frederickson Regional Manufacturing/Industrial Area

While other freight related industry improvements are expected along the Canyon Road East Freight Corridor, these two Manufacturing and/or Industrial areas have been identified through specific freight related industry interviews conducted specifically for the Canyon Road East Freight corridor as being very important to the future of the Canyon Road East Freight Corridor and as such have been included in the BCA. The two areas were selected based on their direct connection to the improved corridor and potential future buildout.

The methodology used to estimate development in each area include:

- Pierce County and King County Buildable Lands Report methodologies.

- Determination of physical developability or re-developability as based on a calculated ratio of improvement value (buildings) per square feet of parcel land area.
- Inventory is categorized by the following ratios:
  - Vacant: < $.001 Improvement Value / Square Foot (land)
  - Potentially Redevelopable, Tier A: $.001-$2.50 Improvement Value / Square Foot (land)
  - Potentially Redevelopable, Tier B: $2.50-$5.00 Improvement Value / Square Foot (land)
- Certain land uses are excluded from inventory, including: Built Schools, Fire Stations, Libraries, C/U Open Space, Parks, Cemeteries, Utilities, etc.
- Deductions are made for future ROW and public-use development (5% of gross parcel area); and for "market factor" (15% of gross parcel area). Market factor is an assumption that not 100% of available land will be developed due to a number of anomalous factors.
- Note that critical areas such as wetlands and streams are not included in the analysis.
- In the large industrial employment centers anchoring both ends of the Canyon Road East Freight corridor –Fife Industrial Area to the north and the Frederickson Regional MIC in the south, large amounts of land remain available for future development – especially in Frederickson. There, of 2,344 total acres, 1,304 acres or 56 percent of total parcel area, are potentially vacant or physically redevelopable.

- **Exhibits B.5** through **B.7** provide an overview of vacant and developable lands in the Fife Industrial Area and Frederickson MIC. Estimated capacity is divided into three tiers as described in the methodology section: Vacant, Underutilized Tier A, Underutilized Tier B.

Exhibit B.5. Summary of Vacant Land Capacity

			Deductions		
	Number of Parcels	Gross Vacant Supply (ac)	Public Facilities & ROWs (5%)	Market Factor (15%)	Net Vacant Supply (ac)
Fife Industrial Area	136	542	27	81	434
Frederickson MIC	131	1,285	64	193	1,028
	267	1,828	91	274	1,462

Exhibit B.6. Summary of Tier A Underutilized Land Capacity

	Tier A: Number of Parcels	Tier A: Gross Underutilized Supply (ac)	Deductions		Total Net Underutilized Supply (ac)
			Public Facilities & ROWs (5%)	Market Factor (15%)	
Fife Industrial Area	68	242	12	36	193
Frederickson MIC	53	229	11	34	183
	121	470	24	71	376

Exhibit B.7. Summary of Tier B Underutilized Land Capacity

	Tier B: Number of Parcels	Tier B: Gross Underutilized Supply (ac)	Deductions		Total Net Underutilized Supply (ac)
			Public Facilities & ROWs (5%)	Market Factor (15%)	
Fife Industrial Area	44	104	5	16	83
Frederickson MIC	21	116	6	17	93
	65	220	11	33	176

Source: Pierce County, Economic Analysis, 2018

A summary of land capacity at either end of the Canyon Road East freight corridor is displayed in **Exhibit B.8.**

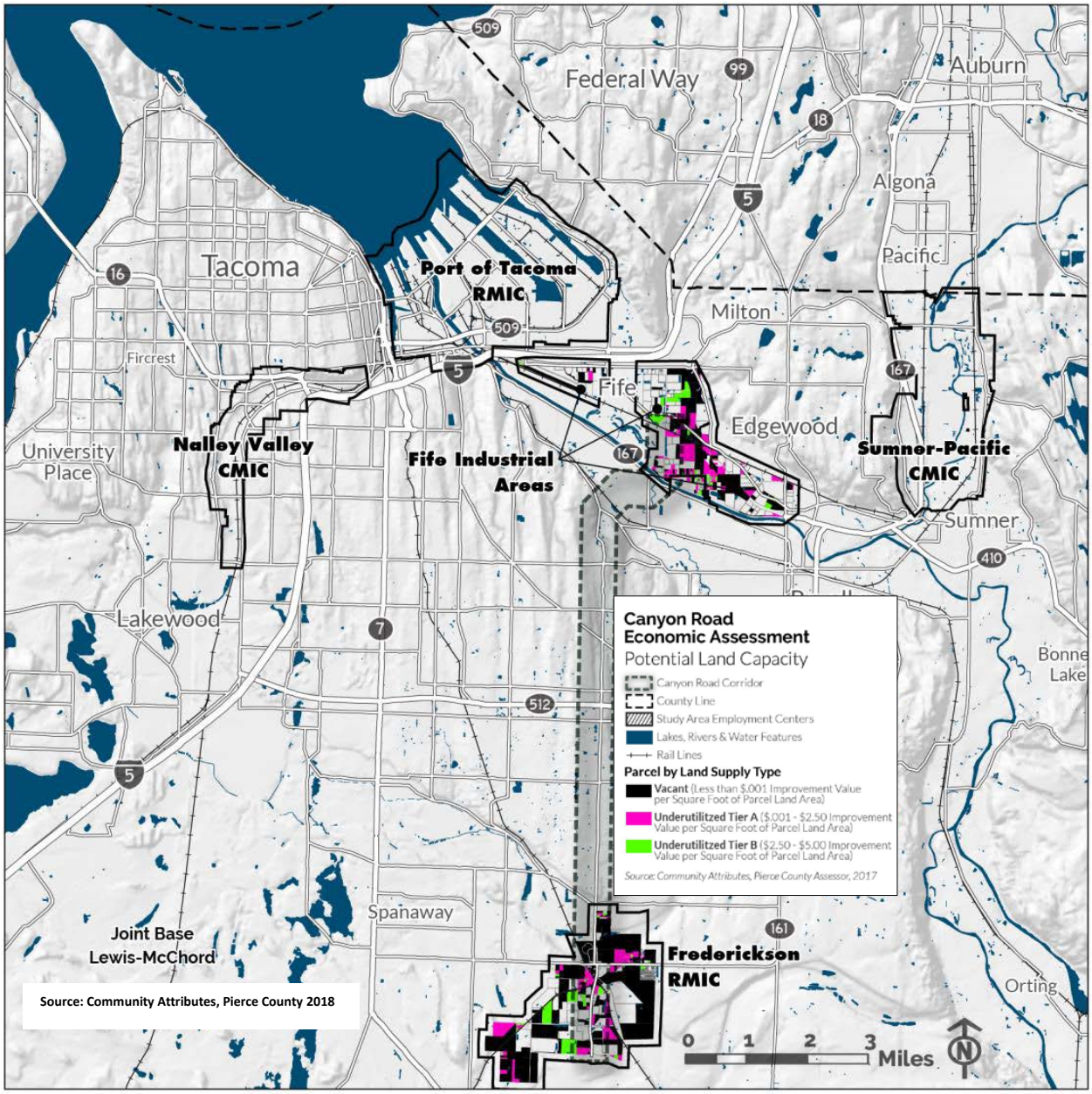


Exhibit B8. Summary Map of Land Capacity in Fife Industrial Areas and Frederickson MIC

A close up of land capacity at the northern and southern ends of the Canyon Road East Freight Corridor is shown in **Exhibit B9 and Exhibit B10.**

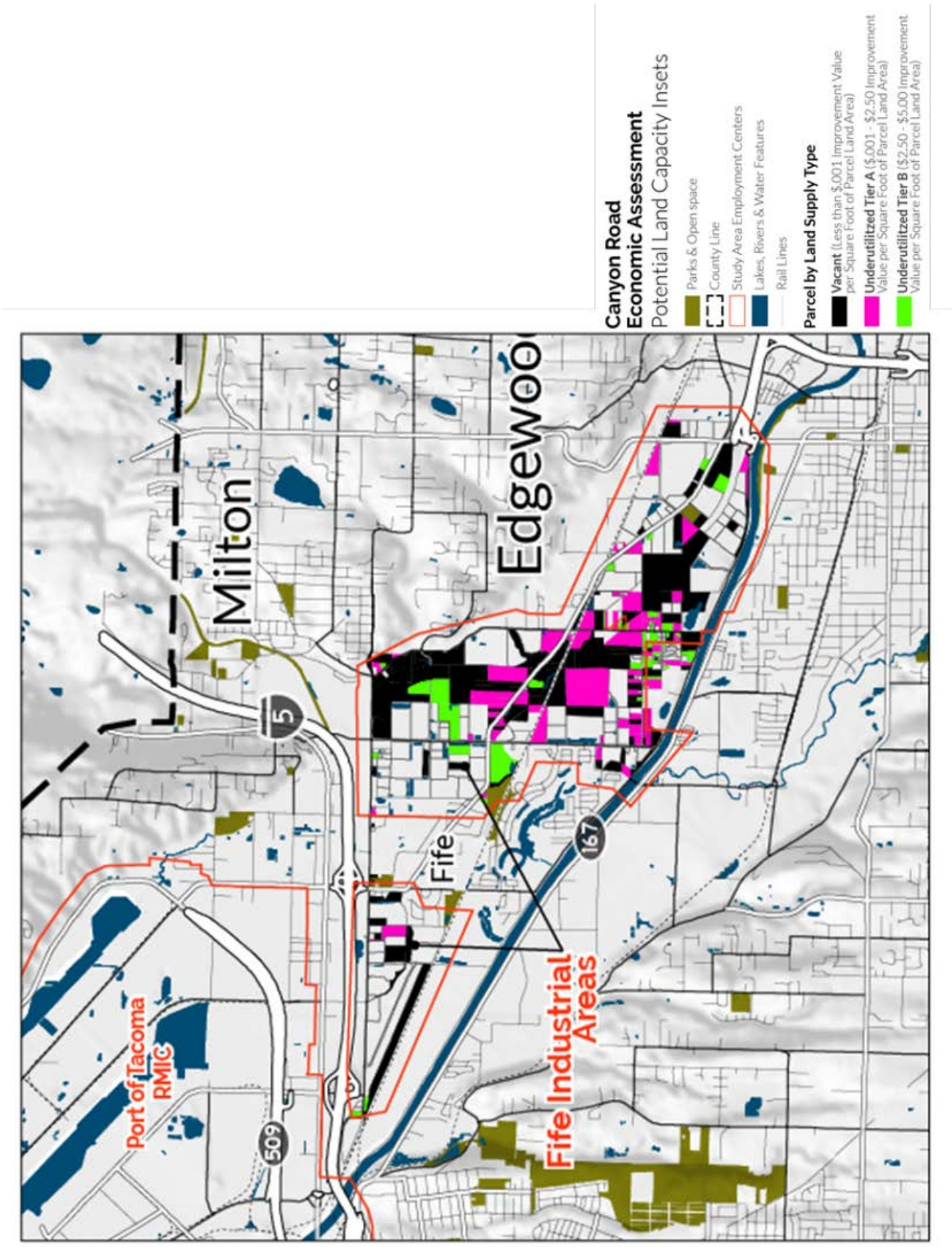
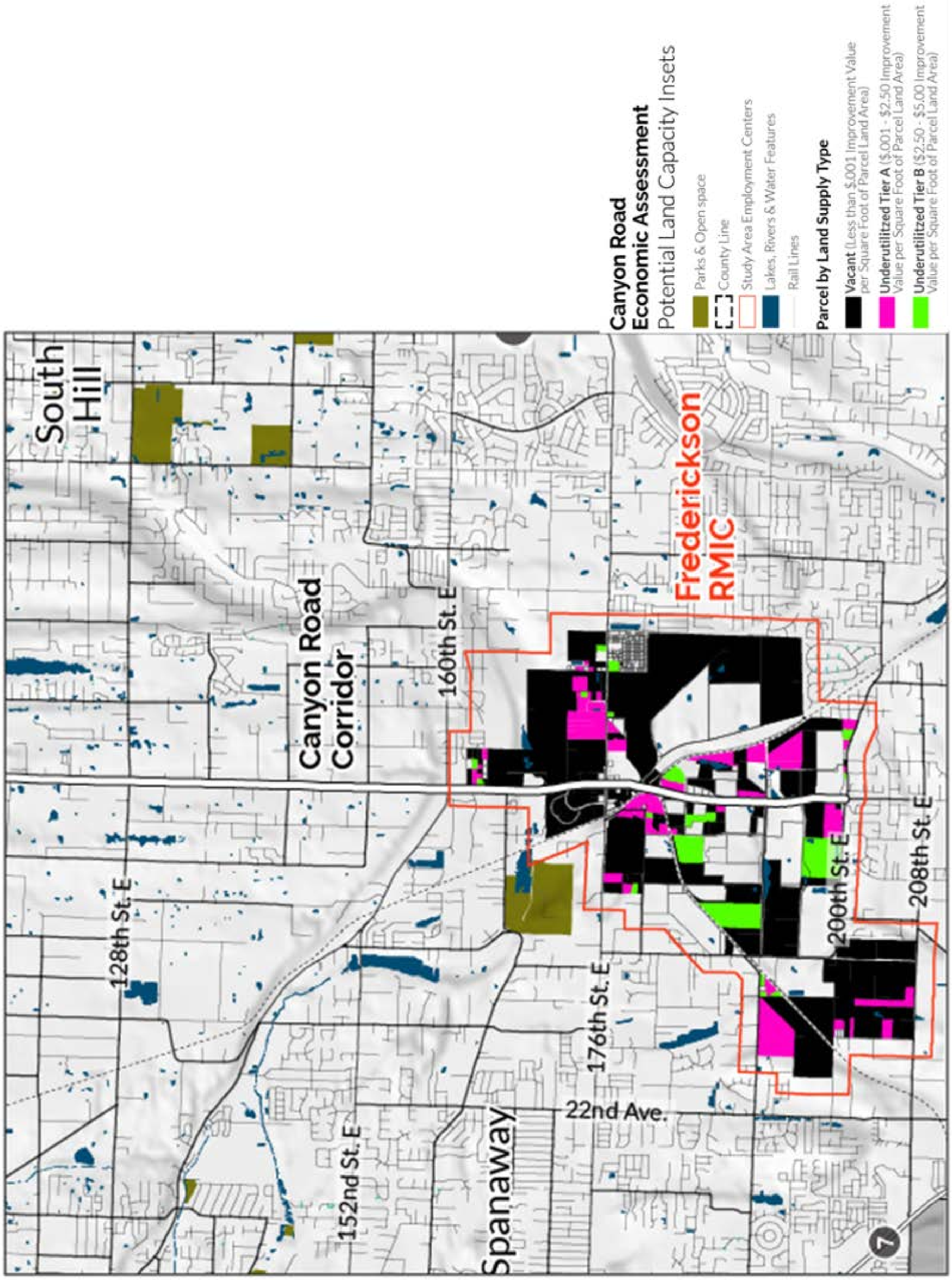


Exhibit B.9. Close-Up of Land Capacity in Fife Industrial Areas



Source: Pierce County Assessor, 2018; Community Attributes, 2018.

Exhibit B.10. Close-Up of Land Capacity in Frederickson Regional MIC

SECTION C. PROJECT COSTS

Project costs are derived solely from estimates developed by Pierce County engineers relating to project design, right-of-way acquisition, and construction costs. All estimates were adjusted to current year (2018) dollars.

C.1. CONSTRUCTION COSTS

The final design, right-of-way, construction and maintenance costs associated with the Canyon Road East Freight Corridor Improvements is estimated at approximately $184,126,610 (Undiscounted value). These figures are based on project designs advanced to approximately a 30% design level. The design, right-of-way acquisition and construction phasing allocates costs between 2024 and 2027. The maintenance costs allocate costs between 2028 and 2056.

C.2. DISCOUNTED PROJECT COSTS

As shown in **Table C.1**, the total cost equates to $110,215,386 at a 7% discount rate.

Table C.1 Detailed Project Cost Summary

Year	2024	2025	2026	2027	2028-2056	**TOTAL**
No Discount Rate						
Project cost	$25,312,000	$57,574,333	$67,228,444	$33,614,222	$ 397,611	**$184,126,610**
7% Discount Rate						
Project Cost	$16,866,454	$35,854,401	$39,127,567	$18,283,910	$ 83,054	**$110,215,386**

Appendix A – BCA Assumptions

Traffic Related Assumptions					
Assumption Subject	Figure	Source Year	CPI Inflation Factor	Figure ($2018)	Source
Automobile Driver and Passenger Value of Time	$14.20	2018	1.000	$14.20	US DOT Resource Guide Table A-3
NHTSA Overall Vehicle Occupancy for all Vehicle Trips				1.6	NHTSA Corporate Average Fuel Economy Passenger Cars and Light Trucks
Hourly Cost of Truck Driver Travel				$28.60	US DOT Resource Guide Table A-3

Project Area Truck Share of ADT	
Element	Share of ADT
70th Ave E / North of Levee Rd (Existing 2014)	8%
Levee Rd Milroy Bridge to 70th Ave	10%
Milroy Bridge	8%
Canyon Rd 66th to River Rd	9%
Canyon Rd Pioneer to 66th	12%
Canyon Rd North of Pioneer	18%
Canyon Rd South of Pioneer	17%
Corridor Average	12%

Project Area ADT		
Element	ADT	Source
Project Area ADT (2014)	7,082	DKS Associates Analysis (Available in Appendix)
Project Area ADT (2056)	32,501	DKS Associates Analysis (Available in Appendix)
Average Growth Rate		3.69%

Corridor Crash Data					
Location	**Shares of Total Accidents (2008-2018)**				**Source**
	Injuries	**Fatalities**	**Property Damage**	**Total Accidents**	
Canyon Rd E ~1000 ft. south of Pioneer	4	0	7	11	Pierce County Crash Data
52 St E - Pioneer to 66 Ave	14	0	22	36	Pierce County Crash Data
66 Ave E - North of 52 St to South of SR 167	3	0	11	14	Pierce County Crash Data
Milroy Bridge	0	0	5	5	Pierce County Crash Data
City of Fife 2 x Segments (Milroy to 45th St E)	22	0	66	88	Pierce County Crash Data
Avg. / year	4.3	0	11.1	15.4	
Sum all years	43	0	111	154	
%	27.92%	0.00%	72.08%	100.00%	

Traffic Accident Cost Benefits					
	Undiscounted Benefit	**Discounted Benefit at 7%**		**Undiscounted Benefit**	**Discounted Benefit at 7%**
Calendar Year	**2018 Dollars**	**2018 Dollars**	**Calendar Year**	**2018 Dollars**	**2018 Dollars**
2027	$723,277	$393,415	2042	$1,584,665	$312,411
2028	$762,090	$387,408	2043	$1,669,756	$307,651
2029	$802,989	$381,494	2044	$1,759,420	$302,964
2030	$846,084	$375,671	2045	$1,853,900	$298,349
2031	$891,494	$369,938	2046	$1,953,458	$293,804
2032	$939,344	$364,294	2047	$2,058,364	$289,330
2033	$989,765	$358,736	2048	$2,168,908	$284,923
2034	$1,042,894	$353,264	2049	$2,285,391	$280,584
2035	$1,098,878	$347,877	2050	$2,408,133	$276,312
2036	$1,157,869	$342,572	2051	$2,537,470	$272,105
2037	$1,220,030	$337,348	2052	$2,673,757	$267,962
2038	$1,285,530	$332,205	2053	$2,817,367	$263,883
2039	$1,354,550	$327,141	2054	$2,968,694	$259,866
2040	$1,427,277	$322,155	2055	$3,128,153	$255,911
2041	$1,503,912	$317,246	2056	$3,296,179	$252,016
			Total Crash Reduction Savings	**$51,209,600**	**$9,528,837**

Rail-Road Crossing Crash Data (1976 -2018)					
	Total Accidents	**Injuries as Share of Total Accidents**	**Fatalities as Share of Total Accidents**	**Property Damage**	**Source**
52nd St Railway Crossing	2	0	1	2	BNSF

Monetized Values for Carbon and Non-Carbon Emissions		
Pollutant	Damage Costs Undiscounted Benefit 2018 (millions)	Damage Costs Discounted Benefit 7% (millions)
Non-SO_2	$ 5.97	$ 1.87
SO_2	$ 3.74	$ 0.68
Total	**$ 9.71**	**$ 2.55**

Conversion	
Grams per Short Ton	907,185

Appendix B – Existing Route Detail Description

The Canyon Road East Freight Corridor project is intended to replace a circuitous system of local roads. The existing route begins at the signalized intersection of Canyon Rd East and Pioneer Way East. Turning to the northeast, the route follows Pioneer Way northerly to a stop-controlled T-intersection at 52nd Street East. The route then turns to the east on 52nd Street East beginning to cross the agricultural Puyallup River Valley and the Burlington Northern Santa Fe railroad mainline. The route then turns north on 66th Avenue East until it intersects with 48th Street East and River Road East at a five-leg signalized intersection. The route then travels across the Puyallup River via Milroy Bridge (still 66th Avenue East). At the northerly intersection of Milroy Bridge and Levee Road, the route turns southeast onto North Levee Road East. North Levee Road East connects to 70th Avenue East at a non-signalized channelized T-intersection. 70th Avenue East extends the freight corridor to the Fife Industrial Areas.

Roadway Alignments

Canyon Road East is a major north-south arterial that connects the Frederickson area in central Pierce County with Pioneer Way East in northcentral Pierce County. The existing roadway consists of two 11-ft travel lanes with 1.5-ft paved shoulders that include a 1-ft wide wedge curb on the outside edge and 6-foot gravel shoulder extensions continuously on the east side and intermittently on the west side.

Pioneer Way is a major east-west arterial that connects between Valley Avenue (SR 162) in Sumner at its eastern terminus and River Road (SR 167) at its western terminus near Interstate 5 (I-5) in Tacoma. The route has several designations as it traverses the several jurisdictions along its length. In the city of Sumner it is known as East Pioneer, as it passes through the Puyallup city center and crosses Meridian Avenue (SR 161) the street name changes to West Pioneer Avenue. In the vicinity of Woodland Avenue East, the street name changes to Pioneer Way East. That name continues for the rest of the route to its western terminus at River Road in Tacoma. In the vicinity of Canyon Road East, the roadway is known as Pioneer Way East and consists of two lanes, except at the intersection with Canyon Road East where the roadway is widened to accommodate a right-turn lane to southbound Canyon Road East. Existing lane widths vary between 10 and 12 feet. The roadway has 5 to 7-foot-wide paved shoulders in the vicinity of the intersection with Canyon Road East. The south shoulder, west of the intersection at Canyon Road East, includes a 1-foot-wide wedge curb. Elsewhere in the vicinity, the roadway has additional 5 to 6-foot-wide gravel shoulders.

River Road is a state highway **(SR 167)** that connects between Renton at its northern terminus and Tacoma at its southern terminus. The Canyon Road East Freight corridor route intersects River road at the intersection with 48th Avenue East and 66th avenue East at the southern terminus of the Milroy Bridge over the Puyallup river. In the vicinity of the Canyon Road East Freight Corridor, the highway consists of a five-lane undivided roadway with four 11-ft travel lanes and one 12-ft two-way left turn lane. The northern edge of the roadway has a 5-ft paved shoulder with guardrail. The southern edge has a paved 4-ft wide shoulder.

52nd Street East is an east-west arterial that connects between 66th Avenue East at its eastern terminus and Pioneer Way East at its western terminus. The roadway typically consists of two 12-foot travel lanes

with 1 to 3 ft paved shoulders. At the entrance to Chief Leschi School, the roadway is widened to include a center two-way-left-turn lane.

At **66th Avenue East** is a north-south arterial that connects between North Levee Road in the City of Fife and Stewart Avenue East in Pierce County just west of the city limits of Puyallup. The roadway typically consists of two 11-ft lanes with approximately 5-ft wide gravel shoulders.
The Milroy Bridge is a 20-feet wide (curb to curb) single-span steel truss bridge with a vertical clearance of 14 feet 6 inches and a 7-feet wide timber plank sidewalk on the east side. The posted speed is 25 mph..

North Levee Road is an east-west arterial that runs on top of the northern levee of the Puyallup River. It connects between North Meridian Avenue (SR 161) at its eastern terminus in the City of Puyallup and 20th Street East at is western terminus near the Port of Tacoma Road in the City of Fife. The roadway typically consists of two 12-ft lanes with 2 ft gravel shoulders at most locations within the vicinity of the project.

70th Avenue East is a north-south arterial connecting North Levee Road at its southern terminus and SR 99 in the City of Fife at its northern terminus.. The roadway typically consists of two 12-ft lanes with no shoulders at most locations within the vicinity project.
The Canyon Road East Freight Corridor continues northerly providing access to manufacturing and industrial areas in Fife.

Existing Signalized Intersections
The project area consists of 2 signalized intersections:

The junction of **SR167 (River Road)/66th Avenue East/Milroy Bridge/48th Street East** forms a five-legged intersection.

- The east and west legs are formed by SR 167. All travel lanes are 11 feet in width, except the turn lanes that are 12 feet wide.
- The southbound approach along the Milroy Bridge and the northbound approach on 66th Avenue East consist of one approach lane each from which all movements are permitted. The approach lanes on the bridge and on 66th Avenue East are only 9.5 feet and 9 feet in width, respectively.
- The 48th Street East approach utilizes approximately 10 feet of the 18-ft wide roadbed to serve all permitted movements from a single lane with nominal shoulders.
- Traffic flow through the intersection is controlled by a traffic actuated signal. The signal operates on seven phases with protected left turns from River Road (SR 167) and split phases for 66th Avenue East, 48th Street East, and the Milroy Bridge. Right turns are prohibited on red for all approaches except the northbound approach of 66th Avenue East to River Road eastbound.

The **Pioneer Way East/Canyon Road East** intersection forms a T-intersection where the existing Canyon Road East connects at about a 60-degree skew angle into Pioneer Way East. The intersection is located on a curve in the alignment of Pioneer Way East, with the Canyon Road East approach entering the intersection from the outside of the curve. Traffic flow through the intersection is controlled by a two-phase traffic actuated signal.

Existing Unsignalized Intersections

The project area consists of 7 unsignalized intersections:

Pioneer Road East and 52nd Street East is an unsignalized T-intersection with stop control on west bound 55th Street East. Each leg of the intersection has one lane in each direction with no designated turn lanes. Turning radiuses are flared to accommodate the skew-angled intersection.

52nd Street East/66th Avenue East is a ninety-degree T-intersection with 52nd Street East forming the intersection's west leg. Each leg of the intersection has one approach and one departure lane.

North Levee Road/Milroy Bridge (66th Avenue East) is a ninety-degree, three-legged intersection with the bridge forming the intersection's south leg. Each of the intersection's legs maintains one approach and one departure lane with stop controls on all approaches (3-way stop).

North Levee Road/70th Avenue East is a three-legged intersection with 70th Avenue East forming the intersection's north leg. Each of the intersection's legs maintains one approach and one departure lane. Painted islands exist on the southbound approach of 70th Avenue East providing a designated right-turn lane for westbound traffic to North Levy Road and a designated right-turn lane for westbound North Levy Road to northbound 70th Avenue East. The southbound approach from 70th Avenue East is stop controlled for left turns and yield controlled for right turns from the designated right-turn lane.

70th Avenue East/48th Street East is a three-legged intersection with 48th Street East forming the intersection's east leg. Each of the intersection's legs maintains one approach and one departure lane. The westbound approach from 48th Street East is stop controlled. A commercial driveway has recently been constructed aligned with 48th Street East, with one lane in and one lane out. The addition of this driveway makes the intersection operate very much like a cross intersection, although the driveway does not have any positive control (no stop or yield sign.)

70th Avenue East/45 Street Ct E is a three-legged intersection with 45th Street Ct E forming the intersection's east leg. Each of the intersection's legs maintains one approach and one departure lane. The westbound approach from 45th Street Ct E is stop controlled.

Appendix C – References

Berger/Abam Engineers Inc., Corridor Design Report, Volume 1 of 2 – Text and Appendixes, Canyon Road East Northerly Extension, Canyon Road East to70th Avenue East CRP Nos. 5369,5498, 5643, 5644, and 5645.

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