Appendix L

Vehicle Traffic Analysis

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Vehicle Traffic Analysis

This appendix provides details of the analysis of vehicle traffic and safety in the study area that extends along the Puget Sound & Pacific Railroad (PS&P) rail line from the project site to Centralia. Specifically, this appendix describes vehicle grade-crossing delay and safety and emergency vehicle access under existing conditions, the no-action alternative, and the proposed action. The specific PS&P rail line grade crossings considered in the analysis are presented in Attachment L-1, *Vehicle Traffic Modeling.*

Attachment L-1 also describes how impacts were evaluated and the sources of information used to complete the analysis.

Existing Conditions

This section describes the roadways, intersections, and grade crossings in the study area that could be affected by construction and routine operation of the proposed action.

Existing Vehicle Traffic

The transportation system in the study area consists of a network of local roads with some collector and arterial roads. A collector road connects local roads with arterial roads. Arterial roads are high-capacity urban roads that allow vehicles to operate at higher speeds for longer distances (Federal Highway Administration 2012). Estimated vehicle traffic in and around the project site in 2012 was 5,500 vehicles per day (both directions) on Industrial Road. For roadways along the PS&P rail line, 2012 estimates range from 20 vehicles per day to 16,720 vehicles per day in both directions at grade crossings and nearby intersections.

Traffic congestion already exists in many places along area roadways and has been the subject of numerous studies over the past 20 years. For example, the *U.S. 101 Regional Circulation Project Report* (Washington State Department of Transportation 2007) examines congestion along the US Route 101 (US 101) corridor, US Route 12 (US 12), and State Route 109 (SR 109) in Aberdeen, Hoquiam, and Cosmopolis. Intersections at H Street, Heron Street, and Tyler Street, among others, were found to be experiencing congestion issues and moderate levels of vehicle delay with level of service (LOS)[1] designations at or below LOS C. These intersections are predicted to drop to a LOS F by 2030 (Washington State Department of Transportation 2007).

According to the Grays Harbor Council of Governments *Metropolitan and Regional Transportation Plan* (Grays Harbor Council of Governments 2009), traffic along the US 101 corridor between Aberdeen and Hoquiam is becoming more congested due to growth at the Port of Grays Harbor and overall population growth. Some existing traffic congestion issues are further exacerbated by current rail operations and the manual operations at the Wishkah River Bridge, such as at E Heron

[1] Level of service (LOS) refers to the movement of traffic in a particular intersection, with LOS A representing free-flowing traffic, LOS C representing increased congestion, and LOS F representing heavy traffic congestion.

Street. A TIGER Grant[2] proposal was submitted for funding to install a new electronic locking system for the bridge to alleviate some of this congestion (Port of Grays Harbor 2011). A planning study by the Grays Harbor Council of Governments is underway for the East Aberdeen Mobility Project to identify ways to relieve congestion and improve safety along US 12 and potential improvements to access into the Olympic Gateway Plaza (Grays Harbor Council of Governments pers. comm.).

Traffic congestion issues also exist in Centralia along Tower and Pearl Streets at grade crossings, particularly when trains are delayed in entering the BNSF Railway Company (BNSF) main line and wait on the PS&P rail tracks, blocking the grade crossings (Stemkoski pers. comm.). There are similar issues at Reynolds Street in Centralia, but lower annual average daily traffic (AADT) (than on Tower Street and Pearl Street) results in delays that are more limited.

Fire and Emergency Services Response

Fire and emergency services in the study area are listed in Table L-1. In addition to these municipal fire departments, Grays Harbor Fire Protection Districts (FPD) 2, 6, 14, and 15 are near the project site and potentially available to provide personnel and fire apparatus in the event of a transportation-related emergency in accordance with the countywide mutual aid agreement (Grays Harbor County 2007: 4-17). Area fire departments have adopted response time objectives that recognize the American Heart Association's 6-minute window of opportunity for resuscitation and 8-minute flashover window in which an entire space is on fire (City of Centralia and Lewis County Fire Protection District 12 2007).

Table L-1. Existing Fire and Emergency Service Stations along the PS&P Rail Line

Fire/Emergency Medical Services Department	Number of Stations	Number of Calls per Year
Hoquiam City Fire Department	2	3,000
Aberdeen City Fire Department	2	4,696
Cosmopolis City Fire Department	1	Not available
Ocean Shores Fire and Rescue Department	2	2,100
City of Westport	1	300
Markham, FPD 14	1	175
FPD 10, Wishkah	3	Not available
FPD 2, Central Park, Brady Wynoochee	3	900
City of Montesano	1	1,110
FPD 5, Satsop, Porter, Elma	4	600
City of Oakville, FPD 1	1	400
FPD 1, Rochester, Grand Mound	17	31,000
Fords Prairie, FPD 12, City of Centralia (Riverside Fire Dept.)	8	4,100

Sources: Personal communications with Fire Chief Mike Mahnke, Fire District 14; Fire Chief Leonard Johnson, Fire District 2; Fire Chief Dan Prater, Fire District 5; Fire Chief of City of Ocean Shores; Fire Chief Paul Dean, City of Hoquiam; Fire Chief Hubbard, City of Aberdeen; Fire Chief Jeff Troumbley, City of Elma; Fire Chief of Fire District #1.

[2] TIGER stands for Transportation Investment Generating Economic Recovery.

The majority of the fire and rescue departments could encounter grade crossings while responding to some calls, with the exception of the City of Ocean Shores Fire Department, City of Westport Fire Department, FPD 10, City of Cosmopolis, and FPD 14, which are not located near the PS&P rail line. However, these stations could encounter delays at grade crossings if they are responding to a call due to a mutual aid agreement with a fire station located near the PS&P rail line. Several of the FPDs have multiple stations. This analysis focuses on grade crossings near the primary station or designated headquarters.

Urgent care is available at Grays Harbor Community Hospital and Providence Centralia Hospital in Centralia and several local medical clinics, including the Harbor Internal Medicine Clinic, the Family Practice Center of Grays Harbor, the Aberdeen Primary Care, Sea Mar, Black Hills Family Practice Clinic in Elma, Broadway Family Health in Montesano, the Summit Pacific Medical Center in Elma, and Mark Reed Healthcare Clinic in McCleary. Ambulance service is provided by American Medical Response, Rochester Metro, FPD 12, FPD 5, City of Hoquiam, City of Aberdeen, City of Cosmopolis, and Ocean Shores. For more information about fire, emergency response, and medical services related to the increased potential for hazardous materials releases, see Chapter 4, *Environmental Health and Safety*.

Methods

This section describes how impacts were evaluated and the sources of information used to complete the analysis. Additional details are presented in Attachment L-1, *Vehicle Traffic Modeling.*

Roadways and Intersections

Several data sources were used to characterize study area roadways and intersections.

- AADT volumes at the grade crossings identified as potential areas of concern by the Washington State Department of Transportation (WSDOT) were dated from 1986 to 2014. Volumes were factored to reflect future 2017 no-action alternative volumes for operations analysis using the following historic growth rates found in the *Annual Energy Outlook* from the U.S. Energy Information Administration (2014).
    - 1970 to 1995: 3.1% per year
    - 1996 to 2007: 2.0% per year
- After 2007, an assumed growth rate of 1.5% was used (Washington State Department of Transportation 2014a).
- AADT for the private drive crossing was approximated from field observations and the AADT from grade crossings with similar characteristics along the corridor. Adams Street AADT was developed based on volumes found in the 2007 *U.S. 101 Regional Circulation Plan* (Washington State Department of Transportation 2007).
- The 2017 traffic volumes estimated at other key study area grade crossings were compared to volumes found in the *U.S. 101 Regional Circulation Plan* and found to be higher (Washington State Department of Transportation 2007).
- Field observations of the Olympic Gateway Plaza at Chehalis Street and Tyler Street on US 12 provided estimates for midday and evening peak hours.

- Ten years of collision records (2003 to 2013) for the study area were obtained from WSDOT and the Federal Railroad Administration (FRA) (Washington State Department of Transportation 2014a; Federal Railroad Administration 2014a).

These data were used to characterize estimated future vehicle traffic along area roadways adjacent to grade crossings of the PS&P rail line. The vehicle traffic data were then used to calculate average queue length[3] to determine if there were any storage capacity constraints. Queue length was calculated based on the number of vehicles delayed due to gate down times throughout a 24-hour period and an average vehicle length of 20 feet.

Grade-Crossing Delay and Safety

Several data sources were used to characterize grade-crossing delay and safety conditions.

- WSDOT (2014a) and Washington Utilities and Transportation Commission (2014) provided available AADT information. All local government agencies along the PS&P rail line were asked to provide updated AADT data, if available. Updated traffic maps and reports were received from the City of Montesano, City of Elma, Grays Harbor Council of Governments, and City of Aberdeen (Wincewicz pers. comm.; Starks pers. comm.; Grays Harbor Council of Governments pers. comm.). The FRA highway/rail database was used as a source of AADT data as well (Federal Railroad Administration 2014a). For S. Fleet St., Tyler St., S. Chehalis, S. Newell, E Heron Street, Dairy Queen Entrance, and the McDonald's Entrance crossings, 2014 traffic count data for peak hour levels was used and extrapolated to estimate AADT (based on 10 times the peak hour).
- Forecasted future increases in vehicle traffic.
- Existing train traffic (average number of trains per day) and operating speed on the PS&P rail line (Federal Railroad Administration 2014a).
- Future train traffic as estimated by the applicant (Chapter 2, *Proposed Action and Alternatives*).
- Train characteristics, including length and speed.
- Grade crossings on the BNSF main line, Maple Street M1, E Main Street M1, and E Locust Street M1, baseline conditions were assumed to be 40 trains per day operating at 40 miles per hour (mph), on average (Federal Railroad Administration 2014a).
- Grade-separated crossings are not included for further analysis because the roadway and train traffic are separated by either a bridge or a tunnel and train traffic does not affect vehicle delay or safety. It was assumed that train speed would increase to 20 mph through the gauntlet.[4]

Delay

For each grade crossing analyzed, the average delay per vehicle in a 24-hour period is based on the estimated time each train would block the grade crossing, the average number of trains per day, and grade-crossing characteristics (e.g., AADT, number of roadway lanes). Average delays were estimated for the no-action alternative and the proposed action. The average gate-down time at a

[3] Queue length is the total average length of delayed vehicles per lane.
[4] The gauntlet is an a series of grade crossings in Aberdeen that include E Heron Street, Newell Street, S Chehalis Street, Dairy Queen Entrance, McDonald's Entrance, Tyler Street, and Fleet Street.

grade crossing and the estimated AADT values for 2017 and 2037 were used to obtain a conservative estimate of average vehicle delay per grade crossing. This value was then used to determine the anticipated LOS at each grade crossing.

LOS designations provide a qualitative measure of traffic flow. While a designation of A indicates free-flowing traffic, a designation of F indicates that traffic is constantly slowed at that location (Table L-2). According to WSDOT LOS standards for peak hours, urban highways should meet a LOS of D and for rural highways a LOS of C in Grays Harbor County and Thurston County (Washington State Department of Transportation 2009); these conditions are currently being met on all of the area roadways.

Table L-2. Level of Service Designations

Level of Service	Average Delay for All Vehicles (seconds/vehicle)
A	≤10
B	>10 and ≤20
C	>20 and ≤35
D	>35 and ≤55
E	>55 and ≤80
F	>80

Source: Transportation Research Board 2010

Peak Hour Delay and LOS Sensitivity Analyses

To supplement the analysis of estimated vehicle delay on a daily basis, delay at each grade crossing was analyzed in two sensitivity analyses for 2017 and 2037: peak hour vehicle traffic and increases in rail traffic compared to impacts on WSDOT LOS standards. For the peak hour analysis, it was assumed that an oil train would pass over the grade crossings during the evening peak hour, and vehicle traffic during the evening peak hour would be 11.5% of average daily traffic, based on available WSDOT traffic count data, except that location-specific peak hour traffic count data were used where available. The LOS sensitivity analysis examined the incremental train traffic growth above the baseline traffic at grade crossings that would cause the LOS to decline below level D or cause average queue lengths to exceed the available vehicle storage capacity.

Safety

Safety at each grade crossing was analyzed by estimating future accident frequency and the corresponding predicted interval between accidents with and without the addition of project-related rail traffic. The FRA GradeDec.Net Model was used to analyze public highway-rail grade crossings (Federal Railroad Administration 2014b) and the general accident prediction formula was used to analyze private highway-rail grade crossings. The GradeDec.Net model accounts for accident history and frequency of trains at existing grade crossings, volume of vehicle traffic, existing safety devices at the grade crossings, and other factors to determine the potential impacts of an increase in rail traffic. The model also considers the existing rail traffic volumes and the additional proposed rail traffic determined by detailed train modeling. Estimates of AADT for vehicles at each grade crossing were calculated for 2012, 2017, and 2037 based on data obtained from local agencies, WSDOT, and FRA. The general accident prediction formula used was based on FRA's *Rail-Highway Crossing Resource Allocation Procedure User's Guide* taking into account the grade crossings protection, train

speed, number of trains per day, road surface, and number of roadway lanes (Federal Railroad Administration 1987).

Impacts of the No-Action Alternative

Under the no-action alternative, the applicant would continue to operate its existing facility as described in Chapter 2, Section 2.1.2.2, *Existing Operations*. Existing rail operations that serve the project site and the immediately surrounding industrial area currently contribute to existing vehicle delays at both grade crossings and area roadways intersections. Traffic under the no-action alternative would continue to experience vehicle delays and grade-crossing safety concerns that are expected to slightly increase over the analysis period (2017 to 2037), primarily as the result of predicted growth in the region (i.e., increases in vehicle traffic).

Under the no-action alternative, AADT is estimated to increase annually at an average rate of 1.5% (U.S. Energy Information Administration 2014). On Industrial Road near the project site, AADT would range from an estimated 5,803 vehicles per day in 2017 to 7,456 vehicles per day (both directions) in 2037.

Grade-Crossing Delay

Motorists, including emergency vehicle operators, would continue to experience delays in the study area as the result of train movements under the no-action alternative. It is estimated that the average delay would range from less than 1 to 42 seconds per vehicle in 2017 and from less than 1 to 29 seconds per vehicle in 2037 for grade crossings along the PS&P rail line. The LOS designation for most grade crossings would range from LOS A to LOS D in 2017 and LOS A to LOS C in 2037 (Attachment L-1, *Vehicle Traffic Modeling*). Table L-3 presents estimated no-action conditions in 2017 and 2037 for a subset of grade crossings, including those that are currently at or have the greatest potential to fall below WSDOT standards. The complete results of the vehicle analysis are presented in Attachment L-1.

Table L-3. No-Action Alternative: LOS Designations for Key Grade Crossings in the Study Area

FRA Crossing ID	Street Name	City	2017 AADT	2037 AADT	Road Type	2017 LOS[a]	2037 LOS[b]
922990N	Industrial Rd	Aberdeen	5,795	7,494	Urban Minor Arterial	B	B
092551K	H Street[c]	Aberdeen	879	1,136	Urban Local	C	C
096695D	E Heron St	Aberdeen	3,452	4,464	Urban Local	D	C
096693P	Newell St	Aberdeen	649	839	Urban Local	C	B
096691B	S Chehalis St	Aberdeen	4,906	6,344	Urban Local	C	B
096689A	Dairy Queen Entrance	Aberdeen	157	216	Urban Local	B	A
096690U	McDonald's Entrance	Aberdeen	1,067	1,380	Urban Local	B	A
096029N	Tyler St	Aberdeen	4,048	5,235	Urban Local	B	A
096688T	Fleet St	Aberdeen	1,611	2,083	Urban Local	B	A

[a] WSDOT LOS Standards for peak-hours, urban highways should meet a LOS of D and for rural highways a LOS of C in Grays Harbor County and Thurston County (Washington State Department of Transportation 2009).

[b] Crossings 096691B, 096689A, 096690U, 096029N, and 096688T improve in 2037 due to assumed higher train speeds. These improvements allow for these grade crossings to meet or exceed the WSDOT urban highway LOS standard.

[c] Existing traffic volume for H Street is from 1986 and extrapolated to the analysis year of 2017 or 2037. Because existing land uses near the H Street grade crossing are currently vacant, actual average daily traffic at this grade crossing would be substantially lower than shown in this table. For this reason, H Street is not included in the potential vehicle delay impacts in Section 3.16, *Vehicle Traffic and Safety*.

LOS = level of service; WSDOT = Washington State Department of Transportation; FRA = Federal Railroad Administration; AADT = annual average daily traffic

In general, modeling showed that average delay (as measured by seconds of delay per vehicle) in a 24-hour period would decrease at grade crossings near Olympic Gateway Plaza over the 20-year analysis period because of infrastructure improvements. For some of the grade crossings, LOS would improve, as infrastructure improvements would allow an increase in train speed over the Wishkah River bridge so that trains would move through grade crossings faster, thereby reducing the average vehicle delay. As discussed in Section 3.15, *Rail Traffic*, additional projects under consideration could contribute to some improvements in vehicle delay. However, these projects were not included in the rail or vehicle modeling for the reasons described in Section 3.15, *Rail Traffic*. Additionally, future roadway improvements could further improve congestion and improve LOS. For example, as mentioned previously, possible options to alleviate congestion along US 12 in Aberdeen related to the East Aberdeen Mobility Project have not yet been determined and were not considered in transportation modeling.

Even if vehicle delay could be reduced by infrastructure improvements, delays in future years under the no-action alternative could still increase compared with existing conditions. Emergency vehicles could experience grade-crossing delays that affect response time. Under the no-action alternative, the chance of any vehicle (including an emergency response vehicle) experiencing some delay from a train occupying a grade crossing would range from 0.11 to 4.95% in 2017 and from 0.22 to 4.57% in 2037 along the PS&P rail line. The potential for delay further depends on where the call is located in relation to the PS&P rail line and the dispatch station, and the availability of alternate routes if a train occupies a grade crossing at the time of the call. Under the no-action alternative, emergency responders would experience additional delay, beyond existing conditions, due to PS&P rail line

operations, at some locations such as at the Olympic Gateway Plaza entrance grade crossings in Aberdeen.

During peak traffic hours (typically from 4:00 pm to 5:00 pm), roadways experience higher volumes of vehicles due to commuting schedules. A sensitivity analysis was conducted to evaluate the potential vehicle delay in the event that one grain train (approximately 6,279 feet in length) operating over public, grade crossings during peak hour traffic for the no-action alternative.[5] Baseline vehicle delay is predicted to range from 12 to 919 seconds per vehicle in 2017 and 20 to 4,500 seconds per vehicle in 2037 in Aberdeen. The higher delay estimates occur at grade crossings affected by switching and train building activities near Poynor Yard. Estimated baseline vehicle delay ranged from 5 to 6 seconds per vehicle in Elma and Montesano; 25 to 319 seconds per vehicle in Centralia; and 4 to 23 seconds per vehicle in Satsop, Malone, Porter, Oakville, and Rochester in 2017; and from 5 to 7 seconds per vehicle in Elma and Montesano; 25 to 116 seconds per vehicle in Centralia; and 4 to 50 seconds per vehicle in Satsop, Malone, Porter, Oakville, and Rochester in 2037.

Vehicle Delay at Adjacent Intersections

Increased vehicle delay from trains blocking grade crossings can have secondary impacts on nearby intersections. As vehicles begin to queue while waiting for the grade crossing to open, increased roadway congestion can affect adjacent intersections and cause additional congestion at those intersections.

Under the no-action alternative, AADT at arterial roads is predicted to range from 5,795 vehicles per day to 17,845 vehicles per day (both directions) in 2017 and from 4,788 vehicles per day to 23,076 vehicles per day (both directions) in 2037, depending on the specific intersection in question. AADT at collector roads is predicted to range from 293 vehicles per day to 13,755 vehicles per day (both directions) in 2017 and from 379 vehicles per day to 17,788 vehicles per day (both directions) in 2037. AADT at local roads is predicted to range from 21 vehicles per day to 6,391 vehicles per day (both directions) in 2017 and from 27 vehicles per day to 8,265 vehicles per day (both directions) in 2037. Attachment L-1, *Vehicle Traffic Modeling*, presents delay information for the specific intersections studied.

AADT and existing gate down time at grade crossings was used to calculate the average queuing length at grade crossings. Tables L-4 and L-5 show existing queuing lengths that exceed storage capacity under the no-action alternative for key intersections in 2017 and 2037, respectively. As mentioned previously, information for all studied intersections is presented in Attachment L-1, *Vehicle Traffic Modeling*. Intersections that are already experiencing vehicle delays and would be most affected are located in Centralia and Aberdeen; however, an increase in queuing from 2017 to 2037 is expected for many intersections in the study area under the no-action alternative due to anticipated growth in vehicle traffic. The complete results of the vehicle analysis are presented in Attachment L-1.

During an 8-hour observation on December 11, 2014, no train crossings were observed. Queue lengths were estimated by sampling the traffic entering and exiting the Olympic Gateway Plaza at Chehalis Street and Tyler Street on US 12 during midday and evening peak hours. Observed queuing

[5] One grain-train passby is used for most crossings with the exception of Industrial Road, Myrtle Street, N Maple Street, and W 1st Street, which do not have baseline grain traffic. Therefore, those crossing used an average of potential proposed action traffic for gate downtime per event.

and intersection operations corroborated the modeled 2017 no-action alternative operations in Aberdeen. The lack of pedestrian facilities and active grade-crossing gate protection in several locations appeared to pose a safety issue to vehicles turning right on red lights and pedestrians.

The queue length for most grade crossings was estimated using 2014 traffic count data with the exception of the Dairy Queen and McDonald's Entrances, which were estimated using grade crossings adjacent to the Olympic Gateway Plaza and distributed onto US 12 approaches based on evening peak hour traffic volumes from the 2007 *U.S. 101 Regional Circulation Plan* (Washington State Department of Transportation 2007). As shown, grade crossings at the Olympic Gateway Plaza in east Aberdeen and inside the plaza experience significant queuing on US 12 under existing conditions and would continue to do so under the no-action alternative.

Table L-4. 2017 No-Action Alternative Queue Estimates

Roadway Name	USDOT Crossing #	Available Storage Length (ft)				Estimated Queue Length[a] (ft)			
		WBL	EBTR	NB	SB	WBL	EBTR	NB	SB
Tower	092546N	-	-	360	-	-	-	**480**	-
Pearl	092547V	-	-	-	440	-	-	-	**820**
Fleet	096688T	350	290	80	100	160	20	**180**	0
Tyler	096029N	150	660	150	100	60	140	**220**	20
Chehalis	096691B	250	300	120	100	80	200	**300**	40
Newell	096693P	-	460	100	-	-	100	100	-
Heron	096695D	-	1000	-	-	-	**1080**	-	-
Port Industrial[b]	096711K	1200	1360	-	-	500	500	-	-

[a] Estimated Queue Length (feet) based on existing distribution of PM peak hour traffic volumes and the length of the average queue.
[b] Portland Industrial Road is an east-west street. Queuing values listed are eastbound and westbound through lengths.
WBL = westbound left; EBTR = eastbound through right; NB = northbound; SB = southbound

Table L-5. 2037 No-Action Alternative Queue Estimates

Roadway Name	USDOT Crossing #	Available Storage Length (ft)				Estimated Queue Length[a] (ft)			
		WBL	EBTR	NB	SB	WBL	EBTR	NB	SB
Tower	092546N	-	-	360	-	-	-	**620**	-
Pearl	092547V	-	-	-	440	-	-	-	**1060**
Fleet	096688T	350	290	80	100	140	20	**160**	0
Tyler	096029N	150	660	150	100	40	120	**200**	20
Chehalis	096691B	250	300	120	100	60	160	**260**	20
Newell	096693P	-	460	100	-	-	100	100	-
Heron	096695D	-	1000	-	-	-	**1,060**	-	-
Port Industrial[b]	096711K	1200	1360	-	-	660	660	-	-
Industrial Rd	922990N	510	530	-	-	**780**	**780**	-	-
W 1st St	808713U	-	-	320	240	-	-	240	240

[a] Estimated Queue Length (ft) based on existing distribution of PM peak hour traffic volumes and the length of the average queue.
[b] Portland Industrial Rd is an east-west street. Queuing values listed are eastbound and westbound through lengths.
Bold values exceed available storage.

Grade-Crossing Safety

Under the no-action alternative, the predicted frequency of a grade-crossing accident—typically a train and motor vehicle collision—would increase slightly over the 20-year analysis period because of the anticipated increase in AADT at grade crossings. The predicted interval between accidents would range from 40 to 454 years in 2017 and from 37 to 410 years in 2037 and from 18 to 742 years in 2017 and from 16 to 669 years in 2037 for all the grade crossings along the PS&P rail line. On the BNSF main line, the interval between predicted accidents for the Maple Street (092521T), E Main Street (092520L), and E Locust Street (092519S) grade crossings for the no-action alternative would range from 32 to 34 years in 2017 and from 31 to 33 years in 2037. The results of predicted accident formula and the GradeDec.Net Model for accident intervals at existing grade crossings are provided in Attachment L-1,*Vehicle Traffic Modeling*.

As with predictions for vehicle delay, accident frequencies would generally improve over the 20-year period for some grade crossings. This is due to improvements such as grade crossing protections that were assumed as part of the modeling (Table L-6). Although some grade crossing closures are likely over the 20-year analysis period, the analysis excluded any proposed closings, including the one currently proposed at Glenn Road (096657U). Additionally, as mentioned above, improvements (grade closures or separation) under the East Aberdeen Mobility project were not included in the detailed modeling, but would likely improve both delay and safety at intersections surrounding the Olympic Gateway Plaza.

Table L-6. Grade Crossing Infrastructure Projects Planned but Not Funded –No-Action Alternative (2017 and 2037)

Project Title[a]	Year	Project Lead	Location	Brief Description	Source
Tower Street Crossing	2017	WSDOT	Tower Street grade crossing with the PS&P rail line in Centralia	Add early warning system and crossing gates. Construction anticipated being complete by 2015	Stemkoski pers. comm.
Pearl Street Crossing	2017	WSDOT	Pearl Street grade crossing with the PS&P rail line in Centralia	Add early warning system and crossing gates. Construction anticipated being complete by 2015	Stemkoski pers. comm.
Devonshire Road Railroad Crossing Protection	2037	Grays Harbor County	US 12 Milepost 7.09 to 7.10	Install concrete crossing, gates, and signs (currently flashers)	Washington State Department of Transportation 2014b
Glenn Road Railroad Crossing Closure	2037	Grays Harbor County	US 12 milepost 0.0 to 0.2	Remove existing crossing and build new access road and cul-de-sac	Washington State Department of Transportation 2014b
Newman Creek Road Railroad Crossing Protection	2037	Grays Harbor County	US 12 milepost 0.21 to 0.22	Install signs and gates (currently passive)	Washington State Department of Transportation 2014b
Calder Road Railroad Crossing Protection	2037	Grays Harbor County	US 12 milepost 0.26 to 0.27	Install signs and gates (currently passive)	Washington State Department of Transportation 2014b

[a] Listed projects are currently planned projects that have not secured funding. These projects are listed under WSDOT's Six Year Transportation Improvement Plan for 2014 to 2019. These projects may or may not be funded after 2019.

WSDOT = Washington State Department of Transportation; PS&P = Puget Sound & Pacific Railroad

Impacts of the Proposed Action

This section describes the vehicle traffic and safety impacts that could occur in the study area as a result of construction and routine operation of the proposed action.

Construction

As described in Chapter 2, *Proposed Action and Alternatives*, construction of the proposed action could occur in two phases, with Phase 1 lasting 10 to 12 months and requiring approximately 86 workers and Phase 2 lasting approximately 10 months and requiring approximately 49 workers. It is assumed that for every one worker there would be one trip to and one trip from the project site, so 86 construction workers during Phase 1 would create 172 vehicle trips. Additional vehicle trips to and from the site associated with this temporary increase in construction workers and the delivery of construction equipment and materials could also increase vehicle delays at intersections

surrounding the project site. However, the potential for additional construction-related vehicle trips to affect vehicle delay times, including emergency vehicle delay times, would be minimal.

AADT on Industrial Road is estimated to be 7,495 vehicles by 2017. Construction-related vehicle traffic would result in a minimal increase to area AADT levels and would not cause a change in LOS designations for any grade crossings. Additionally, construction-related traffic would likely take varying routes to the project site and workers would have fluctuating schedules that would further spread out the potential for impacts over space and time. Increased rail traffic from delivery of construction materials could cause vehicle delays to increase. However, the anticipated delay would be typically be very similar to existing conditions because construction equipment and materials, if delivered by train, would likely occur in the form of additional cars on existing freight trains and would not increase the average number of trains per day to any appreciable extent.

Operations

Onsite

Operation of the proposed action would result in an additional 50 employee trips per day and the use of additional maintenance vehicles at maximum throughput. This would result in a minimal increase to area AADT levels and would not cause a change in LOS designations for any grade crossings. As noted in Chapter 2, *Proposed Action and Alternatives*, transport of crude oil associated with the proposed facilities would rely on rail and vessel transport. It is anticipated that tanker truck traffic would remain the same as for existing conditions and would not affect AADT on surrounding roadways. The potential grade-crossing safety and delay impacts of increased rail traffic related to the proposed action are discussed below.

Rail

Grade-Crossing Delay

As described in Chapter 2, *Proposed Action and Alternatives*, operation of the proposed action would result in increased rail traffic with increased blockages at grade crossings along the PS&P rail line (Section 3.15, *Rail Traffic*). Motorists, including emergency vehicle operators, would experience an increase in vehicle delay at grade crossings during operation of the proposed rail line. The results for all grade crossings along the PS&P rail line are presented in Attachment L-1, *Vehicle Traffic Modeling*.

The increase in the average delay compared to the no-action alternative could range from 7 to 56 additional seconds per vehicle in 2017 and 7 to 55 additional seconds per vehicle in 2037 in Aberdeen. The highest estimated delays of 56 additional seconds per vehicle would occur as a result of switching and train-building activities near Poynor Yard. The increase in the average delay compared to the no-action alternative could average 1 additional second per vehicle in Elma and Montesano; 4 additional seconds per vehicle in Centralia; 2 additional seconds per vehicle in Satsop, Malone, Porter, Oakville, and Rochester in 2017; and an average of 1 additional second per vehicle in Elma and Montesano; 6 additional seconds per vehicle in Centralia; and 2 additional seconds per vehicle in Satsop, Malone, Porter, Oakville, and Rochester in 2037.[6] Some intersections would not be

[6] Train switching movements allow for a train to be broken down into or assembled from smaller groupings of cars and for railcars to be moved between a rail yard and customer facilities.

affected by increased rail traffic related to the proposed action (0 seconds of change), but others could be substantially affected (up to 56 additional seconds of delay). As a result, the LOS designation for most grade crossings would change. Some would drop to LOS E and F, the lowest designations that indicate substantial congestion. The intersections that would be most notably affected are presented in Table L-7.

Of the 81 grade crossings modeled in the study area, nine would experience a decrease in the LOS designation due to the increased train traffic from the proposed action (see Attachment L-1for a complete list of grade crossings and additional delay metrics). These nine grade crossings would experience higher average gate down times per train due to rail switching maneuvers and activities at the Port's facilities to the west. As shown in Table L-7, the grade crossings of H Street, E Heron Street, and Newell Street in Aberdeen would not meet WSDOT operating standards if maximum throughput capacity occurs under 2017 conditions. This assumes none of the planned infrastructure improvements on the PS&P rail line would have been implemented. If the proposed oil terminal facility were to operate at half capacity in 2017, H Street would be the only grade crossing that would not meet WSDOT operating standards.

As noted under the 2037 condition, with the incorporation of PS&P rail line improvements that could allow for increased speeds in East Aberdeen (up to 20 mph in some locations), the predicted declines in LOS would be less than under 2017 conditions. However, as shown in Table L-7, the LOS at H Street still would decline to a level below the WSDOT standard.

The LOS sensitivity analysis determined that, depending on the grade crossing, the incremental increase in train traffic that could be experienced before LOS would decrease below LOS D ranged from 0.4 to 5.8 trains per day in 2017 and 0.6 to 5.3 trains per day in 2037.

Table L-7. Proposed Action: LOS Designations At or Below WSDOT Standards[a]

FRA Crossing ID	Street Name	City	AADT 2017	AADT 2037	Road Type	No Action 2017 LOS	2017 LOS	2017 LOS 50%	No Action 2037 LOS	2037 LOS
922990N	Industrial Rd	Aberdeen	5,795	7,494	Urban Minor Arterial	B	D	C	B	D
092551K	H Street[b]	Aberdeen	879	1,136	Urban Local	C	F	E	C	F
096695D	E Heron St	Aberdeen	3,452	4,464	Urban Local	D	E	D	B	D
096693P	Newell St	Aberdeen	649	839	Urban Local	C	E	D	B	D
096691B	S Chehalis St	Aberdeen	4,906	6,344	Urban Local	C	D	C	B	C
096689A	Dairy Queen Entrance	Aberdeen	157	216	Urban Local	B	D	C	A	C
096690U	McDonald's Entrance	Aberdeen	1,067	1,380	Urban Local	B	D	C	A	C
096029N	Tyler St	Aberdeen	4,048	5,235	Urban Local	B	D	C	A	C
096688T	Fleet St	Aberdeen	1,611	2,083	Urban Local	B	D	C	A	C

[a] WSDOT LOS Standards for peak-hours, urban highways should meet a LOS of D and for rural highways a LOS of C in Grays Harbor County and Thurston County (Washington State Department of Transportation 2009).

[b] Existing traffic volume for H Street is from 1986 and extrapolated to the analysis year of 2017 or 2037. Because existing land uses near the H Street grade crossing are currently vacant, actual average daily traffic at this grade crossing would be substantially lower than shown in this table. For this reason, H Street is not included in the potential vehicle delay impacts in Section 3.16, *Vehicle Traffic and Safety*.

LOS = level of service; WSDOT = Washington State Department of Transportation; FRA = Federal Railroad Administration; AADT = annual average daily traffic

As discussed in Section 3.15, *Rail Traffic*, additional improvements to the PS&P rail line infrastructure have limited potential to alter rail traffic patterns such that blocked grade crossing time could be substantially reduced. The primary mechanisms by which vehicle delay could be minimized are altering how the PS&P rail line operates within the existing infrastructure (e.g., switching movements at night) and constructing grade-separated intersections. These measures would require the participation of a broad group of stakeholders in coordination with the ongoing regional transportation planning efforts that are focused on addressing existing traffic concerns. As noted in *No-Action Alternative*, many of these areas show traffic delays under existing conditions and would continue to do so regardless of the proposed action.

In addition to impacts along the PS&P rail line, grade crossings in Centralia on the BNSF main line near the intersection with PS&P rail line could be affected as trains move from the main line onto the PS&P rail line. These intersections include Maple Street M1, E Main Street M1, and E Locust Street M1, but they were not subject to detailed modeling due to the higher volume of existing train traffic (approximately 40 trains per day) and higher average train speeds (typically about 40 mph) than currently operated on the PS&P rail line. Although these grade crossings could experience increased train traffic as a result of the proposed action, the increase would be small in comparison to the existing conditions at these grade crossings. As is the case today, for trains entering or leaving the PS&P rail line, project-related trains would take about 10 minutes to clear these grade crossings, but would contribute to minor increases in vehicle delay per day (Attachment L-1, *Vehicle Traffic Modeling*).

Grade-Crossing Delay for Peak Hour Traffic

During peak traffic hours (typically from 4:00 pm to 5:00 pm), roadways experience higher volumes of vehicles due to commuting schedules. A sensitivity analysis was conducted to evaluate the potential vehicle delay in the event that an oil train (approximately 7,419 feet in length) operated over public, grade crossings during peak hour traffic. This sensitivity analysis demonstrates that where gate downtimes would be substantial, long peak-hour vehicle queues would cause a large increase in the average delay per vehicle. Estimated increases in average vehicle delay range from 290 to 1,497 additional seconds per vehicle in 2017 and from 20 to 9,180 additional seconds per vehicle in 2037 in Aberdeen. Higher estimates of delay are due to switching activities at Poynor Yard. Estimated increases in average vehicle delay ranged from 5 to 8 additional seconds per vehicle in Elma and Montesano; 39 to 407 additional seconds per vehicle in Centralia; and 6 to 41 additional seconds per vehicle in Satsop, Malone, Porter, Oakville, and Rochester in 2017; and 5 to 8 additional seconds per vehicle in Elma and Montesano; 39 to 148 additional seconds per vehicle in Centralia; and 6 to 88 additional seconds per vehicle in Satsop, Malone, Porter, Oakville, and Rochester in 2037.

Grade-Crossing Delay for Emergency Vehicles

Emergency vehicles would experience grade-crossing delays due to increased vehicle traffic under the proposed action. For vehicles that use the grade crossings between Aberdeen and Centralia, the chance of a vehicle (including an emergency response vehicle) experiencing some delay from a train occupying a grade crossing would result in an incremental increase in possible conflicts compared to the no-action alternative. The predicted increase in potential for delay in Aberdeen would range from 0.70 to 9.4% under 2017 conditions and 0.70 to 9.2% under 2037 conditions. The highest potential delay increase of 9.4% would occur as a result of switching and train building activities near Poynor Yard. The predicted increase in potential for delay in other surrounding communities, including Elma, Montesano, Satsop, Centralia, Malone, Porter, Oakville, and Rochester, would range from 0.28 to 0.92% under 2017 and 2037 conditions. The incidence is expected to be slightly lower over the course of the 20-year analysis period due to the incorporation of infrastructure improvements.

The potential for delay of an emergency vehicle further depends on where the call is located in relation to the PS&P rail line and the dispatched station, and the availability of alternate routes if a train occupies a grade crossing at the time of the call. Emergency responders at some locations, such as the Olympic Gateway Plaza entrance grade crossings in Aberdeen, would experience additional delay beyond what is currently experienced. Refer to Chapter 4, *Environmental Health and Safety*, for a detailed discussion of increased risks and emergency response for potential hazardous materials releases.

Vehicle Delay at Adjacent Intersections

As noted previously, increased vehicle delay from trains blocking grade crossings can have secondary impacts on nearby intersections. As vehicles begin to queue while waiting for the grade crossing to open, increased roadway congestion can affect adjacent intersections and cause additional congestion at those intersections. Grade crossings along the PS&P rail line that are most likely to be affected by the proposed action are located primarily in Aberdeen.

Tables L-8 and L-9 show that the average queue length at the Port Industrial Road (096711K) grade crossing would approximately double compared to the no-action alternative (as shown in Tables L-4

and L-5) due to the lengthy project-related switching movements in 2017 and would not exceed storage capacity under 2037 conditions. With a westbound queue stretching east as far as Division Street, the Port Industrial Road crossing could begin to significantly affect local traffic flow. To mitigate vehicle delays at adjacent intersections from longer queue lengths, the storage capacity could be increased for streets experiencing impacts as a result of the proposed action.

The estimated queue length at grade crossings adjacent to the Olympic Gateway Plaza were distributed onto US 12 approaches based on evening peak hour traffic volumes listed in the 2007 *U.S. 101 Regional Circulation Plan* (Washington State Department of Transportation 2007). Tables L-8 and L-9 also show that grade crossings at the Olympic Gateway Plaza in east Aberdeen experience significant queuing on US 12 and inside the plaza itself. As shown, rail traffic associated with the proposed action, when combined with existing rail traffic, is expected to generate average queues that would exceed the available storage length Fleet Street, Tyler Street, and Chehalis Street. However, queue lengths under the proposed action compared to those anticipated under the no-action alternative (Tables L-4 and L-5) show relatively small increases (a few vehicles). In fact, queue lengths are exceeded without the proposed action

In Centralia, vehicle queues at both Tower Street and Pearl Street (also known as D Street) grade crossings would exceed the available storage under the 2017 and 2037 no-action alternative. With the addition of proposed action rail traffic, increases to average vehicle queues would be minor (a few vehicles).

Table L-8. 2017 Proposed Action Queue Estimates

Roadway Name	USDOT Crossing #	Available Storage Length (ft)				Estimated Queue Length[a] (ft)			
		WBL	EBTR	NB	SB	WBL	EBTR	NB	SB
Tower	092546N	-	-	360	-	-	-	**500**	-
Pearl	092547V	-	-	-	440	-	-	-	**860**
Fleet	096688T	350	290	80	100	200	20	**220**	0
Tyler	096029N	150	660	150	100	60	180	**280**	40
Chehalis	096691B	250	300	120	100	100	240	**360**	40
Newell	096693P	-	460	100	-	-	120	**120**	-
Heron	096695D	-	1,000	-	-	-	**1,240**	-	-
Industrial Rd	922990N	510	530	-	-	880	**880**	-	-
W 1st St	808713U	-	-	320	240	-	-	**380**	**380**

[a] Estimated Queue Length (ft) based on existing distribution of PM peak hour traffic volumes and the length of the average queue.
Bold values exceed available storage.

Table L-9. 2037 Proposed Action Queue Estimates

Roadway Name	USDOT Crossing #	Available Storage Length (ft)				Estimated Queue Length[a] (ft)			
		WBL	EBTR	NB	SB	WBL	EBTR	NB	SB
Tower	092546N	-	-	360	-	-	-	**660**	-
Pearl	092547V	-	-	-	440	-	-	-	**1,120**
Fleet	096688T	350	290	80	100	200	20	**220**	0
Tyler	096029N	150	660	150	100	60	180	**280**	40
Chehalis	096691B	250	300	120	100	100	240	**360**	40
Newell	096693P	-	460	100	-	-	120	**120**	-
Heron	096695D	-	1000	-	-	-	**1,340**	-	-
Port Industrial[b]	096711K	1200	1360	-	-	**1300**	1300	-	-
Industrial Rd	922990N	510	530	-	-	**1,140**	**1,140**	-	-
W 1st St	808713U	-	-	320	240	-	-	**480**	**480**

[a] Estimated Queue Length (ft) based on existing distribution of PM peak hour traffic volumes and the length of the average queue.
[b] Portland Industrial Rd is an east-west street. Queuing values listed are eastbound and westbound through lengths.
Bold values exceed available storage.

Many of these areas are already problems under existing conditions and would continue to be so regardless of the proposed action. A sensitivity analysis was conducted for peak hour traffic estimating vehicle queue lengths using a simulation software (Synchro) for one oil train passby during the evening peak hour traffic at the following intersections.

- Fleet Street and US 12
- Tyler Street and US 12
- Chehalis Street and US 12
- Newell Street and US 12
- Heron Street and S Harbor Street

The simulation modeling conducted analyzed four scenarios of the impacts of inbound and outbound train passbys. Scenarios were generated using the existing roadway lane configurations and traffic signal timing as well as an optimized lane configuration and signal timing to improve overall vehicle operations during/after a train pass by event. All scenarios used future 2017 intersection volumes. The scenarios are as follows.

- 2017 Existing Lanes and Timing PM Peak Hour (Inbound)
- 2017 Existing Lanes and Timing PM Peak Hour (Outbound)
- 2017 Optimized Lanes and Timing PM Peak Hour (Inbound)
- 2017 Optimized Lanes and Timing PM Peak Hour (Outbound)

The Synchro modeling results determined that the railroad crossing at Heron Street conflicts with a significant amount of Wishkah Mall traffic volume headed eastbound on US 12 and serves as the bottleneck for the entire corridor. During an outbound train event (to the project site), the PM peak hour queue spills beyond the model limits to the upstream traffic signal at F Street. During an inbound train event, the queue length at Heron Street experiences some improvement after signal timing is optimized to prioritize the eastbound flow of traffic. However, queues remain in excess of 1,000 feet.

At Chehalis Street, all available storage is filled between Harbor Street and Chehalis Street. Vehicles turning right into Wishkah Mall have few options during an outbound train event, which lasts nearly half the peak hour. The signal at Chehalis Street operates as a meter for the downstream intersections of Tyler and Fleet Street, which explains the shorter queue estimate at each of these intersections.

The optimized outbound scenario shows a longer queue estimate at Tyler and Fleet Street compared to the existing scenario because the new eastbound right turn pocket and increased cycle length at Chehalis Street allow higher volume throughput after the railroad crossing at Chehalis Street opens. This additional volume waits for the outbound train to clear the gate at Tyler Street before it can be serviced by the Tyler Street signal.

Queues in the westbound left turn pockets occur because of a single train event in the PM peak hour. At Tyler and Fleet Street during the outbound train event, the available storage length is filled and queues spill back into the westbound through movement. However, only Tyler Street experiences this problem during the shorter inbound train gate downtime. The optimized westbound left queues are longer than existing queues due to the direct conflict with the eastbound through movement. In an attempt to minimize eastbound queuing, available green time was allocated to the eastbound through movement, and resulted in longer westbound queuing.

Grade-Crossing Safety

Increased rail traffic related to the proposed action could increase the frequency of accidents along the PS&P rail line compared to the no-action alternative. The magnitude of the increase would be determined by the volume of train traffic and growth in AADT. The impacts on grade-crossing safety, specific to each grade crossing for accidents involving trains and vehicles, are summarized in Attachment L-1, *Vehicle Traffic Modeling.* Data in the attachment provide the total predicted accident rate, predicted intervals between accidents, and the decrease in years between the predicted intervals in the analysis year versus the no-action alternative for all the grade crossings along the PS&P rail line.

It is estimated that the predicted interval between accidents under the proposed action would decrease by 4.3 years to an interval of 52.9 years in 2017 and by 4 years to an interval of 43.8 years in 2037 compared to the no-action alternative. The range excludes any proposed closings of grade crossings, including the grade crossing at Glenn Road (096657U). The decrease in the predicted interval between accidents under the proposed action would range from 2.6 to 69.6 years in 2017 and from 1.7 to 62.7 years in 2037.

On the BNSF main line, the decrease in the number of years between predicted accidents for the Maple Street (092521T), E Main Street (092520L), and E Locust Street (092519S) grade crossings for the proposed action compared to the no-action alternative would be 0.3 year in 2017 and 2037.

This small decrease in the interval between the predicted accidents indicates a low level of impact from the proposed action train traffic.

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Attachment L-1
Vehicle Traffic Modeling

This attachment contains detailed analysis methods and results related to the vehicle traffic analysis, including data on roadways and intersections and grade-crossing delay and safety.

Roadways and Intersections

Traffic Volumes and Forecast Method

Available annual average daily traffic (AADT) data for the 25 study crossing intersections was dated from 1986 to 2014. Traffic volumes were increased to reflect anticipated future 2017 no-action alternative volumes using the following historic growth rates found in the *Annual Energy Outlook* from the U.S. Energy Information Administration (2013).

- 1970–1995: 3.1% per year
- 1996–2007: 2.0% per year

After 2007, an assumed growth rate of 1.5% was used, based on the U.S. Energy Information Administration report, and input from Washington State Department of Transportation (WSDOT) (Nizam pers. comm.).

Vehicle queue lengths were estimated for roadways and grade crossings near the Olympic Gateway Plaza using a simulation software (Synchro) during the PM peak hour based on one proposed action train passing by. The following intersections were modeled and analyzed within the simulation software:

- Fleet Street and US Route 12 (US 12)
- Tyler Street and US 12
- Chehalis Street and US 12
- Newell Street and US 12
- Heron Street and South Harbor Street

The model was created for four scenarios to analyze the impacts of inbound and outbound trains passing by. Scenarios were generated using the existing roadway lane configurations and traffic signal timing as well as an optimized lane configuration and signal timing to improve overall vehicle operations during/after a train pass by event. All scenarios used future 2017 intersection volumes. The optimized scenarios increased the actuated cycle length to 180 seconds, adjusted the corridor signal coordination, and added a right-turn pocket at the S Chehalis Street and US 12 intersection. The scenarios are as follows.

- 2017 Existing Lanes and Timing PM Peak Hour (Inbound)
- 2017 Existing Lanes and Timing PM Peak Hour (Outbound)
- 2017 Optimized Lanes and Timing PM Peak Hour (Inbound)

- 2017 Optimized Lanes and Timing PM Peak Hour (Outbound)

City of Aberdeen staff provided available 2014 peak hour traffic counts and WSDOT staff provided existing signal timing information for the study area corridor. Future 2017 volumes are estimated based on a 1.5% growth rate.

The model was calibrated by refining mandatory and positioning distances at all intersections to match with the available storage lengths and lane configurations. These adjustments were carried into the simulation parameters so simulated drivers would not factor the mandatory distance to increase or decrease from original input.

During simulation, the eastbound right-turn volume at Newell Street consistently generated errors. This volume was reallocated to Chehalis Street to resolve the error, but does not affect the overall result of queuing from Chehalis Street to Heron Street.

The 95th percentile vehicle queue length was determined for each movement by taking the average of five modeled simulation runs for each scenario. The 95th percentile queue is the length for a given intersection movement that has only a 5% chance of being exceeded during the peak traffic hour.

The 2017 volumes at other key study area crossings were compared to volumes found in the US Route 101 Regional Circulation Plan (Washington State Department of Transportation 2007) and found to be conservative.

Field Observations

During a field visit on December 11, 2014, existing operating conditions were observed. While no train crossing was observed during the 8-hour observations, queue lengths were estimated by sampling the traffic entering and exiting the Olympic Gateway Plaza at Chehalis Street and Tyler Street on US 12 during mid-day and PM peak hours. Observed queuing and intersection operations corroborated the modeled 2017 no-action alternative operations in Aberdeen. The lack of pedestrian facilities and active crossing gate protection in several locations appeared to pose a safety issue for right-turn-on-red vehicles and pedestrians.

Collision Analysis

Ten years of collision records (2003 to 2013) for the study area were obtained from WSDOT and the Federal Rail Administration (FRA). The data identified one collision involving a train that resulted in a possible injury at the Olympic Gateway Plaza commercial access located between Chehalis Street and Tyler Street in Aberdeen. The identified collision involved a right-turning vehicle not yielding the right-of-way to a slow-moving train. This is consistent with safety concerns identified in the field observations.

Railroad Crossing Performance Measures

Level of service (LOS) ratings and volume-to-capacity ratios are two commonly used performance measures for intersection operations.

- **Delay.** Delay refers to the average delay per vehicle in a 24-hour period, which is measured in seconds for a rail crossing using the average number of daily trains, average train length, train speed, and average daily traffic volumes in both directions.

- **Level of service (LOS).** LOS refers to a rating (A through F) based on the delay experienced by vehicles at the intersection. LOS A, B, and C indicate conditions where traffic moves without significant delays over a 24-hour period. LOS D and E are progressively worse operating conditions. LOS F represents conditions where average vehicle delay has become excessive and demand has exceeded capacity. Based on the LOS definitions in the Highway Capacity Manual (Transportation Research Board 2010) method for signalized intersections, similar delay thresholds were used to assess the average delay experienced per vehicle at each rail crossing during a 24-hour period (Table 1)

Table 1. Level of Service Designations

Level of Service	Average Delay for All Vehicles (seconds/vehicle)
A	<=10
B	>10 and <=20
C	>20 and <=35
D	>35 and <=55
E	>55 and <=80
F	>80

Source: Transportation Research Board 2010

- **Queue:** Queue refers to the total average length of delayed vehicles per lane. Calculation is based on the number of vehicles delayed due to gate down times throughout a 24-hour period and an average vehicle length of 20 feet.

Agency Operating Standards

WSDOT operating standard for all study intersections of state highways in Grays Harbor County meet its minimum acceptable LOS standard, which is LOS D for peak periods (Washington State Department of Transportation 2010). Table 2 shows the at-grade crossing and roadway characteristics.

Table 2. At-Grade Crossing and Roadway Characteristics

	Roadway			Railroad (Trains)		
Roadway Name	2017 AADT	Classification	Lanes	Protection?	No. per day	Ave. Speed (mph)
1. Tower St/SR 507	8,023	Collector	2	Overhead Lights	3.0	7
2. Pearl St/SR 507	13,755	Collector	2	Overhead Lights	3.0	7
3. Joselyn Ave	209	Local	2	Gates/Lights	3.0	25
4. Private Drive	100[a]	Local	2	None	3.0	25
5. 183rd Ave SW	785	Collector	2	Gates/Lights	3.0	25
6. Blockhouse Rd	42	Local	2	None	3.0	25
7. Murray St	178	Local	2	None	3.0	25
8. Newton St	178	Local	2	None	3.0	25
9. Shelton Rd	52	Local	2	None	3.0	25
10. Elma-Gate Rd	94	Local	2	None	3.0	25
11. Porter Creek Rd	805	Collector	2	Gates/Lights	3.0	25
12. Dunlap Rd	188	Local	2	None	3.0	25
13. Blockhouse Rd N	42	Local	2	None	3.0	25
14. Blockhouse Rd N	220	Local	2	None	3.0	25
15. Brady Loop Rd	1,046	Collector	2	Gates/Lights	3.1	25
16. Monte-Brady Rd	785	Collector	2	Gates/Lights	3.1	25
17. Main St	1,569	Collector	2	Gates/Lights	3.1	25
18. Sargent Blvd	1,250	Collector	2	Gates/Lights	3.1	12
19. Fleet St	1,611	Local	2	None	3.2	7
20. Tyler St	4,048	Local	4	Traffic Signal	3.2	7
21. Chehalis St	4,906	Local	4	Traffic Signal	3.2	6
22. Newell St	649	Local	2	Overhead Lights	3.2	6
23. Heron St	3,452	Local	2	None	3.2	5
24. Port Industrial Rd	17,845	Arterial	2	Gates/Lights	3.9	8
25. Adams St	750[a]	Local	2	None	0.2	12

[a] AADT for the Private Drive and Adams Street crossings were approximated from field observations and AADT from prior studies.

AADT = annual average daily traffic

The following Tables 3 through 8 show estimated queues and storage capacity based on AADT in 2017 and 2037 for the no-action alternative and proposed action. The average vehicle queue length is a function of the total number of roadway approach lanes, number of daily trains, and the number of vehicles delayed per day. A sensitivity analysis of peak hour traffic with one oil train pass by and 50% capacity scenarios were also conducted.

Table 3. 2017 No-Action Alternative Queue Estimates

Roadway Name	USDOT Crossing #	Available Storage Length (ft)				Estimated Queue Length[a] (ft)			
		WBL	EBTR	NB	SB	WBL	EBTR	NB	SB
1. Tower	092546N	-	-	360	-	0	0	480	0
2. Pearl	092547V	-	-	-	440	0	0	0	820
3. Joselyn Ave	092569V	220[e]	500+[e]	35[e]	500+[e]	0	0	20	0
5. 183rd Ave SW	092573K	320[e]	440[e]	230[e]		20	20	20	0
6. Blockhouse Rd	092583R	-	-	80	500+	0	0	20	20
7. Murray St	092585E	-	-	150	300	0	0	20	20
8. Newton St	092586L	-	-	220	460	0	0	20	20
9. Shelton Rd	092593W	-	-	500+[c]	60[c]	0	0	20	20
10. Elma Gate Rd W	092595K	-	-	500+	500+	0	0	20	20
11. Porter Creek Rd	092603A	220[d]	200[d]	500+[c]	290[c]	0	0	20	0
12. Dunlap Rd	096510U	-	-	500+	65	0	0	20	20
13. Blockhouse Rd W	096518Y	-	-	500+[c]	60[c]	0	0	20	20
14. Blockhouse Rd E	096515D	-	-	500+	200	0	0	20	20
15. Monte Brady Rd	096652K	-	-	500+	150	0	20	20	0
16. Monte Brady Rd	096658B	-	200	500+	-	0	0	20	20
17. Main Street	096672W	-	-	140	280	0	0	20	20
18. Junction City Rd	096687L	-	-	500+	500+	0	0	40	40
19. Fleet	096688T	350	290	80	100	160	20	180	0
20. Tyler	096029N	150	660	150	100	60	140	220	20
21. Chehalis	096691B	250	300	120	100	80	200	300	40
22. Newell	096693P	-	460	100	-	0	100	100	0
23. Heron	096695D	-	1000	-	-	0	1080	0	0
24. Port Industrial	096711K	1200	1360	-	-	500	500	0	0
25. Monroe St[f]	808707R	-	-	500+	20	0	0	20	20
26. Washington St[f]	096706N	-	-	500+	300	0	0	20	20

[a] Estimated Queue Length (feet) based on existing distribution of PM peak hour traffic volumes and the length of the average queue.
[b] Portland Industrial Road is an east-west street. Queuing values listed are eastbound and westbound through lengths.
[c] NB is actually EB and SB is actually WB
[d] WBL is actually NBL and EBTR is actually SBR
[e] NB is actually SB, EBTR is actually WBR, and WBL is actually EBL
[f] Intersections 25 and 26 were added to this project
Bold values exceed available storage.
WBL = westbound left; EBTR = eastbound through right; NB = northbound; SB = southbound

Table 4. 2037 No-Action Alternative Queue Estimates

Roadway Name	USDOT Crossing #	Available Storage Length (ft)				Estimated Queue Length[a] (ft)			
		WBL	EBTR	NB	SB	WBL	EBTR	NB	SB
1. Tower	092546N	-	-	360	-	0	0	620	0
2. Pearl	092547V	-	-	-	440	0	0	0	1060
3. Joselyn Ave	092569V	220[e]	500+[e]	35[e]	500+[e]	0	0	20	0
5. 183rd Ave SW	092573K	320[e]	440[e]	230[e]		20	20	20	0
6. Blockhouse Rd	092583R	-	-	80	500+	0	0	20	20
7. Murray St	092585E	-	-	150	300	0	0	20	20
8. Newton St	092586L	-	-	220	460	0	0	20	20
9. Shelton Rd	092593W	-	-	500+[c]	60[c]	0	0	20	20
10. Elma Gate Rd W	092595K	-	-	500+	500+	0	0	20	20
11. Porter Creek Rd	092603A	220[d]	200[d]	500+[c]	290[c]	0	0	20	0
12. Dunlap Rd	096510U	-	-	500+	65	0	0	20	20
13. Blockhouse Rd W	096518Y	-	-	500+[c]	60[c]	0	0	20	20
14. Blockhouse Rd E	096515D	-	-	500+	200	0	0	20	20
15. Monte Brady Rd	096652K	-	-	500+	150	0	20	20	0
16. Monte Brady Rd	096658B	-	200	500+	-	0	0	20	20
17. Main Street	096672W	-	-	140	280	0	0	40	40
18. Junction City Rd	096687L	-	-	500+	500+	0	0	60	60
19. Fleet	096688T	350	290	80	100	140	20	160	0
20. Tyler	096029N	150	660	150	100	40	120	200	20
21. Chehalis	096691B	250	300	120	100	60	160	260	20
22. Newell	096693P	-	460	100	-	0	100	100	0
23. Heron	096695D	-	1000	-	-	0	1060	0	0
24. Port Industrial	096711K	1200	1360	-	-	660	660	0	0
25. Monroe St[f]	808707R	-	-	500+	20	0	0	20	20
26. Washington St[f]	096706N	-	-	500+	300	0	0	20	20

[a] Estimated Queue Length (ft) based on existing distribution of PM peak hour traffic volumes and the length of the average queue.
[b] Portland Industrial Rd is an east-west street. Queuing values listed are eastbound and westbound through lengths.
[c] NB is actually EB and SB is actually WB
[d] WBL is actually NBL and EBTR is actually SBR
[e] NB is actually SB, EBTR is actually WBR, and WBL is actually EBL
[f] Intersections 25 and 26 were added to this project
Bold values exceed available storage.
WBL = westbound left; EBTR = eastbound through right; NB = northbound; SB = southbound

Table 5. 2017 Proposed Action Queue Estimates

Roadway Name	USDOT Crossing #	Available Storage Length (ft)				Estimated Queue Length[a] (ft)			
		WBL	EBTR	NB	SB	WBL	EBTR	NB	SB
1. Tower	092546N	-	-	360	-	0	0	500	0
2. Pearl	092547V	-	-	-	440	0	0	0	860
3. Joselyn Ave	092569V	220[e]	500+[e]	35[e]	500+[e]	0	0	20	0
5. 183rd Ave SW	092573K	320[e]	440[e]	230[e]		20	20	20	0
6. Blockhouse Rd	092583R	-	-	80	500+	0	0	20	20
7. Murray St	092585E	-	-	150	300	0	0	20	20
8. Newton St	092586L	-	-	220	460	0	0	20	20
9. Shelton Rd	092593W	-	-	500+[c]	60[c]	0	0	20	20
10. Elma Gate Rd W	092595K	-	-	500+	500+	0	0	20	20
11. Porter Creek Rd	092603A	220[d]	200[d]	500+[c]	290[c]	0	0	20	0
12. Dunlap Rd	096510U	-	-	500+	65	0	0	20	20
13. Blockhouse Rd W	096518Y	-	-	500+[c]	60[c]	0	0	20	20
14. Blockhouse Rd E	096515D	-	-	500+	200	0	0	20	20
15. Monte Brady Rd	096652K	-	-	500+	150	0	20	20	0
16. Monte Brady Rd	096658B	-	200	500+	-	0	0	20	20
17. Main Street	096672W	-	-	140	280	0	0	40	40
18. Junction City Rd	096687L	-	-	500+	500+	0	0	40	40
19. Fleet	096688T	350	290	80	100	200	20	220	0
20. Tyler	096029N	150	660	150	100	60	180	280	40
21. Chehalis	096691B	250	300	120	100	100	240	360	40
22. Newell	096693P	-	460	100	-	0	120	120	0
23. Heron	096695D	-	1000	-	-	0	1240	0	0
24. Port Industrial	096711K	1200	1360	-	-	1000	1000	0	0
25. Monroe St[f]	808707R	-	-	500+	20	0	0	20	20
26. Washington St[f]	096706N	-	-	500+	300	0	0	40	40

[a] Estimated Queue Length (ft) based on existing distribution of PM peak hour traffic volumes and the length of the average queue.
[b] Portland Industrial Rd is an east-west street. Queuing values listed are eastbound and westbound through lengths.
[c] NB is actually EB and SB is actually WB
[d] WBL is actually NBL and EBTR is actually SBR
[e] NB is actually SB, EBTR is actually WBR, and WBL is actually EBL
[f] Intersections 25 and 26 were added to this project
Bold values exceed available storage.
WBL = westbound left; EBTR = eastbound through right; NB = northbound; SB = southbound

Table 6. 2037 Proposed Action Queue Estimates

Roadway Name	USDOT Crossing #	Available Storage Length (ft)				Estimated Queue Length[a] (ft)			
		WBL	EBTR	NB	SB	WBL	EBTR	NB	SB
1. Tower	092546N	-	-	360	-	0	0	660	0
2. Pearl	092547V	-	-	-	440	0	0	0	1120
3. Joselyn Ave	092569V	220[e]	500+[e]	35[e]	500+[e]	0	0	20	0
5. 183rd Ave SW	092573K	320[e]	440[e]	230[e]		20	20	20	0
6. Blockhouse Rd	092583R	-	-	80	500+	0	0	20	20
7. Murray St	092585E	-	-	150	300	0	0	20	20
8. Newton St	092586L	-	-	220	460	0	0	20	20
9. Shelton Rd	092593W	-	-	500+[c]	60[c]	0	0	20	20
10. Elma Gate Rd W	092595K	-	-	500+	500+	0	0	20	20
11. Porter Creek Rd	092603A	220[d]	200[d]	500+[c]	290[c]	0	0	20	0
12. Dunlap Rd	096510U	-	-	500+	65	0	0	20	20
13. Blockhouse Rd W	096518Y	-	-	500+[c]	60[c]	0	0	20	20
14. Blockhouse Rd E	096515D	-	-	500+	200	0	0	20	20
15. Monte Brady Rd	096652K	-	-	500+	150	0	20	20	0
16. Monte Brady Rd	096658B	-	200	500+	-	0	0	20	20
17. Main Street	096672W	-	-	140	280	0	0	40	40
18. Junction City Rd	096687L	-	-	500+	500+	0	0	60	60
19. Fleet	096688T	350	290	80	100	200	20	220	0
20. Tyler	096029N	150	660	150	100	60	180	280	40
21. Chehalis	096691B	250	300	120	100	100	240	360	40
22. Newell	096693P	-	460	100	-	0	120	120	0
23. Heron	096695D	-	1000	-	-	0	1340	0	0
24. Port Industrial	096711K	1200	1360	-	-	1300	1300	0	0
25. Monroe St[f]	808707R	-	-	500+	20	0	0	20	20
26. Washington St[f]	096706N	-	-	500+	300	0	0	60	60

[a] Estimated Queue Length (ft) based on existing distribution of PM peak hour traffic volumes and the length of the average queue.
[b] Portland Industrial Rd is an east-west street. Queuing values listed are eastbound and westbound through lengths.
[c] NB is actually EB and SB is actually WB
[d] WBL is actually NBL and EBTR is actually SBR
[e] NB is actually SB, EBTR is actually WBR, and WBL is actually EBL
[f] Intersections 25 and 26 were added to this project
Bold values exceed available storage.
WBL = westbound left; EBTR = eastbound through right; NB = northbound; SB = southbound

Table 7. 2017 Proposed Action Queue Estimates During Peak Hour

Roadway Name	USDOT Crossing #	Available Storage Length (ft)				Estimated Queue Length[a] (ft)			
		WBL	EBTR	NB	SB	WBL	EBTR	NB	SB
1. Tower	092546N	-	-	360	-	0	0	1540	0
2. Pearl	092547V	-	-	-	440	0	0	0	2620
3. Joselyn Ave	092569V	220[e]	500+[e]	35[e]	500+[e]	0	0	20	0
5. 183rd Ave SW	092573K	320[e]	440[e]	230[e]		40	40	60	0
6. Blockhouse Rd	092583R	-	-	80	500+	0	0	20	20
7. Murray St	092585E	-	-	150	300	0	0	20	20
8. Newton St	092586L	-	-	220	460	0	0	20	20
9. Shelton Rd	092593W	-	-	500+[c]	60[c]	0	0	20	20
10. Elma Gate Rd W	092595K	-	-	500+	500+	0	0	20	20
11. Porter Creek Rd	092603A	220[d]	200[d]	500+[c]	290[c]	20	20	60	0
12. Dunlap Rd	096510U	-	-	500+	65	0	0	20	20
13. Blockhouse Rd W	096518Y	-	-	500+[c]	60[c]	0	0	20	20
14. Blockhouse Rd E	096515D	-	-	500+	200	0	0	20	20
15. Monte Brady Rd	096652K	-	-	500+	150	0	80	80	0
16. Monte Brady Rd	096658B	-	200	500+	-	0	0	60	60
17. Main Street	096672W	-	-	140	280	0	0	120	120
18. Junction City Rd	096687L	-	-	500+	500+	0	0	180	180
19. Fleet	096688T	350	290	80	100	620	60	700	20
20. Tyler	096029N	150	660	150	100	220	560	880	120
21. Chehalis	096691B	250	300	120	100	280	720	1100	120
22. Newell	096693P	-	460	100	-	0	320	320	0
23. Heron	096695D	-	1000	-	-	0	3460	0	0
24. Port Industrial	096711K	1200	1360	-	-	5220	5220	0	0
25. Monroe St[f]	808707R	-	-	500+	20	0	0	20	20
26. Washington St[f]	096706N	-	-	500+	300	0	0	360	360

WBL = westbound left; EBTR = eastbound through right; NB = northbound; SB = southbound

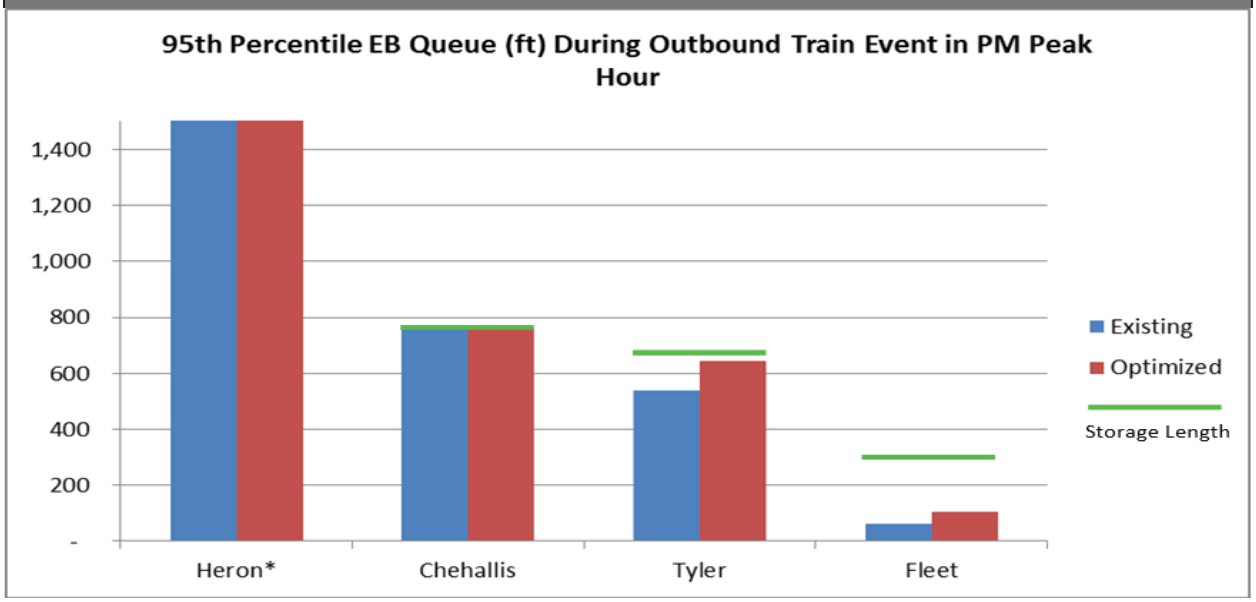
Table 8. 2037 Proposed Action Queue Estimates for During Peak Hour

Roadway Name	USDOT Crossing #	Available Storage Length (ft)				Estimated Queue Length[a] (ft)			
		WBL	EBTR	NB	SB	WBL	EBTR	NB	SB
1. Tower	092546N	-	-	360	-	0	0	1980	0
2. Pearl	092547V	-	-	-	440	0	0	0	3400
3. Joselyn Ave	092569V	220[e]	500+[e]	35[e]	500+[e]	0	0	20	0
5. 183rd Ave SW	092573K	320[e]	440[e]	230[e]		40	40	80	0
6. Blockhouse Rd	092583R	-	-	80	500+	0	0	20	20
7. Murray St	092585E	-	-	150	300	0	0	20	20
8. Newton St	092586L	-	-	220	460	0	0	20	20
9. Shelton Rd	092593W	-	-	500+[c]	60[c]	0	0	20	20
10. Elma Gate Rd W	092595K	-	-	500+	500+	0	0	20	20
11. Porter Creek Rd	092603A	220[d]	200[d]	500+[c]	290[c]	40	40	80	0
12. Dunlap Rd	096510U	-	-	500+	65	0	0	20	20
13. Blockhouse Rd W	096518Y	-	-	500+[c]	60[c]	0	0	20	20
14. Blockhouse Rd E	096515D	-	-	500+	200	0	0	20	20
15. Monte Brady Rd	096652K	-	-	500+	150	0	100	100	0
16. Monte Brady Rd	096658B	-	200	500+	-	0	0	80	80
17. Main Street	096672W	-	-	140	280	0	0	140	140
18. Junction City Rd	096687L	-	-	500+	500+	0	0	240	240
19. Fleet	096688T	350	290	80	100	800	80	900	20
20. Tyler	096029N	150	660	150	100	280	720	1140	140
21. Chehalis	096691B	250	300	120	100	360	920	1420	140
22. Newell	096693P	-	460	100	-	0	420	420	0
23. Heron	096695D	-	1000	-	-	0	4480	0	0
24. Port Industrial	096711K	1200	1360	-	-	6760	6760	0	0
25. Monroe St[f]	808707R	-	-	500+	20	0	0	20	20
26. Washington St[f]	096706N	-	-	500+	300	0	0	460	460

WBL = westbound left; EBTR = eastbound through right; NB = northbound; SB = southbound

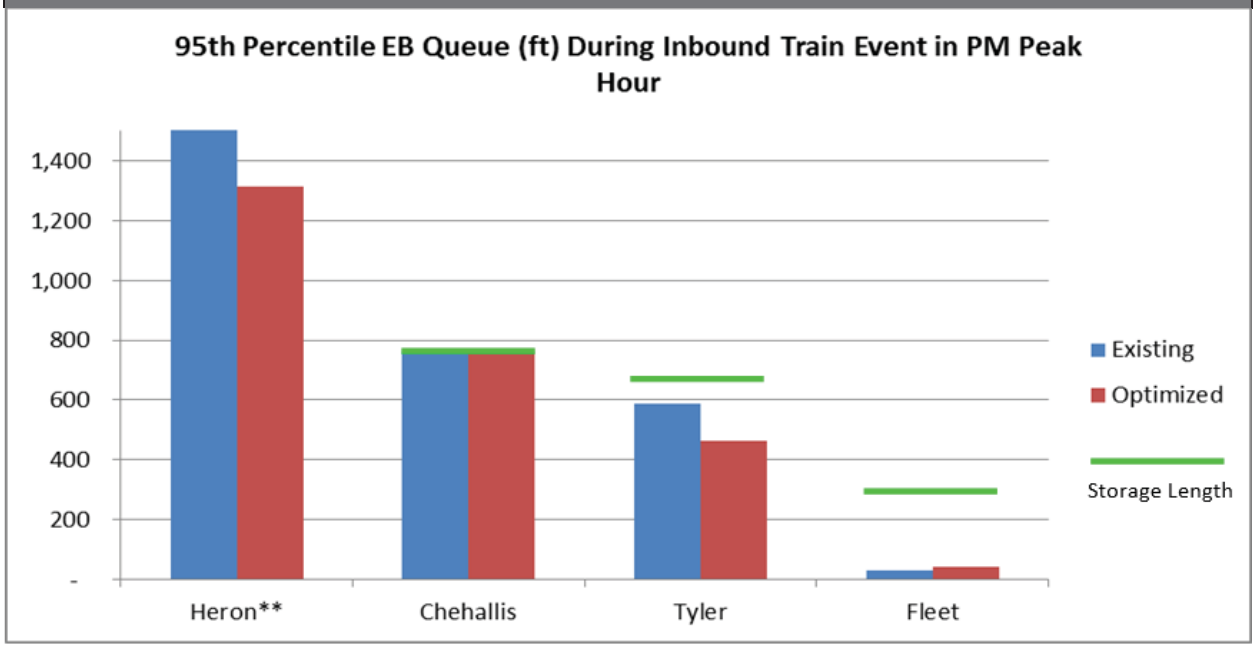
Figures 1 through 4 show the Synchro simulation results for the 95th percentile vehicle queue length was determined for each movement by taking the average of five modeled simulation runs for each scenario. The 95th percentile queue is the length for a given intersection movement that has only a 5% chance of being exceeded during the peak traffic hour. All scenarios assume one train arriving at the beginning of the PM peak hour.

Figure 1. 95th Eastbound Queue (Feet) During Outbound Train Event.



*E Heron St. 95th percentile queue exceeds available model storage.

Figure 2. 95th Eastbound Queue (Feet) During Inbound Train Event.



**E Heron St. 95th percentile queue exceeds available model storage.

Figure 3. 95th Westbound Queue (Feet) During Outbound Train Event.

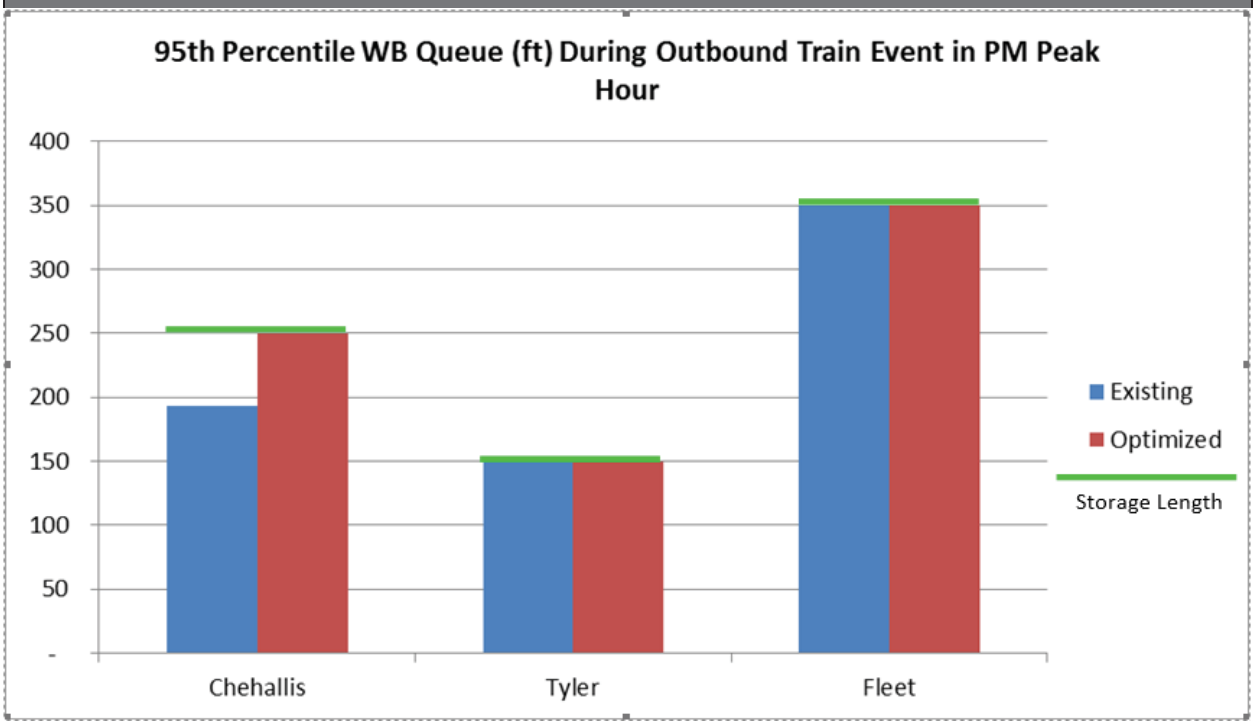
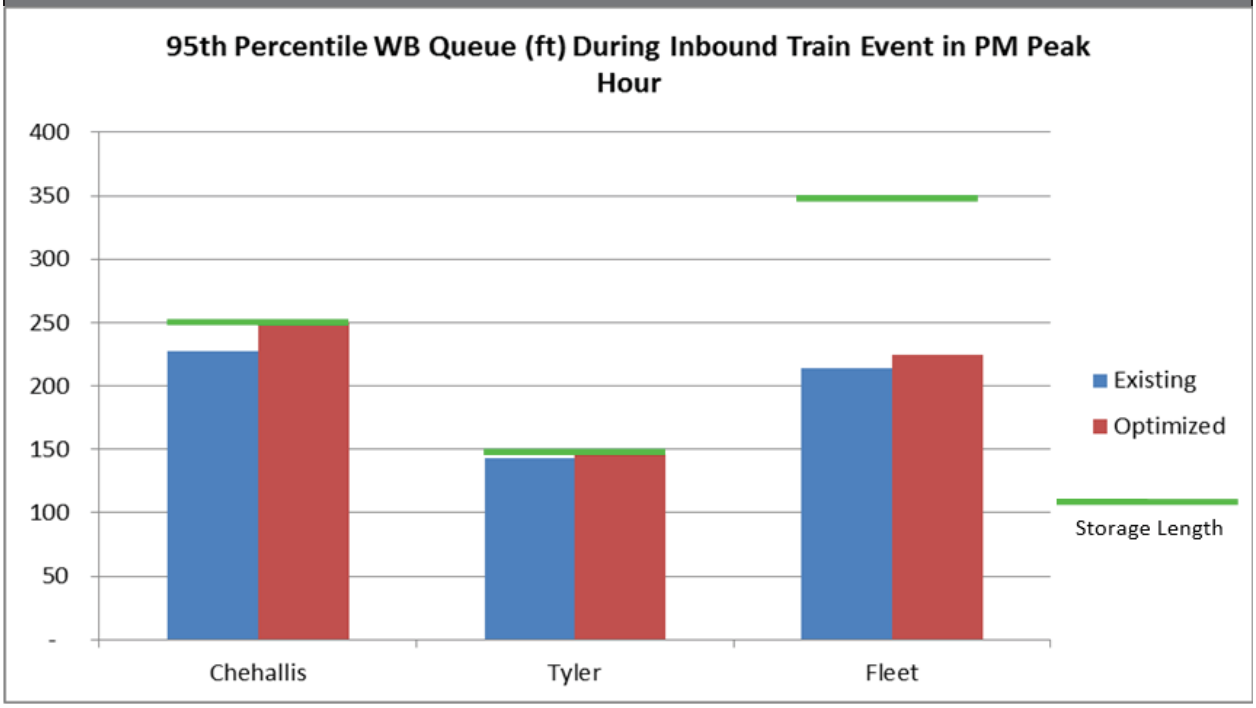


Figure 4. 95th Westbound Queue (Feet) During Inbound Train Event.



Grade-Crossing Delay

Methods

Assumptions and Data Sources for Calculations

Several data sources were used to characterize grade-crossing delay and safety conditions.

- WSDOT (2013) and Washington Utilities and Transportation Commission (2014) provided AADT. All local government agencies along the Puget Sound & Pacific Railroad (PS&P) rail line were contacted to provide up to date AADT data and updated traffic maps and reports were received from the City of Montesano, City of Elma, Grays Harbor Council of Governments, and City of Aberdeen (Wincewicz pers. comm.; Mock pers. comm.; Starks pers. comm.; Grays Harbor Council of Governments pers. comm.). The FRA highway and rail database was used to update AADT data as well (Federal Railroad Administration 2014a).
- A historic vehicle-miles traveled growth rate was applied to AADT data from 1970 to 1995 (3.1% growth rate) and from 1996 to 2011 (2% growth rate) to estimate AADT in 2012 (U.S. Energy Information Administration 2013).
- AADT values were estimated for analysis years 2018, 2023, 2030, and 2037 using the available data and an annual growth rate of 1.5% based on vehicle-miles traveled (U.S. Energy Information Administration 2014) and guidance provided by WSDOT.
- For any grade crossing for which an AADT value could not be located using state data sources or the FRA data, an average AADT value was applied based on collected AADT values for the same road type in that state.
- Existing train traffic (average number of trains per day) and operating speed on the PS&P rail line were provided (Federal Railroad Administration 2014a).
- Future train traffic (average number of trains per day) was estimated by the applicant (Chapter2, *Proposed Action and Alternatives*).
- Road and train traffic characteristics at rail and roadway crossings, including the number of tracks, number of road lanes, warning devices, daily vehicle traffic volume, road paving, road classifications, and the most recent 5 years of accident history were provided (Federal Railroad Administration 2013).
- Train models for proposed action scenarios and cumulative impact analysis included number of trains per day by commodity, train length, number of cars, number and type of locomotives, train speed, and gate-down time (Table 9). For more details on the train modeling, see Appendix K, *Rail Traffic Technical Information*. Weighted averages were used to combine train consist information for total delay and safety calculations.

Table 9. Train Consist Modeling Data

	Eastbound				Westbound			
Train Type	Trains per Year	Cars per Train	Number of Locomotives	Locomotive Type	Trains per Year	Cars per Train	Number of Locomotives	Locomotive Type
Freight	279	68	2	SD40	319	61	2	SD40
Grain	102	101	3	AC4400CW	104	98	3	AC4400CW
Auto	95	65	2	SD70	102	60	2	SD70
Aberdeen – Elma	98	37	4	GP38	26	31	4	GP38
Elma-Centralia	39	63	4	GP38	19	40	4	GP38
Garbage	26	48	3	GP38	26	48	2	GP38
Oil	230-W 365-I 774-C	122	3	AC4400CW	230-W 365-I 774-C	122	3	AC4400CW

W=Westway scenario; I=Imperium scenario; C=Cumulative Impacts Analysis

Calculations for Proposed Action and Cumulative Impacts Analysis

For each at-grade crossing analyzed, the average delay per vehicle in a 24-hour period was estimated based on the estimated time each train would block the crossing, the average number of trains per day, and grade-crossing characteristics (e.g., AADT, number of roadway lanes). The total estimated daily gate-down time at a crossing was divided by the estimated AADT values for 2017 and 2037 to obtain an estimate of average vehicle delay for each crossing. This value was then used to determine the LOS at each at-grade crossing. LOS designations provide a qualitative measure of traffic flow (Table 1). According to WSDOT, traffic for peak-hours, urban highways must meet a LOS of D and for rural highways a LOS of C in Grays Harbor County and Thurston County (Washington State Department of Transportation 2010). LOS was not evaluated for the three crossings on the BNSF Railway Company (BNSF) main line [092521T (Maple St M1), 092520L (E Main St M1), and 092519S (E Locust St M1)] due to limited data on train characteristics.

The following calculations were used to estimate traffic delay for public, at-grade crossings. The traffic delay at a crossing includes the time for the train to pass, and the time for any warning device to engage and disengage. For simplification purposes, it is assumed that both rail and road traffic would be uniform throughout the day. The first step includes the calculation of gate-down time per train event (T).

$$T = T_W + \frac{L}{V}$$

Where:

T_W = Gate warning time

L = Average train length

V = Average train speed

The gate-down time per train event calculation is only used for the manual calculations for crossings 092521T (Maple St M1), 092520L (E Main St M1), and 092519S (E Locust St M1). All remaining gate-down time came from train modeling data presented in Appendix K, *Rail Traffic Technical Information*.

The number of stopped vehicles delayed per day (NV) can be calculated as follows:

$$N_V = \frac{T}{24} * N * ADT$$

Where:

N = Number of trains per day

AADT = Average daily traffic

24 = Hours per day

The average delay per vehicle in a 24-hour period (DV) is:

$$D_V = \frac{N_V}{AADT} * \frac{T * \frac{R_D}{R_D - R_A}}{2}$$

Where:

RD = Departure rate (vehicles/lane/hour)1

RA = Arrival rate, average daily traffic converted to vehicles/lane-hour

2 = Denominator to reflect that vehicles do not experience the entire time the train is blocking the grade crossing. They are assumed to arrive on average at the midpoint of the train crossing period.

Total vehicle delay (D) is the product of average delay per vehicle (DV) and the average daily traffic (ADT).

$$D = D_V * ADT$$

The average queue length per event in a 24-hour period is:

$Q=(N_v/(R_L*N))*L_v$

RL = Number of roadway lanes in both directions

LV = Average length of a vehicle (assumed to be 20 feet)

[1] The vehicle departure rate depends on a wide range of factors such as the presence or absence of signals, number and type of lanes, lane width, grade, sight distances, type and peak of vehicle traffic, and curve radius. Data on these factors are not readily available for the grade crossings included in this analysis and, thus, calculation of crossing-specific departure rates is not feasible. Based on the Highway Capacity Manual (Transportation Research Board 2000), departure rates (in vehicles/lane-hour) are the following: highways (1,800), arterials (1,400), collectors (900), and local roads (700).

Tables 10 through 17 show the results of the grade-crossing delay analysis for the No-Action Alternative; Tables 18 through 25 show the results of the analysis for the proposed action . Tables 26 through 29 show the results of the grade-crossing delay analysis for the cumulative scenario.

No-Action Alternative

Table 10. Grade-Crossing Delay of Baseline Traffic (2017)

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
096687L	Junction City Rd	67.14	3.1	4,472	12	14.7	1,234	2	Collector	900	26	30.87	13	2	A	2	40
096682C	Central Park Dr	61.8	3.1	4,472	11	15.3	293	2	Collector	900	6	7.77	3	2	A	2	20
096680N	Aldergrove Dr	59.72	3.1	4,472	25	7.1	397	2	Local Road	700	8	2.27	2	1	A	0	20
096679U	Heikkinen Rd	59.43	3.1	4,472	25	7.1	209	1	Local Road	700	9	1.20	1	1	A	0	20
096678M	Devonshire Rd	58.91	3.1	4,472	25	7.1	1,056	2	Collector	900	22	6.10	5	1	A	0	20
096677F	County Farm Rd	58.73	3.1	4,472	25	7.1	262	2	Local Road	700	5	1.48	1	1	A	0	20
096672W	Main Street	57.72	3.1	4,472	25	7.1	1,569	2	Collector	900	33	9.20	8	1	A	0	20
400107G	Sylvia St	57.59	3.1	4,472	25	7.1	126	2	Local Road	700	3	0.71	1	1	A	0	20
096659H	Old Beacon Rd	56.02	3.1	4,472	25	7.1	94	2	Local Road	700	2	0.53	0	1	A	0	20
096658B	Monte Brady Rd	55.71	3.1	4,472	25	7.1	785	2	Collector	900	16	4.52	4	1	A	0	20
096657U	Glenn Rd	55.42	3.1	4,472	25	7.1	21	2	Local Road	700	0	0.12	0	1	A	0	20
096655F	Fairbairn Rd	54.38	3.1	4,472	25	7.1	21	2	Local Road	700	0	0.12	0	1	A	0	20
096654Y	Winkerman Rd S	54.1	3.1	4,472	25	7.1	42	2	Local Road	700	1	0.24	0	1	A	0	20
096652K	Monte Brady Rd	53.33	3.1	4,472	25	7.1	1,046	2	Collector	900	22	6.07	5	1	A	0	20
096650W	Foss Av-Monte Elma	51.98	3.1	4,472	25	7.1	4,770	2	Collector	900	99	30.34	24	1	A	0	80
096649C	Hewitt St	51.85	3.1	4,472	25	7.1	345	2	Local Road	700	7	1.98	2	1	A	0	20
096648V	Moore Rd	51.53	3.1	4,472	25	7.1	502	2	Local Road	700	10	2.88	2	1	A	0	20
096646G	Oniel Rd	51.03	3.1	4,472	25	7.1	565	2	Local Road	700	12	3.28	3	1	A	0	20
096644T	Newman Creek Rd	50.56	3.1	4,472	25	7.1	858	2	Local Road	700	18	4.98	4	1	A	0	20
096643L	Hurd Rd	50.08	3.1	4,472	25	7.1	1,370	2	Local Road	700	29	8.02	7	1	A	0	20
096642E	Calder Rd	49.36	3.1	4,472	25	7.1	596	2	Local Road	700	12	3.43	3	1	A	0	20
096641X	N 17th St	48.93	3.1	4,472	25	7.1	115	2	Local Road	700	2	0.65	1	1	A	0	20

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
096640R	N 13th St	48.7	3.1	4,472	25	7.1	649	2	Local Road	700	14	3.74	3	1	A	0	20
096639W	N 11th St	48.57	3.1	4,472	24	7.2	1,914	2	Local Road	700	40	11.74	10	1	A	0	40
096638P	N 10th St	48.51	3.1	4,472	22	8.3	272	2	Local Road	700	6	2.11	2	1	A	0	20
096636B	N 6th St	48.32	3.1	4,472	22	8.8	146	2	Local Road	700	3	1.26	1	1	A	1	20
096635U	N 5th St	48.26	3.1	4,472	22	8.8	73	2	Local Road	700	2	0.64	0	1	A	1	20
096634M	N 3rd St	48.12	3.1	4,472	21	9.9	617	2	Local Road	700	13	6.93	4	2	A	1	20
096525J	N 2d St	48.06	3.1	4,472	24	8.5	471	2	Local Road	700	10	3.83	3	1	A	0	20
096519F	Tridwell Rd	46.71	3.0	4,472	24	7.8	115	2	Local Road	700	2	0.81	1	1	A	0	20
096518Y	Blockhouse Rd W	46.33	3.0	4,568	25	7.1	220	2	Local Road	700	5	1.30	1	1	A	0	20
096515D	Blockhouse Rd E	45.26	3.0	4,568	25	7.1	42	2	Local Road	700	1	0.25	0	1	A	0	20
096510U	Dunlap Rd	44.19	3.0	4,568	25	7.1	188	2	Local Road	700	4	1.10	1	1	A	0	20
092603A	Porter Creek Rd	41.5	3.0	4,568	25	7.1	805	2	Collector	900	17	4.80	4	1	A	0	20
092595K	Elma Gare Rd W	38.46	3.0	4,568	25	7.1	94	2	Local Road	700	2	0.55	0	1	A	0	20
092593W	Shelton Rd	36.71	3.0	4,568	25	7.1	52	2	Local Road	700	1	0.31	0	1	A	0	20
92587T	Scheaffer St	33.95	3.0	4,568	25	7.1	42	2	Local Road	700	1	0.25	0	1	A	0	20
092586L	Newton St	33.65	3.0	4,568	25	7.1	178	2	Local Road	700	4	1.05	1	1	A	0	20
092585E	Murray St	33.39	3.0	4,568	25	7.1	178	2	Local Road	700	4	1.04	1	1	A	0	20
092584X	Merry Rd	33.04	3.0	4,568	25	7.1	52	2	Local Road	700	1	0.31	0	1	A	0	20
092583R	Blockhouse Rd	32.45	3.0	4,568	25	7.1	42	2	Local Road	700	1	0.24	0	1	A	0	20
092577M	Moon Rd SW	28.71	3.0	4,568	25	7.1	262	2	Local Road	700	5	1.54	1	1	A	0	20
092576F	Owings St	13.28	3.0	4,568	25	7.1	324	2	Local Road	700	7	1.90	2	1	A	0	20
092574S	Little Rock Rd	10.95	3.0	4,568	25	7.1	1,004	2	Local Road	700	21	6.05	5	1	A	0	20
092573K	183rd Ave SW	10.05	3.0	4,568	25	7.1	785	2	Collector	900	16	4.65	4	1	A	0	20
092569V	Joselyn Ave	8.45	3.0	4,568	25	7.1	209	2	Local Road	700	4	1.22	1	1	A	0	20
092567G	Tea St	7.18	3.0	4,568	25	7.1	513	2	Local Road	700	11	3.05	3	1	A	0	20
092566A	Grand Mound SW	6.84	3.0	4,568	25	7.1	345	2	Local Road	700	7	2.04	2	1	A	0	20

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
092565T	Old Hwy 99 SW	6.07	3.0	4,568	24	7.5	10,157	2	Collector	900	212	87.14	53	2	A	1	180
092563E	216th Ave SW	5.37	3.0	4,568	13	13.4	94	2	Local Road	700	2	1.96	1	2	A	1	20
092561R	222d Ave SW	4.72	3.0	4,568	10	17.2	178	2	Local Road	700	4	6.14	2	3	A	2	20
922981P	Hoss Rd	4.44	3.0	4,568	10	17.2	1,151	2	Local Road	700	24	40.95	14	3	A	2	40
922982W	Robert Thompson Rd	4.26	3.0	4,568	10	17.3	575	2	Collector	900	12	20.09	7	3	A	2	20
922980H	Kuper Rd	3.92	3.0	4,568	10	18.0	471	2	Local Road	700	10	17.89	6	3	A	2	20
092559P	Fordon Rd	3.53	3.0	4,568	10	18.0	188	2	Local Road	700	4	7.12	2	3	A	2	20
092554F	W Reynolds Ave	2.14	3.0	4,568	10	17.4	6,381	2	Arterial	1,400	133	246.20	77	3	A	2	260
092552S	J St	1.28	3.0	4,568	8	23.0	345	2	Local Road	700	7	21.38	6	4	A	4	20
092551K	H St	1.15	3.0	4,568	7	24.6	879	2	Local Road	700	18	63.18	15	4	A	4	60
092550D	G St	1.09	3.0	4,568	7	26.0	345	2	Local Road	700	7	27.26	6	4	A	5	20
092549J	F St	1.03	3.0	4,568	7	25.4	241	2	Local Road	700	5	18.09	4	4	A	5	20
092548C	E St	0.95	3.0	4,568	7	25.5	345	2	Local Road	700	7	26.20	6	4	A	5	20
092547V	D St	0.89	3.0	4,568	7	25.6	13,755	2	Collector	900	287	1527.78	244	6	A	7	820
092546N	Tower St	0.82	3.0	4,568	7	25.6	8,023	2	Collector	900	167	747.41	143	5	A	6	480
092543T	B St	54.28	3.0	4,568	7	25.1	690	2	Local Road	700	14	51.24	12	4	A	4	40

Table 11. Grade Crossing Delay of Baseline Traffic for Switching Movements (2017)

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
922990N	Industrial Rd	71.04	2.8	718	4	42.36	5,795	2	Arterial	1,400	121	1411	170	8	B	15	600
AA	Myrtle St	70.85	1.4	718	2	6.95	73	2	Arterial	1,400	2	1	0	2	A	1	20
BB	N Maple St	70.55	2.8	718	6	24.85	805	2	Local Road	700	17	63	14	5	A	5	40
808713U	W 1St St	70.41	3.1	3,409	6	18.33	4,623	2	Collector	900	96	196	59	3	A	3	200
096711K	Port Industrial Rd	70.06	3.9	1,018	8	15.99	17,845	2	Arterial	1,400	372	552	198	3	A	2	500
096710D	Division St	69.82	3.9	1,018	7	15.20	21	2	Local Road	700	0	0	0	2	A	1	20
096709J	Heron St	69.81	3.9	1,018	6	15.99	167	2	Local Road	700	3	4	2	2	A	1	20
808707R	Monroe St	69.63	4.9	4,022	6	21.81	21	2	Local Road	700	0	1	0	2	A	2	20
096706N	Washington St	69.49	4.9	4,022	5	21.96	669	2	Local Road	700	14	23	10	2	A	2	20
092551K	H Street	68.8	3.2	3,551	5	69.34	879	2	Local Road	700	18	474	42	11	C	32	140
096695D	E Heron St	68.5	3.2	3,551	5	71.22	3,452	1	Local Road	700	144	2407	171	14	D	42	1080
096693P	Newell St	68.44	3.2	3,551	6	69.55	649	2	Local Road	700	14	349	31	11	C	32	100
096691B	S Chehalis St	68.36	3.2	3,551	6	54.56	4,906	4	Local Road	700	51	1721	186	9	C	21	300
096689A	Dairy Queen Entrance	68.34	3.2	3,551	6	53.69	157	2	Local Road	700	3	50	6	8	B	19	20
096690U	McDonalds Entrance	68.31	3.2	3,551	6	53.11	1,067	2	Local Road	700	22	340	39	9	B	19	120
096029N	Tyler St	68.23	3.2	3,551	7	51.63	4,048	4	Local Road	700	42	1254	145	9	B	19	220
096688T	Fleet St	68.16	3.2	3,551	7	50.29	1,611	2	Local Road	700	34	467	56	8	B	17	180

Table 12. Grade Crossing Delay of Baseline Traffic (2037)

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
096687L	Junction City Rd	67.14	3.1	4,472	12	14.73	1,596	2	Collector	900	33	40.26	16	2	A	2	60
096682C	Central Park Dr	61.8	3.1	4,472	11	15.33	379	2	Collector	900	8	10.06	4	2	A	2	20
096680N	Aldergrove Dr	59.72	3.1	4,472	25	7.10	514	2	Local Road	700	11	2.95	3	1	A	0	20
096679U	Heikkinen Rd	59.43	3.1	4,472	25	7.11	271	1	Local Road	700	11	1.56	1	1	A	0	20
096678M	Devonshire Rd	58.91	3.1	4,472	25	7.09	1,366	2	Collector	900	28	7.95	7	1	A	0	20
096677F	County Farm Rd	58.73	3.1	4,472	25	7.08	338	2	Local Road	700	7	1.92	2	1	A	0	20
096672W	Main Street	57.72	3.1	4,472	25	7.10	2,029	2	Collector	900	42	12.03	10	1	A	0	40
400107G	Sylvia St	57.59	3.1	4,472	25	7.11	162	2	Local Road	700	3	0.92	1	1	A	0	20
096659H	Old Beacon Rd	56.02	3.1	4,472	25	7.11	122	2	Local Road	700	3	0.69	1	1	A	0	20
096658B	Monte Brady Rd	55.71	3.1	4,472	25	7.11	1,015	2	Collector	900	21	5.88	5	1	A	0	20
096657U	Glenn Rd	55.42	3.1	4,472	25	7.11	27	2	Local Road	700	1	0.15	0	1	A	0	20
096655F	Fairbairn Rd	54.38	3.1	4,472	25	7.11	27	2	Local Road	700	1	0.15	0	1	A	0	20
096654Y	Winkerman Rd S	54.1	3.1	4,472	25	7.09	54	2	Local Road	700	1	0.31	0	1	A	0	20
096652K	Monte Brady Rd	53.33	3.1	4,472	25	7.11	1,353	2	Collector	900	28	7.90	7	1	A	0	20
096650W	Foss Av-Monte Elma	51.98	3.1	4,472	25	7.11	6,168	2	Collector	900	129	40.72	30	1	A	0	100
096649C	Hewitt St	51.85	3.1	4,472	25	7.11	446	2	Local Road	700	9	2.56	2	1	A	0	20
096648V	Moore Rd	51.53	3.1	4,472	25	7.10	649	2	Local Road	700	14	3.73	3	1	A	0	20
096646G	Oniel Rd	51.03	3.1	4,472	25	7.14	730	2	Local Road	700	15	4.26	4	1	A	0	20
096644T	Newman Creek Rd	50.56	3.1	4,472	25	7.11	1,109	2	Local Road	700	23	6.49	5	1	A	0	20
096643L	Hurd Rd	50.08	3.1	4,472	25	7.08	1,772	2	Local Road	700	37	10.50	9	1	A	0	20
096642E	Calder Rd	49.36	3.1	4,472	25	7.10	771	2	Local Road	700	16	4.46	4	1	A	0	20
096641X	N 17th St	48.93	3.1	4,472	25	7.10	149	2	Local Road	700	3	0.84	1	1	A	0	20
096640R	N 13th St	48.7	3.1	4,472	25	7.11	839	2	Local Road	700	17	4.87	4	1	A	0	20
096639W	N 11th St	48.57	3.1	4,472	24	7.19	2,475	2	Local Road	700	52	15.46	12	1	A	0	40
096638P	N 10th St	48.51	3.1	4,472	22	8.29	352	2	Local Road	700	7	2.74	2	1	A	0	20

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
096636B	N 6th St	48.32	3.1	4,472	22	8.76	189	2	Local Road	700	4	1.64	1	1	A	1	20
096635U	N 5th St	48.26	3.1	4,472	22	8.83	95	2	Local Road	700	2	0.83	1	1	A	1	20
096634M	N 3rd St	48.12	3.1	4,472	21	9.92	798	2	Local Road	700	17	9.01	5	2	A	1	20
096525J	N 2d St	48.06	3.1	4,472	24	8.46	609	2	Local Road	700	13	4.97	4	1	A	0	20
096519F	Tridwell Rd	46.71	3.0	4,472	24	7.80	149	2	Local Road	700	3	1.05	1	1	A	0	20
096518Y	Blockhouse Rd W	46.33	3.0	4,568	25	7.13	284	2	Local Road	700	6	1.69	1	1	A	0	20
096515D	Blockhouse Rd E	45.26	3.0	4,568	25	7.12	54	2	Local Road	700	1	0.32	0	1	A	0	20
096510U	Dunlap Rd	44.19	3.0	4,568	25	7.09	243	2	Local Road	700	5	1.43	1	1	A	0	20
092603A	Porter Creek Rd	41.5	3.0	4,568	25	7.11	1,042	2	Collector	900	22	6.24	5	1	A	0	20
092595K	Elma Gare Rd W	38.46	3.0	4,568	25	7.10	122	2	Local Road	700	3	0.71	1	1	A	0	20
092593W	Shelton Rd	36.71	3.0	4,568	25	7.11	68	2	Local Road	700	1	0.40	0	1	A	0	20
92587T	Scheaffer St	33.95	3.0	4,568	25	7.12	54	2	Local Road	700	1	0.32	0	1	A	0	20
092586L	Newton St	33.65	3.0	4,568	25	7.11	230	2	Local Road	700	5	1.35	1	1	A	0	20
092585E	Murray St	33.39	3.0	4,568	25	7.10	230	2	Local Road	700	5	1.35	1	1	A	0	20
092584X	Merry Rd	33.04	3.0	4,568	25	7.11	68	2	Local Road	700	1	0.40	0	1	A	0	20
092583R	Blockhouse Rd	32.45	3.0	4,568	25	7.10	54	2	Local Road	700	1	0.32	0	1	A	0	20
092577M	Moon Rd SW	28.71	3.0	4,568	25	7.10	338	2	Local Road	700	7	1.99	2	1	A	0	20
092576F	Owings St	13.28	3.0	4,568	25	7.08	419	2	Local Road	700	9	2.47	2	1	A	0	20
092574S	Little Rock Rd	10.95	3.0	4,568	25	7.11	1,299	2	Local Road	700	27	7.89	6	1	A	0	20
092573K	183rd Ave SW	10.05	3.0	4,568	25	7.09	1,015	2	Collector	900	21	6.05	5	1	A	0	20
092569V	Joselyn Ave	8.45	3.0	4,568	25	7.09	271	2	Local Road	700	6	1.59	1	1	A	0	20
092567G	Tea St	7.18	3.0	4,568	25	7.12	663	2	Local Road	700	14	3.96	3	1	A	0	20
092566A	Grand Mound SW	6.84	3.0	4,568	25	7.10	446	2	Local Road	700	9	2.64	2	1	A	0	20
092565T	Old Hwy 99 SW	6.07	3.0	4,568	24	7.53	13,134	2	Collector	900	274	123.84	69	2	A	1	220
092563E	216th Ave SW	5.37	3.0	4,568	13	13.39	122	2	Local Road	700	3	2.54	1	2	A	1	20
092561R	222d Ave SW	4.72	3.0	4,568	10	17.22	230	2	Local Road	700	5	7.95	3	3	A	2	20

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
922981P	Hoss Rd	4.44	3.0	4,568	10	17.23	1,488	2	Local Road	700	31	53.51	18	3	A	2	60
922982W	Robert Thompson Rd	4.26	3.0	4,568	10	17.26	744	2	Collector	900	15	26.09	9	3	A	2	20
922980H	Kuper Rd	3.92	3.0	4,568	10	18.00	609	2	Local Road	700	13	23.24	8	3	A	2	20
092559P	Fordon Rd	3.53	3.0	4,568	10	18.03	243	2	Local Road	700	5	9.23	3	3	A	2	20
092554F	W Reynolds Ave	2.14	3.0	4,568	10	17.37	8,251	2	Arterial	1,400	172	328.49	100	3	A	2	340
092552S	J St	1.28	3.0	4,568	8	23.02	446	2	Local Road	700	9	27.74	7	4	A	4	20
092551K	H St	1.15	3.0	4,568	7	24.60	1,136	2	Local Road	700	24	82.35	19	4	A	4	60
092550D	G St	1.09	3.0	4,568	7	25.99	446	2	Local Road	700	9	35.36	8	4	A	5	20
092549J	F St	1.03	3.0	4,568	7	25.39	311	2	Local Road	700	6	23.44	5	4	A	5	20
092548C	E St	0.95	3.0	4,568	7	25.48	446	2	Local Road	700	9	33.98	8	4	A	5	20
092547V	D St	0.89	3.0	4,568	7	25.58	17,788	2	Collector	900	371	2289.22	316	7	A	8	1060
092546N	Tower St	0.82	3.0	4,568	7	25.60	10,375	2	Collector	900	216	1035.80	184	6	A	6	620
092543T	B St	54.28	3.0	4,568	7	25.06	893	2	Local Road	700	19	66.67	16	4	A	4	60

Table 13. Grade Crossing Delay of Baseline Traffic for Switching Movements (2037)

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
922990N	Industrial Rd	71.04	2.8	718	4	42.4	7,494	2	Arterial	1,400	156	1877	220	9	B	15	780
AA	Myrtle St	70.85	1.4	718	2	7.0	95	2	Arterial	1,400	2	1	0	2	A	1	20
BB	N Maple St	70.55	2.8	718	6	24.9	1,042	2	Local Road	700	22	82	18	5	A	5	60
808713U	W 1St St	70.41	3.1	3,409	6	18.3	5,979	2	Collector	900	125	263	76	3	A	3	240
096711K	Port Industrial Rd	70.06	3.9	1,018	8	16.0	23,076	2	Arterial	1,400	481	798	256	3	A	2	660
096710D	Division St	69.82	3.9	1,018	7	15.2	27	2	Local Road	700	1	1	0	2	A	1	20
096709J	Heron St	69.81	3.9	1,018	6	16.0	216	2	Local Road	700	5	5	2	2	A	1	20
808707R	Monroe St	69.63	4.9	4,022	6	21.8	27	2	Local Road	700	1	1	0	2	A	2	20
096706N	Washington St	69.49	4.9	4,022	5	22.0	866	2	Local Road	700	18	30	13	2	A	2	20
092551K	H Street	68.8	3.2	3,551	5	65.8	1,136	2	Local Road	700	24	556	52	11	C	29	160
096695D	E Heron St	68.5	3.2	3,551	5	54.5	4,464	1	Local Road	700	186	1973	169	12	C	27	1060
096693P	Newell St	68.44	3.2	3,551	6	52.3	839	2	Local Road	700	17	257	30	8	B	18	100
096691B	S Chehalis St	68.36	3.2	3,551	6	37.5	6,344	4	Local Road	700	66	1074	165	7	B	10	260
096689A	Dairy Queen Entrance	68.34	3.2	3,551	6	36.6	216	2	Local Road	700	5	32	5	6	A	9	20
096690U	McDonalds Entrance	68.31	3.2	3,551	6	35.9	1,380	2	Local Road	700	29	203	34	6	A	9	100
096029N	Tyler St	68.23	3.2	3,551	7	35.0	5,235	4	Local Road	700	55	758	127	6	A	9	200
096688T	Fleet St	68.16	3.2	3,551	7	34.2	2,083	2	Local Road	700	43	284	50	6	A	8	160

Table 14. Grade Crossing Delay of Baseline Traffic for Peak Hour (2017)

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time (min)	Traffic in both directions	Number of lanes in both directions	Urban or Rural	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	vehicles delayed per day	During Gate Down Time	Level of service	per vehicle in a 24-hour period	Length per lane in Each
096687L	Junction City Rd	67.14	1.0	6,279	12	6.6	142	2	Urban Collector	Collector	900	71	56	16	4	C	23.5	160
096682C	Central Park Dr	61.8	1.0	6,279	11	6.6	34	2	Rural Major Collector	Collector	900	17	13	4	3	C	22.4	40
096680N	Aldergrove Dr	59.72	1.0	6,279	25	3.2	46	2	Rural Local	Local Road	700	23	4	2	2	A	5.2	20
096679U	Heikkinen Rd	59.43	1.0	6,279	25	3.2	24	1	Rural Local	Local Road	700	24	2	1	2	A	5.2	20
096678M	Devonshire Rd	58.91	1.0	6,279	25	3.2	121	2	Rural Minor Collector	Collector	900	61	11	6	2	A	5.4	60
096677F	County Farm Rd	58.73	1.0	6,279	25	3.2	30	2	Rural Local	Local Road	700	15	3	2	2	A	5.1	20
096672W	Main Street	57.72	1.0	6,279	25	3.2	180	2	Rural Major Collector	Collector	900	90	17	10	2	A	5.6	100
400107G	Sylvia St	57.59	1.0	6,279	25	3.2	14	2	Urban Local	Local Road	700	7	1	1	2	A	5.1	20
096659H	Old Beacon Rd	56.02	1.0	6,279	25	3.1	11	2	Rural Local	Local Road	700	5	1	1	2	A	5.0	20
096658B	Monte Brady Rd	55.71	1.0	6,279	25	3.2	90	2	Rural Minor Collector	Collector	900	45	8	5	2	A	5.3	40
096657U	Glenn Rd	55.42	1.0	6,279	25	3.2	2	2	Rural Local	Local Road	700	1	0	0	2	A	5.0	20
096655F	Fairbairn Rd	54.38	1.0	6,279	25	3.2	2	2	Rural Local	Local Road	700	1	0	0	2	A	5.1	20
096654Y	Winkerman Rd S	54.1	1.0	6,279	25	3.2	5	2	Rural Local	Local Road	700	2	0	0	2	A	5.1	20
096652K	Monte Brady Rd	53.33	1.0	6,279	25	3.2	120	2	Rural Major Collector	Collector	900	60	11	6	2	A	5.4	60
096650W	Foss Av-Monte Elma	51.98	1.0	6,279	25	3.2	548	2	Rural Major Collector	Collector	900	274	67	29	2	A	7.3	300
096649C	Hewitt St	51.85	1.0	6,279	25	3.2	40	2	Rural Local	Local Road	700	20	3	2	2	A	5.2	20
096648V	Moore Rd	51.53	1.0	6,279	25	3.2	58	2	Rural Local	Local Road	700	29	5	3	2	A	5.2	40
096646G	Oniel Rd	51.03	1.0	6,279	25	3.2	65	2	Rural Local	Local Road	700	32	6	3	2	A	5.3	40
096644T	Newman Creek Rd	50.56	1.0	6,279	25	3.2	99	2	Rural Local	Local Road	700	49	9	5	2	A	5.4	60
096643L	Hurd Rd	50.08	1.0	6,279	25	3.2	157	2	Rural Local	Local Road	700	79	15	8	2	A	5.7	80
096642E	Calder Rd	49.36	1.0	6,279	25	3.2	69	2	Rural Local	Local Road	700	34	6	4	2	A	5.3	40
096641X	N 17th St	48.93	1.0	6,279	25	3.2	13	2	Rural Local	Local Road	700	7	1	1	2	A	5.3	20
096640R	N 13th St	48.7	1.0	6,279	25	3.3	75	2	Rural Local	Local Road	700	37	7	4	2	A	5.6	40
096639W	N 11th St	48.57	1.0	6,279	24	3.2	220	2	Rural Local	Local Road	700	110	23	12	2	A	6.2	120
096638P	N 10th St	48.51	1.0	6,279	23	3.3	31	2	Rural Local	Local Road	700	16	3	2	2	A	5.4	20
096636B	N 6th St	48.32	1.0	6,279	23	3.3	17	2	Rural Local	Local Road	700	8	2	1	2	A	5.4	20
096635U	N 5th St	48.26	1.0	6,279	23	3.2	8	2	Rural Local	Local Road	700	4	1	0	2	A	5.3	20
096634M	N 3rd St	48.12	1.0	6,279	23	3.2	71	2	Rural Local	Local Road	700	35	6	4	2	A	5.5	40

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time (min)	Traffic in both directions	Number of lanes in both directions	Urban or Rural	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	vehicles delayed per day	During Gate Down Time	Level of service	per vehicle in a 24-hour period	Length per lane in Each
096525J	N 2d St	48.06	1.0	6,279	24	3.2	54	2	Rural Local	Local Road	700	27	5	3	2	A	5.3	20
096519F	Tridwell Rd	46.71	1.0	6,279	25	3.2	13	2	Rural Local	Local Road	700	7	1	1	2	A	5.1	20
096518Y	Blockhouse Rd W	46.33	1.0	6,279	25	3.2	25	2	Rural Local	Local Road	700	13	2	1	2	A	5.1	20
096515D	Blockhouse Rd E	45.26	1.0	6,279	25	2.9	5	2	Rural Local	Local Road	700	2	0	0	1	A	4.3	20
096510U	Dunlap Rd	44.19	1.0	6,279	25	3.2	22	2	Rural Local	Local Road	700	11	2	1	2	A	5.1	20
092603A	Porter Creek Rd	41.5	1.0	6,279	25	3.2	93	2	Rural Minor Collector	Collector	900	46	8	5	2	A	5.3	40
092595K	Elma Gare Rd W	38.46	1.0	6,279	25	3.1	11	2	Rural Local	Local Road	700	5	1	1	2	A	4.8	20
092593W	Shelton Rd	36.71	1.0	6,279	25	3.2	6	2	Rural Local	Local Road	700	3	1	0	2	A	5.0	20
92587T	Scheaffer St	33.95	1.0	6,279	25	3.2	5	2	Rural Local	Local Road	700	2	0	0	2	A	5.0	20
092586L	Newton St	33.65	1.0	6,279	25	3.2	20	2	Rural Local	Local Road	700	10	2	1	2	A	5.1	20
092585E	Murray St	33.39	1.0	6,279	25	3.2	20	2	Rural Local	Local Road	700	10	2	1	2	A	5.1	20
092584X	Merry Rd	33.04	1.0	6,279	25	3.2	6	2	Rural Local	Local Road	700	3	1	0	2	A	5.1	20
092583R	Blockhouse Rd	32.45	1.0	6,279	25	3.2	5	2	Rural Local	Local Road	700	2	0	0	2	A	5.0	20
092577M	Moon Rd SW	28.71	1.0	6,279	25	3.2	30	2	Rural Local	Local Road	700	15	3	2	2	A	5.3	20
092576F	Owings St	13.28	1.0	6,279	25	3.2	37	2	Rural Local	Local Road	700	19	3	2	2	A	5.3	20
092574S	Little Rock Rd	10.95	1.0	6,279	25	3.4	115	2	Rural Local	Local Road	700	58	12	7	2	A	6.2	60
092573K	183rd Ave SW	10.05	1.0	6,279	25	3.2	90	2	Rural Minor Collector	Collector	900	45	8	5	2	A	5.5	40
092569V	Joselyn Ave	8.45	1.0	6,279	25	3.2	24	2	Rural Local	Local Road	700	12	2	1	2	A	5.1	20
092567G	Tea St	7.18	1.0	6,279	25	3.2	59	2	Rural Local	Local Road	700	29	5	3	2	A	5.3	40
092566A	Grand Mound SW	6.84	1.0	6,279	25	3.2	40	2	Rural Local	Local Road	700	20	3	2	2	A	5.2	20
092565T	Old Hwy 99 SW	6.07	1.0	6,279	21	4.0	1,167	2	Rural Major Collector	Collector	900	584	447	78	6	C	23.0	780
092563E	216th Ave SW	5.37	1.0	6,279	13	6.4	11	2	Rural Local	Local Road	700	5	4	1	3	C	20.7	20
092561R	222d Ave SW	4.72	1.0	6,279	10	7.5	20	2	Rural Local	Local Road	700	10	10	3	4	C	28.8	20
922981P	Hoss Rd	4.44	1.0	6,279	10	7.5	132	2	Urban Local	Local Road	700	66	69	17	4	C	31.3	160
922982W	Robert Thompson Rd	4.26	1.0	6,279	10	7.5	66	2	Rural Minor Collector	Collector	900	33	32	8	4	C	29.4	80
922980H	Kuper Rd	3.92	1.0	6,279	10	7.6	54	2	Rural Local	Local Road	700	27	27	7	4	C	29.6	60
092559P	Fordon Rd	3.53	1.0	6,279	10	7.0	22	2	Urban Local	Local Road	700	11	9	3	4	C	25.0	20
092554F	W Reynolds Ave	2.14	1.0	6,279	10	6.7	733	2	Urban Minor Arterial	Arterial	1,400	367	370	82	5	C	30.3	820
092552S	J St	1.28	1.0	6,279	8	8.8	40	2	Urban Local	Local Road	700	20	26	6	5	D	39.7	60

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time (min)	Traffic in both directions	Number of lanes in both directions	Urban or Rural	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	vehicles delayed per day	During Gate Down Time	Level of service	per vehicle in a 24-hour period	Length per lane in Each
092551K	H St	1.15	1.0	6,279	7	8.8	101	2	Urban Local	Local Road	700	50	70	15	5	D	41.6	140
092550D	G St	1.09	1.0	6,279	7	9.2	40	2	Urban Local	Local Road	700	20	29	6	5	D	43.4	60
092549J	F St	1.03	1.0	6,279	7	8.8	28	2	Urban Local	Local Road	700	14	18	4	4	D	39.5	40
092548C	E St	0.95	1.0	6,279	7	8.8	40	2	Urban Local	Local Road	700	20	26	6	5	D	39.9	60
092547V	D St	0.89	1.0	6,279	7	8.8	1,580	2	Urban Collector	Collector	900	790	8406	232	36	F	319.1	2320
092546N	Tower St	0.82	1.0	6,279	7	8.8	922	2	Urban Collector	Collector	900	461	1233	136	9	F	80.2	1360
092543T	B St	54.28	1.0	6,279	7	8.9	79	2	Urban Local	Local Road	700	40	56	12	5	D	42.3	120

Table 15. Grade Crossing Delay of Baseline Traffic for Peak Hour Switching Movements (2017)[1]

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	During Gate Down Time (veh/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Length per lane in Each Direction (feet)
808714B	Port Industrial Rd (30th St)		1.0	6,279	7	4.78	734	2	Local Road	700	367	294	59	5	C	24	580
808711F	Myrtle		1.0	6,279	2	4.78	425	2	Arterial	1,400	213	96	34	3	B	13	340
808712M	Maple		1.0	6,279	7	4.78	93	2	Local Road	700	46	19	7	3	B	12	80
922990N	Industrial Rd	71.04	1.0	6,279	4	29.18	666	2	Arterial	1,400	333	6,196	324	19	F	558.4	3240
AA	Myrtle St	70.85	1.0	6,279	2	4.88	8	2	Arterial	1,400	4	2	1	2	B	12	20
BB	N Maple St	70.55	1.0	6,279	7	16.92	93	2	Local Road	700	46	236	26	9	F	153	260
808713U	W 1St St	70.41	1.0	6,279	6	10.58	531	2	Collector	900	266	702	94	8	E	79.3	940
096711K	Port Industrial Rd	70.06	1.0	6,279	8	8.97	2,050	2	Arterial	1,400	1,025	5,136	307	17	F	150.3	3060
096710D	Division St	69.82	1.0	6,279	7	8.97	2	2	Local Road	700	1	2	0	4	D	40.3	20
096709J	Heron St	69.81	1.0	6,279	6	8.97	19	2	Local Road	700	10	13	3	5	D	40.8	20
808707R	Monroe St	69.63	1.0	6,279	6	8.97	2	2	Local Road	700	1	2	0	4	D	40.3	20
096706N	Washington St	69.49	1.0	6,279	5	8.97	77	2	Local Road	700	38	55	11	5	D	42.6	120
092551K	H Street	68.8	1.0	6,279	5	30.01	101	2	Local Road	700	50	817	50	16	F	485.4	500
096695D	E Heron St	68.5	1.0	6,279	5	28.22	397	1	Local Road	700	397	6,071	187	33	F	918.5	3740
096693P	Newell St	68.44	1.0	6,279	6	27.72	75	2	Local Road	700	37	504	34	15	F	405.7	340
096691B	S Chehalis St	68.36	1.0	6,279	6	25.08	564	4	Local Road	700	141	3,698	236	16	F	393.6	1180
096689A	Dairy Queen Entrance	68.34	1.0	6,279	6	24.80	19	2	Local Road	700	10	100	8	13	F	311.8	80
096690U	McDonalds Entrance	68.31	1.0	6,279	6	24.61	123	2	Local Road	700	61	678	50	13	F	331.8	500
096029N	Tyler St	68.23	1.0	6,279	7	24.11	465	4	Local Road	700	116	2,702	187	14	F	348.5	940
096688T	Fleet St	68.16	1.0	6,279	7	23.66	185	2	Local Road	700	93	995	73	14	F	322.5	720

[1] Based on 1 grain train passby. Except for Industrial Rd (922990N), Myrtle St (AA), N Maple St (BB), and W 1st St (808713U) which are based on the average of proposed action train traffic.

Table 16. Grade Crossing Delay of Baseline Traffic for Peak Hour (2037)

Crossing ID	Street	Milepost	Number of Daily Trains	Train Speed (mph)	Gate Down-Time (min)	Peak Hour traffic in both directions (veh/hr)	Number of lanes in both directions	Urban or Rural	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
096687L	Junction City Rd	67.14	1.0	12	6.6	183	2	Urban Collector	Collector	900	92	73.71	20	4	C	24.1	200
096682C	Central Park Dr	61.8	1.0	11	6.6	44	2	Rural Major Collector	Collector	900	22	16.35	5	3	C	22.5	40
096680N	Aldergrove Dr	59.72	1.0	25	3.2	59	2	Rural Local	Local Road	700	30	5.16	3	2	A	5.2	40
096679U	Heikkinen Rd	59.43	1.0	25	3.2	31	1	Rural Local	Local Road	700	31	2.72	2	2	A	5.3	40
096678M	Devonshire Rd	58.91	1.0	25	3.2	157	2	Rural Minor Collector	Collector	900	78	14.40	8	2	A	5.5	80
096677F	County Farm Rd	58.73	1.0	25	3.2	39	2	Rural Local	Local Road	700	19	3.34	2	2	A	5.2	20
096672W	Main Street	57.72	1.0	25	3.2	233	2	Rural Major Collector	Collector	900	117	22.66	12	2	A	5.8	120
400107G	Sylvia St	57.59	1.0	25	3.2	19	2	Urban Local	Local Road	700	9	1.60	1	2	A	5.1	20
096659H	Old Beacon Rd	56.02	1.0	25	3.1	14	2	Rural Local	Local Road	700	7	1.16	1	2	A	5.0	20
096658B	Monte Brady Rd	55.71	1.0	25	3.2	117	2	Rural Minor Collector	Collector	900	58	10.55	6	2	A	5.4	60
096657U	Glenn Rd	55.42	1.0	25	3.2	3	2	Rural Local	Local Road	700	2	0.26	0	2	A	5.0	20
096655F	Fairbairn Rd	54.38	1.0	25	3.2	3	2	Rural Local	Local Road	700	2	0.27	0	2	A	5.1	20
096654Y	Winkerman Rd S	54.1	1.0	25	3.2	6	2	Rural Local	Local Road	700	3	0.53	0	2	A	5.2	20
096652K	Monte Brady Rd	53.33	1.0	25	3.2	155	2	Rural Major Collector	Collector	900	78	14.40	8	2	A	5.6	80
096650W	Foss Av-Monte Elma	51.98	1.0	25	3.2	709	2	Rural Major Collector	Collector	900	354	98.92	38	3	A	8.4	380
096649C	Hewitt St	51.85	1.0	25	3.2	51	2	Rural Local	Local Road	700	26	4.47	3	2	A	5.2	20
096648V	Moore Rd	51.53	1.0	25	3.2	75	2	Rural Local	Local Road	700	37	6.58	4	2	A	5.3	40
096646G	Oniel Rd	51.03	1.0	25	3.2	84	2	Rural Local	Local Road	700	42	7.48	4	2	A	5.3	40
096644T	Newman Creek Rd	50.56	1.0	25	3.2	127	2	Rural Local	Local Road	700	64	11.74	7	2	A	5.5	60
096643L	Hurd Rd	50.08	1.0	25	3.2	204	2	Rural Local	Local Road	700	102	19.95	11	2	A	5.9	100
096642E	Calder Rd	49.36	1.0	25	3.2	89	2	Rural Local	Local Road	700	44	8.00	5	2	A	5.4	40
096641X	N 17th St	48.93	1.0	25	3.2	17	2	Rural Local	Local Road	700	9	1.51	1	2	A	5.3	20
096640R	N 13th St	48.7	1.0	25	3.3	96	2	Rural Local	Local Road	700	48	9.13	5	2	A	5.7	60
096639W	N 11th St	48.57	1.0	24	3.2	284	2	Rural Local	Local Road	700	142	31.22	15	2	A	6.6	160
096638P	N 10th St	48.51	1.0	23	3.3	40	2	Rural Local	Local Road	700	20	3.67	2	2	A	5.4	20
096636B	N 6th St	48.32	1.0	23	3.3	22	2	Rural Local	Local Road	700	11	1.95	1	2	A	5.4	20

Crossing ID	Street	Milepost	Number of Daily Trains	Train Speed (mph)	Gate Down-Time (min)	Peak Hour traffic in both directions (veh/hr)	Number of lanes in both directions	Urban or Rural	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
096635U	N 5th St	48.26	1.0	23	3.2	11	2	Rural Local	Local Road	700	5	0.96	1	2	A	5.3	20
096634M	N 3rd St	48.12	1.0	23	3.2	92	2	Rural Local	Local Road	700	46	8.48	5	2	A	5.5	40
096525J	N 2d St	48.06	1.0	24	3.2	70	2	Rural Local	Local Road	700	35	6.28	4	2	A	5.4	40
096519F	Tridwell Rd	46.71	1.0	25	3.2	17	2	Rural Local	Local Road	700	9	1.44	1	2	A	5.1	20
096518Y	Blockhouse Rd W	46.33	1.0	25	3.2	33	2	Rural Local	Local Road	700	16	2.80	2	2	A	5.2	20
096515D	Blockhouse Rd E	45.26	1.0	25	2.9	6	2	Rural Local	Local Road	700	3	0.44	0	1	A	4.3	20
096510U	Dunlap Rd	44.19	1.0	25	3.2	28	2	Rural Local	Local Road	700	14	2.40	1	2	A	5.1	20
092603A	Porter Creek Rd	41.5	1.0	25	3.2	120	2	Rural Minor Collector	Collector	900	60	10.79	6	2	A	5.4	60
092595K	Elma Gare Rd W	38.46	1.0	25	3.1	14	2	Rural Local	Local Road	700	7	1.13	1	2	A	4.8	20
092593W	Shelton Rd	36.71	1.0	25	3.2	8	2	Rural Local	Local Road	700	4	0.65	0	2	A	5.0	20
92587T	Scheaffer St	33.95	1.0	25	3.2	6	2	Rural Local	Local Road	700	3	0.52	0	2	A	5.0	20
092586L	Newton St	33.65	1.0	25	3.2	26	2	Rural Local	Local Road	700	13	2.26	1	2	A	5.1	20
092585E	Murray St	33.39	1.0	25	3.2	26	2	Rural Local	Local Road	700	13	2.26	1	2	A	5.1	20
092584X	Merry Rd	33.04	1.0	25	3.2	8	2	Rural Local	Local Road	700	4	0.66	0	2	A	5.1	20
092583R	Blockhouse Rd	32.45	1.0	25	3.2	6	2	Rural Local	Local Road	700	3	0.52	0	2	A	5.0	20
092577M	Moon Rd SW	28.71	1.0	25	3.2	39	2	Rural Local	Local Road	700	19	3.48	2	2	A	5.4	20
092576F	Owings St	13.28	1.0	25	3.2	48	2	Rural Local	Local Road	700	24	4.25	3	2	A	5.3	20
092574S	Little Rock Rd	10.95	1.0	25	3.4	149	2	Rural Local	Local Road	700	75	15.96	8	2	A	6.4	80
092573K	183rd Ave SW	10.05	1.0	25	3.2	117	2	Rural Minor Collector	Collector	900	58	10.77	6	2	A	5.5	60
092569V	Joselyn Ave	8.45	1.0	25	3.2	31	2	Rural Local	Local Road	700	16	2.68	2	2	A	5.2	20
092567G	Tea St	7.18	1.0	25	3.2	76	2	Rural Local	Local Road	700	38	6.77	4	2	A	5.3	40
092566A	Grand Mound SW	6.84	1.0	25	3.2	51	2	Rural Local	Local Road	700	26	4.48	3	2	A	5.2	20
092565T	Old Hwy 99 SW	6.07	1.0	21	4.0	1,509	2	Rural Major Collector	Collector	900	755	1257.74	101	12	D	50.0	1020
092563E	216th Ave SW	5.37	1.0	13	6.4	14	2	Rural Local	Local Road	700	7	4.83	1	3	C	20.7	20
092561R	222d Ave SW	4.72	1.0	10	7.5	26	2	Rural Local	Local Road	700	13	12.72	3	4	C	28.9	40
922981P	Hoss Rd	4.44	1.0	10	7.5	171	2	Urban Local	Local Road	700	85	92.02	21	4	C	32.3	220
922982W	Robert Thompson Rd	4.26	1.0	10	7.5	85	2	Rural Minor Collector	Collector	900	43	42.40	11	4	C	29.8	100

Crossing ID	Street	Milepost	Number of Daily Trains	Train Speed (mph)	Gate Down-Time (min)	Peak Hour traffic in both directions (veh/hr)	Number of lanes in both directions	Urban or Rural	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
922980H	Kuper Rd	3.92	1.0	10	7.6	70	2	Rural Local	Local Road	700	35	34.97	9	4	C	30.0	80
092559P	Fordon Rd	3.53	1.0	10	7.0	28	2	Urban Local	Local Road	700	14	11.71	3	4	C	25.1	40
092554F	W Reynolds Ave	2.14	1.0	10	6.7	948	2	Urban Minor Arterial	Arterial	1,400	474	534.09	106	5	C	33.8	1060
092552S	J St	1.28	1.0	8	8.8	51	2	Urban Local	Local Road	700	26	34.23	8	5	D	40.0	80
092551K	H St	1.15	1.0	7	8.8	131	2	Urban Local	Local Road	700	65	92.56	19	5	D	42.5	200
092550D	G St	1.09	1.0	7	9.2	51	2	Urban Local	Local Road	700	26	37.42	8	5	D	43.8	80
092549J	F St	1.03	1.0	7	8.8	36	2	Urban Local	Local Road	700	18	23.66	5	5	D	39.7	60
092548C	E St	0.95	1.0	7	8.8	51	2	Urban Local	Local Road	700	26	34.44	8	5	D	40.3	80
092546N	Tower St	0.82	1.0	7	8.8	1,192	2	Urban Collector	Collector	900	596	2302.90	176	13	F	115.9	1760
092543T	B St	54.28	1.0	7	8.9	103	2	Urban Local	Local Road	700	51	73.61	15	5	D	43.1	160

Table 17. Grade Crossing Delay of Baseline Traffic for Peak Hour Switching Movements (2037)[1]

Crossing ID	Street	Milepost	Number of Daily Trains	Train Speed (mph)	Gate Down-Time per Day (min)	Peak hour traffic in both directions (veh/hr)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
808714B	Port Industrial Rd (30th St)		1.0	6,279	7	950	2	Local Road	700	475	563	76	7	D	35.6	760
808711F	Myrtle		1.0	6,279	7	550	2	Arterial	1,400	275	131	44	3	B	14.2	440
808712M	Maple		1.0	6,279	7	120	2	Local Road	700	60	25	10	3	B	12.5	100
922990N	Industrial Rd	71.04	1.0	6,279	5	861	2	Arterial	1,400	431	8820	419	21	F	614.6	4180
AA	Myrtle St	70.85	1.0	6,279	7	11	2	Arterial	1,400	5	2	1	-	B	11.9	20
BB	N Maple St	70.55	1.0	6,279	7	120	2	Local Road	700	60	312	34	-	F	156.5	340
808713U	W 1St St	70.41	1.0	6,279	6	687	2	Collector	900	343	1035	121	10,949	F	1220	1220
096711K	Port Industrial Rd	70.06	1.0	6,279	7	2,651	2	Arterial	1,400	1,326	33522	396	300,710	F	3960	3960
096710D	Division St	69.82	1.0	6,279	7	3	2	Local Road	700	2	2	0	19	B	20	20
096709J	Heron St	69.81	1.0	6,279	6	25	2	Local Road	700	12	17	4	152	F	40	40
808707R	Monroe St	69.63	1.0	6,279	6	3	2	Local Road	700	2	2	0	19	B	20	20
096706N	Washington St	69.49	1.0	6,279	5	99	2	Local Road	700	50	72	15	644	F	140	140
092551K	H Street	68.8	1.0	6,279	6	131	2	Local Road	700	65	1057	65	31,395	F	640	640
096695D	E Heron St	68.5	1.0	6,279	5	513	1	Local Road	700	513	11081	225	291,710	F	4500	4500
096693P	Newell St	68.44	1.0	6,279	6	96	2	Local Road	700	48	542	40	13,583	F	400	400
096691B	S Chehalis St	68.36	1.0	6,279	6	729	4	Local Road	700	182	4108	272	91,890	F	1360	1360
096689A	Dairy Queen Entrance	68.34	1.0	6,279	6	25	2	Local Road	700	12	102	9	2,236	F	100	100
096690U	McDonalds Entrance	68.31	1.0	6,279	6	159	2	Local Road	700	79	682	57	14,600	F	560	560
096029N	Tyler St	68.23	1.0	6,279	6	601	4	Local Road	700	150	2751	208	57,101	F	1040	1040
096688T	Fleet St	68.16	1.0	6,279	7	239	2	Local Road	700	120	993	81	20,176	F	820	820

[1] Based on 1 grain train passby. Except for Industrial Rd (922990N), Myrtle St (AA), N Maple St (BB), and W 1st St (808713U) which are based on the average of proposed action train traffic.

Proposed Action

Table 18. Grade Crossing Delay of Proposed Action Train Traffic with Baseline Traffic (2017)

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)	No Action Avg. Delay per Vehicle in 24-hr Period (sec/veh)	Change in the Number of Stopped Vehicle	Change in Trips Affected (%)	Change in Average Delay per Vehicle (sec/veh)
096687L	Junction City Rd	67.14	4.4	5,323	12	24.8	1,234	2	Collector	900	26	62	21	3	A	3.0	40	1.5	9	0.70%	1.5
096682C	Central Park Dr	61.8	4.4	5,323	11	25.6	293	2	Collector	900	6	15	5	3	A	3.2	20	1.6	2	0.71%	1.6
096680N	Aldergrove Dr	59.72	4.4	5,323	25	12.2	397	2	Local Road	700	8	5	3	1	A	0.7	20	0.3	1	0.36%	0.4
096679U	Heikkinen Rd	59.43	4.4	5,323	25	12.2	209	1	Local Road	700	9	3	2	1	A	0.7	20	0.3	1	0.36%	0.4
096678M	Devonshire Rd	58.91	4.4	5,323	25	12.1	1,056	2	Collector	900	22	13	9	1	A	0.7	20	0.3	4	0.35%	0.4
096677F	County Farm Rd	58.73	4.4	5,323	25	12.0	262	2	Local Road	700	5	3	2	1	A	0.7	20	0.3	1	0.34%	0.4
096672W	Main Street	57.72	4.4	5,323	25	12.1	1,569	2	Collector	900	33	19	13	1	A	0.7	40	0.4	5	0.34%	0.4
400107G	Sylvia St	57.59	4.4	5,323	25	12.1	126	2	Local Road	700	3	1	1	1	A	0.7	20	0.3	0	0.34%	0.4
096659H	Old Beacon Rd	56.02	4.4	5,323	25	11.9	94	2	Local Road	700	2	1	1	1	A	0.7	20	0.3	0	0.33%	0.3
096658B	Monte Brady Rd	55.71	4.4	5,323	25	12.0	785	2	Collector	900	16	9	7	1	A	0.7	20	0.3	3	0.34%	0.4
096657U	Glenn Rd	55.42	4.4	5,323	25	11.9	21	2	Local Road	700	0	0	0	1	A	0.7	20	0.3	0	0.34%	0.3
096655F	Fairbairn Rd	54.38	4.4	5,323	25	12.0	21	2	Local Road	700	0	0	0	1	A	0.7	20	0.3	0	0.34%	0.4
096654Y	Winkerman Rd S	54.1	4.4	5,323	25	12.0	42	2	Local Road	700	1	0	0	1	A	0.7	20	0.3	0	0.34%	0.4
096652K	Monte Brady Rd	53.33	4.4	5,323	25	12.0	1,046	2	Collector	900	22	12	9	1	A	0.7	20	0.3	4	0.34%	0.4
096650W	Foss Av-Monte Elma	51.98	4.4	5,323	25	12.1	4,770	2	Collector	900	99	62	40	2	A	0.8	100	0.4	16	0.34%	0.4
096649C	Hewitt St	51.85	4.4	5,323	25	12.0	345	2	Local Road	700	7	4	3	1	A	0.7	20	0.3	1	0.34%	0.4
096648V	Moore Rd	51.53	4.4	5,323	25	12.0	502	2	Local Road	700	10	6	4	1	A	0.7	20	0.3	2	0.34%	0.4
096646G	Oniel Rd	51.03	4.4	5,323	25	11.8	565	2	Local Road	700	12	6	5	1	A	0.7	20	0.3	2	0.32%	0.3
096644T	Newman Creek Rd	50.56	4.4	5,323	25	12.0	858	2	Local Road	700	18	10	7	1	A	0.7	20	0.3	3	0.34%	0.4
096643L	Hurd Rd	50.08	4.4	5,323	25	11.1	1,370	2	Local Road	700	29	14	11	1	A	0.6	20	0.4	4	0.28%	0.3
096642E	Calder Rd	49.36	4.4	5,323	25	12.1	596	2	Local Road	700	12	7	5	1	A	0.7	20	0.3	2	0.34%	0.4

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)	No Action Avg. Delay per Vehicle in 24-hr Period (sec/veh)	Change in the Number of Stopped Vehicle	Change in Trips Affected (%)	Change in Average Delay per Vehicle (sec/veh)
096641X	N 17th St	48.93	4.4	5,323	25	11.5	115	2	Local Road	700	2	1	1	1	A	0.6	20	0.3	0	0.30%	0.3
096640R	N 13th St	48.7	4.4	5,323	25	11.6	649	2	Local Road	700	14	7	5	1	A	0.7	20	0.3	2	0.31%	0.3
096639W	N 11th St	48.57	4.4	5,323	24	11.8	1,914	2	Local Road	700	40	22	16	1	A	0.7	40	0.4	6	0.32%	0.3
096638P	N 10th St	48.51	4.4	5,323	23	12.9	272	2	Local Road	700	6	4	2	1	A	0.8	20	0.5	1	0.32%	0.3
096636B	N 6th St	48.32	4.4	5,323	23	13.5	146	2	Local Road	700	3	2	1	2	A	0.9	20	0.5	0	0.33%	0.4
096635U	N 5th St	48.26	4.4	5,323	23	13.6	73	2	Local Road	700	2	1	1	2	A	0.9	20	0.5	0	0.33%	0.4
096634M	N 3rd St	48.12	4.4	5,323	23	14.9	617	2	Local Road	700	13	11	6	2	A	1.1	20	0.7	2	0.34%	0.4
096525J	N 2d St	48.06	4.4	5,323	24	13.3	471	2	Local Road	700	10	7	4	2	A	0.9	20	0.5	2	0.34%	0.4
096519F	Tridwell Rd	46.71	4.3	5,411	25	12.8	115	2	Local Road	700	2	2	1	2	A	0.8	20	0.4	0	0.35%	0.4
096518Y	Blockhouse Rd W	46.33	4.3	5,411	25	12.1	220	2	Local Road	700	5	3	2	1	A	0.7	20	0.4	1	0.34%	0.4
096515D	Blockhouse Rd E	45.26	4.3	5,411	25	12.1	42	2	Local Road	700	1	1	0	1	A	0.7	20	0.4	0	0.35%	0.4
096510U	Dunlap Rd	44.19	4.3	5,411	25	12.0	188	2	Local Road	700	4	2	2	1	A	0.7	20	0.4	1	0.34%	0.4
092603A	Porter Creek Rd	41.5	4.3	5,411	25	12.0	805	2	Collector	900	17	10	7	1	A	0.7	20	0.4	3	0.34%	0.4
092595K	Elma Gare Rd W	38.46	4.3	5,411	25	12.0	94	2	Local Road	700	2	1	1	1	A	0.7	20	0.4	0	0.34%	0.4
092593W	Shelton Rd	36.71	4.3	5,411	25	12.0	52	2	Local Road	700	1	1	0	1	A	0.7	20	0.4	0	0.34%	0.4
92587T	Scheaffer St	33.95	4.3	5,411	25	11.8	42	2	Local Road	700	1	0	0	1	A	0.7	20	0.4	0	0.33%	0.3
092586L	Newton St	33.65	4.3	5,411	25	11.9	178	2	Local Road	700	4	2	1	1	A	0.7	20	0.4	1	0.33%	0.3
092585E	Murray St	33.39	4.3	5,411	25	12.0	178	2	Local Road	700	4	2	1	1	A	0.7	20	0.4	1	0.34%	0.4
092584X	Merry Rd	33.04	4.3	5,411	25	12.0	52	2	Local Road	700	1	1	0	1	A	0.7	20	0.4	0	0.34%	0.4
092583R	Blockhouse Rd	32.45	4.3	5,411	25	12.0	42	2	Local Road	700	1	0	0	1	A	0.7	20	0.4	0	0.34%	0.4
092577M	Moon Rd SW	28.71	4.3	5,411	25	12.1	262	2	Local Road	700	5	3	2	1	A	0.7	20	0.4	1	0.35%	0.4
092576F	Owings St	13.28	4.3	5,411	25	12.0	324	2	Local Road	700	7	4	3	1	A	0.7	20	0.4	1	0.34%	0.4
092574S	Little Rock Rd	10.95	4.3	5,411	25	12.0	1,004	2	Local Road	700	21	12	8	1	A	0.7	20	0.4	3	0.34%	0.4
092573K	183rd Ave SW	10.05	4.3	5,411	25	12.0	785	2	Collector	900	16	9	7	1	A	0.7	20	0.4	3	0.34%	0.4
092569V	Joselyn Ave	8.45	4.3	5,411	25	12.0	209	2	Local Road	700	4	2	2	1	A	0.7	20	0.4	1	0.34%	0.4
092567G	Tea St	7.18	4.3	5,411	25	12.1	513	2	Local Road	700	11	6	4	1	A	0.7	20	0.4	2	0.34%	0.4

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)	No Action Avg. Delay per Vehicle in 24-hr Period (sec/veh)	Change in the Number of Stopped Vehicle	Change in Trips Affected (%)	Change in Average Delay per Vehicle (sec/veh)
092566A	Grand Mound SW	6.84	4.3	5,411	25	12.1	345	2	Local Road	700	7	4	3	1	A	0.7	20	0.4	1	0.35%	0.4
092565T	Old Hwy 99 SW	6.07	4.3	5,411	21	14.5	10,157	2	Collector	900	212	229	103	2	A	1.4	240	0.5	49	0.49%	0.8
092563E	216th Ave SW	5.37	4.3	5,411	13	23.5	94	2	Local Road	700	2	4	2	3	A	2.7	20	1.2	1	0.70%	1.5
092561R	222d Ave SW	4.72	4.3	5,411	10	28.5	178	2	Local Road	700	4	12	4	3	A	4.0	20	2.1	1	0.78%	1.9
922981P	Hoss Rd	4.44	4.3	5,411	10	28.5	1,151	2	Local Road	700	24	79	23	3	A	4.1	60	2.1	9	0.79%	2.0
922982W	Robert Thompson Rd	4.26	4.3	5,411	10	28.9	575	2	Collector	900	12	40	12	3	A	4.1	20	2.1	5	0.81%	2.1
922980H	Kuper Rd	3.92	4.3	5,411	10	29.6	471	2	Local Road	700	10	34	10	4	A	4.4	20	2.3	4	0.81%	2.1
092559P	Fordon Rd	3.53	4.3	5,411	10	29.4	188	2	Local Road	700	4	13	4	3	A	4.3	20	2.3	1	0.79%	2.0
092554F	W Reynolds Ave	2.14	4.3	5,411	10	28.4	6,381	2	Arterial	1,400	133	462	126	4	A	4.3	300	2.3	49	0.76%	2.0
092552S	J St	1.28	4.3	5,411	8	36.0	345	2	Local Road	700	7	37	9	4	A	6.4	20	3.7	3	0.90%	2.7
092551K	H St	1.15	4.3	5,411	7	37.5	879	2	Local Road	700	18	104	23	5	A	7.1	60	4.3	8	0.90%	2.8
092550D	G St	1.09	4.3	5,411	7	39.2	345	2	Local Road	700	7	44	9	5	A	7.6	20	4.7	3	0.92%	2.9
092549J	F St	1.03	4.3	5,411	7	38.3	241	2	Local Road	700	5	29	6	5	A	7.2	20	4.5	2	0.90%	2.7
092548C	E St	0.95	4.3	5,411	7	38.4	345	2	Local Road	700	7	42	9	5	A	7.3	20	4.6	3	0.90%	2.7
092547V	D St	0.89	4.3	5,411	7	38.5	13,755	2	Collector	900	287	2444	368	7	B	10.7	860	6.7	124	0.90%	4.0
092546N	Tower St	0.82	4.3	5,411	7	38.6	8,023	2	Collector	900	167	1197	215	6	A	8.9	500	5.6	72	0.90%	3.4
092543T	B St	54.28	4.3	5,411	7	38.1	690	2	Local Road	700	14	84	18	5	A	7.3	40	4.5	6	0.91%	2.8

Table 19. Grade Crossing Delay of Proposed Action Train Traffic with Baseline Traffic for Switching Movements (2017)

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)	NO ACTION Avg. Delay per Vehicle in 24-hr Period (sec/veh)	Change in the Number of Stopped Vehicle	Change in Trips Affected (%)	Change in Average Delay per Vehicle (sec/veh)
808714B	Port Industrial Rd (30th St)		0.3	6,099	3.93	2.53	6,391	2	Local Road	700	133	65	11	6	A	0.6	420	0.6	0	0.00	-
808711F	Myrtle		0.3	6,099	4.93	2.53	3,703	2	Arterial	1,400	77	32	7	5	A	0.5	240	0.5	0	0.00	-
808712M	Maple		0.3	6,099	5.93	2.53	805	2	Local Road	700	17	7	1	5	A	0.5	60	0.5	0	0.00	-
922990N	Industrial Rd	71.04	4.1	1,206	3.9	89.57	5,795	2	Arterial	1,400	121	4351	360	12	D	45.1	880	14.6	190	3.28	30.4
AA	Myrtle St	70.85	1.4	718	2.2	6.95	73	2	Arterial	1,400	2	1	0	2	A	0.7	20	0.7	0	0.00	-
BB	N Maple St	70.55	4.1	1,206	5.7	56.66	805	2	Local Road	700	17	227	32	7	B	17	80	4.7	18	2.21	12.2
808713U	W 1St St	70.41	4.3	3,652	5.9	49.99	4,623	2	Collector	900	96	1036	161	6	B	13	380	2.5	102	2.20	10.9
096711K	Port Industrial Rd	70.06	5.2	2,071	7.6	42.07	17,845	2	Arterial	1,400	372	2889	521	6	A	10	1,000	1.9	323	1.81	7.9
096710D	Division St	69.82	5.2	2,071	6.9	45.38	21	2	Local Road	700	0	3	1	4	A	8	20	1.2	0	2.10	7.1
096709J	Heron St	69.81	5.2	2,071	6.5	48.44	167	2	Local Road	700	3	27	6	5	A	10	20	1.4	4	2.25	8.1
808707R	Monroe St	69.63	6.2	3,573	6.5	62.09	21	2	Local Road	700	0	5	1	5	B	13	20	2.0	1	2.80	11.0
096706N	Washington St	69.49	6.2	3,573	5.4	64.00	669	2	Local Road	700	14	157	30	5	B	14	40	2.1	20	2.92	12.0
092551K	H Street	68.8	4.4	3,679	5.1	135.48	879	2	Local Road	700	18	1296	83	16	F	88	180	32.4	40	4.59	56.1
096695D	E Heron St	68.5	4.4	3,679	5.5	114.53	3,452	1	Local Road	700	144	4458	275	16	E	77	1,240	41.8	104	3.01	35.7
096693P	Newell St	68.44	4.4	3,679	5.7	112.24	649	2	Local Road	700	14	652	51	13	E	60	120	32.3	19	2.97	28.0
096691B	S Chehalis St	68.36	4.4	3,679	6.0	93.92	4,906	4	Local Road	700	51	3652	320	11	D	45	360	21.0	134	2.73	23.6
096689A	Dairy Queen Entrance	68.34	4.4	3,679	6.0	92.67	157	2	Local Road	700	3	106	10	10	D	40	20	19.0	4	2.71	21.5
096690U	McDonalds Entrance	68.31	4.4	3,679	6.1	91.84	1,067	2	Local Road	700	22	727	68	11	D	41	160	19.1	29	2.69	21.8
096029N	Tyler St	68.23	4.4	3,679	6.5	89.70	4,048	4	Local Road	700	42	2712	252	11	D	40	280	18.6	107	2.64	21.6
096688T	Fleet St	68.16	4.4	3,679	6.7	87.81	1,611	2	Local Road	700	34	1021	98	10	D	38	220	17.4	42	2.61	20.6

Table 20. Grade Crossing Delay of Proposed Action Train Traffic with Baseline Traffic (2037)

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)	No Action Avg. Delay per Vehicle in 24-hr Period (sec/veh)	Change in the Number of Stopped Vehicle	Change in Trips Affected (%)	Change in Average Delay per Vehicle (sec/veh)
096687L	Junction City Rd	67.14	4.4	5,323	12	24.8	1,596	2	Collector	900	33	81.28	28	3	A	3.1	60	1.5	15	0.93%	1.6
096682C	Central Park Dr	61.8	4.4	5,323	11	25.6	379	2	Collector	900	8	19.96	7	3	A	3.2	20	1.6	4	0.96%	1.6
096680N	Aldergrove Dr	59.72	4.4	5,323	25	12.2	514	2	Local Road	700	11	6.21	4	1	A	0.7	20	0.3	2	0.47%	0.4
096679U	Heikkinen Rd	59.43	4.4	5,323	25	12.2	271	1	Local Road	700	11	3.27	2	1	A	0.7	20	0.3	1	0.47%	0.4
096678M	Devonshire Rd	58.91	4.4	5,323	25	12.1	1,366	2	Collector	900	28	16.47	11	1	A	0.7	20	0.3	6	0.46%	0.4
096677F	County Farm Rd	58.73	4.4	5,323	25	12.0	338	2	Local Road	700	7	3.95	3	1	A	0.7	20	0.3	2	0.46%	0.4
096672W	Main Street	57.72	4.4	5,323	25	12.1	2,029	2	Collector	900	42	24.64	17	1	A	0.7	40	0.4	9	0.46%	0.4
400107G	Sylvia St	57.59	4.4	5,323	25	12.1	162	2	Local Road	700	3	1.89	1	1	A	0.7	20	0.3	1	0.46%	0.4
096659H	Old Beacon Rd	56.02	4.4	5,323	25	11.9	122	2	Local Road	700	3	1.37	1	1	A	0.7	20	0.3	1	0.44%	0.3
096658B	Monte Brady Rd	55.71	4.4	5,323	25	12.0	1,015	2	Collector	900	21	11.97	8	1	A	0.7	20	0.3	5	0.45%	0.4
096657U	Glenn Rd	55.42	4.4	5,323	25	11.9	27	2	Local Road	700	1	0.31	0	1	A	0.7	20	0.3	0	0.45%	0.3
096655F	Fairbairn Rd	54.38	4.4	5,323	25	12.0	27	2	Local Road	700	1	0.31	0	1	A	0.7	20	0.3	0	0.45%	0.4
096654Y	Winkerman Rd S	54.1	4.4	5,323	25	12.0	54	2	Local Road	700	1	0.63	0	1	A	0.7	20	0.3	0	0.45%	0.4
096652K	Monte Brady Rd	53.33	4.4	5,323	25	12.0	1,353	2	Collector	900	28	16.09	11	1	A	0.7	20	0.3	6	0.45%	0.4
096650W	Foss Av-Monte Elma	51.98	4.4	5,323	25	12.1	6,168	2	Collector	900	129	83.36	52	2	A	0.8	120	0.4	28	0.46%	0.4
096649C	Hewitt St	51.85	4.4	5,323	25	12.0	446	2	Local Road	700	9	5.22	4	1	A	0.7	20	0.3	2	0.45%	0.4
096648V	Moore Rd	51.53	4.4	5,323	25	12.0	649	2	Local Road	700	14	7.62	5	1	A	0.7	20	0.3	3	0.45%	0.4
096646G	Oniel Rd	51.03	4.4	5,323	25	11.8	730	2	Local Road	700	15	8.22	6	1	A	0.7	20	0.3	3	0.43%	0.3
096644T	Newman Creek Rd	50.56	4.4	5,323	25	12.0	1,109	2	Local Road	700	23	13.22	9	1	A	0.7	20	0.3	5	0.45%	0.4
096643L	Hurd Rd	50.08	4.4	5,323	25	11.1	1,772	2	Local Road	700	37	18.31	14	1	A	0.6	40	0.4	7	0.39%	0.3
096642E	Calder Rd	49.36	4.4	5,323	25	12.1	771	2	Local Road	700	16	9.14	6	1	A	0.7	20	0.3	4	0.46%	0.4
096641X	N 17th St	48.93	4.4	5,323	25	11.5	149	2	Local Road	700	3	1.57	1	1	A	0.6	20	0.3	1	0.42%	0.3
096640R	N 13th St	48.7	4.4	5,323	25	11.6	839	2	Local Road	700	17	9.23	7	1	A	0.7	20	0.3	4	0.42%	0.3
096639W	N 11th St	48.57	4.4	5,323	24	11.8	2,475	2	Local Road	700	52	29.44	20	1	A	0.7	40	0.4	11	0.43%	0.3

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)	No Action Avg. Delay per Vehicle in 24-hr Period (sec/veh)	Change in the Number of Stopped Vehicle	Change in Trips Affected (%)	Change in Average Delay per Vehicle (sec/veh)
096638P	N 10th St	48.51	4.4	5,323	23	12.9	352	2	Local Road	700	7	4.72	3	1	A	0.8	20	0.5	2	0.45%	0.3
096636B	N 6th St	48.32	4.4	5,323	23	13.5	189	2	Local Road	700	4	2.76	2	2	A	0.9	20	0.5	1	0.47%	0.4
096635U	N 5th St	48.26	4.4	5,323	23	13.6	95	2	Local Road	700	2	1.40	1	2	A	0.9	20	0.5	0	0.47%	0.4
096634M	N 3rd St	48.12	4.4	5,323	23	14.9	798	2	Local Road	700	17	14.39	8	2	A	1.1	20	0.7	4	0.50%	0.4
096525J	N 2d St	48.06	4.4	5,323	24	13.3	609	2	Local Road	700	13	8.79	6	2	A	0.9	20	0.5	3	0.47%	0.4
096519F	Tridwell Rd	46.71	4.3	5,411	25	12.8	149	2	Local Road	700	3	1.99	1	2	A	0.8	20	0.4	1	0.47%	0.4
096518Y	Blockhouse Rd W	46.33	4.3	5,411	25	12.1	284	2	Local Road	700	6	3.42	2	1	A	0.7	20	0.4	1	0.46%	0.4
096515D	Blockhouse Rd E	45.26	4.3	5,411	25	12.1	54	2	Local Road	700	1	0.65	0	1	A	0.7	20	0.4	0	0.46%	0.4
096510U	Dunlap Rd	44.19	4.3	5,411	25	12.0	243	2	Local Road	700	5	2.89	2	1	A	0.7	20	0.4	1	0.45%	0.4
092603A	Porter Creek Rd	41.5	4.3	5,411	25	12.0	1,042	2	Collector	900	22	12.61	9	1	A	0.7	20	0.4	5	0.45%	0.4
092595K	Elma Gare Rd W	38.46	4.3	5,411	25	12.0	122	2	Local Road	700	3	1.43	1	1	A	0.7	20	0.4	1	0.45%	0.4
092593W	Shelton Rd	36.71	4.3	5,411	25	12.0	68	2	Local Road	700	1	0.80	1	1	A	0.7	20	0.4	0	0.45%	0.4
92587T	Scheaffer St	33.95	4.3	5,411	25	11.8	54	2	Local Road	700	1	0.62	0	1	A	0.7	20	0.4	0	0.44%	0.3
092586L	Newton St	33.65	4.3	5,411	25	11.9	230	2	Local Road	700	5	2.68	2	1	A	0.7	20	0.4	1	0.45%	0.3
092585E	Murray St	33.39	4.3	5,411	25	12.0	230	2	Local Road	700	5	2.72	2	1	A	0.7	20	0.4	1	0.45%	0.4
092584X	Merry Rd	33.04	4.3	5,411	25	12.0	68	2	Local Road	700	1	0.80	1	1	A	0.7	20	0.4	0	0.45%	0.4
092583R	Blockhouse Rd	32.45	4.3	5,411	25	12.0	54	2	Local Road	700	1	0.64	0	1	A	0.7	20	0.4	0	0.45%	0.4
092577M	Moon Rd SW	28.71	4.3	5,411	25	12.1	338	2	Local Road	700	7	4.06	3	1	A	0.7	20	0.4	2	0.46%	0.4
092576F	Owings St	13.28	4.3	5,411	25	12.0	419	2	Local Road	700	9	5.01	4	1	A	0.7	20	0.4	2	0.46%	0.4
092574S	Little Rock Rd	10.95	4.3	5,411	25	12.0	1,299	2	Local Road	700	27	15.93	11	1	A	0.7	20	0.4	6	0.45%	0.4
092573K	183rd Ave SW	10.05	4.3	5,411	25	12.0	1,015	2	Collector	900	21	12.25	8	1	A	0.7	20	0.4	5	0.45%	0.4
092569V	Joselyn Ave	8.45	4.3	5,411	25	12.0	271	2	Local Road	700	6	3.21	2	1	A	0.7	20	0.4	1	0.45%	0.4
092567G	Tea St	7.18	4.3	5,411	25	12.1	663	2	Local Road	700	14	8.03	6	1	A	0.7	20	0.4	3	0.46%	0.4
092566A	Grand Mound SW	6.84	4.3	5,411	25	12.1	446	2	Local Road	700	9	5.39	4	1	A	0.7	20	0.4	2	0.46%	0.4
092565T	Old Hwy 99 SW	6.07	4.3	5,411	21	14.5	13,134	2	Collector	900	274	325.25	133	2	A	1.5	320	0.5	80	0.61%	1.0
092563E	216th Ave SW	5.37	4.3	5,411	13	23.5	122	2	Local Road	700	3	5.50	2	3	A	2.7	20	1.2	1	0.91%	1.5

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)	No Action Avg. Delay per Vehicle in 24-hr Period (sec/veh)	Change in the Number of Stopped Vehicle	Change in Trips Affected (%)	Change in Average Delay per Vehicle (sec/veh)
092561R	222d Ave SW	4.72	4.3	5,411	10	28.5	230	2	Local Road	700	5	15.35	5	3	A	4.0	20	2.1	2	1.06%	1.9
922981P	Hoss Rd	4.44	4.3	5,411	10	28.5	1,488	2	Local Road	700	31	103.43	29	4	A	4.2	60	2.1	16	1.06%	2.0
922982W	Robert Thompson Rd	4.26	4.3	5,411	10	28.9	744	2	Collector	900	15	51.56	15	3	A	4.2	40	2.1	8	1.08%	2.1
922980H	Kuper Rd	3.92	4.3	5,411	10	29.6	609	2	Local Road	700	13	44.42	13	4	A	4.4	20	2.3	7	1.09%	2.1
092559P	Fordon Rd	3.53	4.3	5,411	10	29.4	243	2	Local Road	700	5	17.31	5	3	A	4.3	20	2.3	3	1.08%	2.0
092554F	W Reynolds Ave	2.14	4.3	5,411	10	28.4	8,251	2	Arterial	1,400	172	616.23	162	4	A	4.5	380	2.3	85	1.04%	2.2
092552S	J St	1.28	4.3	5,411	8	36.0	446	2	Local Road	700	9	47.71	11	4	A	6.4	20	3.7	6	1.26%	2.7
092551K	H St	1.15	4.3	5,411	7	37.5	1,136	2	Local Road	700	24	135.01	30	5	A	7.1	60	4.3	15	1.29%	2.8
092550D	G St	1.09	4.3	5,411	7	39.2	446	2	Local Road	700	9	56.74	12	5	A	7.6	20	4.7	6	1.33%	2.9
092549J	F St	1.03	4.3	5,411	7	38.3	311	2	Local Road	700	6	37.58	8	5	A	7.2	20	4.5	4	1.30%	2.7
092548C	E St	0.95	4.3	5,411	7	38.4	446	2	Local Road	700	9	54.40	12	5	A	7.3	20	4.6	6	1.30%	2.8
092547V	D St	0.89	4.3	5,411	7	38.5	17,788	2	Collector	900	371	3656.88	476	8	B	12.3	1120	6.7	232	1.30%	5.7
092546N	Tower St	0.82	4.3	5,411	7	38.6	10,375	2	Collector	900	216	1656.20	278	6	A	9.6	660	5.6	135	1.30%	4.0
092543T	B St	54.28	4.3	5,411	7	38.1	893	2	Local Road	700	19	108.57	24	5	A	7.3	60	4.5	12	1.30%	2.8

Table 21. Grade Crossing Delay of Proposed Action Train Traffic with Baseline Traffic for Switching Movements (2037)

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)	No Action Avg. Delay per Vehicle in 24-hr Period (sec/veh)	Change in the Number of Stopped Vehicle	Change in Trips Affected (%)	Change in Average Delay per Vehicle (sec/veh)
808714B	Port Industrial Rd (30th St)		0.3	6,099	5	2.53	8,265	2	Local Road	700	172	93	15	6	A	0.7	560	0.7	0	0.00	-
808711F	Myrtle		0.3	6,099	2	2.53	4,788	2	Arterial	1,400	100	44	8	5	A	0.6	320	0.6	0	0.00	-
808712M	Maple		0.3	6,099	7	2.53	1,042	2	Local Road	700	22	9	2	5	A	0.5	80	0.5	0	0.00	-
922990N	Industrial Rd	71.04	4.1	1,206	4	89.57	7,494	2	Arterial	1,400	156	5787	466	12	D	46.3	1140	15.0	246	3.28	31.3
AA	Myrtle St	70.85	1.4	718	2	6.95	95	2	Arterial	1,400	2	1	0	2	A	0.7	20	0.7	0		-
BB	N Maple St	70.55	4.1	1,206	6	56.66	1,042	2	Local Road	700	22	295	41	7	B	17.0	100	4.7	23	2.21	12.3
808713U	W 1St St	70.41	4.3	3,652	6	49.99	5,979	2	Collector	900	125	1387	208	7	B	13.9	480	2.6	131	2.20	11.3
096711K	Port Industrial Rd	70.06	5.2	2,071	8	42.07	23,076	2	Arterial	1,400	481	4180	674	6	B	10.9	1300	2.1	418	1.81	8.8
096710D	Division St	69.82	5.2	2,071	7	45.38	27	2	Local Road	700	1	4	1	4	A	8.3	20	1.2	1	2.10	7.1
096709J	Heron St	69.81	5.2	2,071	6	48.44	216	2	Local Road	700	5	34	7	5	A	9.5	20	1.4	5	2.25	8.1
808707R	Monroe St	69.63	6.2	3,573	6	62.09	27	2	Local Road	700	1	6	1	5	B	13.0	20	2.0	1	2.80	11.0
096706N	Washington St	69.49	6.2	3,573	5	64.00	866	2	Local Road	700	18	204	38	5	B	14.1	60	2.1	25	2.92	12.0
092551K	H Street	68.8	4.4	3,679	5	131.92	1,136	2	Local Road	700	24	1601	104	15	F	84.5	240	29.4	52	4.59	55.2
096695D	E Heron St	68.5	4.4	3,679	5	95.25	4,464	1	Local Road	700	186	4315	295	15	E	58.0	1340	26.5	126	2.83	31.5
096693P	Newell St	68.44	4.4	3,679	6	92.55	839	2	Local Road	700	17	576	54	11	D	41.2	120	18.4	23	2.79	22.8
096691B	S Chehalis St	68.36	4.4	3,679	6	73.62	6,344	4	Local Road	700	66	2970	324	9	C	28.1	360	10.2	159	2.51	17.9
096689A	Dairy Queen Entrance	68.34	4.4	3,679	6	72.39	216	2	Local Road	700	5	89	11	8	C	24.8	20	8.8	5	2.49	15.9
096690U	McDonalds Entrance	68.31	4.4	3,679	6	71.55	1,380	2	Local Road	700	29	576	69	8	C	25.1	160	8.8	34	2.47	16.2
096029N	Tyler St	68.23	4.4	3,679	6	69.82	5,235	4	Local Road	700	55	2165	254	9	C	24.8	280	8.7	127	2.42	16.1
096688T	Fleet St	68.16	4.4	3,679	7	68.01	2,083	2	Local Road	700	43	804	98	8	C	23.1	220	8.2	49	2.35	15.0

Table 22. Grade Crossing Delay of Peak Hour Traffic for the Proposed Action Train Traffic with Baseline Traffic (2017)

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time (min)	Peak Hour Traffic in both directions (veh/hour)	Number of lanes in both directions	Urban or Rural	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
096687L	Junction City Rd	67.14	1.0	7,419	12	7.8	142	2	Urban Collector	Collector	900	71	78	18	4	C	33.1	180
096682C	Central Park Dr	61.8	1.0	7,419	11	7.9	34	2	Rural Major Collector	Collector	900	17	18	4	4	C	31.8	40
096680N	Aldergrove Dr	59.72	1.0	7,419	25	3.8	46	2	Rural Local	Local Road	700	23	6	3	2	A	7.6	20
096679U	Heikkinen Rd	59.43	1.0	7,419	25	3.8	24	1	Rural Local	Local Road	700	24	3	2	2	A	7.6	40
096678M	Devonshire Rd	58.91	1.0	7,419	25	3.8	121	2	Rural Minor Collector	Collector	900	61	16	8	2	A	7.7	80
096677F	County Farm Rd	58.73	1.0	7,419	25	3.8	30	2	Rural Local	Local Road	700	15	4	2	2	A	7.2	20
096672W	Main Street	57.72	1.0	7,419	25	3.8	180	2	Rural Major Collector	Collector	900	90	24	11	2	A	7.9	120
400107G	Sylvia St	57.59	1.0	7,419	25	3.8	14	2	Urban Local	Local Road	700	7	2	1	2	A	7.1	20
096659H	Old Beacon Rd	56.02	1.0	7,419	25	3.7	11	2	Rural Local	Local Road	700	5	1	1	2	A	6.8	20
096658B	Monte Brady Rd	55.71	1.0	7,419	25	3.7	90	2	Rural Minor Collector	Collector	900	45	11	6	2	A	7.4	60
096657U	Glenn Rd	55.42	1.0	7,419	25	3.7	2	2	Rural Local	Local Road	700	1	0	0	2	A	6.9	20
096655F	Fairbairn Rd	54.38	1.0	7,419	25	3.8	2	2	Rural Local	Local Road	700	1	0	0	2	A	7.0	20
096654Y	Winkerman Rd S	54.1	1.0	7,419	25	3.8	5	2	Rural Local	Local Road	700	2	1	0	2	A	7.1	20
096652K	Monte Brady Rd	53.33	1.0	7,419	25	3.7	120	2	Rural Major Collector	Collector	900	60	15	8	2	A	7.5	80
096650W	Foss Av-Monte Elma	51.98	1.0	7,419	25	3.8	548	2	Rural Major Collector	Collector	900	274	93	34	3	B	10.2	340
096649C	Hewitt St	51.85	1.0	7,419	25	3.7	40	2	Rural Local	Local Road	700	20	5	2	2	A	7.2	20
096648V	Moore Rd	51.53	1.0	7,419	25	3.7	58	2	Rural Local	Local Road	700	29	7	4	2	A	7.3	40
096646G	Oniel Rd	51.03	1.0	7,419	25	3.4	65	2	Rural Local	Local Road	700	32	7	4	2	A	6.1	40
096644T	Newman Creek Rd	50.56	1.0	7,419	25	3.7	99	2	Rural Local	Local Road	700	49	12	6	2	A	7.5	60
096643L	Hurd Rd	50.08	1.0	7,419	25	2.9	157	2	Rural Local	Local Road	700	79	13	8	2	A	4.8	80
096642E	Calder Rd	49.36	1.0	7,419	25	3.8	69	2	Rural Local	Local Road	700	34	8	4	2	A	7.4	40
096641X	N 17th St	48.93	1.0	7,419	25	3.3	13	2	Rural Local	Local Road	700	7	1	1	2	A	5.4	20
096640R	N 13th St	48.7	1.0	7,419	25	3.3	75	2	Rural Local	Local Road	700	37	7	4	2	A	5.9	40
096639W	N 11th St	48.57	1.0	7,419	24	3.4	220	2	Rural Local	Local Road	700	110	25	12	2	A	6.8	120

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time (min)	Peak Hour Traffic in both directions (veh/hour)	Number of lanes in both directions	Urban or Rural	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
096638P	N 10th St	48.51	1.0	7,419	23	3.4	31	2	Rural Local	Local Road	700	16	3	2	2	A	5.9	20
096636B	N 6th St	48.32	1.0	7,419	23	3.7	17	2	Rural Local	Local Road	700	8	2	1	2	A	6.8	20
096635U	N 5th St	48.26	1.0	7,419	23	3.7	8	2	Rural Local	Local Road	700	4	1	1	2	A	6.8	20
096634M	N 3rd St	48.12	1.0	7,419	23	3.8	71	2	Rural Local	Local Road	700	35	9	4	2	A	7.4	40
096525J	N 2d St	48.06	1.0	7,419	24	3.7	54	2	Rural Local	Local Road	700	27	7	3	2	A	7.2	40
096519F	Tridwell Rd	46.71	1.0	7,419	25	3.8	13	2	Rural Local	Local Road	700	7	2	1	2	A	7.2	20
096518Y	Blockhouse Rd W	46.33	1.0	7,419	25	3.8	25	2	Rural Local	Local Road	700	13	3	2	2	A	7.2	20
096515D	Blockhouse Rd E	45.26	1.0	7,419	25	3.8	5	2	Rural Local	Local Road	700	2	1	0	2	A	7.2	20
096510U	Dunlap Rd	44.19	1.0	7,419	25	3.8	22	2	Rural Local	Local Road	700	11	3	1	2	A	7.1	20
092603A	Porter Creek Rd	41.5	1.0	7,419	25	3.8	93	2	Rural Minor Collector	Collector	900	46	11	6	2	A	7.4	60
092595K	Elma Gare Rd W	38.46	1.0	7,419	25	3.7	11	2	Rural Local	Local Road	700	5	1	1	2	A	7.0	20
092593W	Shelton Rd	36.71	1.0	7,419	25	3.7	6	2	Rural Local	Local Road	700	3	1	0	2	A	7.0	20
92587T	Scheaffer St	33.95	1.0	7,419	25	3.7	5	2	Rural Local	Local Road	700	2	1	0	2	A	6.7	20
092586L	Newton St	33.65	1.0	7,419	25	3.7	20	2	Rural Local	Local Road	700	10	2	1	2	A	6.9	20
092585E	Murray St	33.39	1.0	7,419	25	3.7	20	2	Rural Local	Local Road	700	10	2	1	2	A	7.1	20
092584X	Merry Rd	33.04	1.0	7,419	25	3.8	6	2	Rural Local	Local Road	700	3	1	0	2	A	7.1	20
092583R	Blockhouse Rd	32.45	1.0	7,419	25	3.8	5	2	Rural Local	Local Road	700	2	1	0	2	A	7.1	20
092577M	Moon Rd SW	28.71	1.0	7,419	25	3.8	30	2	Rural Local	Local Road	700	15	4	2	2	A	7.3	20
092576F	Owings St	13.28	1.0	7,419	25	3.8	37	2	Rural Local	Local Road	700	19	5	2	2	A	7.3	20
092574S	Little Rock Rd	10.95	1.0	7,419	25	3.7	115	2	Rural Local	Local Road	700	58	15	7	2	A	7.6	80
092573K	183rd Ave SW	10.05	1.0	7,419	25	3.8	90	2	Rural Minor Collector	Collector	900	45	11	6	2	A	7.4	60
092569V	Joselyn Ave	8.45	1.0	7,419	25	3.8	24	2	Rural Local	Local Road	700	12	3	2	2	A	7.2	20
092567G	Tea St	7.18	1.0	7,419	25	3.8	59	2	Rural Local	Local Road	700	29	7	4	2	A	7.4	40
092566A	Grand Mound SW	6.84	1.0	7,419	25	3.8	40	2	Rural Local	Local Road	700	20	5	2	2	A	7.3	20
092565T	Old Hwy 99 SW	6.07	1.0	7,419	21	5.3	1,167	2	Rural Major Collector	Collector	900	584	789	104	8	D	40.5	1040

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time (min)	Peak Hour Traffic in both directions (veh/hour)	Number of lanes in both directions	Urban or Rural	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
092563E	216th Ave SW	5.37	1.0	7,419	13	7.8	11	2	Rural Local	Local Road	700	5	6	1	4	C	30.7	20
092561R	222d Ave SW	4.72	1.0	7,419	10	8.8	20	2	Rural Local	Local Road	700	10	13	3	4	D	39.1	20
922981P	Hoss Rd	4.44	1.0	7,419	10	8.8	132	2	Urban Local	Local Road	700	66	94	19	5	D	42.7	200
922982W	Robert Thompson Rd	4.26	1.0	7,419	10	9.2	66	2	Rural Minor Collector	Collector	900	33	48	10	5	D	43.5	100
922980H	Kuper Rd	3.92	1.0	7,419	10	9.0	54	2	Rural Local	Local Road	700	27	38	8	5	D	41.7	80
092559P	Fordon Rd	3.53	1.0	7,419	10	8.8	22	2	Urban Local	Local Road	700	11	14	3	4	D	39.6	40
092554F	W Reynolds Ave	2.14	1.0	7,419	10	8.4	733	2	Urban Minor Arterial	Arterial	1,400	367	588	103	6	D	48.1	1040
092552S	J St	1.28	1.0	7,419	8	10.2	40	2	Urban Local	Local Road	700	20	35	7	5	D	53.2	60
092551K	H St	1.15	1.0	7,419	7	10.2	101	2	Urban Local	Local Road	700	50	94	17	5	E	55.6	180
092550D	G St	1.09	1.0	7,419	7	10.3	40	2	Urban Local	Local Road	700	20	36	7	5	D	54.6	60
092549J	F St	1.03	1.0	7,419	7	10.0	28	2	Urban Local	Local Road	700	14	23	5	5	D	50.5	40
092548C	E St	0.95	1.0	7,419	7	10.0	40	2	Urban Local	Local Road	700	20	34	7	5	D	51.0	60
092547V	D St	0.89	1.0	7,419	7	10.0	1,580	2	Urban Collector	Collector	900	790	10722	262	41	F	407.0	2620
092546N	Tower St	0.82	1.0	7,419	7	10.0	922	2	Urban Collector	Collector	900	461	1568	153	10	F	102.1	1540
092543T	B St	54.28	1.0	7,419	7	10.0	79	2	Urban Local	Local Road	700	40	70	13	5	D	53.2	140

Table 23. Grade Crossing Delay of Peak Hour Traffic for the Proposed Action Train Traffic with Baseline Traffic for Switching Movements (2017)

Crossing ID	Street	Milepost	Number of Daily Trains	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
808714B	Port Industrial Rd (30th St)		1.0	7,419	7	0.00	734	Local Road	700	367	0	0		A	0	0
808711F	Myrtle		1.0	7,419	2	0.00	425	Arterial	1,400	213	0	0		A	0	0
808712M	Maple		1.0	7,419	7	0.00	93	Local Road	700	46	0	0		A	0	0
922990N	Industrial Rd	71.04	1.0	7,419	4	37.62	666	Arterial	1,400	333	10,301	417	25	F	928.2	4180
AA	Myrtle St	70.85	1.0	7,419	2	0.00	8	Arterial	1,400	4	0	0		A	0	0
BB	N Maple St	70.55	1.0	7,419	7	25.35	93	Local Road	700	46	531	39	14	F	344	400
808713U	W 1St St	70.41	1.0	7,419	6	27.14	531	Collector	900	266	4,626	240	19	F	522.6	2400
096711K	Port Industrial Rd	70.06	1.0	7,419	8	20.78	2,050	Arterial	1,400	1,025	27,567	710	39	F	806.7	7100
096710D	Division St	69.82	1.0	7,419	7	24.05	2	Local Road	700	1	12	1	12	F	289.7	20
096709J	Heron St	69.81	1.0	7,419	6	25.86	19	Local Road	700	10	109	8	13	F	339.0	80
808707R	Monroe St	69.63	1.0	7,419	6	32.10	2	Local Road	700	1	21	1	16	F	516.1	20
096706N	Washington St	69.49	1.0	7,419	5	33.50	77	Local Road	700	38	761	43	18	F	593.7	420
092551K	H Street	68.8	1.0	7,419	5	52.71	101	Local Road	700	50	2,519	89	28	F	1497.0	880
096695D	E Heron St	68.5	1.0	7,419	5	34.52	397	Local Road	700	397	9,085	228	40	F	1374.4	4560
096693P	Newell St	68.44	1.0	7,419	6	34.03	75	Local Road	700	37	759	42	18	F	611.4	420
096691B	S Chehalis St	68.36	1.0	7,419	6	31.37	564	Local Road	700	141	5,786	295	20	F	615.9	1480
096689A	Dairy Queen Entrance	68.34	1.0	7,419	6	31.06	19	Local Road	700	10	157	10	16	F	489.0	100
096690U	McDonalds Entrance	68.31	1.0	7,419	6	30.86	123	Local Road	700	61	1,066	63	17	F	521.8	640
096029N	Tyler St	68.23	1.0	7,419	7	30.34	465	Local Road	700	116	4,279	235	18	F	552.0	1180
096688T	Fleet St	68.16	1.0	7,419	7	29.90	185	Local Road	700	93	1,589	92	17	F	515.1	920

Table 24. Grade Crossing Delay of Peak Hour Traffic for the Proposed Action Train Traffic with Baseline Traffic (2037)

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time (min)	Peak Hour traffic in both directions (veh/hr)	Number of lanes in both directions	Urban or Rural	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
096687L	Junction City Rd	67.14	1.0	7,419	12	7.8	183	2	Urban Collector	Collector	900	92	104	24	4	C	33.9	240
096682C	Central Park Dr	61.8	1.0	7,419	11	7.9	44	2	Rural Major Collector	Collector	900	22	23	6	4	C	31.9	60
096680N	Aldergrove Dr	59.72	1.0	7,419	25	3.8	59	2	Rural Local	Local Road	700	30	8	4	2	A	7.7	40
096679U	Heikkinen Rd	59.43	1.0	7,419	25	3.8	31	1	Rural Local	Local Road	700	31	4	2	2	A	7.7	40
096678M	Devonshire Rd	58.91	1.0	7,419	25	3.8	157	2	Rural Minor Collector	Collector	900	78	21	10	2	A	7.9	100
096677F	County Farm Rd	58.73	1.0	7,419	25	3.8	39	2	Rural Local	Local Road	700	19	5	2	2	A	7.3	20
096672W	Main Street	57.72	1.0	7,419	25	3.8	233	2	Rural Major Collector	Collector	900	117	32	15	2	A	8.1	140
400107G	Sylvia St	57.59	1.0	7,419	25	3.8	19	2	Urban Local	Local Road	700	9	2	1	2	A	7.2	20
096659H	Old Beacon Rd	56.02	1.0	7,419	25	3.7	14	2	Rural Local	Local Road	700	7	2	1	2	A	6.8	20
096658B	Monte Brady Rd	55.71	1.0	7,419	25	3.7	117	2	Rural Minor Collector	Collector	900	58	15	7	2	A	7.5	80
096657U	Glenn Rd	55.42	1.0	7,419	25	3.7	3	2	Rural Local	Local Road	700	2	0	0	2	A	6.9	20
096655F	Fairbairn Rd	54.38	1.0	7,419	25	3.8	3	2	Rural Local	Local Road	700	2	0	0	2	A	7.0	20
096654Y	Winkerman Rd S	54.1	1.0	7,419	25	3.8	6	2	Rural Local	Local Road	700	3	1	0	2	A	7.1	20
096652K	Monte Brady Rd	53.33	1.0	7,419	25	3.7	155	2	Rural Major Collector	Collector	900	78	20	10	2	A	7.7	100
096650W	Foss Av-Monte Elma	51.98	1.0	7,419	25	3.8	709	2	Rural Major Collector	Collector	900	354	138	44	3	B	11.7	440
096649C	Hewitt St	51.85	1.0	7,419	25	3.7	51	2	Rural Local	Local Road	700	26	6	3	2	A	7.3	40
096648V	Moore Rd	51.53	1.0	7,419	25	3.7	75	2	Rural Local	Local Road	700	37	9	5	2	A	7.4	40
096646G	Oniel Rd	51.03	1.0	7,419	25	3.4	84	2	Rural Local	Local Road	700	42	9	5	2	A	6.1	40
096644T	Newman Creek Rd	50.56	1.0	7,419	25	3.7	127	2	Rural Local	Local Road	700	64	16	8	2	A	7.7	80
096643L	Hurd Rd	50.08	1.0	7,419	25	2.9	204	2	Rural Local	Local Road	700	102	17	10	2	A	5.0	100
096642E	Calder Rd	49.36	1.0	7,419	25	3.8	89	2	Rural Local	Local Road	700	44	11	6	2	A	7.5	60
096641X	N 17th St	48.93	1.0	7,419	25	3.3	17	2	Rural Local	Local Road	700	9	2	1	2	A	5.5	20
096640R	N 13th St	48.7	1.0	7,419	25	3.3	96	2	Rural Local	Local Road	700	48	10	5	2	A	6.0	60
096639W	N 11th St	48.57	1.0	7,419	24	3.4	284	2	Rural Local	Local Road	700	142	34	16	2	A	7.2	160
096638P	N 10th St	48.51	1.0	7,419	23	3.4	40	2	Rural Local	Local Road	700	20	4	2	2	A	6.0	20

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time (min)	Peak Hour traffic in both directions (veh/hr)	Number of lanes in both directions	Urban or Rural	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
096636B	N 6th St	48.32	1.0	7,419	23	3.7	22	2	Rural Local	Local Road	700	11	2	1	2	A	6.8	20
096635U	N 5th St	48.26	1.0	7,419	23	3.7	11	2	Rural Local	Local Road	700	5	1	1	2	A	6.8	20
096634M	N 3rd St	48.12	1.0	7,419	23	3.8	92	2	Rural Local	Local Road	700	46	12	6	2	A	7.5	60
096525J	N 2d St	48.06	1.0	7,419	24	3.7	70	2	Rural Local	Local Road	700	35	9	4	2	A	7.3	40
096519F	Tridwell Rd	46.71	1.0	7,419	25	3.8	17	2	Rural Local	Local Road	700	9	2	1	2	A	7.2	20
096518Y	Blockhouse Rd W	46.33	1.0	7,419	25	3.8	33	2	Rural Local	Local Road	700	16	4	2	2	A	7.3	20
096515D	Blockhouse Rd E	45.26	1.0	7,419	25	3.8	6	2	Rural Local	Local Road	700	3	1	0	2	A	7.2	20
096510U	Dunlap Rd	44.19	1.0	7,419	25	3.8	28	2	Rural Local	Local Road	700	14	3	2	2	A	7.2	20
092603A	Porter Creek Rd	41.5	1.0	7,419	25	3.8	120	2	Rural Minor Collector	Collector	900	60	15	7	2	A	7.5	80
092595K	Elma Gare Rd W	38.46	1.0	7,419	25	3.7	14	2	Rural Local	Local Road	700	7	2	1	2	A	7.0	20
092593W	Shelton Rd	36.71	1.0	7,419	25	3.7	8	2	Rural Local	Local Road	700	4	1	0	2	A	7.1	20
92587T	Scheaffer St	33.95	1.0	7,419	25	3.7	6	2	Rural Local	Local Road	700	3	1	0	2	A	6.7	20
092586L	Newton St	33.65	1.0	7,419	25	3.7	26	2	Rural Local	Local Road	700	13	3	2	2	A	7.0	20
092585E	Murray St	33.39	1.0	7,419	25	3.7	26	2	Rural Local	Local Road	700	13	3	2	2	A	7.1	20
092584X	Merry Rd	33.04	1.0	7,419	25	3.8	8	2	Rural Local	Local Road	700	4	1	0	2	A	7.1	20
092583R	Blockhouse Rd	32.45	1.0	7,419	25	3.8	6	2	Rural Local	Local Road	700	3	1	0	2	A	7.1	20
092577M	Moon Rd SW	28.71	1.0	7,419	25	3.8	39	2	Rural Local	Local Road	700	19	5	2	2	A	7.3	20
092576F	Owings St	13.28	1.0	7,419	25	3.8	48	2	Rural Local	Local Road	700	24	6	3	2	A	7.3	40
092574S	Little Rock Rd	10.95	1.0	7,419	25	3.7	149	2	Rural Local	Local Road	700	75	20	9	2	A	7.8	100
092573K	183rd Ave SW	10.05	1.0	7,419	25	3.8	117	2	Rural Minor Collector	Collector	900	58	15	7	2	A	7.5	80
092569V	Joselyn Ave	8.45	1.0	7,419	25	3.8	31	2	Rural Local	Local Road	700	16	4	2	2	A	7.2	20
092567G	Tea St	7.18	1.0	7,419	25	3.8	76	2	Rural Local	Local Road	700	38	9	5	2	A	7.5	40
092566A	Grand Mound SW	6.84	1.0	7,419	25	3.8	51	2	Rural Local	Local Road	700	26	6	3	2	A	7.4	40
092565T	Old Hwy 99 SW	6.07	1.0	7,419	21	5.3	1,509	2	Rural Major Collector	Collector	900	755	2219	134	17	F	88.2	1340
092563E	216th Ave SW	5.37	1.0	7,419	13	7.8	14	2	Rural Local	Local Road	700	7	7	2	4	C	30.8	20
092561R	222d Ave SW	4.72	1.0	7,419	10	8.8	26	2	Rural Local	Local Road	700	13	17	4	4	D	39.3	40

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time (min)	Peak Hour traffic in both directions (veh/hr)	Number of lanes in both directions	Urban or Rural	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
922981P	Hoss Rd	4.44	1.0	7,419	10	8.8	171	2	Urban Local	Local Road	700	85	125	25	5	D	44.0	260
922982W	Robert Thompson Rd	4.26	1.0	7,419	10	9.2	85	2	Rural Minor Collector	Collector	900	43	63	13	5	D	43.9	140
922980H	Kuper Rd	3.92	1.0	7,419	10	9.0	70	2	Rural Local	Local Road	700	35	49	10	5	D	42.2	100
092559P	Fordon Rd	3.53	1.0	7,419	10	8.8	28	2	Urban Local	Local Road	700	14	19	4	5	D	39.8	40
092554F	W Reynolds Ave	2.14	1.0	7,419	10	8.4	948	2	Urban Minor Arterial	Arterial	1,400	474	849	133	6	D	53.7	1340
092552S	J St	1.28	1.0	7,419	8	10.2	51	2	Urban Local	Local Road	700	26	46	9	5	D	53.7	80
092551K	H St	1.15	1.0	7,419	7	10.2	131	2	Urban Local	Local Road	700	65	124	22	6	E	56.9	220
092550D	G St	1.09	1.0	7,419	7	10.3	51	2	Urban Local	Local Road	700	26	47	9	5	E	55.1	80
092549J	F St	1.03	1.0	7,419	7	10.0	36	2	Urban Local	Local Road	700	18	30	6	5	D	50.8	60
092548C	E St	0.95	1.0	7,419	7	10.0	51	2	Urban Local	Local Road	700	26	44	9	5	D	51.5	80
092546N	Tower St	0.82	1.0	7,419	7	10.0	1,192	2	Urban Collector	Collector	900	596	2930	198	15	F	147.5	1980
092543T	B St	54.28	1.0	7,419	7	10.0	103	2	Urban Local	Local Road	700	51	93	17	5	D	54.1	180

Table 25. Grade Crossing Delay of Peak Hour Traffic for the Proposed Action Train Traffic with Baseline Traffic for Switching Movements (2037)

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Peak hour traffic in both directions (veh/hr)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)
808714B	Port Industrial Rd (30th St)		1.0	7,419	7	0.00	950	2	Local Road	700	475	0	0		A	0.0	0
808711F	Myrtle		1.0	7,419	7	0.00	550	2	Arterial	1,400	275	0	0		A	0.0	0
808712M	Maple		1.0	7,419	7	0.00	120	2	Local Road	700	60	0	0		A	0.0	0
922990N	Industrial Rd	71.04	1.0	7,419	5	37.62	861	2	Arterial	1,400	431	14662	540	27	F	1021.7	5400
AA	Myrtle St	70.85	1.0	7,419	7	0.00	11	2	Arterial	1,400	5	0	0		A	0.0	0
BB	N Maple St	70.55	1.0	7,419	7	25.35	120	2	Local Road	700	60	701	51	14	F	351.3	500
808713U	W 1St St	70.41	1.0	7,419	6	27.14	687	2	Collector	900	343	6820	311	185,108	F	3100	3100
096711K	Port Industrial Rd	70.06	1.0	7,419	7	20.78	2,651	2	Arterial	1,400	1,326	179945	918	3,739,847	F	9180	9180
096710D	Division St	69.82	1.0	7,419	7	24.05	3	2	Local Road	700	2	15	1	361	F	20	20
096709J	Heron St	69.81	1.0	7,419	6	25.86	25	2	Local Road	700	12	141	11	3,648	F	100	100
808707R	Monroe St	69.63	1.0	7,419	6	32.10	3	2	Local Road	700	2	27	2	859	F	20	20
096706N	Washington St	69.49	1.0	7,419	5	33.50	99	2	Local Road	700	50	1001	56	33,547	F	560	560
092551K	H Street	68.8	1.0	7,419	6	52.71	131	2	Local Road	700	65	3333	115	175,695	F	1140	1140
096695D	E Heron St	68.5	1.0	7,419	5	32.48	513	1	Local Road	700	513	16863	278	547,638	F	5560	5560
096693P	Newell St	68.44	1.0	7,419	6	32.05	96	2	Local Road	700	48	886	51	28,391	F	520	520
096691B	S Chehalis St	68.36	1.0	7,419	6	28.82	729	4	Local Road	700	182	6819	350	196,515	F	1760	1760
096689A	Dairy Queen Entrance	68.34	1.0	7,419	6	28.53	25	2	Local Road	700	12	172	12	4,901	F	120	120
096690U	McDonalds Entrance	68.31	1.0	7,419	6	28.38	159	2	Local Road	700	79	1200	75	34,065	F	740	740
096029N	Tyler St	68.23	1.0	7,419	6	27.78	601	4	Local Road	700	150	4925	278	136,782	F	1400	1400
096688T	Fleet St	68.16	1.0	7,419	7	26.93	239	2	Local Road	700	120	1744	107	46,962	F	1080	1080

Cumulative Impacts

Table 26. Grade Crossing Delay of Proposed Cumulative Train Traffic with Baseline Traffic (2017)

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)	No Action Avg. Delay per Vehicle in 24-hr Period (sec/veh)	Change in the Number of Stopped Vehicle	Change in Trips Affected (%)	Change in Average Delay per Vehicle (sec/veh)
096687L	Junction City Rd	67.14	7.3	6,174	12	47.6	1,234	2	Collector	900	26	136	41	3	A	6.6	60	1.5	28	2.28	5.1
096682C	Central Park Dr	61.8	7.3	6,174	11	48.3	293	2	Collector	900	6	33	10	3	A	6.7	20	1.6	7	2.29	5.1
096680N	Aldergrove Dr	59.72	7.3	6,174	25	22.7	397	2	Local Road	700	8	10	6	2	A	1.5	20	0.3	4	1.08	1.1
096679U	Heikkinen Rd	59.43	7.3	6,174	25	22.7	209	1	Local Road	700	9	5	3	2	A	1.5	20	0.3	2	1.08	1.1
096678M	Devonshire Rd	58.91	7.3	6,174	25	22.4	1,056	2	Collector	900	22	26	16	2	A	1.5	20	0.3	11	1.06	1.1
096677F	County Farm Rd	58.73	7.3	6,174	25	22.2	262	2	Local Road	700	5	6	4	2	A	1.4	20	0.3	3	1.05	1.1
096672W	Main Street	57.72	7.3	6,174	25	22.2	1,569	2	Collector	900	33	38	24	2	A	1.4	40	0.4	16	1.05	1.1
400107G	Sylvia St	57.59	7.3	6,174	25	22.2	126	2	Local Road	700	3	3	2	2	A	1.4	20	0.3	1	1.05	1.1
096659H	Old Beacon Rd	56.02	7.3	6,174	25	21.6	94	2	Local Road	700	2	2	1	1	A	1.3	20	0.3	1	1.00	1.0
096658B	Monte Brady Rd	55.71	7.3	6,174	25	22.1	785	2	Collector	900	16	18	12	2	A	1.4	20	0.3	8	1.04	1.1
096657U	Glenn Rd	55.42	7.3	6,174	25	21.8	21	2	Local Road	700	0	0	0	1	A	1.3	20	0.3	0	1.02	1.0
096655F	Fairbairn Rd	54.38	7.3	6,174	25	22.1	21	2	Local Road	700	0	0	0	2	A	1.4	20	0.3	0	1.04	1.0
096654Y	Winkerman Rd S	54.1	7.3	6,174	25	22.1	42	2	Local Road	700	1	1	1	2	A	1.4	20	0.3	0	1.04	1.1
096652K	Monte Brady Rd	53.33	7.3	6,174	25	22.1	1,046	2	Collector	900	22	25	16	2	A	1.4	20	0.3	11	1.04	1.1
096650W	Foss Av-Monte Elma	51.98	7.3	6,174	25	22.2	4,770	2	Collector	900	99	125	73	2	A	1.6	100	0.4	50	1.05	1.2
096649C	Hewitt St	51.85	7.3	6,174	25	22.1	345	2	Local Road	700	7	8	5	2	A	1.4	20	0.3	4	1.04	1.1
096648V	Moore Rd	51.53	7.3	6,174	25	22.0	502	2	Local Road	700	10	12	8	2	A	1.4	20	0.3	5	1.04	1.1
096646G	Oniel Rd	51.03	7.3	6,174	25	21.1	565	2	Local Road	700	12	12	8	1	A	1.3	20	0.3	5	0.97	0.9
096644T	Newman Creek Rd	50.56	7.3	6,174	25	22.1	858	2	Local Road	700	18	20	13	2	A	1.4	20	0.3	9	1.04	1.1
096643L	Hurd Rd	50.08	7.3	6,174	25	19.0	1,370	2	Local Road	700	29	24	18	1	A	1.1	20	0.4	11	0.82	0.7
096642E	Calder Rd	49.36	7.3	6,174	25	22.2	596	2	Local Road	700	12	14	9	2	A	1.4	20	0.3	6	1.05	1.1
096641X	N 17th St	48.93	7.3	6,174	25	20.2	115	2	Local Road	700	2	2	2	1	A	1.2	20	0.3	1	0.91	0.8

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)	No Action Avg. Delay per Vehicle in 24-hr Period (sec/veh)	Change in the Number of Stopped Vehicle	Change in Trips Affected (%)	Change in Average Delay per Vehicle (sec/veh)
096640R	N 13th St	48.7	7.3	6,174	25	20.6	649	2	Local Road	700	14	13	9	1	A	1.2	20	0.3	6	0.94	0.9
096639W	N 11th St	48.57	7.3	6,174	24	21.0	1,914	2	Local Road	700	40	42	28	2	A	1.3	40	0.4	18	0.96	1.0
096638P	N 10th St	48.51	7.3	6,174	23	22.2	272	2	Local Road	700	6	6	4	2	A	1.4	20	0.5	3	0.97	0.9
096636B	N 6th St	48.32	7.3	6,174	23	23.1	146	2	Local Road	700	3	4	2	2	A	1.5	20	0.5	1	0.99	1.0
096635U	N 5th St	48.26	7.3	6,174	23	23.2	73	2	Local Road	700	2	2	1	2	A	1.5	20	0.5	1	1.00	1.0
096634M	N 3rd St	48.12	7.3	6,174	23	24.9	617	2	Local Road	700	13	19	11	2	A	1.8	20	0.7	6	1.04	1.1
096525J	N 2d St	48.06	7.3	6,174	24	23.3	471	2	Local Road	700	10	12	8	2	A	1.6	20	0.5	5	1.03	1.1
096519F	Tridwell Rd	46.71	7.2	6,237	25	22.9	115	2	Local Road	700	2	3	2	2	A	1.5	20	0.4	1	1.05	1.1
096518Y	Blockhouse Rd W	46.33	7.2	6,237	25	22.2	220	2	Local Road	700	5	5	3	2	A	1.4	20	0.4	2	1.05	1.1
096515D	Blockhouse Rd E	45.26	7.2	6,237	25	22.4	42	2	Local Road	700	1	1	1	2	A	1.4	20	0.4	0	1.06	1.1
096510U	Dunlap Rd	44.19	7.2	6,237	25	22.1	188	2	Local Road	700	4	4	3	2	A	1.4	20	0.4	2	1.04	1.1
092603A	Porter Creek Rd	41.5	7.2	6,237	25	22.1	805	2	Collector	900	17	19	12	2	A	1.4	20	0.4	8	1.04	1.1
092595K	Elma Gare Rd W	38.46	7.2	6,237	25	21.8	94	2	Local Road	700	2	2	1	2	A	1.4	20	0.4	1	1.02	1.0
092593W	Shelton Rd	36.71	7.2	6,237	25	22.1	52	2	Local Road	700	1	1	1	2	A	1.4	20	0.4	1	1.04	1.1
92587T	Scheaffer St	33.95	7.2	6,237	25	21.4	42	2	Local Road	700	1	1	1	1	A	1.3	20	0.4	0	0.99	1.0
092586L	Newton St	33.65	7.2	6,237	25	21.7	178	2	Local Road	700	4	4	3	2	A	1.4	20	0.4	2	1.01	1.0
092585E	Murray St	33.39	7.2	6,237	25	22.0	178	2	Local Road	700	4	4	3	2	A	1.4	20	0.4	2	1.04	1.1
092584X	Merry Rd	33.04	7.2	6,237	25	22.1	52	2	Local Road	700	1	1	1	2	A	1.4	20	0.4	1	1.04	1.1
092583R	Blockhouse Rd	32.45	7.2	6,237	25	22.1	42	2	Local Road	700	1	1	1	2	A	1.4	20	0.4	0	1.04	1.1
092577M	Moon Rd SW	28.71	7.2	6,237	25	22.2	262	2	Local Road	700	5	6	4	2	A	1.4	20	0.4	3	1.05	1.1
092576F	Owings St	13.28	7.2	6,237	25	22.1	324	2	Local Road	700	7	8	5	2	A	1.4	20	0.4	3	1.05	1.1
092574S	Little Rock Rd	10.95	7.2	6,237	25	22.1	1,004	2	Local Road	700	21	24	15	2	A	1.4	20	0.4	10	1.04	1.1
092573K	183rd Ave SW	10.05	7.2	6,237	25	22.1	785	2	Collector	900	16	19	12	2	A	1.4	20	0.4	8	1.04	1.1
092569V	Joselyn Ave	8.45	7.2	6,237	25	22.1	209	2	Local Road	700	4	5	3	2	A	1.4	20	0.4	2	1.04	1.1
092567G	Tea St	7.18	7.2	6,237	25	22.2	513	2	Local Road	700	11	12	8	2	A	1.4	20	0.4	5	1.05	1.1
092566A	Grand Mound SW	6.84	7.2	6,237	25	22.3	345	2	Local Road	700	7	8	5	2	A	1.4	20	0.4	4	1.05	1.1

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)	No Action Avg. Delay per Vehicle in 24-hr Period (sec/veh)	Change in the Number of Stopped Vehicle	Change in Trips Affected (%)	Change in Average Delay per Vehicle (sec/veh)
092565T	Old Hwy 99 SW	6.07	7.2	6,237	21	29.5	10,157	2	Collector	900	212	555	208	3	A	3.3	280	0.5	155	1.53	2.8
092563E	216th Ave SW	5.37	7.2	6,237	13	45.8	94	2	Local Road	700	2	9	3	3	A	6.0	20	1.2	2	2.25	4.8
092561R	222d Ave SW	4.72	7.2	6,237	10	53.6	178	2	Local Road	700	4	25	7	4	A	8.3	20	2.1	4	2.53	6.2
922981P	Hoss Rd	4.44	7.2	6,237	10	53.7	1,151	2	Local Road	700	24	165	43	4	A	8.6	60	2.1	29	2.53	6.5
922982W	Robert Thompson Rd	4.26	7.2	6,237	10	54.9	575	2	Collector	900	12	84	22	4	A	8.8	40	2.1	15	2.61	6.7
922980H	Kuper Rd	3.92	7.2	6,237	10	55.6	471	2	Local Road	700	10	71	18	4	A	9.0	20	2.3	12	2.61	6.7
092559P	Fordon Rd	3.53	7.2	6,237	10	54.8	188	2	Local Road	700	4	27	7	4	A	8.7	20	2.3	5	2.55	6.4
092554F	W Reynolds Ave	2.14	7.2	6,237	10	52.7	6,381	2	Arterial	1,400	133	939	234	4	A	8.8	320	2.3	157	2.45	6.5
092552S	J St	1.28	7.2	6,237	8	65.0	345	2	Local Road	700	7	71	16	5	B	12.3	20	3.7	10	2.92	8.6
092551K	H St	1.15	7.2	6,237	7	66.5	879	2	Local Road	700	18	191	41	5	B	13.1	60	4.3	26	2.91	8.8
092550D	G St	1.09	7.2	6,237	7	68.9	345	2	Local Road	700	7	79	17	5	B	13.8	20	4.7	10	2.98	9.1
092549J	F St	1.03	7.2	6,237	7	67.3	241	2	Local Road	700	5	53	11	5	B	13.1	20	4.5	7	2.91	8.6
092548C	E St	0.95	7.2	6,237	7	67.4	345	2	Local Road	700	7	76	16	5	B	13.2	20	4.6	10	2.91	8.6
092547V	D St	0.89	7.2	6,237	7	67.5	13,755	2	Collector	900	287	4412	645	7	B	19.2	900	6.7	401	2.91	12.6
092546N	Tower St	0.82	7.2	6,237	7	67.7	8,023	2	Collector	900	167	2163	377	6	B	16.2	520	5.6	234	2.92	10.6
092543T	B St	54.28	7.2	6,237	7	67.4	690	2	Local Road	700	14	153	32	5	B	13.3	40	4.5	20	2.94	8.9

Table 27. Grade Crossing Delay of Proposed Cumulative Train Traffic with Baseline Traffic for Switching Movements (2017)

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)	No Action Avg. Delay per Vehicle in 24-hr Period (sec/veh)	Change in the Number of Stopped Vehicle	Change in Trips Affected (%)	Change in Average Delay per Vehicle (sec/veh)
808714B	Port Industrial Rd (30th St)		1.2	6,319	8	14.01	6,391	2	Local Road	700	133	431	62	7	A	4.0	500	0.6	51	0.80	3.4
808711F	Myrtle		1.2	6,319	6	12.92	3,703	2	Arterial	1,400	77	182	33	5	A	2.9	260	0.5	27	0.72	2.4
808712M	Maple		1.2	6,319	6	11.39	805	2	Local Road	700	17	30	6	5	A	2.2	60	0.5	5	0.62	1.7
922990N	Industrial Rd	71.04	6.1	2,298	5	186.22	5,795	2	Arterial	1,400	121	12600	749	17	F	130.5	1240	14.6	579	9.99	115.9
AA	Myrtle St	70.85	1.4	718	2	6.95	73	2	Arterial	1,400	2	1	0	2	A	0.7	20	0.7	0	0.00	-
BB	N Maple St	70.55	6.1	2,298	7	148.31	805	2	Local Road	700	17	1040	83	13	E	77.5	140	4.7	69	8.57	72.8
808713U	W 1St St	70.41	7.3	4,309	6	131.98	4,623	2	Collector	900	96	4280	424	10	E	55.5	580	2.5	365	7.89	53.0
096711K	Port Industrial Rd	70.06	8.1	2,687	7	122.31	17,845	2	Arterial	1,400	372	15491	1516	10	D	52.1	1860	1.9	1318	7.38	50.2
096710D	Division St	69.82	8.1	2,687	7	118.87	21	2	Local Road	700	0	13	2	7	D	36.2	20	1.2	2	7.20	34.9
096709J	Heron St	69.81	8.1	2,687	6	122.82	167	2	Local Road	700	3	108	14	8	D	38.8	20	1.4	12	7.42	37.4
808707R	Monroe St	69.63	9.2	4,189	6	128.10	21	2	Local Road	700	0	13	2	7	D	37.2	20	2.0	2	7.38	35.2
096706N	Washington St	69.49	9.2	4,189	5	130.73	669	2	Local Road	700	14	441	61	7	D	39.6	60	2.1	51	7.55	37.5
092551K	H Street	68.8	7.4	4,281	5	241.48	879	2	Local Road	700	18	2462	147	17	F	168.1	200	32.4	105	11.95	135.8
096695D	E Heron St	68.5	7.4	4,281	5	199.90	3,452	1	Local Road	700	144	8125	479	17	F	141.2	1300	41.8	308	8.94	99.4
096693P	Newell St	68.44	7.4	4,281	6	196.16	649	2	Local Road	700	14	1191	88	13	F	110.2	120	32.3	57	8.79	77.9
096691B	S Chehalis St	68.36	7.4	4,281	6	172.05	4,906	4	Local Road	700	51	7332	586	13	F	89.7	400	21.0	400	8.16	68.6
096689A	Dairy Queen Entrance	68.34	7.4	4,281	6	170.07	157	2	Local Road	700	3	213	19	12	F	81.6	20	19.0	13	8.08	62.6
096690U	McDonalds Entrance	68.31	7.4	4,281	6	168.67	1,067	2	Local Road	700	22	1467	125	12	F	82.5	160	19.1	86	8.02	63.4
096029N	Tyler St	68.23	7.4	4,281	6	165.02	4,048	4	Local Road	700	42	5490	464	12	F	81.4	320	18.6	319	7.87	62.8
096688T	Fleet St	68.16	7.4	4,281	7	161.83	1,611	2	Local Road	700	34	2074	181	11	E	77.3	240	17.4	125	7.75	59.8

Table 28. Grade Crossing Delay of Proposed Cumulative Train Traffic with Baseline Traffic (2037)

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)	No Action Avg. Delay per Vehicle in 24-hr Period (sec/veh)	Change in the Number of Stopped Vehicle	Change in Trips Affected (%)	Change in Average Delay per Vehicle (sec/veh)
096687L	Junction City Rd	67.14	7.3	6,174	12	47.6	1,596	2	Collector	900	33	178	53	3	A	6.7	80	1.5	40	2.52	5.2
096682C	Central Park Dr	61.8	7.3	6,174	11	48.9	379	2	Collector	900	8	43	13	3	A	6.8	20	1.6	10	2.57	5.2
096680N	Aldergrove Dr	59.72	7.3	6,174	25	23.3	514	2	Local Road	700	11	13	8	2	A	1.6	20	0.3	6	1.24	1.2
096679U	Heikkinen Rd	59.43	7.3	6,174	25	23.3	271	1	Local Road	700	11	7	4	2	A	1.6	20	0.3	3	1.24	1.2
096678M	Devonshire Rd	58.91	7.3	6,174	25	22.9	1,366	2	Collector	900	28	35	22	2	A	1.5	20	0.3	17	1.21	1.2
096677F	County Farm Rd	58.73	7.3	6,174	25	22.7	338	2	Local Road	700	7	8	5	2	A	1.5	20	0.3	4	1.20	1.1
096672W	Main Street	57.72	7.3	6,174	25	22.7	2,029	2	Collector	900	42	52	32	2	A	1.5	40	0.4	24	1.20	1.2
400107G	Sylvia St	57.59	7.3	6,174	25	22.7	162	2	Local Road	700	3	4	3	2	A	1.5	20	0.3	2	1.20	1.1
096659H	Old Beacon Rd	56.02	7.3	6,174	25	22.1	122	2	Local Road	700	3	3	2	2	A	1.4	20	0.3	1	1.15	1.1
096658B	Monte Brady Rd	55.71	7.3	6,174	25	22.6	1,015	2	Collector	900	21	25	16	2	A	1.5	20	0.3	12	1.19	1.1
096657U	Glenn Rd	55.42	7.3	6,174	25	22.3	27	2	Local Road	700	1	1	0	2	A	1.4	20	0.3	0	1.17	1.1
096655F	Fairbairn Rd	54.38	7.3	6,174	25	22.7	27	2	Local Road	700	1	1	0	2	A	1.5	20	0.3	0	1.19	1.1
096654Y	Winkerman Rd S	54.1	7.3	6,174	25	22.7	54	2	Local Road	700	1	1	1	2	A	1.5	20	0.3	1	1.19	1.1
096652K	Monte Brady Rd	53.33	7.3	6,174	25	22.6	1,353	2	Collector	900	28	34	21	2	A	1.5	20	0.3	16	1.19	1.2
096650W	Foss Av-Monte Elma	51.98	7.3	6,174	25	22.7	6,168	2	Collector	900	129	176	97	2	A	1.7	140	0.4	74	1.20	1.3
096649C	Hewitt St	51.85	7.3	6,174	25	22.6	446	2	Local Road	700	9	11	7	2	A	1.5	20	0.3	5	1.19	1.1
096648V	Moore Rd	51.53	7.3	6,174	25	22.6	649	2	Local Road	700	14	16	10	2	A	1.5	20	0.3	8	1.19	1.1
096646G	Oniel Rd	51.03	7.3	6,174	25	21.6	730	2	Local Road	700	15	17	11	2	A	1.4	20	0.3	8	1.12	1.0
096644T	Newman Creek Rd	50.56	7.3	6,174	25	22.6	1,109	2	Local Road	700	23	28	17	2	A	1.5	20	0.3	13	1.19	1.2
096643L	Hurd Rd	50.08	7.3	6,174	25	19.5	1,772	2	Local Road	700	37	34	24	1	A	1.1	40	0.4	17	0.98	0.8
096642E	Calder Rd	49.36	7.3	6,174	25	22.7	771	2	Local Road	700	16	19	12	2	A	1.5	20	0.3	9	1.20	1.2
096641X	N 17th St	48.93	7.3	6,174	25	20.8	149	2	Local Road	700	3	3	2	1	A	1.2	20	0.3	2	1.06	0.9
096640R	N 13th St	48.7	7.3	6,174	25	21.2	839	2	Local Road	700	17	18	12	1	A	1.3	20	0.3	9	1.09	1.0
096639W	N 11th St	48.57	7.3	6,174	24	21.5	2,475	2	Local Road	700	52	59	37	2	A	1.4	60	0.4	27	1.11	1.1

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)	No Action Avg. Delay per Vehicle in 24-hr Period (sec/veh)	Change in the Number of Stopped Vehicle	Change in Trips Affected (%)	Change in Average Delay per Vehicle (sec/veh)
096638P	N 10th St	48.51	7.3	6,174	23	22.8	352	2	Local Road	700	7	9	6	2	A	1.5	20	0.5	4	1.14	1.0
096636B	N 6th St	48.32	7.3	6,174	23	23.6	189	2	Local Road	700	4	5	3	2	A	1.6	20	0.5	2	1.17	1.1
096635U	N 5th St	48.26	7.3	6,174	23	23.8	95	2	Local Road	700	2	3	2	2	A	1.6	20	0.5	1	1.18	1.1
096634M	N 3rd St	48.12	7.3	6,174	23	25.5	798	2	Local Road	700	17	25	14	2	A	1.9	20	0.7	10	1.24	1.2
096525J	N 2d St	48.06	7.3	6,174	24	23.8	609	2	Local Road	700	13	17	10	2	A	1.6	20	0.5	7	1.20	1.2
096519F	Tridwell Rd	46.71	7.2	6,237	25	23.5	149	2	Local Road	700	3	4	2	2	A	1.6	20	0.4	2	1.21	1.2
096518Y	Blockhouse Rd W	46.33	7.2	6,237	25	22.8	284	2	Local Road	700	6	7	4	2	A	1.5	20	0.4	3	1.20	1.2
096515D	Blockhouse Rd E	45.26	7.2	6,237	25	22.9	54	2	Local Road	700	1	1	1	2	A	1.5	20	0.4	1	1.21	1.2
096510U	Dunlap Rd	44.19	7.2	6,237	25	22.6	243	2	Local Road	700	5	6	4	2	A	1.5	20	0.4	3	1.19	1.1
092603A	Porter Creek Rd	41.5	7.2	6,237	25	22.7	1,042	2	Collector	900	22	26	16	2	A	1.5	20	0.4	12	1.19	1.2
092595K	Elma Gare Rd W	38.46	7.2	6,237	25	22.4	122	2	Local Road	700	3	3	2	2	A	1.4	20	0.4	1	1.17	1.1
092593W	Shelton Rd	36.71	7.2	6,237	25	22.6	68	2	Local Road	700	1	2	1	2	A	1.5	20	0.4	1	1.19	1.1
92587T	Scheaffer St	33.95	7.2	6,237	25	22.0	54	2	Local Road	700	1	1	1	2	A	1.4	20	0.4	1	1.14	1.0
092586L	Newton St	33.65	7.2	6,237	25	22.3	230	2	Local Road	700	5	6	4	2	A	1.4	20	0.4	3	1.16	1.1
092585E	Murray St	33.39	7.2	6,237	25	22.6	230	2	Local Road	700	5	6	4	2	A	1.5	20	0.4	3	1.19	1.1
092584X	Merry Rd	33.04	7.2	6,237	25	22.7	68	2	Local Road	700	1	2	1	2	A	1.5	20	0.4	1	1.19	1.1
092583R	Blockhouse Rd	32.45	7.2	6,237	25	22.6	54	2	Local Road	700	1	1	1	2	A	1.5	20	0.4	1	1.19	1.1
092577M	Moon Rd SW	28.71	7.2	6,237	25	22.8	338	2	Local Road	700	7	9	5	2	A	1.5	20	0.4	4	1.20	1.2
092576F	Owings St	13.28	7.2	6,237	25	22.7	419	2	Local Road	700	9	10	7	2	A	1.5	20	0.4	5	1.20	1.1
092574S	Little Rock Rd	10.95	7.2	6,237	25	22.6	1,299	2	Local Road	700	27	33	20	2	A	1.5	20	0.4	15	1.19	1.2
092573K	183rd Ave SW	10.05	7.2	6,237	25	22.6	1,015	2	Collector	900	21	26	16	2	A	1.5	20	0.4	12	1.19	1.2
092569V	Joselyn Ave	8.45	7.2	6,237	25	22.6	271	2	Local Road	700	6	7	4	2	A	1.5	20	0.4	3	1.19	1.1
092567G	Tea St	7.18	7.2	6,237	25	22.7	663	2	Local Road	700	14	17	10	2	A	1.5	20	0.4	8	1.20	1.2
092566A	Grand Mound SW	6.84	7.2	6,237	25	22.8	446	2	Local Road	700	9	11	7	2	A	1.5	20	0.4	5	1.20	1.2
092565T	Old Hwy 99 SW	6.07	7.2	6,237	21	30.1	13,134	2	Collector	900	274	818	274	3	A	3.7	380	0.5	221	1.68	3.2
092563E	216th Ave SW	5.37	7.2	6,237	13	46.3	122	2	Local Road	700	3	13	4	3	A	6.2	20	1.2	3	2.50	4.9

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)	No Action Avg. Delay per Vehicle in 24-hr Period (sec/veh)	Change in the Number of Stopped Vehicle	Change in Trips Affected (%)	Change in Average Delay per Vehicle (sec/veh)
092561R	222d Ave SW	4.72	7.2	6,237	10	54.2	230	2	Local Road	700	5	33	9	4	A	8.5	20	2.1	7	2.84	6.4
922981P	Hoss Rd	4.44	7.2	6,237	10	54.3	1,488	2	Local Road	700	31	220	56	4	A	8.9	80	2.1	42	2.84	6.7
922982W	Robert Thompson Rd	4.26	7.2	6,237	10	55.4	744	2	Collector	900	15	111	29	4	A	9.0	40	2.1	22	2.92	6.9
922980H	Kuper Rd	3.92	7.2	6,237	10	56.2	609	2	Local Road	700	13	94	24	4	A	9.2	40	2.3	18	2.93	7.0
092559P	Fordon Rd	3.53	7.2	6,237	10	55.3	243	2	Local Road	700	5	36	9	4	A	8.9	20	2.3	7	2.87	6.6
092554F	W Reynolds Ave	2.14	7.2	6,237	10	53.3	8,251	2	Arterial	1,400	172	1280	305	4	A	9.3	420	2.3	228	2.77	7.0
092552S	J St	1.28	7.2	6,237	8	65.6	446	2	Local Road	700	9	93	20	5	B	12.5	20	3.7	15	3.32	8.8
092551K	H St	1.15	7.2	6,237	7	67.1	1,136	2	Local Road	700	24	254	53	5	B	13.4	80	4.3	38	3.34	9.1
092550D	G St	1.09	7.2	6,237	7	69.5	446	2	Local Road	700	9	105	22	5	B	14.1	20	4.7	15	3.43	9.3
092549J	F St	1.03	7.2	6,237	7	67.8	311	2	Local Road	700	6	69	15	5	B	13.4	20	4.5	10	3.35	8.9
092548C	E St	0.95	7.2	6,237	7	67.9	446	2	Local Road	700	9	100	21	5	B	13.5	20	4.6	15	3.35	8.9
092547V	D St	0.89	7.2	6,237	7	68.1	17,788	2	Collector	900	371	6721	841	8	C	22.7	1160	6.7	597	3.35	16.0
092546N	Tower St	0.82	7.2	6,237	7	68.2	10,375	2	Collector	900	216	3047	491	6	B	17.6	680	5.6	349	3.36	12.0
092543T	B St	54.28	7.2	6,237	7	67.9	893	2	Local Road	700	19	203	42	5	B	13.6	60	4.5	30	3.37	9.2

Table 29. Grade Crossing Delay of Proposed Cumulative Train Traffic with Baseline Traffic for Switching Movements (2037)

Crossing ID	Street	Milepost	Number of Daily Trains	Average Train Length (feet)	Train Speed (mph)	Gate Down-Time per Day (min)	Average daily traffic in both directions (veh/day)	Number of lanes in both directions	Road type	Departure rate (veh/hour.lane)	Arrival rate (veh/hour.lane)	Total Delay (min)	Number of vehicles delayed per day (veh/day)	Ave Delay/Veh During Gate Down Time (min/veh)	Level of service	Average delay per vehicle in a 24-hour period (sec/veh)	Ave Queue Length per lane in Each Direction (feet)	No Action Avg. Delay per Vehicle in 24-hr Period (sec/veh)	Change in the Number of Stopped Vehicle	Change in Trips Affected (%)	Change in Average Delay per Vehicle (sec/veh)
808714B	Port Industrial Rd (30th St)		1.2	6,319	5	14.01	8,265	2	Local Road	700	172	602	80	7	A	4.4	640	0.7	66	0.80	3.7
808711F	Myrtle		1.2	6,319	2	12.92	4,788	2	Arterial	1,400	100	241	43	6	A	3.0	340	0.6	35	0.72	2.5
808712M	Maple		1.2	6,319	7	11.39	1,042	2	Local Road	700	22	39	8	5	A	2.2	60	0.5	6	0.62	1.7
922990N	Industrial Rd	71.04	6.1	2,298	5	186.22	7,494	2	Arterial	1,400	156	16758	969	17	F	134.2	1600	15.0	749	9.99	119.1
AA	Myrtle St	70.85	1.4	718	2	6.95	95	2	Arterial	1,400	2	1	0	2	A	0.7	20	0.7	0	0.00	-
BB	N Maple St	70.55	6.1	2,298	7	148.31	1,042	2	Local Road	700	22	1355	107	13	E	78.0	180	4.7	89	8.57	73.3
808713U	W 1St St	70.41	7.3	4,309	6	131.98	5,979	2	Collector	900	125	5734	548	10	E	57.5	740	2.6	472	7.89	54.9
096711K	Port Industrial Rd	70.06	8.1	2,687	7	121.79	23,076	2	Arterial	1,400	481	22218	1952	11	E	57.8	2400	2.1	1696	7.35	55.7
096710D	Division St	69.82	8.1	2,687	7	117.68	27	2	Local Road	700	1	16	2	7	D	35.4	20	1.2	2	7.12	34.2
096709J	Heron St	69.81	8.1	2,687	6	121.60	216	2	Local Road	700	5	137	18	8	D	38.1	20	1.4	16	7.33	36.7
808707R	Monroe St	69.63	9.2	4,189	6	126.38	27	2	Local Road	700	1	16	2	7	D	36.3	20	2.0	2	7.26	34.3
096706N	Washington St	69.49	9.2	4,189	5	128.62	866	2	Local Road	700	18	556	77	7	D	38.5	80	2.1	64	7.41	36.4
092551K	H Street	68.8	7.4	4,281	6	231.46	1,136	2	Local Road	700	24	2949	183	16	F	155.7	240	29.4	131	11.51	126.4
096695D	E Heron St	68.5	7.4	4,281	5	170.79	4,464	1	Local Road	700	186	8299	529	16	F	111.6	1420	26.5	360	8.08	85.0
096693P	Newell St	68.44	7.4	4,281	6	166.93	839	2	Local Road	700	17	1122	97	12	F	80.3	140	18.4	67	7.96	61.8
096691B	S Chehalis St	68.36	7.4	4,281	6	140.61	6,344	4	Local Road	700	66	6482	619	10	E	61.3	420	10.2	454	7.16	51.2
096689A	Dairy Queen Entrance	68.34	7.4	4,281	6	138.75	216	2	Local Road	700	5	196	21	9	D	54.4	20	8.8	15	7.09	45.6
096690U	McDonalds Entrance	68.31	7.4	4,281	6	137.52	1,380	2	Local Road	700	29	1274	132	10	E	55.4	180	8.8	97	7.05	46.6
096029N	Tyler St	68.23	7.4	4,281	6	134.11	5,235	4	Local Road	700	55	4779	488	10	D	54.8	320	8.7	360	6.89	46.1
096688T	Fleet St	68.16	7.4	4,281	7	129.89	2,083	2	Local Road	700	43	1754	188	9	D	50.5	260	8.2	138	6.64	42.3

Grade-Crossing Safety

Methods

Assumptions and Data Sources for Calculations

The data sources and assumptions used to characterize grade-crossing safety conditions were similar to those described for Grade-Crossing Delay above.

Calculation of Accident Frequency

For grade crossings not included in the GradeDec.net model (including private at-grade crossings), the FRA accident prediction formula was used to calculate a total predicted annual accident rate. Because grade-separated crossings do not pose a collision safety hazard, they are not included in the analysis.

Below is the accident prediction formula. The remaining values are summarized in Table 30.

a = K * EI *DT *MS *MT *HP *HL

Where:

K = the basic accident prediction constant

EI = the exposure index factor based on the product of the number of roadway vehicles and trains per day

DT = the factor for the number of through trains per day during daylight

MS = the factor for maximum timetable speed

MT = the factor for number of main tracks

HP = the factor for paved roadway

HL = the factor for number of roadway lanes

The exposure index factor (EI) is calculated using:

((c*t)+0.2/0.2)^0.37

Where:

c=number of vehicles (AADT)

t=number of trains per day

Table 30. FRA Accident Prediction Formula Constants

Formula Constant	Equation or Description	Formula Value
Passive Protection (i.e. signs and crossbucks)		
K =	Basic accident prediction constant	0.0006938
EI=	((c*t)+0.2/0.2)^0.3334	
DT =	((d+0.2)/0.2)^0.1396	
	0 train per day	1
	1 train per day	1.27
	2 train per day	1.38
	3 train per day	1.45
	4 train per day	1.5
	5 train per day	1.55
	6 train per day	1.58
	7 train per day	1.61
	8 train per day	1.64
	9 trains per day	1.67
MS =		e^0.0077ms
	0 mph	1
	5 mph	1.04
	10 mph	1.08
	15 mph	1.12
	20 mph	1.17
	25 mph	1.21
MT=	Number of main tracks	1
HP =	Paved/Unpaved	1/0.55
HL =	roadway lanes	1
Gates		
K =	Basic accident prediction constant	0.001088
EI=	((c*t)+0.2/0.2)^0.3116	
DT =	0 train per day	1
	1 train per day	1
	2 train per day	1
	3 train per day	1
	4 train per day	1
	5 train per day	1
	6 train per day	1
	7 train per day	1
MS =	0 mph	1
	5 mph	1
	10 mph	1
	15 mph	1
	20 mph	1
	25 mph	1
MT=	e^0.1512mt	1.16
HP =		1
HL =	e^0.1093(hl-1)	1.15

Formula Constant	Equation or Description	Formula Value
Flashing Lights		
K =	Basic accident prediction constant	0.003646
EI=	((c*t)+0.2/0.2)^0.2953	
DT =	((d+0.2)/0.2)^0.0470	
	0 train per day	1
	1 train per day	1
	2 train per day	1
	3 train per day	1
	4 train per day	1
	5 train per day	1
	6 train per day	1
	7 train per day	1
MS =	0 mph	1
	5 mph	1
	10 mph	1
	15 mph	1
	20 mph	1
MT=	e^0.1512mt	1.16
HP =		1
HL =	e^0.1390(hl-1)	1.15

Notes:
mph = miles per hour
Source: Federal Railroad Administration 1987

The crossings that required manual calculations using the accident prediction formula are as shown in Table 31.

Table 31. Additional Information for Manual Safety Calculations

FRA Crossing ID	Street	Milepost	Crossing Protection	Road Type
922981P	Hoss Rd	4.44	gates	paved
922982W	Robert Thompson Rd	4.26	gates	paved
Switching				
922990N	Industrial Rd	71.04	gates	paved
096710D	Division St	69.82	No signs or signals	paved
096709J	Heron St	69.81	No signs or signals	paved
808707R	Monroe St	69.63	Stop signs	paved
096706N	Washington St	69.49	No signs or signals	paved
096689A	Dairy Queen Entrance	68.34	Crossbucks	paved
096690U	McDonald's Entrance	68.31	No signs or signals	paved

The FRA GradeDec.Net model was used to calculate the total annual predicted accident frequency for existing grade crossings along PS&P. The analysis of this segment accounted for accident history and frequency of trains at grade crossings, volume of vehicle traffic, existing safety devices at grade crossings, and other factors to determine the potential impacts of an increase in rail traffic.

The potential change in the predicted accident frequency (accidents per year) was estimated from the no-action alternative to the expected train traffic levels under proposed action. The predicted accident frequency was calculated using the FRA GradeDec.Net model (Federal Railroad Administration 2014b). This free and open-source model was released in January 2003 and integrates several modeling capabilities into a single package. It analyzes the following components.

- Grade-crossing safety
- Cost-benefit for future investments
- High-speed rail corridors
- GradeDec.Net allows the user to import up to 600 grade crossings and accepts the following data to calculate the annual accident prediction rate.
- Number of freight and passenger trains
- AADT
- Train length
- Train speed
- Crossing devices

GradeDec.Net uses two safety prediction models, the U.S. Department of Transportation Accident Prediction and Severity Model and the Volpe National Transportation System Center High-Speed Rail Accident Severity Model. The results of the accident prediction and severity model were used, which reports accident prediction rates for injuries, fatalities, property damage only, and total accidents (Federal Railroad Administration 2013).

Each at-grade crossing is then analyzed by an estimated future accident frequency and the corresponding predicted interval between accidents using the general accident prediction formula (Federal Railroad Administration 1987). The FRA GradeDec.Net Model was used to analyze public highway-rail grade crossings (Federal Railroad Administration 2014b) and the general accident prediction formula was used to analyze private highway-rail grade crossings. The GradeDec.Net model accounts for accident history and frequency of trains at existing at-grade crossings, volume of vehicle traffic, existing safety devices at the at-grade crossings, and other factors to determine the potential impacts of an increase in rail traffic. The model also considers the existing rail traffic volumes provided by FRA's grade-crossing database (2014c) and the additional proposed rail traffic. Estimates of AADT for vehicles at each road crossing were calculated for 2012, 2017, and 2037. The general accident prediction formula used was based on FRA's *Rail-Highway Crossing Resource Allocation Procedure User's Guide* taking into account the crossings protection, train speed, number of trains per day, road surface, and number of roadway lanes (Federal Railroad Administration 1987).

Crossing protection upgrades were identified by WSDOT in 2017 to have crossing protection upgrades at crossing 092546N, Tower St, and crossing 092547V, D Street (also known as Pearl Street), where protection would be upgraded from flashing lights to early warning systems and crossing gates (Stemkoski pers. comm.). WSDOT is currently in the planning phase to have several crossing protection upgrades by 2037 including: crossings 096642E, Calder Road, and 096644T, Newman Creek Rd, protection would be upgraded from stop signs to signs and gates; Devonshire Road, 096678M, crossing would have concrete crossing, gates, and signs installed on top of the

existing flashing lights; and the Glenn Road crossing, 096657U, would be removed and a new access road and cul-de-sac would be built (Washington State Department of Transportation 2014).

Tables 32 through 35 show the results of the grade-crossing delay analysis for the No Action Alternative; Tables 36 through 39 show the results of the grade-crossing delay analysis for the proposed action. Tables 40 through 43 show the results of the grade-crossing delay analysis for the cumulative scenario.

No-Action Alternative

Table 32. Predicted Accident Frequency and Interval, No-Action Alternative (2017)

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)
096687L	Junction City Rd	2	1,249	12	4,472	3.1	0.000329	0.003716	0.011662	0.015707	63.7
096682C	Central Park Dr	2	291	11	4,472	3.1	0.000097	0.001011	0.002447	0.003554	281.4
096680N	Aldergrove Dr	2	398	25	4,472	3.1	0.000710	0.003743	0.007424	0.011877	84.2
096679U	Heikkinen Rd	1	215	25	4,472	3.1	0.000333	0.001757	0.003484	0.005574	179.4
096678M	Devonshire Rd	2	1,066	25	4,472	3.1	0.000973	0.005126	0.010167	0.016266	61.5
096677F	County Farm Rd	2	258	25	4,472	3.1	0.000616	0.003245	0.006435	0.010296	97.1
096672W	Main Street	2	1,583	25	4,472	3.1	0.000403	0.002123	0.004211	0.006737	148.4
400107G	Sylvia St	2	129	25	4,472	3.1	0.000347	0.002168	0.005638	0.008154	122.6
096659H	Old Beacon Rd	2	86	25	4,472	3.1	0.000132	0.000695	0.001378	0.002205	453.5
096658B	Monte Brady Rd	2	797	25	4,472	3.1	0.000312	0.001646	0.003264	0.005222	191.5
096657U	Glenn Rd	2	22	25	4,472	3.1	0.000264	0.001390	0.002757	0.004412	226.7
096655F	Fairbairn Rd	2	22	25	4,472	3.1	0.000271	0.001427	0.002830	0.004528	220.8
096654Y	Winkerman Rd S	2	43	25	4,472	3.1	0.000334	0.001759	0.003489	0.005582	179.1
096652K	Monte Brady Rd	2	1,055	25	4,472	3.1	0.000955	0.005033	0.009982	0.015970	62.6
096650W	Foss Av-Monte Elma	2	4,813	25	4,472	3.1	0.000669	0.003525	0.006992	0.011186	89.4
096649C	Hewitt St	2	345	25	4,472	3.1	0.000678	0.003572	0.007084	0.011334	88
096648V	Moore Rd	2	506	25	4,472	3.1	0.000768	0.004047	0.008027	0.012841	78
096646G	Oniel Rd	2	571	25	4,472	3.1	0.000798	0.004208	0.008345	0.013351	75
096644T	Newman Creek Rd	2	861	25	4,472	3.1	0.000910	0.004795	0.009510	0.015215	66
096643L	Hurd Rd	2	1,378	25	4,472	3.1	0.001053	0.005548	0.011005	0.017606	57
096642E	Calder Rd	2	603	25	4,472	3.1	0.000812	0.004282	0.008493	0.013587	74
096641X	N 17th St	2	118	25	4,472	3.1	0.000473	0.002493	0.004944	0.007910	126
096640R	N 13th St	2	646	25	4,472	3.1	0.000831	0.004377	0.008682	0.013890	72
096639W	N 11th St	2	1,916	24	4,472	3.1	0.001112	0.006072	0.012147	0.019332	52

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)
096638P	N 10th St	2	280	22	4,472	3.1	0.000549	0.003230	0.006583	0.010362	97
096636B	N 6th St	2	140	22	4,472	3.1	0.000435	0.002559	0.005214	0.008208	122
096635U	N 5th St	2	75	22	4,472	3.1	0.000351	0.001891	0.004384	0.006627	151
096634M	N 3rd St	2	624	21	4,472	3.1	0.000679	0.004150	0.008546	0.013375	75
096525J	N 2d St	2	474	24	4,472	3.1	0.000719	0.003592	0.008178	0.012488	80
096519F	Tridwell Rd	2	118	24	4,472	3.0	0.000452	0.002467	0.004935	0.007854	127
096518Y	Blockhouse Rd W	2	226	25	4,568	3.0	0.000589	0.003105	0.006158	0.009851	102
096515D	Blockhouse Rd E	2	43	25	4,568	3.0	0.000334	0.001759	0.003489	0.005582	179
096510U	Dunlap Rd	2	194	25	4,568	3.0	0.000560	0.002950	0.005851	0.009360	107
092603A	Porter Creek Rd	2	803	25	4,568	3.0	0.000415	0.002185	0.004333	0.006933	144
092595K	Elma Gare Rd W	2	86	25	4,568	3.0	0.000424	0.002237	0.004437	0.007098	141
092593W	Shelton Rd	2	54	25	4,568	3.0	0.000204	0.001077	0.002137	0.003419	292
092587T	Scheaffer St	2	43	25	4,568	3.0	0.000188	0.000993	0.001970	0.003152	317
092586L	Newton St	2	172	25	4,568	3.0	0.000308	0.001487	0.003359	0.005154	194
092585E	Murray St	2	172	25	4,568	3.0	0.000308	0.001624	0.003222	0.005154	194
092584X	Merry Rd	2	43	25	4,568	3.0	0.000188	0.000993	0.001970	0.003152	317
092583R	Blockhouse Rd	2	43	25	4,568	3.0	0.000188	0.000993	0.001970	0.003152	317
092577M	Moon Rd SW	2	258	25	4,568	3.0	0.000355	0.001561	0.004023	0.005940	168
092576F	Owings St	2	323	25	4,568	3.0	0.000663	0.003200	0.007227	0.011091	90
092574S	Little Rock Rd	2	1,004	25	4,568	3.0	0.000506	0.002443	0.005517	0.008465	118
092573K	183rd Ave SW	2	785	25	4,568	3.0	0.000412	0.002171	0.004307	0.006890	145
092569V	Joselyn Ave	2	215	25	4,568	3.0	0.000579	0.003053	0.006056	0.009688	103
092567G	Tea St	2	517	25	4,568	3.0	0.000773	0.004075	0.008083	0.012931	77
092566A	Grand Mound SW	2	345	25	4,568	3.0	0.000678	0.003572	0.007084	0.011334	88
092565T	Old Hwy 99 SW	2	10,250	24	4,568	3.0	0.000742	0.004050	0.008102	0.012894	78
092563E	216th Ave SW	2	86	13	4,568	3.0	0.000209	0.001901	0.004402	0.006512	154
092561R	222nd Ave SW	2	172	10	4,568	3.0	0.000219	0.002463	0.006122	0.008804	114
922981P	Hoss Rd	2	1,152	10	4,568	3.0				0.018384	54
922982W	Robert Thompson Rd	2	571	10	4,568	3.0				0.014771	114

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)
922980H	Kuper Rd	2	474	10	4,568	3.0	0.000107	0.001200	0.002982	0.004288	233
092559P	Fordon Rd	2	183	10	4,568	3.0	0.000052	0.000677	0.002238	0.002967	337
092554F	W Reynolds Ave	2	6,449	10	4,568	3.0	0.000442	0.005238	0.019563	0.025243	40
092552S	J St	2	345	8	4,568	3.0	0.000121	0.001707	0.006799	0.008627	116
092551K	H St	2	894	7	4,568	3.0	0.000169	0.002626	0.010876	0.013671	73
092550D	G St	2	345	7	4,568	3.0	0.000124	0.002117	0.007771	0.010011	100
092549J	F St	2	237	7	4,568	3.0	0.000109	0.001695	0.007022	0.008826	113
092548C	E St	2	345	7	4,568	3.0	0.000124	0.002117	0.007771	0.010011	100
092547V	D St	2	13,878	7	4,568	3.0	0.000205	0.003196	0.013237	0.016638	60
092546N	Tower St	2	8,097	7	4,568	3.0	0.000158	0.002705	0.009929	0.012791	78
092543T	B St	2	700	7	4,568	3.0	0.000156	0.002427	0.010052	0.012635	79
092521T	Maple St M1	2	3628	40	4,568	40.0	0.002478	0.007366	0.021074	0.030918	32
092520L	E Main St M1	2	2756	40	4,568	40.0	0.002344	0.006966	0.019931	0.029241	34
092519S	E Locust St M1	2	2885	40	4,568	40.0	0.002366	0.007032	0.020118	0.029516	34

Notes:
Hoss Road (922981P) and Robert Thompson Road (922982W) were calculated using the predicted accident frequency formula. The rest were calculated using the GradeDec.Net model.
D Street (092547V) and Tower Street (092546N) are proposed to receive a crossing protection upgrade to gates by 2017 (Washington State Department of Transportation 2014).

Table 33. Predicted Accident Frequency and Interval, No-Action Alternative (2017)–Switching Movements

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)
922990N	Industrial Rd	2	5,803	4	718	2.8				0.029777	33.6
808711F	Myrtle St	2	75	2	718	1.4	0.000004	0.000209	0.001135	0.001348	741.8
808712M	N Maple St	2	808	6	718	2.8	0.000073	0.001804	0.006863	0.008739	114.4
808713U	W 1St St	2	4,296	6	3,409	3.1	0.000074	0.001832	0.006969	0.008875	112.7
096711K	Port Industrial Rd	2	18,002	8	1,018	3.9	0.000183	0.003718	0.012924	0.016825	59.4
096710D	Division St	2	22	7	1,018	3.9				0.015569	64.2
096709J	Heron St	2	172	6	1,018	3.9				0.031035	32.2
808707R	Monroe St	2	22	6	4,022	4.9				0.017386	57.5
096706N	Washington St	2	678	5	4,022	4.9				0.054754	18.3
092551K	H Street	2	894	5	3,551	3.2	0.000063	0.001610	0.007307	0.008980	111.4
096695D	E Heron St	2	205	5	3,551	3.2	0.000018	0.000514	0.002073	0.002606	383.7
096693P	Newell St	2	366	6	3,551	3.2	0.000046	0.000941	0.004548	0.005536	180.6
096691B	S Chehalis St	4	7,504	6	3,551	3.2	0.000097	0.002401	0.009136	0.011634	86.0
096689A	W Mall Entrance	2	172	6	3,551	3.2				0.028009	35.7
096690U	E Mall Entrance	2	172	6	3,551	3.2				0.028009	35.7
096029N	Tyler St	4	5,502	7	3,551	3.2	0.000136	0.003008	0.010906	0.014051	71.2
096688T	Fleet St	2	2,810	7	3,551	3.2	0.000129	0.002844	0.010311	0.013284	75.3

Notes:
Industrial Road (922990N), Division Street (110912), Heron Street (096709J), Monroe Street (860101), Washington Street (110912), W Mall Entrance (096689A), and E Mall Entrance (096690U) were calculated using the predicted accident frequency formula. The rest were calculated using the GradeDec.Net model.

Table 34. Predicted Accident Frequency and Interval, No-Action Alternative (2037)

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)
096687L	Junction City Rd	2	1,605	12	4,472	3.1	0.000356	0.004017	0.012606	0.016979	59
096682C	Central Park Dr	2	374	11	4,472	3.1	0.000107	0.001113	0.002695	0.003915	255
096680N	Aldergrove Dr	2	512	25	4,472	3.1	0.000771	0.004062	0.008057	0.012890	78
096679U	Heikkinen Rd	1	277	25	4,472	3.1	0.000364	0.001919	0.003806	0.006089	164
096678M	Devonshire Rd	2	1,370	25	4,472	3.1	0.000479	0.002526	0.005010	0.008015	125
096677F	County Farm Rd	2	332	25	4,472	3.1	0.000669	0.003527	0.006995	0.011192	89
096672W	Main Street	2	2,034	25	4,472	3.1	0.000441	0.002326	0.004613	0.007381	135
400107G	Sylvia St	2	166	25	4,472	3.1	0.000378	0.002362	0.006141	0.008882	113
096659H	Old Beacon Rd	2	111	25	4,472	3.1	0.000146	0.000769	0.001524	0.002439	410
096658B	Monte Brady Rd	2	1,024	25	4,472	3.1	0.000346	0.001823	0.003616	0.005785	173
096657U	Glenn Rd	2	28	25	4,472	3.1	0.000000	0.000000	0.000000	0.000000	0
096655F	Fairbairn Rd	2	28	25	4,472	3.1	0.000299	0.001575	0.003125	0.004999	200
096654Y	Winkerman Rd S	2	55	25	4,472	3.1	0.000364	0.001917	0.003801	0.006082	164
096652K	Monte Brady Rd	2	1,356	25	4,472	3.1	0.001048	0.005521	0.010951	0.017519	57
096650W	Foss Av-Monte Elma	2	6,184	25	4,472	3.1	0.000714	0.003762	0.007461	0.011936	84
096649C	Hewitt St	2	443	25	4,472	3.1	0.000735	0.003876	0.007688	0.012299	81
096648V	Moore Rd	2	650	25	4,472	3.1	0.000832	0.004386	0.008699	0.013917	72
096646G	Oniel Rd	2	733	25	4,472	3.1	0.000865	0.004557	0.009038	0.014460	69
096644T	Newman Creek Rd	2	1,107	25	4,472	3.1	0.000452	0.002384	0.004729	0.007566	132
096643L	Hurd Rd	2	1,771	25	4,472	3.1	0.001136	0.005987	0.011875	0.018998	53
096642E	Calder Rd	2	775	25	4,472	3.1	0.000411	0.002164	0.004291	0.006866	146
096641X	N 17th St	2	152	25	4,472	3.1	0.000515	0.002717	0.005389	0.008621	116
096640R	N 13th St	2	830	25	4,472	3.1	0.000899	0.004740	0.009401	0.015040	66
096639W	N 11th St	2	2,462	24	4,472	3.1	0.001198	0.006542	0.013086	0.020826	48
096638P	N 10th St	2	360	22	4,472	3.1	0.000597	0.003510	0.007153	0.011260	89
096636B	N 6th St	2	180	22	4,472	3.1	0.000474	0.002786	0.005678	0.008937	112
096635U	N 5th St	2	97	22	4,472	3.1	0.000384	0.002067	0.004790	0.007241	138

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)
096634M	N 3rd St	2	802	21	4,472	3.1	0.000735	0.004497	0.009259	0.014491	69
096525J	N 2d St	2	609	24	4,472	3.1	0.000779	0.003894	0.008866	0.013540	74
096519F	Tridwell Rd	2	152	24	4,472	3.0	0.000493	0.002689	0.005379	0.008560	117
096518Y	Blockhouse Rd W	2	291	25	4,568	3.0	0.000641	0.003377	0.006698	0.010715	93
096515D	Blockhouse Rd E	2	55	25	4,568	3.0	0.000364	0.001917	0.003801	0.006082	164
096510U	Dunlap Rd	2	249	25	4,568	3.0	0.000608	0.003207	0.006360	0.010175	98
092603A	Porter Creek Rd	2	1,039	25	4,568	3.0	0.000445	0.002344	0.004648	0.007437	134
092595K	Elma Gare Rd W	2	111	25	4,568	3.0	0.000463	0.002441	0.004842	0.007747	129
092593W	Shelton Rd	2	69	25	4,568	3.0	0.000223	0.001176	0.002332	0.003731	268
092587T	Scheaffer St	2	55	25	4,568	3.0	0.000206	0.001085	0.002151	0.003441	291
092586L	Newton St	2	221	25	4,568	3.0	0.000336	0.001624	0.003667	0.005628	178
092585E	Murray St	2	221	25	4,568	3.0	0.000336	0.001773	0.003518	0.005628	178
092584X	Merry Rd	2	55	25	4,568	3.0	0.000206	0.001085	0.002151	0.003441	291
092583R	Blockhouse Rd	2	55	25	4,568	3.0	0.000206	0.001085	0.002151	0.003441	291
092577M	Moon Rd SW	2	332	25	4,568	3.0	0.000388	0.001704	0.004392	0.006484	154
092576F	Owings St	2	415	25	4,568	3.0	0.000720	0.003474	0.007846	0.012041	83
092574S	Little Rock Rd	2	1,299	25	4,568	3.0	0.000542	0.002617	0.005910	0.009069	110
092573K	183rd Ave SW	2	1,015	25	4,568	3.0	0.000442	0.002329	0.004619	0.007390	135
092569V	Joselyn Ave	2	277	25	4,568	3.0	0.000630	0.003322	0.006589	0.010542	95
092567G	Tea St	2	664	25	4,568	3.0	0.000838	0.004416	0.008759	0.014012	71
092566A	Grand Mound SW	2	443	25	4,568	3.0	0.000735	0.003876	0.007688	0.012299	81
092565T	Old Hwy 99 SW	2	13,169	24	4,568	3.0	0.000804	0.004390	0.008782	0.013977	72
092563E	216th Ave SW	2	111	13	4,568	3.0	0.000228	0.002076	0.004807	0.007111	141
092561R	222nd Ave SW	2	221	10	4,568	3.0	0.000219	0.002463	0.006122	0.008804	114
922981P	Hoss Rd	2	1,480	10	4,568	3.0				0.019877	50
922982W	Robert Thompson Rd	2	733	10	4,568	3.0				0.015970	63
922980H	Kuper Rd	2	609	10	4,568	3.0	0.000117	0.001320	0.003280	0.004717	212
092559P	Fordon Rd	2	235	10	4,568	3.0	0.000057	0.000747	0.002467	0.003271	306

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)
092554F	W Reynolds Ave	2	8,286	10	4,568	3.0	0.000474	0.005612	0.020958	0.027044	37
092552S	J St	2	443	8	4,568	3.0	0.000154	0.002167	0.008631	0.010953	91
092551K	H St	2	1,148	7	4,568	3.0	0.000183	0.002843	0.011777	0.014803	68
092550D	G St	2	443	7	4,568	3.0	0.000134	0.002300	0.008443	0.010878	92
092549J	F St	2	304	7	4,568	3.0	0.000118	0.001843	0.007635	0.009597	104
092548C	E St	2	443	7	4,568	3.0	0.000134	0.002300	0.008443	0.010878	92
092547V	D St	2	17,831	7	4,568	3.0	0.000218	0.003396	0.014065	0.017679	57
092546N	Tower St	2	10,403	7	4,568	3.0	0.000158	0.002705	0.009929	0.012791	78
092543T	B St	2	899	7	4,568	3.0	0.000169	0.002630	0.010896	0.013695	73
092521T	Maple St M1	2	4,662	40	4,568	40	0.002604	0.007741	0.022147	0.032492	31
092520L	E Main St M1	2	3,541	40	4,568	40	0.002466	0.007330	0.020972	0.030768	33
092519S	E Locust St M1	2	3,707	40	4,568	40	0.002489	0.007398	0.021165	0.031052	32

Notes:
Hoss Road (922981P) and Robert Thompson Road (922982W) were calculated using the predicted accident frequency formula. The rest were calculated using the GradeDec.Net model.
D Street (092547V) and Tower Street (092546N) are proposed to receive a crossing protection upgrade to gates by 2017. Devonshire Road (096678M), Newman Creek Road (096644T), Calder Road (096642E) are proposed to receive a crossing protection upgrade to gates and signs by 2037 and the Glenn Road crossing (096657U) is proposed to close by 2037 (Washington State Department of Transportation 2014).

Table 35. Predicted Accident Frequency and Interval, No-Action Alternative (2037)–Switching Movements

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)
922990N	Industrial Rd	2	7,456	6	718	2.8				0.032196	31.1
808711F	Myrtle St	2	97	6	718	1.4	0.000013	0.000308	0.001173	0.001494	669.3
808712M	N Maple St	2	1,038	6	718	2.8	0.000079	0.001963	0.007467	0.009508	105.2
110912	W 1St St	2	5,520	7	3,409	3.1	0.000102	0.002245	0.008142	0.010489	95.3
110912	Port Industrial Rd	2	23,129	14	1,018	3.9	0.000341	0.004510	0.013266	0.018117	55.2
110912	Division St	2	28	14	1,018	3.9				0.017562	56.9
096709J	Heron St	2	221	14	1,018	3.9				0.035034	28.5
860101	Monroe St	2	28	15	4,022	4.9				0.020341	49.2
110912	Washington St	2	872	15	4,022	4.9				0.064104	15.6
110912	H Street	2	1,148	23	3,551	3.2	0.000345	0.002738	0.007978	0.011060	90.4
096695D	E Heron St	2	263	23	3,551	3.2	0.000090	0.000780	0.002004	0.002874	347.9
110912	Newell St	2	470	23	3,551	3.2	0.000189	0.001367	0.004520	0.006076	164.6
110912	S Chehalis St	4	9,642	23	3,551	3.2	0.000394	0.003429	0.008816	0.012639	79.1
096689A	W Mall Entrance	2	221	23	3,551	3.2				0.035423	28.2
096690U	E Mall Entrance	2	221	23	3,551	3.2				0.035423	28.2
096029N	Tyler St	4	7,069	23	3,551	3.2	0.000474	0.004124	0.010604	0.015201	65.8
100111	Fleet St	2	3,611	23	3,551	3.2	0.000498	0.004336	0.011149	0.015983	65.8

Notes:
Industrial Road (922990N), Division Street (110912), Heron Street (096709J), Monroe Street (860101), Washington Street (110912), W Mall Entrance (096689A), and E Mall Entrance (096690U) were calculated using the predicted accident frequency formula. The rest were calculated using the GradeDec.Net model.

Proposed Action

Table 36. Predicted Accident Frequency and Interval, Proposed Action (2017)

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)	Decrease between Predicted Intervals from No-Action Alternative
096687L	Junction City Rd	2	1,249	12	5,323	4.4	0.000381	0.004220	0.013265	0.017866	56.0	7.7
096682C	Central Park Dr	2	291	11	5,323	4.4	0.000110	0.001127	0.002734	0.003971	251.8	29.5
096680N	Aldergrove Dr	2	398	25	5,323	4.4	0.000828	0.004269	0.008496	0.013593	73.6	10.6
096679U	Heikkinen Rd	1	215	25	5,323	4.4	0.000392	0.002024	0.004028	0.006444	155.2	24.2
096678M	Devonshire Rd	2	1,066	25	5,323	4.4	0.001126	0.005805	0.011554	0.018485	54.1	7.4
096677F	County Farm Rd	2	258	25	5,323	4.4	0.000719	0.003710	0.007384	0.011813	84.7	12.5
096672W	Main Street	2	1,583	25	5,323	4.4	0.000456	0.002349	0.004675	0.007480	133.7	14.7
400107G	Sylvia St	2	129	25	5,323	4.4	0.000407	0.002489	0.006492	0.009388	106.5	16.1
096659H	Old Beacon Rd	2	86	25	5,323	4.4	0.000150	0.000776	0.001544	0.002470	404.9	48.7
096658B	Monte Brady Rd	2	797	25	5,323	4.4	0.000354	0.001826	0.003635	0.005815	172.0	19.5
096657U	Glenn Rd	2	22	25	5,323	4.4	0.000311	0.001604	0.003193	0.005109	195.7	30.9
096655F	Fairbairn Rd	2	22	25	5,323	4.4	0.000311	0.001604	0.003193	0.005109	195.7	25.1
096654Y	Winkerman Rd S	2	43	25	5,323	4.4	0.000393	0.002026	0.004033	0.006453	155.0	24.2
096652K	Monte Brady Rd	2	1,055	25	5,323	4.4	0.001106	0.005702	0.011349	0.018157	55.1	7.5
096650W	Foss Av-Monte Elma	2	4,813	25	5,323	4.4	0.000765	0.003946	0.007853	0.012564	79.6	9.8
096649C	Hewitt St	2	345	25	5,323	4.4	0.000791	0.004077	0.008115	0.012982	77	11.2
096648V	Moore Rd	2	506	25	5,323	4.4	0.000894	0.004608	0.009172	0.014673	68	9.7
096646G	Oniel Rd	2	571	25	5,323	4.4	0.000928	0.004787	0.009528	0.015244	66	9.3
096644T	Newman Creek Rd	2	861	25	5,323	4.4	0.001055	0.005439	0.010826	0.017320	58	8.0
096643L	Hurd Rd	2	1,378	25	5,323	4.4	0.001216	0.006270	0.012479	0.019965	50	6.7
096642E	Calder Rd	2	603	25	5,323	4.4	0.000944	0.004870	0.009693	0.015507	64	9.1

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)	Decrease between Predicted Intervals from No-Action Alternative
096641X	N 17th St	2	118	25	5,323	4.4	0.000555	0.002861	0.005695	0.009111	110	16.7
096640R	N 13th St	2	646	25	5,323	4.4	0.000965	0.004976	0.009904	0.015845	63	8.9
096639W	N 11th St	2	1,916	24	5,323	4.4	0.001281	0.006844	0.013737	0.021862	46	6.0
096638P	N 10th St	2	280	23	5,323	4.4	0.000642	0.003694	0.007552	0.011888	84	12.4
096636B	N 6th St	2	140	23	5,323	4.4	0.000510	0.002936	0.006003	0.009449	106	16.0
096635U	N 5th St	2	75	23	5,323	4.4	0.000413	0.002175	0.005059	0.007648	131	20.1
096634M	N 3rd St	2	624	23	5,323	4.4	0.000789	0.004724	0.009757	0.015270	65	9.3
096525J	N 2nd St	2	474	24	5,323	4.4	0.000837	0.004091	0.009350	0.014278	70	10.0
096519F	Tridwell Rd	2	118	25	5,411	4.3	0.000530	0.002832	0.005685	0.009047	111	16.8
096518Y	Blockhouse Rd W	2	226	25	5,411	4.3	0.000689	0.003552	0.007070	0.011311	88	13.1
096515D	Blockhouse Rd E	2	43	25	5,411	4.3	0.000393	0.002026	0.004033	0.006453	155	24.2
096510U	Dunlap Rd	2	194	25	5,411	4.3	0.000655	0.003378	0.006723	0.010756	93	13.9
092603A	Porter Creek Rd	2	803	25	5,411	4.3	0.000477	0.002460	0.004897	0.007835	128	16.6
092595K	Elma Gare Rd W	2	86	25	5,411	4.3	0.000499	0.002571	0.005117	0.008186	122	18.7
092593W	Shelton Rd	2	54	25	5,411	4.3	0.000242	0.001246	0.002479	0.003966	252	40.3
092587T	Scheaffer St	2	43	25	5,411	4.3	0.000223	0.001149	0.002286	0.003658	273	43.9
092586L	Newton St	2	172	25	5,411	4.3	0.000363	0.001714	0.003886	0.005963	168	26.3
092585E	Murray St	2	172	25	5,411	4.3	0.000363	0.001873	0.003727	0.005963	168	26.3
092584X	Merry Rd	2	43	25	5,411	4.3	0.000223	0.001149	0.002286	0.003658	273	43.9
092583R	Blockhouse Rd	2	43	25	5,411	4.3	0.000223	0.001149	0.002286	0.003658	273	43.9
092577M	Moon Rd SW	2	258	25	5,411	4.3	0.000418	0.001796	0.004649	0.006863	146	22.6
092576F	Owings St	2	323	25	5,411	4.3	0.000774	0.003653	0.008282	0.012709	79	11.5
092574S	Little Rock Rd	2	1,004	25	5,411	4.3	0.000581	0.002744	0.006221	0.009546	105	13.4
092573K	183rd Ave SW	2	785	25	5,411	4.3	0.000474	0.002445	0.004867	0.007787	128	16.7
092569V	Joselyn Ave	2	215	25	5,411	4.3	0.000678	0.003494	0.006955	0.011127	90	13.3
092567G	Tea St	2	517	25	5,411	4.3	0.000900	0.004640	0.009234	0.014774	68	9.6

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)	Decrease between Predicted Intervals from No-Action Alternative
092566A	Grand Mound SW	2	345	25	5,411	4.3	0.000791	0.004077	0.008115	0.012982	77	11.2
092565T	Old Hwy 99 SW	2	10,250	21	5,411	4.3	0.000829	0.004427	0.008886	0.014142	71	6.8
092563E	216th Ave SW	2	86	13	5,411	4.3	0.000245	0.002190	0.005081	0.007517	133	20.5
092561R	222nd Ave SW	2	172	10	5,411	4.3	0.000236	0.002600	0.006474	0.009311	107	6.2
922981P	Hoss Rd	2	1,152	10	5,411	4.3				0.020499	49	5.6
922982W	Robert Thompson Rd	2	571	10	5,411	4.3				0.016469	61	52.9
922980H	Kuper Rd	2	474	10	5,411	4.3	0.000121	0.001336	0.003327	0.004784	209	24.2
092559P	Fordon Rd	2	183	10	5,411	4.3	0.000059	0.000757	0.002504	0.003319	301	35.7
092554F	W Reynolds Ave	2	6,449	10	5,411	4.3	0.000505	0.005859	0.021918	0.028282	35	4.3
092552S	J St	2	345	8	5,411	4.3	0.000166	0.002286	0.009118	0.011571	86	29.5
092551K	H St	2	894	7	5,411	4.3	0.000196	0.002993	0.012412	0.015601	64	9.0
092550D	G St	2	345	7	5,411	4.3	0.000145	0.002427	0.008920	0.011492	87	12.9
092549J	F St	2	237	7	5,411	4.3	0.000128	0.001947	0.008076	0.010150	99	14.8
092548C	E St	2	345	7	5,411	4.3	0.000145	0.002427	0.008920	0.011492	87	12.9
092547V	D St	2	13,878	7	5,411	4.3	0.000233	0.003557	0.014753	0.018543	54	6.2
092546N	Tower St	2	8,097	7	5,411	4.3	0.000180	0.003028	0.011126	0.014334	70	8.4
092543T	B St	2	700	7	5,411	4.3	0.000182	0.002770	0.011490	0.014442	69	9.9
092521T	Maple St M1	2	3,628	40	5,411	41.3	0.002503	0.007420	0.021241	0.031164	32	0.3
092520L	E Main St M1	2	2,756	40	5,411	41.3	0.002367	0.007018	0.020093	0.029479	34	0.3
092519S	E Locust St M1	2	2,885	40	5,411	41.3	0.002390	0.007084	0.020282	0.029756	34	0.3

Notes:

Hoss Road (922981P) and Robert Thompson Road (922982W) were calculated using the predicted accident frequency formula. The rest were calculated using the GradeDec.Net model.

D Street (092547V) and Tower Street (092546N) are proposed to receive a crossing protection upgrade to gates by 2017 (Washington State Department of Transportation 2014).

Table 37. Predicted Accident Frequency and Interval, Proposed Action (2017)–Switching Movements

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)	Decrease between Predicted Intervals from No-Action Alternative
922990N	Industrial Rd	2	5,803	4	3,892	4.1				0.033432	29.9	3.7
808711F	Myrtle St	2	75	2	0	1.4	N/A	N/A	N/A	N/A	N/A	N/A
808712M	N Maple St	2	808	6	3,892	4.1	0.000079	0.001989	0.007560	0.009628	103.9	10.6
808713U	W 1St St	2	4,296	6	3,652	4.3	0.000080	0.002027	0.007705	0.009812	101.9	10.8
096711K	Port Industrial Rd	2	18,002	8	3,459	5.2	0.000192	0.003975	0.013806	0.017972	55.6	3.8
096710D	Division St	2	22	7	3,459	5.2				0.017643	56.7	7.5
096709J	Heron St	2	172	6	3,459	5.2				0.035198	28.4	3.8
808707R	Monroe St	2	22	6	3,508	6.2				0.019104	52.3	5.2
096706N	Washington St	2	678	5	3,508	6.2				0.060202	16.6	1.7
092551K	H Street	2	894	5	5,326	4.4	0.000068	0.001775	0.008048	0.009890	101.1	10.2
096695D	E Heron St	2	205	5	5,326	4.4	0.000020	0.000576	0.002321	0.002917	342.8	40.9
096693P	Newell St	2	366	6	5,326	4.4	0.000050	0.001049	0.005062	0.006161	162.3	18.3
096691B	S Chehalis St	4	7,504	6	5,326	4.4	0.000105	0.002642	0.010045	0.012793	78.2	7.8
096689A	W Mall Entrance	2	172	6	5,326	4.4				0.032382	30.9	4.8
096690U	E Mall Entrance	2	172	6	5,326	4.4				0.032382	30.9	4.8
096029N	Tyler St	4	5,502	7	5,326	4.4	0.000146	0.003295	0.011935	0.015377	65.0	6.1
096688T	Fleet St	2	2,810	7	5,326	4.4	0.000139	0.003120	0.011303	0.014562	65.0	10.2

Notes:
Industrial Road (922990N), Division Street (110912), Heron Street (096709J), Monroe Street (860101), Washington Street (110912), W Mall Entrance (096689A), and E Mall Entrance (096690U) were calculated using the predicted accident frequency formula. The rest were calculated using the GradeDec.Net model.

Table 38. Predicted Accident Frequency and Interval, Proposed Action (2037)

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)	Decrease between Predicted Intervals from No-Action Alternative
096687L	Junction City Rd	2	1,605	12	5,323	4.4	0.000411	0.004552	0.014310	0.019274	52	7
096682C	Central Park Dr	2	374	11	5,323	4.4	0.000121	0.001241	0.003010	0.004372	229	27
096680N	Aldergrove Dr	2	512	25	5,323	4.4	0.000897	0.004625	0.009206	0.014728	68	10
096679U	Heikkinen Rd	1	277	25	5,323	4.4	0.000428	0.002209	0.004396	0.007033	142	22
096678M	Devonshire Rd	2	1,370	25	5,323	4.4	0.000551	0.002840	0.005653	0.009044	111	14
096677F	County Farm Rd	2	332	25	5,323	4.4	0.000781	0.004027	0.008015	0.012822	78	11
096672W	Main Street	2	2,034	25	5,323	4.4	0.000498	0.002570	0.005115	0.008184	122	13
400107G	Sylvia St	2	166	25	5,323	4.4	0.000443	0.002708	0.007062	0.010213	98	15
096659H	Old Beacon Rd	2	111	25	5,323	4.4	0.000166	0.000858	0.001707	0.002731	366	44
096658B	Monte Brady Rd	2	1,024	25	5,323	4.4	0.000392	0.002021	0.004022	0.006435	155	17
096657U	Glenn Rd	2	28	25	5,323	4.4	0.000000	0.000000	0.000000	0.000000	0	0
096655F	Fairbairn Rd	2	28	25	5,323	4.4	0.000356	0.001835	0.003652	0.005843	171	29
096654Y	Winkerman Rd S	2	55	25	5,323	4.4	0.000428	0.002206	0.004391	0.007025	142	22
096652K	Monte Brady Rd	2	1,356	25	5,323	4.4	0.001210	0.006240	0.012420	0.019870	50	7
096650W	Foss Av-Monte Elma	2	6,184	25	5,323	4.4	0.000816	0.004206	0.008371	0.013393	75	9
096649C	Hewitt St	2	443	25	5,323	4.4	0.000857	0.004418	0.008792	0.014067	71	10
096648V	Moore Rd	2	650	25	5,323	4.4	0.000967	0.004986	0.009923	0.015876	63	9
096646G	Oniel Rd	2	733	25	5,323	4.4	0.001004	0.005176	0.010301	0.016481	61	8
096644T	Newman Creek Rd	2	1,107	25	5,323	4.4	0.000520	0.002683	0.005340	0.008542	117	15
096643L	Hurd Rd	2	1,771	25	5,323	4.4	0.001309	0.006751	0.013437	0.021497	47	6
096642E	Calder Rd	2	775	25	5,323	4.4	0.000473	0.002437	0.004850	0.007760	129	17
096641X	N 17th St	2	152	25	5,323	4.4	0.000604	0.003115	0.006199	0.009918	101	15
096640R	N 13th St	2	830	25	5,323	4.4	0.001043	0.005378	0.010704	0.017125	58	8
096639W	N 11th St	2	2,462	24	5,323	4.4	0.001377	0.007356	0.014764	0.023497	43	5

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)	Decrease between Predicted Intervals from No-Action Alternative
096638P	N 10th St	2	360	22	5,323	4.4	0.000697	0.004008	0.008195	0.012899	78	11
096636B	N 6th St	2	180	22	5,323	4.4	0.000555	0.003193	0.006528	0.010277	97	15
096635U	N 5th St	2	97	22	5,323	4.4	0.000451	0.002375	0.005523	0.008348	120	18
096634M	N 3rd St	2	802	21	5,323	4.4	0.000853	0.005109	0.010552	0.016515	61	8
096525J	N 2nd St	2	609	24	5,323	4.4	0.000906	0.004428	0.010120	0.015454	65	9
096519F	Tridwell Rd	2	152	24	5,411	4.3	0.000577	0.003083	0.006189	0.009849	102	15
096518Y	Blockhouse Rd W	2	291	25	5,411	4.3	0.000748	0.003858	0.007679	0.012286	81	12
096515D	Blockhouse Rd E	2	55	25	5,411	4.3	0.000428	0.002206	0.004391	0.007025	142	22
096510U	Dunlap Rd	2	249	25	5,411	4.3	0.000711	0.003667	0.007298	0.011676	86	13
092603A	Porter Creek Rd	2	1,039	25	5,411	4.3	0.000511	0.002637	0.005249	0.008398	119	15
092595K	Elma Gare Rd W	2	111	25	5,411	4.3	0.000544	0.002803	0.005579	0.008925	112	17
092593W	Shelton Rd	2	69	25	5,411	4.3	0.000263	0.001359	0.002704	0.004327	231	37
092587T	Scheaffer St	2	55	25	5,411	4.3	0.000243	0.001254	0.002495	0.003992	251	40
092586L	Newton St	2	221	25	5,411	4.3	0.000396	0.001870	0.004240	0.006506	154	24
092585E	Murray St	2	221	25	5,411	4.3	0.000396	0.002043	0.004066	0.006506	154	24
092584X	Merry Rd	2	55	25	5,411	4.3	0.000243	0.001254	0.002495	0.003992	251	40
092583R	Blockhouse Rd	2	55	25	5,411	4.3	0.000243	0.001254	0.002495	0.003992	251	40
092577M	Moon Rd SW	2	332	25	5,411	4.3	0.000456	0.001959	0.005070	0.007485	134	21
092576F	Owings St	2	415	25	5,411	4.3	0.000839	0.003960	0.008978	0.013776	73	10
092574S	Little Rock Rd	2	1,299	25	5,411	4.3	0.000622	0.002937	0.006659	0.010218	98	12
092573K	183rd Ave SW	2	1,015	25	5,411	4.3	0.000508	0.002621	0.005217	0.008346	120	16
092569V	Joselyn Ave	2	277	25	5,411	4.3	0.000736	0.003797	0.007557	0.012090	83	12
092567G	Tea St	2	664	25	5,411	4.3	0.000973	0.005019	0.009989	0.015982	63	9
092566A	Grand Mound SW	2	443	25	5,411	4.3	0.000857	0.004418	0.008792	0.014067	71	10
092565T	Old Hwy 99 SW	2	13,169	24	5,411	4.3	0.000897	0.004789	0.009612	0.015297	65	6
092563E	216th Ave SW	2	111	13	5,411	4.3	0.000268	0.002389	0.005543	0.008201	122	19

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)	Decrease between Predicted Intervals from No-Action Alternative
092561R	222nd Ave SW	2	221	10	5,411	4.3	0.000256	0.002828	0.007041	0.010125	99	15
922981P	Hoss Rd	2	1,480	10	5,411	4.3				0.022163	45	5
922982W	Robert Thompson Rd	2	733	10	5,411	4.3				0.017807	56	6
922980H	Kuper Rd	2	609	10	5,411	4.3	0.000133	0.001469	0.003657	0.005259	190	22
092559P	Fordon Rd	2	235	10	5,411	4.3	0.000065	0.000833	0.002758	0.003657	273	32
092554F	W Reynolds Ave	2	8,286	10	5,411	4.3	0.000540	0.006259	0.023415	0.030214	33	4
092552S	J St	2	443	8	5,411	4.3	0.000180	0.002481	0.009893	0.012554	80	12
092551K	H St	2	1,148	7	5,411	4.3	0.000212	0.003235	0.013416	0.016862	59	8
092550D	G St	2	443	7	5,411	4.3	0.000157	0.002634	0.009679	0.012469	80	12
092549J	F St	2	304	7	5,411	4.3	0.000139	0.002115	0.008770	0.011023	91	13
092548C	E St	2	443	7	5,411	4.3	0.000157	0.002634	0.009679	0.012469	80	12
092547V	D St	2	17,831	7	5,411	4.3	0.000247	0.003774	0.015652	0.019674	51	6
092546N	Tower St	2	10,403	7	5,411	4.3	0.000192	0.003223	0.011844	0.015258	66	13
092543T	B St	2	899	7	5,411	4.3	0.000197	0.002998	0.012434	0.015628	64	9
092521T	Maple St M1	2	4,662	40	5,411	41.3	0.002630	0.007796	0.022318	0.032744	31	0.2
092520L	E Main St M1	2	3,541	40	5,411	41.3	0.002491	0.007384	0.021139	0.031013	32	0.3
092519S	E Locust St M1	2	3,707	40	5,411	41.3	0.002514	0.007451	0.021333	0.031298	32	0.3

Notes:
Hoss Road (922981P) and Robert Thompson Road (922982W) were calculated using the predicted accident frequency formula. The rest were calculated using the GradeDec.Net model.
D Street (092547V) and Tower Street (092546N) are proposed to receive a crossing protection upgrade to gates by 2017. Devonshire Road (096678M), Newman Creek Road (096644T), Calder Road (096642E) are proposed to receive a crossing protection upgrade to gates and signs by 2037 and the Glenn Road crossing (096657U) is proposed to close by 2037 (Washington State Department of Transportation 2014).

Table 39. Predicted Accident Frequency and Interval, Proposed Action (2037)–Switching Movements

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)	Decrease between Predicted Intervals from No-Action Alternative
922990N	Industrial Rd	2	7,456	6	3,892	4.1				0.036148	27.7	3.4
808711F	Myrtle St	2	97		0	1.4	N/A	N/A	N/A	N/A	N/A	N/A
808712M	N Maple St	2	1,038	6	3,892	4.1	0.000086	0.002162	0.008219	0.010466	95.5	9.6
808713U	W 1st St	2	5,520	7	3,652	4.3	0.000110	0.002477	0.008972	0.011559	86.5	8.8
096711K	Port Industrial Rd	2	23,129	11	3,459	5.2	0.000283	0.004582	0.014450	0.019315	51.8	3.4
096710D	Division St	2	28	12	3,459	5.2				0.019905	50.2	6.7
096709J	Heron St	2	221	12	3,459	5.2				0.039734	25.2	3.4
808707R	Monroe St	2	28	12	3,508	6.2				0.021556	46.4	2.8
096706N	Washington St	2	872	12	3,508	6.2				0.067965	14.7	0.9
092551K	H Street	2	1,148	18	5,326	4.4	0.000283	0.002796	0.008669	0.011748	85.1	5.3
096695D	E Heron St	2	263	19	5,326	4.4	0.000082	0.000847	0.002287	0.003215	311.0	36.9
096693P	Newell St	2	470	20	5,326	4.4	0.000180	0.001489	0.005086	0.006755	148.0	16.5
096691B	S Chehalis St	4	9,642	19	5,326	4.4	0.000352	0.003653	0.009864	0.013870	72.1	7.0
096689A	W Mall Entrance	2	221	19	5,326	4.4				0.037908	26.4	1.9
096690U	E Mall Entrance	2	221	19	5,326	4.4				0.037908	26.4	1.9
096029N	Tyler St	4	7,069	20	5,326	4.4	0.000443	0.004411	0.011744	0.016598	60.2	5.5
096688T	Fleet St	2	3,611	20	5,326	4.4	0.000458	0.004554	0.012127	0.017138	58.3	7.4

Notes:
Industrial Road (922990N), Division Street (110912), Heron Street (096709J), Monroe Street (860101), Washington Street (110912), W Mall Entrance (096689A), and E Mall Entrance (096690U) were calculated using the predicted accident frequency formula. The rest were calculated using the GradeDec.Net model.

Cumulative Impacts

Table 40. Predicted Accident Frequency and Interval, Cumulative Impacts (2017)

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)	Decrease between Predicted Intervals from No-Action Alternative
096687L	Junction City Rd	2	1,249	12	6,174	7.3	0.000506	0.005355	0.016897	0.022758	43.9	19.7
096682C	Central Park Dr	2	291	11	6,174	7.3	0.000142	0.001390	0.003384	0.004916	203.4	78.0
096680N	Aldergrove Dr	2	398	25	6,174	7.3	0.001111	0.005473	0.010976	0.017560	56.9	27.2
096679U	Heikkinen Rd	1	215	25	6,174	7.3	0.000540	0.002657	0.005330	0.008527	117.3	62.1
096678M	Devonshire Rd	2	1,066	25	6,174	7.3	0.001487	0.007324	0.014689	0.023500	42.6	18.9
096677F	County Farm Rd	2	258	25	6,174	7.3	0.000971	0.004784	0.009595	0.015351	65.1	32.0
096672W	Main Street	2	1,583	25	6,174	7.3	0.000578	0.002845	0.005706	0.009128	109.6	38.9
400107G	Sylvia St	2	129	25	6,174	7.3	0.000555	0.003239	0.008504	0.012299	81.3	41.3
096659H	Old Beacon Rd	2	86	25	6,174	7.3	0.000195	0.000959	0.001923	0.003076	325.1	128.4
096658B	Monte Brady Rd	2	797	25	6,174	7.3	0.000452	0.002227	0.004466	0.007145	140.0	51.5
096657U	Glenn Rd	2	22	25	6,174	7.3	0.000430	0.002116	0.004243	0.006789	147.3	79.4
096655F	Fairbairn Rd	2	22	25	6,174	7.3	0.000430	0.002116	0.004243	0.006789	147.3	73.6
096654Y	Winkerman Rd S	2	43	25	6,174	7.3	0.000540	0.002661	0.005336	0.008537	117.1	62.0
096652K	Monte Brady Rd	2	1,055	25	6,174	7.3	0.001462	0.007202	0.014444	0.023108	43.3	19.3
096650W	Foss Av-Monte Elma	2	4,813	25	6,174	7.3	0.000993	0.004889	0.009806	0.015688	63.7	25.7
096649C	Hewitt St	2	345	25	6,174	7.3	0.001064	0.005238	0.010504	0.016806	60	28.7
096648V	Moore Rd	2	506	25	6,174	7.3	0.001195	0.005887	0.011807	0.018889	53	24.9
096646G	Oniel Rd	2	571	25	6,174	7.3	0.001240	0.006104	0.012243	0.019586	51	23.8
096644T	Newman Creek Rd	2	861	25	6,174	7.3	0.001399	0.006888	0.013815	0.022102	45	20.5
096643L	Hurd Rd	2	1,378	25	6,174	7.3	0.001599	0.007872	0.015789	0.025260	40	17.2
096642E	Calder Rd	2	603	25	6,174	7.3	0.001260	0.006204	0.012443	0.019907	50	23.4
096641X	N 17th St	2	118	25	6,174	7.3	0.000756	0.003723	0.007467	0.011947	84	42.7

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)	Decrease between Predicted Intervals from No-Action Alternative
096640R	N 13th St	2	646	25	6,174	7.3	0.001286	0.006332	0.012700	0.020318	49	22.8
096639W	N 11th St	2	1,916	24	6,174	7.3	0.001675	0.008543	0.017273	0.027491	36	15.4
096638P	N 10th St	2	280	23	6,174	7.3	0.000867	0.004766	0.009812	0.015445	65	31.8
096636B	N 6th St	2	140	23	6,174	7.3	0.000695	0.003819	0.007862	0.012376	81	41.0
096635U	N 5th St	2	75	23	6,174	7.3	0.000566	0.002845	0.006667	0.010078	99	51.7
096634M	N 3rd St	2	624	23	6,174	7.3	0.001054	0.006029	0.012536	0.019618	51	23.8
096525J	N 2nd St	2	474	24	6,174	7.3	0.001121	0.005231	0.012051	0.018403	54	25.7
096519F	Tridwell Rd	2	118	25	6,237	7.2	0.000723	0.003687	0.007456	0.011866	84	43.0
096518Y	Blockhouse Rd W	2	226	25	6,237	7.2	0.000932	0.004589	0.009203	0.014723	68	33.6
096515D	Blockhouse Rd E	2	43	25	6,237	7.2	0.000540	0.002661	0.005336	0.008537	117	62.0
096510U	Dunlap Rd	2	194	25	6,237	7.2	0.000888	0.004371	0.008767	0.014026	71	35.5
092603A	Porter Creek Rd	2	803	25	6,237	7.2	0.000628	0.003092	0.006201	0.009921	101	43.4
092595K	Elma Gare Rd W	2	86	25	6,237	7.2	0.000681	0.003356	0.006730	0.010767	93	48.0
092593W	Shelton Rd	2	54	25	6,237	7.2	0.000335	0.001649	0.003308	0.005292	189	103.5
092587T	Scheaffer St	2	43	25	6,237	7.2	0.000309	0.001523	0.003054	0.004885	205	112.6
092586L	Newton St	2	172	25	6,237	7.2	0.000500	0.002253	0.005150	0.007903	127	67.5
092585E	Murray St	2	172	25	6,237	7.2	0.000500	0.002463	0.004940	0.007903	127	67.5
092584X	Merry Rd	2	43	25	6,237	7.2	0.000309	0.001523	0.003054	0.004885	205	112.6
092583R	Blockhouse Rd	2	43	25	6,237	7.2	0.000309	0.001523	0.003054	0.004885	205	112.6
092577M	Moon Rd SW	2	258	25	6,237	7.2	0.000574	0.002352	0.006143	0.009068	110	58.1
092576F	Owings St	2	323	25	6,237	7.2	0.001042	0.004694	0.010731	0.016466	61	29.4
092574S	Little Rock Rd	2	1,004	25	6,237	7.2	0.000761	0.003428	0.007837	0.012026	83	35.0
092573K	183rd Ave SW	2	785	25	6,237	7.2	0.000624	0.003073	0.006164	0.009862	101	43.7
092569V	Joselyn Ave	2	215	25	6,237	7.2	0.000917	0.004517	0.009059	0.014492	69	34.2
092567G	Tea St	2	517	25	6,237	7.2	0.001203	0.005925	0.011883	0.019011	53	24.7
092566A	Grand Mound SW	2	345	25	6,237	7.2	0.001064	0.005238	0.010504	0.016806	60	28.7

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)	Decrease between Predicted Intervals from No-Action Alternative
092565T	Old Hwy 99 SW	2	10,250	21	6,237	7.2	0.001024	0.005223	0.010560	0.016807	59	18.1
092563E	216th Ave SW	2	86	13	6,237	7.2	0.000337	0.002874	0.006699	0.009909	101	52.6
092561R	222nd Ave SW	2	172	10	6,237	7.2	0.000322	0.003395	0.008484	0.012201	82	31.6
922981P	Hoss Rd	2	1,152	10	6,237	7.2				0.024191	41	13.1
922982W	Robert Thompson Rd	2	571	10	6,237	7.2				0.019435	51	62.1
922980H	Kuper Rd	2	474	10	6,237	7.2	0.000156	0.001642	0.004104	0.005902	169	63.8
092559P	Fordon Rd	2	183	10	6,237	7.2	0.000077	0.000936	0.003107	0.004120	243	94.3
092554F	W Reynolds Ave	2	6,449	10	6,237	7.2	0.000648	0.007192	0.027002	0.034842	29	10.9
092552S	J St	2	345	8	6,237	7.2	0.000225	0.002965	0.011859	0.015049	66	49.5
092551K	H St	2	894	7	6,237	7.2	0.000262	0.003830	0.015929	0.020021	50	23.2
092550D	G St	2	345	7	6,237	7.2	0.000196	0.003150	0.011604	0.014950	67	33.0
092549J	F St	2	237	7	6,237	7.2	0.000174	0.002538	0.010553	0.013264	75	37.9
092548C	E St	2	345	7	6,237	7.2	0.000196	0.003150	0.011604	0.014950	67	33.0
092547V	D St	2	13,878	7	6,237	7.2	0.000298	0.004353	0.018101	0.022752	44	16.2
092546N	Tower St	2	8,097	7	6,237	7.2	0.000233	0.003752	0.013820	0.017805	56	22.0
092543T	B St	2	700	7	6,237	7.2	0.000244	0.003559	0.014802	0.018605	54	25.4
092521T	Maple St M1	2	3,628	40	6237	47.4	0.002641	0.007719	0.022179	0.032540	31	1.6
092520L	E Main St M1	2	2,756	40	6237	47.4	0.002501	0.007310	0.021004	0.030816	32	1.7
092519S	E Locust St M1	2	2,885	40	6237	47.4	0.002524	0.007377	0.021197	0.031099	32	1.7

Notes:
Hoss Road (922981P) and Robert Thompson Road (922982W) were calculated using the predicted accident frequency formula. The rest were calculated using the GradeDec.Net model.
D Street (092547V) and Tower Street (092546N) are proposed to receive a crossing protection upgrade to gates by 2017 (Washington State Department of Transportation 2014).

Table 41. Predicted Accident Frequency and Interval, Cumulative Impacts (2017)–Switching Movements

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)	Decrease between Predicted Intervals from No-Action Alternative
922990N	Industrial Rd	2	5,803	5	5,406	6.1				0.037876	26.4	7.2
808711F	Myrtle St	2	75	2	718	1.4	0.000004	0.000209	0.001135	0.001348	741.8	0.0
808712M	N Maple St	2	808	7	5,406	6.1	0.000088	0.002278	0.008651	0.011017	90.8	23.7
808713U	W 1st St	2	4,296	6	4,309	7.3	0.000093	0.002454	0.009315	0.011862	84.3	28.4
096711K	Port Industrial Rd	2	18,002	7	4,907	8.1	0.000212	0.004549	0.015773	0.020534	48.7	10.7
096710D	Division St	2	22	7	4,907	8.1				0.021704	46.1	18.2
096709J	Heron St	2	172	6	4,907	8.1				0.043341	23.1	9.1
808707R	Monroe St	2	22	6	4,777	9.2				0.022995	43.5	14.0
096706N	Washington St	2	678	5	4,777	9.2				0.072522	13.8	4.5
092551K	H Street	2	894	5	6,167	7.4	0.000078	0.002138	0.009682	0.011899	84.0	27.3
096695D	E Heron St	2	205	5	6,167	7.4	0.000024	0.000717	0.002885	0.003627	275.7	108.0
096693P	Newell St	2	366	6	6,167	7.4	0.000059	0.001289	0.006210	0.007559	132.3	48.3
096691B	S Chehalis St	4	7,504	6	6,167	7.4	0.000120	0.003162	0.012002	0.015284	65.4	20.5
096689A	W Mall Entrance	2	172	6	6,167	7.4				0.041241	24.2	11.5
096690U	E Mall Entrance	2	172	6	6,167	7.4				0.041241	24.2	11.5
096029N	Tyler St	4	5,502	6	6,167	7.4	0.000166	0.003903	0.014116	0.018186	55.0	16.2
096688T	Fleet St	2	2,810	7	6,167	7.4	0.000159	0.003722	0.013460	0.017341	57.7	17.6

Notes:
Industrial Road (922990N), Division Street (110912), Heron Street (096709J), Monroe Street (860101), Washington Street (110912), W Mall Entrance (096689A), and E Mall Entrance (096690U) were calculated using the predicted accident frequency formula. The rest were calculated using the GradeDec.Net model.

Table 42. Predicted Accident Frequency and Interval, Cumulative Impacts (2037)

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)	Decrease between Predicted Intervals from No-Action Alternative
096687L	Junction City Rd	2	1,605	12	6,174	7.3	0.000543	0.005751	0.018145	0.024439	41	18
096682C	Central Park Dr	2	374	11	6,174	7.3	0.000156	0.001527	0.003719	0.005403	185	70
096680N	Aldergrove Dr	2	512	25	6,174	7.3	0.001200	0.005908	0.011849	0.018956	53	25
096679U	Heikkinen Rd	1	277	25	6,174	7.3	0.000588	0.002895	0.005806	0.009288	108	57
096678M	Devonshire Rd	2	1,370	25	6,174	7.3	0.000722	0.003556	0.007132	0.011410	88	37
096677F	County Farm Rd	2	332	25	6,174	7.3	0.001051	0.005176	0.010380	0.016607	60	29
096672W	Main Street	2	2,034	25	6,174	7.3	0.000630	0.003104	0.006225	0.009959	100	35
400107G	Sylvia St	2	166	25	6,174	7.3	0.000602	0.003514	0.009227	0.013343	75	38
096659H	Old Beacon Rd	2	111	25	6,174	7.3	0.000215	0.001059	0.002123	0.003397	294	116
096658B	Monte Brady Rd	2	1,024	25	6,174	7.3	0.000499	0.002458	0.004929	0.007886	127	46
096657U	Glenn Rd	2	28	25	6,174	7.3	0.000000	0.000000	0.000000	0.000000	0	0
096655F	Fairbairn Rd	2	28	25	6,174	7.3	0.000490	0.002414	0.004842	0.007746	129	71
096654Y	Winkerman Rd S	2	55	25	6,174	7.3	0.000587	0.002891	0.005798	0.009276	108	57
096652K	Monte Brady Rd	2	1,356	25	6,174	7.3	0.001591	0.007837	0.015718	0.025147	40	17
096650W	Foss Av-Monte Elma	2	6,184	25	6,174	7.3	0.001056	0.005199	0.010427	0.016681	60	24
096649C	Hewitt St	2	443	25	6,174	7.3	0.001148	0.005655	0.011341	0.018144	55	26
096648V	Moore Rd	2	650	25	6,174	7.3	0.001288	0.006344	0.012723	0.020356	49	23
096646G	Oniel Rd	2	733	25	6,174	7.3	0.001335	0.006573	0.013182	0.021089	47	22
096644T	Newman Creek Rd	2	1,107	25	6,174	7.3	0.000683	0.003364	0.006747	0.010794	93	40
096643L	Hurd Rd	2	1,771	25	6,174	7.3	0.001713	0.008434	0.016916	0.027063	37	16
096642E	Calder Rd	2	775	25	6,174	7.3	0.000622	0.003063	0.006143	0.009828	102	44
096641X	N 17th St	2	152	25	6,174	7.3	0.000821	0.004042	0.008107	0.012970	77	39
096640R	N 13th St	2	830	25	6,174	7.3	0.001384	0.006815	0.013669	0.021868	46	21

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)	Decrease between Predicted Intervals from No-Action Alternative
096639W	N 11th St	2	2,462	24	6,174	7.3	0.001790	0.009133	0.018467	0.029391	34	14
096638P	N 10th St	2	360	22	6,174	7.3	0.000938	0.005154	0.010611	0.016703	60	29
096636B	N 6th St	2	180	22	6,174	7.3	0.000753	0.004142	0.008527	0.013423	74	37
096635U	N 5th St	2	97	22	6,174	7.3	0.000616	0.003098	0.007261	0.010975	91	47
096634M	N 3rd St	2	802	21	6,174	7.3	0.001135	0.006494	0.013502	0.021131	47	22
096525J	N 2d St	2	609	24	6,174	7.3	0.001209	0.005640	0.012994	0.019843	50	23
096519F	Tridwell Rd	2	152	24	6,237	7.2	0.000785	0.004004	0.008095	0.012883	78	39
096518Y	Blockhouse Rd W	2	291	25	6,237	7.2	0.001009	0.004968	0.009964	0.015941	63	31
096515D	Blockhouse Rd E	2	55	25	6,237	7.2	0.000587	0.002891	0.005798	0.009276	108	57
096510U	Dunlap Rd	2	249	25	6,237	7.2	0.000961	0.004731	0.009489	0.015181	66	32
092603A	Porter Creek Rd	2	1,039	25	6,237	7.2	0.000672	0.003309	0.006636	0.010616	94	40
092595K	Elma Gare Rd W	2	111	25	6,237	7.2	0.000741	0.003650	0.007320	0.011710	85	44
092593W	Shelton Rd	2	69	25	6,237	7.2	0.000365	0.001797	0.003604	0.005766	173	95
092587T	Scheaffer St	2	55	25	6,237	7.2	0.000337	0.001660	0.003329	0.005326	188	103
092586L	Newton St	2	221	25	6,237	7.2	0.000545	0.002453	0.005609	0.008606	116	61
092585E	Murray St	2	221	25	6,237	7.2	0.000545	0.002682	0.005380	0.008606	116	61
092584X	Merry Rd	2	55	25	6,237	7.2	0.000337	0.001660	0.003329	0.005326	188	103
092583R	Blockhouse Rd	2	55	25	6,237	7.2	0.000337	0.001660	0.003329	0.005326	188	103
092577M	Moon Rd SW	2	332	25	6,237	7.2	0.000625	0.002560	0.006685	0.009869	101	53
092576F	Owings St	2	415	25	6,237	7.2	0.001126	0.005070	0.011591	0.017786	56	27
092574S	Little Rock Rd	2	1,299	25	6,237	7.2	0.000813	0.003662	0.008372	0.012847	78	32
092573K	183rd Ave SW	2	1,015	25	6,237	7.2	0.000668	0.003288	0.006595	0.010552	95	41
092569V	Joselyn Ave	2	277	25	6,237	7.2	0.000993	0.004892	0.009811	0.015697	64	31
092567G	Tea St	2	664	25	6,237	7.2	0.001296	0.006384	0.012804	0.020484	49	23
092566A	Grand Mound SW	2	443	25	6,237	7.2	0.001148	0.005655	0.011341	0.018144	55	26

Crossing ID	Street	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)	Decrease between Predicted Intervals from No-Action Alternative
092565T	Old Hwy 99 SW	2	13,169	24	6,237	7.2	0.001102	0.005624	0.011371	0.018098	55	16
092563E	216th Ave SW	2	111	13	6,237	7.2	0.000367	0.003128	0.007291	0.010786	93	48
092561R	222nd Ave SW	2	221	10	6,237	7.2	0.000349	0.003682	0.009201	0.013232	76	38
922981P	Hoss Rd	2	1,480	10	6,237	7.2				0.026155	38	12
922982W	Robert Thompson Rd	2	733	10	6,237	7.2				0.021014	48	15
922980H	Kuper Rd	2	609	10	6,237	7.2	0.000171	0.001802	0.004503	0.006475	154	58
092559P	Fordon Rd	2	235	10	6,237	7.2	0.000084	0.001030	0.003419	0.004533	221	85
092554F	W Reynolds Ave	2	8,286	10	6,237	7.2	0.000688	0.007637	0.028671	0.036996	27	10
092552S	J St	2	443	8	6,237	7.2	0.000243	0.003206	0.012825	0.016274	61	30
092551K	H St	2	1,148	7	6,237	7.2	0.000282	0.004123	0.017146	0.021551	46	21
092550D	G St	2	443	7	6,237	7.2	0.000212	0.003407	0.012550	0.016169	62	30
092549J	F St	2	304	7	6,237	7.2	0.000188	0.002748	0.011427	0.014363	70	35
092548C	E St	2	443	7	6,237	7.2	0.000212	0.003407	0.012550	0.016169	62	30
092547V	D St	2	17,831	7	6,237	7.2	0.000315	0.004603	0.019142	0.024061	42	15
092546N	Tower St	2	10,403	7	6,237	7.2	0.000248	0.003983	0.014672	0.018902	53	25
092543T	B St	2	899	7	6,237	7.2	0.000263	0.003837	0.015955	0.020054	50	23
092521T	Maple St M1	2	4,662	40	6,237	47.4	0.002772	0.008102	0.023279	0.034153	29	1
092520L	E Main St M1	2	3,541	40	6,237	47.4	0.002629	0.007683	0.022074	0.032386	31	2
092519S	E Locust St M1	2	3,707	40	6,237	47.4	0.002653	0.007752	0.022273	0.032677	31	2

Notes:
Hoss Road (922981P) and Robert Thompson Road (922982W) were calculated using the predicted accident frequency formula. The rest were calculated using the GradeDec.Net model.
D Street (092547V) and Tower Street (092546N) are proposed to receive a crossing protection upgrade to gates by 2017. Devonshire Road (096678M), Newman Creek Road (096644T), Calder Road (096642E) are proposed to receive a crossing protection upgrade to gates and signs by 2037 and the Glenn Road crossing (096657U) is proposed to close by 2037 (Washington State Department of Transportation 2014).

Table 43. Predicted Accident Frequency and Interval, Cumulative Impacts (2037)–Switching Movements

Crossing ID	Street	Milepost	Number of Roadway Lanes	AADT	Train Speed (mph)	Train Length (feet)	Trains per Day	Fatality Rate	Injury Rate	PDO Rate	Total Rate	Predicted Intervals Between Accidents (years)	Decrease between Predicted Intervals from No-Action Alternative
922990N	Industrial Rd	71.04	2	7,456	7	5,406	6.1				0.040953	24.4	6.6
808711F	Myrtle St	70.85	2	97	4	718	1.4	0.000013	0.000308	0.001173	0.001494	669.3	0.0
808712M	N Maple St	70.55	2	1,038	6	5,406	6.1	0.000095	0.002474	0.009393	0.011961	83.6	21.6
808713U	W 1St St	70.41	2	5,520	7	4,309	7.3	0.000127	0.002979	0.010772	0.013878	72.1	23.3
096711K	Port Industrial Rd	70.06	2	23,129	10	4,907	8.1	0.000283	0.005117	0.016572	0.021972	45.5	9.7
096710D	Division St	69.82	2	28	10	4,907	8.1				0.024492	40.8	16.1
096709J	Heron St	69.81	2	221	10	4,907	8.1				0.048928	20.4	8.1
808707R	Monroe St	69.63	2	28	10	4,777	9.2				0.025951	38.5	10.6
096706N	Washington St	69.49	2	872	10	4,777	9.2				0.081873	12.2	3.4
092551K	H Street	68.8	2	1,148	13	6,167	7.4	0.000229	0.003054	0.010333	0.013616	73.4	17.0
096695D	E Heron St	68.5	2	263	15	6,167	7.4	0.000077	0.001010	0.002904	0.003992	250.5	97.4
096693P	Newell St	68.44	2	470	15	6,167	7.4	0.000160	0.001735	0.006372	0.008267	121.0	43.6
096691B	S Chehalis St	68.36	4	9,642	15	6,167	7.4	0.000320	0.004176	0.012005	0.016501	60.6	18.5
096689A	W Mall Entrance	68.34	2	221	15	6,167	7.4				0.048281	20.7	7.5
096690U	E Mall Entrance	68.31	2	221	15	6,167	7.4				0.048281	20.7	7.5
096029N	Tyler St	68.23	4	7,069	16	6,167	7.4	0.000403	0.005006	0.014128	0.019537	51.2	14.6
096688T	Fleet St	68.16	2	3,611	16	6,167	7.4	0.000409	0.005073	0.014317	0.019799	50.5	15.3

Notes:
Industrial Road (922990N), Division Street (110912), Heron Street (096709J), Monroe Street (860101), Washington Street (110912), W Mall Entrance (096689A), and E Mall Entrance (096690U) were calculated using the predicted accident frequency formula. The rest were calculated using the GradeDec.Net model.

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