Appendix A

Data Dictionary and Definitions

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Appendix A:
Data Dictionary and Definitions

The Database Dictionary and Definitions Appendix provides information on the database created for the JTC Road-Rail Conflicts Study, including the process used to develop it, the data that was assembled, and the scoring scheme that was used.

The central database created as part of the Road-Rail Conflicts Study contains all 2,180 at-grade rail crossings in Washington State that are on active rail lines and publicly accessible. The purpose of the database is to create a central repository of mobility, safety, and community impacts information for all at-grade crossings in the state. The database is a tool that can be used by local, regional, and state agencies and decision-makers to evaluate road-rail conflicts and prioritize at-grade rail crossing solutions.

1.0 DATABASE DESCRIPTION

In the context of the Road-Rail Conflicts Study, a database is a structured set of data maintained in Microsoft Excel and ESRI GIS formats. The database is organized by columns that contain attributes and rows that contain each at-grade crossing location. See Figure 1 for a visual representation of the database structure.

Figure 1 Example Database Structure

The attributes associated with each crossing location can be categorized as either general data or criteria. General data includes information that will not be used to score and prioritize crossing locations, such as latitude, longitude, city, USDOT crossing number, and county to name a few. Criteria data will be used to evaluate crossings, such as train volumes, traffic volumes, and environmental impacts. See Section 3.0 below for a detailed list of each of the different attributes and criteria. The database includes 2,180 rows representing each at-grade crossing, 87 columns representing attributes, and 103 columns containing criteria for each crossing.

2.0 DATABASE DEVELOPMENT

The database was created by assembling readily available data from a variety of sources, including the Washington State Department of Transportation (WSDOT), the Washington Utilities and Transportation Commission (UTC), the Federal Railroad Administration (FRA), and the Washington Department of Ecology (DOE).

UTC maintains an official inventory of public railroad crossings in Washington State. UTC updates this inventory on a monthly basis and makes it available to the public for download on their website (http://www.utc.wa.gov/regulatedIndustries/transportation/rail/Pages/CrossingInventory.aspx). Washington UTC also provides additional information beyond what is included in the inventory that is downloadable from their website. This information was requested from UTC through a public records disclosure request and was received in April of 2016. The public records request included information such as crossing status, traffic volumes, crossing level of protection, road and rail speeds, among other things (see Section 3.0 for a detailed summary of the data).

The UTC inventory was used as the basis for creating the Road-Rail Conflicts database because it contains a large set of data that is regularly updated and maintained by the UTC. The UTC inventory contained a total of 4,171 discreet crossings locations, including a number of crossings that were beyond the scope of this project. Analysts performed the following filters to remove crossings that would not be included in the database:

- Filter 1: identified all crossings that were on active rail lines and publicly accessible (2,831 crossings)
    - This removed crossings with the following crossing status:
        - Abandonment
        - Closed
        - Closed in UTC-Not Main Line
        - Inactive
        - Private Not Routinely Inspected
        - Proposed
        - Proposed Abandonment
    - This removed crossings with the following category description:
        - Private Pedestrian
        - Private
- Filter 2: identified all crossings that were at-grade (2,180 crossings[1])
    - This removed crossings with the following crossing type description:
        - Overcrossing
        - Undercrossing

The Federal Railroad Administration (FRA) also maintains an inventory of rail crossings by State that can be downloaded from their website (http://safetydata.fra.dot.gov/OfficeofSafety/publicsite/downloaddbf.aspx). The FRA inventory was retrieved in April 2016 and some data was used to assemble the Road-Rail Conflicts database. This inventory was not used as the basis for the Road-Rail Conflicts database because it is not updated and

1 The database includes 2,080 at-grade crossings because the crossings at Spokane Street in Seattle (USDOT Crossings 099009M and 099007Y) were combined into one crossing to address the fact that they operate as one crossing rather than two.

maintained as routinely as the UTC inventory. Of the 2,180 crossing from the UTC inventory that met the crossing status, category, and grade requirements described above, a total of 2,140 (~98%) had matching records in the FRA inventory.

Data from the abovementioned sources were retrieved in Microsoft Excel format. To prepare the data for ESRI GIS, analysts performed the following steps:

- Convert Data: Before crossings could be spatially located into ESRI GIS software, the dataset was converted from a Microsoft Excel file into an ESRI compliant file geodatabase table.
    - Locate Data: Using the latitude and longitude values that were included in the database, the crossings were spatially located and the ensuing points were added as a feature class to the geodatabase described above.
    - Filter Data: Using the crossing status, category, and crossing type variables listed above, the initial 4,171 crossings included in the UTC database were reduced to 2,180 publicly accessible, at-grade crossings for either cars or pedestrians and cyclists.
    - Populate Data and Criteria: After locating and filtering the crossings to include only publicly accessible at-grade crossings, individual criteria and data were added.

Once the data was incorporated into ESRI GIS, analysts verified the data to ensure accuracy and identify any data challenges using the following steps:

- Review Spatial Accuracy: 10% or 218 records from the 2,180 eligible crossings were randomly selected and visually reviewed in GIS to confirm the point location matched the street description provided.
- Review Data Accuracy: Prior to adding specific attributes, the existing information for crossings (FRA and WSDOT) was reviewed for consistency and accuracy through a series of summaries. Whenever possible crossing data values were reviewed against a secondary data source to ensure accuracy. Visual reviews and a histogram of each project criteria were also completed using GIS. Visual reviews included displaying individual data sets on maps to confirm the data was consistent with the primary data source and consistent across rail lines. Histograms were used as a secondary quality control measure to review consistency and completeness and identify outliers.
- Group Review: Points representing each of the 2,180 crossings as well as thematic map layers representing each criteria were loaded to a web map and made available to the project team for review.

3.0 DATA SOURCES

The Road-Rail Conflicts Database was developed by assembling readily available data from a variety of sources. This section lists and sources the data that is included in the database, as shown in Table 1. Limitations or issues with the data are also summarized.

Table 1 Data Description, Sources and Limitations

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Railroad Classification	L1 Mobility Value: Railroad Class	Railroad classification designation from the FRA; Class I or Class III in Washington State.	Step I Criteria	FRA (HERE)	• Selected Level I routes by company name. • All crossings not identified as Level I attributed as Level III	None
Railroad Classification Score	L1 Mobility Score: Railroad Class	Score assigned to the Railroad Classification in Step 1 (1 or 2)	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Existing Vehicle Volumes (AADT)	L1 Mobility Value: Vehicles (existing) (Step I), mExVehVols (Step II)	Existing average annual daily vehicles volumes at crossing.	Step I, Step II Criteria	UTC	• If year of AADT was provided, vehicle volume grown by 1% per year to 2015. • If no year of AADT was provided, assumed 2015.	• Data could be outdated. • Inconsistencies in year of count.
Existing Vehicle Volumes Score	L1 Mobility Score: Vehicle (existing)	Score assigned to Existing Vehicle Volumes in Step 1 (1 or 2)	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Future Vehicle Volumes (AADT)	L1 Mobility Value: Vehicles (future) (Step I), mFutVehVols (Step II)	Projected average annual daily vehicle volumes at crossing.	Step I, Step II Criteria	WSDOT Historical Volume Counts by road segment (HERE)	• Existing AADT volume grown using nearest annual growth rate (historical growth rate between 2005 to 2015) to 2035	• Growth rates used are a historical average and could change in future years.

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Future Vehicle Volumes Score	L1 Mobility Score: Vehicle (Future)	Score assigned to Future Vehicle Volumes in Step 1 (1 or 2)	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Existing Freight Train Volumes (daily average)	L1 Mobility Value: Freight (Existing)	Existing average daily freight train counts at crossing	Step I Criteria	WSDOT State Rail Plan	• Existing Freight Train Volumes as reported in the State Rail Plan were applied wherever available. • Where Existing Freight Train Volumes were not available in the State Rail Plan, an assumption of 2 freight trains per day was applied.	• Data sourcing inconsistent (WSDOT and assumptions used). • Data is a daily average and does not reflect daily fluctuations in volumes.
Existing Freight Train Volumes Score	L1 Mobility Score: Freight (Existing)	Score assigned to Existing Freight Train Counts in Step 1 (1 or 2)	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Future Freight Train Volumes (daily average)	L1 Mobility Value: Freight (Future)	Projected Average daily freight train counts at crossing.	Step I Criteria	WSDOT State Rail Plan	• Future Freight Train Volumes as reported in the State Rail Plan were applied wherever available. • Assumed same Freight Train Volume as existing wherever data was not available.	• Data sourcing inconsistent (WSDOT and assumptions). • Data is a daily average and does not reflect daily fluctuations in volumes.

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Future Freight Train Volumes Score	L1 Mobility Score: Freight (Future)	Score assigned to Future Freight Train Counts in Step 1 (1 or 2)	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Existing Unit Train Presence and Count	L1 Mobility Value: Unit (existing)	Existing average daily unit train count at crossing.	Step I Criteria	WSDOT, DOE	• Crossings along BNSF lines known to carry oil trains based on Bakken Train GIS data provided by DOE. • Cereal grains and agricultural product trains and coal trains as reported by WSDOT were applied.	• Unit train volumes are highly dependent on economic trends and can fluctuate.
Existing Unit Train Presence and Count Score	L1 Mobility Score: Unit Trains	Score assigned to presence of Unit Trains in Step 1 (1 or 2)	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Existing Passenger Train Volumes	L1 Mobility Value: Passenger (existing)	Existing average daily passenger train count at crossing.	Step I Criteria	WSDOT	• Existing Passenger Train Volumes as reported in the State Rail Plan were applied wherever available. • Volumes were confirmed against Amtrak and Sounder Schedules.	None

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Existing Passenger Train Volumes Score	L1 Mobility Score: Passenger (future)	Score assigned to existing passenger train counts in Step 1 (1 or 2)	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Future Passenger Train Volumes	L1 Mobility Value: Passenger (future)	Projected average daily passenger train count at crossing.	Step I Criteria	WSDOT	• Future Passenger Train Volumes as reported in the State Rail Plan were applied wherever available.	None
Future Passenger Train Volumes Score	L1 Mobility Score: Passenger (future)	Score assigned to future passenger train counts in Step 1 (1 or 2)	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Presence of Alternate Grade Separated Crossing	L1 Safety Value: Alternate Crossings	Presence of an alternate grade separated crossing (over- or undercrossing) within a half-mile of the at-grade crossing.	Step I, Step II Criteria	Parametrix	• Alternate crossings were identified by completing a half-mile proximity analysis using ESRI GIS software. • The locations of over- and undercrossings were provided by UTC.	• Could indicate the presence of a grade separated crossing that would not actually allow travel around a blocked crossing (i.e. road network does not provide access).
Presence of Alternate Grade Separated Crossing Score	L1 Safety Score: Alternate Crossings (Step I); sAltGradeSep (Step II)	Score assigned for presence of alternate grade separated crossings	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Number of Mainline Tracks	L1 Safety Value: Mainline Tracks	Number of mainline tracks at crossing.	Step I, Step II Criteria	UTC	• No processing required	None
Number of Mainline Tracks Score	L1 Safety Score: Mainline Tracks (Step I); sNumTracks (Step II)	Score assigned for number of mainline tracks at crossing	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Roadway Functional Classification	L1 Community Value: Functional Class	Federal Roadway Functional Classification that denotes the character of service a street should provide.	Step I Criteria	WSDOT (Here)	• A table was developed to link the functional class described in the UTC data (*Roadway Type Code* attribute) with the WSDOT functional class standards.	None
Roadway Functional Classification Score	L1 Community Score: Functional Class	Score assigned for roadway classification at crossing (1 or 2)	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Previously Identified Project	L1 Community Value: Previously Identified (Step I); Project, ProjectIdentifiedbyRTPO (Step II)	Identified by regional and local agencies as a crossing included in an existing or planned project.	Step I Criteria	MPO, RTPO Plans	• Crossings identified by MPO and RTPO Plans were selected based on location and crossing ID.	None
Previously Identified Project Score	L1 Community Score: Previously Identified	Score assigned for previously identified projects	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Freight Gate-Down Time (minutes)	ExistingFreightGateDownTime(mins) (in spreadsheet)	The estimated total average daily delay at a crossing associated with freight trains.	Step II Criteria (used to calculate Total Gate-Down Time)	Parametrix	• Freight train gate-down time = freight train volume*((freight train length + crossing width/(train speed in ft/s)+lead/lag time)/60) • {freight train volume *(((6660/(freight train speed*5280/3600))+30)/60}	• Assumptions are used to calculate; actual gate-down times could be different depending on the location.
Passenger Gate-Down Time (minutes)	ExistingPassengerGateDownTime(mins) (in spreadsheet)	The estimated total average daily delay at a crossing associated with passenger trains.	Step II Criteria (used to calculate Total Gate-Down Time)	Parametrix	• Passenger train gate-down time =passenger train volume*((passenger train length + crossing width/(train speed in ft/s)+lead/lag time)/60) • {passenger train volume*(((660/(passenger train speed*5280/3600))+30)/60}	• Assumptions are used to calculate; actual gate-down times could be different depending on the location.
Unit Train Gate-Down Time (minutes)	ExistingUnitGateDownTime (in spreadsheet)	The estimated total average daily delay at a crossing associated with unit trains.	Step II Criteria (used to calculate Total Gate-Down Time)	Parametrix	• Unit train gate-down time (assumes 30 mph operating speed) = unit train volume*3.5	• Assumptions are used to calculate; actual gate-down times could be different depending on the location.

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Combined Gate-Down Time	ExistingTotalGateDownTime(mins) (in spreadsheet)	The estimated total average daily delay at a crossing associated with freight, passenger, and unit trains.	Step II Criteria	Parametrix	• Combined time of Freight, Passenger, and Unit Train Gate Down time	• Assumptions are used to calculate; actual gate-down times could be different depending on the location.
Combined Gate-Down Time Score	mGateDownTime (Step II)	Score assigned to total gate-down time at crossing in Step II	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Proximity to Emergency Services	ProximityToEmergencyServices_Miles (in spreadsheet)	Miles to nearest emergency service provider (hospital, police, fire)	Step II Criteria	DOH, Wikipedia (HERE), Google Maps	• DOH Hospital and Fire station databases joined with all police locations gathered from Wikipedia and Google Maps. Nearest Emergency point distance joined to crossings	• Only points with emergency location within 100 miles was evaluated.
Proximity to Emergency Services Score	sProxEmergSrv1	Score assigned to proximity to emergency service providers in Step II	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Collision History	Collisions 5 Years, PDO, Injuries, Fatalities, Total Accidents (in spreadsheet)	A five-year history of incidents involving trains at crossings.	Step II Criteria	UTC	• Data Joined based on USDOT Number	• Only captures collisions with trains (i.e. collisions between vehicles near the crossing due to congestion/delay are not captured).

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Collision History Score	sIncidTotal1 (Total Collisions); sIncidFatal1 (fatal collisions); sIncidServer (injury accidents)	Score assigned to total, fatal, and injury collisions in Step II	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Level of Crossing Protection	S2LevelProtection, S2_Lights, S2_Gates, S2_SignsOnly, S2_MedianBarrier, S2_PoorGeometry, S2)CrossingAngleLess60, S2_RoadGradeMore6	Passive and active protection improvements at crossings.	Step II Criteria	UTC; Google Maps; Transpo	• Level of Protection was verified using Google Maps street view	None
Level of Crossing Protection Score	sProtection1	Score assigned to level of protection in Step II	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Roadway Freight Classification	FGTSClass (in spreadsheet)	Freight and Goods Transportation System classification for roadways.	Step II Criteria	WSDOT	• No processing required	None
Roadway Freight Classification Score	mRdFreightClass1	Score assigned to freight classification at crossing in Step II	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Employment Density	Employment Density (in spreadsheet)	Number of jobs per acre.	Step II Criteria	EPA Smart Location Database (HERE)	• Intersect UTC Crossings with 2010 SLD Blockgroups	• Density per blockgroup
Employment Density Score	cEmpDen	Score assigned to employment density in Step II	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Population Density	Population Density	Number of people per acre.	Step II Criteria	EPA Smart Location Database (HERE)	• Intersect UTC Crossings with 2010 SLD Blockgroups	• Density per blockgroup
Population Density Score	cPopDen	Score assigned to population density in Step II	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
First/Last Mile Roadway Crossing	FirstLastMile (in spreadsheet)	Roadway designated as a first/last mile connection between major freight and goods origins and destinations.	Step II Criteria	WSDOT Freight Economic Corridors Database (HERE)	• First/Last mile line segment information joined spatially to rail lines.	• Only Step II Selection set evaluated closely – Analysis required looking at intersections on case by case basis due to lines and points not being snapped in GIS • 0= no, 1=yes
First/Last Mile Roadway Crossing Score	cFLMFreight	Score assigned to first/last mile roadway crossing in Step II	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Proximity to Minority Populations (percent)	NONWHITE_PER (in spreadsheet)	Minority population density by census tract within proximity to crossing.	Step II Criteria	US Census Bureau	• Intersect UTC Crossings with 2010 Census Tracts (Percent Non-White Reported)	• Percent by census tract
Proximity to Minority Populations Score	cPercMinority	Score assigned to percent minority near crossing in Step II	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Proximity to Low-Income Populations	Percent Low Income Population (in spreadsheet)	Low-income population density by blockgroup within proximity to crossing.	Step II Criteria	US Census Bureau	• Intersect UTC Crossing with 2007-2010 American Community Survey Summary File – Blockgoups. Percent Low Income Reported	• Percent by blockgroup
Proximity to Low-Income Populations Score	cPercLowInc	Score assigned to percent low income near crossing in Step II	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Network Sensitivity	Major Intersections Within 200 Ft (in spreadsheet)	Number of major (arterials and above) roadway intersections within 200 feet of crossing.	Step II Criteria	Parametrix	• Create Major Intersection points where Major Streets intersected (Major Collectors, Arterials, and above). Join count of intersections within 200 foot buffer of crossings	• Only Step II Selection set evaluated closely – Accurate count required looking at intersections on case by case basis due to inaccuracy of centerlines and crossing locations at 200 foot scale.

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Network Sensitivity Score	mNetSense	Score assigned to crossing network sensitivity in Step II	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
At-Grade Crossing Density	At Grade Crossings Within 1 Mile (in spreadsheet)	Number of at-grade crossings on the same rail line within a half mile in each direction of crossing.	Step II Criteria	Parametrix	• Count of all At-grade crossings joined to Step II crossings within 1 mile buffer of crossings on same rail line.	• Only Step II Selection set evaluated closely – Accurate count required looking at intersections on case by case basis
At-Grade Crossing Density Score	mCrossDen	Score assigned to crossing density in Step II	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Quiet Zone	Quiet_Zone (in spreadsheet)	Crossing is located within a quiet zone.	Step II Criteria	UTC	• No processing required	• 0=no, 1=yes
Quiet Zone Score	cNoise1	Score assigned to quiet zone presence at crossing in Step II	N/A (score)	See Chapter 2 in the report for scoring methodology		• Score will change as data changes
Daily Emissions	cAnnEmission1	Score assigned to estimated emissions at crossing associated with delay and vehicle volumes.	Step II Criteria	Transpo	• Emissions were estimated using assumptions of emissions and vehicle volumes at crossings.	• This is an estimate and may not reflect exact emissions at a crossing due to traffic volumes and queuing.
USDOT Number	Same	Crossing assigned by USDOT	Attribute	UTC	• No processing required	None

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Crossing Status	Same	Status of crossing (closed, active, private, proposed abandonment, etc)	Attribute	UTC	• No processing required	None
Last Inspection Date	Same	Date when crossing was last inspected by UTC staff	Attribute	UTC	• No processing required	None
UTC Number	Same	Identification number assigned by UTC	Attribute	UTC	• No processing required	None
Crossing Type	Same	Description of whether crossing is at-grade, overcrossing, or undercrossing	Attribute	UTC	• No processing required	None
Category	Same	Denotes whether public, private, or pedestrian crossing	Attribute	UTC	• No processing required	None
City Name	Same	City crossing is located in	Attribute	UTC	• No processing required	None
County Name	Same	County crossing is located in	Attribute	UTC	• No processing required	None
Latitude	Same	Latitude of crossing	Attribute	UTC	• No processing required	None
Longitude	Same	Longitude of crossing	Attribute	UTC	• No processing required	None
Section Township Range	Same	Locational description assigned by UTC	Attribute	UTC	• No processing required	None

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Roadway	Same	Roadway crossing intersects with	Attribute	UTC	• No processing required	None
In City Limits	Same	Whether crossing is located within city limits	Attribute	UTC	• No processing required	• True=within city limits; false=not within city limits
Highway Milepost	Same	If located on a highway, mile post location of where crossing is located	Attribute	UTC	• No processing required	• 0=not located on highway
State District Code	Same	Locational description assigned by UTC	Attribute	UTC	• No processing required	None
Roadway Type Code	Same	Roadway designation assigned by UTC	Attribute	UTC	• No processing required	None
State System Code	Same	Identifier designation assigned by UTC	Attribute	UTC	• No processing required	None
Highway	Same	If applicable, description of highway crossing is located on	Attribute	UTC	• No processing required	None
Road Surface	Same	Type of road surface of roadway crossing intersects	Attribute	UTC	• No processing required	• Pav=paved • Unp=unpaved • UPA=unpaved with asphalt apron
Road Grade	Same	Grade of roadway crossing intersects	Attribute	UTC	• No processing required	None

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Road Grade Opposite	Same	Roadway grade of opposite approach	Attribute	UTC	• No processing required	None
Number of Lanes	Same	Number of lanes of roadway crossing intersects	Attribute	UTC	• No processing required	None
Percent of Trucks Using Crossing	Same	Percentage of trucks traveling over crossing	Attribute	UTC	• No processing required	None
Road Type	Same	Whether roadway that crossing intersects is one-way or two-way	Attribute	UTC	• No processing required	• 1W=one-way • 2W=two-way
AADT Year of Count	Same	Year that AADT count was taken	Attribute	UTC	• No processing required	None
Vehicle Speed	Same	Vehicle speed of roadway crossing intersects	Attribute	UTC	• No processing required	None
Road Width	Same	Width in feet of roadway crossing intersects	Attribute	UTC	• No processing required	None
Average Daily Bus Count	Same	Counts of buses traveling over crossing	Attribute	UTC	• No processing required	None
School Bus Count Year	Same	Year that bus count was recorded	Attribute	UTC	• No processing required	None

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Road Designation	Same	Designates whether roadway that crossing intersects is a street or state highway	Attribute	UTC	• No processing required	None
Railroad Company	Same	Rail Company that owns the crossing	Attribute	UTC	• No processing required	None
Line	Same	Rail line designation	Attribute	UTC	• No processing required	None
Branch	Same	Rail line branch designation	Attribute	UTC	• No processing required	None
Railroad Milepost	Same	Rail line milepost where crossing is located	Attribute	UTC	• No processing required	None
Is Spur Track	Same	Rail line that crossing is located on is spur line	Attribute	UTC	• No processing required	• 0=no • 1=yes
Spur Location	Same	Locational designation of spur line	Attribute	UTC	• No processing required	None
Spur Identifier	Same	Identification designation of spur line	Attribute	UTC	• No processing required	None
Freight Train Speed	Same	Allowable freight train speed over crossing	Attribute	UTC	• No processing required	• Used to calculate freight train gate-down time

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Passenger Train Speed	Same	Allowable passenger train speed over crossing	Attribute	UTC, FRA	• No processing required	• Used to calculate passenger train gate-down time. • Some Step 2 crossings had no data from UTC database; FRA inventory sheets were queried and used.
Bike Lane	Same	Presence of bike lanes at crossing	Attribute	UTC	• No processing required	• False=none • True=present
Commercial Power	Same	Presence of commercial power at crossing	Attribute	UTC	• No processing required	• False=none • True=present
High Speed Corridor	Same	Crossing is located on a high speed rail corridor	Attribute	UTC	• No processing required	• False=no • True=yes
USDOT Number is Posted	Same	Sign posted with USDOT number at crossing	Attribute	UTC	• No processing required	• False=no • True=yes
Number of Siding Tracks	Same	Number of siding tracks at crossing	Attribute	UTC	• No processing required	None

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Crossing Surface	Same	Type of crossing surface	Attribute	UTC	• No processing required	• AS=asphalt • CC=concrete • TM=timber • TAA=timber with asphalt apron • CAA=concrete with asphalt apron • Un=unconsolidated (gravel) • RB=rubber • GR=gravel with asphalt apron • Other designations also included that are uncommon/no longer used
Crossing Angle	Same	Angle of intersection between road and crossing	Attribute	UTC	• No processing required	None
Truck Pullout Lanes	Same	Presence of truck pullout lanes at crossing	Attribute	UTC	• No processing required	• False=no • True=yes
Sidewalk	Same	Presence of sidewalks at crossing	Attribute	UTC	• No processing required	None
Emergency Number Posted	Same	Sign with emergency number posted at crossing	Attribute	UTC	• No processing required	None
Other Surface Siding Spur	Same	Spur/siding has other surface	Attribute	UTC	• No processing required	• All values are null

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Wayside Horn	Same	Use of Wayside Horn at crossing	Attribute	UTC	• No processing required	None
Number of Spur Tracks	Same	Number of spur tracks at crossing	Attribute	UTC	• No processing required	None
RTU	Same	Remote terminal unit present	Attribute	UTC	• No processing required	• False=no • True=yes
Power Off Indicator	Same	Presence of power off indicator at crossing	Attribute	UTC	• No processing required	• False=no • True=yes
Active Advance Warning Signs	Same	Presence of active advance warning signs	Attribute	UTC	• No processing required	• False=no • True=yes
Number of Bells	Same	Number of bells at crossing	Attribute	UTC	• No processing required	None
Circuit Overlay	Same	Description of infrastructure at crossing	Attribute	UTC	• No processing required	None
Event Recorder	Same	Description of infrastructure at crossing	Attribute	UTC	• No processing required	None
Gate Delay Timer	Same	Description of infrastructure at crossing	Attribute	UTC	• No processing required	None
Train Detection Type	Same	Description of train detection type	Attribute	UTC	• No processing required	None

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Interconnect	Same	Description of infrastructure at crossing	Attribute	UTC	• No processing required	None
Switch Cutout	Same	Description of infrastructure at crossing	Attribute	UTC	• No processing required	None
Stick Release Timer	Same	Description of infrastructure at crossing	Attribute	UTC	• No processing required	None
Number of Flashing Light Pairs	Same	Number of flashing light pairs at crossing	Attribute	UTC	• No processing required	None
Cantilever Lights	Same	Presence of cantilever lights at crossing	Attribute	UTC	• No processing required	• False=no • True=yes
Four Quadrant Gates	Same	Presence of four quadrant gates at crossing	Attribute	UTC	• No processing required	• False=no • True=yes
Advance Warning Sign (North, South, East, West)	Same	Number of advance warning signs for each approach	Attribute	UTC	• No processing required	None
Road Markings (North, South, East, West)	Same	Roadway markings for each approach	Attribute	UTC	• No processing required	None
Reflectorized Crossbucks (North, South, East, West)	Same	Reflectorized crossbucks for each approach	Attribute	UTC	• No processing required	None

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Reflectorized Crossbuck Post (North, South, East, West)	Same	Crossbuck posts for each approach	Attribute	UTC	• No processing required	None
Median Barriers (North, South, East, West)	Same	Presence of median barriers for each approach	Attribute	UTC	• No processing required	None
Stop Lines (North, South, East, West)	Same	Presence of stop lines for each approach	Attribute	UTC	• No processing required	None
Stop Line Distance (North, South, East, West)	Same	Stop bar distance from crossing for each approach	Attribute	UTC	• No processing required	None
Siding Tracks	Same	Number of siding tracks at crossing	Attribute	UTC	• No processing required	None
Comments	Same	UTC inspection comments	Attribute	UTC	• No processing required	None
Down a Street	Same	Whether track runs down a street rather intersect it	Attribute	UTC	• No processing required	• False=no • True=yes
Number of Yard Tracks	Same	Number of yard tracks at crossing	Attribute	UTC	• No processing required	None

Data Name	Name in Online Tool/ Database	Description	Attribute or Criteria	Source	Processing	Limitations/Notes
Intersection Density	Same	Density of intersections near at-grade crossing	Attribute	EPA Smart Location Database (HERE)	• Intersect UTC Crossings with 2010 SLD Blockgroups	None
Passenger Train Type	Same	Type of passenger train service	Attribute	Various	• Conducted online search to locate commuter, passenger, and tourist trains.	None
RTPO	Same	Regional Transportation Planning Organization crossing is located in	Attribute	WDOT	• Intersect UTC Crossings with RTPO dataset	None
MPO	Same	Metropolitan Planning Organization crossing is located in	Attribute	WDOT	• Intersect UTC Crossings with MPO dataset	None
TMA	Same	Transportation Management Area crossing is located in	Attribute	WDOT	• Intersect UTC Crossings with TMA dataset	None
Legislative District	Same	Legislative District crossing is located in	Attribute	WDOT	• Intersect UTC Crossings with Legislative District dataset.	None

3.1 Methodologies for Created Data

Some data included in the database was created using other existing data and GIS mapping functions. This allowed analysts to address data gaps and evaluate certain criteria that were not readily available. Table 2 in Section 3.2 describes in additional detail why it was necessary to create each of the data described below.

Presence of Alternate Grade Separated Crossings

This criteria was developed for all 2,180 at-grade crossings before completing Step I of the prioritization process. Analysts were able to identify whether there were grade separated crossings within a half-mile of an at-grade crossing by using a network proximity function and the locations of over- and undercrossings (retrieved from the UTC database). This function populated the criteria for each at at-grade crossing with the number of grade-separated crossings were located within a half-mile on the road network.

Gate-Down Time

This criteria was estimated for the 302 at-grade crossing included in Step II using the train count by type (freight, passenger, unit), the allowable freight and passenger train speeds (UTC database), and some assumptions regarding train lengths. Gate-down time was calculated for each type of train and then summed to develop the total amount of estimated daily gate-down time. The following equations were used to calculate gate-down time:

- Freight trains: freight train volume*((freight train length + crossing width/(train speed in ft/s)+lead/lag time)/60)
  - freight train volume *(((6660/(freight train speed*5280/3600))+30)/60)
- Passenger trains: passenger train volume*((passenger train length + crossing width/(train speed in ft/s)+lead/lag time)/60)
  - passenger train volume*(((660/(passenger train speed*5280/3600))+30)/60)
- Unit trains: unit train volume*3.5

The following assumptions were used to calculate gate-down time:

- Average train lengths were assumed for freight and passenger trains to calculate gate-down time. Freight train lengths were determined by multiplying the average dimension of BNSF rail equipment (http://www.bnsf.com/customers/equipment) by the average number of cars for trains on Western Class I railroads (Cambridge Systematics, Inc., National Rail Freight Infrastructure Capacity and Investment Study, 2007). Passenger train lengths were calculated based on equipment dimensions (Amtrak, Amtrak Station Program and Planning Guide, 2013) and the average number of cars used on the Amtrak Cascades route as reported by WSDOT (http://www.wsdot.wa.gov/Rail/TrainEquipment.htm):
  - Freight trains: 1.25 miles long
  - Passenger train: 600 feet
- Unit trains were assumed to close a crossing for 3.5 minutes each. This was based on the assumption that unit trains are traveling at approximately 30 mph. Unit train lengths were consistent with train lengths reported in recent unit train studies for Washington State (Washington Department of Ecology, Washington State 2014 Marine and Rail Oil Transportation Study, 2014; Pacific International Terminals, Inc., Project Information Document, 2011).

- It was assumed that gates would close approximately 20 seconds before a train reached the crossing and would remain closed an additional 10 seconds after the train cleared the crossing for a total of 30 seconds of lead/lag time.
- It was assumed that crossings were approximately 60 feet wide. The width of the crossings was added to the train length in the gate-down time calculation.

At-Grade Crossing Density

This criteria was developed for the 302 crossings that were included in Step II of the prioritization process using a network proximity buffer of a half-mile. Analysts used this function to identify to the number of at-grade crossings were located within the half-mile distance on the same rail line of an at-grade crossing.

Proximity to Emergency Services

This criteria was completed only for the 302 crossings that were included in Step II of the prioritization process using a network proximity buffer of a half-mile. Similarly to other criteria, the Proximity to Emergency Services populated the criteria for each crossing with the distance to the nearest emergency service provider, including fire, hospital, and police.

Daily Emissions

This criteria was completed only for the 302 crossings that were included in Step II of the prioritization process based on daily traffic volumes and gate down time. The emissions are for VOC (volatile organic compounds), THC (total hydrocarbons), CO (carbon monoxide), and NOx (nitrogen oxides) for a vehicle fleet that is 95 percent cars (gasoline) and 5 percent trucks (diesel). The formula used was:

- Grams of emissions per day = (Delay/(60*16))*AADT*(84.7049/60)
- Where:
    - "Delay" is gate down time in minutes
    - "60*16" is a unit conversion factor based on a 16-hour travel day (most daily vehicle travel occurs in a 16-hour window).
    - "AADT" is the daily traffic volume
    - "84.7049/60" is grams per minute of emissions

Network Sensitivity

This criteria was completed only for the 302 crossings that were included in Step II of the prioritization process. This metric is supposed to highlight the sensitivity the local network to trains blocking the crossing. If the crossings in blocked, and that crossing is within 200 feet of a major traffic signal (or signal corridor), the local network could have major delays even for vehicles not using the crossing. The following datasets were gathered:

- Functional classification (WSDOT)
- Traffic Signal, or Signal System (Google Maps).

Based on the characteristics above, the crossing received a Network Sensitivity score. For example, a crossing within 200 feet of a traffic signal that was on a state highway got a higher score than a crossing with a nearby traffic signal on a local street.

3.2 Data Challenges

Relevant data was assembled from a variety of sources. This is the first tool in Washington State, and perhaps the nation, that assembles this breadth of data related to at-grade crossing impacts into one database. There are some inherent consistency challenges that arise when assembling data from multiple sources. Those challenges were addressed to the extent possible within the resources available to the study. As the prioritization tool is used in the future, data will need to be maintained and updated to remain relevant and useful. Data challenges that were identified during data assembly included the following:

- Quality: data is correct and accurate
- Consistency: data is available for all crossings and from the same source
- Availability: data exists and is available for inclusion

There were several steps that analysts took to address data challenges. Table 2 summarizes the specific challenges and the solutions that were developed for each of the criteria.

Table 2 Data Challenges and Solutions

Criteria	Type of Data Challenge	Challenge Description	Solution
Railroad Classification	None	N/A	N/A
Existing Vehicle Volumes (AADT)	Quality, Consistency	• Data could be outdated. • Inconsistencies in year of count.	• Data was included as is since it still provides a relative measure of traffic volumes for crossings across the state. • Some locations that did not have a year of traffic count were verified against traffic counts that were readily available online.
Future Vehicle Volumes (AADT)	Availability	• Future traffic volume projections do not exist. • Growth rates used to project volumes are a historical average and could change in future years.	• Analysts used readily available data to estimate future traffic volumes.
Existing Freight Train Volumes (daily average)	Quality, Consistency	• Data sourcing inconsistent (WSDOT and assumptions used). • Data is a daily average and does not reflect daily fluctuations in volumes.	• WSDOT data was used as is for Mainline crossings. • A reasonable assumption was used for branch lines. • A daily average is the best available estimate.

Criteria	Type of Data Challenge	Challenge Description	Solution
Future Freight Train Volumes (daily average)	Quality, Consistency	• Data sourcing inconsistent (WSDOT and assumptions used). • Data is a daily average and does not reflect daily fluctuations in volumes.	• WSDOT projections data was used as is for Mainline crossings. • A reasonable assumption was used for branch lines. • A daily average is the best available estimate.
Existing Unit Train Presence and Count	Quality, Consistency	• Unit train volumes are highly dependent on economic trends and can fluctuate.	• WSDOT data was used as is for crossings. • A daily average is the best available estimate.
Existing Passenger Train Volumes	None	N/A	N/A
Future Passenger Train Volumes	None	N/A	N/A
Presence of Alternate Grade Separated Crossing	Availability	• Included in UTC database but not accurate. • Data created could indicate the presence of a grade separated crossing that would not actually allow travel around a blocked crossing (i.e. road network does not provide access).	• Data was created using the locations of grade separated crossings using GIS functions.
Number of Mainline Tracks	None	N/A	N/A
Roadway Functional Classification	None	N/A	N/A
Previously Identified Project	Consistency	• Data was provided voluntarily by RTPOs/MPOs and may not be comprehensive	• Data was verified where possible against available plans. • Data included as is since it is currently the best possible measure.
Combined Gate-Down Time	Availability, Quality, Consistency	• Actual gate-down time data not available. • Assumptions are used to calculate; actual gate-down times could be different depending on the location.	• Data was estimated using best possible information and assumptions.
Proximity to Emergency Services	Availability	• Data did not exist	• Data was created using locations of emergency services and GIS function.

Criteria	Type of Data Challenge	Challenge Description	Solution
Collision History	Quality	• Data for collisions with trains readily available. • Only captures collisions with trains (i.e. collisions between vehicles near the crossing due to congestion/delay are not captured).	• Data was used as is since it is a good measure of incident history.
Level of Crossing Protection	Quality	• Data available from UTC but not accurate	• Data was verified and corrected using Google Maps Streetview
Roadway Freight Classification	None	N/A	N/A
Employment Density	Quality	• Data uses information from 2010 Census, which could be outdated.	• Data used as is since this is the best available estimate.
Population Density	Quality	• Data uses information from 2010 Census, which could be outdated.	• Data used as is since this is the best available estimate.
First/Last Mile Roadway Crossing	None	N/A	N/A
Proximity to Minority Populations	Quality	• Data uses information from the 2010 Census, which could be outdated.	• Data used as is since this is the best available estimate.
Proximity to Low-Income Populations	Quality	• Data uses information from the 2007-2010 American Community Survey, which could be outdated.	• Data used as is since this is the best available estimate.
Network Sensitivity	Availability	• Data not readily available.	• Data created using Roadway Functional Classification and GIS function.
At-Grade Crossing Density	Availability	• Data not readily available.	• Data created using locations of other at-grade crossings and GIS function.
Quiet Zone	None	N/A	N/A
Daily Emissions	Availability	• Data not readily available.	• Data created using traffic volume information, gate down time, and assumptions of vehicle emissions.

As the database tool is introduced to and used by agencies across the state, it is likely that higher quality data will be developed and incorporated into the database. Users of the tool will have an interest in providing better data and a process to allow data to be updated efficiently could be provided.

4.0 FUTURE UPDATES OF THE DATABASE

There were some data limitations that were identified during the study. Future enhancements of the database could improve or resolve these concerns:

- New data could be created to replace data that had consistency, availability, or quality concerns, such as existing vehicle volumes and gate-down time.
- Data that was not readily or publicly available could be assembled from their respective sources, such as near-miss data and regional growth projections.
- Data included in the database could be updated more regularly during future iterations of the tool.

Table 3 summarizes the enhancements that could be made to data that is currently included in the database. Future data enhancements would be needed to ensure that data is up-to-date and accurate, which could change how the crossings rank.

Table 3 Enhancements to Existing Evaluation Criteria

Data Name & Description	Source	Data Enhancement Opportunity
Railroad Classification		
Railroad classification designation from the FRA; Class I or Class III in Washington State	FRA	Data is accurate; changes in railroad classification would occur rarely
Existing Vehicle Volumes (AADT)		
Existing average annual daily vehicle volumes at crossing	UTC	Data could be collected on location at the crossing and incorporated into the database
Future Vehicle Volumes (AADT)		
Projected average annual daily vehicle volumes at crossing	WSDOT Historical Volume Counts	Project vehicle volume data could be incorporated from local travel demand models, or could be projected by local jurisdictions
Existing Freight Train Count (daily average)		
Existing average daily freight train counts at crossing	WSDOT State Rail Plan, Interviews with Chris Herman	Train count data could be collected on location at the crossing and/or provided by rail operators

Future Freight Train Count (daily average)		
Projected Average daily freight train counts at crossing	WSDOT State Rail Plan	Future freight train counts could be projected using more detailed models, such as the Marine Cargo Forecast
Existing Unit Train Presence and Count		
Existing average daily unit train count at crossing	WSDOT, DOE	Train count data could be collected on location at the crossing and/or provided by rail operators
Existing Passenger Train Count		
Existing average daily passenger train count at crossing	WSDOT, Sound Transit, Amtrak	Data is currently available and reliable from passenger rail schedules
Future Passenger Train Count		
Projected average daily passenger train count at crossing	WSDOT, Sound Transit, Amtrak	As changes in future passenger rail operations occur, those could be incorporated
Presence and Number of Alternate Grade Separated Crossing		
Presence of an alternate grade separated crossing (over- or undercrossing) within a half-mile of the at-grade crossing	Parametrix	Data could be verified on a crossing by crossing basis to ensure that only grade-separated crossings that allow travel around a blocked at-grade crossing are included
Number of Mainline Tracks		
Number of mainline tracks at crossing	UTC	Data is currently available and reliable, but could be verified on a crossing by crossing basis
Roadway Functional Classification		
Federal Roadway Functional Classification that denotes the character of service a street should provide	WSDOT	Data is accurate; changes in roadway functional classification would occur rarely
Previously Identified Project		
Identified by regional and local agencies as a crossing included in an existing or planned project	MPO, RTPO Plans	Data could be updated and assembled from agencies on a routine basis

Average Daily Gate-Down Time (minutes)		
The estimated total average daily delay at a crossing associated with freight, passenger, and unit trains	Parametrix, UTC	Data could be recorded in the field, or more detailed modeling could be completed, such as that completed in the Marine Cargo Forecast
Proximity to Emergency Services		
Number of emergency service providers (hospital, police, fire) within a half mile of a crossing	DOH, Google Maps, Parametrix	Data is accurate; changes would occur rarely
Incident History		
A five-year history of incidents involving trains at crossings	UTC	Data could continue to be included from UTC; additional collision data and analysis could be included to analyze collisions between vehicles near the crossing due to congestion/delay
Level of Crossing Protection		
Passive and active protection improvements at crossings	UTC, Google Maps	Data could be verified on a crossing by crossing basis
Roadway Freight Classification		
Freight and Goods Transportation System classification for roadways	WSDOT	Data is accurate; changes would occur rarely
Employment Density		
Number of jobs per acre	EPA Smart Location Database	Data is accurate; major changes in land use would require the data to be updated
Population Density		
Number of people per acre	EPA Smart Location Database	Data is accurate; major changes in land use would require the data to be updated
First/Last Mile Roadway Crossing		
Roadway designated as a first/last mile connection between major freight and goods origins and destinations	WSDOT Freight Economic Corridors Database	Data is accurate; changes would occur rarely

Proximity to Minority Populations (percent)		
Minority population density by census tract within proximity to crossing	US Census Bureau	Data is accurate; major changes in land use would require the data to be updated
Proximity to Low-Income Populations		
Low-income population density by block group within proximity to crossing	US Census Bureau	Data is accurate; major changes in land use would require the data to be updated
Network Sensitivity		
Number of major (arterials and above) roadway intersections within 200 feet of crossing	Parametrix	Data could be verified on a crossing by crossing basis
At-Grade Crossing Density		
Number of at-grade crossings on the same rail line within a half mile of crossing	Parametrix	Data could be verified on a crossing by crossing basis
Noise: Quiet Zone		
Crossing is located within a quiet zone	UTC	Data could be verified on a crossing by crossing basis; any changes to quiet zones could be incorporated as they occur
Daily Emissions		
Estimated emissions at crossing associated with delay and vehicle volumes	Transpo	Data could be modeled using more detailed methodologies

Table 4 summarizes the data that could be included in the database in the future. This includes information that could be created, such as vehicle queuing, as well as existing data that could be incorporated from other sources, such as near miss data.

Table 4 Data that could be Included or Enhanced in the Future

Data	Category	Description	Reason not Currently Included/Suggested Improvement
Near Miss Data	Safety	Data that documents when incidents/collision almost occurred between trains and vehicles/non-motorized users.	Available from only one rail company source (BNSF)

Data	Category	Description	Reason not Currently Included/Suggested Improvement
Collisions within 250 feet	Safety	Data that documents collisions within a certain distance of an at-grade crossing; could be used to indicate collisions due to congestion/queuing related to train crossing events.	Requires assembly from multiple sources and processing to evaluate collisions
Transit Volumes/Presence	Mobility	Data that indicates the presence and magnitude of transit service near an at-grade crossing	Requires assembly from multiple sources
Non-motorized Volumes/Presence	Mobility	Data that indicates the presence and magnitude of non-motorized activity near an at-grade crossing	Requires assembly from multiple sources and/or is not consistently available
Regional Growth Projections	Community	Data that documents potential development and/or land use nearby an at-grade crossing	Requires assembly from multiple sources and/or is not consistently available
Future Vehicle Volumes	Mobility	Data that documents future increases in traffic volumes	Requires assembly from regional travel demand models; may not be consistently available
Gate-Down Time	Mobility	Data that documents actual gate-down time, including train building and other activities	Requires actual data collection of gate-down times, or inclusion of model results from Marine Cargo Forecast
School Bus/Walking Routes	Safety	Data that indicates whether a school bus or walking route is designated across an at-grade crossing	Requires assembly from multiple sources and/or may not be consistently available
Crossing Geometrics/Sight Distance	Safety	Data that indicates if there are sight distance issues at a crossing	Requires some processing of existing data and/or may not be consistently available
Vehicle Queuing	Mobility	Data that measures queuing due to train crossing events	Requires actual data collection and analysis
Proximity to Sensitive Receptors	Community	Data that indicates proximity to sensitive receptors, such as hospitals, schools, etc	Requires assembly from multiple sources and/or may not be consistently available

Data	Category	Description	Reason not Currently Included/Suggested Improvement
Designated Routes	Community	Data identifying crossings that are located on designated response or evacuation routes, such as emergency response routes, oil spill response routes, and/or evacuation routes (lahar, tsunami).	Partial data available and/or requires assembly from multiple sources.
Accident Predictive Modeling	Safety	Data that identifies estimated number of collisions to occur at the at-grade crossing.	Requires substantial processing and expertise with modeling tools.

For the tool to remain useful, the data should be updated and maintained over time. Depending on the nature of what is being measured in each criteria, the timing for when data should be updated or replaced varies. Much of the data will not change drastically between update cycles and could be replaced only as changes happen. For example, railroad classification does not change frequently and could be updated only when there is a known update to a classification. Also, updates to the overall list of at-grade crossings could be modified when projects are completed or changes occur, as this would not be expected to occur often.

Vehicle volumes likely change more frequently depending on local factors such as development, population or employment growth, and the economy. More regular updates to this information would ensure the tool remains useful. The Pacific Northwest Marine Cargo Forecast and Rail Capacity Assessment, another source of information on train volume projections and activity, is updated every five years. Data updates to the prioritization tool could be aligned with the update cycle of this report. The following criteria would benefit from a five-year update cycle:

- Existing Vehicle Volumes (AADT)
- Future Vehicle Volumes (AADT)
- Gate-down Time
- Collision History
- Daily Emissions
- Existing Freight Train Volumes (daily average)
- Future Freight Train Volumes (daily average)
- Existing Unit Train Presence and Count
- Existing Passenger Train Volumes
- Future Passenger Train Volumes
- Previously Identified Project

- Level of Crossing Protection

The remaining criteria would not be expected to change frequently. It's important to note that there are varying degrees of processing and expertise required to maintain the criteria. Although all of the criteria at minimum will require review before inclusion, some of the criteria require calculations in order to update. The majority of the criteria can be incorporated with minimal processing. Criteria that require calculations include future vehicle volumes, average daily gate-down time, and daily emissions. Other criteria will require some GIS processing before they can be updated, including employment density, population density, proximity to low-income populations, and proximity to minority populations. Refer back to Section 3.0 for descriptions of processing required for the different criteria.