DOCKET NO. XX- XXXXXX
PETITION TO CONSTRUCT A HIGHWAY-RAIL GRADE CROSSING

Appendix A – Feasibility Study and Supplemental Information

Project: Proposed at-grade crossing for the Port of Pasco Reimann Industrial Center industry lead track across N. Railroad Ave.

Background

Roadways

North Railroad Ave is a two-lane roadway that runs north/south north adjacent to the BNSR railroad terminal / yards in the north of Pasco WA. Land use along the corridor is currently agricultural and light industrial. The speed limit is 50 mph. The proposed track will cross N Railroad Ave at-grade between Northern St. and W. Vineyard Dr.

Why is a Grade Separation Not Warranted?

1.) Does not meet minimum threshold for FHWA Grade Separation Guidelines warranting a Grade Separation
   a. Roadway characteristics
   b. Average Daily Vehicle Delay
   c. Crossing Exposure Value
   d. Accident Prediction

FHWA – Crossing Handbook

While N. Railroad Ave. is a rural route and not a State Route, evaluation of it as if it was is informative. State Route-rail grade crossings should be considered for grade separation or otherwise eliminated across the railroad right-of-way whenever one or more of the following conditions exist:

Item	Yes/No
The State Route highway is a part of the designated Interstate State Route System;	No
The State Route highway is otherwise designed to have full controlled access;	No
The posted State Route highway speed equals or exceeds 70 mph;	No
AADT exceeds 100,000 in urban areas or 50,000 in rural areas;	No
Maximum authorized train speed exceeds 110 mph;	No
An average of 150 or more trains per day or 300 Million Gross Tons (MGT) per year;	No
An average of 75 or more passenger trains per day in urban areas or 30 or more passenger trains per day in rural areas;	No
Crossing exposure (the product of the number of trains per day and AADT) exceeds 1,000,000 in urban areas or 250,000 in rural areas;	No
Passenger train crossing exposure (the product of the number of passenger trains per day and AADT) exceeds 800,000 in urban areas or 200,000 in rural areas.	No
The expected accident frequency (EAF) for active devices with gates, as calculated by the USDOT Accident Prediction Formula including 5-year accident history, exceeds 0.5; or	No
Vehicle delay exceeds 40 vehicle hours per day	No

Summary of Results

1.) Does not meet minimum threshold for FHWA Grade Separation Guidelines warranting a Grade Separation
   a. Average Daily Vehicle Delay
      0.061 hours < 40 hours
   b. Crossing Exposure Value
      2167 < 250,000
   c. Accident Prediction
      0.030 < 0.5

1. FHWA Grade Separation Guidelines warranting a Grade Separation

FHWA Grade Separation Guidelines Rough Screening

The FHWA Grade Separation Guidelines identifies the preliminary project analysis phase (Level 1) to include factors that, if sufficiently negative, will eliminate the project from further consideration. These include physical feasibility, surrounding land development, and cost. Additionally, Level 1 Analysis includes:

- Roadway and Rail Traffic:
  - Current
    - AADT – 1,084(2022)
    - Trains Average
      - Freight – 2 (1,000 feet in length)
      - Passenger – 0
  - 2032
    - AADT – 4,000(2032)
    - Trains Average
      - Freight – 2 (assumed no growth in number of trains, train lengths assumed to increase up to 2,000 feet)
      - Passenger – 0
- The expected vehicle delay with current (2022) conditions is summarized in Table 1. The USDOT Railroad-State Route Grade Crossing Handbook, Revised Second Edition August 2007 identified several conditions which, if exceeded would cause a grade separation project to be considered. The Vehicle Delay threshold is a maximum of 40 vehicle hours per day. The estimated daily Vehicle Delay in 2032 is 0.686 hours.

Table 1. Expected Vehicle Delay

Expected Daily Vehicle Delay (Hours)
0.061

ESTIMATED DELAY COST, ESTIMATED ANNUAL COST OF CRASHES AND COST OF VEHICULAR DELAYS

Tables 2 contains a summary of estimated cost of crashes, delay costs. and annual cost of vehicular delay, as well as an exposure value

Table 2. Estimated Costs by Year – (See following pages)

ACCIDENT CALCS - per NCHRP Report 288				
VARIABLE DESCRIPTION	VARIABLE NAME	EXISTING CONDITION (2022)	FUTURE (2032)	NOTES
Formula constant	K	0.001088	0.001088	
Annual traffic growth factor (2018 to 2022)			2.00%	
# of vehicles per day	c	1084	4000	2022 traffic is based on County-provided count of 1001 ADT in 2018, plus 2% annual growth. Our analysis assumes that 100% of new traffic generated from Reimann development will arrive from/depart to the south (viewed to be conservative, as a significant percent of new traffic is expected to arrive from/depart to the north). Full-buildout of Reimann Industrial Center is assumed to occur by 2032 (rather than 2040 as assumed in JUB's POP Master Plan traffic analysis).
# of train moves per day	t	2	2	
Crossing Exposure		2167	8000	<< Threshold for Grade Sep:
Exposure index factor	EI	18.3	26.06	
Main tracks factor	MT	1.34	1.34	
Day thru trains factor	DT	1	1	
Highway paved factor	HP	1	1	
Maximum timetable speed factor	MS	1	1	
Highway type factor	HT	1	1	
Highway lanes factor	HL	1.11	1.11	
Total # of predicted annual accidents	a	**0.030**	**0.042**	
Factor values for total accident probability formula				
VARIABLE DESCRIPTION	VARIABLE NAME	EXISTING CONDITION (2022)	FUTURE (2032)	
Formula constant	CF	695	695	
Max timetable speed factor	MS	0.084	0.084	
Thru train factor	TT	0.894	0.894	
Switch train factor	TS	1	1	
Urban-rural crossing factor	UR	1	1	
Probability of fatal accident	**P(FA/A)**	**0.019**	**0.019**	
Factor values for injury accident probability formulas				
VARIABLE DESCRIPTION	VARIABLE NAME	EXISTING CONDITION (2022)	FUTURE (2032)	
Formula Constant	CI	4.28	4.28	
Max timetable speed factor	MS	0.584	0.584	
Total number of tracks factor	TK	1.125	1.125	
Urban-rural crossing factor	UR	1	1	
Probability of injury accident	**P(IA/A)**	**0.26**	**0.26**	
		EXISTING CONDITION (2022)	FUTURE (2032)	
Total predicted accidents per year		0.030	0.042	
Predicted fatal accidents per year		0.00056	0.00079	
Predicted injury accidents per year		0.0076	0.0109	
Avg. Time (in Years) between accidents		33.8	23.7	
Avg. Time (in Years) between fatal accidents		1796.1	1261.3	
Avg. Time (in Years) between injury accidents		131.2	92.1	
Assumed annual inflation rate:			1.8%	
Avg. cost per Fatality accident		$ 7,222,380.00	$ 8,632,927.92	Per Mid-America Transportation Center "Development of a Methodology for Assessment of Crash Costs at Highway- Rail Grade Crossings in Nebraska" (2012) adjusted to 2022 dollars using CPI. Adjustment to 2032 dollars using assumed 1.8% inflation
Avg. cost per Injury accident		$ 164,249.78	$ 196,328.15	Per Mid-America Transportation Center "Development of a Methodology for Assessment of Crash Costs at Highway- Rail Grade Crossings in Nebraska" (2012) adjusted to 2022 dollars using CPI. Adjustment to 2032 dollars using assumed 1.8% inflation
				Detour costs due to accidents are considered to be negligible
Avg. Cost from Accidents per Year		$ 5,273.14	$ 8,975.75	

DELAY CALCS - per NCHRP Report 288				
VARIABLE DESCRIPTION	VARIABLE NAME	EXISTING CONDITION (2022)	FUTURE (2032)	
Train Length (feet)	L	1000	2000	Intial train length is based on maximum anticipated traffic to the Reimann Industrial Center (RIC). Because of the overall size of the RIC, future traffic is not expected to increase more than 100%.
Speed entering (mph)	Se	10	10	
Speed exiting (mph)	Sx	10	10	
Time xing closed per train (mins)	T	3.11	5.38	
# of trains per day:		2	2	
Total time xing closed per day (mins):		6.21	10.76	
VARIABLE DESCRIPTION	VARIABLE NAME	EXISTING CONDITION (2022)	FUTURE (2032)	
Daily Traffic	V	1084	4000	
Time xing closed per train (secs)	T	186.40	322.80	
Probability of Delay	P	0.00	0.00	
# of vehicles delayed	N	2.34	14.94	
# of highway lanes	n	2	2	
Total vehicle delay in minutes per day	D	3.66	41.16	
% of Trucks	Tp	54%	54%	Existing truck traffic % per County (2018). Future % is assumed to be conservative considering input from Mead & Hunt, which indicates a decrease in daily % of trucks
Delay to standard vehicles (min/day)		1.68	18.93	
Delay to trucks (min/day)		1.98	22.22	
Cost per hour of vehicular delay at xing, cars	CMC	$ 52.03	$ 62.19	Per Mid-America Transportation Center "Development of a Methodology for Assessment of Crash Costs at Highway- Rail Grade Crossings in Nebraska" (2012) adjusted to 2022 dollars using CPI. Adjustment to 2032 dollars using assumed 1.8% inflation
Cost per hour of vehicular delay at xing, commercial trucks	CMT	$ 84.33	$ 100.80	Per Mid-America Transportation Center "Development of a Methodology for Assessment of Crash Costs at Highway- Rail Grade Crossings in Nebraska" (2012) adjusted to 2022 dollars using CPI. Adjustment to 2032 dollars using assumed 1.8% inflation
Total Delay Cost per Day:		**$ 4.24**	**$ 56.96**	
Total Delay Cost per Year:		**$ 1,545.83**	**$ 20,790.39**	

Results

The current (2022) and future (2032) Crossing Exposure Value results for the proposed railway crossing are shown in Table . The model shows the N. Railroad Ave. Crossing Exposure Value of 2,167 and 8,000 respectively is below the FHWA Crossing exposure (the product of the number of trains per day and AADT) threshold of 250,000 in rural areas.

ACCIDENT PREDICTION MODEL

Methodology

The methodology used for the N. Railroad Ave. grade crossing Accident Prediction Model was developed using principles consistent with the USDOT Accident Prediction Model as outlined in NCHRP Report 288[1]. This method involves first calculating an expected total number of collisions per year based on road and rail traffic and physical characteristics of the grade crossing. Then two additional equations are used to predict the probability of accidents of various severity, particularly injury accidents and fatality accidents. From those probabilities, an expected average number of injury and fatality accidents per year can be calculated.

Results

The Accident Prediction Model results are shown in Table 3. The model shows the N. Railroad Ave. crossing is below the FHWA expected accident frequency threshold of 0.5 accidents per year, where grade separation should be considered. Further, the results are below the FHWA expected accident frequency threshold of 0.2, where grade separation should be considered based on fully allocated life-cycle costs, for all scenarios.

Table 3. N. Railroad Ave. Accident Prediction Model Results

Scenario	Trains per Day	Vehicles per Day	Expected Number of Accidents per Year
2022 Current Trains, Current Vehicles	2	1084	0.030
2032 Future Trains, Future Vehicle	2	4000	0.042

The results from the Accident Prediction Model suggest that grade separation at the N Railroad Ave. crossing is not warranted from a public benefit perspective.

Existing Conditions

Traffic Volumes

Average Annual Daily Traffic Volumes

The existing AADT volumes are presented in Exhibit 1.

Exhibit 1
Existing (2022) AADT Traffic Volumes

Location	AADT
N.Railroad Ave Study Area	1,084

[1] USDOT. Accident Prediction Model. https://onlinepubs.trb.org/Onlinepubs/nchrp/nchrp_rpt_288.pdf

As shown in Exhibit 1, existing AADT volumes are low. The capacity of a typical two-lane roadway is approximately 10,000 Vehicles Per Day.

Vehicular Delays and Queues

Exhibit 2 presents a summary of the average vehicular delay and vehicle queue lengths due to the train movements at 2022 traffic levels.

Exhibit 2
Vehicle Delays and Queues (2022)

At-Grade Crossing	Time Crossing is Closed Per Train (seconds) Freight	Average Queue Length (vehicles)
N Railroad Ave.	186	2.3

2032 Condition

Traffic volumes for the 2032 condition include the existing volumes plus 2% growth of background volume plus the estimated growth in traffic due to full build-out of the Reimann Industrial Center development. This assumes full build-out of the RIC occurs within 10 years.

Traffic Volumes

The estimated future traffic volumes for the N. Railroad Ave. area is provided in Exhibit 3.

Exhibit 3
Future (2032) AADT Traffic Volumes

Study Area	Estimated Background Traffic Growth Rate (percent per year)	Estimated Added Daily Traffic From RIC	Total AADT
N. Railroad Ave.	2.0	2,679	4,000

Vehicular Delays and Queues

Exhibit 4 presents a summary of the average vehicular delay and vehicle queue lengths due to the train movements at 2032 traffic levels.

Exhibit 4
Vehicle Delays and Queues (2032)

At-Grade Crossing	Time Crossing is Closed Per Train (seconds) Freight	Average Queue Length (vehicles)
N Railroad Ave.	323	14.9

Results

Existing Conditions

- The AADT volumes on the analyzed roadways are significantly less than the typical two-lane capacity of 10,000 vehicles per day.

2032 Conditions

- The 2032 AADT volumes on the analysis roadways are still below the typical two-lane roadway capacity of 10,000 vehicles per day.
- Since emergency vehicles will continue to use existing routes, which are not constrained by capacity limitations, the response time would be minimally affected.

References

1. Mid-America Transportation Center, Report # MATC-UNL:422, WBS: 25-1121-0001-4222
2. National Cooperative Highway Research Program, Report 288 “Evaluating Grade-Separated Rail and Highway Crossing Alternatives”