RAILPROS

Finalized
New Interconnected Crossing Review Report

DOT #085700S

Railroad Interconnected Traffic Signal at:

7th Street NW at Stewart Avenue

Puyallup, WA

BNSF

Seattle Subdivision

MP 32.194

23 U.S.C. § 409 Document

Prepared For: BNSF RAILWAY

June 24, 2021

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Appendices

Certification

I, Andrew Maximous, certify that this report was prepared under my responsible charge.

Sincerely,

Andrew Maximous, PE
RailPros Inc.
213-929-1111
andrew.maximous@railpros.com

BNSF Contact Information

In case of crossing related emergency, call the BNSF Hotline number posted on the Emergency Notification System (ENS) sign at the crossing: 800-832-5452.

In case of any proposed physical changes, operational changes, or traffic control work at/near the grade crossing, contact Stephen Semenick at BNSF 206-625-6152.

Appendix C

Agency Provided Preemption Calculations

Version 07/12/2017

RESET

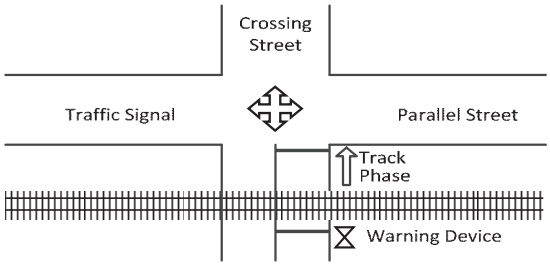
Form 2304
(Rev. 7/17)

Texas Department of Transportation

GUIDE FOR DETERMINING TIME REQUIREMENTS FOR TRAFFIC SIGNAL PREEMPTION AT HIGHWAY-RAIL GRADE CROSSINGS

City: Puyallup
County: Pierce
District: Northwest
CSJ:
Date: 5/12/2021
Completed by: Benesch - Fort Worth
District Approval:

Show North Arrow

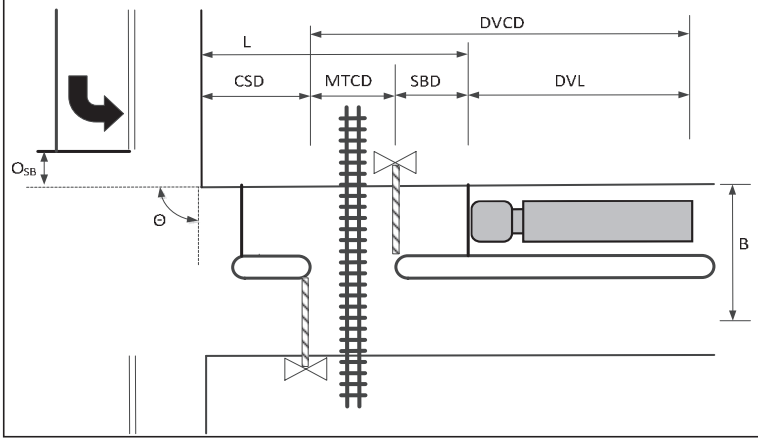


Parallel Street Name: West Stewart Avenue
Crossing Street Name: 7th Street NW

Railroad: BNSF Railway
Crossing DOT#: 085700S
Railroad Contact: Stephen Semenick
Phone: 253-841-5542

NOTE: After approval by the District, a copy of this form, along with the traffic signal design sheets and the phasing diagrams for normal and preempted operation, shall be placed in the traffic signal cabinet. See Section 7 for traffic signal timings.

SECTION 1: GEOMETRY DATA & DEFAULTS



CSD = Clear storage distance (ft)
MTCD = Minimum track clearance distance (ft)
SBD = Stop bar setback distance (ft)
DVL = Design vehicle length (ft)
L= Queue start-up distance, also stop-line distance (ft)
DVCD = Design vehicle clearance distance (ft)
O_{SB} = Offset distance to Left-turn stop bar (ft)
B = Distance from curb line to center of nearest lane receiving left turns (ft)
Θ = Angle of turn (degrees)

GEOMETRIC DATA FOR CROSSING

			Remarks
1.	Clear storage distance (CSD, feet)	1. 18	
2.	Minimum track clearance distance (MTCD, feet)	2. 41	
3.	Stop bar setback distance (SBD, feet)	3. 8	"0" if no stop bar present
4.	Width of receiving approach (B, feet)	4. 26	
5.	Offset distance of left turn stop bar (O_{SB}, feet)	5. 46	
6.	Approach grade. % (0 if approach is on downgrade)	6. 2.5	
7.	Angle of turn at Intersection (Θ, degrees)	7. 80	

DESIGN VEHICLE DATA

8. Select Design Vehicle

☐ School Bus ☐ Intermediate Truck ☑ Interstate Semi-Truck ☐ Other

9.	Default design vehicle length (feet)	9. 75	Based on selected Design Vehicle
a.	Additional vehicle length, if needed (feet)	9a. 0	
10.	Total design vehicle length (DVL, feet)	10. 75	
11.	Centerline turning radius of design vehicle (R, feet)	11. 41	Based on selected Design Vehicle
12.	Passenger car vehicle length (LV, feet)	12. 19	Default value

SECTION 2: RIGHT-OF-WAY TRANSFER TIME CALCULATION

Preempt verification and response time

				Remarks
13.	Preempt delay time (seconds)	13.	0	
14.	Controller response time to preempt (seconds)	14.	0.0	Manufacturer:
				Firmware Version:
15.	Preempt verification and response time (seconds): add lines 13 and 14	15.	0.0	

Worst-case conflicting vehicle time

				Remarks
16.	Minimum green time during right-of-way transfer (seconds)	16.	2	Minimum green time reduced
17.	Other green time during right-of-way transfer (seconds)	17.	0	for railroad limitations
18.	Yellow change time (seconds)	18.	3.0	
19.	Red clearance time (seconds)	19.	4.2	
20.	Worst-case conflicting vehicle time (seconds): add lines 16 through 19	20.	9.2	

Worst-case conflicting pedestrian time

				Remarks
21.	Minimum walk time during right-of-way transfer (seconds)	21.	0	* Advance Pedestrian Preemption Time *
22.	Pedestrian clearance time during right-of-way transfer (seconds)	22.	0	west crosswalk = 57 ft PC = (57 ft / 3.5 fps) - (3.0+4.2) = 9.1 sec (Round up) 10 seconds
23.	Vehicle yellow change time, if not included on line 22 (seconds)	23.	0.0	
24.	Vehicle red clearance time, if not included on line 22 (seconds)	24.	0.0	
25.	Worst-case conflicting pedestrian time (seconds): add lines 21 through 24	25.	0.0	

Worst-case conflicting vehicle or conflicting pedestrian time

26.	Worst-case conflicting vehicle or conflicting pedestrian time (seconds): maximum of lines 20 and 25	26.	9.2
27.	**Right-of-way transfer time (seconds): add lines 15 and 26**	27.	9.2

SECTION 3: QUEUE CLEARANCE TIME CALCULATION

				Remarks
28.	Are there left-turns towards the tracks? ☑ Yes ☐ No			
29.	Distance traveled by truck during left-turn (LTL, feet):	29.	57	LTL = ∏RΘ/180
30.	Travel speed of left-turning truck (S_{LTT}, mph):	30.	10	Default value
31.	Distance required to clear left-turning truck from travel lanes on track clearance approach (feet):	31.	182	Equation: (line 4 + line 5 + line 12 - line 11) + line 29 + line 10
32.	Additional time required to clear left-turning truck from travel lanes on track clearance approach (seconds):	32.	5.2	Equation: [(line 31 * 3600) / (line 30 * 5280) - line 18 - line 19]
33.	Worst-case Left Turning Truck time (seconds): if Line 28 = 'Yes', use line 32; otherwise Use 0	33.	5.2	
34.	Queue start-up distance, L (feet): add lines 1 through 3	34.	67	
35.	Time required for design vehicle to start moving (seconds): calculate as 2+(L÷20)	35.	5.4	
36.	Design vehicle clearance distance, DVCD (feet): add lines 2, 3 and 10	36.	124	
37.	Time for design vehicle to accelerate through the DVCD (seconds), level terrain	37.	14.9	
38.	Factor to account for slower acceleration on uphill grade	38.	1.17	
39.	Time for design vehcle to accelerate through DVCD (seconds), adjusted for grade: multiply lines 37 and 38	39.	17.5	
40.	**Queue clearance time (seconds): add lines 33, 35 and 39**	40.	28.0	

SECTION 4: MAXIMUM PREEMPTION TIME CALCULATION

				Remarks
41.	Right-of-way transfer time (seconds): line 27	41.	9.2	
42.	Queue clearance time (seconds): line 40	42.	28.0	Separation Time reduced
43.	Desired minimum separation time (seconds)	43.	2.0	for railroad limitations
44.	Maximum preemption time for Queue Clearance (seconds): add lines 41 through 43	44.	39.2	

SECTION 5: SUFFICIENT WARNING TIME CHECK

Remarks

45.	Required minimum time, MT (seconds): per regulations	45.	20
46.	Clearance time, CT (seconds): (line 2 -35) / 10 (rounded up to nearest second)	46.	1
47.	Total minimum warning time, MWT, needed (seconds): add lines 45 and 46 (excludes buffer time and equipment response time)	47.	21
48.	Required advance preemption time (APT) from railroad (seconds): subtract line 47 from line 44, round up to nearest full second, enter 0 if less than 0	48.	19
49.	APT currently provided by railroad (seconds): Enter "0" if new crossing or signal	49.	0

If the required advance preemption time (line 48) is greater than the amount of advance preemption time currently provided by the railroad (line 49), additional warning time must be requested from the railroad. Alternatively, the maximum preemption time (line 48) may be decreased after performing an engineering study to investigate the possibility of reducing the values on lines 13, 16, 17, 21, 22 and 43.

Remarks:

* Advance Pedestrian Preemption Time and Advance Vehicle Preemption Time *

* Input #1 - Advance Pedestrian Preemption Time for pedestrian clearance = 10 seconds
* Input #2 - Advance Vehicle Preemption Time is shown on line 48 = 19 seconds

SECTION 6: TRACK CLEARANCE GREEN TIME CALCULATION (IF NO GATE DOWN CIRCUIT PROVIDED)

Preempt Trap Check

Remarks

50. Warning Time Variability (Select One)

☐ Consistent Warning Times ☐ Low Warning Time Variability ☑ High Warning Time Variability

51.	APT required or provided (seconds): maximum of Line 48 or Line 49	51.	19
52.	Multiplier for maximum APT due to train handling	52.	1.60
53.	Maximum APT (seconds): multiply line 51 and 52	53.	30.4
54.	Minimum duration for the track clearance green interval (seconds)	54.	15
55.	Track Clearance Green Time to avoid Preempt Trap (seconds): add lines 53 and 54	55.	45.4

Clearing of Clear Storage Distance

56.	Time waiting on left-turn truck (seconds): line 33	56.	5.2
57.	Time required for design vehicle to start moving (seconds): line 35	57.	5.4
58.	Design vehicle clearance distance (DVCD, feet): line 36	58.	124

If CSD ≤ DVL, you must clear the design vehicle through the entire CSD during the traffic clearance phase; however, if CSD > DVL, you should consider providing enough time to clear the design vehicle from the crossing.

Is the clear storage distance (CSD) less than or equal to the design vehicle length (DVL)?

☑ YES. The design vehicle MUST clear through the entire CSD. (CSD will be entered in Line 59).
☐ NO. The design vehicle may clear through a portion of the CSD.

Do you want to clear the design vehicle through the entire CSD?

☑ YES. Clear the entire CSD. (CSD will be entered in Line 59).
☐ NO. Clear the crossing ONLY. (DVL will be entered in Line 59).

59.	Portion of CSD to clear during track clearance phase (feet)	59.	18
60.	Design vehicle relocation distance (DVRD, feet): add lines 58 and 59	60.	142
61.	Time required to accelerate design vehicle through DVRD (seconds), level terrain:	61.	16.1
62.	Factor to account for slower acceleration on uphill grade	62.	1.17
63.	Time required to accelerate design vehicle through DVRD (seconds), adjusted for grade: multiply lines 61 and 62	63.	18.9
64.	Time to clear portion of clear storage distance (seconds): add lines 56, 57 and 63	64.	29.4
65.	**Track clearance green interval (seconds): maximum of lines 55 or 64, round up to nearest full second**	65.	46

Maximum Duration of Track Clearance Green after gates are down (in absence of a gate down circuit)

66.	Total time to complete track clearance green (seconds): line 27 + line 65	66.	55.2
67.	Total time before gates are down (seconds): subtract 5 seconds from line 44 (per AREMA Manual)	67.	34.2
68.	**Maximum Duration of Track Clearance Green after gates are down (seconds): Line 66 - Line 67**	68.	21

SECTION 7: SUMMARY OF CONTROLLER PREEMPTION SETTINGS

			Remarks
69.	Duration Time (seconds)	0	From Line 18
70.	Preempt Delay Time (seconds)	0	From Line 19

Right of Way Transfer Phase

			Remarks
71.	Minimum Green Interval (seconds)	2	From Line 65
72.	Pedestrian Walk Interval (seconds)	0	From Line 40
73.	Pedestrian Clearance Interval (Flashing "DON'T WALK", seconds)	0	From Line 18
74.	Yellow Change Interval (seconds)	3.0	From Line 19
75.	All Red Vehicle Clearance (seconds)	4.2	Default Value

Track Clearance Phase

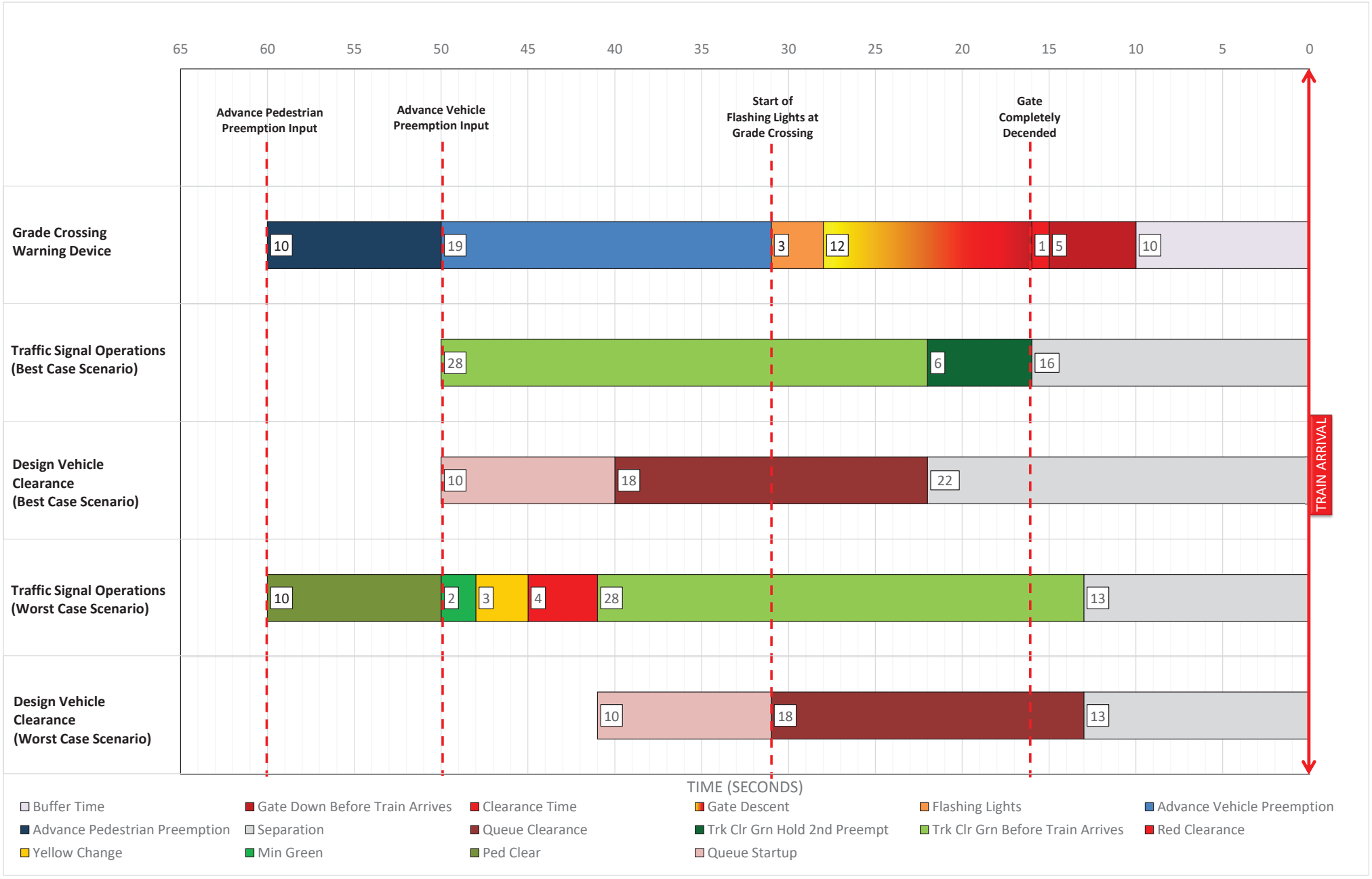
			Remarks
76.	Green Interval (seconds) (in the absence of gate down circuit)	46	From Line 18
77.	Green Interval (seconds) with gate down circuit	28	From Line 19
78.	Yellow Change Interval (seconds)	3.0	From Line 18
79.	All Red Vehicle Clearance (seconds)	4.2	From Line 19

Exit Phase

			Remarks
80.	Dwell/Cycle Minimum Green Time (seconds)	0	Default Value
81.	Yellow Change Interval (seconds)	3.0	From Line 18
82.	All Red Vehicle Clearance (seconds)	4.2	From Line 19

Remarks:

Railroad Interconnection Timeline - 7th Street - Puyallup, WA - DOT# 085700S



benesch