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Ext.

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

)	DOCKET NO. TR-	-AF
)		
Clark County Public Works)	PETITION TO RECONSTRUCT A	
_____)	HIGHWAY-RAIL GRADE	
Petitioner,)	CROSSING AND INSTALL AN	
)	INTER-TIE BETWEEN A HIGHWAY	
vs.)	SIGNAL AND A RAILROAD	
Clark County Railroad)	CROSSING SIGNAL SYSTEM	
_____)		
Respondent)		
)		
)	USDOT CROSSING NO.: 852-429-T	
.....)		

Prior to submitting a Petition to **Construct** a highway-rail grade crossing and install an inter-tie between a Highway Signal and a Railroad Crossing Signal System to the Washington Utilities and Transportation Commission (UTC), State Environmental Protection Act (SEPA) requirements must be met. Washington Administrative Code (WAC) 197-11-865 (2) requires:

All actions of the utilities and transportation commission under statutes administered as of December 12, 1975, are exempted, except the following:

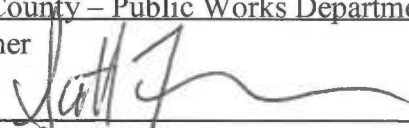
(2) Authorization of the openings or closing of any highway/railroad grade crossing, or the direction of physical connection of the line of one railroad with that of another;

Please attach sufficient documentation to demonstrate that the SEPA requirement has been fulfilled. For additional information on SEPA requirements contact the Department of Ecology.

The Petitioner asks the Washington Utilities and Transportation Commission to approve construction or reconstruction of a highway-rail grade crossing and inter-tie the highway signal with the railroad crossing signal system.

Construction Reconstruction

Section 1 – Petitioner’s Information

Clark County – Public Works Department
Petitioner

Signature
1300 Franklin Street
Street Address

RECEIVED
 RECORDS MANAGEMENT
 2014 SEP 18 AM 8:48
 STATE OF WASH.
 UTIL. AND TRANSP.
 COMMISSION

Vancouver WA 98666
City, State and Zip Code

PO Box 9810, Vancouver, WA 98666
Mailing Address, if different than the street address

Scott Fakler (Project Manager)
Contact Person Name

(360) 397-6118 ext 4394 and Scott.Fakler@clark.wa.gov
Contact Phone Number and E-mail Address

Section 2 – Respondent's Information

Clark County Railroad
Respondent

1300 Franklin Street
Street Address

Vancouver, WA 98666
City, State and Zip Code

PO Box 9810, Vancouver, WA 98666
Mailing Address, if different than the street address

Jeff Swanson (Director of Economic Development)
Contact Person Name

(360) 397-6118 ext 4113 Jeff.Swanson@clark.wa.gov
Contact Phone Number and E-mail Address

Section 3 – Proposed Crossing Location

1. Existing highway/roadway NE 78th Street at NE 47th Avenue

2. Existing railroad Clark County Railroad

3. Location of proposed crossing:
Located in the SE 1/4 of the SE 1/4 of Sec. 10, Twp. 2N, Range 1E W.M.

4. GPS location, if known Longitude is -122.62323; Latitude is 45.67855,

5. Railroad mile post (nearest tenth) 4.1

6. City N/A County Clark County

Section 4 – Proposed Crossing Information

1. Railroad company Chelatchie Prairie Railroad

2. Type of railroad at crossing Common Carrier Logging Industrial
 Passenger Excursion

3. Type of tracks at crossing Main Line Siding or Spur

4. Number of tracks at crossing two

5. Average daily train traffic, freight 6
Authorized freight train speed 10mph Operated freight train speed 10mph

6. Average daily train traffic, passenger -0-
Authorized passenger train speed N/A Operated passenger train speed N/A

7. Will the proposed crossing eliminate the need for one or more existing crossings?
Yes No

8. If so, state the distance and direction from the proposed crossing.
N/A

9. Does the petitioner propose to close any existing crossings?
Yes No

Section 5 – Temporary Crossing

1. Is the crossing proposed to be temporary? Yes No

2. If so, describe the purpose of the crossing and the estimated time it will be needed

3. Will the petitioner remove the crossing at completion of the activity requiring the temporary crossing? Yes No

Approximate date of removal _____

Section 6 – Current Highway Traffic Information

1. Name of roadway/highway NE 78th Street

2. Roadway classification Urban Principal Arterial

3. Road authority Clark County

4. Average annual daily traffic (AADT) 33,200

5. Number of lanes 5

6. Roadway speed 45 mph

7. Is the crossing part of an established truck route? Yes No

8. If so, trucks are what percent of total daily traffic? 2.5%

9. Is the crossing part of an established school bus route? Yes No

10. If so, how many school buses travel over the crossing each day? 35

11. Describe any changes to the information in 1 through 7, above, expected within ten years:

Section 7 – Alternatives to the Proposal

1. Does a safer location for a crossing exist within a reasonable distance of the proposed location?
Yes No

2. If a safer location exists, explain why the crossing should not be located at that site.

N/A

3. Are there any hillsides, embankments, buildings, trees, railroad loading platforms or other barriers in the vicinity which may obstruct a motorist's view of the crossing?

Yes No

4. If a barrier exists, describe:

- ◆ Whether petitioner can relocate the crossing to avoid the obstruction and if not, why not.
- ◆ How the barrier can be removed.
- ◆ How the petitioner or another party can mitigate the hazard caused by the barrier.

N/A

5. Is it feasible to construct an over-crossing or under-crossing at the proposed location as an alternative to an at-grade crossing?

Yes No

6. If an over-crossing or under-crossing is not feasible, explain why.

A suitable place for an over-crossing or under-crossing does not exist at this location. In addition, the volume of train traffic is very low. Financial cost of grade separating the crossing would be prohibitive

7. Does the railway line, at any point in the vicinity of the proposed crossing, pass over a fill area or trestle or through a cut where it is feasible to construct an over-crossing or an under-crossing, even though it may be necessary to relocate a portion of the roadway to reach that point?

Yes No

8. If such a location exists, state:

- ◆ The distance and direction from the proposed crossing.
- ◆ The approximate cost of construction.
- ◆ Any reasons that exist to prevent locating the crossing at this site.

N/A

9. Is there an existing public or private crossing in the vicinity of the proposed crossing?
Yes X No (none other than the existing crossing to be modified)

10. If a crossing exists, state:
- ◆ The distance and direction from the proposed crossing.
 - ◆ Whether it is feasible to divert traffic from the proposed to the existing crossing.

The nearest crossing to the northeast is approximately 3/4 mile away, on 88th Street. The nearest crossing to the southwest is approximately 1/4 mile away, on 43rd Ave.

Section 8 – Sight Distance

1. Complete the following table, describing the sight distance for motorists when approaching the tracks from either direction.

a. Approaching the crossing from East, the current approach provides an unobstructed view as follows: (North, South, East, West)

Direction of sight (left or right)	Number of feet from proposed crossing	Provides an unobstructed view for how many feet
Right	300	100 (STAND 2)
Right	200	310 (STAND 1)
Right	100	330 (STAND 1)
Right	50	350 (STAND 1)
Right	25	350 (STAND 1)
Left	300	100 (STAND 3)
Left	200	160 (STAND 3)
Left	100	+400
Left	50	+400
Left	25	+400

(*) SEE EXHIBIT B FOR SIGHT OBSTRUCTION NOTED

b. Approaching the crossing from West, the current approach provides an unobstructed view as follows: (Opposite direction-North, South, East, West)

Direction of sight (left or right)	Number of feet from proposed crossing	Provides an unobstructed view for how many feet
Right	300	85 (BUILDING C)
Right	200	120 (BUILDING C)
Right	100	160 (BUILDING C)
Right	50	200 (BUILDING C)
Right	25	250 (BUILDING C)
Left	300	340 (STAND 1)
Left	200	350 (STAND 1)
Left	100	380 (STAND 1)
Left	50	+400
Left	25	+400

(*) SEE EXHIBIT B FOR SIGHT OBSTRUCTION NOTED

2. Will the new crossing provide a level approach measuring 25 feet from the center of the railway on both approaches to the crossing?

Yes X No

3. If not, state in feet the length of level grade from the center of the railway on both approaches to the crossing. _____

4. Will the new crossing provide an approach grade of not more than five percent prior to the level grade?

Yes X No

5. If not, state the percentage of grade prior to the level grade and explain why the grade exceeds five percent.

N/A

Section 9 – Illustration of Proposed Crossing Configuration

Attach a detailed diagram, drawing, map or other illustration showing the following:

- ◆ The vicinity of the proposed crossing.
- ◆ Layout of the railway and highway 500 feet adjacent to the crossing in all directions.
- ◆ Percent of grade.
- ◆ Obstructions of view as described in Section 7 or identified in Section 8.
- ◆ Traffic control layout showing the location of the existing and proposed signage.

Section 10 – Sidewalks

1. Provide the following information:

- a. Provide a description of the type of sidewalks proposed.
- b. Describe who will maintain the sidewalks.
- c. Attach a proposed diagram or design of the crossing including the sidewalks.

a) Pedestrian sidewalks in the immediate vicinity of the rail crossing (including track crossings) will be concrete and newly constructed as part of the intersection/grade-crossing project. Tactile warning strips will be installed on the sidewalk surface, at the edge of the dynamic envelope on all pedestrian approaches to a rail crossing

b) Sidewalks will be maintained by the roadway authority (Clark County) .

c) See Exhibit “A” for pedestrian sidewalk layout.

Section 11 – Proposed Warning Signals or Devices

1. Explain in detail the number and type of automatic signals or other warning devices planned at the proposed crossing, including a cost estimate for each. If requesting pre-emption include the type of train detection circuitry, sequencing and advanced preemption time, justification for the changes and its effects on current warning devices and warning times for drivers.

WARNING DEVICES

Flashing Light Signals with Automatic gate will be provided on all vehicle approaches to the crossing, each installation will conform with MUTCD requirements. **(four total)**

Each assembly will include "2 TRACKS" (R15-2P) and "DO NOT STOP ON TRACKS" (R8-8) signs.

Cantilevered Flashing Light Signals will be provided on all vehicle approaches with more than one vehicle lane (North, West and South approaches to the crossing). **(three total)**

Flashing Light Signal Assembly for Pedestrian Crossings will be provided on all pedestrian approaches to the crossing (except northeast quadrant, where Automatic Gate signal is adjacent to pedestrian approach) each installation will conform with MUTCD requirements. **(three total)**

Grade Crossing Advance Warning Signs will be provided on all vehicle approaches to the proposed crossing signs will be located in advance of the crossing per MUTCD/WSDOT requirements. **(four total)**

Grade Crossing Pavement Markings will be provided will be provided on all vehicle approach lanes to the proposed crossing markings will be located in advance of the crossing per MUTCD/WSDOT requirements. **(six total)**

See Exhibit "A" for schematic of proposed warning devices for the crossing

Expected cost to furnish and install rail crossing equipment is approximately \$350,000.00

TRAIN DETECTION

Train detection will include Constant Warning Time Predictors on both approaches.

WAYSIDE TO TRAFFIC SIGNAL INTERCONNECT

Interconnect will consist of 8-wire supervisory circuit.

Interconnected Grade-Crossing Operations Recorders (IGOR) units will be installed in both the wayside rail bungalow and the traffic signal controller cabinet to jointly monitor rail and traffic operations at the crossing.

2. Provide an estimate for maintaining the signals for 12 months. \$20,000.00

3. Is the petitioner prepared to pay to the respondent railroad company its share of installing the warning devices as provided by law?

Yes X No _____

Section 12 – Traffic Signal Preemption

Complete the attached Guide for Determining Time Requirements for Traffic Signal Preemption at Highway-Rail Grade Crossings.

1. Specify simultaneous or advance preemption requested.

Advance preemption

2. If advance preemption, what is the preemption time.

12.0 seconds of advance preemption

Section 13 – Additional Information

Provide any additional information supporting the proposal, including information such as the public benefits that would be derived from constructing a new crossing as proposed.

The reconstructed crossing will provide gates and warning devices on all vehicle approaches to the crossing (only two approaches are currently gated). Upgraded train detection will reduce vehicle delay on 78th Street through improved accuracy in triggering and releasing preemption of the traffic signal. Improved train detection will also minimize the occurrence of unnecessary gate activations by train switching in the yard south of the crossing.

Section 14 – Waiver of Hearing by Respondent

Waiver of Hearing

The undersigned represents the Respondent in the petition to construct or reconstruct a highway-railroad grade crossing and inter-tie the highway signal with the railroad crossing signal system.

USDOT Crossing No.: 852 - 429 - T

We have investigated the conditions at the proposed or existing crossing site. We are satisfied the conditions are the same as described by the Petitioner in this docket. We agree that a crossing be installed or reconstructed and the highway signals inter-tied with the railroad crossing signal system and consent to a decision by the commission without a hearing.

Dated at Vancouver, Washington, on the 11th day of September, 20 14.

Jeffrey Robert Swanson
Printed name of Respondent

Jeff R Swanson
Signature of Respondent's Representative

Director of Economic Development
Title

Clark County Railroad
Name of Company

(360) 397-2004 jeff.swanson@clark.wa.gov
Phone number and e-mail address

P.O. Box 5000

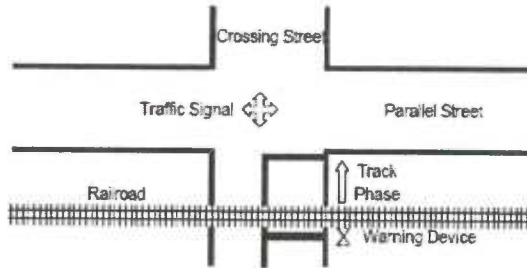
Vancouver, WA 98660-5000
Mailing address

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

City _____
 County _____
 District _____

Date _____
 Completed by _____
 District Approval _____


 Show North Arrow



Parallel Street Name _____
 Crossing Street Name _____

Railroad _____
 Crossing DOT# _____

Railroad Contact _____
 Phone _____

SECTION 1: RIGHT-OF-WAY TRANSFER TIME CALCULATION

Preempt verification and response time

- 1. Preempt delay time (seconds) 1.
- 2. Controller response time to preempt (seconds) 2.
- 3. Preempt verification and response time (seconds): add lines 1 and 2 3.

Remarks _____
 Controller type: _____

Worst-case conflicting vehicle time

- 4. Worst-case conflicting vehicle phase number 4.
- 5. Minimum green time during right-of-way transfer (seconds) 5.
- 6. Other green time during right-of-way transfer (seconds) 6.
- 7. Yellow change time (seconds) 7.
- 8. Red clearance time (seconds) 8.
- 9. Worst-case conflicting vehicle time (seconds): add lines 5 through 8 9.

Remarks _____

Worst-case conflicting pedestrian time

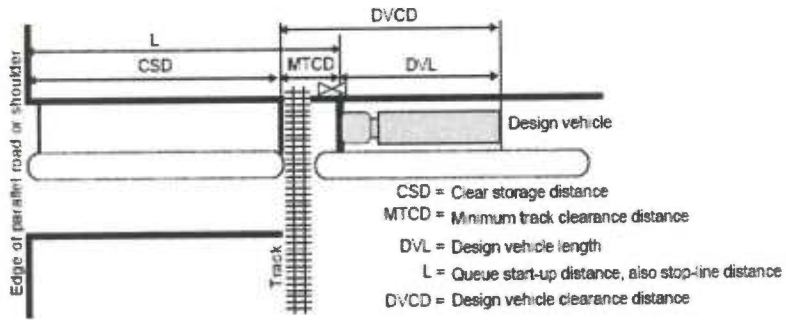
- 10. Worst-case conflicting pedestrian phase number 10.
- 11. Minimum walk time during right-of-way transfer (seconds) 11.
- 12. Pedestrian clearance time during right-of-way transfer (seconds) 12.
- 13. Vehicle yellow change time, if not included on line 12 (seconds) 13.
- 14. Vehicle red clearance time, if not included on line 12 (seconds) 14.
- 15. Worst-case conflicting pedestrian time (seconds): add lines 11 through 14 15.

Remarks _____

Worst-case conflicting vehicle or pedestrian time

- 16. Worst-case conflicting vehicle or pedestrian time (seconds): maximum of lines 9 and 15 16.
- 17. Right-of-way transfer time (seconds): add lines 3 and 16 17.

SECTION 2: QUEUE CLEARANCE TIME CALCULATION



		Remarks
18. Clear storage distance (CSD, feet)	18. <input type="text"/>	_____
19. Minimum track clearance distance (MTCD, feet)	19. <input type="text"/>	_____
20. Design vehicle length (DVL, feet)	20. <input type="text"/>	Design vehicle type: _____
21. Queue start-up distance, L (feet): add lines 18 and 19	21. <input type="text"/>	Remarks
22. Time required for design vehicle to start moving (seconds): calculate as $2+(L+20)$	22. <input type="text"/>	_____
23. Design vehicle clearance distance, DVCD (feet): add lines 19 and 20	23. <input type="text"/>	
24. Time for design vehicle to accelerate through the DVCD (seconds)	24. <input type="text"/>	Read from Figure 2 in Instructions.
25. Queue clearance time (seconds): add lines 22 and 24	25. <input type="text"/>	

SECTION 3: MAXIMUM PREEMPTION TIME CALCULATION

		Remarks
26. Right-of-way transfer time (seconds): line 17	26. <input type="text"/>	_____
27. Queue clearance time (seconds): line 25	27. <input type="text"/>	_____
28. Desired minimum separation time (seconds)	28. <input type="text" value="4.0"/>	_____
29. Maximum preemption time (seconds): add lines 26 through 28	29. <input type="text"/>	

SECTION 4: SUFFICIENT WARNING TIME CHECK

		Remarks
30. Required minimum time, MT (seconds): per regulations	30. <input type="text"/>	_____
31. Clearance time, CT (seconds): get from railroad	31. <input type="text"/>	_____
32. Minimum warning time, MWT (seconds): add lines 30 and 31	32. <input type="text"/>	<u>Excludes buffer time (BT)</u>
33. Advance preemption time, APT, if provided (seconds): get from railroad ..	33. <input type="text"/>	_____
34. Warning time provided by the railroad (seconds): add lines 32 and 33	34. <input type="text"/>	
35. Additional warning time required from railroad (seconds): subtract line 34 from line 29, round up to nearest full second, enter 0 if less than 0	35. <input type="text"/>	

If the additional warning time required (line 35) is greater than zero, additional warning time has to be requested from the railroad. Alternatively, the maximum preemption time (line 29) may be decreased after performing an engineering study to investigate the possibility of reducing the values on lines 1, 5, 6, 7, 8, 11, 12, 13 and 14.

Remarks: _____

SECTION 5: TRACK CLEARANCE GREEN TIME CALCULATION (OPTIONAL)

Preempt Trap Check

36. Advance preemption time (APT) provided (seconds): 36. Line 33 only valid if line 35 is zero.
37. Multiplier for maximum APT due to train handling 37. See instructions for details.
38. Maximum APT (seconds): multiply line 36 and 37 38. **Remarks**
39. Minimum duration for the track clearance green interval (seconds) 39. **For zero advance preemption time**
40. Gates down after start of preemption (seconds): add lines 38 and 39 40.
41. Preempt verification and response time (seconds): line 3 41. **Remarks**
42. Best-case conflicting vehicle or pedestrian time (seconds): usually 0 42.
43. Minimum right-of-way transfer time (seconds): add lines 41 and 42 43.
44. Minimum track clearance green time (seconds): subtract line 43 from line 40 44.

Clearing of Clear Storage Distance

45. Time required for design vehicle to start moving (seconds), line 22 45.
46. Design vehicle clearance distance (DVCD, feet), line 23 46. **Remarks**
47. Portion of CSD to clear during track clearance phase (feet) .. 47. **CSD* in Figure 3 in Instructions.**
48. Design vehicle relocation distance (DVRD, feet): add lines 46 and 47 48.
49. Time required for design vehicle to accelerate through DVRD (seconds) 49. Read from Figure 2 in Instructions.
50. Time to clear portion of clear storage distance (seconds): add lines 45 and 49 50.
51. Track clearance green interval (seconds): maximum of lines 44 and 50, round up to nearest full second 51.

SECTION 6: VEHICLE-GATE INTERACTION CHECK (OPTIONAL)

52. Right-of-way transfer time (seconds): line 17 52.
53. Time required for design vehicle to start moving (seconds), line 22 53.
54. Time required for design vehicle to accelerate through DVL (on line 20, seconds) 54. Read from Table 3 in Instructions.
55. Time required for design vehicle to clear descending gate (seconds): add lines 52 through 54 55. **Remarks**
56. Duration of flashing lights before gate descent start (seconds): get from railroad 56. **Remarks**
57. Full gate descent time (seconds): get from railroad 57.
58. Proportion of non-interaction gate descent time 58. Read from Figure 5 in Instructions.
59. Non-interaction gate descent time (seconds): multiply lines 57 and 58 59.
60. Time available for design vehicle to clear descending gate (seconds): add lines 56 and 59 60.
61. Advance preemption time (APT) required to avoid design vehicle-gate interaction (seconds):
 subtract line 60 from line 55, round up to nearest full second, enter 0 if less than 0 61.



INSTRUCTIONS

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

USING THESE INSTRUCTIONS: *These instructions are designed to assist applicants in completing the Guide For Determining Time Requirements For Traffic Signal Preemption At Highway-Rail Grade Crossings. This assists in determining if additional time (advance preemption) is required for the traffic signal to move stationary vehicles out of the crossing before the arrival of the train. If you have any questions about completing the form, please contact Kathy Hunter, commission staff at (360)664-1257 or by e-mail at khunter@utc.wa.gov.*

SITE DESCRIPTIVE INFORMATION:

Enter the location for the highway-rail grade crossing including the (nearest) **City** and the **County** in which the crossing is located. Next, enter the **Date** the analysis was performed, your (the analyst's) name next to **Completed by**.

To complete the reference schematic for this site, place a **North Arrow** in the provided circle to correctly orient the crossing and roadway. Record the name of the **Parallel Street** and the **Crossing Street** in the spaces provided and remember to include any street sign or local name for the streets as well as any state or interstate highway designation. You may wish to note other details on the intersection and crossing diagram as well, including the number of lanes or turn bays on the intersection approach crossing the tracks and any adjacent land use.

Enter the **Railroad** name, **Railroad Contact** person's name and **Phone** number for the responsible railroad company and its equipment maintenance and operations contractor (if any). Finally, record the unique 7-character **Crossing USDOT#** (6 numeric plus one alphanumeric characters) for the crossing.

Note that this guide for determining warning time requirements for traffic signal preemption requires you to input many controller unit timing and phasing values. To preserve the accuracy of these values, record all values to the next highest tenth of a second (i.e., record 5.42 seconds as 5.5 seconds).

SECTION 1: RIGHT-OF-WAY TRANSFER TIME CALCULATION

Preempt Verification and Response Time

Line 1. The **preempt delay time** is the amount of time, in seconds, that the traffic signal controller is programmed to wait from the initial receipt of a preempt call until the call is "verified" and considered a viable request for transfer into preemption mode. Preempt delay time is a value entered into the controller unit for purposes of preempt call validation, and may not be available on all manufacturer's controllers.

Line 2. Unlike preempt delay time (Line 1) which is a value entered into the controller, **controller response time to preempt** is the time that elapses while the controller unit electronically registers the preempt call (i.e., it is the controller's equipment response time for the preempt call). The controller manufacturer should be consulted to find the correct value (in seconds) for use here. For future reference, you may wish to record the controller type in the **Remarks** section to the right of the controller response time to preempt value. However, note that the manufacturer's given response time may be unique for a controller unit's model and software generation; other models and/or software generations may have different response times.

Line 3. The sum of Line 1 and Line 2 is the **preempt verification and response time**, in seconds. It represents the number of seconds between the receipt at the controller unit of a preempt call issued by the railroad's grade crossing warning equipment and the time the controller software actually begins to respond to the preempt call (i.e., by transitioning into preemption mode).

Worst-Case Conflicting Vehicle Time

Line 4. **Worst-case conflicting vehicle phase number** is the number of the controller unit phase which

conflicts with the phase(s) used to clear the tracks—the track clearance phase(s)—that has the longest sum of minimum green (if provided), other (additional) green time (if provided), yellow change interval, and red clearance interval durations that may need to be serviced during the transition into preemption. Note that all of these time elements are for vehicular phases only; pedestrian phase times will be assessed in the next part of the analysis. The worst-case vehicle phase can be any phase that conflicts with the track clearance phase(s); it is not restricted to only the phases serving traffic parallel to the tracks.

Line 5. Minimum green time during right-of-way transfer is the number of seconds that the worst-case vehicle phase (see Line 4 discussion) must display a green indication before the controller unit will terminate the phase through its yellow change and red clearance intervals and transition to the track clearance green interval. The minimum green time during right-of-way transfer may be set to zero to allow as rapid a transition as possible to the track clearance green interval. However, local policies will govern the amount of minimum green time provided during the transition into preemption.

Line 6. If any additional green time is preserved beyond the preempt minimum green time for the worst-case vehicle phase (line 4), it should be entered here as **Other green time during right-of-way transfer**. Given the time-critical nature of the transition to the track clearance green interval during preempted operation, this value is usually zero except in unusual circumstances. One situation where other green time may be present is when a trailing green overlap is used on the worst-case vehicle phase, and the controller unit is set up to time out the trailing green overlap on entry into preemption.

Line 7. Yellow change time is the required yellow change interval time for the worst-case vehicle phase (line 4) given prevailing operating conditions. Yellow change time for the phase under preemption is usually the same value, in seconds, programmed for the phase under normal operating circumstances.

Line 8. Red clearance time is the required red clearance interval for the worst-case vehicle phase (line 4) given prevailing operating conditions. Red clearance time for the phase under preemption is usually the same value, in seconds, programmed for the phase under normal operating circumstances.

Line 9. Worst-case conflicting vehicle time is the sum of lines 5 through 8. It will be compared with the worst-case conflicting pedestrian time to determine whether vehicle or pedestrian phase times are the most critical in their impact on warning time requirements during the transition to the track clearance green interval.

Worst-case Conflicting Pedestrian Time

Line 10. Worst-case pedestrian phase number is the pedestrian phase number (referenced as the vehicle phase number that the pedestrian phase is associated with) that has the longest sum of walk time, pedestrian clearance (i.e., flashing don't walk) times, and associated vehicle clearance times that have to be provided during the transition into preemption. The worst-case pedestrian phase is not restricted to pedestrian phases running concurrently with vehicle phases that serve traffic parallel to the tracks. The vehicle phase associated with the worst-case pedestrian phase may even be one of the track clearance phases if the pedestrian phase is not serviced concurrently with the associated track clearance phase.

Line 11. Minimum walk time during right-of-way transfer (seconds) is the minimum pedestrian walk time for the worst-case pedestrian phase (line 10).

Line 12. Pedestrian clearance time during right-of-way transfer (seconds) is the clearance (i.e., flashing don't walk) time for the worst-case pedestrian phase.

Line 13. Enter a **Yellow change time** if the pedestrian clearance interval does not time simultaneously with the yellow change interval of the vehicular phase associated with your worst-case pedestrian phase; enter zero if does. Local policies will determine if this is allowed. Simultaneous timing of the pedestrian clearance interval and the yellow change interval (i.e. a zero value on line 13) allows for the most rapid transition to the track clearance green interval. If a non-zero value is entered, make sure to enter the yellow change time of the vehicular phase associated with your worst-case pedestrian phase. This value

may not be the same value you enter on Line 7, since the worst-case pedestrian phase may not be the same as the worst-case vehicular phase.

Line 14. Enter a **Red clearance time** if the pedestrian clearance interval does not time simultaneously with the red clearance interval of the vehicular phase associated with your worst-case pedestrian phase; enter zero if does. Local policies will determine if this is allowed. Also, note that not all traffic signal controllers allow simultaneous timing of the pedestrian clearance interval and the red clearance interval. Simultaneous timing of the pedestrian clearance interval and the red clearance interval (i.e. a zero value on line 14) allows for the most rapid transition to the track clearance green interval. If a non-zero value is entered, make sure to enter the red clearance time of the vehicular phase associated with your worst-case pedestrian phase. This value may not be the same value you enter on Line 8, since the worst-case pedestrian phase may not be the same as the worst-case vehicular phase.

Line 15. Add lines 11 through 14 to calculate the **Worst -case conflicting pedestrian time**. This value will be compared to the worst-case conflicting vehicle time to determine whether vehicle or pedestrian phase times are the most critical in their impact on warning time requirements during the transition to the track clearance green interval.

Worst-case Conflicting Vehicle or Pedestrian Time

Line 16. Record the **Worst-case conflicting vehicle or pedestrian time** (in seconds) by comparing lines 9 and 15 and writing the larger of the two as the entry for line 16.

Line 17. Calculate the **Right-of-way transfer time** by adding lines 3 and 16. The right-of-way transfer time is the maximum amount of time needed for the worst case condition, prior to display of the track clearance green interval.

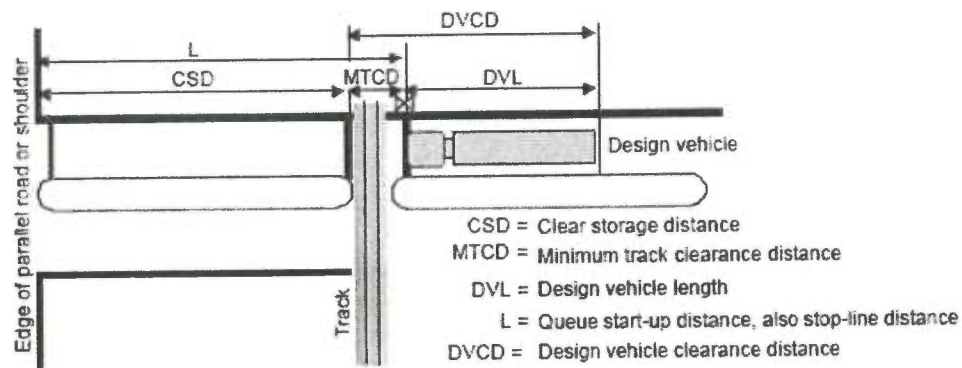


Figure 1 Queue clearance distances.

SECTION 2: QUEUE CLEARANCE TIME CALCULATION

Line 18. Record the **Clear storage distance** (CSD in Figure 1), in feet, as the shortest distance along the crossing street between the edge of the grade crossing nearest the signalized intersection—identified by a line parallel to the rail 6 feet (2 m) from the rail nearest to the intersection—and the edge of the street or shoulder of street that parallels the tracks. If the normal stopping point on the crossing street is significant different from the edge or shoulder of parallel street, measure the distance to the normal stopping point. For angled (i.e., non-perpendicular) railroad crossings, always measure the distance along the inside (centerline) edge of the leftmost lane or the distance along the outside (shoulder) edge of the rightmost lane, as appropriate, to determine the shortest clear storage distance and record that value.

Line 19. **Minimum track clearance distance** (MTCD in Figure 1), in feet, is the length along the highway

at one or more railroad tracks, measured from the railroad crossing stop line, warning device, or 12 feet (4 m) perpendicular to the track centerline—whichever is further away from the tracks, to 6 feet (2 m) beyond the tracks measured perpendicular to the far rail. For angled (i.e., non-perpendicular) railroad crossings, always measure the distance along the inside (centerline) edge of the leftmost lane or the distance along the outside (shoulder) edge of the rightmost lane, as appropriate, to determine the longest minimum track clearance distance and record that value.

Line 20. Design vehicle length (DVL in Figure 1), in feet, is the length of the design vehicle, the longest vehicle permitted by road authority statute on the subject roadway. In the **Remarks** section to the right of the data entry box for Line 20, note the design vehicle type for ease of reference. Some design vehicles from the *AASHTO Green Book (A Policy on Geometric Design of Highways and Streets)* are given in Table 1.

Table 1. AASHTO Design vehicle lengths and heights.

Design Vehicle Type	Symbol	Length (ft)
Passenger Car	P	19
Single Unit Truck	SU	30
Large School Bus	S-BUS 40	40
Intermediate Semi-Trailer	WB-50	55

Line 21. Queue start-up distance (L in Figure 1), in feet, is the maximum length over which a queue of vehicles stopped for a red signal indication at an intersection downstream of the crossing must get in motion so that the design vehicle can move out of the railroad crossing prior to the train's arrival. Queue start-up distance is the sum of the clear storage distance (Line 18) and minimum track clearance distance (Line 19).

Line 22. Time required for the design vehicle to start moving (seconds) is the time elapsed between the start of the track clearance green interval and the time the design vehicle, which is located at the edge of the railroad crossing on the opposite side from the signalized intersection, begins to move. This elapsed time is based on a "shock wave" speed of 20 feet per second and a 2 second start-up time (the additional time for the first driver to recognize the signal is green and move his/her foot from the brake to the accelerator). The time required for the design vehicle to start moving is calculated, in seconds, as 2 plus the queue start-up distance, L (Line 21) divided by the wave speed of 20 feet per second. The time required for the design vehicle to start moving is a conservative value taking into account the worst-case vehicle mix in the queue in front of the design vehicle as well as a limited level of driver inattentiveness. This value may be overridden by local observation, but care must be taken to identify the worst-case (longest) time required for the design vehicle to start moving.

Line 23. Design vehicle clearance distance (DVCD in Figure 1) is the length, in feet, which the design vehicle must travel in order to enter and completely pass through the railroad crossing's minimum track clearance distance (MTCD). It is the sum of the minimum track clearance distance (Line 19) and the design vehicle's length (Line 20).

Line 24. The Time for design vehicle to accelerate through the design vehicle clearance distance (DVCD) is the amount of time required for the design vehicle to accelerate from a stop and travel the complete design vehicle clearance distance. This time value, in seconds, can be found through local observation or by using by Figure 2. If local observation is used, take care to identify the worst-case (longest) time required for the design vehicle to accelerate through the DVCD. If Figure 2 is used to estimate the time for the design vehicle to accelerate through the DVCD, locate the DVCD from Line 23 on the horizontal axis of Figure 2 and then draw a line straight up until that line intersects the acceleration time performance curve for your design vehicle. Then, draw a horizontal line from this point to the left until it intersects the vertical axis, and record the appropriate acceleration time. Round up to the next higher tenth of a second. For example, with a DVCD of 80 feet and a WB-50 semi-trailer design vehicle on a level surface, the time required for the design vehicle to accelerate through the DVCD will be 12.2 seconds.

If your design vehicle is a WB-50 semi-trailer, large school bus (S-BUS 40), or single unit (SU) vehicle, you may need to apply a correction factor to estimate the effect of grade on the acceleration of the vehicle. Determine the average grade over a distance equal to the design vehicle clearance distance

(DVCD), centered around the minimum track clearance distance (MTCD). If the grade is 1% uphill (+1%) or greater, multiply the acceleration time obtained from Figure 2 with the factor obtained from Table 2 and round up to the next higher tenth of a second to get an estimate of the acceleration time on the grade. For example, with a DVCD of 80 feet and a WB-50 semi-trailer design vehicle on a 4% uphill, the (interpolated) factor from Table 2 is 1.30. Therefore, the estimated time required for the design vehicle to accelerate through the DVCD will be $12.2 \times 1.30 = 15.86$ seconds, or 15.9 seconds rounded up to the next higher tenth of a second.

If you selected a design vehicle different from those listed in Figure 2 and Table 2, you may still be able to use Figure 2 and Table 2 if you can match your design vehicle to the weight, weight-to-power ratio, and power application characteristics of the design vehicles in Figure 2 and Table 2. The WB-50 curve and grade factors are based on an 80,000 lb vehicle with a weight-to-power ratio of 400 lb/hp accelerating at 85% of its maximum power on level grades and at 100% of its maximum power on uphill grades, and may therefore be representative of any heavy tractor-trailer combination with the same characteristics. The school bus curve and grade factors are based on a 27,000 lb vehicle with a weight-to-power ratio of 180 lb/hp accelerating at 70% of its maximum power on level grades and at 85% of its maximum power on uphill grades. The SU curve and grade factors are based on a 34,000 lb vehicle with a weight-to-power ratio of 200 lb/hp accelerating at 75% of its maximum power on level grades and at 90% of its maximum power on uphill grades.

Table 2. Factors to account for slower acceleration on uphill grades. Multiply the appropriate factor (depending on the design vehicle, grade, and acceleration distance) with the acceleration time in Figure 2 to obtain the estimated acceleration time on the grade.

Acceleration Distance (ft)	Design Vehicle and Percentage Uphill Grade														
	Single Unit Truck (SU)				Large School Bus (S-BUS 40)					Intermediate Tractor-Trailer (WB-50)					
	0-2%	4%	6%	8%	0-1%	2%	4%	6%	8%	0%	2%	4%	6%	8%	
25	1.00	1.06	1.13	1.19	1.00	1.01	1.10	1.19	1.28	1.00	1.09	1.27	1.42	1.55	
50	1.00	1.09	1.17	1.25	1.00	1.01	1.12	1.21	1.30	1.00	1.10	1.28	1.44	1.58	
75	1.00	1.10	1.19	1.29	1.00	1.02	1.13	1.23	1.33	1.00	1.11	1.30	1.47	1.61	
100	1.00	1.11	1.21	1.32	1.00	1.02	1.14	1.25	1.35	1.00	1.11	1.31	1.48	1.64	
125	1.00	1.12	1.23	1.34	1.00	1.03	1.15	1.26	1.37	1.00	1.12	1.32	1.50	1.66	
150	1.00	1.12	1.24	1.37	1.00	1.03	1.16	1.28	1.40	1.00	1.12	1.33	1.52	1.68	
175	1.00	1.13	1.25	1.38	1.00	1.03	1.17	1.29	1.42	1.00	1.12	1.34	1.53	1.70	
200	1.00	1.13	1.26	1.40	1.00	1.04	1.17	1.30	1.43	1.00	1.13	1.35	1.54	1.72	
225	1.00	1.14	1.27	1.42	1.00	1.04	1.18	1.32	1.45	1.00	1.13	1.35	1.56	1.74	
250	1.00	1.14	1.28	1.43	1.00	1.04	1.19	1.33	1.47	1.00	1.13	1.36	1.57	1.76	
275	1.00	1.14	1.29	1.44	1.00	1.05	1.20	1.34	1.49	1.00	1.14	1.37	1.58	1.77	
300	1.00	1.14	1.30	1.46	1.00	1.05	1.20	1.35	1.50	1.00	1.14	1.37	1.59	1.79	
325	1.00	1.15	1.30	1.47	1.00	1.05	1.21	1.36	1.52	1.00	1.14	1.38	1.60	1.81	
350	1.00	1.15	1.31	1.48	1.00	1.05	1.22	1.37	1.54	1.00	1.15	1.39	1.61	1.82	
375	1.00	1.15	1.31	1.49	1.00	1.06	1.22	1.38	1.55	1.00	1.15	1.39	1.62	1.84	
400	1.00	1.15	1.32	1.50	1.00	1.06	1.23	1.40	1.57	1.00	1.15	1.40	1.63	1.85	

For design vehicle clearance distances greater than 400 feet, use Equation 1 to estimate the time for the design vehicle to accelerate through the design vehicle clearance distance or any other distance:

$$T = e^{\left[a - b \sqrt{c + \frac{2}{b} \ln \left(\frac{d}{X} \right)} \right]} \quad (1)$$

where

- T = time to accelerate through distance X, in seconds;
- X = distance over which acceleration takes place, in feet;
- ln = natural logarithm function;
- e = 2.71828, the base of natural logarithms; and
- a, b, c, and d = calibration parameters from Table 3.

Note: To interpolate between grades, do not interpolate the parameters in Table 3. The correct way to interpolate is to calculate the acceleration time T using Equation 1 for the two nearest grades and then interpolate between the two acceleration times.

Line 25. Queue clearance time is the total amount of time required (after the signal has turned green for the approach crossing the tracks) to begin moving a queue of vehicles through the queue start-up distance (L, Line 21) and then move the design vehicle from a stopped position at the far side of the crossing completely through the minimum track clearance distance (MTCD, Line 19). This value is the sum of the time required for design vehicle to start moving (Line 22) and the time for design vehicle to accelerate through the design vehicle clearance distance (Line 24).

Table 3. Parameters to estimate vehicle acceleration times over distances greater than 400 feet using Equation 1.

Design Vehicle	Grade	a	b	c	d
Through Passenger Car	Level	7.75	3.252	5.679	2.153
Left Turning Passenger Car	Level	10.29	5.832	3.114	5.090
Single Unit Truck (SU)	Level to 2%	8.16	3.624	5.070	2.018
	4%	10.39	4.865	4.560	1.739
	6%	9.52	4.542	4.393	1.700
	8%	9.38	4.597	4.165	1.668
Large School Bus (S-BUS 40)	Level to 1%	10.02	4.108	5.95	0.885
	2%	11.51	5.254	4.801	1.300
	4%	10.79	5.042	4.577	1.266
	6%	10.61	5.101	4.329	1.253
Intermediate Semi-Trailer (WB-50)	8%	11.84	6.198	3.652	1.554
	Level	17.75	7.984	4.940	0.481
	2%	10.26	4.026	6.500	0.249
	4%	9.39	3.635	6.670	0.193
	6%	9.38	3.732	6.310	0.188
	8%	10.31	4.515	5.219	0.265

SECTION 3: MAXIMUM PREEMPTION TIME CALCULATION

Line 26. Right-of-way transfer time, in seconds, recorded on Line 17. The right-of-way transfer time is the maximum amount of time needed for the worst case condition, prior to display of the track clearance green interval.

Line 27. Queue clearance time, in seconds, recorded on Line 25. Queue clearance time starts simultaneously with the track clearance green interval (i.e. after right-of-way transfer), and is the time required for the design vehicle stopped just inside the minimum track clearance distance to start up and move completely out of the minimum track clearance distance.

Line 28. Desired minimum separation time is a time "buffer" between the departure of the last vehicle (the design vehicle) from the railroad crossing (as defined by the minimum track clearance distance) and the arrival of the train. Separation time is added for safety reasons and to avoid driver discomfort. If no separation time is provided, a vehicle could potentially leave the crossing at exactly the same time the train arrives, which would certainly lead to severe driver discomfort and potential unsafe behavior. The recommended value of four (4) seconds is based on the minimum recommended value found in the Institute of Transportation Engineer's *ITE Journal* (in an article by Marshall and Berg in February 1997).

Line 29. Maximum preemption time is the total amount of time required after the preempt is initiated by the railroad warning equipment to complete right-of-way transfer to the track clearance green interval, initiate the track clearance phase(s), move the design vehicle out of the crossing's minimum track

clearance distance, and provide a separation time “buffer” before the train arrives at the crossing. It is the sum of the right-of-way transfer time (Line 26), the queue clearance time (Line 27), and the desired minimum separation time (Line 28).

SECTION 4: SUFFICIENT WARNING TIME CHECK

Line 30. Minimum time (seconds) is the least amount of time active warning devices shall operate prior to the arrival of a train at a highway-rail grade crossing.

Line 31. Clearance time (seconds), typically known as CT, is the additional time that may be provided by the railroad to account for longer crossing time at wide (i.e., multi-track crossings) or skewed-angle crossings. You must obtain the clearance time from the railroad responsible for the railroad crossing. In cases where the minimum track clearance distance (Line 19) exceeds 35 feet, the railroads’ *AREMA Manual* requires clearance time of one second be provided for each additional 10 feet, or portions thereof, over 35 feet. Additional clearance time may also be provided to account for site-specific needs. Examples of extra clearance time include cases where additional time is provided for simultaneous preemption (where the preemption notification is sent to the signal controller unit simultaneously with the activation of the railroad crossing’s active warning devices), instead of providing advance preemption time.

Line 32. Minimum warning time (seconds) is the sum of the minimum time (Line 30) and the clearance time (Line 31). This value is the actual minimum time that active warning devices can be expected to operate at the crossing prior to the arrival of the train under normal, through-train conditions. The term “through-train” refers to the case where trains do not stop or start moving while near or at the crossing. Note that the minimum warning time, does not include buffer time (BT). Buffer time is added by the railroad to ensure that the minimum warning time is always provided despite inherent variations in warning times; however, it is not consistently provided and cannot be relied upon by the traffic engineer for signal preemption and/or warning time calculations.

Line 33. Advance preemption time (seconds), if provided, is the period of time that the notification of an approaching train is forwarded to the highway traffic signal controller unit or assembly prior to activating the railroad active warning devices. Only enter advance preemption time if you can verify from the railroad that advance preemption time is already being provided for your site. If you are determining whether or not you need advance preemption time, enter zero for the advance preemption time in Line 33.

Line 34. Warning time provided by the railroad is the sum of the minimum warning time (Line 32) and the advance preemption time (Line 33), in seconds. This value should be verified with the railroad, and should not include buffer time (BT).

Line 35. Additional warning time required from railroad is the additional time needed (if any), in seconds, that is required to provide safe preemption in the worst case (the maximum preemption time on Line 29), given the warning time provided by the railroad (Line 34). The additional warning time required is calculated by subtracting the warning time provided by the railroad (Line 34) from the maximum preemption time (Line 29). If the result of the subtraction is equal to or less than zero, it means that sufficient warning time is available, and you should enter zero (0) on Line 35. However, keep in mind that highly negative (-10 or less) subtraction results may indicate the potential for operational problems due to insufficient track clearance green time. Section 5 of the worksheet contains a methodology for calculating sufficient track clearance green time.

If the additional warning time is greater than zero (0), it means that the warning time provided by the railroad is insufficient, and additional warning time has to be requested from the railroad to ensure safe operation. The railroad can provide additional warning time either by providing additional clearance time (CT) (Line 30), or by providing or increasing advance preemption time (Line 33).

As an alternative, it may be possible to reduce the maximum preemption time (Line 29). To reduce the maximum preemption time, you can reduce either the preempt delay time (Line 1), if this is possible; reduce preempt minimum green time (Line 5) or other green time (Line 6), as long as you do not violate

local policies for signal timing; or, reduce yellow change time (Line 7) or red clearance time (Line 8) as long as adequate and appropriate yellow change and red clearance intervals are provided.

If pedestrian rather than vehicular phasing controls warning time requirements for preemption, it may be possible to reduce the minimum walk time (Line 11) and/or pedestrian clearance time (Line 12) as long as you do not violate local policies for signal timing. You can also let the pedestrian clearance time (flashing don't walk) time simultaneous with vehicular yellow change and red clearance and so reduce the values on Line 13 (yellow change time) and Line 14 (red clearance time) to zero (0). If local policies do not currently allow simultaneous clearance for pedestrian and vehicular phasing, you may want to consider allowing this type of operation to reduce your worst-case conflicting pedestrian time. Once you have made all of the possible adjustments to the warning time, recompute the totals in Lines 3, 9, 15, 16, 17, 26, 29, and 35. If Line 35 remains greater than zero, then you will have to request additional warning time from the railroad, as described above, to ensure safe preemption of the adjacent signalized intersection.

SECTION 5: TRACK CLEARANCE GREEN TIME CALCULATION (OPTIONAL)

Note: This section is optional and is used to calculate the duration of the track clearance green interval. If this worksheet is only used to determine if additional warning time has to be requested from the railroad, this section need not be completed. The objective of the section is to calculate the duration of the track clearance green interval to ensure safe and efficient operations at the crossing and adjacent traffic signal.

The Preempt Trap Check section (lines 36 to 44) focuses on safety by calculating the minimum duration of the track clearance green interval to ensure that the track clearance green does not terminate before the gates block access to the crossing. If the gates do not block access to the crossing before the expiration of the track clearance green, it is possible that vehicles can continue to cross the tracks and possibly stop on the tracks. However, the track clearance green interval has already expired and there will be no further opportunity to clear. This potentially hazardous condition is called the "preempt trap".

The Clearing of Clear Storage Distance section (lines 45 to 50) focuses on efficiency by calculating duration of the track clearance green interval that is needed to clear the clear storage distance (CSD in Figure 1), or a specific portion thereof.

Preempt Trap Check

Line 36. Advance preemption time provided is the duration (in seconds) the preempt sequence is active in the highway traffic signal controller before the activation of the railroad active warning devices. If Line 35 is zero (i.e. no additional warning time is required from the railroad), the value on Line 33 can be used. In other cases, use the actual value of the advance preemption time (APT) provided by the railroad. If no APT is provided, enter zero on Line 36.

Line 37. Multiplier for maximum APT due to train handling is a value that relates the maximum duration of the advance preemption time (APT) to the minimum value guaranteed by the railroad. Although the railroad guarantees a minimum duration for the APT, it is probable that in most cases the actual duration of the APT will be longer than the guaranteed duration. This variability in APT occurs due to "train handling", which is a term that describes the acceleration and deceleration of trains on their approach to the crossing. If a train accelerates or decelerates while approaching to the crossing, the railroad warning system cannot estimate the arrival time of the train at the crossing accurately, resulting in variation in the actual duration of APT provided. This variation needs to be taken into account to ensure safe operation.

To make sure that the preempt trap does not occur we need to determine the maximum value of the APT so that a sufficiently long track clearance green interval can be provided to ensure that the gates block access to the crossing before the track clearance green ends. The maximum APT can be estimated by multiplying the advance preemption time provided (and guaranteed) by the railroad (Line 36) with the multiplier for maximum APT due to train handling. This value is only significant if the value for APT on Line 36 is non-zero. If APT is zero, continue to line 38.

In the case where APT is provided, the difference between the minimum and maximum values of APT is termed excess APT. Excess APT usually occurs when the train decelerates on the approach to the crossing, or where train handling affects the accuracy of the estimated time of train arrival at the crossing so that the preempt sequence is activated earlier than expected. The amount of excess APT is increased by the following conditions:

- Increased variation in train speeds, since more trains will be speeding up and slowing down;
- Lower train speeds, since a fixed deceleration rate has a greater effect on travel time at low speeds than at higher speeds; and
- Longer warning times, because more time is available for the train to decelerate on the approach to the crossing.

The multiplier for maximum APT can be determined from field measurements as the largest advance preemption time observed (or the 95th percentile, if enough observations are available) divided by the value on Line 36. If no field observations are available, the multiplier for maximum APT can be estimated as 1.60 if warning time variability is high or 1.25 if warning time variability is low. High warning time variability can typically be expected in the vicinity of switching yards, branch lines, or anywhere low-speed switching maneuvers takes place. According to Section 16.30.10 of the *AREMA Signal Manual* the railroad can provide a “timer for constant time between APT and CWT.” The effect of such a “not to exceed” timer is to eliminate excess APT, and if provided, the multiplier on Line 37 can be set to 1.0.

Line 38. Maximum APT is largest value (in seconds) of the advance preemption time that can typically be expected, which corresponds to the earliest possible time the preemption sequence in the traffic signal controller will be activated before the activation of the railroad grade crossing warning system (flashing lights and gates). It is calculated by multiplying the APT provided by the railroad (Line 36) with the multiplier for maximum APT due to train handling (Line 37).

Line 39. Minimum duration for the track clearance green is the minimum duration (in seconds) of the track clearance green interval to ensure that the gates block access to the crossing before the track clearance green expires in the case where no advance preemption time is provided. It is necessary to block access to the crossing before the track clearance green expires to ensure that vehicles do not enter the crossing after the expiration of the track clearance green and so be subject to the preempt trap (described in the introduction to Section 5). The 15 seconds minimum duration for the track clearance green interval is calculated from federal regulations and requirements.

Line 40. Gates down after start of preemption is the maximum duration (in seconds) from when the preempt is activated in the highway traffic signal controller until the gates reach a horizontal position. Calculate this value by adding the maximum advance preemption time on Line 38 to the minimum duration for the track clearance green interval on Line 39.

Line 41. Preempt verification and response time, recorded on Line 3, is the number of seconds between the receipt at the controller unit of a preempt call issued by the railroad’s grade crossing warning equipment and the time the controller software actually begins to respond to the preempt call.

Line 42. Best-case conflicting vehicle or pedestrian time (in seconds) is the minimum time from when the preempt starts to time in the controller (i.e. after verification and response) until the track clearance green interval can start timing. In most cases, this value is zero, since the controller may already be in the track clearance phase(s) when the preempt starts timing, and therefore the track clearance green interval can start timing immediately. The best-case conflicting vehicle or pedestrian time may be greater than zero if the track clearance green interval contains phases that are not in normal operation (and conflicts with the normal phases), or where another phase or interval always has to terminate before the track clearance green interval can start timing.

Line 43. Minimum right-of-way transfer time is the minimum amount of time needed for the best case condition, prior to display of the track clearance green interval. Calculate the minimum right -of-way transfer time by adding lines 41 and 42.

Line 44. Calculate the **Minimum track clearance green time** by subtracting Line 43 from Line 40. This yields the minimum time that the track clearance green interval has to be active to avoid the preempt trap.

Clearing of Clear Storage Distance

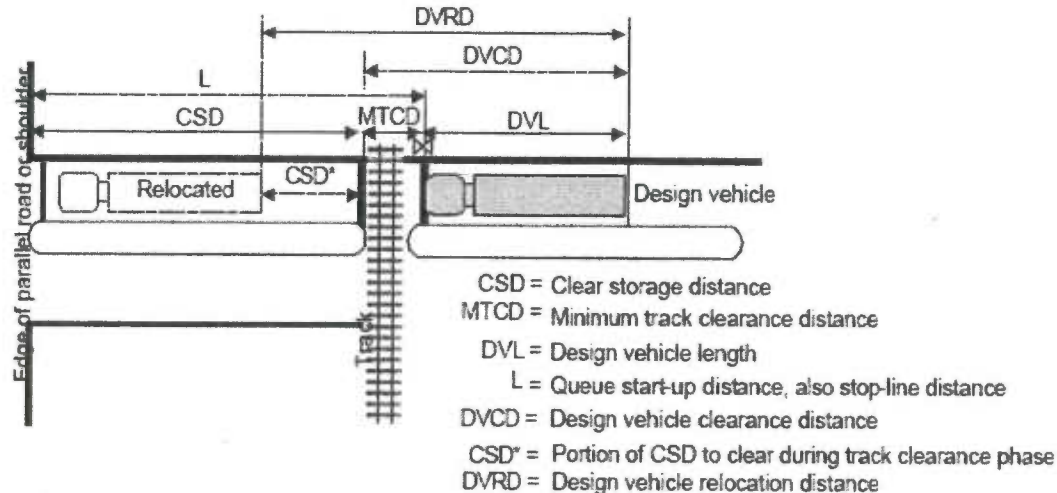


Figure 3 Relocation distances during the track clearance green interval.

Line 45. Time required for design vehicle to start moving, recorded on Line 22, is the number of seconds that elapses between the start of the track clearance green interval and the time the design vehicle, which is located at the edge of the railroad crossing on the opposite side from the signalized intersection, begins to move.

Line 46. Design vehicle clearance distance (DVCD in Figure 3) is the length, in feet, which the design vehicle must travel in order to enter and completely pass through the railroad crossing's minimum track clearance distance (MTCD). This is the same value as recorded on Line 23.

Line 47. Portion of CSD to clear during track clearance, (CSD* in Figure 3) is the portion of the clear storage distance (CSD), in feet, that must be cleared of vehicles before the track clearance green interval ends. For intersections with a CSD greater than approximately 150 feet it is desirable—but not necessary—to clear the full CSD during the track clearance green interval. In other words, it is desirable to set Line 47 to the full value of CSD (Line 18). If the full CSD is not cleared, however, vehicles will be stopped in the CSD during the preempt dwell period, and if not serviced during the preempt dwell period, will be subject to unnecessary delays which may result in unsafe behavior. For CSD values less than 150 feet the full CSD is typically cleared to avoid the driver task of crossing the tracks followed immediately by the decision to stop or go when presented by a yellow signal as the track clearance green interval terminates.

Line 48. Design vehicle relocation distance (DVRD in Figure 3) is the distance, in feet, that the design vehicle must accelerate through during the track clearance green interval. It is the sum of the design vehicle clearance distance (Line 46) and the portion of CSD to clear during the track clearance green interval (Line 47).

Line 49. The Time required for design vehicle to accelerate through DVRD is the amount of time required for the design vehicle to accelerate from a stop and travel the complete design vehicle relocation distance (DVRD). This time value, in seconds, can be found by locating your design vehicle relocation distance from Line 48 on the horizontal axis of Figure 2 and then drawing a line straight up until that line intersects the acceleration time performance curve for your design vehicle. For a WB-50 semi-trailer, large school bus (S -BUS 40), or single unit (SU) vehicle, multiply the acceleration time with a correction factor obtained from Table 2 to estimate the effect of grade on the acceleration of the vehicle. Use the average grade over the design vehicle relocation distance. For design vehicle relocation distances greater than 400 feet, use Equation 1 with the appropriate parameters listed in Table 3.

Line 50. Time to clear portion of clear storage distance, in seconds, is the total amount of time

required (after the signal has turned green for the approach crossing the tracks) to begin moving a queue of vehicles through the queue start-up distance (L in Figure 3) and then move the design vehicle from a stopped position at the far side of the crossing completely through the portion of clear storage distance that must be cleared (CSD* in Figure 3). This value is the sum of the time required for design vehicle to start moving (Line 45) and the time for the design vehicle to accelerate through the design vehicle relocation distance, DVRD (Line 49).

Line 51. The Track clearance green interval is the time required, in seconds, for the track clearance green interval to avoid the occurrence of the preempt trap and to provide enough time for the design vehicle to clear the portion of the clear storage distance specified on Line 47. The track clearance green interval time is the maximum of the minimum track clearance green time (Line 44) and the time required to clear a portion of clear storage distance (Line 50).

SECTION 6: VEHICLE-GATE INTERACTION CHECK (OPTIONAL)

Note: This section is optional and is used to calculate the required advance preemption time to avoid the automatic gates descending on a stationary or slow moving design vehicle as it moves through the minimum track clearance distance (MT CD). If this worksheet is only used to determine if additional warning time has to be requested from the railroad to ensure that vehicles have enough time to clear the crossing before the arrival of the train, this section need not be completed.

Line 52. Right-of-way transfer time, in seconds, recorded on Line 17, is the maximum amount of time needed for the worst case condition, prior to display of the track clearance green interval.

Line 53. Time required for design vehicle to start moving, recorded on Line 22, is the time (in seconds) elapsed between the start of the track clearance green interval and the time the design vehicle, which is located at the edge of the railroad crossing on the opposite side from the signalized intersection, begins to move.

Line 54. Time required for design vehicle to accelerate through the design vehicle length, DVL, is the time required for the design vehicle to accelerate through its own length. The design vehicle length is recorded on Line 20. This time value, in seconds, can be read from Figure 2 and Table 2 or looked up in Table 4 for standard design vehicles. For a WB-50 semi-trailer, large school bus, or single unit (SU) truck use the average grade over the design vehicle length at the far side of the crossing.

Line 55. Time required for design vehicle to clear the descending gates, in seconds, is the sum of the right-of-way transfer time on Line 52, the time required for design vehicle to start moving on Line 53, and the time required for design vehicle to accelerate through the design vehicle length on Line 54.

Line 56. Duration of flashing lights before gate descent start, in seconds, is the time the railroad warning lights flash before the gates start to descend. This value typically ranges from 3 to 5 seconds and must be obtained from the railroad. The value obtained from the railroad may be verified using field observation.

Table 4. Time required for the design vehicle to accelerate through the design vehicle length.

Design Vehicle	Design Vehicle Length (feet)	Grade	Acceleration Time (seconds)
Through Passenger Car	19	Level	2.6
Left Turning Passenger Car	19	Level	2.7
Single Unit Truck (SU)	30	Level to 2%	3.8
		4%	4.0
		6%	4.3
		8%	4.6
Large School Bus (S-BUS 40)	40	Level to 1%	5.5
		2%	5.5
		4%	6.1
		6%	6.6
Intermediate Semi-Trailer (WB-50)	55	8%	7.0
		Level	10.0
		2%	11.0
		4%	12.8
		6%	14.4
		8%	15.8

Line 55. Time required for design vehicle to clear the descending gates, in seconds, is the sum of the right-of-way transfer time on Line 52, the time required for design vehicle to start moving on Line 53, and the time required for design vehicle to accelerate through the design vehicle length on Line 54.

Line 56. Duration of flashing lights before gate descent start, in seconds, is the time the railroad warning lights flash before the gates start to descend. This value typically ranges from 3 to 5 seconds and must be obtained from the railroad. The value obtained from the railroad may be verified using field observation.

Line 57. Full gate descent time, in seconds, is the time it takes for the gates to descend to a horizontal position after they start their descent. This value must be obtained from the railroad and may be verified using field observation. In the case where multiple gates descend at different speeds, use the descent time of the gate that reaches the horizontal position first.

Line 58. The Proportion of non-interaction gate descent time is the decimal proportion of the full gate descent time on Line 57 during which the gate will not interact with (i.e. not hit) the design vehicle if it is located under the gate. This value depends on the design vehicle height, h , and the distance from the center of the gate mechanism to the nearest side of the design vehicle, d , as shown in Figure 4. Figure 5 can be used to determine the proportion of non-interaction gate descent time. Select the distance from the center of the gate mechanism to the nearest side of the design vehicle, d , on the vertical axis of Figure 5, draw a horizontal line until you reach the curve that represents the design vehicle, and then draw a vertical line down to the horizontal axis and read off the value of the proportion of non-interaction gate descent time.

Line 59. Non-interaction gate descent time is time (in seconds) during gate descent that the gate will not interact with (i.e. not hit) the design vehicle if it is located under the gate. In other words, it is the time that expires after the gate starts to descend until it hits the design vehicle if it is located under the gate. This value is calculated by multiplying the full gate descent time on Line 57 with the proportion of non-interaction gate descent time on Line 58.

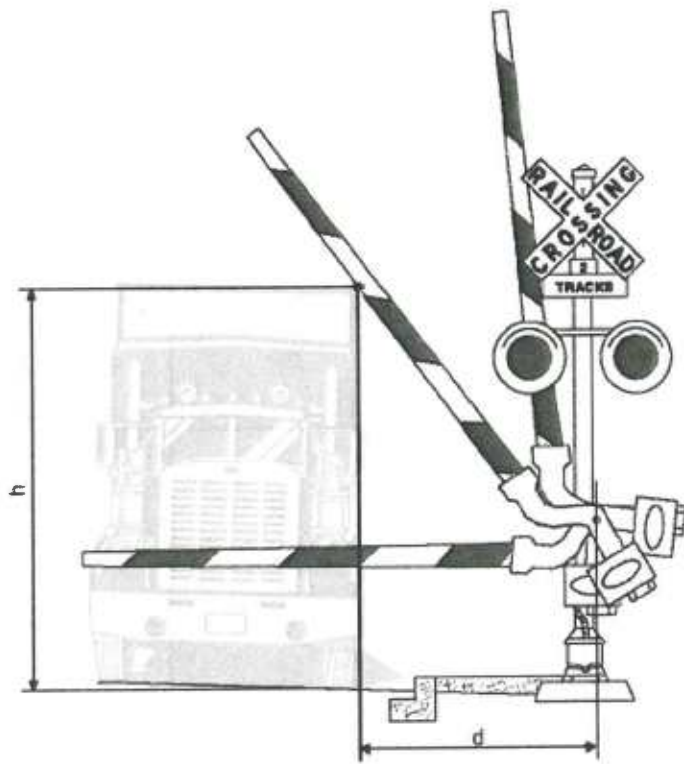


Figure 4 Gate interaction with the design vehicle.

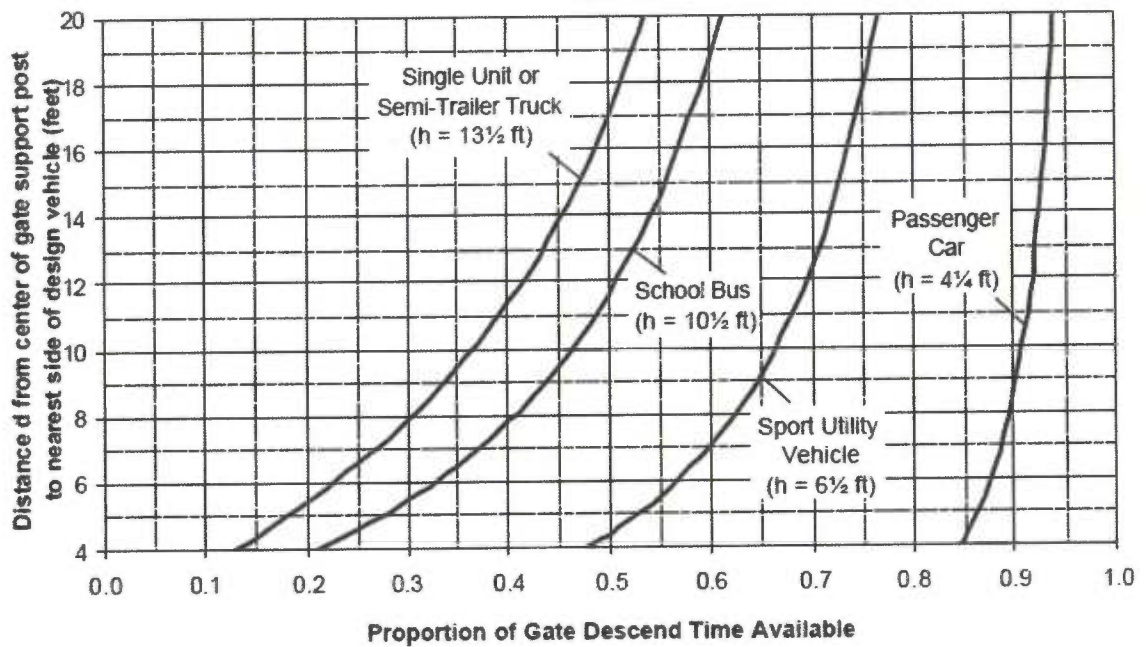


Figure 5 Proportion of gate descent time available as a function of the design vehicle height and the distance from the center of the gate mechanism to the nearest side of the design vehicle.

Line 60. Time available for design vehicle to clear descending gate, in seconds, is the time, after the railroad warning lights start to flash, that is available for the design vehicle to clear the descending gate before the gate hits the vehicle. It is the sum of the duration of the flashing lights before gate descent start (Line 56) and the non-interaction gate descent time (Line 59).

Line 61. Advance preemption time required to avoid design vehicle-gate interaction, in seconds, is calculated by subtracting the time available for the design vehicle to clear descending gate (Line 60) from the time required for the design vehicle to clear descending gate (Line 55). The result is the amount of advance preemption time that is required to avoid the gates descending on a stationary or slow-moving design vehicle. If the result of the subtraction is equal to or less than zero, it means that sufficient time is available, and you should enter zero (0) on Line 61. If the result is greater than the amount of advance preemption time provided by the railroad, as given on Line 36, there is a possibility that the gates could descend on a stationary or slow-moving design vehicle. To avoid this situation, additional advance preemption time should be requested from the railroad.

It should be kept in mind that on its own, gates descending on a vehicle is not a critical safety failure, because enough time still exists to clear the crossing before the arrival of the train, if the advance preemption time on Line 36 is provided. Therefore, local policies may vary on whether additional advance preemption time (over and above that on Line 36) should be requested solely for the purpose of prohibiting gates descending on vehicles.

If additional advance preemption time is provided to avoid design vehicle-gate interaction, Line 33 of this Worksheet has to be updated, and Lines 34 and 35 recomputed. Section 5 also needs to be recomputed to calculate the track clearance green time.



Environmental Services
Resource Enhancement & Permitting Division

SEPA Exemption Worksheet

Environmental Permitting Program



Date: 8/12/2014

Responsible Official: Heath Henderson, PE

CRP#: 323222

Permit Coordinator: Brent Davis

Project: NE 47th Ave/Ne 78th St Intersection

email: brent.davis@clark.wa.gov

This worksheet is intended for use in documenting analysis of the project specified above against the various exemptions from the requirements of SEPA. It is not to be used if SEPA is required. Under SEPA rules (WAC 197-11) only one exemption needs to be met. Note that this worksheet paraphrases much of the exemption criteria listed and does not include exemptions that generally will not apply to County capital projects. Refer to WAC and Clark County Code when making exemption determinations. Attach supporting documentation as necessary.

Categorical Exemption (WAC197-11-305 and CCC40.570.090)

Minor new construction (thresholds set under CCC 40.570.090.C)

- (a) *The exemptions in this subsection apply to all licenses required to undertake the construction in question. To be exempt under this subsection, the project must be equal to or smaller than the exempt level. For a specific proposal, the exempt level in (b) of this subsection shall control, unless the city/county in which the project is located establishes an exempt level under (c) of this subsection. If the proposal is located in more than one city/county, the lower of the agencies' adopted levels shall control, regardless of which agency is the lead agency. The exemptions in this subsection apply except when the project:*
- (i) *Is undertaken wholly or partly on lands covered by water;*
 - (ii) *Requires a license governing discharges to water that is not exempt under RCW 43.21C.0383;*
 - (iii) *Requires a license governing emissions to air that is not exempt under RCW 43.21C.0381 or WAC 197-11-800 (7) or (8);*
or
 - (iv) *Requires a land use decision that is not exempt under WAC 197-11-800(6).*

Basis: Does not apply

Other Minor new construction (WAC 197-11-800 (2))

- (a) *The exemptions in this subsection apply to all licenses required to undertake the following types of proposals except when the project:*
- (i) *Is undertaken wholly or partly on lands covered by water;*
 - (ii) *Requires a license governing discharges to water that is not exempt under RCW 43.21C.0383;*
 - (iii) *Requires a license governing emissions to air that is not exempt under RCW 43.21C.0381 or WAC 197-11-800 (7) or (8);*
or
 - (iv) *Requires a land use decision that is not exempt under WAC 197-11-800(6).*

- Basis: (b) The construction or designation of bus stops, loading zones, shelters, access facilities and pull-out lanes for taxicabs, transit and school vehicles.
- (d) The construction or installation of minor road and street improvements by any agency or private party that include:
- (i) Safety structures and equipment: Such as pavement marking, freeway surveillance and control systems, railroad protective devices (not including grade-separated crossings), grooving, glare screen, safety barriers, energy attenuators;
 - (iii) Temporary traffic controls and detours;
 - (iv) Correction of substandard curves and intersections within existing rights of way, widening of a highway by less than a single lane width where capacity is not significantly increased and no new right of way is required;
 - (vii) Installation of catch basins and culverts for the purposes of road and street improvements;
 - (viii) Reconstruction of existing roadbed (existing curb-to-curb in urban locations), including adding or widening of shoulders where capacity is not increased and no new right of way is required;
 - (ix) Addition of bicycle lanes, paths and facilities, and pedestrian walks and paths, but not including additional automobile lanes

- (2)(f) Additions or modifications to or replacement of any building or facility exempted as minor new construction when such addition, modification or replacement will not change the character of the building or facility in a way that would remove it from an exempt class.
- (2)(g) The demolition of any structure or facility, the construction of which would be exempted as minor new construction, except for structures or facilities with recognized historical significance such as listing in a historic register.
- Other: Does not apply

Repair, remodeling and maintenance activities (WAC 197-11-800 (3))

The following activities shall be categorically exempt: The repair, remodeling, maintenance, or minor alteration of existing private or public structures, facilities or equipment, including utilities, recreation, and transportation facilities involving no material expansions or changes in use beyond that previously existing; except that, where undertaken wholly or in part on lands covered by water, only minor repair or replacement of structures may be exempt (examples include repair or replacement of piling, ramps, floats, or mooring buoys, or minor repair, alteration, or maintenance of docks). The following maintenance activities shall not be considered exempt under this subsection:

- (a) *Dredging of over fifty cubic yards of material;*
- (b) *Reconstruction or maintenance of groins and similar shoreline protection structures;*
- (c) *Replacement of utility cables that must be buried under the surface of the bedlands; or*
- (d) *Repair/rebuilding of major dams, dikes, and reservoirs shall also not be considered exempt under this subsection.*

Utilities (WAC 197-11-800 (23))

The utility-related actions listed below shall be exempt, except for installation, construction, or alteration on lands covered by water. The exemption includes installation and construction, relocation when required by other governmental bodies, repair, replacement, maintenance, operation or alteration that does not change the action from an exempt class.

- Basis: (a) All communications lines, including cable TV, but not including communication towers or relay stations.
- (b) All storm water, water and sewer facilities, lines, equipment, hookups or appurtenances including, utilizing or related to lines twelve inches or less in diameter.

Other (Does not apply)

Basis: Does not apply

Statutory Exemption

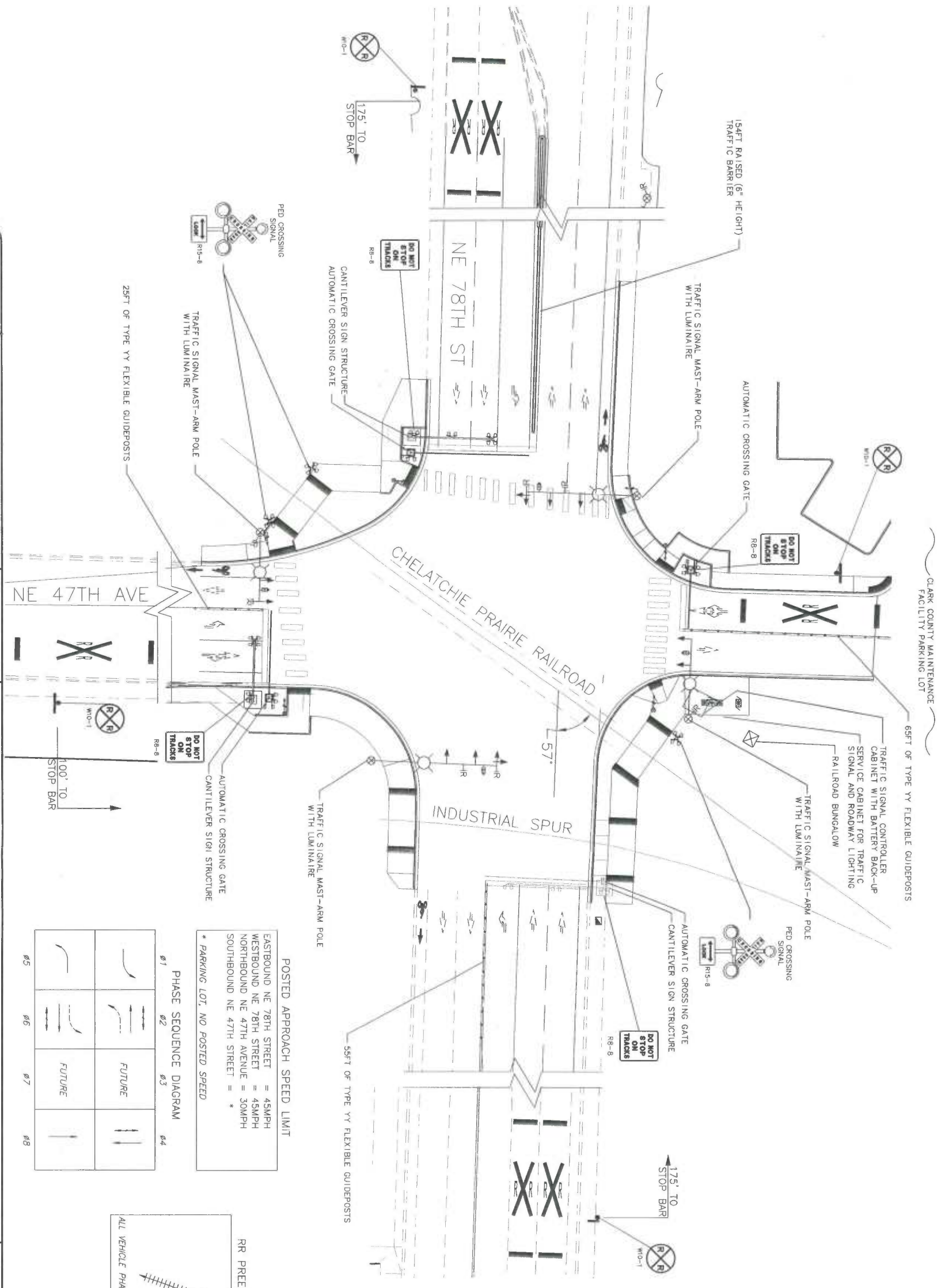
- Does not apply**
Written description

Verification that the project avoids Timber Harvest and designated Critical Areas

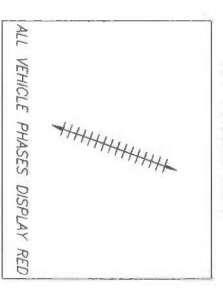
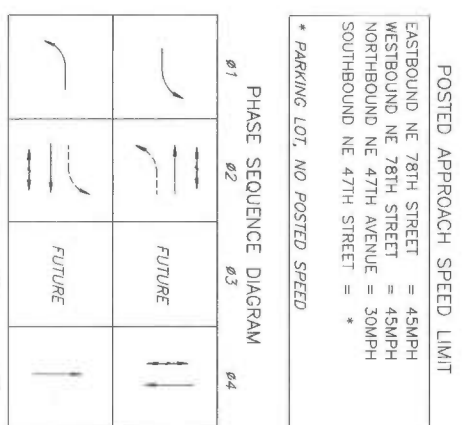
- The project is not located within any designated SEPA Critical Areas (WAC 197-11-908 and CCC 40.570.090)**
Clark County designates the following as critical areas, in which the exemptions as specified above do not apply:
- a. *Designated Shoreline Management Areas, except that SEPA review shall not be required for the exempt shoreline developments listed in Section 40.460.230(B); provided, that no part of the exempt shoreline development is undertaken on lands covered by water as defined in WAC 197-11-756. In addition, the minor repair or replacement of structures such as pilings, ramps, floats, or mooring buoys, or minor repair, alteration, or maintenance of docks that are specifically exempted within WAC 197-11-800(3) shall also be exempt from SEPA review.*
- b. *Floodplains. All areas within the Floodway Fringe as delineated by the Federal Emergency Management Agency (FEMA) under the Flood Insurance Study for Clark County are critical areas.*
- c. *Wetlands subject to the provisions of Chapter 40.450 are critical areas. However:*
- (1) *Exemptions listed in CCC 40.450.010.C shall be exempt from SEPA.*
- (2) *Other exemptions as specified above do not apply unless authorized by a Type I wetland permit under CCC 40.450.040.G.1.a.*
- The project will not require a Class IV Forest Practice application pursuant to CCC 40.260.080 (WAC 222-20-010 (7b))**

Attachments

None



CLARK COUNTY MAINTENANCE FACILITY PARKING LOT



RAILROAD TRAFFIC SIGNAL PREEMPTION

Crossing DOT Number: 852-429-T

1. Site Specific Description:
 - 1.1. Green Vehicle Clear Out Interval (VCOI) - Not Required
 - 1.2. Pedestrian Clear Out Interval (PCOI) - Not Required
 - 1.3. Limited Service Vehicle Phases - None
 - 1.4. Limited Service Pedestrian Phases - 2, 4, 6
2. The preemption sequence is as follows:
 - 2.1. When Railroad Preemption (Preemption RR Input) is initiated:
 - 2.1.1. All vehicle phases transition to solid Red display
 - 2.1.2. No change to pedestrian phase sequence
 - 2.1.3. All programmed Limited Service pedestrian phases are served in their normal sequence based on demand.
 - 2.2. After the railroad preemption inputs return to non-preempt status:
 - 2.2.1. Extended time provided for peak movement vehicle phases
 - 2.2.2. Normal operation resumes

GENERAL NOTES:
 This drawing provides a schematic representation of the traffic control and rail crossing safety elements for the at-grade, gated crossing of the NE 78th Street / NE 47th Avenue intersection. Some elements shown are Existing.

LOCATIONS OF EXISTING UTILITIES ARE APPROXIMATE AND MAY BE INCOMPLETE
 RIGHT-OF-WAY LINEWORK DISPLAYED IS REFERENCING CLARK COUNTY GIS TAXILOT INFORMATION AND SHOULD NOT BE CONSIDERED AS SURVEYED RIGHT-OF-WAY



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 "It's the Law"
 NORTHWEST NOTIFICATION CENTER

PUBLIC WORKS
 ENGINEERING & CONSTRUCTION DIVISION

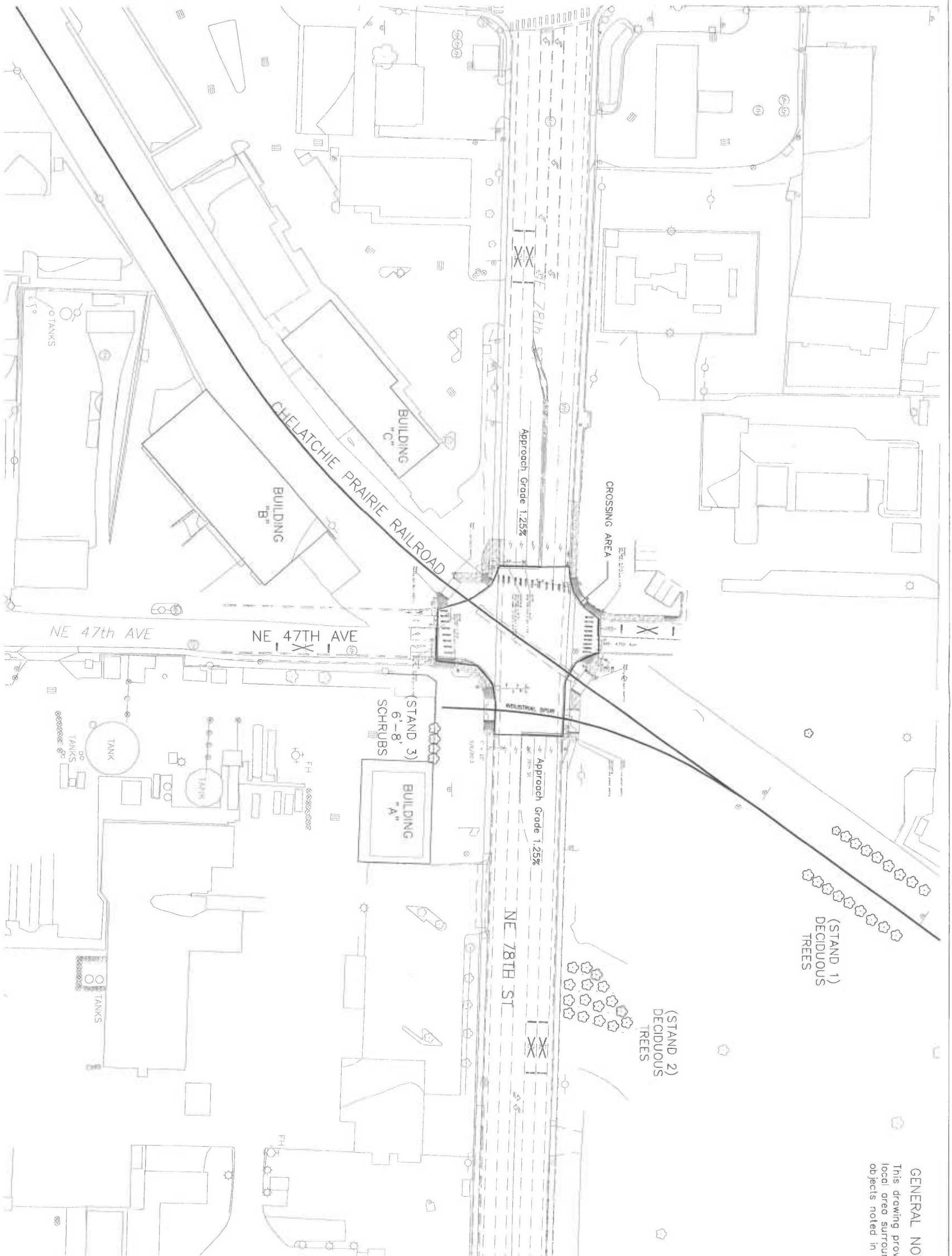
ENGINEERING AND DESIGN SECTION

NE 78th STREET at NE 47th STREET
EXHIBIT "A"
 DOT # 852-429-T

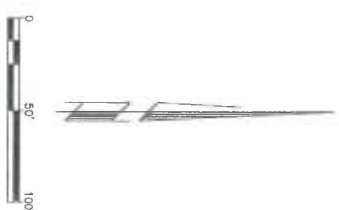
TRANSPORTATION PROGRAM

90% PRELIMINARY
 DATE 11/27/2013
 RR-A





GENERAL NOTES:
 This drawing provides a schematic representation of the local area surrounding the at-grade crossing, including objects noted in Section 8 - Sight Distance.



LOCATIONS OF EXISTING UTILITIES ARE APPROXIMATE AND MAY BE INCOMPLETE
 RIGHT-OF-WAY LINENWORK DISPLAYED IS REFERENCING CLARK COUNTY GIS TAXLOT INFORMATION AND SHOULD NOT BE CONSIDERED AS SURVEYED RIGHT-OF-WAY



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PUBLIC WORKS
 ENGINEERING & CONSTRUCTION DIVISION

ENGINEERING AND DESIGN SECTION

NE 78th STREET at NE 47TH STREET
 EXHIBIT "B"
 DOT # 852-429-T

TRANSPORTATION PROGRAM

90% PRELIMINARY

DATE 11/27/2013
 RR-A