



**Texas Department of Transportation**  
**GUIDE FOR DETERMINING TIME REQUIREMENTS FOR**  
**TRAFFIC SIGNAL PREEMPTION AT HIGHWAY-RAIL GRADE CROSSINGS**

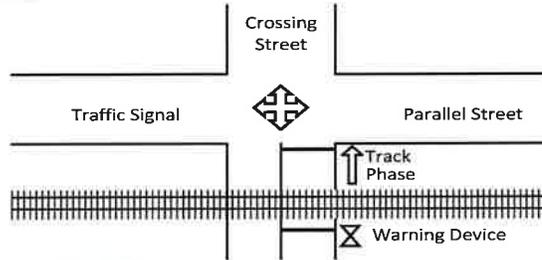
**RESET**

Form 2304  
(Rev. 7/17)

City   
 County   
 District

CSJ

Date   
 Completed by   
 District Approval



Parallel Street Name

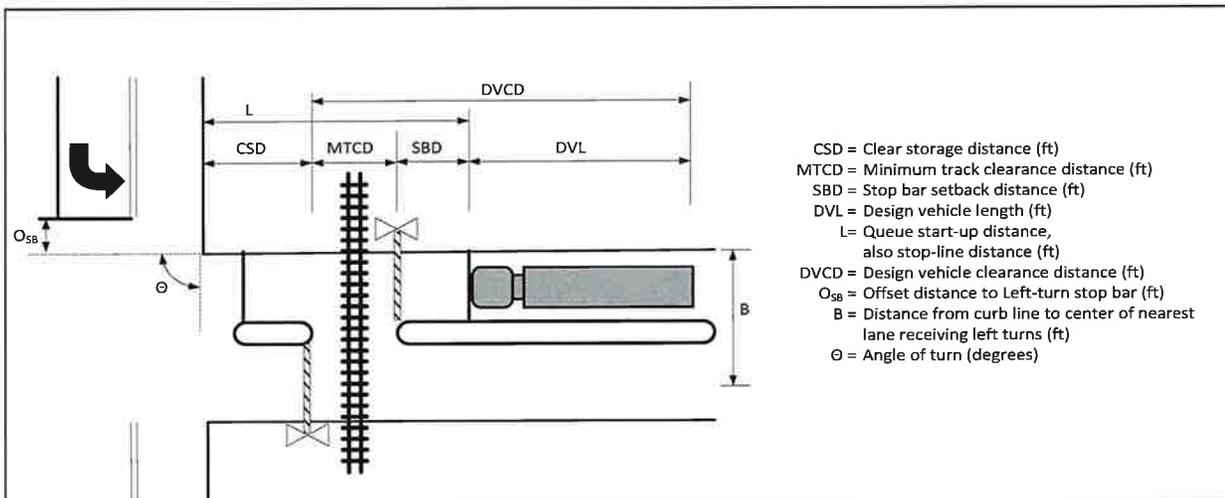
Crossing Street Name

Railroad   
 Crossing DOT#

Railroad Contact   
 Phone

**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<sub>SB</sub> = 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**

1. Clear storage distance (CSD, feet) .....	1.	<input type="text" value="195"/>
2. Minimum track clearance distance (MTCD, feet) .....	2.	<input type="text" value="24"/>
3. Stop bar setback distance (SBD, feet) .....	3.	<input type="text" value="8"/>
4. Width of receiving approach (B, feet).....	4.	<input type="text" value="47"/>
5. Offset distance of left turn stop bar (O <sub>SB</sub> , feet).....	5.	<input type="text" value="0"/>
6. Approach grade. % ( 0 if approach is on downgrade) .....	6.	<input type="text" value="1.9"/>
7. Angle of turn at Intersection (Θ, degrees).....	7.	<input type="text" value="90"/>

**Remarks**

6' east from E rail to edge of stop bar at signal  
 W crossing gate to 6' beyond E rail  
 Enter "0" if no stop bar is present 8' foot per chan plan  
 curb line to center of nearest receiving lane (fr: Valentine)  
 Per centerline profile for EB approach to tracks

**DESIGN VEHICLE DATA**

8. Select Design Vehicle

School Bus       Intermediate Truck       Interstate Semi-Truck       Other

9. Default design vehicle length (feet) .....	9.	<input type="text" value="75"/>
a. Additional vehicle length, if needed (feet) .....	9a.	<input type="text" value="0"/>
10. Total design vehicle length (DVL, feet) .....	10.	<input type="text" value="75"/>
11. Centerline turning radius of design vehicle (R, feet).....	11.	<input type="text" value="41"/>
12. Passenger car vehicle length (LV, feet).....	12.	<input type="text" value="19"/>

Based on selected Design Vehicle  
 Use only if "Other" selected as Design Vehicle  
 Sum of line 9 and 9a  
 Based on selected Design Vehicle  
 Default value

**SECTION 2: RIGHT-OF-WAY TRANSFER TIME CALCULATION**

**Preempt verification and response time**

- 13. Preempt delay time (seconds) ..... 13. 

0
---
- 14. Controller response time to preempt (seconds) ..... 14. 

0.0
-----
- 15. Preempt verification and response time (seconds): add lines 13 and 14 ..... 15. 

0.0
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**Remarks**

None.  
 Manufacturer: Econolite - Cobalt  
 Firmware Version: - ASC3 v.32.67.20

**Worst-case conflicting vehicle time**

- 16. Minimum green time during right-of-way transfer (seconds) ..... 16. 

3
---
- 17. Other green time during right-of-way transfer (seconds) ..... 17. 

0
---
- 18. Yellow change time (seconds) ..... 18. 

4.0
-----
- 19. Red clearance time (seconds) ..... 19. 

2.0
-----
- 20. Worst-case conflicting vehicle time (seconds): add lines 16 through 19 ..... 20. 

9.0
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**Remarks**

Value may be adjusted to meet local conditions  
 NCHRP 3-95  
 2 sec red revert. 1 sec red clear matched

**Worst-case conflicting pedestrian time**

- 21. Minimum walk time during right-of-way transfer (seconds) ..... 21. 

0
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- 22. Pedestrian clearance time during right-of-way transfer (seconds) ..... 22. 

10
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- 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. 

1.0
-----
- 25. Worst-case conflicting pedestrian time (seconds): add lines 21 through 24 ..... 25. 

11.0
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**Remarks**

TTI recommends Intermediate truncation of pedestrian interval. Measured 35 feet from SW corner to midpoint of furthest lane in eastbound direction.  
 Buffer included in ped clearance  
 All red phase

**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. 

11.0
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- 27. Right-of-way transfer time (seconds): add lines 15 and 26 ..... 27. 

11.0
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**SECTION 3: QUEUE CLEARANCE TIME CALCULATION**

- 28. Are there left-turns towards the tracks?  Yes  No
- 29. Distance traveled by truck during left-turn (LTL, feet): ..... 29. 

0
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- 30. Travel speed of left-turning truck (S<sub>LTT</sub>, mph): ..... 30. 

10
----
- 31. Distance required to clear left-turning truck from travel lanes on track clearance approach (feet): ..... 31. 

0
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- 32. Additional time required to clear left-turning truck from travel lanes on track clearance approach (seconds): ..... 32. 

0.0
-----
- 33. Worst-case Left Turning Truck time (seconds): if Line 28 = 'Yes', use line 32; otherwise Use 0 ..... 33. 

0.0
-----
- 34. Queue start-up distance, L (feet): add lines 1 through 3 ..... 34. 

227
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- 35. Time required for design vehicle to start moving (seconds): calculate as 2+(L÷20) ..... 35. 

13.4
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- 36. Design vehicle clearance distance, DVCD (feet): add lines 2, 3 and 10..... 36. 

107
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- 37. Time for design vehicle to accelerate through the DVCD (seconds), level terrain ..... 37. 

13.8
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- 38. Factor to account for slower acceleration on uphill grade ..... 38. 

1.10
------
- 39. Time for design vehicle to accelerate through DVCD (seconds), adjusted for grade: multiply lines 37 and 38 ..... 39. 

15.2
------
- 40. Queue clearance time (seconds): add lines 33, 35 and 39 ..... 40. 

28.5
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**Remarks**

Approx 200' distance  
 LTL =  $\frac{TRQ}{180}$   
 Default value  
 Equation: (line 4 + line 5 + line 12 - line 11) + line 29 + line 10  
 Equation: [(line 31 \* 3600) / (line 30 \* 5280) - line 18 - line 19]

**SECTION 4: MAXIMUM PREEMPTION TIME CALCULATION**

- 41. Right-of-way transfer time (seconds): line 27 ..... 41. 

11.0
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- 42. Queue clearance time (seconds): line 40 ..... 42. 

28.5
------
- 43. Desired minimum separation time (seconds) ..... 43. 

4.0
-----
- 44. Maximum preemption time for Queue Clearance (seconds): add lines 41 through 43 ..... 44. 

43.5
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**Remarks**

**SECTION 5: SUFFICIENT WARNING TIME CHECK**

**Remarks**

45. Required minimum time, MT (seconds): per regulations .....	45.	<input type="text" value="20"/>	
46. Clearance time, CT (seconds): (line 2 -35) / 10 (rounded up to nearest second).....	46.	<input type="text" value="0"/>	
47. Total minimum warning time, MWT, needed (seconds): add lines 45 and 46 (excludes buffer time and equipment response time).....	47.	<input type="text" value="20"/>	
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.	<input type="text" value="24"/>	
49. APT currently provided by railroad (seconds): Enter "0" if new crossing or signal .....	49.	<input type="text" value="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:** New signal Installation. Assume no APT is currently provided at the location.

TTI instructions (Appendix A) recommends Intermediate Pedestrian Truncation based on Light (5-10) preemption events and Light (1 out of 10 to 20 cycles) pedestrian crossings. Distance measured (35') is from SW corner to 1/2 through furthest lane in eastbound direction. Line 22 assumes 3.5 ft/s crossing speed.

**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.	<input type="text" value="24"/>	See Instructions for details.
52. Multiplier for maximum APT due to train handling .....	52.	<input type="text" value="1.25"/>	Note: Section 6 values not applicable since
53. Maximum APT (seconds): multiply line 51 and 52 .....	53.	<input type="text" value="30.0"/>	Gate Down Relay will be used to terminate
54. Minimum duration for the track clearance green interval (seconds) .....	54.	<input type="text" value="15"/>	Track Clearance Green.
55. Track Clearance Green Time to avoid Preempt Trap (seconds): add lines 53 and 54 .....	55.	<input type="text" value="45.0"/>	

**Clearing of Clear Storage Distance**

56. Time waiting on left-turn truck (seconds): line 33 .....	56.	<input type="text" value="0.0"/>
57. Time required for design vehicle to start moving (seconds): line 35 .....	57.	<input type="text" value="13.4"/>
58. Design vehicle clearance distance (DVCD, feet): line 36 .....	58.	<input type="text" value="107"/>

*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.	<input type="text" value="75"/>	Clear crossing only for Design Vehicle
60. Design vehicle relocation distance (DVRD, feet): add lines 58 and 59 .....	60.	<input type="text" value="182"/>	
61. Time required to accelerate design vehicle through DVRD (seconds), level terrain: .....	61.	<input type="text" value="18.4"/>	
62. Factor to account for slower acceleration on uphill grade .....	62.	<input type="text" value="1.11"/>	
63. Time required to accelerate design vehicle through DVRD (seconds), adjusted for grade: multiply lines 61 and 62 .....	63.	<input type="text" value="20.4"/>	
64. Time to clear portion of clear storage distance (seconds): add lines 56, 57 and 63 .....	64.	<input type="text" value="33.8"/>	
65. Track clearance green interval (seconds): maximum of lines 55 or 64, round up to nearest full second .....	65.	<input type="text" value="45"/>	

**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.	<input type="text" value="56.0"/>
67. Total time before gates are down (seconds): subtract 5 seconds from line 44 (per AREMA Manual) .....	67.	<input type="text" value="38.5"/>
68. Maximum Duration of Track Clearance Green after gates are down (seconds): Line 66 - Line 67 .....	68.	<input type="text" value="18"/>

**SECTION 7: SUMMARY OF CONTROLLER PREEMPTION SETTINGS**

69. Duration Time (seconds) .....	69.	0
70. Preempt Delay Time (seconds) .....	70.	0

Remarks	
Default Value	
From Line 13	

Right of Way Transfer Phase

71. Minimum Green Interval (seconds) .....	71.	3
72. Pedestrian Walk Interval (seconds) .....	72.	0
73. Pedestrian Clearance Interval (Flashing "DON'T WALK", seconds) .....	73.	10
74. Yellow Change Interval (seconds) .....	74.	4.0
75. All Red Vehicle Clearance (seconds) .....	75.	2.0

Remarks	
From Line 16	
From Line 21	
From Line 22	
From Line 18	
From Line 19	

Track Clearance Phase

76. Green Interval (seconds) (in the absence of gate down circuit) .....	76.	45
77. Green Interval (seconds) <u>with</u> gate down circuit .....	77.	29
78. Yellow Change Interval (seconds) .....	78.	4.0
79. All Red Vehicle Clearance (seconds) .....	79.	2.0

Remarks	
From Line 65	
From Line 40	
From Line 18	
From Line 19	

Exit Phase

80. Dwell/Cycle Minimum Green Time (seconds) .....	80.	0
81. Yellow Change Interval (seconds) .....	81.	4.0
82. All Red Vehicle Clearance (seconds) .....	82.	2.0

Remarks	
Default Value	
From Line 18	
From Line 19	

**Remarks:** Line 73. TTI instructions (Appendix A) recommends Intermediate Pedestrian Truncation based on Light (5-10) preemption events and Light (1 out of 10 to 20 cycles) pedestrian crossings. Distance measured (35') is from SW corner to 1/2 through furthest lane in eastbound direction. The minimum 3 second pedestrian buffer interval (MUTCD 4E) is included in the pedestrian clearance time in order to meet AREMA 50 second rule.

Line 76. (Line 65) Note: Section 6 values not applicable since Gate Down Relay will be used to terminate Track Clearance Green.

