

**North Carolina Department of Transportation  
Highway – Railroad Interconnection and Preemption Inspection Form**

Date of Inspection: \_\_\_\_\_ Recorded By: \_\_\_\_\_

Inspection Team Members: \_\_\_\_\_  
\_\_\_\_\_

Signal Inventory No.: \_\_\_\_\_ DOT Crossing No.: \_\_\_\_\_

Railroad Co: \_\_\_\_\_ RR Representative: \_\_\_\_\_

Railroad Milepost: \_\_\_\_\_ RR Rep. Phone: (\_\_\_\_) \_\_\_\_\_

Division: \_\_\_\_\_ County: \_\_\_\_\_ City or Town: \_\_\_\_\_

Date of Last Inspection: \_\_\_\_\_

**Intersection**

Route Number: \_\_\_\_\_ Name: \_\_\_\_\_  
at

Route Number: \_\_\_\_\_ Name: \_\_\_\_\_

.....

It is important to note that in doing these inspections, there are three primary objectives that you are to achieve:

- **Verify that the total railroad warning time is adequate to accommodate preemption time required by signal plans.**
- **Identify railroad preemption phasing and timing required for traffic signal.**
- **Verify operation and condition of both railroad and traffic signal control equipment.**
- **Verify safe operation of preemption sequence and ensure that vehicles are clear of crossing dynamic envelope as train approaches.**

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**General Information**

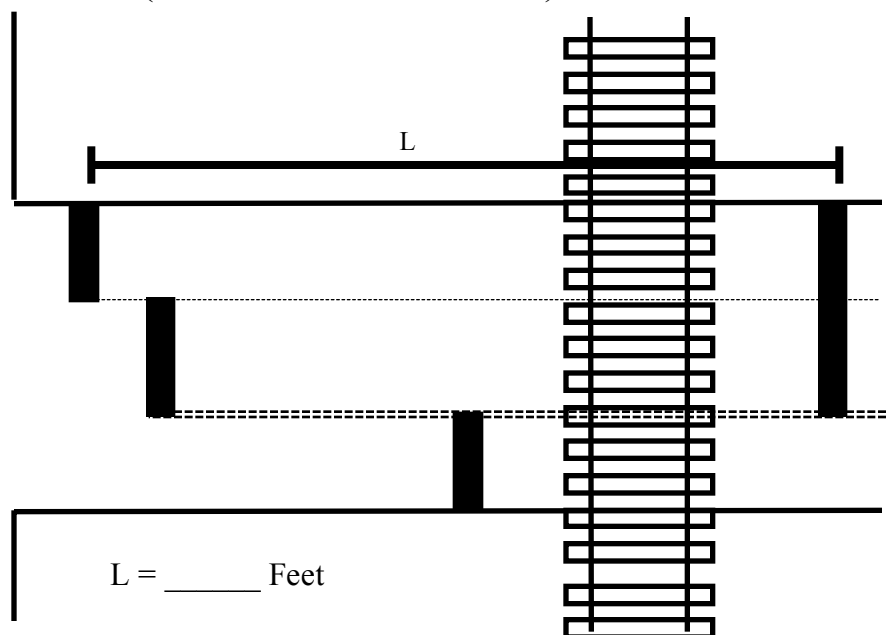
1. **Using Signal Plans** – Make sure the location is the correct location by checking the following items:
  - a. Signal inventory number shown on the signal plans is the same as shown on the signal cabinet.
  - b. All street names and route numbers in the field are the same as shown on the plans.

- c. DOT Railroad Crossing Number, which should be posted on the Railroad equipment.
  - d. Name of Railroad Company operating on tracks at location.
2. Take **photos** (*if new installation or major upgrade*) to show:
- a. All intersection and track approaches,
  - b. Clear location of tracks as it relates to the intersection,
  - c. Location of traffic signal cabinet and railroad cabinet/bungalow,
  - d. Inside of traffic signal cabinet to show equipment,
  - e. Inside of railroad signal cabinet/bungalow to show equipment,
  - f. Span/metal pole arrangement showing signal heads and signs,
  - g. Pavement markings and locations of stopbars and crosswalks.

### Geometric Inspection

3. Calculate track clearance green by current standard (Greenshield's formula).

#### **Distance To Measure To Calculate Track Clearance Green Time** (Greenshield's Formula)



If an approach has multiple stopbars, measure the distance from the stopbar behind the track to the farthest stopbar (closest to intersection).

Measure from stopbar behind track to stopbar at intersection. If calculation is less than 10 sec., use 10 sec. minimum.

- a.) Calculation for above:
- |  |   |
|--|---|
| 2 sec. x L/20                                    | (L = distance divided by 20 feet per car) |
| + _____ 4 sec.                                   | (start-up delay)                          |
| _____ Seconds = Greenshield's Formula Green Time |   |

b.) If Simultaneous Preemption is used, total amount of Track Clear Green required is  
Greenshield's Formula Green Time =  Seconds

c.) If Advance Preemption is used, calculate Track Clear Green Time:

Amount of Advance Preemption =  (Min Green)  
(Should be 6-8 Seconds) +  (Ped Clear)  
+  (Yellow Clear Before Preempt)  
+  (Red Clear Before Preempt)  
Amount of Advance Preemption =  Seconds  
+ Greenshield's Formula Green (From 3a):   
Total Amount of Track Clear Green Time =  Seconds

*You will need to enter the appropriate calculated Track Clearance Green time into the chart in Item 10 of this form.*

- d.) Is the calculated time above for the type of preemption used at this crossing (advance or simultaneous) consistent with what is shown on the signal plans and/or programmed in the field?
4. Compare actual intersection geometrics with what is shown on the signal design plans. (This check includes stopbar locations, LED signal head displays and configuration, signing, etc.) List any differences below: \_\_\_\_\_  
\_\_\_\_\_

Note any additional signing needs (example: "DO NOT STOP ON TRACK", "LOW VEHICLE MAY DRAG", "ONCOMING TRAFFIC MAY HAVE [HAS] EXTENDED GREEN" etc.). \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## Traffic Signal Operation Inspection

5. Intersection Operation:
6. Do vehicle and pedestrian heads (if present) appear to be L.E.D. and conform to the current design standards?  
*NOTE: Countdown pedestrian heads should not be used at railroad preemption locations.*
7. Are pedestrian signal heads programmed to clear concurrently with Yellow Clear Before Preempt?
8. Are blankout signs Fiber Optic or L.E.D.?
9. Note controller timing for preemption operation. Compare timing shown on the signal plans to times programmed into controller in field. The Appendix may be used to document the times if needed. If timing requires changing, cross out existing time and circle new time.

10. Calculate the total preemption warning time required based on the type of crossing warning system used at this location (Also Enter this Time in Item 34a):

*If 4 Quadrant / Exit Gates are Present:*

*If No Gates or 2 Quadrant Gates:*

Function	Seconds
<b>Equipment Reaction Time</b>	4
<b>Delay Time</b>	
<b>Min Green Before Preempt</b>	
<b>Ped Clear Before Preempt #</b>	
<b>Yellow Clear Before Preempt*</b>	
<b>Red Clear Before Preempt*</b>	
<b>Track Clearance Green</b>	
<b>Exit Gate Drop Time</b>	11
<b>Gates Horizontal Before Train</b>	5
<b>Total Warning Time Required</b>	

Function	Seconds
<b>Equipment Reaction Time</b>	4
<b>Delay Time</b>	
<b>Min Green Before Preempt</b>	
<b>Ped Clear Before Preempt #</b>	
<b>Yellow Clear Before Preempt*</b>	
<b>Red Clear Before Preempt*</b>	
<b>Track Clearance Green</b>	
<b>Track Clearance Yellow</b>	
<b>Track Clearance Red</b>	
<b>Total Warning Time Required</b>	

# If Ped Clear Time is timed concurrently with Yellow Clear Before Preempt, enter only the exclusive amount of Ped Clear Time that is not displayed concurrently with the Yellow Clear.

\* For Yellow and Red Clear Before Preempt, use the times shown on plans and controller if Overlap P (\*\*D) is used. If 0.0 is shown on the plans and programmed on the controller, use the yellow and red clearance times for the normal phase that has the highest total clear time required. If this phase is the Track Clearance Phase, use the times for the next highest phase.

\*\* *Note: Overlap P is available on all 2070 controllers and some types of NEMA controllers. On some older NEMA controllers, Overlap D (or the last overlap available) is used instead.*

For Track Clearance Green, use the time calculated in Item 3 for the type of preemption used.

11. Is the phase/movements used during the Track Clearance phase also an exclusive phase/move during normal operation? (No, if normal phase also has an overlapping turning movement that does not operate during Track Clearance phase.)

If Yes, are all parent phases used in normal operation programmed for Overlap "P" ("D") on the controller.

Is Track Clearance Phase programmed as an exclusive phase that does not operate during normal operation (ex, TC Phase = Phase 9)?

12. Observe operation of the signal, including control equipment in the cabinet and field equipment for proper operation. Is equipment operating properly and does the operation coincide with the signal plans?

If No, identify any malfunctions or discrepancies observed. Include: bulbs out, signal heads in need of repair, pavement conditions, pavement markings, signage, etc. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

13. If protective/permissive phasing is used and/or “yellow trap” backup protection is required for normal signal operation, ensure Phase Omits are used and NOT Red Revert.

14. Activate the railroad preemption sequence from the cabinet and observe operation.

Does sequence match the signal plans?

Does preemption override minimum green times?

If no, list reasons for nonconformance here: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

15. If intersection has multiple preempts programmed, verify that Railroad Preempt is highest priority.

16. If crossing has multiple through line tracks, perform second train sequence test (preempt re-service). Does **preempt call release** immediately when gates **begin** to rise?

*Note: This is very important to the correct operation of preempt re-service.*

### Traffic Signal Electrical Inspection

17. Signal equipment manufacturer (controller, cabinet and conflict monitor)

Type of Controller : \_\_\_\_\_ **Other:** \_\_\_\_\_

Controller Manufacturer and Model: \_\_\_\_\_

Type of Cabinet: \_\_\_\_\_ **Other:** \_\_\_\_\_

Cabinet Manufacturer and Model: \_\_\_\_\_

Conflict Monitor/MMU: \_\_\_\_\_

18. Cabinet Mounting:

19. Discuss location with Traffic Signal Technician Supervisor and note any issues or recent trouble calls at this location (maintenance problems, spares, etc.): \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

20. Check to make sure that phases used only during preemption are omitted during normal operation.

21. Check track interconnect circuit (relay for NEMA, AC isolator for 170 and 2070) for conformance to fail safe operation (normally energized).

22. Perform the following tests while signal is in **flash mode**:
- a.) Check **blankout sign(s)** during flash (make sure controller switch is off during test). Blankout sign(s) should still illuminate for preemption during flash.
  - b.) Check **flash color** of signals. Do flash colors match signal plans?
  - c.) Check **start-up sequence**.
23. Ensure that the controller is not programmed for late night flash.

### **Railroad Crossing Signal Electrical Inspection**

24. Identify the railroad signal warning equipment used (advance signal heads, flashers, cantilevers, 4 quadrant gates, etc.) \_\_\_\_\_  
\_\_\_\_\_
25. What is the condition of the interconnect circuit / contact in the railroad cabinet and/or junction box? \_\_\_\_\_  
\_\_\_\_\_
26. Identify the general type of railroad signal equipment (motion detector, predictor, ac/dc, etc.) \_\_\_\_\_  
\_\_\_\_\_
27. Perform the following tests with a shunt placed across the rails in the island circuit or while a train is present:
- a.) Observe traffic signal **preemption operation**.
  - b.) Examine **RR flashers** and focus.
  - c.) Examine **RR flash sequence** (all approaches should alternate together). *Note: Gate tip light burns solid.*
  - d.) Observe when preempt call to traffic signal is released. Preempt call should be released as soon as practical.
28. What is the general condition of the railroad-crossing surface?

Details: \_\_\_\_\_

Type of Crossing Surface: \_\_\_\_\_

- |                      |                   |
|----------------------|-------------------|
| 1) Section Timber    | 6) Rubber         |
| 2) Full Wood Plank   | 7) Metal Sections |
| 3) Asphalt           | 8) Other Metal    |
| 4) Concrete Slab     | 9) Unconsolidated |
| 5) Concrete Pavement | 10) Other _____   |

## Railroad Crossing Signal Track Circuit Inspection

29. Obtain the circuit length as shown on plan of record in the railroad signal cabinet. (*Measure from edge of travel lane/impact area*)

**From Plans** – Approach: \_\_\_\_\_ Approach: \_\_\_\_\_

**Measured in Field** – Approach: \_\_\_\_\_ Approach: \_\_\_\_\_

30. Check the condition of bonds (Head Bonds & Long Bonds) \_\_\_\_\_

31. Obtain maximum train speed for the crossing from railroad maintainer / inspector (*using Timetable Speed or Railroad Permanent Speed Restriction*).

Railroad Approach: \_\_\_\_\_ MPH

Railroad Approach: \_\_\_\_\_ MPH

(NOTE: City / Town ordinance does not apply – federal preemption of local or state laws, RR activities are interstate commerce)

32. Calculate amount of warning time provided by track circuitry: \_\_\_\_\_ Seconds

(Shortest Approach Length) (Minus) Equipment Reaction Time  
(1.47) (Train Speed in MPH)

33. Is crossing signal equipped with **advance preemption**?

**Note:** If advance preemption is utilized, an actual train movement **must** be observed.

Observed total warning time of actual train movement: \_\_\_\_\_ Seconds

34. If Railroad crossing signal equipment is designed for constant warning time (i.e. predictor):

a) How much warning time is programmed in the unit? \_\_\_\_\_ Seconds

b) How much time does railroad program for flashers to flash before train arrival? \_\_\_\_\_ Seconds

c) If railroad provides advance preemption, how many seconds of advance warning time is programmed? \_\_\_\_\_ Seconds

*NOTE: The total of b) and c) above should equal the total amount of warning time programmed in the predictor (a) if advance preempt is used ( $a = b+c$  OR  $a-b = c$ ).*

35. Compare preemption time required with RR advance warning time.

a) Total Preemption Warning Time Required (from Item 10): \_\_\_\_\_ Seconds

b) Total Warning Time Programmed on Railroad Predictor (if used) (from Item 34a): \_\_\_\_\_ Seconds

c) Total Warning Time Available from Track Circuitry (From Item 32): \_\_\_\_\_ Seconds

*Track Circuitry Warning Time (c) should be greater than or equal to the Total Preemption Time Required (a) and the time programmed on the predictor (b) (if used). If (a) and/or (b) is greater than (c), immediate action must be taken ( $a \leq b \leq c$ ).*

### Documentation

36. Mark-up a copy of the signal plan (if necessary). Show any field changes in red. The team leader should sign and date the changes on the plan and submit them to Traffic Engineering for an updated Plan of Record.

37. Document any changes made in the field. (i.e. timing, etc.) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

38. Are there any suggested signal / railroad revisions? (consider any geometric or environmental changes in the area.) \_\_\_\_\_  
\_\_\_\_\_

39. General comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



Send copy of this Inspection Form and any marked-up plans to:

	<u>Traffic Signal Issues</u>	<u>Rail Crossing Issues</u>
Mail:	NCDOT Traffic Engineering Branch Signals and ITS Unit Attn: Rob Ziemba, PE 1561 Mail Service Center Raleigh N.C. 27699-1561	Mr. Drew Thomas, PE NCDOT Rail Division Engineering and Safety Branch Capital Yard 1556 Mail Service Center Raleigh, N.C. 27699-1556
Office/ Delivery:	750 North Greenfield Parkway Garner, NC 27529 (919) 773-2800	Capital Yard 862 Capital Boulevard Raleigh, NC 27603 (919) 733-5564



## Appendix A: 2070 Oasis

2070L OASIS	Plan (Sec.)	Field (Sec.)
<b>Interval 1 – Track Clearance Green</b>		
<b>Interval 1 – Track Clearance Yellow</b>		
<b>Interval 1 – Track Clearance Red</b>		
<b>Interval 2 – Dwell Green</b> (= 255 if dwell interval; See Note below)		
<b>Interval 2 – Dwell Yellow *</b> (Yellow Clear after Pre) or (TC 2 Yellow)		
<b>Interval 2 – Dwell Red *</b> (Red Clear after Preempt) or (Track Clear 2 Red)		
<b>Interval 3 – Green</b> (Used as Needed; See Note Below)		
<b>Interval 3 – Yellow *</b> (Used as Needed; See Note Below)		
<b>Interval 3 – Red *</b> (Used as Needed; See Note Below)		
<b>Interval 5 – Exit Green</b> (Normally 1 – denotes exit phase is used)		
<b>Interval 5 – Yellow</b> (Normally 0.0 sec. if exit interval)		
<b>Interval 5 – Red</b> (Normally 0.0 sec. if exit interval)		
<b>Delay Time</b> (Should be 0 sec.)		
<b>Min Green Before Pre</b> (Should be 1 sec.)		
<b>Ped Clear Before Preempt</b>		
<b>Yellow Clear Before Preempt *</b>		
<b>Red Clear Before Preempt *</b>		
<b>Dwell Min Time</b>		
<b>Ped Clearance Through Yellow</b> (Yes or No)		
<b>Omit Overlaps</b>		

\* If 0.0 is shown/programmed for this time, use the appropriate yellow and red time for the phase with the highest total clearance time in normal operation.

*Note: If a single track clearance phase is used, Interval 2 is used to denote the Dwell Interval and Yellow and Red Clear times after preempt. If 2 Track Clearance phases are used, enter times for 2<sup>nd</sup> Track Clearance Phase in Interval 2 and use Interval 3 for Dwell times.*

*Preempt Dwell Interval is set by entering 255 for green time of particular interval. If interval is set as dwell, then the following yellow and red intervals will function as “Yellow Clear After Preempt” and “Red Clear After Preempt” respectively.*

Track Clearance Phase(s): \_\_\_\_\_ Preempt Dwell Phase(s): \_\_\_\_\_

Preempt Exit Phase(s): \_\_\_\_\_

## Appendix B: NEMA Equipment

TRACONEX		Plan (Sec.)	Field (Sec.)
<b>Delay Before Preempt</b>	N\A	N\A	N\A
<b>Minimum Walk Before Preempt</b>	N\A	N\A	N\A
<b>Pedestrian Clearance Before Preempt</b>	TPC		
<b>Minimum Green Before Preempt</b>	N\A	N\A	N\A
<b>Yellow Clearance Before Preempt</b>	TY1		
<b>Red Clearance Before Preempt</b>	TR1		
<b>Track Clearance Green</b>	TCM		
<b>Track Clearance Yellow Clearance</b>	TY2		
<b>Track Clearance Red Clearance</b>	TR2		
<b>RR Dwell Minimum Green</b>	TPM		
<b>Yellow Clearance After Preempt</b>	TY4		
<b>Red Clearance After Preempt</b>	TR4		

Track Clearance Phase(s): \_\_\_\_\_      Preempt Dwell Phase(s): \_\_\_\_\_  
 Preempt Exit Phase(s): \_\_\_\_\_

ECONOLITE ASC-8000 & ASC/2-2100 and EAGLE EPAC 300		Plan (Sec.)	Field (Sec.)
<b>Delay Before Preempt</b>	DELAY TIME		
<b>Minimum Walk Before Preempt</b>	N\A	N\A	N\A
<b>Pedestrian Clearance Before Preempt</b>	MIN PED CLEAR		
<b>Minimum Green Before Preempt</b>	MIN GREEN		
<b>Yellow Clearance Before Preempt*</b>	MIN YELLOW		
<b>Red Clearance Before Preempt*</b>	MIN RED		
<b>Track Clearance Green</b>	TRACK CLEAR GREEN		
<b>Track Clearance Yellow Clearance</b>	TRACK CLEAR YELLOW		
<b>Track Clearance Red Clearance</b>	TRACK CLEAR RED		
<b>RR Dwell Minimum Green</b>	HOLD GREEN		
<b>Yellow Clearance After Preempt*</b>	HOLD YELLOW		
<b>Red Clearance After Preempt*</b>	HOLD RED		
<b>Ped Clear Through Yellow</b>			
<b>Omit Overlaps</b>			

\* If 0.0 is shown/programmed for this time, use the appropriate yellow and red time for the phase with the highest total clearance time in normal operation.

Track Clearance Phase(s): \_\_\_\_\_      Preempt Dwell Phase(s): \_\_\_\_\_  
 Preempt Exit Phase(s): \_\_\_\_\_

<b>PEEK/TRANSYT 3000</b>		<b>Plan (Sec.)</b>	<b>Field (Sec.)</b>
<b>Delay Before Preemption</b>	<b>PRE-EMPT DELAY</b> MUST HAVE TRACK CALL FOR MORE THAN 1.5 SEC.		
<b>Minimum Walk Before Preempt</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
<b>Pedestrian Clearance Before Preempt</b>	<b>PED CLEAR</b>		
<b>Minimum Green Before Preempt</b>	<b>MIN ENTRY TIME</b>		
<b>Yellow Clearance Before Preempt</b>	<b>MIN ENTRY YELLOW</b>		
<b>Red Clearance Before Preempt</b>	<b>MIN ENTRY RED</b>		
<b>Track Clearance Green</b>	<b>INTERVAL 1</b>		
<b>Track Clearance Yellow Clearance</b>	<b>INTERVAL 2</b>		
<b>Track Clearance Red Clearance</b>	<b>INTERVAL 3</b>		
<b>RR Dwell Minimum Green</b>	<b>INTERVAL 4</b>		
<b>Yellow Clearance After Preempt</b>	<b>INTERVAL 5</b>		
<b>Red Clearance After Preempt</b>	<b>INTERVAL 6</b>		

Track Clearance Phase(s): \_\_\_\_\_ Preempt Dwell Phase(s): \_\_\_\_\_  
 Preempt Exit Phase(s): \_\_\_\_\_

<b>LMD 8000 (PEEK/TCT 9200)</b>		<b>Plan (Sec.)</b>	<b>Field (Sec.)</b>
<b>Delay Before Preemption</b>			
<b>Minimum Walk Before Preemption</b>			
<b>Pedestrian Clearance Before Preemption</b>			
<b>Minimum Green Before Preemption</b>			
<b>Yellow Clearance Before Preemption</b>			
<b>Red Clearance Before Preemption</b>			
<b>Track Clearance 1 Green</b>			
<b>Track Clearance 1 Yellow Clearance</b>			
<b>Track Clearance 1 Red Clearance</b>			
<b>Track Clearance 2 Green</b>			
<b>Track Clearance 2 Yellow Clearance</b>			
<b>Track Clearance 2 Red Clearance</b>			
<b>RR Dwell Minimum Green</b>			
<b>Yellow Clearance After Preemption</b>			
<b>Red Clearance After Preemption</b>			

Track Clearance Phase(s): \_\_\_\_\_ Preempt Dwell Phase(s): \_\_\_\_\_  
 Preempt Exit Phase(s): \_\_\_\_\_

### Appendix C: 170 Bi-Trans

170 Bi-Trans		Plan (Sec.)	Field (Sec.)
<b>Delay Before Preempt</b>	<b>RR 2 DLY</b>		
<b>Track Clearance Green</b>	<b>RR 2 CLR</b>		

Track Clearance Phase(s): \_\_\_\_\_

Preempt Dwell Phase(s) [RR 2 LTD SRV]: \_\_\_\_\_