Where the Rail Meets the Road

Traffic Signal & Railroad Preemption
Two Types of Railroad Preemption

**Simultaneous Preemption** – Notification of an approaching train is forwarded to the highway traffic signal controller unit or assembly and railroad active warning devices at the same time.

**Advance Preemption** – Notification of an approaching train is forwarded to the highway traffic signal controller unit or assembly by the railroad equipment in advance of the activation of the railroad warning devices. (Current Ohio standards require Advance Preemption.)
What is Advance Preemption?

The basic purpose of traffic signal preemption is to interrupt the normal sequence of the traffic signal operation, clear the vehicular traffic on the roadway approach crossing the railroad tracks prior to train arrival and then to allow traffic movement that does not conflict with the railroad movement.
When Preempted, the Traffic Signal Must:

1. Terminate any allowable combination of phases (1+5, 1+6, 2+5, 2+6, 3+7, 3+8, 4+8) and associated pedestrian movements.

2. Bring up Green for Track Clearance Phases (4+7) and hold in Green until RR gates are down.

3. Allow only phases that do not conflict with crossing (1+6, 2+6, 3) until preemption ends.
Why is this Important?
Fox River Grove, IL - 1995
Contributing to the accident was the failure of the Illinois Department of Transportation and its contractors, the Illinois Commerce Commission, and the railroads to have a communication system that ensures understanding of the integration and working relationship of the railroad and highway signal systems.
But why do we need to clear the tracks? Everybody knows not to stop on the tracks. There’s even a sign!
The highway agency that is responsible for timing and operation of the traffic signal that is being preempted is responsible for determining the need for preemption, type of preemption, and time interval for any advance preemption.

Information regarding the type of preemption and any related timing parameters is provided to the railroad company so that they can design the appropriate train detection circuitry.
What is ODOT/ORDC doing about this?
Reviewed existing ODOT practices, policies, standards, and specifications.

Developed recommended practice, policies, and standards to be included in Ohio Traffic Engineering Manual and OMUTCD.

Developed traffic signal controller and interface requirements for RR preemption.

Developed standard methodology to calculate appropriate preemption timing.

Provided training.
Ohio Action Plan continued...

- Identified and field surveyed all traffic signals within 200’ of a RR crossing that were not currently preempted.
- Identified and field surveyed all traffic signals located greater than 200’ from RR crossing where traffic queues over crossing.
- Identified and field surveyed all currently existing RR preempted traffic signals in Ohio.
- Developed cost estimates for proposed improvements.
- Recommended and prioritized improvements for each location.
400 Total Locations Identified for Review

- 175 Completed Projects
- 23 Active Projects
- 21 Preemption Needed
- 181 Preemption Upgrade not Required

225 total locations have or require advance preemption
How does this affect you?
ODOT, County, City and/or Village

- Are you responsible for signals which are within 200’ of active railroad crossings?
- Are you responsible for signals which are located greater than 200’ but exhibit queuing on a railroad crossing?
- Do you have a project which requires a new signal installation or upgrade that is near a railroad crossing?
If you are responsible for a signal near a railroad crossing and if it is within 200’ or exhibits queuing then ORDC/ODOT has classified each location based upon a high/medium/low cost.

ORDC intends to allocate approximately $2 million/year for corrective action at identified locations. Projects will be addressed based upon highest priority and/or cost of improvement.

Contact Cathy Stout or Deb Weaver to confirm.
If you have plans to upgrade contact:

- Cathy Stout – ORDC Safety Program Manager
- ODOT Projects – Richard Behrendt – ORDC Program Manager/State Rail Coordinator
Highway Rail Grade Crossing Warning System Interconnection

TEM Section 804-4
The purpose of this design guideline is to define the required interface between a highway-rail grade crossing warning system and a traffic control signal for the purpose of railroad preemption. It defines the standard interface to provide the operation as specified by the TEM (Traffic Engineering Manual) for each interconnected highway-rail grade crossing.
The traffic signal controller shall be provided with either a relay based interface, a solid state interface using DC isolator cards or a serial data interface using the IEEE 1570 protocol. If not specified on the plans, a basic controller unit with a cabinet relay interface shall be provided. The interface shall provide the following functions:
Advance Preemption. This circuit will notify the traffic signal controller of an approaching train prior to the operation of the active warning devices.

Simultaneous Preemption. This circuit will notify the traffic signal controller of an approaching train at the point the active warning devices begin their operation. This circuit is commonly known as an “XR” circuit.

Island Occupied. This circuit will notify the traffic signal controller of the occupancy of the island circuit by the train.

Gate Down. This circuit will notify the traffic signal controller when the gate(s) controlling access to the track(s) is lowered to within 5 degrees of horizontal.

Gate Up. This circuit will notify the traffic signal controller when all gates at the crossing are raised. This circuit is commonly known as the “GP” circuit.

Traffic Signal Health. This circuit will notify the railroad warning system whenever the traffic signal has entered conflict flash or the power has failed.
A preemption input test switch panel with six test switches shall be provided and mounted in a convenient location within the controller cabinet. The railroad circuits shall be connected through the test switch panel to directly simulate the input from the railroad. Each switch shall be labeled exactly as indicated below by use of a silk screened legend or an engraved plastic plate. Rub-on, adhesive or other markings which are not permanent are not acceptable. The following switches shall be provided:
Preemption Input Test continued....

- Advance Preemption Test
- Simultaneous Preemption Test
- Island Circuit Test
- Gate Up Test
- Gate Down Test
- Traffic Signal Health Test
Indicator Panel

An indicator panel shall be provided for mounting on the signal support or strain pole adjacent to the controller. The indicator panel shall be fabricated from stainless steel and shall be provided with 6 LED indicators.

- Indicator lights shall be 1-inch diameter, waterproof, with LED lamps.
  - Advance Preempt – Normally Closed – Green
  - Advance Preempt – Normally Open – Yellow
  - Simultaneous Preempt – Red
  - Island – Orange
  - Gate Up – Blue
INDICATOR PANEL LEGEND

- **Advance Preempt-Normally Closed (Always Lit)**
- **Gate Up (Always Lit)**
- **Advance Preempt-Normally Open**
- **Gate Down**
- **Simultaneous Preempt (Always Lit)**
- **Island Circuit (Always Lit)**
Currently available controller units meeting new ODOT standards:

- **Basic Operation**
  - Econolite ASC/3 (NEMA or 2070)
  - Los Angeles TSCP software (2070 or 2070 N)

- **Enhanced Operation**
  - Los Angeles TSCP software (2070 or 2070 N)

Los Angeles TSCP software requires a license per agency for unlimited use within that agency.
Unless otherwise specified, the railroad bungalow shall be provided with suitable relay contacts and one control relay for the interface. The interface shall function as follows:

- Advance Preemption
- Simultaneous Preemption
- Island Occupied
- Gate Down
- Gate Up
- Traffic Signal Health
New ODOT Standard

- A warning label shall be provided and installed by the railroad on the interior of the bungalow indicating the interconnection of the two systems.

- Upon completion of the project and release of the as-built drawings, the railroad & signal owner shall furnish a copy of every sheet of the signal wiring diagrams which contain information necessary to verify the approach length, minimum warning time, advance preemption time and maximum authorized train speed applicable to the project at the time the project is placed in service. The plan sheets should be provided in .pdf format to the ORDC project manager.
How to Determine Timing Requirements
Bay Village – Signal Plans
OHIO DEPARTMENT OF TRANSPORTATION
GUIDE FOR DETERMINING TIME REQUIREMENTS FOR
TRAFFIC SIGNAL PREEMPTION AT HIGHWAY-RAIL GRADE CROSSINGS

City: City of Bay Village
County: Cuyahoga County
District: 

Date: 8/14/2012
Completed by: DLWBS

Railroad: Norfolk Southern
DOT No: 472252D

Parallel Street Name:
Naigle Road

Crossing Street Name:
Bradley Road

Railroad Contact: Aaron Pease
Phone: 

Enter values in non-shaded boxes. Shaded boxes are calculated.

SECTION 1: RIGHT-OF-WAY TRANSFER TIME CALCULATION

Preempt verification and response time
1. Programmed preempt delay time (sec) ........................................ 1. 0.0
2. Controller response time to preempt (sec) ................................. 2. 0.0
3. Preempt verification and response time (sec): add lines 1 and 2 ........ 3. 0.0

Worst-case conflicting vehicle
4. Worst-case conflicting vehicle phase number(s) .......................... 4. ph 1 & ph 6
5. Minimum green time during right-of-way transfer (sec) ............... 5. 7.0
6. Other green time during right-of-way transfer (sec) .................... 6. 0.0
7. Yellow change time (sec) .................................................... 7. 3.5
8. Red clearance time (sec) .................................................... 8. 2.5
9. Worst-case conflicting vehicle time (sec): add lines 5 through 8 .... 9. 13.0

Worst-case conflicting pedestrian time
10. Worst-case conflicting pedestrian phase number(s) .................. 10. Phase 8
11. Minimum walk time during right-of-way transfer (sec) ............. 11. 0.0
12. Pedestrian clearance time during right-of-way transfer (sec) ...... 12. 9.0
13. Vehicle yellow change time, if not included on line 12 (sec) ....... 13. 3.5
14. Vehicle red clearance time, if not included on line 12 (sec) ...... 14. 2.5
15. Worst-case conflicting pedestrian time (sec): add lines 11 through 14 15. 15.0

Worst-case conflicting vehicle or pedestrian time
16. Worst-case conflicting vehicle or pedestrian time (sec): maximum of lines 9 and 15 ........ 16. 15.0

17. Right-of-way transfer time (sec): add lines 3 and 16 .......... 17. 15.0
Intersection Design Requirements
Traffic Signal/Intersection Design Issues

- Turn Restrictions During Preemption
- Protected Movements for Track Clearance
- Yellow Trap Condition
- Battery Backup
- Pedestrian Considerations
- Flashing Operation
- Pre-Signals
- Queue Cutter Signals
Queue Cutter Signals

A queue cutter signal is a traffic signal installed at a highway-rail grade crossing in a manner similar to a pre-signal.

A queue cutter signal is not connected to or operated as a part of a downstream signalized intersection.

Generally, a queue cutter signal is installed where the CSD exceeds 450’.

It is interconnected with the railroad warning system with a 3 to 5 second advance preemption time.
Village of Mount Victory
Village of Mount Victory
Village of Mount Victory
How ORDC Can Help
All Projects are a Collaboration Between:

- MPO
- ODOT
- Local Municipality
- Railroad Owner
- ORDC
- PUCO

Project
Once a project has been identified:

1. Establish points of contact
   a. Project Manager/ODOT/LPA/County
   b. ODOT Rail Coordinator – Richard Behrendt
   c. ORDC Safety Manager – Cathy Stout
   d. Railroad Owner
   e. PU.CO
Once a project has been identified continued...

2. Establish a timeline
   a. Roadway construction project
   b. Signal construction
   c. Railroad construction
   d. Lights and gates project

3. Set-up project
   a. Complete ITS form
   b. Complete timing form
   c. Determine Signal Construction Cost
   d. Determine Railroad Construction cost
   e. Set up contract
Once a project has been identified continued...

4. ORDC will monitor project progress.
5. Once completed, ORDC will perform final inspection.
   a. Complete In-Service inspection form.
Example Projects
Hartville – Location Map
Hartville
Contact Information

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