Preemption Workshop

The purpose of this workshop is to highlight a number of design elements typically encountered to successfully implement railroad preemption operation.
Preemption Workshop

Presentation Overview

- Railroad Preemption and Operation
- Intersection Design Considerations
- Interconnection Options
- Pre-Signals
- Queue Cutter Signals
- Closing thoughts

Traffic Signal and Intersection Design Considerations

- Timing Requirements
- Preemption Operating Mode
- Pedestrian Considerations
- Turn Restrictions During Preemption
- Protected Movements for Track Clearance
- Yellow Trap Condition
- Back-Up Power
- Flashing Operation
- Pre-Signals
- Queue Cutter Signals
- Interconnection Options
It’s an issue nationwide…

Anytime we have a grade crossing between a railroad and a highway

AND

There is an adjacent intersection

AND

The adjacent intersection has a traffic signal
BACKGROUND OF RAILROAD PREEMPTION ISSUES

Recent incidents

2015

Menlo Park, CA – Ravenswood Ave
Valhalla, NY – Commerce St
DeKalb County, GA – Turner Hill Rd
Selma, CA – Highland Ave
Los Angeles, CA – USC Watt Way
Why do people stop on the tracks?
Is it all driver error?

Or...

*Is the preemption system designed correctly to allow them to clear the tracks prior to train arrival?*
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Railroad Preemption
what is railroad preemption?

the point of railroad preemption is to provide an opportunity for vehicles to clear the track area before the train arrives at the crossing.

rick’s rule #1

you have to have gates to provide effective preemption
So how should preemption operate to address the issue of being stopped on the tracks?

Step 1:
Transition the traffic signal to provide green indications to a driver which may be stopped on the track
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Step 2:
Provide the opportunity for a design vehicle to clear the tracks prior to the arrival of a train
Step 3:
Allow traffic movements that do not conflict with the train
Now that we know the basic steps of the preemption operation...

How much time does it take?
Maximum Preemption Time is the sum of 3 parameters:

- **Right-of-way Transfer Time** - time to transition the traffic signal to green indication

- **Queue Clearance Time** – amount of time to clear the design vehicle from the track area

- **Separation Time** – amount of additional safety time after the track area is clear until train arrival

Maximum Preemption Time Example = 52 sec
Seems simple enough...

But, how do we calculate the time that’s required?

Guide for Determining Time Requirements for Traffic Signal Preemption at Highway-Rail Grade Crossings

3 page form developed through extensive research by TTI and Texas DOT under FHWA contract
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Guide for Determining Time Requirements for Traffic Signal Preemption at Highway-Rail Grade Crossings

16 pages of instructions to provide guidance to the user

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Preemption Time Calculations

The Texas DOT methodology is currently used by many state departments of transportation, local road authorities and railroads
It is also referenced in the FHWA Railroad-Highway Grade Crossing Handbook.

Additional work is underway by Texas DOT to update the preemption form.

The Utah DOT is also developing an updated preemption form.
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Who determines How Preemption Operates?

In addition to the national MUTCD, many states will publish their own MUTCD or a state supplement.

Regardless of the form, they must be in substantial conformance to the national MUTCD

National MUTCD

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Who determines How Preemption Operates?

2009 MUTCD Section 8A.02  Traffic Control Signals at or Near Highway-Rail Grade Crossings

Guidance:
The appropriate traffic control system to be used at a highway-rail grade crossing should be determined by an engineering study involving both the highway agency and the railroad company.

This is commonly referred to as a Diagnostic Team Inspection.
Who determines How Preemption Operates?

**USC Title 23 – Highways**
**Section 109**
**Railroads**

A Diagnostic Team means a group of knowledgeable individuals of the parties of interest in a railroad-highway crossing or group of crossings.

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**Who determines How Preemption Operates?**

**2009 MUTCD Section 8A.02 Traffic Control Signals at or Near Highway-Rail Grade Crossings**

**Standard:**

Before any new highway-rail grade crossing traffic control system is installed or before modifications are made to an existing system, approval shall be obtained from the highway agency with the jurisdictional and/or statutory authority, and from the railroad company.
Who determines How Preemption Operates?

2009 MUTCD Section 8C.09  Traffic Control Signals at or Near Highway-Rail Grade Crossings

Guidance:
The highway agency or authority with jurisdiction and the regulatory agency with statutory authority, if applicable, should jointly determine the preemption operation and the timing of traffic control signals interconnected with highway-rail grade crossings adjacent to signalized highway intersections.

Who determines How Preemption Operates?

2009 MUTCD Section 8C.09  Traffic Control Signals at or Near Highway-Rail Grade Crossings

Standard:
Information regarding the type of preemption and any related timing parameters shall be provided to the railroad company so that they can design the appropriate train detection circuitry.
Application of Railroad Preemption

2009 MUTCD Definitions:

114. Maximum Highway Traffic Signal Preemption Time—the maximum amount of time needed following initiation of the preemption sequence for the highway traffic signals to complete the timing of the right-of-way transfer time, queue clearance time, and separation time.
Typical Intersection with Railroad Preemption

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2009 MUTCD Definitions:

175. Right-of-Way Transfer Time—when used in Part 8, the maximum amount of time needed for the worst case condition, prior to display of the track clearance green interval. This includes any railroad or light rail transit or highway traffic signal control equipment time to react to a preemption call, and any traffic control signal green, pedestrian walk and clearance, yellow change, and red clearance intervals for conflicting traffic.
Receive Preemption Request
• Phase 2 Minimum Green (7 seconds)
• Phase 2 WALK (7 seconds) - truncate to 0 seconds
(These two parameters should time concurrently)
Not true in all controllers!

Right-of-Way Transfer Time
• Phase 2 Minimum Green continues (7 seconds)
• Phase 2 Pedestrian Clearance (29 seconds at 3.5 FPS)
• Phase 2 Pedestrian Change begins (23 seconds)
(MiRi Green & Ped Change time concurrently)
Right-of-Way Transfer Time
• Phase 2 Yellow Change (4 seconds)

Right-of-Way Transfer Time
• Phase 2 Red Clearance (2 seconds)
So, pedestrian timing is challenging, what does an agency need to do?

1. An agency policy is an absolute requirement to establish a standardized methodology.

2. Recognize that many legacy systems failed to address pedestrian clearance issues.

3. New designs must consider pedestrian needs.

4. Begin a systematic program to address legacy systems.
Considerations regarding a Pedestrian Change a policy at intersections with railroad preemption

1. Speed of roadway / sight distance per crosswalk
2. Pedestrian volume over 24 hours
3. Peak hour pedestrian volume
4. School crosswalk / safe route to school
5. Other factors

2009 MUTCD Definitions:

116. Minimum Track Clearance Distance — for standard two-quadrant warning devices, the minimum track clearance distance is the length along a highway at one or more railroad or light rail transit tracks, measured from the highway stop line, warning device, or 12 feet perpendicular to the track center line, to 6 feet beyond the track(s) measured perpendicular to the far rail, along the center line or edge line of the highway, as appropriate, to obtain the longer distance.
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Minimum Track Clearance Distance:

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Preemption Workshop

Minimum Track Clearance Distance:

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Minimum Track Clearance Distance:

32. Clear Storage Distance - when used in Part 8, the distance available for vehicle storage measured between 6 feet from the rail nearest the intersection to the intersection stop line or the normal stopping point on the highway. At skewed grade crossings and intersections, the 6-foot distance shall be measured perpendicular to the nearest rail either along the center line or edge line of the highway, as appropriate, to obtain the shorter distance.
49. Design Vehicle:
The longest vehicle permitted by statute of the road authority (State or other) on that roadway.

65' or 70' or 75' or 85' or 105'?
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Design Vehicle

This vehicle with a sleeper cab tractor and 53' trailer can approach 80' in Over All Length

Queue Clearance (First Component)

Queue Start-up – Time elapsed after beginning of track clearance green until design vehicle can start moving. Queued vehicles (red cars) must start in motion before the design vehicle (yellow truck – just inside the gate) can begin to accelerate. Calculate as 2 + (L/20)
**Queue Clearance (Second Component)**

**Design Vehicle Clearance** – Time required for design vehicle to accelerate from a stop and travel through and clear of MTCD. For a 90-degree, single track crossing and 65’ design vehicle, it takes approximately 13 seconds to start up and clear the MTCD.

---

**Queue Clearance Time**

<table>
<thead>
<tr>
<th>Queue Start-up</th>
<th>6 seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time before the design vehicle begins to move</td>
<td></td>
</tr>
<tr>
<td>Calculate as 2 + (L/20) or per agency policy</td>
<td></td>
</tr>
</tbody>
</table>

**Design Vehicle Clearance**

| Time for design vehicle to accelerate through the design vehicle length and MTCD | 13 seconds |

**TOTAL Queue Clearance**

<table>
<thead>
<tr>
<th>19 seconds</th>
</tr>
</thead>
</table>

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2009 MUTCD Definitions:

188. Separation Time—the component of maximum highway traffic signal preemption time during which the minimum track clearance distance is clear of vehicular traffic prior to the arrival of rail traffic.

Separation Time
Design vehicle allowed to move more than 6 ft clear of MTCD prior to train arrival.
### Train Arrival

![Train Arrival Image]

### Preemption Workshop

<table>
<thead>
<tr>
<th>Maximum Preemption Time</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Right-of-Way Transfer Time</td>
<td>29 seconds</td>
</tr>
<tr>
<td>Queue Clearance Time</td>
<td>19 seconds</td>
</tr>
<tr>
<td>Separation Time</td>
<td>4 seconds</td>
</tr>
<tr>
<td><strong>TOTAL Max Preemption Time</strong></td>
<td><strong>52 seconds</strong></td>
</tr>
</tbody>
</table>
Is there a way to make preemption work adequately with only 20 seconds of RR MWT by programming the traffic signal controller to transition as quickly as possible to Track Clearance Green interval when preempted?

Even though MUTCD permits eliminating the Minimum Green, Walk and Pedestrian Change values, Yellow Change and Red Clearance must be timed in their entirety.

<table>
<thead>
<tr>
<th>Right-of-Way Transfer Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min Green</td>
</tr>
<tr>
<td>WALK</td>
</tr>
<tr>
<td>Flashing DONT WALK</td>
</tr>
<tr>
<td>YELLOW Change</td>
</tr>
<tr>
<td>RED Clearance</td>
</tr>
<tr>
<td>TOTAL Right-of-Way Transfer</td>
</tr>
</tbody>
</table>
Preemption Workshop

Even when transitioning to Track Clearance Green interval as quickly as possible, additional warning time is required.

<table>
<thead>
<tr>
<th>Maximum Preemption Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right-of-Way Transfer Time</td>
</tr>
<tr>
<td>Queue Clearance Time</td>
</tr>
<tr>
<td>Separation Time</td>
</tr>
<tr>
<td><strong>TOTAL Max Preemption Time</strong></td>
</tr>
</tbody>
</table>

9 seconds of additional time is required

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Once the maximum preemption time has been determined, the next step is to choose the **type** of preemption operation.
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.

Simultaneous Preemption vs. Advance Preemption

What’s the correct solution?

Is there a difference in time?

Doesn't advance preemption cost more?

Does one cost more?

Why choose one over the other?
Most legacy preemption systems were based on **SIMULTANEOUS** Preemption Operation.

**Why?** It was simple and quick

**AND – we just didn’t know what we didn’t know**

The **REALITY** is that simultaneous preemption operation may not be performing as well as you may think.
Many newer systems are based on ADVANCE Preemption Operation

The REALITY is that advance preemption operation may not be performing as well as you may think.

What we have learned in the past 20 years is that each method has its advantages and its disadvantages.
Simultaneous preemption is easier to implement, but generally results in gates lowering and striking vehicles if they are stopped under the gate.

Advance preemption is more complex to implement, but generally overcomes gates lowering and striking vehicles if they are stopped under the gate.
Which mode to use requires careful study and understanding of all of the operational issues prior to making a determination of which to use.

Simultaneous Preemption

RR Minimum Warning Time is equal to Maximum Preemption Time

\[ MWT = MPT \]

In the example intersection: RR MWT would have to be set to 52 seconds. Railroad warning devices would activate at least 52 seconds prior to train arrival.
Simultaneous Preemption Operation:
Example of a Gate Hitting a Truck
Simultaneous Preemption Operation: Example of a Gate Hitting a Truck

Simultaneous Preemption Operation: Example of Northbound Left Turn Toward Crossing Blocking Exit from Crossing
Simultaneous Preemption Operation:
Example of Northbound Left Turn Toward Crossing Blocking Exit from Crossing

Advance Preemption

Advance Preemption Time is equal to Maximum Preemption Time minus RR Minimum Warning Time

\[ \text{if } MWT = 20, \quad APT = MPT - 20 \]

For above example: \( APT = 52 - 20 = 32 \) seconds.
Traffic signal would start the preemption sequence 32 seconds before the railroad warning devices activate.
Advance Preemption

The Total Approach Time is the SAME!
So it’s not the Advance Preemption that adds cost, it’s the time required to clear the design vehicle, right?

Right. It’s all about the time.

So, maybe all those folks “stopped on track” didn’t have a chance after all.

Just when you thought you had it all figured out:

What happens if the traffic signal is already green for the track clearance phase(s) when the preemption sequence is initiated?
The RWTT is zero and Track Clearance Green can time out before the railroad warning devices are activated. In other words, any “fresh” vehicle that stops on the tracks will not get a green indication to clear the tracks prior to the arrival of the train.
So how should preemption operate to address the issue of being stopped on the tracks?

Advance Preemption Simulation
The reality is that in many cases, a number of issues may lead to the improper operation of preemption.

The two most common issues involve the time required to move a design vehicle from the path of an approaching train.

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Short Track Clearance Green Time

Preemption Simulation
Preemption Workshop

Example Video
Not Enough Time to Clear
Preemption Simulation
Preemption Workshop

Example Video

Preemption Workshop

[Image of a traffic intersection with the text "BELT LINE / JEFFERSON"]
Preemption Workshop

Other Intersection Design Considerations

- Pedestrian Considerations
- Turn Restrictions During Preemption
- Protected Movements for Track Clearance
- Yellow Trap Condition
- Back-Up Power
- Flashing Operation
- Interconnection Options
- Pre-Signals
- Queue Cutter Signals

Pedestrians

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Pedestrians

Fencing for pedestrian channelization and Another Train Warning

Pedestrians

AUDIBLE DEVICE

DO NOT ENTER (R5-1) sign on the side of the swing gate facing away from the track.
PUSH TO EXIT (R8-11) sign on the track side of the swing gate.

Curb Sidewalk

Emergency Exit Route
Pedestrians

Looks good for a pedestrian???

LOOK again!

Pedestrian Operation Considerations

- Avoid pedestrian recall
- Avoid use of pedestrian rest-in-walk
- Consider use of pedestrian refuge islands to reduce long pedestrian clearance requirements
- Avoid mid-block pedestrian crosswalks in close proximity to the grade crossing
- Consider elimination of crosswalk parallel and closest to the railroad track (nearest conflict to track clearance)
- If pedestrian change interval is shortened when preempted, consider using conventional non-countdown pedestrian signals or signage
**2009 MUTCD**  
**Section 8B.08 Turn Restrictions During Preemption**

Guidance:  
At a signalized intersection that is located within 200 feet of a highway-rail grade crossing, measured from the edge of the track to the edge of the roadway, where the intersection traffic control signals are preempted by the approach of a train, all existing turning movements toward the highway-rail grade crossing should be prohibited during the signal preemption sequences.
Phase 7 and associated green arrow signal indication is needed during preemption even if not part of normal signal sequence.

Protected Movements for Track Clearance

Confusing?
2009 MUTCD
Section 4D.05 Application of Steady Signal Indications

Standard:

F. A steady GREEN ARROW signal indication:

2. Shall be displayed on a signal face that controls a left-turn movement when said movement is not in conflict with other vehicles moving on a green or yellow signal indication (except for the situation regarding U-turns provided in Paragraph 4) and is not in conflict with pedestrians crossing in compliance with a WALKING PERSON (symbolizing WALK) or flashing UPRAISED HAND (symbolizing DONT WALK) signal indication.

Protected Movements for Track Clearance

Phase 7 and associated green arrow signal indication is needed during preemption even if not part of normal signal sequence.
Yellow Trap

- Yellow Trap is a term used to describe a condition which occurs during certain yellow change intervals usually involving a lagging green interval.

- During a Yellow Trap event, drivers facing a CIRCULAR YELLOW signal indication are enticed to complete their movement in order to clear the intersection by the display of the CIRCULAR YELLOW signal indication.

- What they fail to realize is that opposing motor vehicles are facing a CIRCULAR GREEN signal indication and not a CIRCULAR YELLOW signal indication.

Yellow Trap condition occurs when a left turning driver receives a yellow indication and the opposing through driver has a green indication. The left turning vehicle assumes the other driver also has a yellow and will stop. **This leads to driver confusion and potential accident blocking the exit path from the tracks.**
Yellow Trap

Resolving Yellow Trap:

- Protected left turn movement opposing track clearance movement
- Split phase opposing movements
- Flashing yellow arrow
- Transition through all-red when changing to track clearance phases

Yellow Trap

Resolving Yellow Trap:

Protected Only Left Turn opposite track clearance phases:
Yellow Trap

Resolving Yellow Trap:

Split Phase operation on roadway crossing track:

[Diagram of traffic lights and road symbols]

Flashing Yellow Arrow:

[Diagram of traffic lights and road symbols]
Backup power supply should be provided and should have sufficient capacity to assure continued operation of the traffic signal for a minimum period the permit alternate traffic control measures to be put in place in the event of an extended duration.

Guidance:

Except for traffic control signals interconnected with light rail transit systems, traffic control signals with railroad preemption or coordinated with flashing-light signal systems should be provided with a back-up power supply.

Backup power supply should be provided and should have sufficient capacity to assure continued operation of the traffic signal for a minimum period the permit alternate traffic control measures to be put in place in the event of an extended duration.
Flashing Operation

- Do not use off-peak scheduled flash

- Do not use red/yellow malfunction flash unless the yellow flash is in same direction as track clearance

INTERCONNECTION CIRCUITS

7 Years After Installation
Most traffic signal engineers think of “interconnect” as a means to achieve “coordinated” operation of traffic control signals.

Where railroad preemption is required, the INTERCONNECTION is the electrical circuit between the railroad equipment and the traffic signal controller for the purpose of preemption.

While simple in theory, \textit{this is one of the most challenging issues in completing the preemption design.}

\begin{itemize}
  \item Not well supported by traffic signal manufacturers in controller unit software
  \item Many controller units have preemption operation limitations
  \item General lack of understanding of operation
\end{itemize}
Interconnection Circuits

Advance Preemption Circuit

The advance preemption circuit begins the preemption sequence when the railroad equipment first notifies the traffic signal controller of the approaching train.

Supervision

Supervision is an additional circuit that works in conjunction with the advance preemption circuit or primary preemption circuit. A supervision circuit closes when the advance preemption or other supervised circuit opens, providing a means to verify the integrity of the interconnection cable between the traffic signal controller and the railroad warning system.
Supervision

A supervision circuit fault should initiate an all-red flashing operation condition until repairs can be made as there may be no preemption operation provided.

Crossing Active Circuit

The crossing active circuit activates when the lights on the railroad warning devices begin to flash. This circuit may also be called Simultaneous Preemption circuit or the XR circuit.

- The use of the crossing active circuit is critical where advance preemption is used and train restart moves occur which result in reduced or no APT.
- This circuit can also be used to activate turn restriction blank-out signs.
### Gate Down Circuit

The gate down circuit activates when the gate arm(s) controlling access to the railroad tracks are lowered to within approximately five (5) degrees of the horizontal position.

This circuit prevents the traffic signal controller from leaving the track clearance green interval before the railroad warning devices become active and the gates are lowered.

### Traffic Signal Health Circuit

The traffic signal health circuit is an output from the traffic signal cabinet that notifies the railroad warning system whenever the traffic signal has failed as a result of conflict flash, manual flash, soft flash, manual signals off or commercial power and back-up power system failure.

The traffic signal health circuit typically requires a special processor or relay logic in the traffic signal cabinet that can monitor the health status of the traffic signals and have the ability to provide and control an isolated 12 V dc power source.
**Traffic Signal Health Circuit**

If the traffic signal health is bad, no track clearance interval can be displayed. The safest operation is to activate the railroad crossing warning devices as soon as possible to allow additional time for vehicles to clear the tracks.

The amount of APT provided determines how early the flashing-lights and gates are activated.

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**Maximum Preemption Timer**

While this is not a specific electrical circuit in the interconnection between the traffic signal controller and the railroad, the following function is derived from the interconnection circuits:

- This function is used to place the traffic signal in an all-red flash condition if the preemption circuit from the railroad exceeds a pre-programmed time.
- Usually set to 1 ½ to 2 times the expected longest train time.
- Newer controllers may be able to use internal preemption plan programming. Where not supported internally, may be accomplished via an external time delay relay.
Interconnection Circuits

Advance Pedestrian Preemption

While this is not a specific electrical circuit in the interconnection between the traffic signal controller and the railroad, the following function is derived from the interconnection circuits:

• This function is derived from the advance preemption circuit and initiates the pedestrian change interval on any active pedestrian movement.

• It is especially beneficial where long pedestrian change times are required and it has been determined that the APT should provide for this time.

Single Break vs. Double Break

Single or double break refers to the electrical design of the interconnection.

Double break is a railroad signal design technique intended to maximize the fail-safe design of circuits which pass from one signal enclosure to another. It requires that both the positive (+) and negative (-) energy is opened or closed through the relay contacts or isolated circuits are used.
Interconnection Circuits

So how many wires do I need?

<table>
<thead>
<tr>
<th>Interconnection Type</th>
<th>Single Break (with Supervision)</th>
<th>Double Break (without Supervision)</th>
<th>Double Break (with Supervision)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advance preemption</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Crossing active / Simultaneous preemption</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Gate down</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Traffic signal health</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Isolated interconnection energy</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
<td>10</td>
<td>12</td>
</tr>
</tbody>
</table>

Pre-Signals

A pre-signal is a signal located in a position near the crossing (either upstream or downstream) so as to control traffic approaching the tracks and not obstruct the visibility of the railroad flashing-light signals. The pre-signal works in conjunction with a downstream signalized intersection and is usually implemented where the clear storage distance is insufficient to safely store a design vehicle.
Pre-Signals

Things to Consider:

- Use of pre-signals for long clear storage distances must carefully consider driver expectancy for stopping traffic well in advance of the normal stopping point for the intersection, as well as, the inherent inefficiency of pre-signal operation
- Use of pre-signals must carefully consider the location of the signal indications (downstream or upstream)

Pre-Signals

Things to Consider:

- Additional signing and turning restrictions are required
- Visibility-limited signal faces should be installed for the downstream signal indications beyond the pre-signal
- The pre-signal indications should be progressively timed with the downstream signal to permit the design vehicle to clear the CSD prior to the display of the red indication for each cycle
Pre-Signals

Limited Effectiveness?

• The use of a pre-signal does not replace the need for a proper track clearance interval.

• Motorists feel entitled to make a right turn on red.

• Many motorists only view a pre-signal as “near-side” signal faces and still pull up to the intersection.

• Pre-signal faces are a primary signal indication
Pre-Signals

How many problems can you spot with this pre-signal?

Driver Comprehension?
Pre-Signals

Too many signs?

Driver Confusion?
### Pre-Signals

**Pre-Signal Installation**

Good design?

Plenty of signs

Crossbuck obstructed

Flashing-lights obstructed

Advance warning sign in odd location?

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**Pre-Signals**

**Pre-Signal Installation**

What happened?

I thought a pre-signal was supposed to prevent this!

Yikes, this driver IS waiting for the pre-signal!

No, it wasn’t staged

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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.
- The queue cutter’s function is to provide a means to prevent vehicles from stopping on the tracks or within the MTCD as a result of traffic queuing from a downstream signalized intersection.

Queue Cutter Signals

- Generally, a queue cutter signal is installed where the CSD exceeds 450 feet.
- A queue cutter signal installed less than 450’ from the downstream intersection **WILL BE A PROBLEM**.
- It is interconnected with the railroad warning system with a 3 to 5 second advance preemption time.
Queue Cutter Signals

Queue loops must use fail-safe design and self-checking loop processor system.

Each loop wire has 2 independent loop circuits – a detect loop and a check loop.

Queue cutter signal flashes red if there is a loop system failure.

Train Hits Car in Pompano – May 20, 2008

“The collision happened where traffic had backed up behind a red light at the North Andrews Extension intersection.”

CSD = 785’
Queue Cutter Signals

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Queue Cutter Signals

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Queue Cutter Signals

San Juan Capistrano, California

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Queue Cutter Signals

Queue Cutter Signal Requirements

- A “safety critical” vehicle detection system using self check capabilities is used to activate the queue cutter control system.

- The vehicle detection system must detect the buildup of a queue of vehicles before the queue reaches MTCD.

- A queue cutter signal control system must have battery back-up.

- Any fault of the queue cutter system must result in a flashing red display.

Queue Cutter Signals

Queue Cutter Signal Requirements

- The stop line location must be 40 feet in advance of the queue cutter signals.

- Queue cutter signals can be located upstream or downstream from the railroad crossing similar to pre-signals.

- The queue cutter signals and support structures must be located to maintain visibility of the railroad flashing-lights.
Closing Thoughts

- Remember – It’s much more detailed than you will ever imagine.
- Seek expert advice if you have not had specific in-depth training on preemption design.
Closing Thoughts

• Remember – It’s much more detailed than you will ever imagine.
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Closing Thoughts

- Remember – It’s much more detailed than you will ever imagine.
- Seek expert advice if you have not had specific in-depth training on preemption design.
- Communication between all parties is essential.
- It will take longer than you ever thought due to the complexity of the solutions.
- You will uncover traffic signal problems and challenges in almost every location.

Good to have an Expert On-Site
QUESTIONS

Saving lives one crossing at a time

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