
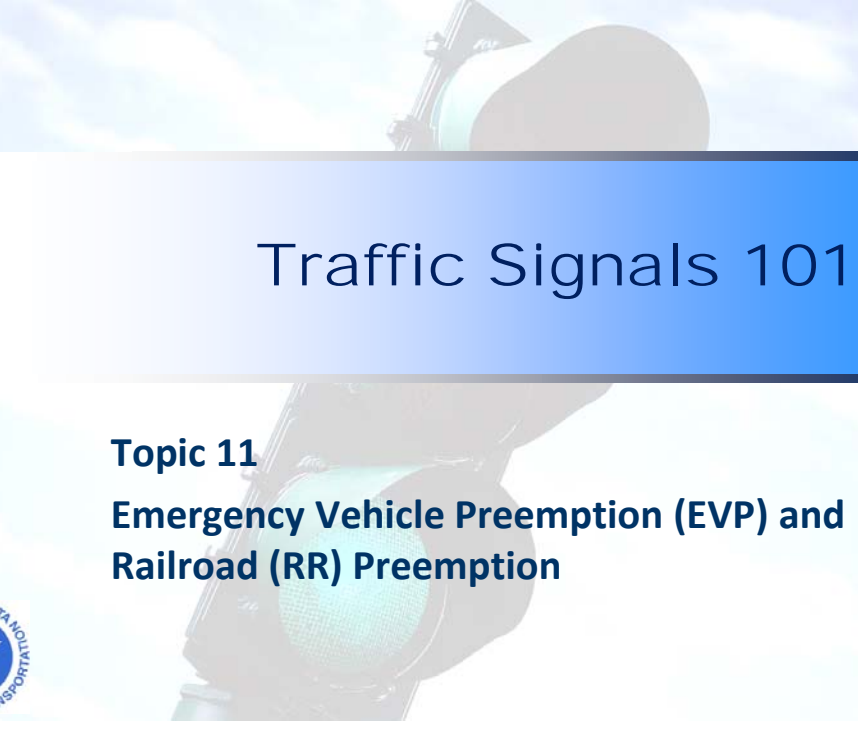


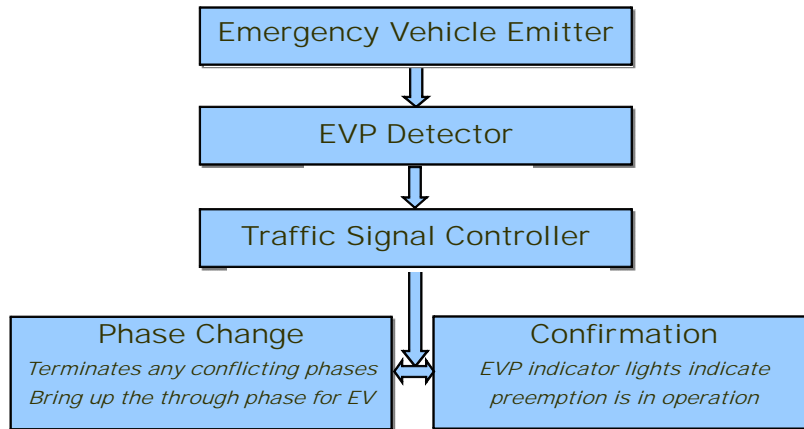


TOPIC 11: EMERGENCY VEHICLE PREEMPTION (EVP) AND RAILROAD PREEMPTION

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Office of Traffic, Safety & Technology</p> 		<p>The transfer of signal control to a special signal operation is called preemption.</p> <p>There are three common types of preemption, based on different reasons:</p> <ul style="list-style-type: none"> • Emergency Vehicle • Railroad • Transit Vehicle <p>This topic will cover emergency vehicle and railroad preemption. A handout is included at the back of this topic on these topics.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Office of Traffic, Safety & Technology</p> 	<h3>EVP and RR</h3> <ul style="list-style-type: none"> ➤ Emergency Vehicle Preemption (EVP) <ul style="list-style-type: none"> – Emergency vehicle preemption (EVP) is a system installed on authorized emergency vehicles and at traffic signals which allows the authorized emergency vehicles to travel through signalized intersections in a safe and timely manner 	<p>This is the EVP definition.</p>

EVP and RR



The system works as follows: An authorized emergency vehicle approaching a signalized intersection en-route to a call has an activated emitter (a strobe light oscillating at a specified frequency). The oscillations are detected by an EVP detector mounted on the signal mast arm. The detector may be located elsewhere to increase the range. The signal controller terminates any conflicting phases to bring up the through phase for the authorized emergency vehicle. Indicator lights mounted on the mast arm indicate that preemption is in operation.

3

EVP and RR

➤ Guidelines for Construction

- Within the State of Minnesota, EVP detection systems shall respond to emitted frequencies:
 - High Priority - 14.035 Hz ± 0.05 Hz
 - Low Priority - 9.639 Hz ± 0.03 Hz

All newly constructed signals shall be wired for EVP. This includes running the necessary electrical conductors to the base of each pole or terminating in the mast arm as appropriate.

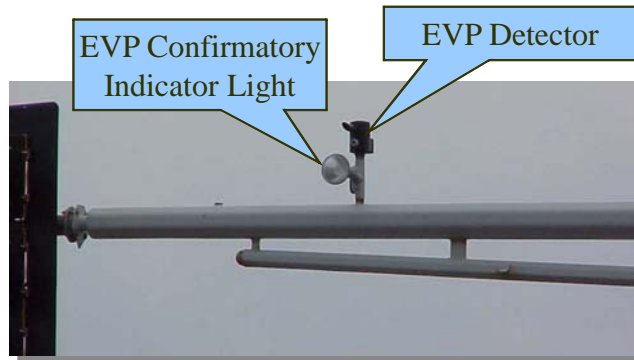
Traffic signals with EVP shall use confirmatory white indicator lights. The confirmatory light shall only be used during signal preemption. Railroad preemption shall have priority over all other types of preemption, including authorized emergency vehicles.

4

EVP and RR

➤ Guidelines for Operation

– EVP Confirmatory Indicator Light



The white/clear confirmatory indicator light shall be mounted, in most cases, on the signal mast arm, one indication light facing each direction of approach. The EVP confirmatory light shall remain dark (off) when the EVP Operation is not active. When the EVP is in operation, the indicator light shall flash or be steady under conditions defined below.

5



EVP and RR

– Purpose of the Confirmatory Indicator Light

- Verify to the authorized emergency vehicle driver that the signal controller has received the call
- Verify to the authorized emergency vehicle drivers approaching from different directions which direction of approach would receive preemption

Note: The indications do not assign any right of way at the intersection.

6





EVP and RR

– Meaning of the Confirmatory Indicator Light

- Steady EVP Confirmatory Indicator Light facing an approach means that the authorized emergency vehicle preemption has been received by the signal controller for that approach
- Flashing EVP Confirmatory Indicator Light facing an approach means that the signal controller has received a call for preemption from an authorized emergency vehicle on a conflicting approach, and is responding to that call

This defines the meaning of the confirmatory light.

7



EVP and RR

➤ Operation of the Confirmatory Light

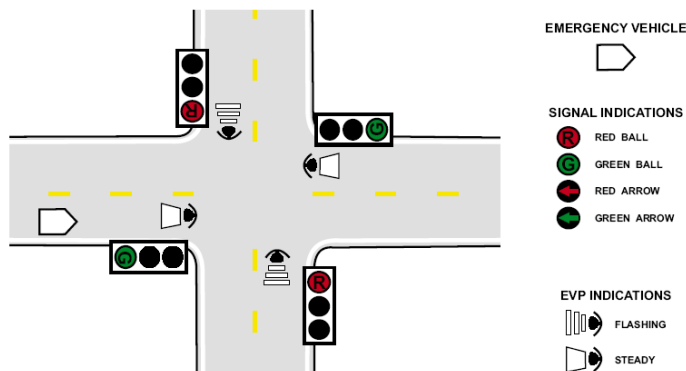


Figure 4D-1. Emergency Vehicle Preemption (EVP) Two-Phase Operation

The approach that is preempted will receive a steady confirmatory light along with the opposing approach. The controller will cycle through to bring up the circular green indications. The conflicting approaches will receive flashing confirmatory lights and circular red indications.

8



EVP and RR

➤ Operation of the Confirmatory Light

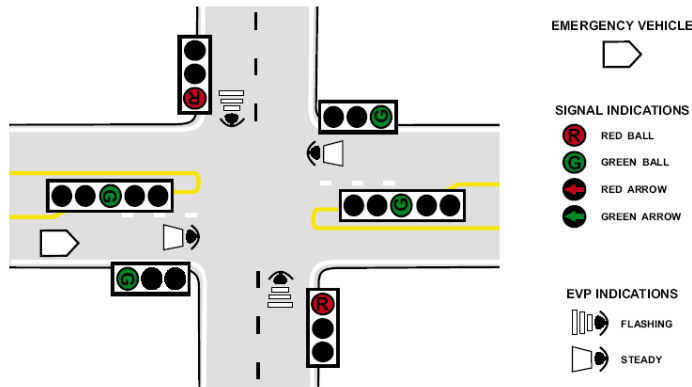


Figure 4D-2. Emergency Vehicle Preemption (EVP) Protected/Permissive Operation

The approach that is preempted will receive a steady confirmatory indication light along with the opposing approach. The controller will cycle through to bring up the circular green signal indication. The left turn green arrow is not given on the preempted approach since a permissive green ball for the opposing flow would have to be terminated first. An opposing left turner, seeing the signal go to yellow, might mistakenly assume that the preempted approach was also yellow, and turn into the oncoming traffic proceeding on a green. This is referred to as a “left turn trap.” To avoid this, the left turn green arrow is not given to any approach.

9

The operation of this intersection, under preemption, is similar to that of a two-phase intersection. Conflicting approaches will receive flashing confirmatory indication lights and circular red signal indications.



EVP and RR

➤ Operation of the Confirmatory Light

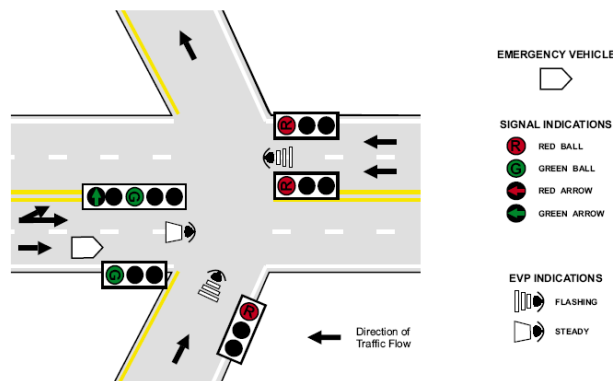


Figure 4D-3. Emergency Vehicle Preemption (EVP) Ramp/One-Way/T-Intersection Protected/Permissive Operation

The approach that is preempted will receive a steady confirmatory indicator light, a protected left turn green arrow, and a circular green. The opposing and conflicting approaches will receive flashing confirmatory indicator lights and red indications.

10

EVP and RR

➤ Operation of the Confirmatory Light

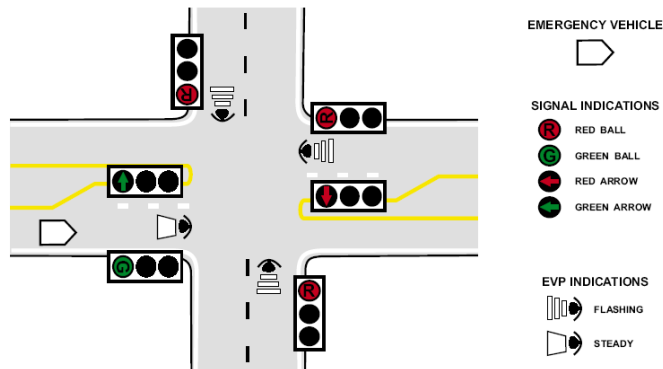


Figure 4D-4. Emergency Vehicle Preemption (EVP) Protected Operation

The approach that is preempted will receive a steady confirmatory indicator light, a protected left turn green arrow, and a circular green. The opposing and conflicting approaches will receive flashing confirmatory indicator lights and red indications.

If roadway geometry, signal operation, or preemption recognition distance is insufficient to clear left turning vehicles ahead of the authorized emergency vehicle, the engineer may bring up concurrent circular green through signal indications and leave all other movements red, including the protected left turn movements.

11

This alternative is permitted in low speed applications where clearing the left-turn bay is a problem. In this operation the confirmatory indications would operate similar to the two phase operation.

EVP and RR

➤ Railroad Preemption

- Railroad preemption is a system installed on traffic signals which allows trains or Light Rail Transit (LRT) vehicles to preempt the signal and travel through the intersection in a safe and timely manner

This is the railroad preemption definition.

12



EVP and RR

➤ Guidelines for Preemption

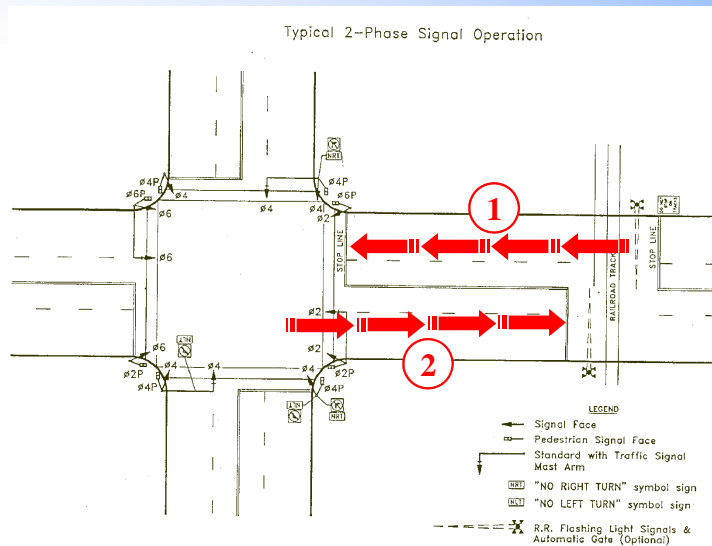
- If either of the following conditions are present, consideration should be given to interconnect the traffic signal and railroad grade crossing:
 - Highway traffic queues that have the potential for extending across a nearby rail crossing
 - Traffic queued from a downstream railroad grade crossing that have the potential to interfere with an upstream signalized intersection

The preemption conditions are described below (next slide).

13





EVP and RR

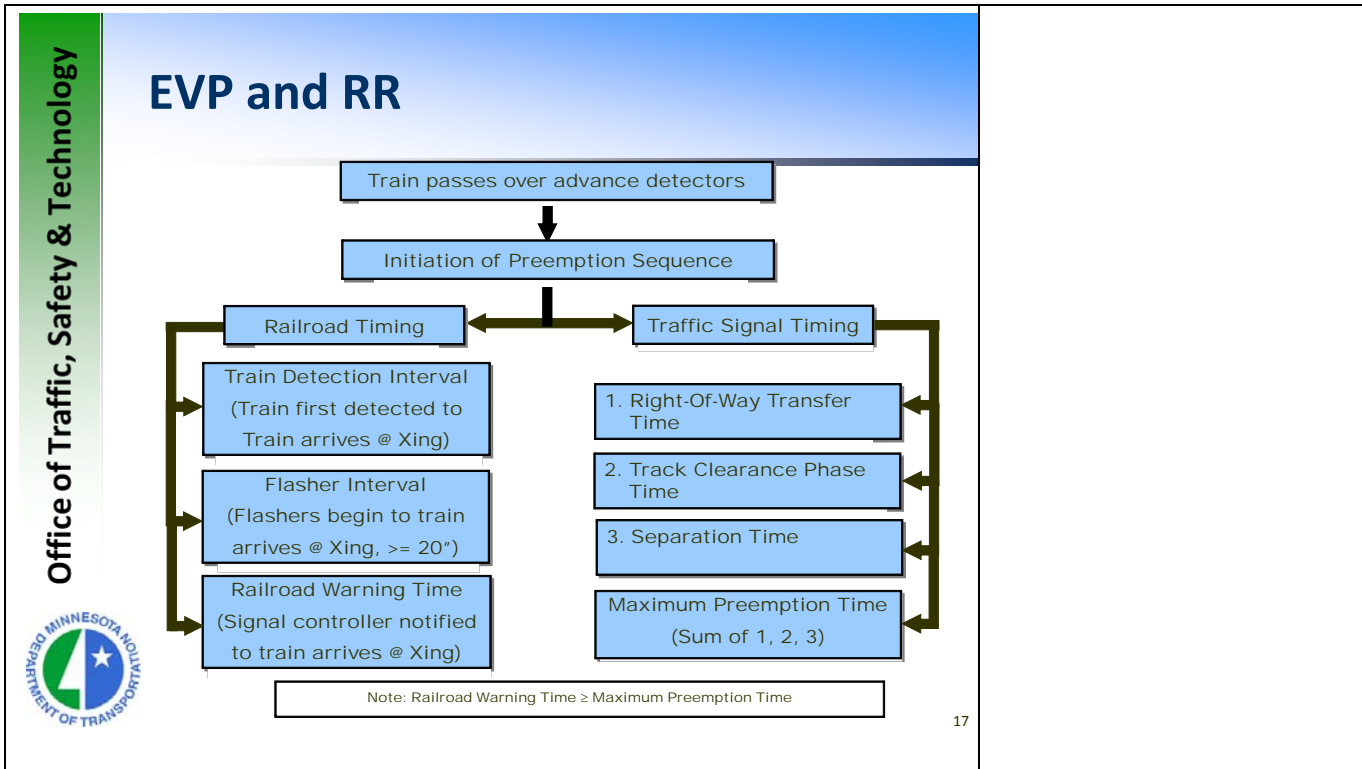


Condition 1: Highway traffic queues behind the intersection stop line, and has the potential to block the railroad tracks.

Condition 2: Highway traffic queues behind the railroad grade crossing stop line, and has the potential to interfere with the signalized intersection. (Some vehicles stacked in the middle of the intersection).

14

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Office of Traffic, Safety & Technology</p> 	<h2 style="background-color: #ADD8E6; padding: 5px;">EVP and RR</h2> <p>➤ Guidelines for Design</p> <ul style="list-style-type: none"> – When the determination has been made to preempt the traffic signal for a train, many items need to be considered – Some are listed here: <ul style="list-style-type: none"> • distance between the traffic signal and the grade crossing • intersection geometry • track orientation • approach speed of train • etc. <p style="text-align: right;">15</p>	<p>Things to consider for preemption.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Office of Traffic, Safety & Technology</p> 	<h2 style="background-color: #ADD8E6; padding: 5px;">EVP and RR</h2> <p>➤ Guidelines for Operation</p> <ul style="list-style-type: none"> – Goal 1: Permit traffic to clear the tracks before the train reaches the crossing. – Goal 2: Clear the traffic at the intersection. <p style="text-align: right;">16</p>	<p>Guidelines for operation; goals.</p>



GUIDELINES FOR OPERATION

The MMUTCD (Section 8C-6) requires that “The preemption sequence initiated when the train first enters the approach circuit, shall at once bring into effect a highway signal display which will permit traffic to clear the tracks before the train reaches the crossing. The preemption shall not cause any short vehicular clearances and all necessary vehicular clearances shall be provided. However, because of the relative hazards involved, pedestrian clearances may be abbreviated in order to provide the track clearance display as early as possible. After the track clearance phase, the highway intersection traffic control signals should be operated to permit vehicle movements that do not cross the tracks, but shall not provide a through circular green or arrow indication for movements over the tracks”.

If the traffic signal is equipped with emergency vehicle preemption, the confirmation lights shall flash for all approaches during the preempt sequence.

TRAFFIC SIGNAL TIMING

Maximum Preemption Time

The Maximum Preemption Time is the amount of time needed following initiation of the preemption sequence for the highway traffic signals to complete the entire sequence to clear the crossing within the minimum track clearance distance, of any vehicles prior to the arrival of the train at the crossing. This is the total of the Right-of-Way Transfer Time, Track Clearance Phase Time and Separation Time. A tabulation of the calculation appears below.

Right-Of-Way Transfer Time

- Equipment Response _____ seconds
- Pedestrian Clearance Time _____ seconds
- Minimum Green on Conflicting Phase _____ seconds
- Leading Flash Time of AWF (if present) _____ seconds



EVP and RR

– Railroad Crossing



19

This is a field picture of railroad preemption.



EVP and RR

– Railroad Cabinet



20

This is a field picture of a railroad cabinet.

Handouts

EVP handout from MN MUTCD (Page 4D-9 to 4D-14)

**Railroad Preemption handout from the Traffic Signal Timing and
Coordination Manual**

For the latest version, please visit:

www.dot.state.mn.us/trafficeng/publ/index.html