A. Purpose
This Manual Part recommends functional/operating guidelines for an interconnection to provide notification to a highway traffic signal controller from a highway-rail grade crossing warning system.

B. Warning Devices
1. For highway-rail grade crossing warning devices, see Manual Part 3.1.1 (Recommended Functional/Operating Guidelines for Highway-Rail Grade Crossing Warning Devices).

2. Control of highway-rail grade crossing warning devices shall be in accordance with Manual Part 3.1.15 (Recommended Functional/Operating Guidelines for control of Automatic Highway-Rail Grade Crossing Warning Devices).

C. Glossary
1. **Interconnection** – The electrical connection between the railroad active warning system and the traffic signal controller assembly for the purpose of preemption.

2. **Preemption** – The transfer of normal operation of traffic signals to be a special control mode.

3. **Advance Preemption and Advance Preemption Time** – Notification of an approaching train is forwarded to the highway traffic signal controller unit or assembly by railroad equipment for a period of time prior to activating the railroad active warning devices. This period of time is the difference in the Maximum Preemption Time required for highway traffic signal operation and the Minimum Warning Time needed for railroad operation and is called the Advance Preemption Time.

4. **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.
D. General
1. When a highway intersection controlled by traffic signals is located at or near a highway-rail grade crossing warning system (see 2000 MUTCD Section 8D-7), consideration should be given to the preemption of the normal operating sequence of the traffic signal controller when a train approaches. The traffic signal controller’s preemption operating sequence should be designed to provide proper signal information to clear the tracks of vehicles and pedestrians before the train occupies the crossing.

2. The need for preemption, type of preemption and time interval, shall be determined by the public agency having jurisdictional authority; as stated in the applicable part of the Manual on Uniform Traffic Control Devices.

E. Operation

2. Advance preemption should be provided by a constant warning time control device. On approaches where restarts occur from trains stopping or switching, advance preemption requirements should be reviewed, as restarts could result in reduced or no advance time.

3. It should be noted that because of the failsafe design criteria of the highway-rail grade crossing warning control system, any failure would result in a continuous preemption of the traffic controller, without a train present, until the problem is diagnosed and repaired.

4. After the train clears the highway-rail grade crossing, preemption shall be cancelled at the time the gates start to raise (XR circuit energizes).

5. Where advance preemption is utilized at multiple track highway-rail grade crossings, second train logic shall be provided to prevent gates from raising when advance preemption is requested on another track (XR circuit energizes, APR circuit remains de-energized).

6. Where advance preemption is utilized, a timing circuit should be employed to maintain a maximum time interval between the initiation of advance preemption and
operation of the warning system for a train move where speed is decreasing. It should be noted however, that this maximum time interval will decrease in the event train speed is increasing.

7. Design of preemption systems should consider not only the maximum right-of-way transfer time, but also the minimum right-of-way transfer time, which in many cases may be zero. Evaluation of right-of-way transfer time should be made to assure the proper track clearance green interval(s) is/are displayed by the traffic control signals in relation to operation of the highway-rail grade crossing warning system under all conditions.

8. Evaluation of traffic control signal equipment should be made to assure the ability to return to the start of the preemption sequence or retime the entire track clearance green interval, as appropriate, in the event of a momentary loss of the preemption request, such as the arrival of a second train.

F. Supplemental Definitions

1. **Minimum Track Clearance Distance (MTCD)** – For standard two-quadrant railroad warning devices, the minimum track clearance distance is the length along a highway at one or more railroad tracks, measured either from the railroad stop line, warning device or 4 meters (12 feet) perpendicular to the track centerline to 2 meters (6 feet) beyond the track(s) measured perpendicular to the far rail, along the centerline or edge line of the highway, as appropriate, to obtain the longer distance.

2. **Clear Storage Distance** – The distance available for vehicle storage measured between 2 meters (6 feet) from the rail nearest the intersection to the intersection STOP BAR or the normal stopping point on the highway. At skewed crossings and intersections, the 2 meter (6 foot) distance shall be measured perpendicular to the nearest rail either along the centerline, or edge line of the highway as appropriate to obtain the shorter clear distance.

3. **Monitored Interconnected Operation** – An interconnected operation that has the capability to be monitored by the railroad and/or highway authority at a location away from the railroad-highway grade crossing.
4. **Minimum Warning Time – Through Train Movements** – The least amount of time active warning devices shall operate prior to the arrival of a train at a railroad-highway grade crossing.

5. **Right-of-Way Transfer Time** – The maximum amount of time needed for the worst case condition, prior to display of the clear track green interval. This includes any railroad or traffic signal control equipment time to react to a preemption call, and any traffic signal green, pedestrian walk and clearance, yellow change and red clearance intervals for opposing traffic.

6. **Queue Clearance Time** – The time required for the design vehicle stopped within the minimum track clearance distance to start up and move through the minimum track clearance distance. If pre-signals are present, this time should be long enough to allow the vehicle to move through the intersection, or clear the tracks if there is sufficient clear storage distance.

7. **Separation Time** – The component of maximum preemption time during which the minimum track clearance distance is clear of vehicular traffic prior to the arrival of the train.

8. **Maximum 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.

9. **Pre-Signal** – Supplemental highway traffic signal faces operated as part of the highway intersection traffic signals, located in a position that controls traffic approaching the railroad crossing and intersection.

10. **Cantilevered Signal Structure** – A cantilevered signal structure is a structure that is rigidly attached to a vertical pole and is used to provide overhead support of signal units.

11. **Design Vehicle** – The longest vehicle permitted by statute of the road authority (State or other) on that roadway.