National Committee on Uniform Traffic Control Devices

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NOTE: This is a draft recommendation by the Railroad and Light Rail Transit Technical Committee and the Signals Technical Committee of the NCUTCD. It is being distributed to the National Committee Sponsoring agencies for review and is subject to revision. This draft recommendation is not a revision to the MUTCD and does not constitute official standards, guidance, or options. No proposed revision to the MUTCD is effective unless and until approved by FHWA through an Interim Approval or through the Federal rulemaking process.

TECHNICAL COMMITTEE:	**Railroad and Light Rail Transit and Signals Technical Committees**
TOPIC:	**Draft Recommendation - Traffic signal preemption for grade crossings**
STATUS/DATE OF ACTION:	Recommended to send to sponsors as a draft recommendation at the June 2013 National Committee Meeting by the by the Railroad and Light Rail Transit Committee and the Signals Technical Committee
Technical Committee Vote:	RRLRT – Unanimous FOR Signals – Unanimous FOR
Transmitted to Sponsors:	July 2013
Council Approval:	____________________
ORIGIN OF REQUEST:	RRLRT
AFFECTED SECTIONS OF MUTCD:	**Various definitions and various sections in Part 8**

SUMMARY:

The purpose of these proposed changes is to update the existing MUTCD standards, guidance, and options for traffic signal preemption for grade crossings to incorporate current capabilities, technology, and practice. This includes the addition of provisions for the use of queue cutter signals at grade crossings. It also includes preemption features and operation for specified busways in addition to light rail transit. Additional information regarding BRT and busways will be provided in a new section in the future.

The changes are extensive as preemption for grade crossings has remained largely untouched through previous editions of MUTCD. The state of the practice has changed considerably following the tragic crash between a train and school bus in Illinois in 1995. These changes are considered of highest priority by the RRLRT TC to bring MUTCD into compliance with current practice and to promote consistent design where applicable. In many cases, the proposed changes serve to clarify and guide the successful implementation of preemption and interconnection through additional support information. While the proposed changes are extensive, the need for preemption remains a Guidance condition. It is the intent of the Technical Committees to allow for site specific engineering to be conducted by a Diagnostic Team. The Diagnostic Team must reach a consensus on the various elements of traffic control devices and their application. The proposed changes support various elements which may be used at a given location and provide Standards, Guidance and Options in order to provide for uniform application of the devices.

DISCUSSION:

The RRLRT Technical Committee initiated work on these changes in 2008 and to date, there have been two requests for comments sent to sponsors. In 2011, the RRLRT Technical Committee presented a previous version of revisions to preemption for grade crossings to the National Committee Council. The item received extensive discussion and was tabled to allow for coordination with the Signals Technical Committee.

This draft recommendation has been developed through a series of conference calls between several STC members and Rick Campbell, Chair of the RRLRT Technical Committee plus follow-up discussions of the two technical committees at recent National Committee meetings. It represents hundreds of man-hours of work and has been debated in detail by the RRLRT Technical Committee over the last four years.

This draft recommendation includes major changes to what currently exists in Part 8. The amount of new, relocated, and deleted text makes it impractical to use underline and strike through text to show the changes to the current MUTCD language. Therefore, except for changes to existing MUTCD definitions, additions, relocations, and deletions are not color coded or otherwise identified. However, changes to existing definitions are shown with red underline (red underline) for new text and red double strike through (~~red double strikethrough)~~ for deleted text.

Most items sent to Sponsors for review are a technical committee recommendation that is likely to be presented to the National Committee Council for action at the following National Committee meeting. This is not the case with this item. This is considered a draft recommendation at this point. Due to its complexity and since it is being developed jointly by the Railroad and Light Rail Transit Technical Committee and the Signals Technical Committee, sponsors are asked to review and provide comments to assist the technical committees in developing the final recommendation. The two technical committees will review the comments received, make changes based on the comments, and send the item to sponsors a second time as a technical recommendation for review. Following the second sponsor review, the two committees will make further refinements to the recommendation, vote on the refined version, and present the item to the National Committee Council. It will then be forwarded to FHWA as a recommended change to the MUTCD if or as approved by The National Committee Council.

Some text in the draft recommendation is in yellow highlight. Yellow highlighting indicates text that is providing supplemental information related to the draft recommendation, but it is not part of the recommended text.

Traffic signal preemption for grade crossings is a complex topic. While most traffic signal operations are governed only by the traffic signal controller unit and associated traffic signal equipment, preemption for grade crossings is also governed by the railroad signal system. Active railroad signal systems include lights and may also include gates. If equipped with gates, the gates may be only on approach lanes or they may be four-quadrant gates covering approach and departure lanes. As with traffic signal controller units, the capabilities of railroad signal systems vary based on the age and sophistication of the equipment.

Since the overall operation of preemption for grade crossings is influenced by separate control systems typically owned and operated by separate agencies, it is important that that specific compliance dates or “trigger points” be specified for various items included in the recommendation. It may be necessary to replace the traffic signal controller unit and related equipment, the railroad signal system control equipment, or both in order to comply with the operation described in this draft recommendation. Therefore, while it is not anticipated that such compliance dates or “trigger points” would be included in the MUTCD text, they should be included in the recommendation to FHWA. Comments are requested concerning whether or not compliance dates or “trigger points” should be included in the recommendation to FHWA as well as any recommendations on what the compliance dates or “trigger points” should be.

Please include specific comments concerning items in the draft recommendation that you feel should be changed or omitted. If you believe additional information should be provided, those comments should be included as well. When applicable, alternate text would be appreciated as it will help the technical committees in their review and revision. Also, if there are items that are included in the draft recommendation that you feel are appropriate and important, please include comments to that effect so the technical committees will be aware that such text is desirable.

RECOMMENDED CHANGES TO THE MUTCD

PROPOSED NEW OR REVISED DEFINITIONS

Note: Numbered definitions exist in the 2009 MUTCD. The changes to the existing MUTCD definitions are shown. Definitions that are not numbered are proposed new definitions to be added to the MUTCD.

The definitions for “bus” and “bus rapid transit” were added by RRLRT during preparation of the draft recommendation following the June meeting. Therefore, they were not reviewed or discussed by the Signals Committee. This should not be interpreted to mean that the Signals committee is opposed to adding these definitions or to the text of the definitions. It only means that the Signals Committee has not reviewed or discussed adding these definitions. These definitions are included in this draft recommendation in order to provide Sponsors an opportunity to comment at this time.

Bus — when used in Part 8, a vehicle, including an articulated vehicle, which operates on rubber tires and is designed to transport not less than 32 passengers from one location to another location usually operating on a fixed route. A van, taxicab, limousine, or recreational vehicle is not considered to be a bus.

Bus Lane — a portion of a roadway that has been designated for preferential or exclusive use by buses by pavement markings and, if used, signs in a mixed-use environment.

Bus Rapid Transit - is a mode of metropolitan transportation that employs buses that operate on streets in mixed traffic, on a busway in a semi-exclusive right-of-way or on a busway in an exclusive right-of-way.

Busway — A busway is a traveled way intended for exclusive use of buses in a semi-exclusive or exclusive alignment.

Busway Grade Crossing – A busway grade crossing is the general area where a roadway and busway cross at the same level, within which are included the busway, roadway, and traffic control devices for the BRT operators and road users traversing that area.

Blank-out sign - A sign that displays its message only when activated. When not activated, the sign legend shall not be visible. (New definition based on text in 8B.08 paragraph 03.)

37. Constant Warning Time Train Detection - A means of detecting rail traffic that provides relatively uniform warning time for the approach of through trains ~~or light rail transit traffic~~ that are not accelerating or decelerating after being detected.

Diagnostic Team – A group of knowledgeable representatives of the parties of interest in a highway-rail crossing or group of crossings (see 23 CFR Section 109, Part 646.204). (This definition was approved by the Council following the June 2013 NCUTCD meeting as it is used in other portions of MUTCD)

Fail-Safe – When used in Part 8, a railroad signal design philosophy applied to a system or device such that the result of hardware failure or the effect of a software error shall either prohibit the system or device from assuming or maintaining an unsafe state or shall cause the system or device to assume a state known to be safe.

LED enhanced sign – a sign, other than a changeable message or blank-out sign, that includes LED units as described in Section 2A.07 to improve the conspicuity or increase the legibility of sign legends and borders.

LRT or BRT exclusive alignment ("exclusive alignment") — LRT track(s) or a BRT busway alignment that is grade-separated or protected by a fence or traffic barrier. Motor vehicles, pedestrians, and bicycles are prohibited within the right-of-way. Subways and aerial structures are included within this group.

LRT or BRT semi-exclusive alignment ("semi-exclusive alignment") — LRT track(s) or a BRT busway alignment that is in a separate right-of-way or along a street or railroad right-of-way where motor vehicles, pedestrians, and bicycles have limited access and cross

at designated locations only. In a semi-exclusive right-of-way, the LRT or BRT vehicles usually have right-of-way over other roadway users at grade crossings.

LRT or BRT bus lane mixed-use alignment ("mixed-use alignment") — An LRT alignment or bus lane where the LRT or BRT vehicles operate in mixed traffic with all types of road users. This includes streets, transit malls and pedestrian malls where the right-of-way is shared. In a mixed-use alignment, the LRT or BRT vehicles do not have right-or-way over other roadway users at grade crossings and intersections.

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~~,~~. Where flashing light signals with automatic gates are used, the distance is measured from the portion of the gate arm farthest from the near rail. Where flashing light signals are used without automatic gates, the distance is measured from the flashing light signal mast farthest from the near rail. Where passive traffic control devices are used, the distance is measured from the stop line. Where the roadway is not paved, the distance is measured from ~~the highway stop line, warning device, or~~ 12 feet perpendicular to the track center line. The distance ends ~~, 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. For Four-Quadrant Gate systems, the ~~minimum track clearance~~ distance is extended ~~is the length along a highway at one or more railroad or light rail transit tracks, measured either from the highway stop line or entrance warning device,~~ to the point where the rear of the vehicle would be clear of the exit gate arm. In cases where the exit gate arm is parallel to the track(s) and is not perpendicular to the highway, the distance is measured either along the center line or edge line of the highway, as appropriate, to obtain the longer distance.

152. Preemption – the transfer of normal operation of a traffic control signal or a hybrid beacon to a special control mode of operation.

Preemption Clearance Interval – the part of a traffic signal sequence displayed as a result of a preemption request when vehicles are provided the opportunity to clear a railroad or light rail transit track, drawbridge, or busway prior to the arrival or the train, boat, or bus for which the traffic signal is being preempted. Note: replaces the term "track clearance green interval used in:

1A.13 def 175. Right-of-Way Transfer Time

8C.06 Four-Quadrant Gate Systems, # 16

and "track clearance" used in 8C.09 Traffic Control Signals at or Near Highway-Rail Grade Crossings, #12

92. Preemption Interconnection — When used in Part 8, the ~~electrical~~ connection between the railroad,~~or~~ light rail transit, or busway active warning system and the ~~highway~~ traffic signal controller assembly for the purpose of preemption.

Preemption Time Variability – the result that occurs when the traffic signal controller enters the Preemption Clearance Interval with less than the maximum design Right-of-Way Transfer Time.

154 Pre-signal — highway traffic ~~control~~ signal faces located at a grade crossing positioned to ~~that~~ control traffic approaching ~~a~~ the grade crossing and operated as a part

of the adjacent interconnected intersection traffic control signals. ~~**in conjunction with the traffic control signal faces that control traffic approaching a highway-highway intersection beyond the tracks. Supplemental near-side traffic control signal faces for the highway-highway intersection are not considered pre-signals. Pre-signals are typically used where the clear storage distance is insufficient to store one or more design vehicles.**~~

158. Priority Control – a means by which the assignment of right-of-way is obtained or modified. Note: This definition is going to go be revised by the STC for clarification. As written, a vehicle or ped call on an actuated side street not on recall would be covered by the definition – but this is clearly not intended as priority control. Following is a possible alternative for discussion and comments are encouraged:

> **Priority** - the variation of a traffic control signal's operation to expedite the passage of specific emergency, transit or other vehicles which are still subject to the signal's control.

Queue cutter signal — A traffic control signal that is intended to prevent vehicular queuing across tracks at a grade crossing where traffic queuing occurs and is activated for one direction of travel by an approaching train or by an approaching vehicle on a busway, actuation from a downstream queue detection system, by time of day or a combination of any of these. A queue cutter signal is not operated as a part of a downstream intersection traffic control signal but is an independently controlled traffic control signal.

166. Quiet Zone —a segment of a rail line, within in which is situated one or a number of consecutive public highway-rail grade crossings at which locomotive horns are not routinely sounded per 49 CFR Part 222.

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~~ Preemption Clearance Interval. This includes any railroad, ~~or~~ light rail transit, bus rapid 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.

Sidewalk Grade Crossing – the portion of a Highway-Rail Grade Crossing or a Highway-Light Rail Transit Grade Crossing where a sidewalk and railroad or light rail transit tracks cross at the same level, within which are included the tracks, sidewalk, and traffic control devices for sidewalk users traversing that area.

Through Train – a through train is a train movement that continues without stopping or reversing direction throughout the entire length of the rail traffic detection circuit length approaching a highway-rail grade crossing.

255. Wayside Horn System —a stationary horn (or series of horns) located at a grade crossing that is used in conjunction with train-activated or light rail transit-activated warning systems to provide audible warning of approaching rail traffic to road users on the highway or pathway approaches to a grade crossing, either as a supplement or alternative to the sounding of a locomotive horn.

CHAPTER 8A. GENERAL

Section 8A.01 Introduction

Support:

Whenever the acronym "LRT" is used in Part 8, it refers to "light rail transit."

Whenever the acronym "BRT" is used in Part 8, it refers to "bus rapid transit."

Part 8 describes the traffic control devices that are used at highway-rail, highway-LRT and highway-BRT grade crossings. Unless otherwise provided in the text or on a figure or table, the provisions of Part 8 are applicable to highway-rail, highway-LRT and highway-BRT grade crossings. When the phrase "grade crossing" is used by itself without the prefix "highway-rail," "highway-LRT" or "highway-BRT," it refers to highway-rail, highway-LRT and highway-BRT grade crossings.

Traffic control for grade crossings includes all signs, signals, markings, other warning devices and their supports along highways approaching and at grade crossings. The function of this traffic control is to promote safety and provide effective operation of rail and/or LRT and/or BRT and highway traffic at grade crossings.

For purposes of design, installation, operation and maintenance of traffic control devices at grade crossings, it is recognized that the crossing of the highway and rail tracks or busway is situated on a right-of-way available for the joint use of both highway traffic and railroad, LRT or BRT traffic.

The highway agency or authority with jurisdiction and the regulatory agency with statutory authority, if applicable, jointly determine the need and selection of devices at a highway-rail grade crossing.

The highway agency or authority with jurisdiction, the regulatory agency with statutory authority, if applicable and the transit agency jointly determine the need and selection of devices at a highway-LRT or highway-BRT grade crossing.

In Part 8, the combination of devices selected or installed at a specific grade crossing is referred to as a "traffic control system."

Standard:

The traffic control devices, systems, and practices described in this Manual shall be used at all grade crossings open to public travel, consistent with Federal, State, and local laws and regulations.

Support:

Part 8 also describes the traffic control devices that are used in locations where light rail vehicles (Light Rail Transit or LRT) or designated transit vehicles (Bus Rapid Transit or BRT) are operating along streets and highways in mixed traffic with automotive vehicles.

LRT is a mode of metropolitan transportation that employs LRT vehicles (commonly known as light rail vehicles, streetcars, or trolleys) that operate on rails in streets in mixed traffic or that operate in semi-exclusive or exclusive rights-of-way. Grade crossings with LRT can occur at intersections or at midblock locations, including public and private driveways.

BRT is a mode of metropolitan transportation that employs buses or other rubber-tired vehicles that operate on streets in mixed traffic or that operate on busways in semi-exclusive or exclusive rights-of-way. Grade crossings with busways can occur at intersections or at midblock locations, including public and private driveways.

An initial educational campaign along with an ongoing program to continue to educate new drivers is beneficial when introducing LRT or BRT operations to an area and, hence, new traffic control devices.

LRT and BRT alignments can be grouped into one of the following three types:

A. LRT or BRT exclusive alignment ("exclusive alignment"). This type of alignment does not have grade crossings and is not further addressed in Part 8.
B. LRT or BRT semi-exclusive alignment ("semi-exclusive alignment").
C. LRT or BRT lane mixed-use alignment ("mixed-use alignment").

Standard:

Where LRT and railroads use the same tracks or adjacent tracks, the traffic control devices, systems, and practices for highway-rail grade crossings shall be used.

The following Standard statement was added by RRLRT during preparation of the draft recommendation following the June meeting. Therefore, it was not reviewed or discussed by the Signals Committee. This should not be interpreted to mean that the Signals committee is opposed to adding this statement or to the text of the statement. It only means that the Signals Committee has not reviewed or discussed the statement. This statement is included in this draft recommendation in order to provide Sponsors an opportunity to comment at this time.

Where BRT and railroads are adjacent to one another, the control system for the railroad shall operate independently from the control system for the BRT. A Diagnostic Team shall determine the appropriate traffic control devices and their operation.

Support:

To promote an understanding of common terminology between highway, railroad, LRT and BRT signaling issues, definitions and acronyms pertaining to Part 8 are provided in Sections 1A.13 and 1A.14.

Section 8A.02 Use of Standard Devices, Systems, and Practices at Highway-Rail Grade Crossings

Support:

Because of the large number of significant variables to be considered, no single standard system of traffic control devices is universally applicable for all grade crossings.

Guidance:

The appropriate traffic control system to be used at a highway-rail grade crossing should be determined by an engineering study conducted by a Diagnostic Team involving both the highway agency with jurisdiction, the regulatory agency with statutory authority (if applicable) and the railroad company. Factors to be considered in the determination of what should be installed include, but are not limited to: road geometrics, stopping sight distance, clearing sight distance, the proximity of nearby roadway intersections including the traffic control devices at the intersections adjacent driveways, traffic volume across the grade crossing, extent of queuing upstream or downstream of the grade crossing, train volume, pedestrian volume, operation of passenger trains, presence of nearby passenger station stops, variable train speeds, accelerating and decelerating trains, multiple tracks, high speed train operation, number of school buses or hazardous material haul vehicles or locations where a history of accidents occur.

Operational changes made to a traffic control system at a grade crossing requiring the use of engineering judgment or an engineering study should be conducted or approved by a Diagnostic Team.

Standard:

The Diagnostic Team members shall reach a determination on proposed changes to a traffic control system at a highway-rail grade crossing based on site visits, meetings, conference calls, or a combination of some or all of these methods. The Diagnostic Team determination shall be made based on a consensus of the Diagnostic Team members.

Option:

When determined by the responsible public agency, minor changes to the traffic control system at a grade crossing that do not have a negative impact on the overall operation of the traffic control system may be made without a review and determination by a Diagnostic Team.

Guidance:

The determination made by the Diagnostic Team should be documented and distributed to the Diagnostic Team members.

Option:

The engineering study may include the Highway-Rail Intersection (HRI) components of the National Intelligent Transportation Systems (ITS) architecture, which is a USDOT accepted method for linking the highway, vehicles, and traffic management systems with rail operations and wayside equipment.

Support:

More detail on Highway-Rail Intersection components is available from the USDOT's Federal Railroad Administration, 1200 New Jersey Avenue, SE, Washington, DC 20590, or www.fra.dot.gov.

Standard:

Traffic control devices, systems, and practices shall be consistent with the design and application of the Standards contained in this Manual.

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.

Guidance:

To stimulate effective responses from road users, these devices, systems, and practices should use the five basic considerations employed generally for traffic control devices and described fully in Section 1A.02: design, placement, operation, maintenance, and uniformity.

Support:

Many other details of highway-rail, LRT, and busway grade crossing traffic control systems that are not set forth in Part 8 are contained in the publications listed in Section 1A.11, including the latest version of the AREMA Communications & Signals Manual published by the American Railway Engineering & Maintenance-of-Way Association (AREMA) and the latest version of "Preemption of Traffic Signals Near Railroad Crossings" published by the Institute of Transportation Engineers (ITE).

Section 8A.03 Use of Standard Devices, Systems, and Practices at Highway-LRT and Highway-BRT Grade Crossings

Support:

The combination of devices selected or installed at a specific highway-LRT grade crossing is referred to as a LRT Traffic Control System.

The combination of devices selected or installed at a specific BRT grade crossing is referred to as a BRT Traffic Control System.

Because of the large number of significant variables to be considered, no single standard system of traffic control devices is universally applicable for all LRT or BRT grade crossings.

For the safety and integrity of operations by highway and LRT or BRT users, the highway agency with jurisdiction, the regulatory agency with statutory authority, if applicable, and the transit authority jointly determine the need and selection of traffic control devices and the assignment of priority to LRT or BRT vehicles at highway-LRT or highway-BRT grade crossings.

The normal rules of the road and traffic control priority identified in the "Uniform Vehicle Code" and its successor govern the order assigned to the movement of vehicles at an intersection unless the local agency determines that it is appropriate to assign a higher priority to LRT or BRT vehicles. Examples of different types of LRT or BRT priority control include separate traffic control signal phases for LRT or BRT movements, restriction of movement of roadway vehicles in favor of LRT or BRT operations, and preemption of highway traffic signal control to accommodate LRT and BRT movements.

The following Standard paragraph was added by RRLRT during preparation of the draft recommendation following the June meeting. Therefore, it was not reviewed or discussed by the Signals Committee. This should not be interpreted to mean that the Signals committee is opposed to adding this paragraph or to the text of the paragraph. It only means that the Signals Committee has not reviewed or discussed the paragraph. This paragraph is included in this draft recommendation in order to provide Sponsors an opportunity to comment at this time.

Standard:

The appropriate traffic control system to be used at a highway-LRT or BRT grade crossing shall be determined by an engineering study conducted by representatives from the transit agency and the highway agency in cooperation with other appropriate State agencies and local organizations. The agency representatives shall reach a determination on proposed changes to a traffic control system at a highway-LRT or BRT grade crossing based on site visits, meetings, conference calls, or a combination of some or all of these methods. The final determination shall be made based on a consensus of the agency representatives.

Traffic control devices, systems, and practices shall be consistent with the design and application of the Standards contained in this Manual.

The traffic control devices, systems, and practices described in this Manual shall be used at all highway-LRT and highway-BRT grade crossings.

Before any new highway-LRT or highway-BRT 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 transit agency.

Guidance:

To stimulate effective responses from road users, these devices, systems, and practices should use the five basic considerations employed generally for traffic control devices and described fully in Section 1A.02: design, placement, operation, maintenance, and uniformity.

Support:

Many other details of highway-LRT and highway-BRT grade crossing traffic control systems that are not set forth in Part 8 are contained in the publications listed in Section 1A.11.

Additional information regarding highway-BRT traffic control systems is provided in Section 8E.

Standard:

Highway-LRT grade crossings in semi-exclusive alignments shall be equipped with a combination of automatic gates and flashing-light signals, or flashing-light signals only, or traffic control signals, unless an engineering study indicates that the use of Crossbuck Assemblies, STOP signs, or YIELD signs alone would be adequate.

Option:

Highway-LRT grade crossings in mixed-use alignments may be equipped with traffic control signals unless an engineering study indicates that the use of Crossbuck Assemblies, STOP signs, or YIELD signs alone would be adequate.

Support:

Sections 8B.03 and 8B.04 contain provisions regarding the use and placement of Crossbuck signs and Crossbuck Assemblies. Section 8B.05 describes the appropriate conditions for the use of STOP or YIELD signs alone at a highway-LRT grade crossing. Section 8C.15 contains provisions regarding the use of traffic control signals at highway-LRT grade crossings.

Section 8A.04 Uniform Provisions

Standard:

All signs used in grade crossing traffic control systems shall be retroreflectorized or illuminated as described in Section 2A.07 to show the same shape and similar color to an approaching road user during both day and night.

No sign or signal shall be located in the center of an undivided highway, unless it is crashworthy (breakaway, yielding, or shielded with a longitudinal barrier or crash cushion) or unless it is placed on a raised island.

Guidance:

Any signs or signals placed on a raised island in the center of an undivided highway should be installed with a clearance of at least 2 feet from the outer edge of the raised island to the nearest edge of the sign or signal, except as permitted in Section 2A.19.

Where the distance between tracks, measured along the highway between the inside rails, exceeds 100 feet, additional signs or other appropriate traffic control devices should be used to inform approaching road users of the long distance to cross the tracks.

Support:

Additional details of active traffic control device location and operation at adjacent highway-rail or highway-LRT grade crossings located within 200’ of each other that are not set forth in Part 8 are contained in Part 3.1.11 of the AREMA Communications & Signals Manual published by the American Railway Engineering & Maintenance-of-Way Association (AREMA).

Section 8A.05 Grade Crossing Elimination

Guidance:

Because grade crossings are a potential source of crashes and congestion, agencies should conduct engineering studies to determine the cost and benefits of eliminating these crossings.

Standard:

When a grade crossing is eliminated, the traffic control devices for the crossing shall be removed.

If the existing traffic control devices at a multiple-track grade crossing become improperly placed or inaccurate because of the removal of some of the tracks, the existing devices shall be relocated and/or modified.

Guidance:

Any grade crossing that cannot be justified should be eliminated.

Where a roadway is removed from a grade crossing, the roadway approaches in the railroad or LRT right-of-way should also be removed and appropriate signs and object markers should be placed at the roadway end in accordance with Section 2C.66.

Where a railroad or LRT is eliminated at a grade crossing, the tracks should be removed or covered.

Option:

Based on engineering judgment, the TRACKS OUT OF SERVICE (R8-9) sign (see Figure 8B-1) may be temporarily installed until the tracks are removed or covered. The length of time before the tracks will be removed or covered may be considered in making the decision as to whether to install the sign.

Section 8A.06 Illumination at Grade Crossings

Support:

Illumination is sometimes installed at or adjacent to a grade crossing in order to provide better nighttime visibility of trains or LRT equipment and the grade crossing (for example, where a substantial amount of railroad or LRT operations are conducted at night, where grade crossings are blocked for extended periods of time, or where crash history indicates that road users experience difficulty in seeing trains or LRT equipment or traffic control devices during hours of darkness).

Recommended types and locations of luminaires for illuminating grade crossings are contained in the American National Standards Institute’s (ANSI) “Practice for Roadway Lighting RP-8,” which is available from the Illuminating Engineering Society (see Section 1A.11).

Section 8A.07 Quiet Zone Treatments at Highway-Rail Grade Crossings

Support:

49 CFR Part 222 (Use of Locomotive Horns at Highway-Rail Grade Crossings; Final Rule) prescribes Quiet Zone requirements and treatments.

Standard:

Any traffic control device and its application where used as part of a Quiet Zone shall comply with all applicable provisions of the MUTCD.

Section 8A.08 Temporary Traffic Control Zones

Support:

Temporary traffic control planning provides for continuity of operations (such as movement of traffic, pedestrians and bicycles, transit operations, and access to property/utilities) when the normal function of a roadway at a grade crossing is suspended because of temporary traffic control operations. Temporary traffic control planning is also needed when roadway or grade crossing construction results in the detouring of traffic over an existing grade crossing with passive warning devices.

Standard:

Traffic controls for temporary traffic control zones that include grade crossings shall be as outlined in Part 6.

When a grade crossing exists either within or in the vicinity of a temporary traffic control zone, lane restrictions, flagging (see Chapter 6E), or other operations shall not be performed in a manner that would cause highway vehicles to stop on the railroad or LRT tracks, unless a flagger or uniformed law enforcement officer is provided at the grade crossing to minimize the possibility of highway vehicles stopping on the tracks, even if automatic warning devices are in place.

When a temporary traffic control zone extends over a grade crossing equipped with automatic gates and one lane two-way or reversible lane operation is used, one or more gate arms shall be removed to avoid stopping vehicles within the a Minimum Track Clearance Distance by an improperly located gate. A railroad employee serving as a flagger and one or more uniformed law enforcement officer(s) shall be in place at all times that a train may occupy the grade crossing.

When traffic is detoured over an existing grade crossing with passive warning devices, a traffic control plan shall be prepared in accordance with Section 6C.01 Temporary Traffic Control Plans.

Guidance:

Public and private agencies, including emergency services, businesses, and railroad or LRT companies, should meet to plan appropriate traffic detours and the necessary signing, marking, signalization, and flagging requirements for operations during a) temporary traffic control zone activities; or b) activities that result in the detouring of traffic over a grade crossing with passive warning devices. Consideration should be given to the length of time that the grade crossing is to be closed and the length of time the detour is to be in place. In addition, the type of rail or LRT and highway traffic affected, the time of day, and the materials and techniques of repair.

The agencies responsible for the operation of the LRT and highway should be contacted when the initial planning begins for any temporary traffic control zone that might directly or indirectly influence the flow of traffic on mixed-use facilities where LRT and road users operate.

Temporary traffic control operations should minimize the inconvenience, delay, and crash potential to affected traffic. Prior notice should be given to affected public or private agencies, emergency services, businesses, railroad or LRT companies, and road users before the free movement of road users or rail traffic is infringed upon or blocked.

Temporary traffic control zone activities should not be permitted to extensively prolong the closing of the grade crossing.

The width, grade, alignment, and riding quality of the highway surface at a grade crossing should, at a minimum, be restored to correspond with the quality of the approaches to the grade crossing.

Support:

Section 6G.18 contains additional information regarding temporary traffic control zones in the vicinity of grade crossings, and Figure 6H-46 shows an example of a typical situation that might be encountered.

CHAPTER 8B. SIGNS AND MARKINGS

Note: Section 8b.08 is being moved into Section 8C.

CHAPTER 8C. FLASHING-LIGHT SIGNALS, GATES, AND TRAFFIC CONTROL SIGNALS

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

Standard:

Except as provided in the option below, traffic control signals shall not be used instead of flashing-light signals to control road users at a highway-rail grade crossing.

Option:

Traffic control signals may be used instead of flashing-light signals to control road users at industrial highway-rail grade crossings and other places where the maximum speed of trains is 10 m.p.h. or less.

Standard:

The appropriate provisions of Part 4 relating to traffic control signal design, installation, and operation shall be applicable where traffic control signals are used to control road users instead of flashing-light signals at highway-rail grade crossings.

Section 8C.10 Preemption of Traffic Control Signals at Grade Crossings

Support:

Traffic signal preemption for grade crossings is a complex topic which requires very specific understating of both traffic signals and grade crossing warning systems. While most traffic signal operations are governed only by the traffic signal controller unit and associated traffic signal equipment, preemption for grade crossings is also governed by the railroad warning system. Active railroad warning systems include flashing light signals and may include automatic gates as well as varying types of train detection equipment. When the two systems are interconnected to each other for the purpose of preemption, a third system is created. It is the third system which requires thorough understanding of the design and operating parameters in order to provide proper operation of the preemption system.

Many agencies which have a number of signalized intersections may have a very limited number of locations interconnected to a grade crossing. For this reason, the use of an engineering firm with expertise in the design and operation of preemption may be of benefit in order to successfully implement preemption operation.

The Federal Railroad Administration (FRA) has issued two documents which provide additional information relating to preemption of traffic signals near grade crossings. The first document is Technical Bulletin S-12-01, Guidance Regarding the Appropriate Process for the Inspection of Highway-Rail Grade Crossing Warning System Pre-emption Interconnections with Highway Traffic Signals The second document is Safety Advisory 2010-02 which addresses Signal Recording Devices for Highway-Rail Grade Crossing Active Warning Systems that are Interconnected with Highway Traffic Signal Systems.

Guidance:

If a grade crossing is equipped with a flashing-light signal system and is located within 200 feet of any traffic control signal or hybrid beacon, the traffic control signal or hybrid beacon should be provided with preemption in accordance with Part 4.

Coordination with the flashing-light signal system, examples of which may include queue detection, a queue cutter signal, blank-out signs, preemption, or other alternatives should be considered for traffic control signals or hybrid beacons located farther than 200 feet from the highway-rail grade crossing. Factors to be considered should include traffic volumes, highway vehicle mix, highway vehicle and train approach speeds, frequency of trains, presence of midblock driveways or unsignalized intersections, traffic backed up from a nearby downstream railroad crossing and the likelihood of vehicular queues extending into the Minimum Track Clearance Distance.

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.

If a traffic control signal or hybrid beacon is installed near a grade crossing with passive traffic control devices and traffic is likely to queue onto the tracks, an active grade crossing warning system should be installed at the grade crossing to provide a means to preempt the traffic control signal or hybrid beacon in order to clear vehicles from the Minimum Track Clearance Distance upon approach of a train.

Note to sponsors: The RRLRT & STC has not been able to reach a consensus on which of the following Guidance paragraphs should be included in the final version. STC prefers A, RRLRT prefers B. We are requesting sponsor comments for technical committee review to help determine the language that will be presented to the NC Council for their vote. Please include a comment in your response whether you prefer A or B, or please provide alternative language if you feel neither of these paragraphs is appropriate:

A. - If a traffic control signal is interconnected with a flashing light signal system, a diagnostic team should determine if the flashing light signal system should be provided with automatic gates.

or

B. - If a traffic control signal is interconnected with a flashing light signal system, the flashing light signal system should be provided with automatic gates unless a diagnostic team determines otherwise.

The highway agency or authority with jurisdiction, and the regulatory agency with statutory authority, if applicable and the railroad or LRT operator should jointly inspect and verify the preemption operation, the amount of warning time and/or advanced preemption time being provided by the railroad warning system and the timing of traffic control signals interconnected and/or coordinated with flashing-light signals no less than once per year.

Support:

Section 4D.27 includes a recommendation that traffic control signals that are adjacent to highway-rail grade crossings and that are coordinated with the flashing-light signals or that include railroad preemption features be provided with a back-up power supply.

Guidance:

When a backup power supply is installed for a traffic control signal that is interconnected with a grade crossing, the backup power supply should provide for a minimum operating *period sufficient to allow the implementation of alternative traffic control measures during a power outage.*

Standard:

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

If preemption is provided, unless otherwise determined by a diagnostic team, the normal sequence of traffic control signal indications shall be preempted upon the approach of through trains to provide a preemption clearance interval of adequate duration to minimize the likelihood of vehicles not having sufficient time to clear the minimum track clearance distance prior to the arrival of the train.

Where a flashing light signal system is in place at a grade crossing, any traffic control signal faces or hybrid beacon signal faces installed within 50' prior to or beyond the nearest rail shall be preempted upon the approach of a train. The signal faces shall display RED indications in accordance with Section 4D.27 in order to avoid conflicting indications with the flashing light signal system.

Guidance:

The operation of any flashing yellow beacon installed within 50' prior to or beyond the nearest rail should be considered by a Diagnostic Team to determine whether the operation of the beacon should be terminated during the approach and passage of the train. .

Standard:

This preemption special control mode shall be activated by a supervised preemption interconnection using fail-safe design principles between the control circuits of the grade crossing warning system and the traffic control signal controller. The approach of a train to a grade crossing shall de-energize the interconnection or send a message via a fail-safe data communication protocol, which in turn shall activate the traffic control signal controller preemption sequence. This shall establish and maintain the preemption condition during the time the grade crossing warning system is activated, except that when automatic gates are used, the preemption condition shall be terminated at the point the automatic gates are energized to start their upward movement.

Support:

A supervised preemption interconnection incorporates both a normally-open and a normally-closed circuit from the grade crossing warning system to verify the proper operation of the interconnection.

An example of a fail-safe data communication protocol for preemption is IEEE 1570

Option:

In lieu of supervision, a double-break preemption interconnection circuit may be used. A double-break interconnection utilizes two normally-closed circuits which open both the source and return energy circuits.

A preemption interconnection may incorporate both supervision and double-break circuits.

Standard:

At locations where conflicting preemption calls may be received to serve boats and trains, the Diagnostic Team shall determine which mode shall receive first priority when conflicting preemption calls occur. Where the boat and the train do not conflict, the Diagnostic Team shall determine the preemption sequence when the two preemption calls occur simultaneously. The Coast Guard or other appropriate authority that regulates the operation of the waterway shall be invited to participate on the Diagnostic Team and/or to provide input to the Diagnostic Team.

Guidance:

Where left turns are allowed from the approach that crosses the track, a protected left turn movement should be provided during the preemption clearance interval if a delayed or impeded left turn movement could prevent vehicles from clearing the track.

The decision to implement simultaneous or advance preemption should include consideration of the Right-of-Way Transfer Time, Queue Clearance Time and the Separation Time in order to determine the Maximum Preemption Time. These time periods should be compared to and verified with the operation of the grade crossing traffic control devices in order to evaluate the operation of the traffic control signal and the preemption operation. These factors should be considered regardless of whether simultaneous or advance preemption operation is implemented as they are based on traffic signal minimum timing, vehicle acceleration and physical distances along the roadway.

Support:

Preemption time variability occurs when the traffic signal controller enters the preemption clearance interval with less than the maximum design Right-of-Way Transfer Time.

Guidance:

If advance preemption is used, an analysis of preemption operation and sequencing should be conducted to identify preemption time variability. The analysis should include the "worst case scenario" requiring the longest period of time to enter preemption clearance interval and the "best case scenario" in which the currently displayed green phase when a preemption call is received is the preemption clearance interval green phase.

If simultaneous preemption is used, an analysis of gate descent upon standing vehicles and extended grade crossing warning times should be conducted as these conditions are frequently encountered with simultaneous preemption operation.

Standard:

Where preemption is used, it shall be designed such that the traffic signal does not leave the preemption clearance interval green until the automatic gate(s) that control access over the crossing toward the intersection is/are fully lowered.

Support:

The following are two examples of mutually exclusive methods to resolve preemption time variability:

1. Gate Down – Gate down circuitry is utilized to provide a means to hold the traffic signal controller sequence in the preemption clearance interval green until the gate(s) controlling access over the grade crossing approaching the signalized intersection is/are down.
2. Timing Correction – Timing correction is utilized to resolve Preemption Time Variability by adding the Right-of-Way Transfer Time to the preemption clearance interval green in the traffic signal controller unit and setting a fixed maximum period of time between the start of advance preemption and the operation of the flashing light signals.

Standard:

In the event a gate is broken or is not fully lowered and where Gate Down circuitry is used to resolve preemption time variability, the crossing control circuits shall release the preemption clearance interval green no earlier than when the train enters the crossing.

Where Timing Correction is utilized to resolve preemption time variability, a timing circuit shall be employed to maintain a maximum time interval between the initiation of advance preemption and operation of the warning system for a train movement where speed is decreasing.

Support:

The time interval between the initiation of advance preemption and operation of the warning system for a train will decrease in the event train speed is increasing.

Guidance:

When a highway intersection controlled by traffic control signals is interconnected with a grade crossing equipped with exit gates, advance preemption should be used due to the required additional operating time for the exit gates.

Where trains routinely stop and re-start within or just outside of approaches to grade crossings interconnected with traffic control signals, the effects of train operations on the preemption operation should be considered.

Traffic signal control equipment should be capable of providing immediate re-service of successive requests for preemption from the railroad warning devices, even if the initial preemption sequence has not completed. As appropriate, the traffic control equipment should be able to promptly return to the start of the preemption clearance interval at any time the demand for preemption is cancelled and then reactivated. The traffic signal control equipment should have the ability to provide this re-service from within any point of the preemption sequence.

Standard:

Where traffic control signals are programmed to operate in a flashing mode during the preemption dwell interval (period following preemption clearance interval green) the beginning of flashing mode shall be delayed until the railroad equipment indicates that the train has entered the crossing.

Support:

Section 4C.10 describes the Intersection Near a Grade Crossing signal warrant that is intended for use at a location where the proximity to the intersection of a grade crossing on an intersection approach controlled by a STOP or YIELD sign is the principal reason to consider installing a traffic control signal.

Section 4D.27 describes additional considerations regarding preemption of traffic control signals at or near grade crossings.

Section 8C.11 Movements Prohibited During Preemption

Guidance:

At a signalized intersection where the clear storage distance is 100 feet or less and the intersection traffic control signals are preempted by the approach of a train, all movements toward the grade crossing should be prohibited during the signal preemption sequences.

Option:

All movements toward the track may be prohibited at a signalized intersection that has a clear storage distance of more than 100 feet.

A blank-out or changeable message sign and/or appropriate highway traffic signal indication or other similar type sign may be used to prohibit movements toward the grade crossing during preemption. The R3-1 and R3-2 signs shown in Figure 8C-1 may be used for this purpose.

Figure 8C-1

Example graphic

Option:

A supplemental blank-out legend which displays the word "TRAIN" may be included as a part of the blank-out or changeable message sign. A supplemental blank-out legend which displays the symbol for a train or a light-rail transit vehicle may be included as a part of the blank-out or changeable message sign. See Section 2H-1 for train and LRT symbols.

Support:

Including the word "TRAIN" or a symbol for a train or light-rail transit vehicle as part of the blank-out or changeable message sign advises road users that the prohibition being displayed by the sign is in effect due to the presence of a train approaching or across a nearby rail grade crossing.

Rail operations can include the use of activated blank-out signs for turn prohibitions at grade crossings other than intersections controlled by a traffic control signal. The signs are typically used where a semi-exclusive or mixed-use alignment is within or parallel to the roadway where road users might turn across the tracks.

Guidance:

An LRT-activated blank-out turn prohibition (R3-1a or R3-2a) sign should be used where:

1.) there is no active warning system for the grade crossing, and

2.) vehicles travelling along a roadway would typically be permitted to turn left or right across tracks located within or adjacent to the roadway, and

3.) the turning drivers are not controlled by a traffic signal.

8C.12 Pre-Signals at or Near Grade Crossings

Guidance:

If a highway-rail grade crossing is in close proximity to a signalized intersection and the clear storage distance is less than the design vehicle length, the use of pre-signals to control traffic approaching the grade crossing should be considered.

A pre-signal should be provided if a grade crossing equipped with flashing light signals but without automatic gates is within 200 feet of a signalized intersection.

Option:

If used, the pre-signal faces may be located either upstream or downstream from the grade crossing in order to provide the most effective display to road users approaching the crossing.

Standard:

If used, the pre-signals shall display a steady red signal indication during the p**reemption** c**learance** i**nterval portion of a signal preemption sequence to prohibit additional highway vehicles from entering the Minimum Track Clearance Distance.**

Pre-signal faces shall not display green indications when the grade crossing flashing-light signal system is displaying flashing red indications.

Guidance:

Visibility-limited signal faces (see definition in Section 1A.13) should be used at the intersection for the downstream signal faces that control any approach that is equipped with a pre-signal.

Where a pre-signal is used with a Permissive or a Protected/Permissive Mode leading left-turn movement, a green clearance interval with a lagging left turn movement should be considered for every traffic control signal cycle to clear vehicles from the Minimum Track Clearance Distance.

Option:

The duration of the green clearance interval may be adjusted by vehicle detection located between the pre-signal and the downstream signalized intersection.

Support:

Left turn lanes at some signalized intersections near grade crossings could extend from the signalized intersection back to and across the grade crossing. In such cases, vehicles that are in that lane as they cross the tracks are expected to make a left turn when the reach the signalized intersection. However, they are making a straight through movement as they cross the grade crossing.

Guidance:

Where a pre-signal is used with a Protected Only Mode left-turn movement and the left turn storage area extends from the adjacent intersection to and across the grade crossing, a separate left turn signal face should be provided as a part of the pre-signal in addition to the signal faces provided for the through movement.

Standard:

If the left turn storage area extends from the adjacent intersection to and across the grade crossing and a separate left turn signal face is provided as part of a pre-signal, the separate left turn signal face shall be capable of displaying the following signal indications: steady straight-through RED ARROW, steady straight-through YELLOW ARROW, and steady straight-through GREEN ARROW. Only one of the three indications shall be displayed at any given time. (➔Note: will require exception language to be added in Part 4 as straight through red and yellow arrows are not allowed.)

Option:

The pre-signal phase sequencing may be timed with an offset from the downstream signalized intersection where the pre-signal green indication terminates before the downstream signals such that the minimum track clearance distance and the clear storage distance is generally kept clear of stopped highway vehicles.

Guidance:

If a pre-signal is installed at an interconnected grade crossing near a signalized intersection, a STOP HERE ON RED (R10-6) sign should be installed near the pre-signal or at the stop line.

Standard:

If the clear storage distance between the tracks and an adjacent signalized intersection is less than 100 feet and pre-signals are used, a NO TURN ON RED (R10-11, R10-11a, or R10-11b) sign (see Section 2B.53) shall be installed for the approach that crosses the track in the direction of the signalized intersection if the turn can be made. If a No Turn on Red (R10-11, R10-11a, or R10-11b) sign (see Section 2B.53) is installed for the approach that crosses the track, it shall not be installed on the same pole as the Stop Here on Red (R10-6) sign.

Option:

If traffic control signals must be located within close proximity to the flashing-light signal system, the traffic control signals may be mounted on the same overhead structure as the flashing-light signals.

Section 8C.13 Queue Cutter Signals at or Near Grade Crossings

Support:

A queue cutter signal is a traffic control signal used to reduce the likelihood of vehicles stopping within the Minimum Track Clearance Distance. A queue cutter signal is located at a grade crossing in a manner similar to a pre-signal but is operated independently from a downstream signalized intersection.

Option:

Queue cutter signal faces may be located either upstream or downstream from the grade crossing in order to provide the most effective display to road users approaching the crossing.

Support:

While queue cutter signals and queue jumping signals have similar names, their purpose, design, and operation are quite different. Care must be taken to avoid confusion between queue cutter signals used in conjunction with a grade crossing and queue jumping signals used with transit operations.

Guidance:

A STOP HERE ON RED (R10-6) sign should be installed at the stop line in conjunction with a queue cutter signal.

Option:

A "DO NOT STOP ON TRACKS" (R8-8) sign may be installed in conjunction with a queue cutter signal.

If queue-cutter signal faces must be located within close proximity to the flashing-light signal system, the highway signal faces may be mounted on the same overhead structure as the flashing-light signals.

A queue cutter signals may be operated in one or all of the following modes:

Mode	Operation
Actuated	In actuated mode, the queue cutter operation is dependent on downstream detection of a building queue.
Non-Actuated	In non-actuated mode, the queue cutter operates on a time of day plan based on anticipated downstream queues. This mode may replicate the functional operation of a pre-signal.
Variable	In variable mode, the queue cutter operation may use both actuated and non-actuated operation based on time of day, queue detection, a combination of the two or other means to limit the queue onto the MTCD

Support:

A pre-signal is generally used where the grade crossing is less than 200' from a downstream signalized intersection.

A non-actuated queue cutter signal is generally used where the grade crossing is greater than 200' from a downstream signalized intersection.

An actuated queue cutter signal is generally used where the grade crossing is greater than 400' from a downstream signalized intersection.

Guidance:

Where a queue cutter signal operates in actuated mode based on vehicle presence detection, the queue detector should be located to provide adequate distance to detect a building queue, permit the queue cutter signal to complete any programmed minimum green or yellow change time and then allow a design vehicle which lawfully enters during the yellow change interval to clear the minimum track clearance distance (MTCD) before the building queue extends to the grade crossing.

A queue cutter signal that is equipped with downstream detection and that is displaying CIRCULAR RED indications should continue to display CIRCULAR RED indications after the downstream signal changes to green as long as the vehicle presence detection system detects a vehicular queue at the detection point on the departure side of the grade crossing.

Where a queue cutter signal operates in actuated mode based on vehicle presence detection, consideration should be given to the potential for turning movements between the grade crossing and the downstream signalized intersection which could create an intermediate queue of vehicles. Supplemental queue detectors should be considered to detect the formation of these queues to activate the queue cutter signal.

When a queue cutter signal is operated solely in non-actuated mode based on anticipated queues, consideration should be given to operating the queue cutter in flashing mode when its use in not required.

When operated on a cyclic basis, a queue cutter signal should be coordinated with adjacent signals for progressive movement.

A queue cutter signal operating in variable mode under non-actuated operation may use the queue detector to extend the duration of the red period until it has been determined that the queue is dissipating.

Standard

A queue cutter signal shall be interconnected with a flashing light signal system.

If a queue cutter signal operates in flashing mode during certain times of the day, it shall still change to red whenever a call for preemption is received from the railroad flashing light signal system.

Support:

Following is a typical sequence of indications for an actuated queue cutter signal:

1. Rest while displaying GREEN indications permitting traffic to proceed across the grade crossing
2. Following an actuation from the vehicle presence detection system or advance preemption by the approach of a train, finish timing any active minimum green interval, followed by the YELLOW indications during the yellow change interval, followed by RED indications
3. Resume the display of GREEN indications when
   A. no preemption call is present and the railroad flashing light system is not active, and
   B. there is no actuation from the vehicle presence detection system, and
   C. the length of time since the last vehicle presence detection system actuation is such that it is appropriate to permit vehicles to again cross the grade crossing.

Standard:

A queue-cutter signal operating in actuated mode shall display a CIRCULAR GREEN indication except when it receives an actuation from the vehicle presence detection system or is preempted by the approach of a train. When it receives an actuation from the vehicle presence detection system, the queue-cutter signal shall finish timing any active minimum green interval if used, then display YELLOW indications during the yellow change interval followed by RED indications in accordance with Section 4D.26.

If a minimum green interval is used with a queue-cutter signal operating in actuated mode, the minimum green time shall be included in the time requirements used to determine the location of the queue detectors.

When a queue cutter signal it is preempted by the approach of a train, it shall display YELLOW indications during the yellow change interval followed by RED indications in accordance with Section 4D.26.

Advance preemption shall be used if a queue cutter signal uses a minimum green interval in order to prevent the display of GREEN indications with the operation of the flashing light signals.

An actuated queue-cutter signal shall include a vehicle presence detection system located between the highway-rail grade crossing and the downstream signalized

intersection. When queue lengths extend to the detection zone of the vehicle presence detection system, an actuation shall be sent to the queue-cutter signal.

When no preemption call is present and the queue length is such that no vehicles are detected in the detection zone of the vehicle presence detection system, the queue-cutter signal shall return the display of green indications.

The failure modes of the queue cutter signal control system and vehicle presence detection circuitry shall be evaluated and accounted for in the design of any such system. Because the purpose of the queue cutter signal system is to keep road users clear of the Minimum Track Clearance Distance, fail-safe design techniques should be used in the system design. The vehicle presence detection system shall incorporate health monitoring and self-check operation to validate the proper functioning of the system. If the queue detector fails to properly self-check or the health circuit indicates a fault, the queue cutter signal should transition to FLASHING RED until the normal functioning of the system can be restored.

Section 8C.14 Beacons or LED enhanced signs used for Advance Warning at Highway-Rail or LRT Grade Crossings

Option:

Warning beacons or LED enhanced sign may be used to supplement warning signs installed on an approach to grade crossings when additional emphasis is desired for the warning sign (see Section 4L.03).

When used at or on approach to a grade crossing, a warning beacon or LED enhanced sign may operate continuously or be activated upon approach of a train.

Support:

Signs, such as a W10-1 through W10-6 and aW10-8 through W10-15 warn of physical conditions that exist whether or not a train is approaching or present. Therefore, a train activated warning beacon or LED enhanced sign does not provide any additional information about the physical conditions the signs warn about, but instead provides increased emphasis for the sign.

Other signs, such as a W3-4 BE PREPARED TO STOP sign, when used in advance of a grade crossing and equipped with a W16-14 WHEN FLASHING plaque, provide information that is typically not applicable except when a train is approaching or present. Likewise, a special word message (See Section 2A.06) TRAIN WHEN FLASHING or other similar message sign provides notice of a condition that does not exist when no train is approaching or present. Where used, consideration must be given to the message displayed to motorists when the warning beacon or LED enhanced sign is not operating.

Standard:

When activated by the approach of a train, a warning beacon or LED enhanced sign that is used in conjunction with a sign that includes “when flashing” in either the sign legend or on a supplemental plaque shall utilize a fail-safe system to operate the beacon or sign.

Support:

In the event of a system failure, the normal fault state for a train activated warning beacon or LED enhanced sign using a fail-safe system would be for the beacon or LED enhanced sign to operate with no train present. See Section 8C.09 for additional information regarding interconnect circuit standards.

Option:

A warning beacon or LED enhanced sign that is activated by the approach of a train may continue to operate for a period of time following the passage of the train to permit the standing queue to start in motion.

Guidance:

When a warning beacon or LED enhanced sign is activated by the approach of a train, it should begin its flashing operation prior to the beginning of operation of the flashing-light signals at the grade crossing based upon the travel time of a design vehicle between the location of the warning beacon or LED enhanced sign and the grade crossing.

When a warning beacon or LED enhanced sign is activated by the approach of a train, it should be connected to the railroad equipment by means of an advance preemption interconnection.

When a warning beacon or LED enhanced sign is activated by the approach of a train, it should be capable of providing a minimum operating period sufficient to allow the implementation of alternative traffic control measures. A beacon or sign operated by commercial AC power should be provided with a back-up power system. A beacon or sign operated by one or more batteries, whether charged by commercial AC power or by solar panels, should be designed such that the battery or batteries provide a sufficient operating period in the event the batteries are not recharged for an extended period of time.

Standard:

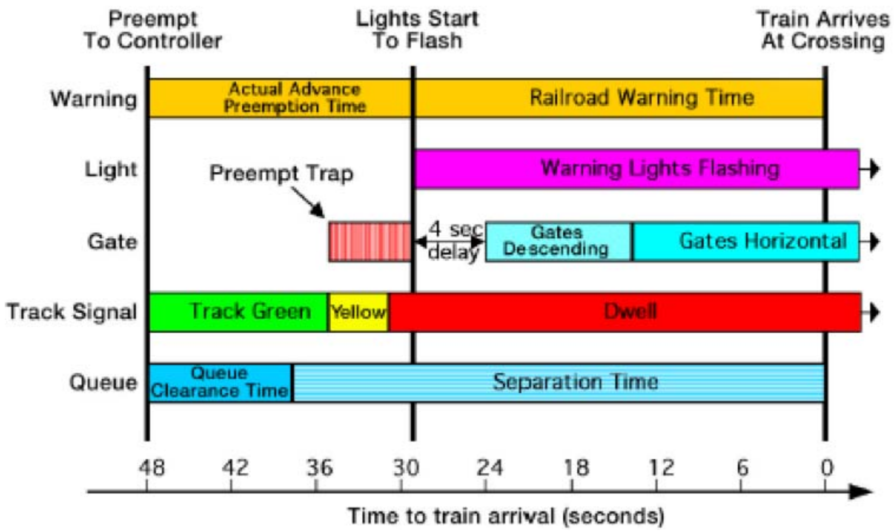
If a warning beacon or LED enhanced sign is activated to indicate that a train is either approaching or present, one or both of the following shall be used in conjunction with the warning beacon or LED enhanced sign:

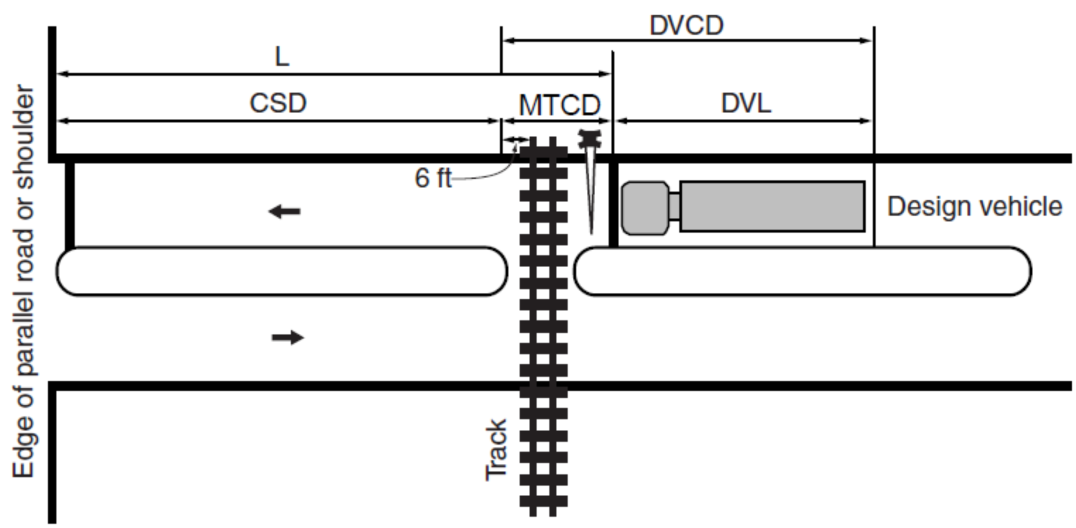
1. **A (insert plaque # here) WHEN FLASHING plaque**
2. **A WHEN FLASHING message included in the legend of a word message sign.**

Option:

A warning beacon or LED enhanced sign used to indicate that a train is either approaching or present and therefore provide notice of a condition that does not exist when no train is approaching or present may be activated by typical traffic control equipment or by railroad flasher equipment.

Note: The following two graphics, or similar versions, have been discussed for inclusion in Part 8 in order to help demonstrate various terms. Please indicate whether or not you feel such graphics would be beneficial if included. If yes, do you recommend any modifications to the shown versions?





Notes:

1. See Section 1A.13 definition of the Clear Storage Distance (CSD) for additional guidance
2. The MTCD varies depending on site conditions including the type of warning devices. See Section 1A.13 definition of the Minimum Track Clearance Distance for additional guidance

CSD = Clear storage distance (see Note 1)
MTCD = Minimum track clearance distance (see Note 2)
DVL = Design vehicle length
L = Queue start-up distance
DVCD = Design vehicle clearance distance
= Flashing lights and gates (if applicable)
Direction of travel

Note: In addition to the changes to definitions and to Part 8 included in this draft recommendation, some items in other parts of the MUTCD will need to be reviewed and/or revised if the draft recommendation is approved in its current form. Following is information on items in other parts that will need to be reviewed and/or revised. Although these items are not yet in a recommendation format, feel free to provide any comments you feel are appropriate that relate to the following items:

<u>Part 4</u>

1. Provide authorization to flash intersection –but keep some indications steady red for preemption operation.
2. Review priority order listed in 4D.27 relating to trains, boats, etc.
3. Add the following (or similar) STANDARD to Part 4

    Standard:

    A steady GREEN ARROW, steady YELLOW ARROW, flashing YELLOW ARROW or flashing RED ARROW shall not be simultaneously displayed with the display of a blank-out or changeable message sign prohibiting the same movement.

4. Change "track clearance green interval" to "preemption clearance interval" in:

    1A.13 def 175. Right-of-Way Transfer Time, and in

    8C.06 Four-Quadrant Gate Systems, # 16

    And replace the term "track clearance" with "track clearance green interval" in 8C.09 Traffic Control Signals at or Near Highway-Rail Grade Crossings, #12

5. Review/revise the term "interconnection" as used in - 4H.02 Design of Traffic Control Signals for One-Lane, Two-Way Facilities, # 01B. "Interlock" may be a better term.
6. Add the following guidance statement to part 4 in 4d.27

    Guidance:

    When a backup power supply is installed for a traffic control signal that is interconnected with a grade crossing, the backup power supply should provide for a minimum operating period sufficient to allow the implementation of alternative traffic control measures during a power outage.

7. Add language in Part 4 to permit the following operation:

    Standard:

    If the left turn storage area extends from the adjacent intersection to and across the grade crossing and a separate left turn signal face is provided as part of a pre-signal, the separate left turn signal face shall be capable of displaying the following signal indications: steady straight-through RED ARROW, steady straight-through YELLOW ARROW, and steady straight-through GREEN ARROW. Only one of the three indications shall be displayed at any given time. `(➔straight through red and yellow arrows are not currently allowed.)`

8. Review use of beacons used to indicate when a condition exists and address a potential need for a failsafe system when used with a 'when flashing" message. May also need to address other applications such as colored LEDs in a sign legend that are either on or off but steady when on. May want to address these although these are likely not MUTCD compliant.
9. Review/revise definition of priority control –

158. Priority Control– a means by which the assignment of right-of-way is obtained or modified.

As written, a vehicle or ped call on an actuated side street not on recall would be covered by the definition – but this is clearly not intended as priority control. Following is a possible alternative for discussion:

Priority - The variation of a Highway Traffic Signal’s operation to expedite the passage of specific emergency, transit or other vehicles which are still subject to the signal’s control.

For RW Signs –

1. New definition for blank-out sign
2. New definition of LED enhanced sign