



California Traffic Control Devices Committee Agenda Item Report



Meeting Date: November 03, 2022 Item Number: 22-15	From: Chi Cheung To, PE, CPUC Kevin Schumacher, PE, CPUC
Sponsored By: Yue Wang, PE, Caltrans	Presented By: Chi Cheung To, PE, CPUC Kevin Schumacher, PE, CPUC
Description: Revisions to California Manual on Uniform Traffic Control Devices (CA MUTCD) Section 4D. 27 Preemption and Priority Control of Traffic Control Signals to provide the option to allow pedestrian walk or clearance intervals during Right-of-Way Transfer time where sufficient time has been allocated to serve pedestrians during railroad preemption.	

Recommendation:

Motion by committee to recommend inclusion of the proposed changes to the CA MUTCD Section 4D.27 "Preemption and Priority Control of Traffic Control Signals".

Agency Making Request/Sponsor:

California Public Utilities Commission (CPUC) / Yue Wang, Caltrans, CTCDC Member.

Background:

Current CA MUTCD defines Right-of-Way Transfer Time to include components of pedestrian walk and/or clearance prior to display of the track clearance green interval.

Section 4D.27 standard language for railroad preemption states "Any walk or pedestrian clearance intervals in effect when preemption is initiated shall be immediately terminated."

Most of the existing locations with railroad preemption in California were designed with simultaneous preemption. For simultaneous preemption, where the traffic signal is notified at the same time as the warning devices start to flash, it is critical to quickly transition to clearing vehicles off the tracks by abbreviating the pedestrian walk interval and pedestrian clearance interval. Thus, the language in Section 4D.27 "Any pedestrian walk or clearance interval, in effect when preemption is initiated, shall immediately be terminated..." is critical for simultaneous preemption. However, the language no longer applies to all preemption operations because technology has improved, and current traffic signal and railroad equipment can support advance preemption. The proposed option statements provide flexibility to use advance preemption and include pedestrian walk and clearance intervals as components of the Right-of-Way Transfer Time.



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Shortening or omitting pedestrian clearance interval is a safety concern for preempted crossing locations with vulnerable users and/or high volume of pedestrian traffic. By abbreviating pedestrian walk and clearance intervals, slow-moving pedestrians may not have sufficient time to complete their movements across the crosswalks, which may delay vehicles from clearing off the tracks. This is especially important for preempted traffic signal locations near schools, senior centers, transit stations and event centers.

The motion includes option language to serve pedestrian walk and clearance intervals during railroad preemption where there is sufficient time to implement those measures through advance preemption. Advance Preemption is currently implemented by Caltrans for new installations of railroad preemption, or where the traffic signal or railroad warning devices equipment is being constructed or reconstructed on the State Highway System. Similarly, local roadway agencies typically implement advance preemption on local roadways for new installations.

Attachments:

Attachment A – Caltrans memorandum dated October 24, 2022 “Proposed Edits to Section 4D.27 of 2014 CA MUTCD Revision 6 Concerning to Pedestrian Walk and Clearance Interval during Railroad Preemption”.

Attachment B – Caltrans Publication Titled “Standard Interconnect for Traffic Signal Preemption at Railroad Crossings”.

Attachment C – Proposed Text Revisions to CA MUTCD Section 4D.27.



ATTACHMENT A



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Attachment A – Caltrans memorandum dated October 24, 2022 “Proposed Edits to Section 4D.27 of 2014 CA MUTCD Revision 6 Concerning to Pedestrian Walk and Clearance Interval during Railroad Preemption”.

State of California
M e m o r a n d u m



Date: October 24, 2022
To: File
From: Chi Cheung To, CPUC Senior Utilities Engineer Specialist
Kevin Schumacher, CPUC Senior Utilities Engineer Specialist
James Esparza, CPUC Senior Utilities Engineer Specialist
Subject: **Proposed Edits to Section 4D.27 of 2014 CA MUTCD Revision 6
Concerning to Pedestrian Walk and Clearance Interval during Railroad
Preemption**

RECOMMENDATION

California Public Utilities Commission (CPUC) staff plans to present a proposal to the California Traffic Control Devices Committee (CTCDC) to edit language in the California Manual on Uniform Traffic Control Devices (CA MUTCD) regarding pedestrian walk interval and pedestrian clearance interval during railroad preemption. The existing standard statement requires immediate termination of any pedestrian walk or clearance intervals upon railroad preemption. Such operation is inappropriate for locations where local agencies and railroads design advance preemption time or advance pedestrian preemption time to accommodate for pedestrian walk and clearance intervals. Current industry guidance¹ discusses concerns that truncating or eliminating the pedestrian change interval presents potential safety conflicts and is inadvisable. CPUC staff proposes to include an Option statement to provide flexibility to include pedestrian walk and clearance intervals during preemption.

CURRENT LANGUAGE

Section 4D.27 of the 2014 CA MUTCD Revision 6 states the following for railroad preemption:

Railroad Preemption

Support:

²⁸ Railroad preemption results in a special traffic signal operation depending on the relation of the railroad tracks to the intersection, the number of phases in the traffic signal and other traffic conditions. Railroad preemption is normally initiated by a notification from the railroad grade crossing warning equipment.

Guidance:

²⁹ Typical circumstances where railroad preemption is required, the following type of signal operation should be provided during preemption:

1. Where a railroad grade crossing, provided with grade crossing warning equipment, is within 200 feet of a signalized intersection, preemption of the traffic signal should provide the following sequence of operation:

Standard:

- a. A yellow change interval and any required red clearance interval for any signal phase that is green or yellow when preemption is initiated, and which will be red

¹ “Preemption of Traffic Signals Near Railroad Grade Crossings, 2nd Edition: A Recommended Practice of the Institute of Transportation Engineers”, Institute of Transportation Engineers (ITE), April 2021

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during the track clearance interval. The length of yellow change and red clearance intervals shall not be altered by preemption. Phases, which are in the green interval when preemption is initiated, and which will be green during the track clearance interval, shall remain green. Any pedestrian walk or clearance interval, in effect when preemption is initiated, shall immediately be terminated and all pedestrian signal faces shall display steady UPRAISED HAND.

- b. A track clearance interval for the signal phase or phases controlling the approach that crosses the railroad tracks.

Option:

The signal indication for the clearance interval may be either green or flashing red.

Guidance:

- c. A yellow change interval if green signal indications were provided during the track clearance interval.
- d. Depending on traffic requirements and phasing of the traffic signal controller, the traffic signal may then do one of the following:
 - (1) Go into flashing operation, with flashing red or flashing yellow indications for the approaches parallel to the railroad tracks and flashing red indications for all other approaches.

Standard:

Pedestrian signals shall be extinguished. If flashing red is used for all approaches, an all-red or other clearance interval shall be provided prior to returning to normal operation.

(2) Revert to limited operation with those signal indications controlling through and left turn approaches towards the railroad tracks displaying steady red. Permitted pedestrian signal phases shall operate normally. This operation shall be used only if the grade crossing warning equipment includes gates.

- e. The traffic signal shall return to normal operation following release of preemption control.

Guidance:

- 2. Where the railroad tracks run within a roadway and train speeds exceed 10 mph, preemption of the traffic signal should provide the following sequence of operation.
 - a. A yellow change interval and any required red clearance interval for all signal phases that are green or yellow when preemption is initiated and which will be red during the preemption period.

Standard:

The length of yellow change and red clearance intervals shall not be altered by preemption. Phases, which are in the green interval when preemption is initiated, and which will be green during the preemption period, shall remain green. Any walk or pedestrian clearance intervals in effect when preemption is initiated shall be immediately terminated and all pedestrian signal faces shall display UPRAISED HAND.

- b. All signal faces controlling traffic movements parallel to the railroad tracks will display green or flashing yellow indications. All other vehicle signal faces will display steady red indications; pedestrian signal faces will display UPRAISED HAND.

Option:

- 3. Where the railroad tracks run along a roadway of a signalized intersection and train speeds do not exceed 10 mph, trains may be controlled by the vehicle signal indications. This type of train control requires approval from the railroad, the Public Utilities Commission and the Director of Transportation.



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4. Unusual or unique track or roadway configurations may require other solutions than those described above.

PROPOSED CHANGES

Note: Red text is proposed text.

Blue text is existing language in CA MUTCD Revision 6.

Two Option statements are proposed in Section 4D.27 of the 2014 CA MUTCD Revision 6 as follows:

Railroad Preemption

Support:

²⁸ Railroad preemption results in a special traffic signal operation depending on the relation of the railroad tracks to the intersection, the number of phases in the traffic signal and other traffic conditions. Railroad preemption is normally initiated by a notification from the railroad grade crossing warning equipment.

Guidance:

²⁹ *Typical circumstances where railroad preemption is required, the following type of signal operation should be provided during preemption:*

1. *Where a railroad grade crossing, provided with grade crossing warning equipment, is within 200 feet of a signalized intersection, preemption of the traffic signal should provide the following sequence of operation:*

Standard:

- a. **A yellow change interval and any required red clearance interval for any signal phase that is green or yellow when preemption is initiated, and which will be red during the track clearance interval. The length of yellow change and red clearance intervals shall not be altered by preemption. Phases, which are in the green interval when preemption is initiated, and which will be green during the track clearance interval, shall remain green. Any pedestrian walk or clearance interval, in effect when preemption is initiated, shall immediately be terminated and all pedestrian signal faces shall display steady UPRAISED HAND.**
- b. **A track clearance interval for the signal phase or phases controlling the approach that crosses the railroad tracks.**

Option:

Pedestrian walk or clearance intervals may be used during preemption if such intervals are implemented as components of the Right-of-Way Transfer Time.

The signal indication for the clearance interval may be either green or flashing red.

Guidance:

- c. *A yellow change interval if green signal indications were provided during the track clearance interval.*
- d. *Depending on traffic requirements and phasing of the traffic signal controller, the traffic signal may then do one of the following:*
 - (1) *Go into flashing operation, with flashing red or flashing yellow indications for the approaches parallel to the railroad tracks and flashing red indications for all other approaches.*

Standard:



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Pedestrian signals shall be extinguished. If flashing red is used for all approaches, an all-red or other clearance interval shall be provided prior to returning to normal operation.

(2) Revert to limited operation with those signal indications controlling through and left turn approaches towards the railroad tracks displaying steady red. Permitted pedestrian signal phases shall operate normally. This operation shall be used only if the grade crossing warning equipment includes gates.

- e. **The traffic signal shall return to normal operation following release of preemption control.**

Guidance:

- 2. *Where the railroad tracks run within a roadway and train speeds exceed 10 mph, preemption of the traffic signal should provide the following sequence of operation.*
 - a. *A yellow change interval and any required red clearance interval for all signal phases that are green or yellow when preemption is initiated and which will be red during the preemption period.*

Standard:

The length of yellow change and red clearance intervals shall not be altered by preemption. Phases, which are in the green interval when preemption is initiated, and which will be green during the preemption period, shall remain green. Any walk or pedestrian clearance intervals in effect when preemption is initiated shall be immediately terminated and all pedestrian signal faces shall display UPRAISED HAND.

- b. **All signal faces controlling traffic movements parallel to the railroad tracks will display green or flashing yellow indications. All other vehicle signal faces will display steady red indications; pedestrian signal faces will display UPRAISED HAND.**

Option:

Pedestrian walk or clearance intervals may be used during preemption if such intervals are implemented as components of the Right-of-Way Transfer Time.

- 3. **Where the railroad tracks run along a roadway of a signalized intersection and train speeds do not exceed 10 mph, trains may be controlled by the vehicle signal indications. This type of train control requires approval from the railroad, the Public Utilities Commission and the Director of Transportation.**
- 4. **Unusual or unique track or roadway configurations may require other solutions than those described above.**

DISCUSSION

Definitions of Right-of-Way Transfer Time, Advance Preemption, and Simultaneous Preemption are included in Section 1A.13 of the 2014 CA MUTCD Revision 6:

6. Advance Preemption—the notification of approaching rail traffic that is forwarded to the highway traffic signal controller unit or assembly by the railroad or light rail transit equipment in advance of the activation of the railroad or light rail transit warning devices.

175. Right-of-Way Transfer Time—when used in Part 8, the maximum amount of time needed for the worst case condition, prior to display of the track clearance green interval. This includes any railroad or light rail transit or highway traffic signal control equipment time to react to a preemption

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call, and any traffic control signal green, pedestrian walk and clearance, yellow change, and red clearance intervals for conflicting traffic.

212. Simultaneous Preemption—notification of approaching rail traffic is forwarded to the highway traffic signal controller unit or assembly and railroad or light rail transit active warning devices at the same time.

Advance preemption time allows the traffic signal controller to begin the preemption sequence for a defined period of time prior to the activation of railroad warning devices, which may provide walk and pedestrian clearance intervals during right-of-way transfer time (RWTT) prior to transferring to the track clearance time to clear roadway vehicles off the track. This is critical for an intersection with high volumes of pedestrian traffic and long crosswalks, as noted in Section 4E.06 Paragraph 07.

Section 4E.06, Paragraph 07 states:

07. Except as provided in Paragraph 8, the pedestrian clearance time should be sufficient to allow a pedestrian crossing in the crosswalk who left the curb or shoulder at the end of the WALKING PERSON (symbolizing WALK) signal indication to travel at a walking speed of 3.5 feet per second to at least the far side of the traveled way or to a median of sufficient width for pedestrians to wait.

For situation where there is not enough advance preemption time to provide walk or full pedestrian clearance intervals during RWTT, item B in Section 4D.27 paragraph 08 of the 2014 CA MUTCD Revision 6 provides flexibility to permit the shortening or omission of pedestrian walk and change intervals.

Section 4D.27, Paragraph 08 item B states:

Standard:

08 During the transition into preemption control:

B. The shortening or omission of any pedestrian walk interval and/or pedestrian change interval shall be permitted.

In the CA MUTCD, the word "shall" in a Standard statement is identified as denoting a "required, mandatory, or specifically prohibitive practice" that roadway agencies must follow.

Section 4D.27 -Railroad Preemption Guidance Paragraph 29, item 1, Standard a. states:

Standard:

- a. A yellow change interval and any required red interval for any signal phase that is green or yellow when preemption is initiated, and which will be red during the track clearance interval. The length of the yellow change and red clearance intervals shall not be altered by preemption. Phases, which are in the green interval when preemption is initiated, and which will be green during the track clearance interval, shall remain green. Any pedestrian walk or clearance interval, in effect when preemption is initiated, shall immediately be terminated and all pedestrian signal faces shall display steady UPRAISED HAND.

Section 4D.27 -Railroad Preemption Guidance Paragraph 29, item 2 for train speeds that exceed 10 mph, Standard a. states

- a. The length of the yellow change and red clearance intervals shall not be altered by preemption. Phases, which are in the green interval when preemption is initiated, and which



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will be green during the track clearance interval, shall remain green. Any pedestrian walk or clearance interval, in effect when preemption is initiated, shall immediately be terminated and all pedestrian signal faces shall display steady UPRAISED HAND.

Most of the existing locations with railroad preemption in California were designed with simultaneous preemption. For simultaneous preemption, where the traffic signal is notified at the same time as the warning devices start to flash, it is critical to quickly transition to clearing vehicles off the tracks by abbreviating the pedestrian walk interval and pedestrian clearance interval. Thus, the language in Section 4D.27 “**Any pedestrian walk or clearance interval, in effect when preemption is initiated, shall immediately be terminated...**” is critical for simultaneous preemption. However, the language no longer applies to all preemption operations because technology has improved and current traffic signal and railroad equipment can support advance preemption. The proposed option statements provide flexibility to use advance preemption and include pedestrian walk and clearance intervals as components of the Right-of-Way Transfer Time.

RECOMMENDATION RATIONALE

Safety

Shortening or omitting pedestrian clearance interval is a safety concern for preempted crossing locations with vulnerable users and/or high volume of pedestrian traffic. By abbreviating pedestrian walk and clearance intervals, slow-moving pedestrians may not have sufficient time to complete their movements across the crosswalks, which may delay vehicles from clearing off the tracks. This is especially important for traffic signal locations near schools, senior centers, transit stations and event centers.

Caltrans Current Practice

Caltrans requires all new installations of railroad preemption, or where the traffic signal or railroad warning devices equipment is being constructed or reconstructed on the State Highway System to comply with the safety improvement design requirements in the 2016 CPUC letter and the Caltrans Standard Interconnect for Traffic Signal Preemption at Railroad Crossings manual by installing or upgrading existing two-wire interconnection circuit with multi-wire interconnection circuits. Advance preemption and advance pedestrian preemption circuits are included as part of the manual. Therefore, the existing language in Part 4D.27 concerning to immediately terminating the walk and pedestrian clearance interval is no longer applicable to the Caltrans current practice.

Local Roadway Agencies Implementing Best Practice

The original language in Part 4D.27 for immediately terminating walk and pedestrian clearance intervals create confusion, unnecessary conflict during design review and liability burdens to local roadway agencies that choose to implement advance preemption with pedestrian walk and/or clearance intervals for best practice. The option statements eliminate the concerns of deviating from the CAMUTCD standard language.

REFERENCES

- Preemption of Traffic Signals Near Railroad Grade Crossings, 2nd Edition: A Recommended Practice of the Institute of Transportation Engineers, Institute of Transportation Engineers (ITE), April 2021
- 2014 CA MUTCD Revision 6
- Caltrans Standard Interconnect for Traffic Signal Preemption at Railroad Crossings



ATTACHMENT B

Attachment B – Caltrans Publication Titled “Standard Interconnect for Traffic Signal Preemption at Railroad Crossings”.



Standard Interconnect for Traffic Signal Preemption at Railroad Crossings



DIVISION OF TRAFFIC OPERATIONS
OFFICE OF SYSTEM DEVELOPMENT

Mohammad Iraki

Version 1.09

12/07/2021



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Standard Interconnection for Traffic Signal Preemption at Railroad Crossings

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Standard Interconnection for Traffic Signal Preemption at Railroad Crossings

1.0 Legacy Design

Caltrans currently uses a simple 2-wire circuit for preempting traffic signals at railroad crossings (legacy design). This 2-wire system incorporates a normally closed circuit, allowing the traffic signal to perform preemption operation. Traffic signal preemption routines are handled by Caltrans Traffic Signal Control Program. Although the legacy design shown in **Figure 1** has worked well for decades, the California Public Utilities Commission (CPUC) identified safety enhancements requiring additional hardware and software modifications.

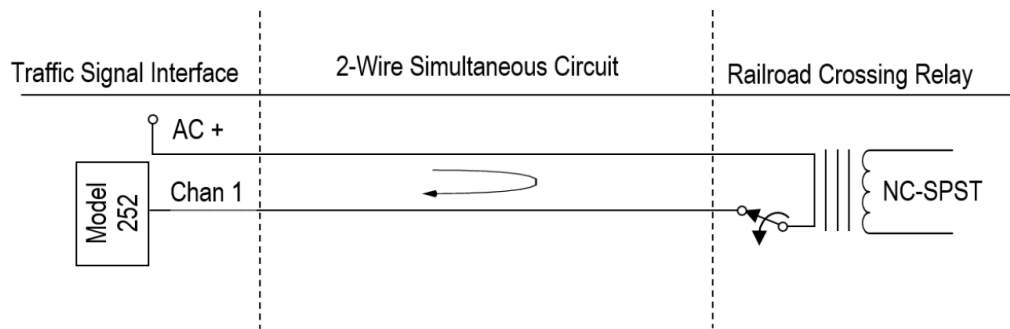


Figure 1: Legacy Interconnect Preemption Circuit (NORMAL state)

Standard Interconnection for Traffic Signal Preemption at Railroad Crossings

2.0 Objectives

The objective of the new design is to maintain the simplicity of the legacy design but provide additional functionality as described in this standard. The new design provides the following features:

Supervised Circuits: An additional wire provides a way to detect circuit faults (a short circuit or a break in the wire). As indicated in the American Railway Engineering and Maintenance-of-Way Association (AREMA) research paper, reference, No.1, it is important to detect a potential short in the interconnection circuit between the traffic signal and railroad equipment. It is also important to detect the difference between a railroad preemption notification and a break in the wire.

Simultaneous (SIM) and Advance (ADV) Preemption: Two supervised circuits are utilized to transition the traffic signal into preemption. The use of these inputs (SIM and ADV) will vary depending on the preemption timing.

Advance Pedestrian Preemption (APP): A circuit utilized to obtain early notification of an approaching train, prior to advance preemption or simultaneous preemption. This circuit, allows the traffic signal to serve pedestrians upon the approach of a train.

Gate Down/Island (GD/ISL): A circuit utilized to monitor gate arm position and presence of the train at the crossing. This will remain de-energized until either the gate arm reaches horizontal or the train reaches the crossing. With this circuit, if the gate arm has not reached horizontal position, the traffic signal would typically continue to provide a green for track clearance until the train reaches the crossing.

Traffic Signal Health Status: A circuit that provides the health status of the traffic signal to the railroad equipment.



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Standard Interconnection for Traffic Signal Preemption at Railroad Crossings

3.0 Standard Interconnect for Traffic Signal Preemption at Railroad Crossings

This Standard Interconnect for Traffic Signal Preemption at Railroad Crossings provides supervised simultaneous preemption, supervised advance preemption, advance pedestrian preemption, gate down/island as shown in **Figure 2**, and traffic signal health status (HS) as shown in **Figure 5**.

Standard Interconnection for Traffic Signal Preemption at Railroad Crossings

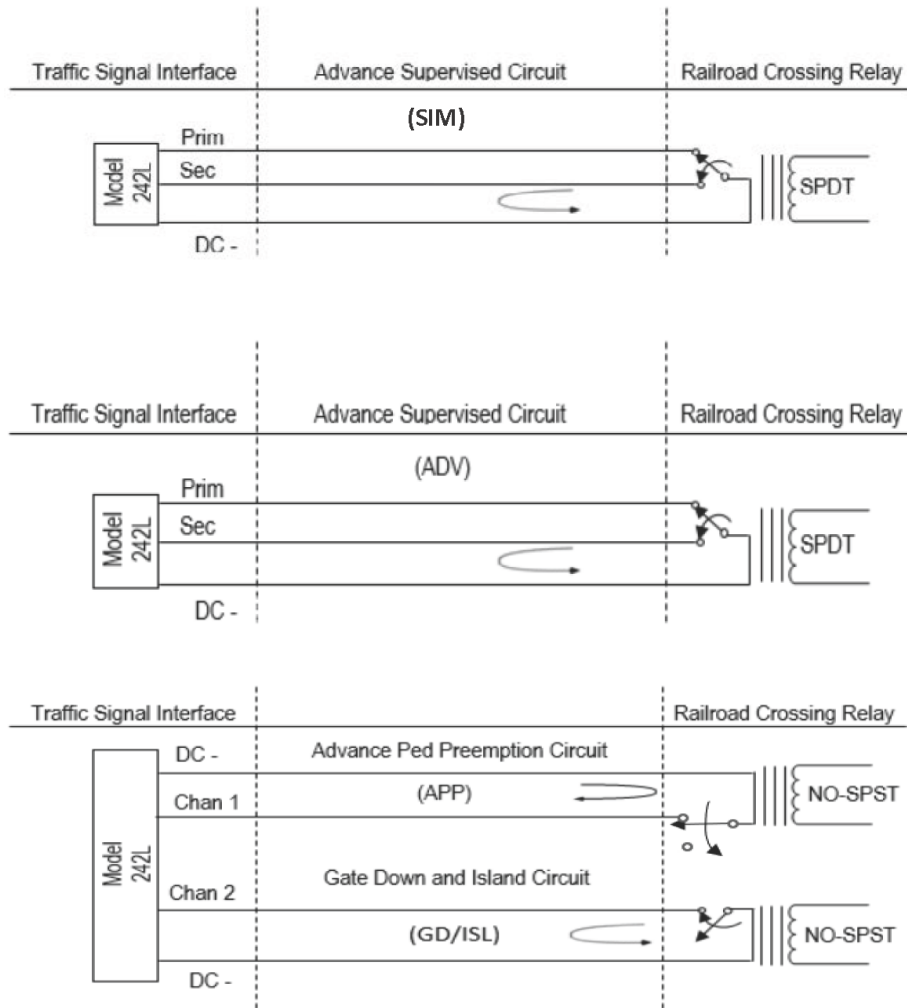


Figure 2: Interconnect using three Model 242L DC isolator modules (NORMAL state)

Standard Interconnection for Traffic Signal Preemption at Railroad Crossings

4.0 Simultaneous (SIM) and Advance (ADV) Preemption Circuits

Simultaneous Preemption (SIM) and Advance Preemption (ADV)

The Simultaneous Preemption and Advance Preemption circuits (both shown in **Figure 2**) are used to notify the traffic signal of an approaching train. Upon notification, the traffic signal transitions from normal operation to preemption operation. The use of these inputs (SIM and ADV) will vary depending on the preemption timing.

SIM and ADV are both implemented as supervised circuits.

Supervised Circuit Design

Implementation of a supervised circuit such as shown in **Figure 3** allows the traffic signal to continuously monitor the condition of the supervised circuit and respond to circuit fault conditions.

In the legacy standard, the preemption circuit shown in **Figure 1** will de-energize when a train approaches the crossing. This does not distinguish between an open circuit and a preemption request. For example, a break in the circuit will transition the traffic signal to preemption and remain in preemption until the circuit is restored.

Another type of fault occurs if the circuit is not de-energized upon a preemption request. Under that condition, the traffic signal will not transition into preemption during the approach of a train. This condition can occur, even if the railroad relay opens properly, but the circuit remains energized due to a short circuit. A similar condition could occur if the 252 AC isolator module were removed from the traffic signal input file. The legacy preemption circuit logic is shown in **Table 1**.

Legacy Preemption Circuit Logic	
Model 252 Input	Traffic Signal Operation
High	NORMAL
Low	PREEMPT

Table 1: Truth Table for Legacy Preemption Circuit Logic

The supervised circuit design, in this standard, allows the traffic signal to identify the conditions above as fault conditions. The traffic signal monitors the state of primary and secondary inputs, in the form of an exclusive-or (XOR) truth-table, as shown in **Table 2**. A short circuit or a break in the wire will result in a fault condition, which will put the traffic signal into all-red-flash.

Standard Interconnection for Traffic Signal Preemption at Railroad Crossings

Supervised Preemption Circuit Logic		
Model 242L Input		Traffic Signal Operation
Primary	Secondary	
High	Low	NORMAL
Low	High	PREEMPT
High	High	FAULT
Low	Low	FAULT

Table 2: Truth Table for Supervised Preemption Circuit Logic

As shown in **Table 2**, for each supervised circuit, the primary input is energized, while the secondary input is de-energized (NORMAL state). During preemption, the primary input becomes de-energized and the secondary input becomes energized (PREEMPT state). When the primary and secondary inputs are either both high or both low, the supervised circuit is in a fault condition (one of the FAULT states), which puts the traffic signal into all-red flash operation.

When a short in the circuit is introduced, the supervised circuit, in combination with the DC isolator logic, detects it as a circuit "FAULT" and puts the traffic signal into all-red-flash. This functionality is accomplished by utilizing a single relay at the railroad side and two inputs at the traffic signal as shown in Figure 3.

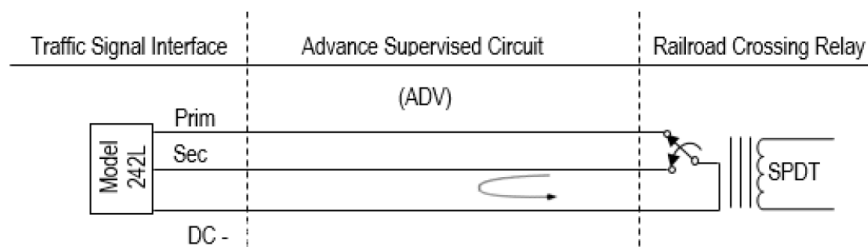


Figure 3: Example of a Supervised Circuit

Standard Interconnection for Traffic Signal Preemption at Railroad Crossings

5.0 Advance Pedestrian Preemption (APP) Notification Circuit

The Advance Pedestrian Preemption Notification circuit is as shown in **Figure 4**. The purpose of the circuit is to provide early notification of an approaching train, prior to advance or simultaneous preemption.

This early notification may allow the traffic signal to more smoothly transition from normal operation to railroad preemption, such as to allow for pedestrian clearance.

6.0 Gate Down/Island (GD/ISL) Circuit

The Gate Down/Island circuit as shown in **Figure 4** is a normally open circuit. The purpose of the circuit is to monitor both the gate arm position and presence of the train at the crossing. This circuit remains de-energized until either the gate arm reaches horizontal position, or the train reaches the crossing.

If the gate arm does not reach horizontal position, the traffic signal continues to provide a green for track clearance, until the train reaches the crossing (occupies the island circuit).

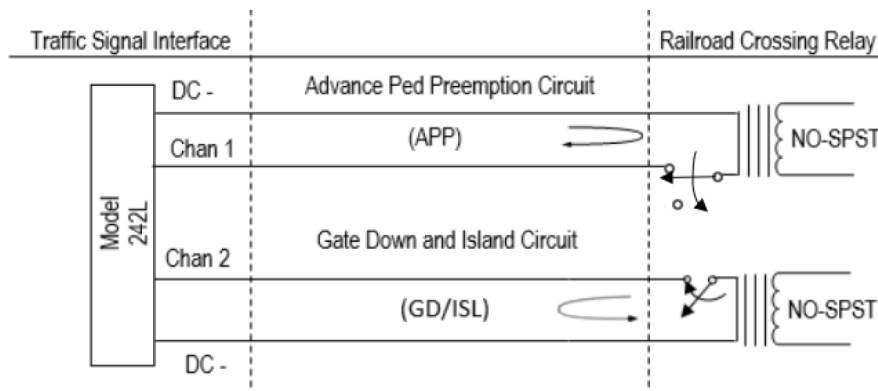


Figure 4: Advance Pedestrian Preemption (APP) Circuit and Gate Down and Island Circuit

Standard Interconnection for Traffic Signal Preemption at Railroad Crossings

7.0 Traffic Signal Health Status (HS) Circuit

The Traffic Signal Health Status (HS) circuit shown in **Figure 5** is a normally energized circuit that provides the health status of the traffic signal to the railroad equipment.

When the circuit is energized, the traffic signal is healthy and operating normal. When the circuit is de-energized, the traffic signal is typically operating in all-red-flash. If the traffic signal is in all-red-flash mode due to railroad preemption, the circuit will remain energized.

The Traffic Signal Health Status circuit consists of a 24 VDC output from the traffic signal control cabinet to the railroad equipment. This circuit uses a redesigned Auxiliary Output File No. 2LX, Model (AUX-RR), for the logic control circuit.

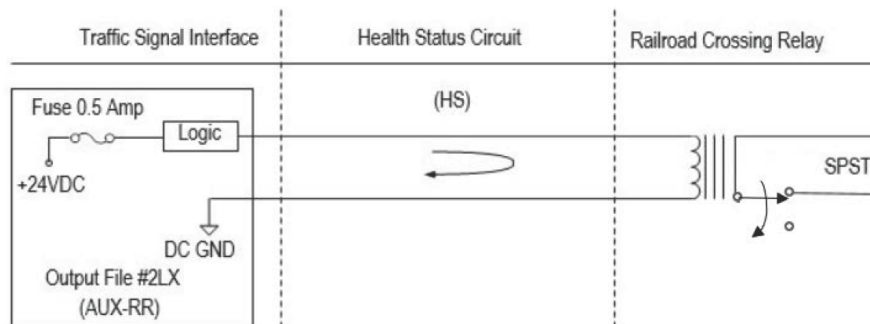


Figure 5: Health Status (HS) Circuit



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Standard Interconnection for Traffic Signal Preemption at Railroad Crossings

8.0 Traffic Signal Equipment Requirements

The standard requires circuits for simultaneous preemption, advance preemption, gate down/island, advance pedestrian preemption and traffic signal health status. Implementation requires three slots in the Caltrans Cabinet input file and the following list of equipment:

a)	Three (3) Model 242L DC Isolator Modules
b)	Model 2070 Controller with CTSCP v3
c)	18-Wire, 14 AWG Stranded Conductor, Railroad Interconnect Cable
d)	Output File No. 2 (AUX-RR) and C16 Harness

Table 3: Hardware Requirements



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Standard Interconnection for Traffic Signal Preemption at Railroad Crossings

9.0 References

1. [“Supervised Interconnection Circuits at Highway-Rail Grade Crossings,”](#)
By Douglas M. Mansel, Vernon H. Waight and John T. Sharkey,
ITE Journal, Institute of Transportation Engineers, March 1999.
2. [“Preemption of Traffic Signals near Railroad Crossings – An ITE Recommended Practice,”](#)
Institute of Transportation Engineers, 2006.
3. “Railroad Preemption of Traffic Signals,” Letter from CPUC to Caltrans,
California Public Utilities Commission, July 28, 2016.



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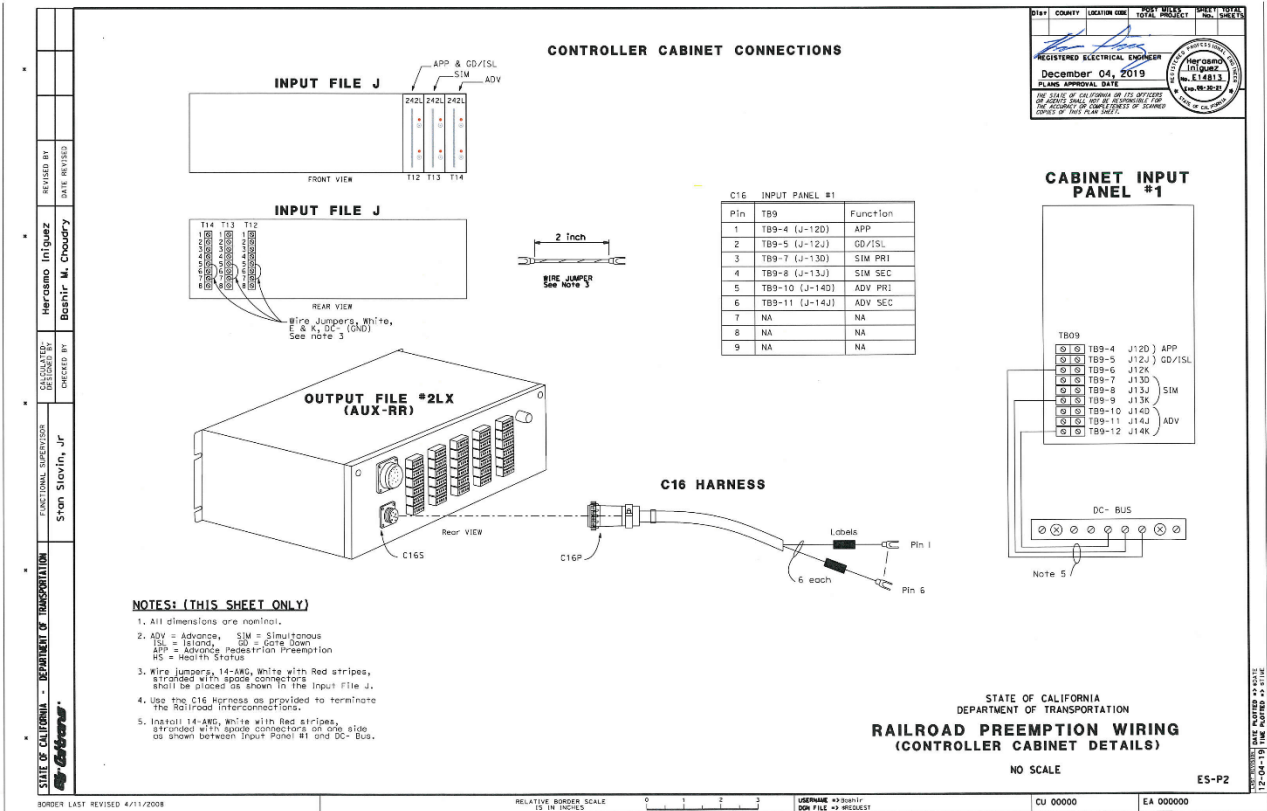


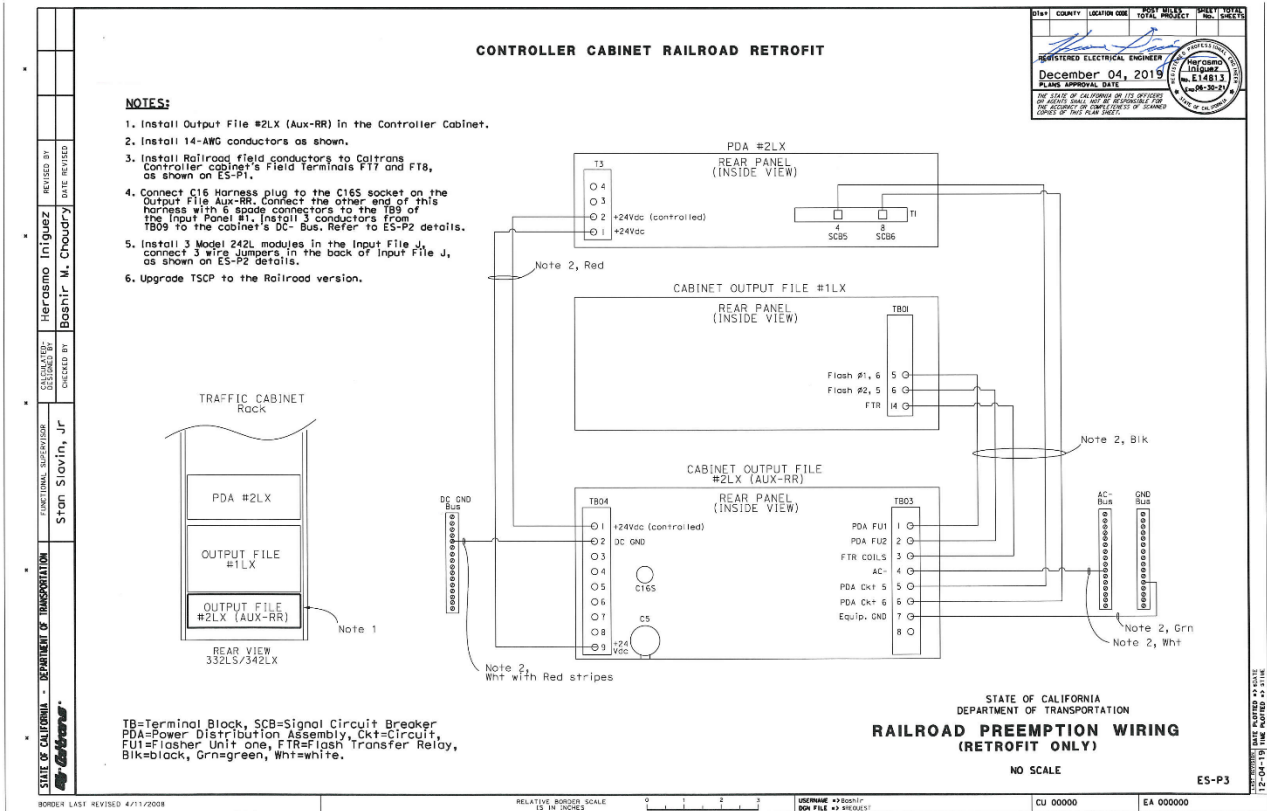
Standard Interconnection for Traffic Signal Preemption at Railroad Crossings

10.0 Railroad Preemption Standard Plan Details

ES-P1: Railroad Preemption Wiring (Controller Cabinet to Railroad Details)
ES-P2: Railroad Preemption Wiring (Controller Cabinet Details)
ES-P3: Railroad Preemption Wiring (Retrofit Only)

Table 4: Electrical Design Plans







ATTACHMENT C



California Traffic Control Devices Committee Agenda Item Report



Attachment C – Proposed Text Revisions to CA MUTCD Section 4D.27.

Note: **Red** text is proposed to be included in the current CA MUTCD by this proposal.
Blue text is California text additions adopted for use in current CA MUTCD.

Railroad Preemption

Support:

²⁸ Railroad preemption results in a special traffic signal operation depending on the relation of the railroad tracks to the intersection, the number of phases in the traffic signal and other traffic conditions. Railroad preemption is normally initiated by a notification from the railroad grade crossing warning equipment.

Guidance:

²⁹ *Typical circumstances where railroad preemption is required, the following type of signal operation should be provided during preemption:*

- 1. Where a railroad grade crossing, provided with grade crossing warning equipment, is within 200 feet of a signalized intersection, preemption of the traffic signal should provide the following sequence of operation:*

Standard:

- A yellow change interval and any required red clearance interval for any signal phase that is green or yellow when preemption is initiated, and which will be red during the track clearance interval. The length of yellow change and red clearance intervals shall not be altered by preemption. Phases, which are in the green interval when preemption is initiated, and which will be green during the track clearance interval, shall remain green. Any pedestrian walk or clearance interval, in effect when preemption is initiated, shall immediately be terminated and all pedestrian signal faces shall display steady UPRAISED HAND.**
- A track clearance interval for the signal phase or phases controlling the approach that crosses the railroad tracks.**

Option:

Pedestrian walk or clearance intervals may be used during preemption if such intervals are implemented as components of the Right-of-Way Transfer Time.

The signal indication for the clearance interval may be either green or flashing red.

Guidance:

- A yellow change interval if green signal indications were provided during the track clearance interval.*
- Depending on traffic requirements and phasing of the traffic signal controller, the traffic signal may then do one of the following:*
 - (1) Go into flashing operation, with flashing red or flashing yellow indications for the approaches parallel to the railroad tracks and flashing red indications for all other approaches.*

Standard:

Pedestrian signals shall be extinguished. If flashing red is used for all approaches, an all-red or other clearance interval shall be provided prior to returning to normal operation.

(2) Revert to limited operation with those signal indications controlling through and left turn approaches towards the railroad tracks displaying steady red. Permitted pedestrian signal phases shall operate normally. This operation shall be used only if the grade crossing warning equipment includes gates.

- e. The traffic signal shall return to normal operation following release of preemption control.**

Guidance:

- 2. Where the railroad tracks run within a roadway and train speeds exceed 10 mph, preemption of the traffic signal should provide the following sequence of operation.*
 - a. A yellow change interval and any required red clearance interval for all signal phases that are green or yellow when preemption is initiated and which will be red during the preemption period.*

Standard:

The length of yellow change and red clearance intervals shall not be altered by preemption. Phases, which are in the green interval when preemption is initiated, and which will be green during the preemption period, shall remain green. Any walk or pedestrian clearance intervals in effect when preemption is initiated shall be immediately terminated and all pedestrian signal faces shall display UPRAISED HAND.

- b. All signal faces controlling traffic movements parallel to the railroad tracks will display green or flashing yellow indications. All other vehicle signal faces will display steady red indications; pedestrian signal faces will display UPRAISED HAND.**

Option:

Pedestrian walk or clearance intervals may be used during preemption if such intervals are implemented as components of the Right-of-Way Transfer Time.

- 3. Where the railroad tracks run along a roadway of a signalized intersection and train speeds do not exceed 10 mph, trains may be controlled by the vehicle signal indications. This type of train control requires approval from the railroad, the Public Utilities Commission and the Director of Transportation.*
- 4. Unusual or unique track or roadway configurations may require other solutions than those described above.*