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PRESENTS

Trespassing & Suicide Prevention Summit 2022

Rail Technology as a Tool for the 21st Century

Moderator

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LA City Council
Metrolink Board

Panelists

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Consulting Systems Engineer
World Wide Technology

Early Earthquake Warning System Overview

Jairo Rodriguez
PTC Equipment Engineer
Safety Summit Sept. 21, 2022

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Background

- The Metrolink commuter rail system operates in six densely populated Southern California counties over 538 total route miles.
- In FY 2015, Metrolink was the first railroad in the nation to fully-implement Positive Train Control (PTC).
- PTC is GPS-based safety technology that can automatically stop or slow trains to prevent train-to-train collisions, over-speed derailments, and unauthorized train movement to safeguard against human errors and other potential hazards.

Project Overview

In 2019, Metrolink received a grant from Caltrans to develop and deploy the Commuter Railway Seismic Interface (CRSI) earthquake early warning system to integrate USGS ShakeAlert notifications with its PTC system.

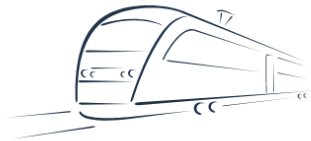
ShakeAlert
Available

- Sensors throughout California
- Earthquake detection
- Calculates earthquake magnitude and determines epicenter
- Predicts peak ground acceleration radiating away from the epicenter
- Sends earthquake alerts

CRSI
In development

- Receive earthquake alerts
- Establish rules for notifications to trains
- Send notifications to PTC
- Send notifications to Operations Center
- Phase I - IV: Send & receive alerts directly to the train
- Phase V: Automate stop or slowing of trains

PTC
Available



- Stops or slows trains
- Utilizes braking algorithms based on train characteristics

Project Overview

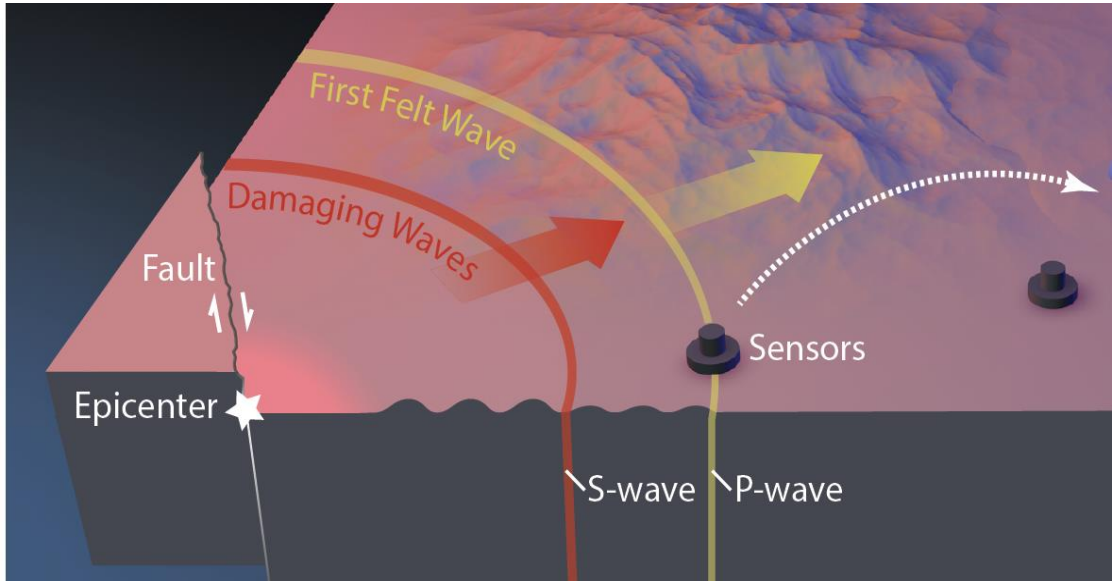
This project automates the stopping or slowing of trains during an earthquake by developing the Commuter Railway Seismic Interface (CRSI) to process USGS ShakeAlert notifications, determine impacted trains and send alerts through the Authority's PTC system.

Key Characteristics:

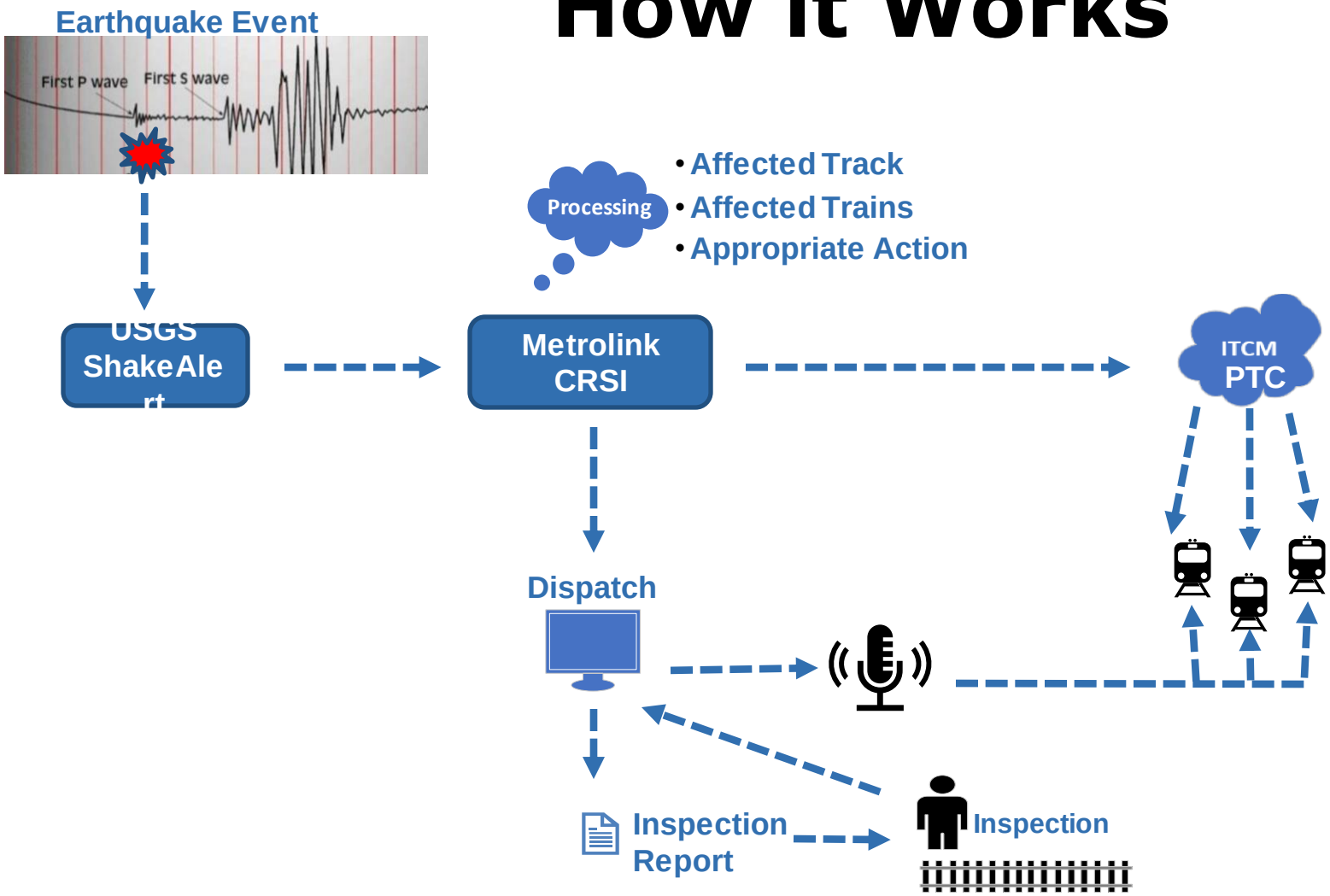
- Initial pilot implementation on the Perris Valley Line
- System designed for system-wide deployment
- Includes update of earthquake response procedures - train operations and field inspections
- Improved inspections and return to service utilizing real-time data and enhanced reporting tools - field crew deployment prioritized based on shaking intensity and asset data
- System designed for scalability, ease of use and efficiencies in system maintenance

USGS ShakeAlert Integration

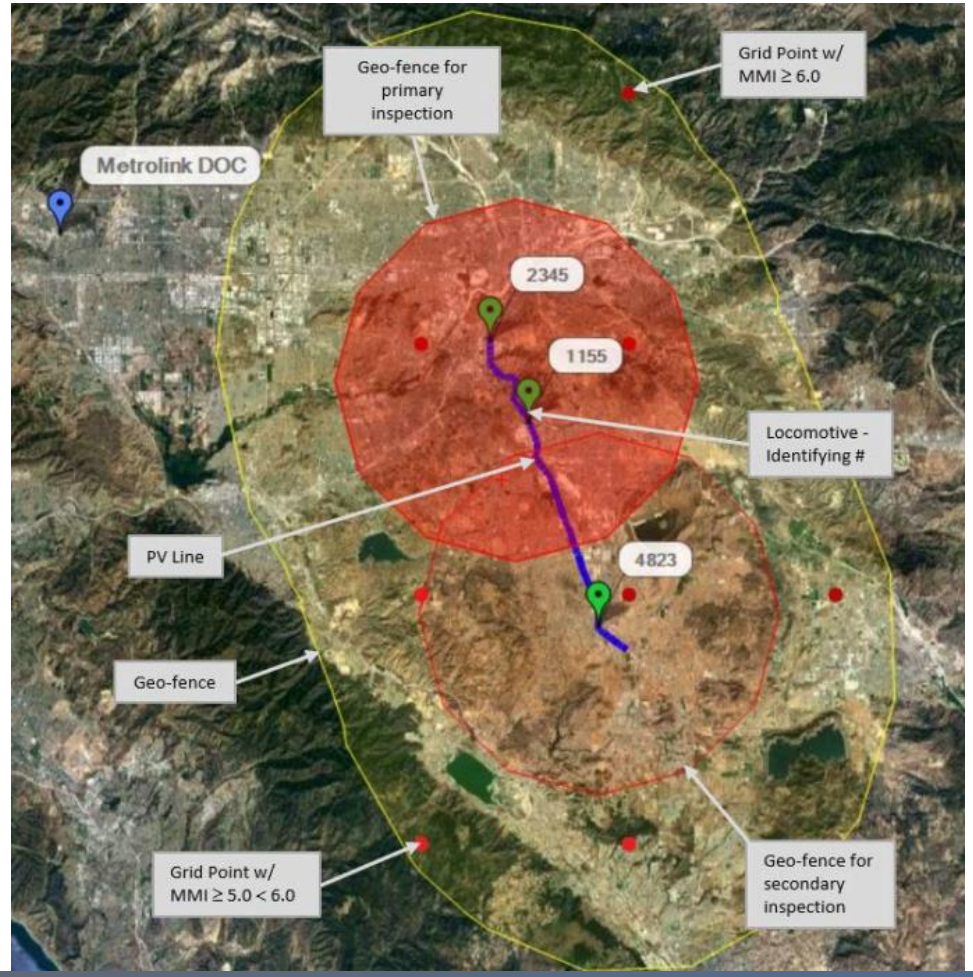
- When USGS sensors detect the initial P-wave, ShakeAlert estimates shaking at grid points across the region and sends a notification to subscribers.
- P-waves (compression waves) are the first waves to be detected by sensors - before S-waves (shear waves) that cause the strongest of shaking.
- The amount of advance warning varies based on factors including proximity to epicenter.



How it Works


Earthquake Event
First P wave
First S wave
USGS ShakeAlert
Processing
• Affected Track
• Affected Trains
• Appropriate Action
Metrolink CRSI
ITCM PTC
Dispatch
Inspection Report
Inspection

Commuter Rail Seismic Interface



Commuter Rail Seismic Interface

Shaking Threshold	Crew Action
MMI 3.5 - 4.5	Advisory to train of minor earthquake in the area. Notify operations if shaking is felt.
MMI 4.6 - 5.5	Train to immediately slow down speed to restricted speed and contact operations
MMI >5.5	Train to immediately stop train but not to stop on bridges, under overpasses, nor in tunnels and to contact operations

Project Status

Complete:

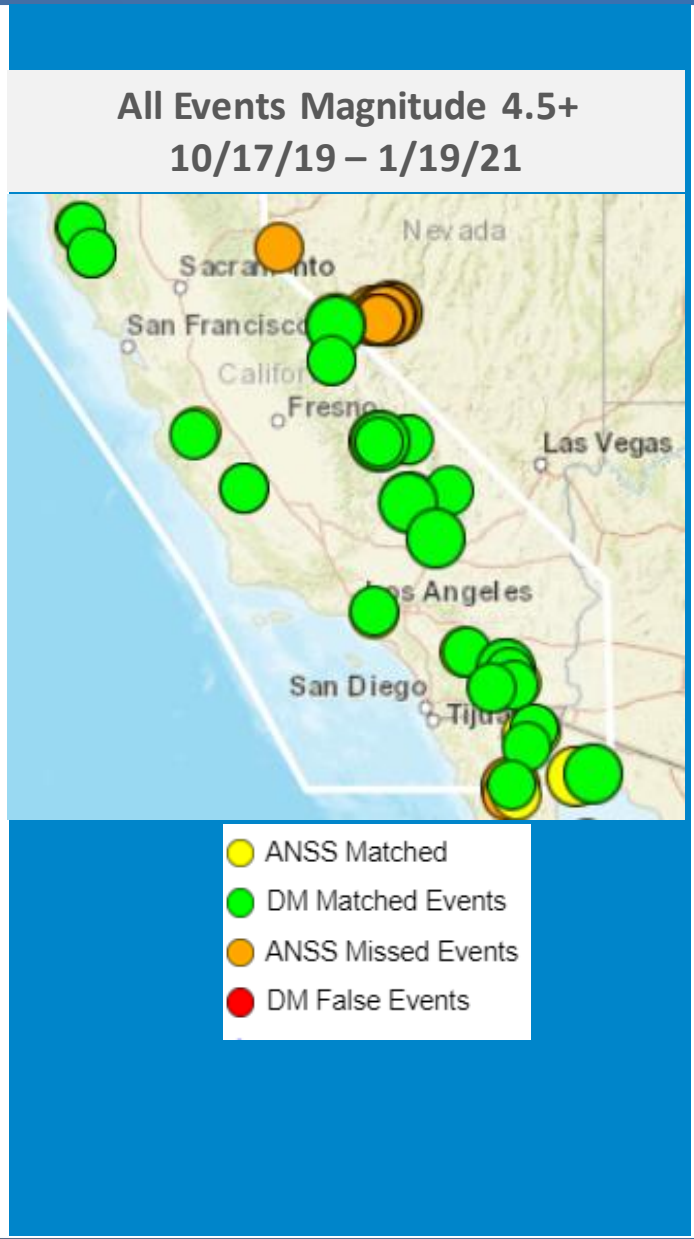
- ✓ Develop system requirements
- ✓ CRSI software coding and unit testing
- ✓ Extensive lab and field testing (with test train)
- ✓ Production deployment of initial version of CRSI
- ✓ Regulatory coordination and approvals
- ✓ Developed & tested CRSI version to improve automation
- ✓ Updated SCRRA earthquake response procedures
- ✓ Production Deployment of CRSI w/increased automation

Underway:

- System-wide deployment and technical documents

Next Steps

- Testing and deployment of CRSI incrementally on subdivisions system-wide
- Complete technical documentation, including System User Manual
- Project Close-out



Wireless Crossing Nearside Station Stop (WCNSS) Functionality

Jerone Hurst, Director, Train Control and Communications Systems

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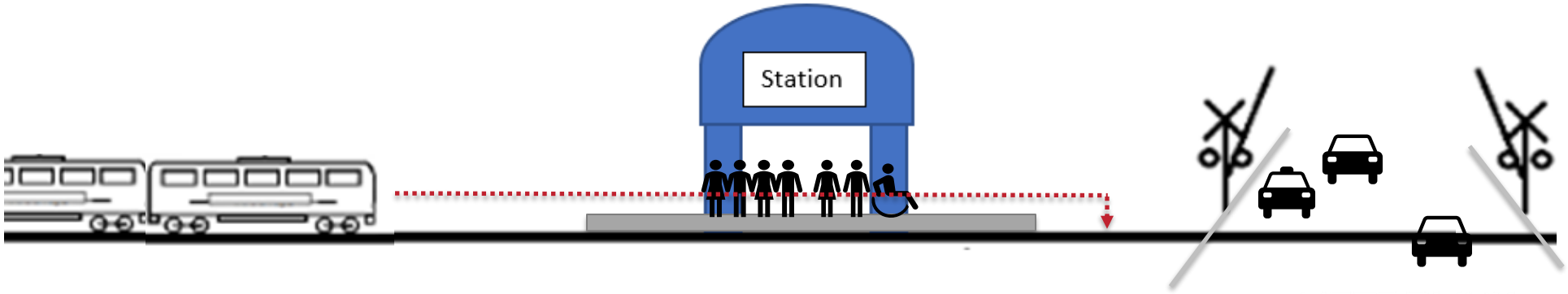
Background

- When a train is going to make a station stop and there is a crossing located past the station, the train activates the crossing as it approaches.
- The train executes a station stop and when it is stopped for a set amount of time, the crossing's warning system recovers and allows the flow of traffic over the crossing.
- After completion of the station stop, when train starts moving towards crossing the crossing gates come down again to protect vehicular traffic.
- The result is the grade crossing just past the station stop will activate twice; once for a train stopping at the station, and a second time for the same train leaving the station. The train only traverses the grade crossing during the second activation.

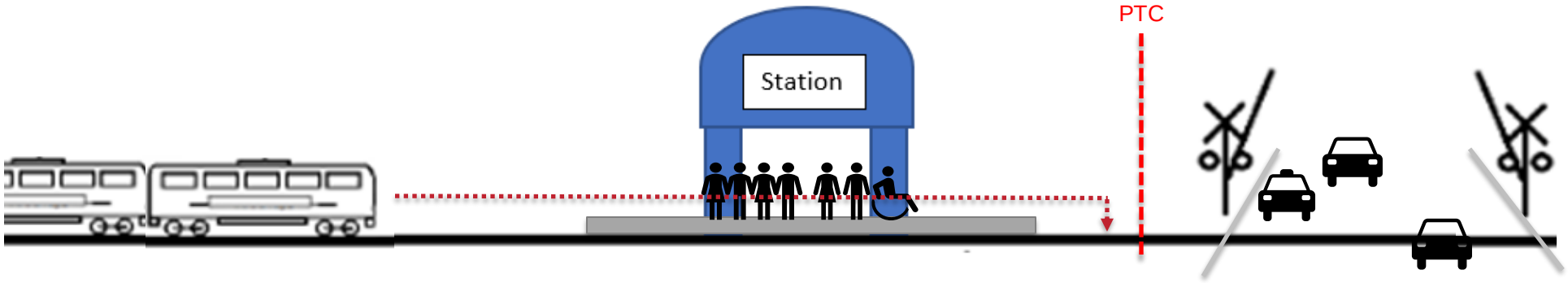


Positive Train Control

- The Positive Train Control (PTC) system established communication between the wayside, the locomotive and the Back Office
- PTC prevents train-to-train collisions, over speed derailments, incursions into established work zone limits, movement of a train through a main line switch in an improper position
- Train location is determined by GPS in conjunction with geographic track data base to ensure adherence to train movement information

Integrating the Roadway Crossing with PTC

- By utilizing the PTC system and making the roadway crossing communicate with PTC we can forestall the pre-activation at crossings adjacent to a station.
- This will allow vehicles and pedestrian traffic to proceed on road when trains are stopping at a station.
- PTC will place a stop target at the edge of the crossing to protect the crossing from train going through crossing while gates are up
- Crossing gates will remain up until the train starts moving to activate the crossing using conventional track circuits



Benefits of WCNSS Technology

- Reduce warning system pre-activations and the amount of gate down time at designated nearside crossings due to a scheduled commuter/passenger train stops at the station.
- Minimize the impacts to vehicular and pedestrian traffic and reduce delays and confusion to the public at station stops with a nearby crossing.
- Extends the life of the crossing equipment since it will activate less because of this technology.

How Does WCNSS Work?

[1] Train nearing the approach circuit of the WCNSS crossing

- As a WCNSS-licensed train gets within 5 miles of a WCNSS crossing, the train will register with the back office to start receiving crossing status messages for the specific crossing; at this point, the train will start monitoring the various conditions to be met for the train to initiate a wireless crossing session with the crossing downstream of a station stop by the time the train reaches the approach circuit.

[2] Start of the WCNSS session between train and crossing

- If all conditions are met for the wireless crossing session to be initiated by the time the train gets to the approach circuit of the crossing to be inhibited, the system will place and enforce a zero (0) MPH target at the nearside crossing edge of the crossing being inhibited on the PTC system onboard the train
- If the conditions mentioned are not met by the time the train reaches the approach circuit, WCNSS communication will be suppressed on the train and crossing will activate based on conventional means.

How Does WCNSS Work? (continued)

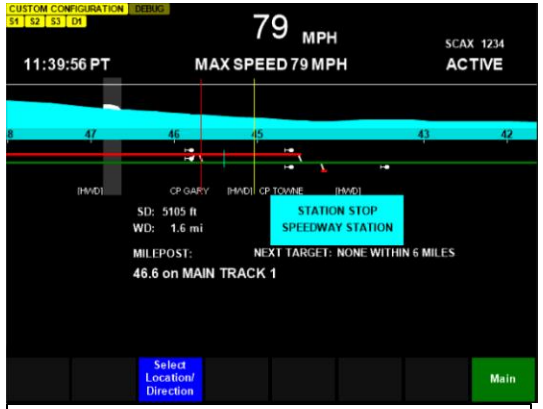
[3] Train has active wireless session and approaches station

- The train will continue to send crossing inhibit messages to the WCNSS crossing until the train dwells at the station stop area for a configurable amount of time.
- If there is a problem and the crossing stops receiving inhibit request messages from the train for configurable amount of time, the crossing will release the inhibit relay and the crossing would activate via the conventional crossing technology. Meanwhile the train would continue to enforce the station stop until the dwell time concludes.

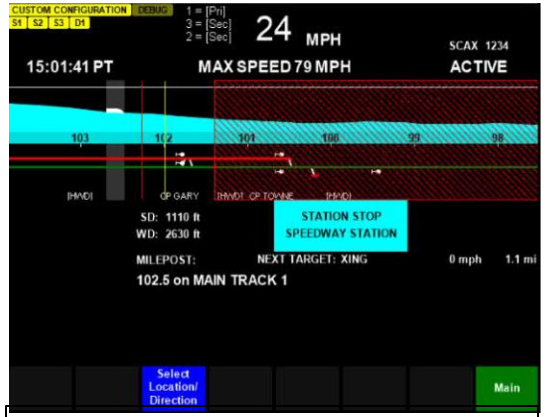
[4] Station Stop and End of Wireless session

- After the train completes a station stop and remains stopped for configurable amount of time, the train sends a station release message to the crossing to end the wireless session. The train will remove the 0 mph target at edge of the crossing.
- When the train moves the crossing will then identify movement advancing towards it and will activate using the conventional crossing technology.

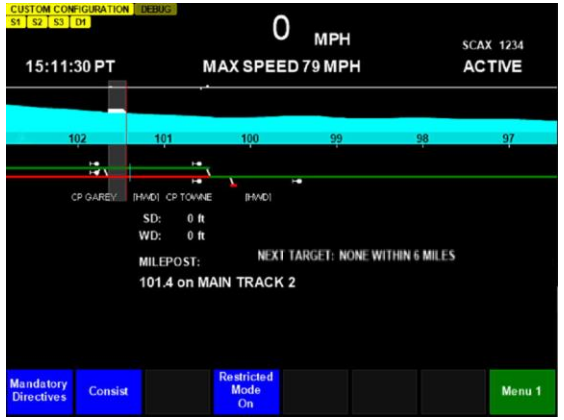
Wireless Crossing Nearside Station Stop (WCNSS)



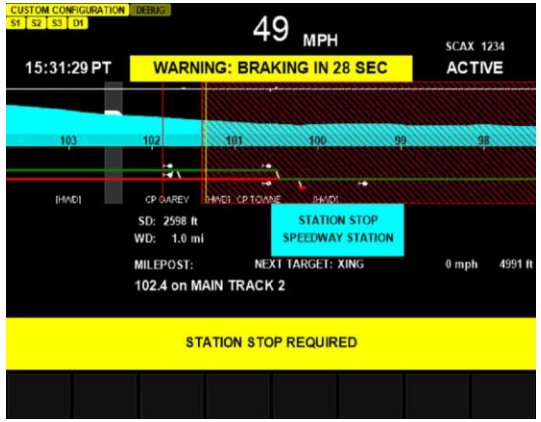
CDU station stop indicator as train approaches crossing approach circuit



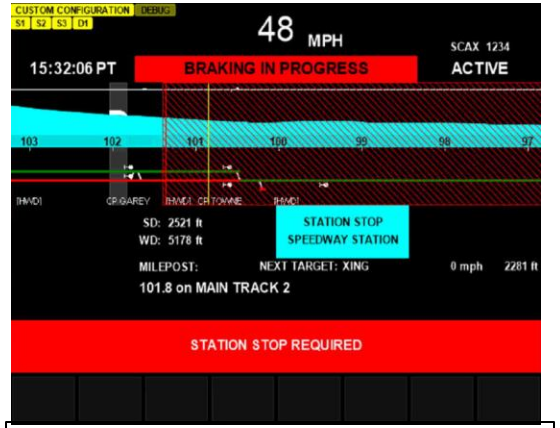
Placement of 0 mph target at crossing edge when wireless session is initiated



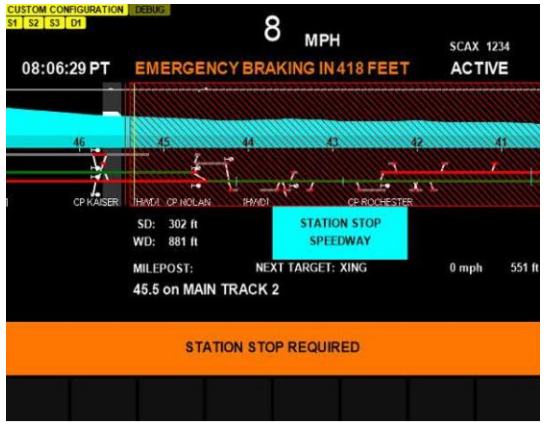
Removal of 0 mph target at crossing edge after train completes station stop



PTC predictive warning if train gets within warning distance of target



PTC predictive penalty enforcement if train gets within braking distance of target



PTC predictive emergency enforcement if train gets within braking distance of target

THANK YOU

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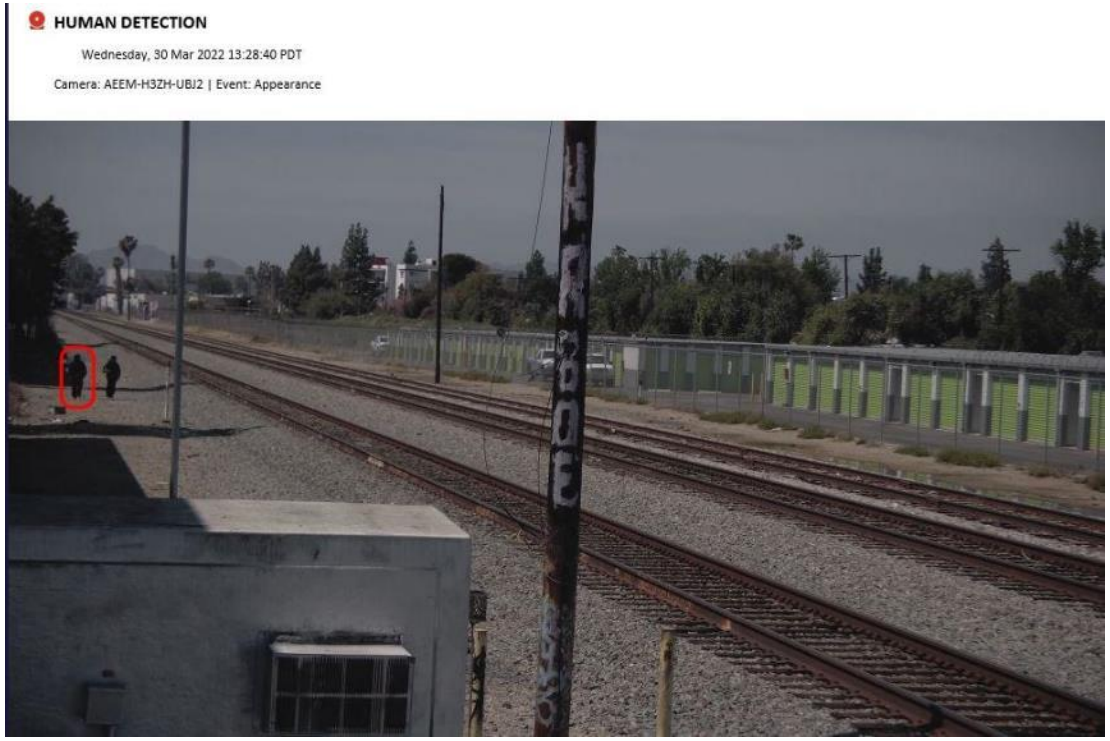
SCRRA On-Site Video PoC Van Nuys

Trespasser Detection Proof of Concept

Observed Trespasser Events
Day 1 & 2

West View

East View



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