



LARKSPUR EXTENSION SYSTEMS TESTING SEPTEMBER 4, 2019

TRAIN CONTROL AND GRADE CROSSING WARNING SYSTEMS

- Systems onboard the train
- Systems along the rail line
- Systems at the grade crossings



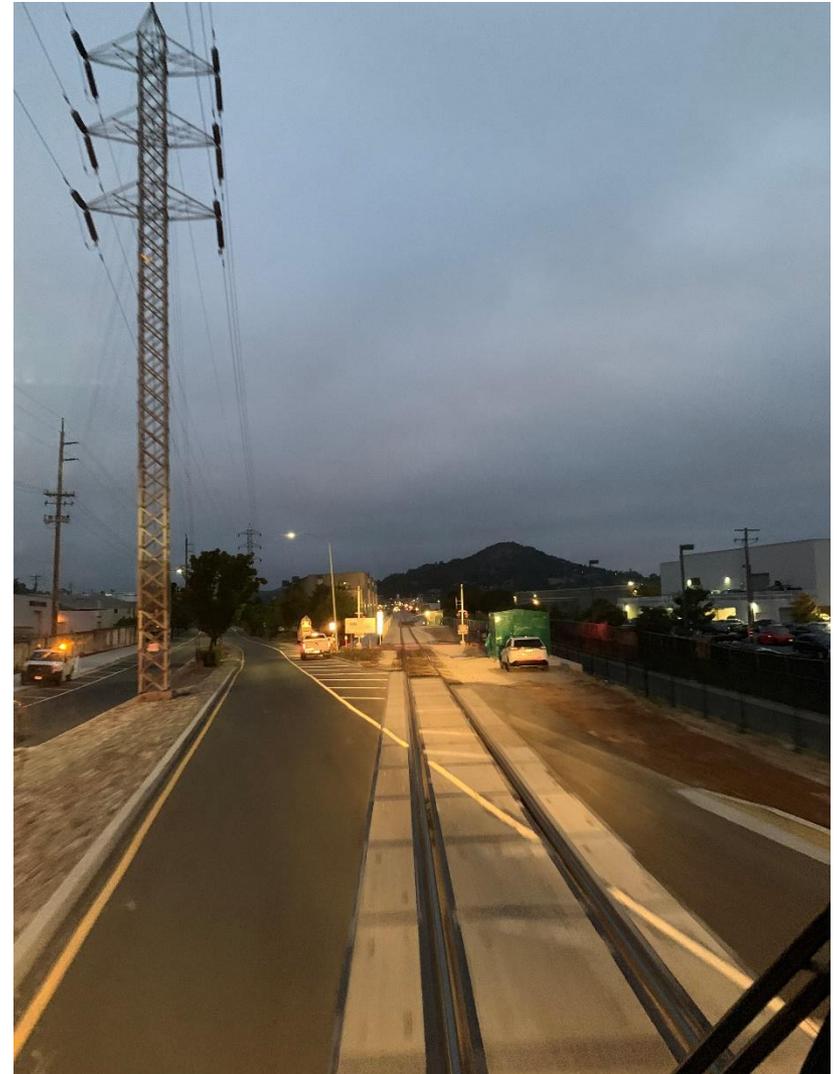
PURPOSE OF TESTING

- Testing is performed to demonstrate that ALL safety systems designed to protect the public, including passengers, motorists, pedestrians and bicyclists function as designed.
- Testing is first performed using simulated train movements
- Once tests with simulated train movements pass, testing with trains is performed



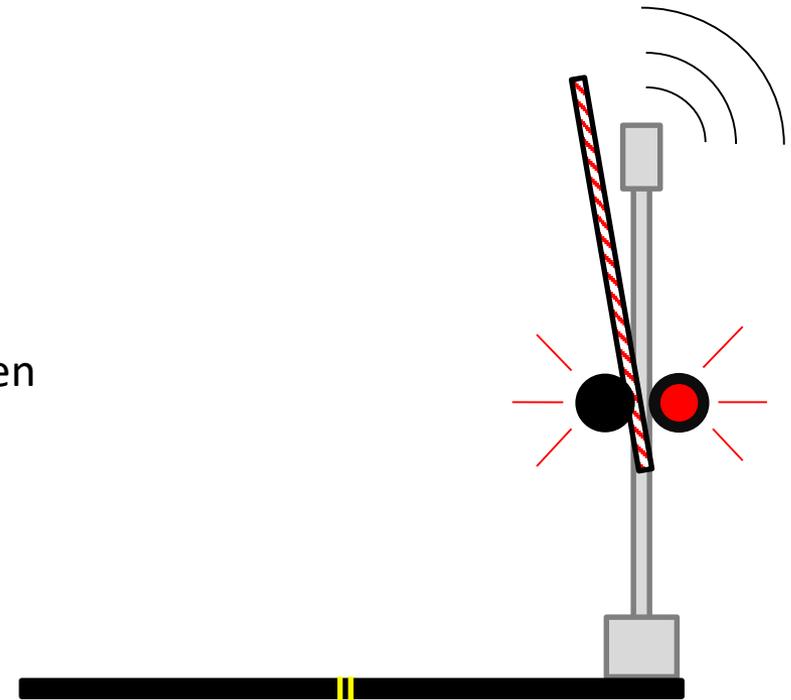
LARKSPUR SYSTEMS AND TEST PHASES

- 1 - Grade Crossing Warning Systems
- 2 - Positive Train Control System
- 3 - Simulated Service



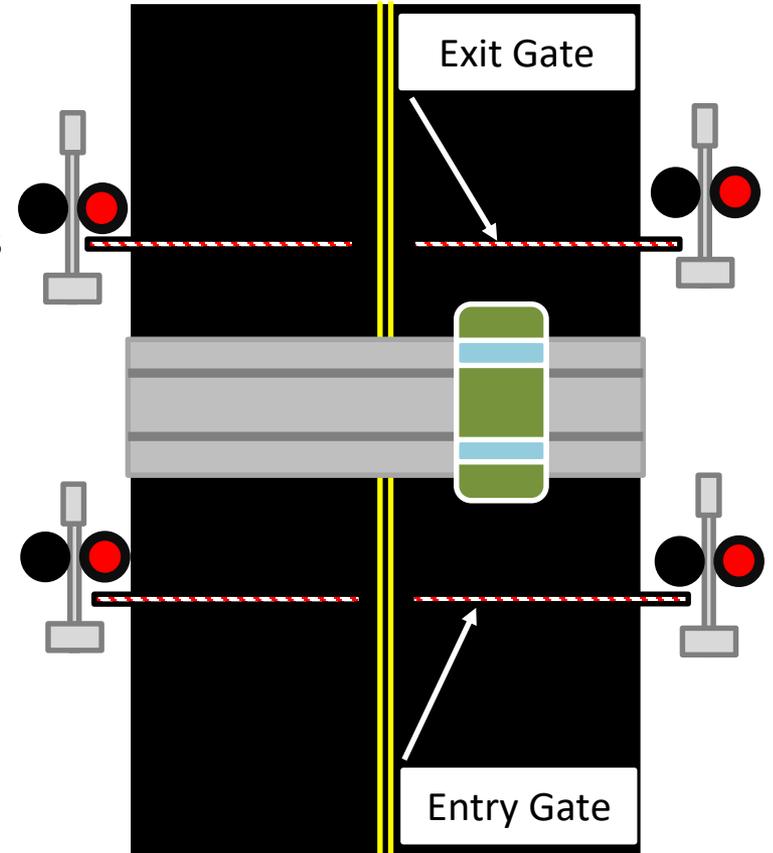
1 - GRADE CROSSING OPERATION OVERVIEW (ALL CROSSINGS)

- Crossing Operation Basics
 - » Designed to provide a minimum of 25 seconds warning time
 - » Design warning time can be greater dependent on crossing width, roadway geometry
 - » Exit gates are required to be horizontal when the train reaches crossing



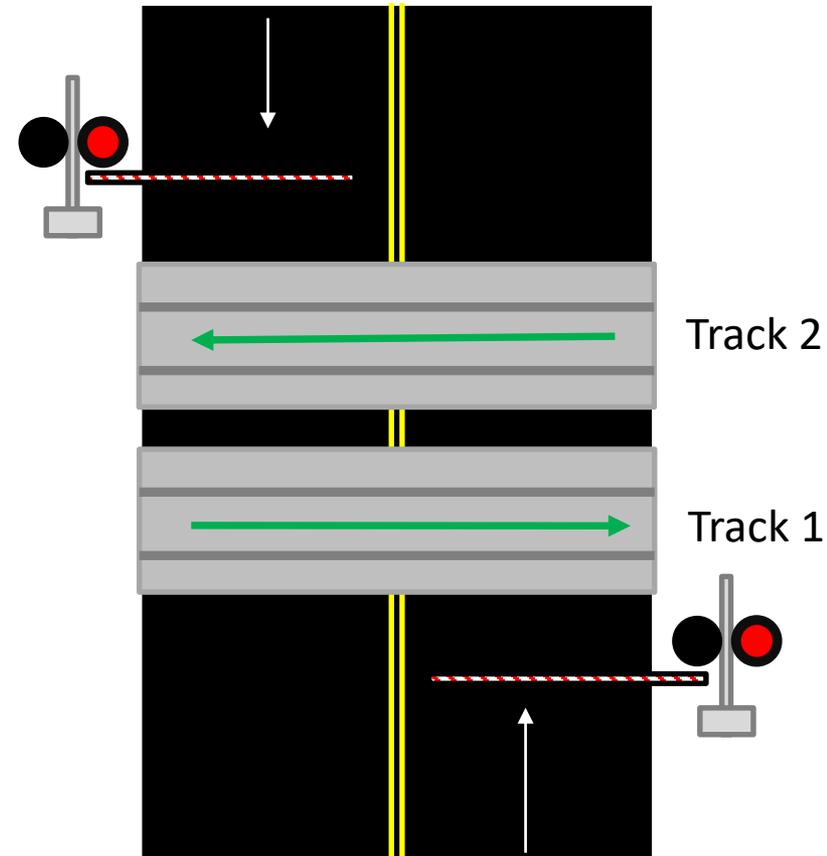
FOUR QUADRANT GATE CROSSINGS (FRANCISCO BLVD)

- Four Quadrant Gate Crossings
- Entry Gates Are Used to Block Entry to the crossing in the normal direction of traffic
 - » Exit Gates are used to block entry to the crossing in the opposing direction of traffic
 - » Exit gates descend after entry gates to allow vehicles to clear the crossing
 - » Exit gates do not descend if a car is detected in the crossing
 - » Exit gates rise if a car is detected in the crossing
 - » Exit gates rise first once the train is detected to be clear of crossing
 - » Once exit gates are vertical, entry gates will rise



DOUBLE TRACK CROSSINGS (2ND ST, 3RD ST, FRANCISCO BLVD)

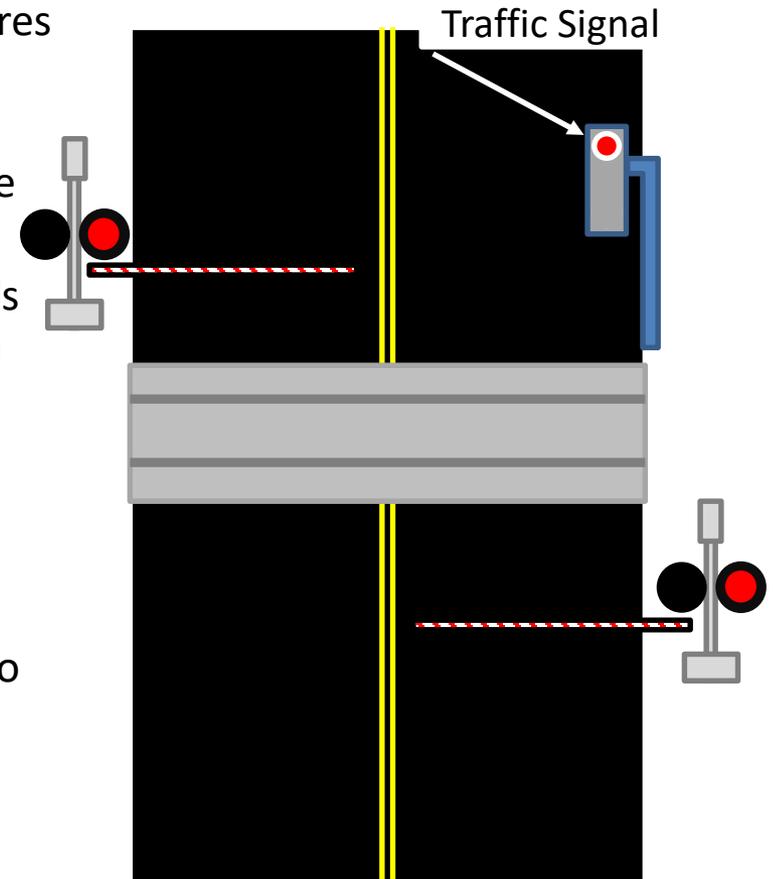
- Designed to provide a minimum of 25 seconds of warning time for movements in both directions of travel on both tracks
- Double track crossings exist where two trains “meet”, or pass one another



CITY OF SAN RAFAEL – TRAFFIC SIGNAL INTERCONNECTS

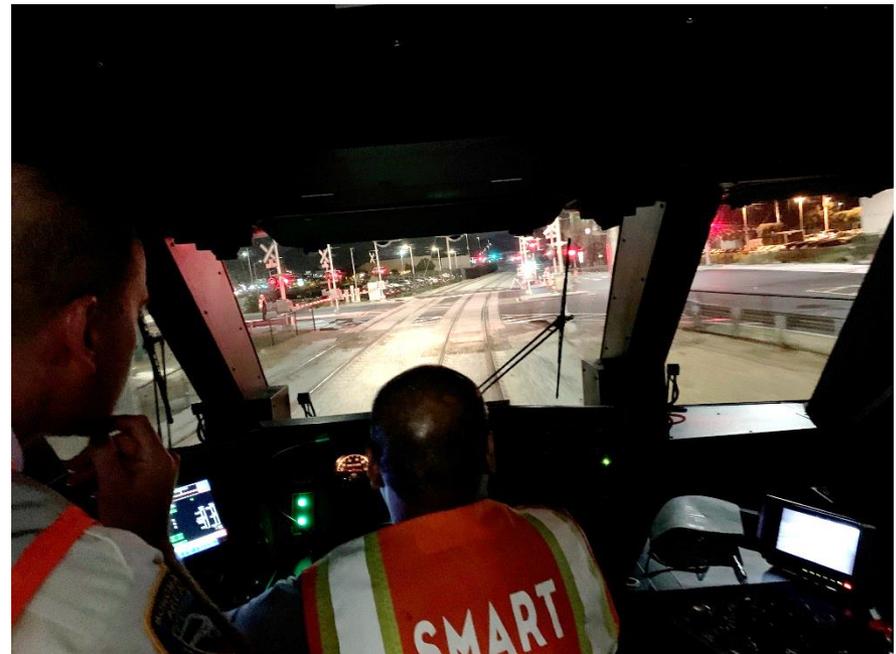
Traffic Signal Interconnects

- » Each public crossing on the Larkspur Extension features traffic signals adjacent to the crossing
- » These systems must be properly coordinated in advance of a train's arrival to clear traffic that may be stopped on the track
- » SMART's system communicates with the City's signals to provide the necessary advanced notification of an approaching train
- » The City's system responds by clearing cars from the crossing, and then holding traffic from entering crossing
- » The City may need to make adjustments to the operation of the traffic signals as SMART continues to test into Pre-Revenue Operation



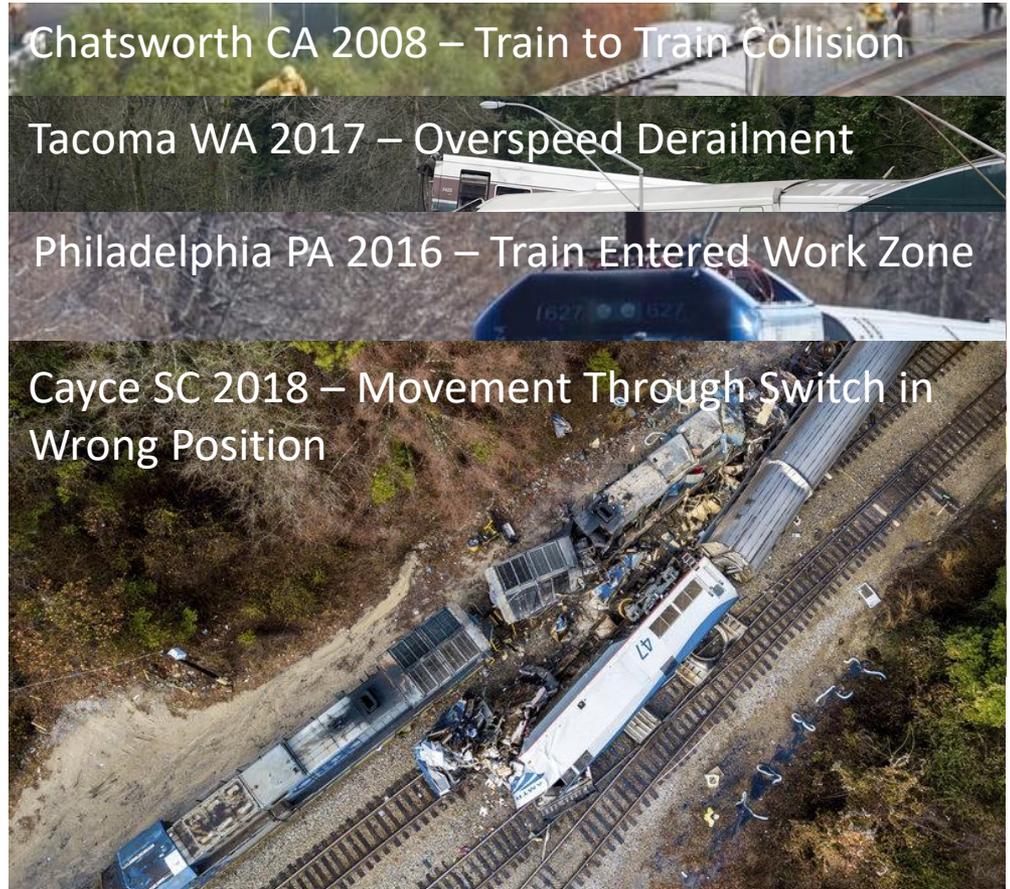
STATUS OF GRADE CROSSING TESTING

- There are five at-grade crossings between Downtown San Rafael & Larkspur Station
- The field testing of these crossings is 99% complete. One more test period is needed to complete this phase which is scheduled for this coming weekend.
- It is anticipated that by the end of this weekend, each of these crossings will have been determined to have met the required State & Federal regulations .



2 - POSITIVE TRAIN CONTROL OVERVIEW

- Positive Train Control Prevents:
 - » Train-to-train collisions
 - » Derailments caused by overspeed
 - » Unauthorized train movement into Work Zones
 - » Movement of a train through a switch left in the wrong position



POSITIVE TRAIN CONTROL TESTING

- Positive Train Control System Tests
 - » Demonstrate that the PTC hardware and software enforces the proper speed throughout SMART's track
 - » Involves moving a test train at various speeds through the track
 - » Each curve, switch, route and circuit must be tested multiple times
 - » Over 100 individual tests need to be performed

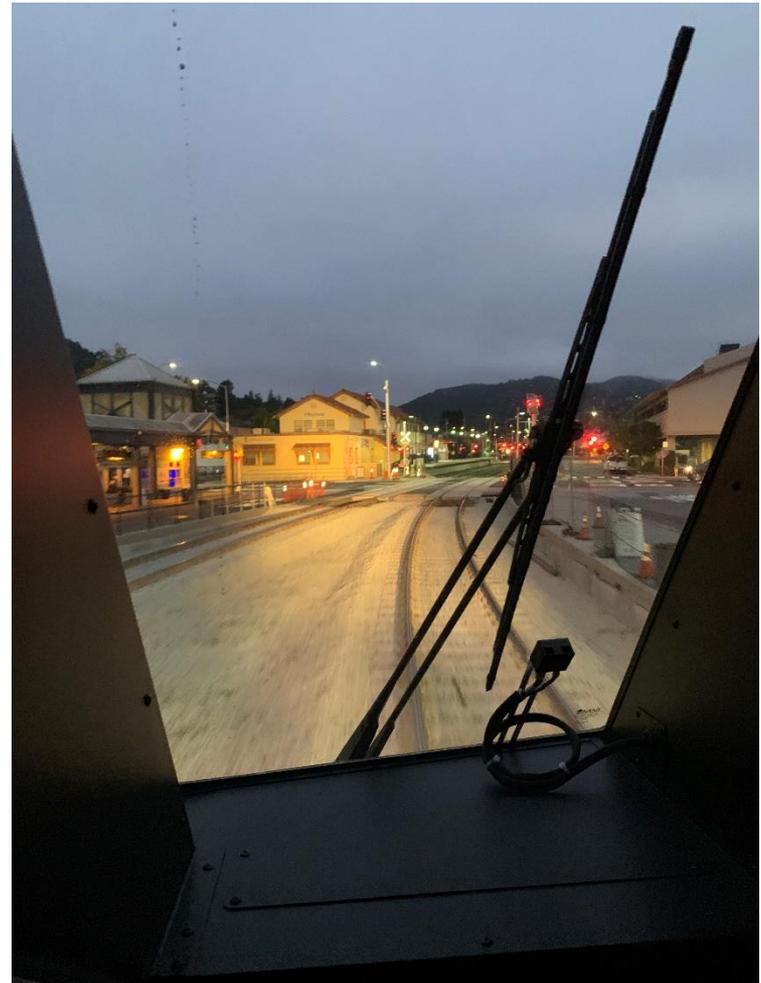


STATUS OF PTC TESTING PHASE

- SMART is **currently** planning seven more overnight test periods to progress this phase of testing:
 - » FRI (9/6) & SAT(9/7)
 - Test train operating between 11 pm and 8 am
 - 5 more nights are needed to complete this phase. We are currently planning specific dates for these 5 nights and will inform the public as soon as we have specific information.
- Depending on the success of these tests, this overall period may be longer or shorter than currently planned
- Once this phase is successfully completed, the need for more overnight testing will be **minimal**

3 - SIMULATED SERVICE

- » Demonstrates the full functioning of the system at full operational frequency from Airport to Larkspur
- » Simulated Service takes place during normal service hours and not overnight
- » Southbound trains drop passengers at San Rafael, and continue south to the Larkspur station without passengers
- » Northbound trains stop and pick up passengers at San Rafael station
- » Operation of the entire system is monitored for proper function
- » At crossings where there is no Quiet Zone established, the train engineer sounds the horn as required by Federal regulations. This is done until the Quiet Zone is established, which is underway by City of San Rafael.



OVERNIGHT TESTING? WHY SO LATE? WHY CAN'T YOU TEST DURING THE DAY?

- SMART's tests must be performed overnight because:
 - » Testing must be performed within an exclusive area of track
 - » No other trains can be on the track between Novato and Larkspur
- SMART's tests start at 11 pm for the following reasons:
 - » Safety Train Control software work must be performed after the last train of the night travels north and passes Novato
 - » The test train must travel from Santa Rosa to San Rafael for testing
 - » Software needs to be loaded and pre-tested in order to begin testing
 - » Once testing is complete, the test train needs to travel north, and pass Novato before preparation can begin for morning service
 - » Software needs to be re-loaded and tested again in preparation for the first passenger train of the morning