



Construction

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Project Title:  
Orange Temporary Pavement  
Delineation in Construction Zones

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Task Manager:  
John Slonaker  
Senior Transportation Electrical  
Engineer (specialist)  
john.slonaker@dot.ca.gov

## Orange Temporary Pavement Delineation in Construction Zones

Evaluating the effectiveness of orange pavement delineation in construction zones by measuring driver lane position before and after installation

### WHAT IS THE NEED?

Highway workers working in construction zones are injured and killed every year by errant drivers. Orange temporary pavement delineation has been used around the world as a method of increasing driver awareness and improving safety in construction zones. European countries, Canada, and New Zealand have implemented this striping with positive results. Testing in three U.S. states has indicated that it can reduce driver confusion and improve worker safety, but it has not been tested in California yet. It is anticipated that orange delineation will increase lane visibility to motorists, their awareness of being in a work zone and the likelihood of them driving at reasonable speeds. This research will also provide an opportunity to test benefits of orange striping for Connected and Automated Vehicles (CAV). Caltrans sees this research as an opportunity to improve the safety along the state highway system for both drivers and workers.

### WHAT ARE WE DOING?

This project will assess the influence of orange pavement delineation in a work zone in Caltrans District 11 in the Interstate 5 (I-5) North Coast Corridor (NCC) Construction Project in San Diego County (about 14 miles one-way). Construction Units 1, 2, and 3 of the I-5 NCC Project are using standard temporary white striping. For Unit 4, striping with orange contrast will be implemented from Palomar Airport Road to State Route 78 (about 4.1 miles in each direction, northbound and southbound). It is planned to have two alternative orange striping patterns for lane lines, right edge line, lane drop, and gores in the southbound direction and northbound direction. The different units allow the researchers to compare driver behavior and evaluate the effectiveness of the orange temporary delineation compared to standard temporary white striping.



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Driver behavior will be observed by temporary installations of closed-circuit television (CCTV) cameras to measure vehicle speed, lateral position in lanes and number of lane departures. Visibility and durability of the orange delineation paint will be measured in terms of chromaticity and retro-reflectivity values when first installed and at approximately 2-month intervals afterwards over one year. The influence of the orange striping on the number and severity of traffic incidents will be observed according to available data from the California Highway Patrol (CHP) by comparing reports from Units 1, 2, or 3 (using white delineation) with Unit 4 (using orange delineation). Driver perception of, and preference for, orange versus white delineation will be measured by a website survey through a partnership with a Caltrans District 11 public relations consultant.

## WHAT IS OUR GOAL?

Evaluate the effectiveness of orange pavement delineation in a work zone by comparing driver behavior in zones with white and orange delineation. Measure the influence of orange delineation on motorists' lane position and speed.

## WHAT IS THE BENEFIT?

The results of this project will allow Caltrans to make an informed decision about whether to use orange striping for temporary work zone delineation. If proven effective, subsequent statewide implementation of orange work zone delineation could save the lives and property of road-side construction workers and the travelling public.

## WHAT IS THE PROGRESS TO DATE?

The kick-off meeting was held on April 8, 2021, and an on-site project meeting was held on June 15th, 2021 in the field office in Cardiff, CA.

The researchers procured and assembled 7 camera systems with an electronics box, a solar panel and two cameras each. All cameras have

been installed by Caltrans and contractors. There are now two cameras at Jefferson overcrossing, two at Las Flores overcrossing, two at La Costa overcrossing, one at Cassidy overcrossing, and one at Palomar Airport Road overcrossing. The researchers painted reference markings on the freeway to calibrate the machine vision algorithm and downloaded and tested initial video data. The researchers wrote machine vision software to determine the volume, speed and lane position of vehicles passing through the construction zone. So far, they have retrieved video segments spanning a six-month period for analysis.

The researchers ordered, received and tested the reflectometer to measure retro-reflectivity and nighttime chromaticity of the striping and the spectrometer to measure daytime chromaticity. They developed initial protocols for measuring striping quality with the reflectometer and spectrometer. So far, they have taken four sets of measurements with the reflectometer and spectrometer: one just after the orange striping was installed (month 0), another two months later (month 2), another at month 4 and another at month 6.

The researchers developed a draft web-based survey with Southwest Strategies, the Caltrans District 11 public relations consultant. As of 10/10/22, the web-based survey of drivers who have frequently driven through the work zone had 813 responses in English and 5 in Spanish.

The researchers acquired a Light Detection and Ranging (LiDAR) sensor.

Work planned for next quarter:

The researchers will analyze the video data for vehicle lane position maintenance, speed and volume in the work zone for a period when only the white temporary striping existed and the subsequent period after the orange striping was installed.

After consolidating data from the zero, two, four,

and six-month measurements, the researchers will send the spectrometer back to the customer, i.e., Caltrans District 11 Construction, in January 2023.

The researchers plan to keep the web-based survey of drivers who have frequently driven through the work zone open until at least 1,000 answers are received.

The researchers will deploy The LiDAR sensor in the work zone with orange temporary striping during their 12-month visit.

The researchers will start analyzing SWITRS and HERE data, in addition to PEMS data, for vehicle speed and flow.

## IMAGES



Image 1: I-5 North Coast Corridor (NCC) construction project area



Image 2: Caltrans District 11 temporary work zone pavement delineation pattern – alternative 1



Image 3: Caltrans District 11 temporary work zone pavement delineation pattern – alternative 2

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Image 4: Spectrometer to measure daytime chromaticity



Image 5: Spectrometer to measure daytime chromaticity

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