



# INCREASING SAFETY IN WORK ZONE

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# PROJECTS

- Orange Temporary Pavement Delineation in Construction Zone (Construction)
  - Evaluating the effectiveness of orange pavement delineation in construction zones by measuring driver lane position before and after installation
- Roadside Safety Performance Measures for Specific Countermeasures to Protect Workers (Design)
  - Develop draft guidance documents for safety recommendations

# BACKGROUND

- 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.
- Orange delineation will increase lane visibility to motorists, their awareness of being in a work zone and the likelihood of them driving at a reasonable speeds.
- Caltrans sees this research project as an opportunity to improve the safety along the state highway system for both drivers and workers.

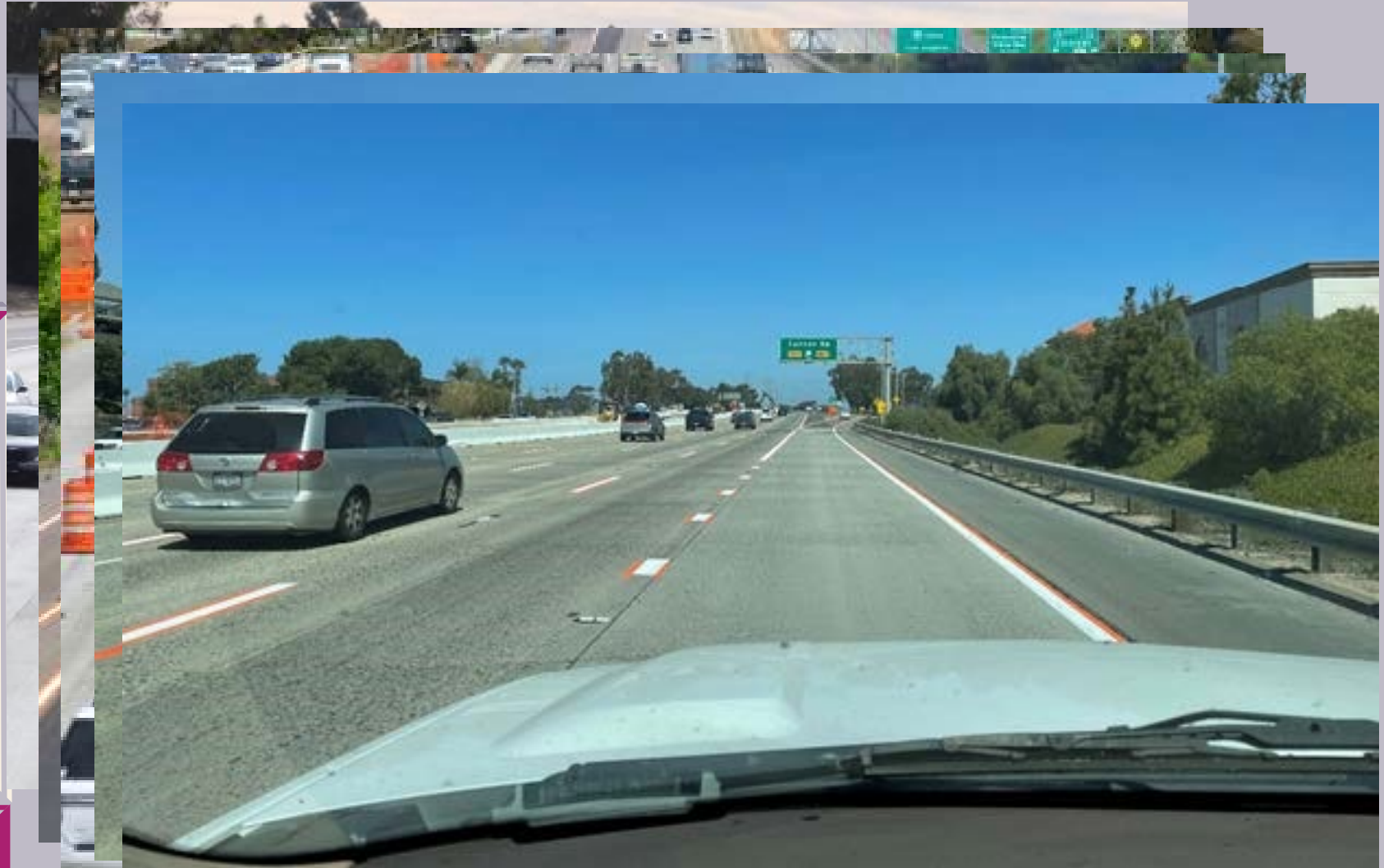




# PROJECT INFORMATION

- This project assessed the influence of orange pavement delineation in a work zone in Caltrans District 11 in the Interstate 5 North Coast Corridor Construction Project in San Diego County.
- The construction started with standard temporary white striping and then temporary orange contrast striping was added later.
- The different time periods with white and orange temporary striping allowed the researchers to compare driver behavior and evaluate the effectiveness of the orange temporary delineation.
- There were two alternatives used for orange striping with lane lines.
  - The southbound direction had orange preceding white temporary striping
  - The northbound direction had orange along both sides of white striping
- The orange contrast with the right edge line, lane drop, and gores was the same in both directions.

# PROJECT INFORMATION






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- This project collected measurable and subjective data about driver behavior and traffic incidents.
- In particular, the following assessments were performed
  - Assessment of driver behavior in the work zones with orange delineation as compared to work zones with standard temporary white delineation
  - Assessment of driver perception of effectiveness of orange delineation
  - Evaluation of visibility of orange temporary striping
  - Analysis of influence on traffic incidents and speed




# DRIVER BEHAVIOR


- Driver behavior in work zones with orange delineation was evaluated using three means:
    - Visual observation
    - Video recordings (CCTV)
    - Light Detection and Ranging sensors (LiDAR) - The LiDAR measurements were preliminary feasibility studies
  - Visual observations highlighted that pavement joints, road defects, slabs, and curves also influence driver behavior in addition to lane striping.
  - Automated video analysis was very time consuming but produced many data points.
  - The comparison of lane keeping behavior during work zone with white and with orange temporary striping was inconclusive on the influence of the presence of orange striping or striping type due to high data uncertainty over few data points.
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# DRIVER PERCEPTION

- Developed a survey to assess driver perception on work zone awareness, visibility of pavement delineation, and preference of white vs. orange contrasted white.
    - Soft launch on May 18, 2022 and by June 5, 2023 a total of 1,185 responses were recorded and it was closed.
    - 1,136 respondents (93.9%) lived in San Diego County, 2.4% lived in Orange County, 1.1% lived in Los Angeles County, 2.3% in “other regions”, and 0.4% lived in Baja California.
  - Total of 80.4% respondents found that the orange contrasted striping increased their awareness of being in a work zone.
  - The overwhelming majority 84.3% would like to see orange contrasted striping used in more road construction zones.
  - The majority respondents did not have prior knowledge of the orange contrasted striping before entering the work zone. This finding shows that public communication could make the orange contrasted striping even more effective.
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# EVALUATION OF VISIBILITY OF ORANGE TEMP STRIPING

- Retroreflectivity values RL of freshly painted white temporary striping was 2.1 times higher than freshly painted orange temporary striping.
  - Retroreflectivity values RL of painted white and orange temporary striping decreased over 12.6 months between 53.9% to 76.5% of the initial value at installation (0 months).
  - Both daytime and nighttime color coordinates for orange paint stripe showed a color change over the 12.6 months of installation.
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# INFLUENCE ON SPEED/ACCIDENTS

- Communication with local CHP found that no officers referred to the orange striping in their collision reports. Additionally, no CHP officer had taken any complaints regarding the orange striping.
  - Accident data from different sources showed a drop in accident rates during the time period affected by COVID-19 shutdowns. Accident rates continued to increase afterwards.
  - In the work zone road stretch, NB accident rates were generally slightly higher than in the SB direction.
  - Only 27 accidents reported in the NB direction and 16 in the SB direction for two five-month periods of work zone installation. Therefore, no clear trend of striping color and pattern can be detected. Rear-end collisions were the main accident types as expected.
  - Median average speeds in the work zone for orange temporary striping were slightly lower than in the work zone with white temporary striping. This finding indicates a position effect of orange temporary striping on average vehicle speeds.
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# CONCLUSIONS

- The effectiveness of the orange contrasted striping to increase driver awareness of being in a work zone was strongly confirmed from a driver survey.
- Also, average speeds were lower during orange temporary striping compared with white striping
- The influence of the orange striping pattern on lane keeping behavior and accidents was not provable due to data uncertainty and additional influencing parameters, such as delayed effects from COVID-19 shutdowns and busy junctions.



# MOBILE BARRIERS MBT-1

- Have anyone use the Mobile Barriers MBT-1 on their project?

