AHMCT

Annual Report

2023 / 2024

For individuals with sensory disabilities, this document is available in alternate formats. To obtain a copy in an alternate format, contact:

Caltrans Division of Research, Innovation and System Information
PO Box 942873,
Sacramento, CA 94273-0001
916-654-8899 Voice
711 TTY

Advanced Highway Maintenance and Construction Technology Research Center

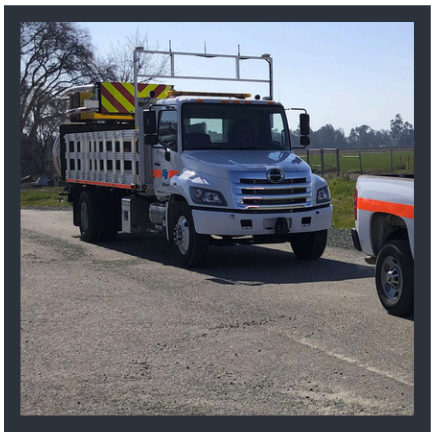
Fiscal Year 2023-2024
Annual Research
Program Highlights

For more information:
AHMCT Research Center
ahmct.ucdavis.edu

Table of Contents

CONTENTS

AHCMT covering research on...



Land

Air

& Water

Directors' Message

We are pleased to present the Advanced Highway Maintenance and Construction Technology (AHMCT) Research Center's Annual Report for July 1, 2023 to June 30, 2024. The AHMCT Research Center continued its deployment-focused research involving implementation of research results into Caltrans practice. The center has also continued to diversify its Principal Investigator pool to better support different research needs of the California Department of Transportation (Caltrans).

The AHMCT Research Center, established in 1991, investigates scientific methods and technologies that will improve safety, mobility and efficiency of highway construction, maintenance and operational tasks while addressing reliability of infrastructure and environmental impact of highway operations. The emphasis is on the development of innovative human-centric technologies and scientific methods utilizing sensors, robotic and automation systems, driver and operator assist systems, navigations systems, use of drone technology and other digital platforms as well as pushing such technologies and methods towards implementation in real Caltrans operations and workflow. For example, in terms of implementation of a technology, the Center's work during the past year has led to implementation of eight Mountain-Pass Road Opening (MPRO) systems: four in State Route 4, two in State Route 108 (Sonora), two in State Route 120 (Tioga) for Districts 9 and 10. In terms of implementation into workflow or policy, the Center's work from its research on effectiveness of orange temporary pavement striping in construction zones were presented at the California Traffic Control Devices Committee meeting on Nov. 2, 2023. The findings supported a motion to adopt revisions to the California Manual on Uniform Traffic Control Devices (MUTCD) 2014 Edition to allow orange to be used as a contrast color with white and yellow striping in construction zones.

AHMCT has developed extensive experience aligning its research and development work towards implementations achieving Caltrans' mission. The research projects completed in the last year together with a brief outline of some of the ongoing research projects are described in the remainder of this report. A major goal in each research project is to push towards implementation or policy decisions improving Caltrans' operations and safety of workers and traveling public.

Bahram Ravani and Ty Lasky
Co-Directors, AHMCT Research Center

Spotlight on Maintenance and Equipment Research

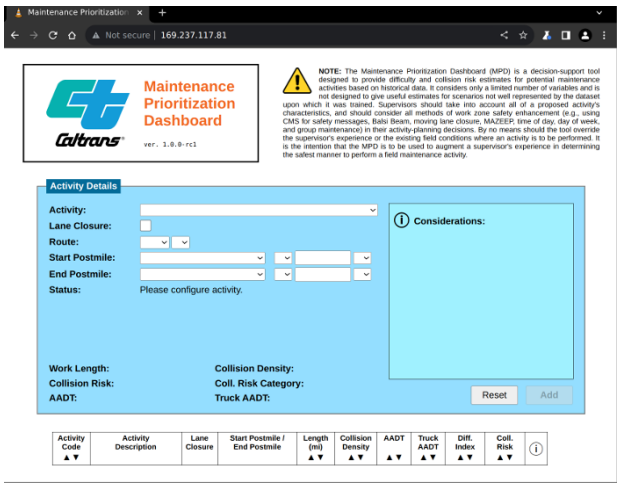
Task 3847: Development of a Maintenance Prioritization Assessment and Safety Tool

Customer: Division of Maintenance

Problem: According to the U.S. Bureau of Labor Statistics, highway construction and maintenance work is one of the most hazardous occupations in the United States. In 2018, more than 7,000 work-zone collisions occurred on California roadways. About 2,300 of these resulted in injuries, and 46 involved a fatality. Caltrans needs operational performance metrics that can be used to evaluate the safety risks to highway workers in planning and scheduling of maintenance operations.

Goal: The goal of this research project was to develop the Maintenance Planning Dashboard (MPD) tool to help Caltrans improve the safety and efficiency of its highway maintenance activities by providing detailed data that can be used to plan lane closures, time duration of operation, and consider other factors. The tool allows for planning that would improve the safety of highway workers and the traveling public.

Methodology: The AHMCT Research Center employed a Project Panel (panel), including the Caltrans Project Manager (PM), Caltrans project customers, and other stakeholders to guide this research. Data from the Integrated Maintenance Management System (IMMS) were integrated with data from best practices of other state Departments of Transportation (DOTs), along with data obtained from Caltrans Districts and field operational personnel, to establish the baseline necessary for performing the cost-benefit analysis.



MPD user interface at application start

Conclusions: The research project developed a Maintenance Planning Dashboard (MPD) that can be used by the Division of Maintenance for planning of their maintenance work activities. The tool is based on index of difficulty and collision risks to maintenance workers.

The key deliverables of this project included:

- The design and implementation of the MPD backend

- MPD user interface design and implementation documented
- The final version of the MPD tool and installer

This tool is available for Caltrans to use.

Benefit: With the developed MPD tool, Caltrans now has the ability to incorporate statistical inputs/data into their work activities prioritization decision process based on difficulty index and collision risk. This will facilitate decision making in planning and will lead to improved worker safety.

Task 3848: Cost-Benefit Analysis for Concrete vs. Metal Guardrails and Wood vs. Metal Posts for Signs and Guardrails

Customer: Division of Maintenance

Problem: Findings from previous research at the AHMCT Research Center revealed that maintenance work on guardrails, barriers, and end-treatments incurs the highest average cost per work order compared to other roadside features. This finding underscored the urgent need to evaluate these costs for enhanced efficiency. Therefore, this study aimed to develop a comprehensive life-cycle cost analysis and cost benefit evaluation to assist the decision-making processes and reduce safety risks and overall operational costs.

Goal: The purpose of this research task was to compute and compare the lifecycle costs of concrete barriers vs. steel guardrails, as well as wooden vs. steel guardrail posts and signposts. Another objective of the study was to develop a software tool that could calculate and compare the lifetime costs of these barriers, taking into account their construction, maintenance, and public costs, as well as the risks associated with exposure of the workers to live traffic during maintenance activities.

CalBarrier startup splash screen

Methodology: The AHMCT Research Center employed a Project Panel (panel), including the Caltrans Project Manager (PM), Caltrans project customers, and other stakeholders to guide this research. Data from the Integrated Maintenance Management System (IMMS) were integrated with data from best practices of other state Departments of Transportation (DOTs), along with data obtained from Caltrans Districts and field operational personnel, to establish the baseline necessary for performing the cost-benefit analysis.

Conclusions: The results of this research showed that selecting the most cost-effective barrier requires the inclusion of many parameters, such as construction, maintenance,

exposure, and public costs, while carefully considering factors like traffic mixture, economic factors, and road geometry. CalBarrier was developed to incorporate all these factors in computing and comparing the lifetime cost of concrete barriers versus steel guardrails, as a part of this study. Analyzing the lifetime cost of wooden vs. steel guardrail posts and signposts revealed that, while wooden posts have a lower initial cost, they incur higher maintenance and disposal costs, making them less cost-effective over their lifetime. This tool is currently being used by Caltrans.

Benefit: The benefits of this project include improved safety for maintenance/construction workers and cost savings in certain high-cost maintenance operations associated with barriers, guardrails, and signposts. This research may assist in the decision-making process when:

- Choosing between concrete versus metal guardrails.
- Replacing wooden versus metal guardrail posts and signposts.

Task 3924: Integration of Thermal Infrared (IR) Imaging into the Caltrans Inspection Program for Pavements and Bridge Decks

Customer: Division of Construction

Problem: Caltrans must inspect pavement and bridge decks to support proactive maintenance. This need is increased by the recent Senate Bill-1 mandates. Caltrans must leverage nondestructive evaluation technologies for sensing and data processing to improve inspection speed and efficiency.

Goal: Caltrans has installed a thermal infrared (IR) system on its 3D Ground-Penetrating Radar (GPR) vehicle, allowing georeferenced visual and thermal IR imaging of pavement and deck surfaces concurrent with 3D GPR imaging of the subsurface. The purpose of this research was to continue integration of the technology within Caltrans inspection practices.

Methodology: The research included the following tasks:

- Identify available commercial off-the-shelf software for thermal IR data processing.
- Develop custom software to add georeferencing of data.
- Add electronics and wiring for georeferencing images from IR and B/W cameras.

Conclusion: Key contributions of this research project included:

Upgraded front vehicle display showing the vehicle trajectory and GNSS satellite availability

- Reviewed and selected IrSUITE IR camera data collection and analysis software for pavement delamination and debonding.
- Changed the Caltrans nondestructive evaluation vehicle to support the installation and operation of the IrSUITE software as well as georeferencing of IR camera data.
- Facilitated IrSUITE training for Caltrans users.
- Developed a Python program to update IrSUITE position log file with postprocessed Applanix POS position coordinates.
- Upgraded the Caltrans NDE vehicle hardware based on the lessons learned from these projects.
- Modified B/W camera wiring to the Applanix system to support high accuracy georeferencing of B/W images.
- Developed and tested B/W camera data collection and post-processing software.
    - Implemented high-accuracy georeferencing of B/W images.
    - Implemented a glare reduction process for B/W images.
    - Implemented an MP4 video exporting feature.
    - Implemented perspective view to orthographic view image transformation.
    - Implemented a GeoTIFF export feature.

Benefit: The results of this project enable Caltrans to start using thermal IR camera for early identification of shallow-seated deterioration in pavements and bridge decks. The B/W imagery could help users better identify real and false anomalies in the 3D-GPR and IR data. There is a second phase project in development to focus on implementing into Caltrans.

Task 4049: TMS Innovative Product Proof of Concept (POC) Support, Including Technical Evaluation of Detectors for Pedestrian Walk Time Extension

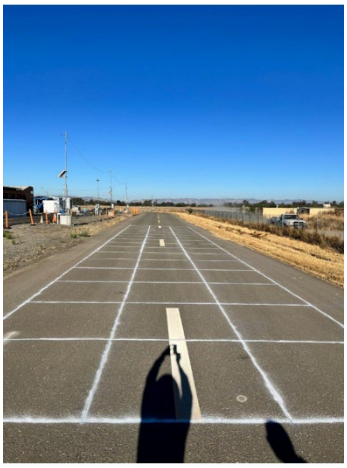
Customer: Traffic Operations

Problem: Pre-set crosswalk walk time does not always provide pedestrians enough time to walk across the road, especially when it comes to elders and individuals with disabilities. To address this problem, an available technology that aids with adding walk time is considered. The sensor picks up pedestrian motion and signals the controller to add walk time as desired. This evaluation includes three candidate sensors: AGD 326, SmartWalk XM, and iComs TMA-011 LV. If one of the sensors fits Caltrans' needs, the commercial off-the-shelf (COTS) technology is ready to be applied in the field.

Goal: The objective of this research is to evaluate each of the three sensors and help Caltrans make decisions in choosing a sensor that satisfies Caltrans' purposes.

Methodology: Each sensor was tested separately. The sensor was mounted on a rigid structure built on a truck bed to achieve a ten-foot mounting height that would not allow it to wobble in the wind. In addition, having the structure on the truck helped with transporting test equipment.

To identify detection range, a spray-painted grid was created on the AHMCT test track. The grid outer dimensions were 20 by 105 feet . The grid accommodated most of the sensors' detection specifications. The grid did not have the capacity to accommodate the full AGD 326 detection width. Therefore, the testing result for the AGD 326's maximum detection width might not be fully evaluated.



Spray-painted grid on AHMCT test track

A phone-controlled camera was setup to oversee the testing process and the custom light-emitting diode (LED) indicator cable. This cable connected to the sensor's relay, and the LED would light up when the relay was activated. In addition, a pedestrian would walk to cover the whole grid, as well as walking off-grid. When the crosswalk motion sensor picked up a pedestrian, the LED would light up. The process was recorded and re-watched to analyze sensor activity. Each sensor was tested five times to ensure the accuracy of the evaluation.

Conclusions: Overall, AHMCT would recommend the AGD 326 sensor to be the best candidate for Caltrans' purposes. The AGD 326 has the most user-friendly interface, which makes the setting adjustment process straightforward. The AGD 326 sensor is the only candidate that allows flexibility in adjusting the detection zone parameters to match the desired crosswalk parameters. The AGD 326 also presents a visual

demonstration in its manual where the user can check the integrity of the sensor detection parameters. These unique features are more valuable when compared to the SmartWalk XM and iComs features.

Benefit: The results of this research allows Caltrans to be more efficient by deploying promising systems that will have safety benefits and will improve efficiency and mobility.

Task 4133: Evaluation of a Portable Snow Melter for Use in Caltrans Maintenance Yards

Customer: Division of Maintenance

Problem: Caltrans must remove snow in its maintenance yards. Current operation involves physically hauling snow away from these challenging sites and relocating the snow to remote locations. Such operation has significant economic, time, labor, and environmental costs.

Goal: The roles of the AHMCT team were to observe, collect field data, perform analysis, and document snow melter performance. The results provided by the AHMCT team help determine whether using a snow melter is more efficient and cost-beneficial compared to the current trucking operation.

Methodology: To evaluate the Snow Dragon, the AHMCT team observed the system, documented the performance, collected field data, and interviewed Caltrans operators for feedback. In addition, the AHMCT team provided Caltrans personnel with log sheets and followed up through email and phone conversations when they were not on site. For cost, efficiency, and performance evaluations of the Snow Dragon, AHMCT used the data collected in the field, from the log sheets, and provided by Caltrans. In addition, Caltrans operators' inputs were considered in the evaluation since they had worked directly with the Snow Dragon.

Left side view of the Snow Dragon SND900

Conclusions: This research showed that the cost to truck a cubic yard of snow with minimal sediment (or snow with less sand) is less than the cost to melt a cubic yard of snow with minimal sediment using the Snow Dragon at this study location. Water discharged from the Snow Dragon was tested. From the water testing results conducted by the UC Davis Analytical Lab, most elements decreased in concentration, some elements remained unchanged, and one element increased in concentration after being processed by the Snow Dragon. The entire system, including clean-out,

should be in taken into consideration when analyzing the environmental impact on water quality.

Benefit: The benefit of using the Snow Dragon is having the TSS (Total Suspended Solids) concentrate inside the Snow Dragon, allowing for easier TSS (sand) reclamation than the current approach. According to Caltrans operators, the advantage and disadvantage of using the Snow Dragon are:

- Advantage: The Snow Dragon only requires one operator for the snow removal process.
- Disadvantage: The clean-out after a work shift is very time-consuming, and a clean-out is required every 12 hours (for the snow in Kingvale yard). The operator cannot continuously feed snow into the Snow Dragon due to the water tank temperature recovery conditions. The operator must pause between loads of snow input into the machine.

Caltrans has chosen not to implement the Snow Dragon into its operations. They system was sold and proceeds were returned to the sponsor.

Spotlight on Operational and Implementation Research

Task 3919: Targeted Warning Messages to Protect Moving and Stationary Maintenance Lane Closures

Customer: Division of Maintenance

Problem: In today's dynamic traffic environments, a critical problem emerges: ensuring the safety of both workers and drivers while maintaining efficient traffic flow, particularly near temporary lane closures in work zones. Despite the presence of traditional traffic management tools, like arrow boards and signposts, a challenge persists in ensuring driver attention and compliance with such warning message signs. Generic warning signs and instructions are frequently overlooked or misinterpreted by drivers. The resulting delayed reaction or non-compliance can potentially lead to unsafe conditions, including abrupt lane changes, collisions, and near-miss incidents, exacerbating the risk to road workers and other motorists. This problem is particularly pronounced in high-speed traffic conditions where the available response time is limited, and the consequences of errors are potentially severe. The need is for an innovative approach that not only captures the attention of drivers more effectively but also provides them with timely, relevant, and personalized information to guide their actions. Addressing this challenge is important for enhancing the safety and efficiency of highway maintenance operations, especially in the face of increasing traffic volumes and the complex dynamics of modern road networks.

Goal: The purpose of this research was to develop an intelligent truck mounted attenuator (TMA) truck messaging system based on artificial intelligence that alerts drivers more effectively with the goal of reducing the number of collisions and improving traffic flow near work zones involving lane closures.

Methodology: Our research methodology adopted a two-pronged approach with each prong tailored to evaluate distinct, yet complementary, components of work zone traffic management solutions.

The first approach focused on integrating cost-effective commercial technologies with custom-developed AI techniques. We selected a commercial camera system based on specific criteria: cost-effectiveness, vehicle detection, license plate recognition, and speed measurement capabilities. Our team then developed AI algorithms capable of extracting vehicle-specific information, such as make and model, from the visual data captured by these cameras.

The second approach sought to assess an all-in-one commercial solution, a system inherently equipped to perform the functions of the camera system but with added VMMR (vehicle make and model recognition) capabilities. This advanced system was

designed to detect vehicles, read their license plates, measure their speed, and identify vehicle-specific information, such as make, model, and color.

In our research, we carefully selected two distinct COTS (commercial off the shelf) systems for evaluation: Milesight and VIDAR. The selection of these two systems was strategic; Milesight allowed us to explore the feasibility of pairing basic vehicle detection with our custom-developed AI for enhanced functionality at a lower cost, while VIDAR offered an all-in-one solution that could potentially streamline the process by integrating all desired features into a single, albeit more expensive, package. This distinction between the two systems was pivotal in our methodology, allowing for a comparative analysis of a modular versus an integrated approach in work zone traffic management technology.

Deployment illustration during daytime and nighttime.

Both systems underwent rigorous field testing to quantify their performance across various parameters. We evaluated their performance in vehicle detection, license plate recognition, speed measurement, and the extraction of make, model, and color data. These field tests were important in comparing the efficacy of the custom AI-enhanced low-cost system versus the comprehensive capabilities of the all-in-one commercial solution.

In parallel with the field testing of these systems, our research relied on traffic simulation studies using VISSIM software. These simulations served two critical purposes: firstly, to gain a deeper understanding of the role of driver compliance in safe and efficient merging near lane closures, and secondly, to ascertain the optimal placement of targeted message boards. By simulating various traffic scenarios, we were able to analyze the potential impact of different message board locations on driver behavior and overall traffic flow.

Additionally, our methodology encompassed a continuous process of data analysis and refinement. Based on the insights gained from both field tests and simulations, we iteratively improved our systems and strategies. This approach ensured that our recommendations are grounded in empirical evidence and tailored to the nuances of real-world work zone traffic management challenges.

Overall, our research methodology combined practical field tests with simulations, creating a robust framework for decision making and design selection. This comprehensive approach aimed to not only address the immediate challenges of work zone traffic management but also to contribute insights for future advancements in the field.

Conclusion: Our research yielded promising results that have important implications for traffic management in work zones. The two systems we evaluated, Milesight and VIDAR, demonstrated distinct strengths in their respective areas of application.

Both systems demonstrated high accuracy during daylight field tests in their respective functionalities. In light of our research and evaluations, we recommend the VIDAR system for traffic management in work zones, particularly in scenarios where budgetary constraints are less restrictive. The recommendation for VIDAR is anchored in its more robust design and the comprehensive nature of its capabilities. Unlike the Milesight system, which requires additional development for VMMR, VIDAR offers an all-encompassing solution that seamlessly integrates vehicle detection, license plate recognition, speed measurement, and the identification of specific vehicle attributes like make, model, and color.

Benefit: By providing personalized, relevant information to drivers through this system, we anticipate an improvement in driver compliance with the warning signs. Such an enhancement in driver compliance is expected to contribute to smoother traffic flow and heightened safety in work zones. Therefore, the targeted warning system could be an effective tool in improving current work zone traffic management practices. There is a phase two project in development to help Caltrans in implementing this system.

Task 4163: Roadside Safety Performance Measures for Specific Countermeasures to Protect Workers

Customer: Divisions of Maintenance and Design

Problem: There is a need to develop new policies and practices for roadside features that support Caltrans' safety and asset management goals. The goal of these policies and practices is to assist highway designers in including maintenance planning strategies to improve worker safety and working conditions. Such policies and practices should be defensible and based on data and scientific methodologies and techniques.

Goal: The recent research project "Performance Measures for Roadside Features" (Task 2761) identified a number of items, such as including more hardscape, which would enhance worker safety if fully implemented. Caltrans needed research to prioritize these items and to create draft guidance (such as memorandums in the appendices) that would provide templates for the Divisions of Maintenance and Design to use to update the Maintenance Manual and the Highway Design Manual, and thus realize these safety benefits. The purpose of this research was to execute this prioritization and develop the corresponding guidance documents.

Methodology: AHMCT researchers will revisit the safety enhancements identified in Caltrans research Task 2761 and its follow-on project Task 3289 "Research to Develop

Performance Measures for Maintenance of Roadside Features" and develop an updated and combined list of potential safety enhancements. This list will be presented to the Caltrans project panel, and further input will be solicited. Once the list has been finalized, the researchers will work with the project panel to prioritize the list based upon panel-developed criteria. An appropriate subset of enhancements will be selected, and the researchers will develop draft guidance (memo, candidate Highway Design Manual subsection, or similar) which could then be used by Caltrans Maintenance or Design as a template for updating the appropriate manual. In addition to project management and reports, the proposed research will include the following tasks: a. Develop updated list of safety enhancements, b. Finalize and prioritize list in accordance with Caltrans project panel input, c. Develop draft guidance useful for update of manuals

Conclusion: Key contributions of this research project included:

- Guidance documents for roadside maintenance, which will improve worker and traveler safety
- GIS-based decision support tools, which will aid the implementation of some of the guidance provided

The development of guidance documents and supporting tools will have a significant impact on improvements for roadside maintenance safety as the documents will promulgate best practices and support supervisors and workers in making improved decisions. The approach used in this project for development of guidance documents and supporting tools would be useful in future projects concerning necessary safety updates to other Caltrans responsibilities, including roadway maintenance, winter maintenance, highway operations, and construction. We recommend that a similar project be established to develop guidance documents and tools for one of these critical areas.

Benefit: The results of this project will improve worker safety based upon a prioritized list of safety enhancements and draft guidelines supporting Caltrans' efforts to supplement their Design and Maintenance manuals. Caltrans is working to implement the benefits.

Summary of Activities in Addition to the Completed Projects

- Initiated evaluation project for the Fotokite tethered drone system, including procurement, training, and initial testing.
- Developed Preliminary Investigation for Multimodal Common Operating Picture systems for emergency response management.
- Resolved procurement issues for the Omniflow security camera system.
- Provided rapid response in developing research tasks and methods for the DOE initiative on evaluation of Mobile Charging stations for electric heavy-duty vehicles.
- Completed drone structure asset pilot certification.
- Extended Starlink evaluation project to support additional testing.
- Extended Omniflow yard security project to allow completion of procurement followed by installation and pilot testing.
- Extended Fotokite project to allow additional testing time, particularly for Caltrans field testing.
- Provided tour of AHMCT for DRISI upper management, including to deputy director of DRISA: April Nitsos.
- Provided tour of AHMCT for OTTR (Traffic Management) team in DRISI.
- Worked with Caltrans Aeronautics to establish a project for airport runway inspection and data management.
- Provided final presentation to Caltrans Emergency Services for Multimodal Common Operating Picture systems for emergency response management.
- Extended Responder transition project to provide ongoing support for the Responder system while Caltrans continues to seek a third-party vendor.
- Provided training for MPRO (Mountain Pass Road Opening).
- Submitted proposal for next AHMCT master contract.
- Supported Caltrans audit of AHMCT and other research centers. AHMCT procedures were selected for many of the best practice recommendations.
- Provided interview on wrong-way driving research for ABC 10 news in San Diego.
- Extended GTPG2 project to allow more time for support as well as target spacing experiments and analysis.
- As part of an implementation project, AHMCT supported the upgrade of a heavy equipment simulator used for research and Caltrans training purposes.
- Two more projects were selected to receive funding for implementation of research results.
- AHMCT presented a webinar about Robotic Security for Caltrans Facilities to a large audience of nearly 300 attendees at the Caltrans May Research Connection Presentation.
- Three alternative Truck Mounted Attenuator (TMA) accessories systems are being evaluated how they reduce speeds of the traveling public in work zones to increase worker safety.

Active Research Task Summary

For more information on all active projects, see the Research Notes posted at https://dot.ca.gov/programs/research-innovation-system-information/research-notes

Task ID	Task Name and Summary	End Date
3870	*Research and Development of the Caltrans' Geospatial Technology Proving Ground* • Caltrans and AHMCT established a Geospatial Technology Proving Ground (GTPG) facility to support the integration of mobile mapping and Light Detecting and Ranging (LiDAR)-based data collection systems into Caltrans' business practices. AHMCT is performing research to capitalize on the efficiencies gained through a "collect once, use it many times" best practice. This research is leveraging the existing GTPG facility and the new Caltrans-owned Trimble MX9 and MX50 Mobile Terrestrial Laser Scanning (MTLS) systems, and expanding upon them to provide Caltrans with the needed capabilities.	4/30/2025
3926	*Evaluation of Unmanned Surface Vessel-Based Topographic and Bathymetric Survey System in Flood Conditions* • Caltrans needs a reliable teleoperated system benefitting from semi-automation or automation technologies for topographical and bathymetric surveys that removes the safety concerns and makes scheduling and undertaking of such operations easier. AHMCT is developing a teleoperated unmanned surface vehicle (USV) with semi-automated or automated functionalities and onboard bathymetry capability. The main objective is to make it easier and safer for Caltrans to undertake survey operations on deep as well as shallow waters.	4/30/2025

Task ID	Task Name and Summary	End Date
4008	*Responder Study - Interim Phase II - Continued Support for Responder Transition* • With successful completion of pilot field testing of the Responder System during a previous task (2927), Caltrans needs the prototype to be transitioned to a third-party vendor to reproduce 12+ units and deploy them into the Caltrans Districts. AHMCT is providing on-going technical support for Caltrans' use of the Responder system until a vendor is contracted. The task will also allow AHMCT to provide in-person training to the selected vendor, and support for the vendor while they establish or modify their software development tool chain, install the Responder code base, and confirm that they are able to build the Responder software system.	04/30/2025
4059	*SpaceX Starlink Satellite Broadband Communications for ITS* • AHMCT will procure, install, operate, and evaluate up to five SpaceX Starlink satellite broadband communication services for various ITS elements in Caltrans District 2. This project will evaluate the procurement, construction, installation, integration, operation, and maintenance of up to five selected sites in rural regions of the state. The results of this project will allow Caltrans to procure a reliable and cost-effective communications solution for use in field sites located in remote rural areas of the State.	4/30/2025
4128	*Evaluation of Commercial Forward-Looking Infrared Driver Assistance Technology for use in Emergency Tow Trucks and Snowplows* • Caltrans needs Advanced Driver Assistance Systems (ADAS) that will improve the safety and efficiency of emergency tow truck and snowplow operations. This will enable Caltrans to operate appropriately outfitted machinery under low-visibility conditions by providing operators with warning systems and the ability to observe and avoid obstacles. AHMCT will deploy and evaluate commercial off the shelf IR-camera-based collision avoidance and driver assistance systems on tow trucks and snowplows under low-visibility conditions.	11/30/2024

Task ID	Task Name and Summary	End Date
4153	*Evaluation of Advanced Security Systems for Caltrans Equipment Yards/Maintenance Stations* • Caltrans needs evaluation of a modern security system. One possible system is mobile robot security guards for potential deployment in Caltrans yards. Another potential system leverages fixed cameras (e.g. 4K) and human monitoring or analytics to monitor the yard. Each of these systems holds the promise of greatly reducing this theft problem and associated costs. AHMCT will survey the security landscape (mobile robot security guards, video analytics security) to determine current state of the art, and identify a system suited to DOE's issue.	4/30/2025
4158	*Caltrans field trials of the Truck-Mounted Attenuator Accessory (TMAA) package* • AHMCT will procure, install, and test up to three TMAA packages in cooperation with Caltrans. This project will develop a field testing plan and two surveys for operator feedback.	3/31/2025
4159	*Caltrans field trials of the Intelligent Truck-Mounted Attenuator (ITMA)* • Caltrans needs field trials of the ITMA on public roads. The field trials and utilization of the ITMA for moving closures on public roads are a precursor to full deployment of this technology for Caltrans operations. AHMCT proposes to support Caltrans as they confer with the California Department of Motor Vehicles (DMV), the California Highway Patrol (CHP), and California State Transportation Agency (CalSTA) to determine if limited monitored field trials on a remote public roadway can be performed with the ITMA.	12/31/2024
4161	*Evaluation of remote operation of truck-mounted attenuator (TMA)-equipped shadow vehicles for use in Caltrans' operations* • AHMCT will evaluate available non-line-of-sight remote-control technologies for the operation of TMA vehicles. Although the focus of the study will be on TMAs, the results of this research will inform the applicability of the state-of-the-art technologies for other Caltrans operations.	11/30/2024

Task ID	Task Name and Summary	End Date
4189	*Point Cloud Feature Extraction for ADA Ramp Compliance Assessment* • AHMCT proposes to develop machine learning algorithms that automate extraction of ADA CRPCs (curb ramps at pedestrian crossings) from MTLS data. AHMCT will further develop technologies that automate conduction of quantitative measurements from the extracted features to ensure of compliance and identify CRPCs that require repair or modification.	10/31/2024
4199	*Research Implementation Accelerator: Workshops and Seed Funding Program for IA65A0749* • Caltrans annually needs to identify completed research projects whose results are underutilized and have the potential to bring the department greater efficiency, saving time, money and resources that can be used to deliver more projects. The results of this project will accelerate the implementation of research results and benefit Caltrans in achieving its goals of efficiency, safety, and stewardship in enhancing mobility in California. These benefits will be obtained each fiscal year the project is in force.	4/30/2025