DRISI

CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION

TRANSFORMING IDEAS INTO SOLUTIONS

Research Results

Research and Development of the Caltrans' Geospatial Technology Proving Ground

Integrating mobile mapping and LiDAR-based geospatial data collection systems into Caltrans' business practices for safe, efficient delivery of transportation projects.

Right of Way and Land Surveys

JULY 2025

Project Title: Evaluating Mobile Laser Scanning

Task Number: 3870

Start Date: October 1, 2021

Completion Date: July 31, 2025

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WHAT WAS THE NEED?

The California Department of Transportation (CA DOT or Caltrans) continually sought ways to deliver transportation projects more safely and efficiently. To produce high-quality projects and optimize limited transportation dollars, Caltrans needed to continually innovate and improve existing processes and procedures. In addition, the Department needed to evaluate methods to lower project support costs, accelerate project schedules, minimize rework, and be transparent and accountable to taxpayers.

Minimizing risk to workers and traveling motorists during Caltrans' operations was an on-going priority. Identifying which tools are best to use for specific purposes and how to integrate data collected from various platforms yields the safest and most cost-efficient way of doing business. Caltrans, via research Task 3179 under Contract 65A0749, established a Geospatial Technology Proving Ground (GTPG) facility to support the integration of mobile mapping and LiDAR-based data collection systems into Caltrans' business practices. The Caltrans Survey Program and other Caltrans Divisions had a need for research to capitalize on efficiencies gained through a "collect once, use it many times" best practice.

WHAT WAS OUR GOAL?

The research goal was to leverage the existing GTPG facility to improve efficiencies of utilizing common collected geospatial data from a wide variety of Caltrans programs for various Caltrans projects and field operations. In addition, the goal included capitalizing on the efficiencies gained from the research to transition the "collect once, use it many times" theory into an applicable best practice into Caltrans business operations.

Caltrans

DRISI provides solutions and knowledge that improves California's transportation system.

WHAT DID WE DO?

The research supported deployment of Caltrans-owned Trimble MX9 Mobile Terrestrial Laser Scanning (MTLS) systems. Next, the research team used the GTPG to investigate time-based vs. distance-based MTLS target spacing with the MX9 system. The researchers collaborated with Caltrans Construction to conduct As-Built survey pilot projects utilizing the MX50 and MX9 MTLS systems, documented lessons learned and best practices for capturing As-Builts during and/or after construction and recommended the best platforms for digital As-Builts.

The research team explored means to improve cross-functional, programmatic data collection and to achieve the "collect once, use it many times" best practice. Also, the researchers experimented and evaluated MX9 use for Americans with Disabilities Act (ADA) ramp survey. Then, the research supported Caltrans Office of Land Surveys (OLS) to update the Caltrans MTLS Guidelines document with additional data collection methods, software, and processing workflows for the MX9 as well as reflected any changes to the Riegl software and workflow for the VMX-1 MTLS system. Lastly, the research team encompassed the research findings into a final report and presented the project results to the project panel.

WHAT WAS THE OUTCOME?

The research results include a detailed operators manual covering MX system operation, maintenance plan, system installation, and vehicle integration, which surveyors utilize for ongoing MX system usage. Also, the research showed that Time-based ground control point (GCP) spacing is better suited for applications of slower speed MTLS data collection scans, such as highway on/off ramps and city streets. Distance-based GCP spacing works well for higher speed MTLS data collection scans and for surveyors with little or no in-depth MTLS experience. Next to optimizing target spacing for different applications, the research team demonstrated success of integrating high-resolution cameras with MX system sensors, which expands the capability of combining MTLS with other technical tools, such as infrared cameras, ground penetrating radar, and pavement polarized cameras for a variety of DOT workflows.

WHAT IS THE BENEFIT?

OLS and District surveyors gained continual deployment support for six Caltrans-owned MTLS MX systems. The MX system manufacturer and a local surveying vendor gained troubleshooting and parts replacement trainings, which minimize downtime and optimizes MX system usage on Caltrans projects. The research aided OLS with newly developed best practices for MTLS ADA ramp data collection and enabled the Survey Program to deliver improved products in alignment with the Department's Enterprise Statewide Field Data Collection efforts. In addition, the research supported Surveys to closer achieving its goal of the "collect once, use it many times" practice for all Geospatial data, therefore yielding known safety, efficiency, and cost benefits.

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To view the complete report:
https://ahmct.ucdavis.edu/sites/g/files/dgvnsk8581/files/inline-files/UCD-ARR-25-07-31-01.pdf