# Application Note

U.S. Department of Transportation
**Federal Highway Administration**

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## E-TICKETING

The sixth round of the Every Day Counts (EDC-6) initiative selected electronic ticketing (e-Ticketing) for rapid deployment among highway agencies to enhance work zone safety, improve quality, and realize cost savings through digitalization.

Highway construction projects generate massive amounts of valuable data that historically were communicated via paper. Paper tickets to track the delivery of materials at a construction site is one such source of data. The emergence of electronic technologies on highway construction projects has made the paper-based processes outdated, inefficient, and cumbersome. Highway agencies are integrating paper processes into electronic and digital workflows. Earlier rounds of EDC successfully promoted the deployment of e-Construction technologies.

E-Ticketing is a market-ready digital innovation that automates the recording and transfer of information and quantities in real-time, in lieu of paper tickets, as materials are moved from the plant to the site. E-Ticketing simplifies handling and integration of materials data into information systems for acceptance, payment, and source documentation. The overarching goal of the EDC-6 initiative is to facilitate the adoption of e-Ticketing by state and local highway agencies.

FHWA initiated peer-to-peer exchanges to deliver technical assistance to highway agencies exploring implementation of e-Ticketing. The peer-to-peer exchanges provide opportunities for an exploring agency to learn from the experience of states that have successfully adopted e-Ticketing. The peer-to-peer exchanges facilitate interactions among participating agencies to share effective practices and address challenges and barriers relating to e-Ticketing implementation. The discussions focus on various critical success factors, including a business case, planning for pilots, field readiness, stakeholder engagement, data management, and specifications. The peer-to-peer exchange facilitates dialogue with stakeholders and decision-makers on the next steps of implementation.

# IMPLEMENTATION OF E-TICKETING IN CALIFORNIA

## OVERVIEW

In 2020, the California Department of Transportation (Caltrans) began preliminary piloted use of e-Ticketing on construction projects with hot mix asphalt (HMA). Caltrans limited use to partial segments of 12 projects from May 2021 until November 2022, when Caltrans had our first peer exchange with other State Departments of Transportation (DOTs) and the Federal Highway Administration (FHWA). Caltrans piloted HaulHub Technologies' DOTSlip and Command Alkon's CONNEX software, and the results of the initial pilot were partial and incomplete.

After discussing our pilot program during the peer exchange, Caltrans expanded the pilot program to a wider range of projects to obtain more involvement from district project personnel. This expansion would allow Caltrans to achieve more comprehensive data and results because there would be more usage of the portal and the mobile app. For the pilot expansion, we drafted a "roadmap" containing four phases, two of which are underway. The preliminary 12 pilot projects were considered part of Phase 1. Phase 2 will include capturing engaged resident engineers and inspectors in a larger portfolio of about 50 construction projects to be piloted for HMA, ready mix concrete, and aggregates. Caltrans has contacted various industry organizations, such as the Association of General Contractors, United Contractors, and Southern California Contractor's Association. Caltrans has also provided e-Ticketing information to contractors, suppliers, and other agencies, such as the California Asphalt Pavement Association and the Construction and Industrial Materials Association.

## PROJECT INFORMATION

A summary on where e-Ticketing has been implemented:

- HMA overlay on Interstate 5 in Sacramento in District 3 (Marysville); also, HMA overlay projects in Districts 4 (San Francisco Bay Area), 7 (Los Angeles), 8 (San Bernadino), and 11 (San Diego).
- To date, only HMA projects have used e-Ticketing. E-Ticketing for ready-mix concrete and aggregates in Phase 2 will begin June 2023.

Contractors and suppliers who have implemented e-Ticketing:

- Granite Construction, Teichert Construction, Matich Corporation, Granite Rock, George Reed Inc., Griffith Company.

## IMPLEMENTATION PLANNING

Caltrans is currently in the development stage of e-Ticketing. Caltrans has an e-Ticketing champion and implementation team and have provided some training to some project staff and stakeholders from e-Ticketing software developers (HaulHub and Command Alkon). Caltrans has re-traced its strategy and has retroactively gone back to the Development Stage from the Demonstration Stage.

The piloting in the demonstration stage did not go as planned. State staff did not actively pilot all projects planned to be piloted (14 projects). Only two projects were actively piloted, yielding insufficient information for the program. Caltrans is currently backing away from the planned pilots for HMA and rethinking our strategy and roadmap after the peer exchange on October 18 and 19, 2022. On these dates, Caltrans hosted a peer exchange with representatives from Minnesota, Indiana, and Kentucky attending, as well as representatives from FHWA, vendors, and other subject matter experts. Discussions and valuable feedback from peers helped the agency realize that the previous piloting was insufficient. Caltrans had to rework its strategy roadmap to include a wider range of projects and approach innovation-interested staff willing to participate so that the agency has a realistic and effective pilot program. Caltrans has created a new skeleton roadmap to include four phases, summarized below:

- **Phase 1 (10/18/2022 to 3/31/2023):**
  - Support current pilots, pay vendors, survey for feedback, and evaluate information from current pilots.
  - Define staff roles and responsibilities.
  - Develop new pilot criteria (outreach, selection, duration, people, goals, and connectivity differences).
  - Define the measure of success and metrics of Phase 2 (success/failure reporting).
- **Phase 2 (2/1/23 to 3/31/2024):**
  - Select innovative and interested resident engineers and their projects.
  - Consider additional e-Ticketing vendors.
  - Determine database storage location.
  - Include projects with HMA, concrete, or aggregate, or a combination of the three.
  - Develop required data fields.
  - Develop specifications/contract change orders (CCO) templates.
  - Survey field staff and industry feedback.
  - Reevaluate application training.
- **Phase 3 (4/1/24 to 6/30/2025):**
  - Finalize specifications and CCO.
  - Select Phase 3 resident engineers and their projects.
  - Finalize database storage for e-Ticketing information.
  - Evaluate Veta.
  - Verify Weighmaster, California Highway Patrol, local law enforcement, and other legal requirements.
  - Expand to all materials if recommended.
- **Phase 4 (6/30/25 to ongoing):**
  - Implement fully with bid item and specification.

## FIELD USE AND INSPECTION

A summary of how e-Tickets are generated, transmitted, verified, and accepted:

- See above section “Implementation Planning.”
- For the pilots, Caltrans plans to collect both e-Tickets and paper tickets for spot checking and comparison purposes. After the pilots are complete, the agency plans to collect only e-Tickets.
- For locations with no internet connectivity, Caltrans will be using an “Offline Mode” that synchronizes the data after connecting.
- State phones with mobile application will be used.
- For verification, paper tickets will also be collected.

## DATA MANAGEMENT

Currently, Caltrans’ vendors deliver e-Ticketing data to a designated cloud storage space. Caltrans pulls that data into our internal database storage space, MariaDB.

Caltrans is in the process of establishing spatial database storage for e-Ticketing. The e-Ticketing data will be structured as defined elements grouped intelligently, organized hierarchically, and linked with other data sets using Building Information Modeling for Infrastructure (BIM4I) file formats. The object-based ticket enforces data quality rules to validate data attributes and relationship requirements. The object-based ticket also allows some operations, such as data

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retrieval or updating, to be automated using a set of procedures. These procedures make the data easier to use in extensive data mining applications. Using this approach, Caltrans has the potential for new processes, such as automated contractor payment from the e-Ticket data transfer and other roadway quality and asset management processes.

## ANTICIPATED BENEFITS, STRENGTHS, AND CHALLENGES OF IMPLEMENTATION

- Will improve data transfer from supplier to contractor to state field staff for all stakeholders to track and to inspect in real-time.
- Will improve safety by reducing staff exposures to material deliveries and exposure to public traffic.
- Will improve data and location tracking for historical analysis of failures of pavements, bases, and subbases.
- Will reduce time to transfer weight ticketing information from plant to supplier to contractor to inspector.

## LESSONS LEARNED

The most significant and impactful lesson learned was that the agency must find volunteered and interested field staff to accurately and comprehensively pilot projects with e-Ticketing. Forcing selected field staff who are not interested in innovations such as e-Ticketing required a lot of supervision and frequently failed to produce the results and data, the championing development team seeks.

## FUTURE OF E-TICKETING

In the near term, the future of e-Ticketing is in the four phases of piloting. Long term, Caltrans hopes to have a contract specification and contract item to pay for e-Ticketing in a statewide implementation by 2026.