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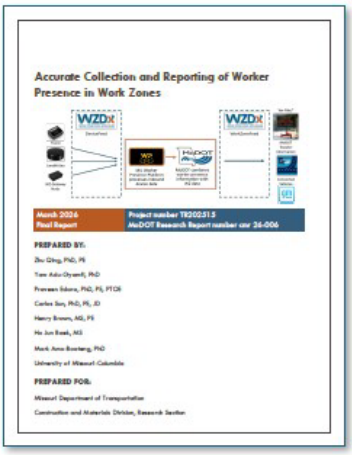
Research Summary

Accurate Collection and Reporting of Worker Presence in Work Zones



Highway work zones present complex safety challenges due to the close interaction between workers, live traffic, and heavy equipment. Although the Missouri Department of Transportation (MoDOT) shares work zone locations and traffic impacts through traveler information systems and the Work Zone Data Exchange (WZDx), real-time verification of worker presence within active work zones has not been systematically available. The absence of reliable worker presence information limits the effectiveness of traveler alerts, Smart Work Zone (SWZ) messaging, and emerging connected vehicle applications.

This research evaluated device-based location technologies and investigated practical methods for determining and sharing worker presence in Missouri highway work zones. A structured technology assessment compared Global Navigation Satellite System (GNSS)–based devices and Bluetooth Low Energy (BLE)–based devices under controlled urban and rural conditions, as well as under smartphone-restricted scenarios consistent with MoDOT operational policy. Field testing demonstrated that BLE-based devices relying on crowdsourced smartphone networks produced intermittent reporting, large spatial errors, and frequent data gaps, particularly in rural environments. GNSS-based devices provided more stable and temporally consistent location data but exhibited tradeoffs related to cost, battery life, wearability, and access to raw data. To address these limitations, the study developed and piloted a prototype device, the WZ-Gateway Node. The prototype employs a shared Wi-Fi–based communication architecture to reduce recurring communication costs while providing direct access to time-stamped location and speed data. Pilot testing confirmed that multiple prototype devices could reliably transmit data through a single gateway with acceptable latency.

> *"Knowing the real-time location of workers can enhance safety by improving situational awareness for motorists, connected vehicle applications, and work zone intrusion detection systems."*

Building on the device-level evaluation, this research developed the MU Worker Presence Platform, a centralized system that aggregates device-based location data and derives worker presence as a work zone–level attribute consistent with WZDx practices. As shown in Figure 1, the platform applies spatial buffering and activity classification to reduce false-positive indications while preserving worker privacy. Field evaluations demonstrated that the platform could generate enriched, WZDx-compliant WorkZoneFeeds with verified worker presence

information suitable for traveler information systems, Smart Work Zone operations, and connected vehicle applications.

The results demonstrate that worker presence determination in highway work zones is technically feasible using device-based location technologies combined with standardized data processing and integration strategies. The research provides a practical foundation for future MoDOT-led pilot deployments and incremental implementation.

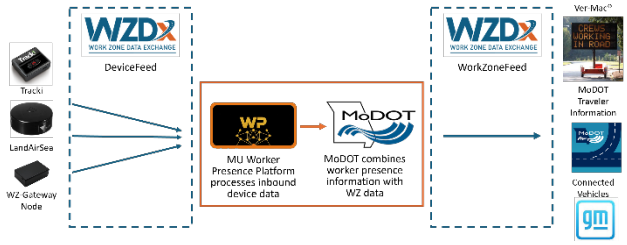


Figure 1: MU Worker Presence Platform and WZDx Integration Plan

Project Information

PROJECT NAME: TR202515—Accurate Collection and Reporting of Worker Presence in Work Zones

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