

Research Summary

Piloting an AI-Enabled Immersive Multi-Agency Traffic Incident Management (TIM) Training Platform

Traffic Incident Management (TIM) requires coordinated actions among transportation agencies, law enforcement, fire and rescue, emergency medical services, towing and recovery, dispatch, and other partners. Existing training methods differ in realism, interactivity, and logistical demands. This pilot project developed and demonstrated a modular immersive platform intended to supplement these methods with a safe, repeatable, and portable environment for examining roadway conditions, responder positioning, simulated traffic, and multi-agency coordination.

The platform used a Virtual Operational Environment (VOE) framework that separated reusable roadway settings from scenario-specific incident content. Phase I included two VOEs. The Interstate VOE represented a multilane, high-speed roadway with lane blockages, passing traffic, and emergency-response activities. The Rural Highway VOE represented a two-lane, two-way roadway with opposing traffic, limited shoulder space, and constrained responder staging.

The application was developed in Unity and deployed on Meta Quest 3 standalone Virtual Reality (VR) headsets. It incorporated first-person navigation, selected object interactions, in-application voice communication, and shared sessions supporting up to four participants. Rule-



based simulated traffic provided representative roadway activity, and traffic movement could be enabled or disabled during demonstrations. A tunneling-vignette comfort function helped reduce potential discomfort during virtual locomotion.

Phase I also implemented an initial Unity–OpenAI application programming interface (API) connection that allowed model-generated text to be presented within the VR environment. This proof of concept demonstrated the feasibility of incorporating generative artificial intelligence (AI) but did not constitute a validated AI-enabled virtual responder.

Three pilot demonstrations were conducted with Missouri Department of Transportation personnel and TIM partners. Practitioner feedback contributed to further refinement of the Rural Highway VOE and implementation of an injured avatar and related animation. Feedback also emphasized the importance of representing towing and recovery as an active operational role and providing standardized participant orientation and practice with VR controls.

The demonstrations provided qualitative feedback on technical feasibility, operational relevance, usability, and potential applications. Practitioners recognized value in representing different roadway contexts, communicating within a shared environment, and discussing responder positioning, traffic control, incident clearance, towing and recovery, and lane



reopening. However, the demonstrations were exploratory and did not use standardized surveys, comparison groups, or validated measures of training effectiveness.

“The immersive platform provides a safe, repeatable, and portable setting for practicing multi-agency TIM coordination across different roadway environments.”

The pilot established a reusable technical and operational foundation rather than a complete training system. Near-term development should prioritize high-value scenarios within the existing VOEs, standardized participant orientation, and additional incident elements or agency functions only when they directly support training objectives. A focused Phase II effort should expand the Unity–OpenAI API proof of concept into a limited number of validated, role-specific virtual responders. A structured incident-state model and controlled Unity interface should allow approved AI actions to influence scenario conditions while maintaining traceability and instructor oversight. Structured data capture could support exercise timelines, selected replay, instructor-led after-action review, and phased evaluation. Initial evaluation should emphasize technical performance, usability, operational validity, AI-agent behavior, and instructor controls. Formal training-effectiveness evaluation should occur after the scenarios, participant roles, AI functions, data-capture procedures, and delivery methods have stabilized.



Figure 1. TIM Incident Scene in the Interstate VOE

Project Information

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