Automated Commercial Motor Vehicle (CMV) Test Scenarios

AUTOMATED CMV EVALUATION (ACE) PROGRAM

Source: FMCSA

The Federal Motor Carrier Safety Administration, or FMCSA, is conducting hands-on research on the safe deployment of advanced driver assistance systems (ADAS) and automated driving systems (ADS) and cooperative driving automation (CDA) for commercial motor vehicles (CMV). This research is led by FMCSA's Automated CMV Evaluation program - or ACE, for short. ACE is a multi-faceted research, development, and testing program that advances ADS and CDA use cases for CMVs. Current use cases include truck inspection, enforcement, weigh station procedures, work zone safety, and emergency response safety.

Inside the Freight Vehicle: Automation Technology

FMCSA has three Class 8 tractors and trailers. FMCSA worked collaboratively with the Federal Highway Administration (FHWA) and the Intelligent Transportation System Joint Program Office (ITS-JPO) to transform these heavy vehicles into research vehicles capable of SAE International Level 3 driving automation. The vehicles run FHWA's CARMA℠ open-source software for CDA.

The following can be found in each CARMA heavy vehicle:

- Computer and controller equipment.
- Communications equipment.
- Networking and power equipment.
- Sensors.

Source: FMCSA

ACE Demo


Source: FMCSA

In January 2021, FMCSA conducted demos at the US Army Aberdeen Test Center (ATC) Army Test and Evaluation Command's (ATEC) 4.5-mile track in Maryland. The goal was to highlight the vehicles' capabilities as new assets and tools for FMCSA's research program. During three days of testing, a total of 45 runs were completed. The vehicles were able to pinpoint themselves on the map and drive using lateral and longitudinal controls.

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

ACE
Automated Commercial Motor Vehicle Evaluation

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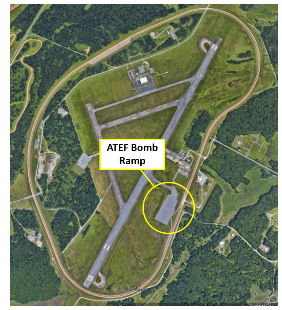
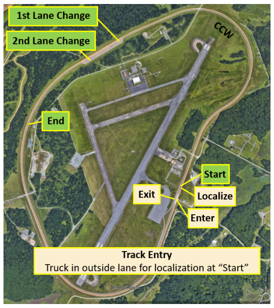
The following is a high-level implementation for the scenarios:



Scenario 1: Maneuverability

The first scenario was designed to show a wide range of steering wheel motion under automated control. Here, the CMV started from a stop and navigated a slalom at speeds between 10 and 20 MPH. The CMV was able to follow steering commands throughout.

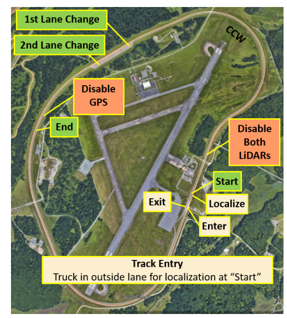


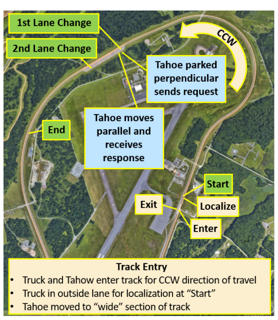
Scenario 2: Automated Driving Capability

The second scenario demonstrated basic automated driving and lane changing. The CMV accelerated from a stop to 30 MPH, made an unobstructed lane change to the right, back to the original lane. It slowed to a stop before the end of the route and returned control to the driver. Exterior light bars showed the status of the CMV's automation mode.

Scenario 3: Sensor Failure

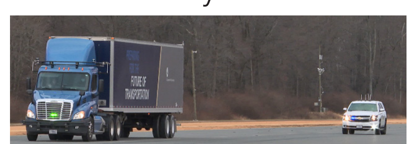
The third scenario demonstrated an automated driving control handover to a safety driver during full sensor failure. Both LiDAR sensors were manually disabled to emulate sensor failure, diminishing but not stopping the vehicle's ability to position itself. When the GPS sensor was also manually disabled, positioning capabilities fell below the minimum requirements for automated controls. The system then automatically initiated a controlled handover to the driver, with a notification.





Scenario 4: Law Enforcement Interaction

The fourth scenario demonstrated two use cases. First, a CMV notifying a law enforcement vehicle that it is under automated control. Secondly, a law enforcement vehicle requesting information from the CMV and then receiving that information. Different variations of these use cases were conducted to show how they could be accomplished without the CMV needing to slow down or stop. For example, in one variation, the CMV did not slow down as it passed a parked law enforcement vehicle. In another, the law enforcement vehicle traveled behind the CMV.


Source: FMCSA

FMCSA's mission is to reduce crashes, injuries, and fatalities involving large trucks and buses. FMCSA partners with industry, safety advocates, and state and local governments to keep our nation's roadways safe and improve CMV safety through regulation, education, enforcement, research, and technology.

Additional ACE programs and related projects include:

- ACE Program: Emergency Response and Work Zone Research.
- ACE Program: Inspections, Demonstrations, and Evaluations.
- Port Drayage Demonstrations.
- Safety Impacts of Human-ADS Shared Driving Applications.

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