Wireless Roadside Inspection Proof-of-Concept Test

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Background

Safety inspections are performed on commercial vehicles to promote safety on the roadways; over half of all these inspections detect safety violations. The use of a wireless inspection method could dramatically increase the number of safety inspections to at least the number of weight inspections by checking driver licensing, medical card, carrier, and weight information without requiring the driver to stop. Routine inspections could then supplement wireless inspections by further investigating trucks with questionable wireless inspection data and trucks randomly selected for hands-on inspection. The implementation of such a system must be preceded by a proof-of-concept (POC) test to determine the feasibility, effectiveness, and limitations of the wireless inspection method. ORNL was tasked by FMCSA to develop a Wireless Roadside Inspection System (WRI), conduct the POC, and analysis the data to determine the viability of moving forward with a WRI Pilot Test.

F M C S A
Federal Motor Carrier Safety Administration

Phase 1A: Generate Safety Data Message Set (SDMS)

ORNL partnered with PeopleNet, a producer of electronic on-board recorder technology, to design a system to produce a Safety Data Message Set (SDMS). Data obtained during a 10-hour test was compared to similar data obtained through an ORNL monitoring system comprised of an eDAQ-lite, VBOX III, Air-Weigh, and custom software. The results showed that 99.9% of the SDMS files created in the Phase 1A testing always contained the required information. Detailed analysis of some of the individual SDMS data elements revealed that Speed information was 99.4% accurate with a 5 mph tolerance level; location was 100% accurate with a 1000 ft tolerance level and the odometer information was 78.8% accurate with a .25 mile tolerance level.

Phase 1B: Testing Wireless Transceivers

Static tests were conducted to assess the ability to send and receive an SDMS at varying truck orientations (in 45-degree increments), distances (100 ft to 400 ft), and frequencies (5.9 GHz and 2.4 GHz) were tested. The results from these tests showed that the best reception under static conditions was found to be either side, or slightly ahead of the instrumented truck (Figure 1). Reception was best on the right side, where the antenna was located. This was due to antenna placement and the presence of the tractor's trailer.

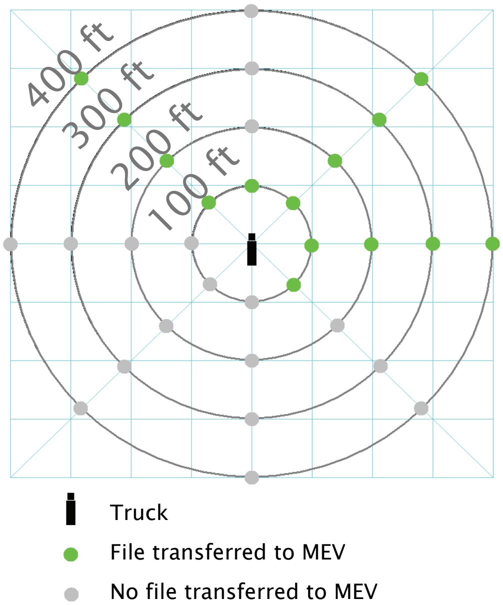

Figure 1. Static test results for 5.9 Ghz communication with MEV (dome antenna).

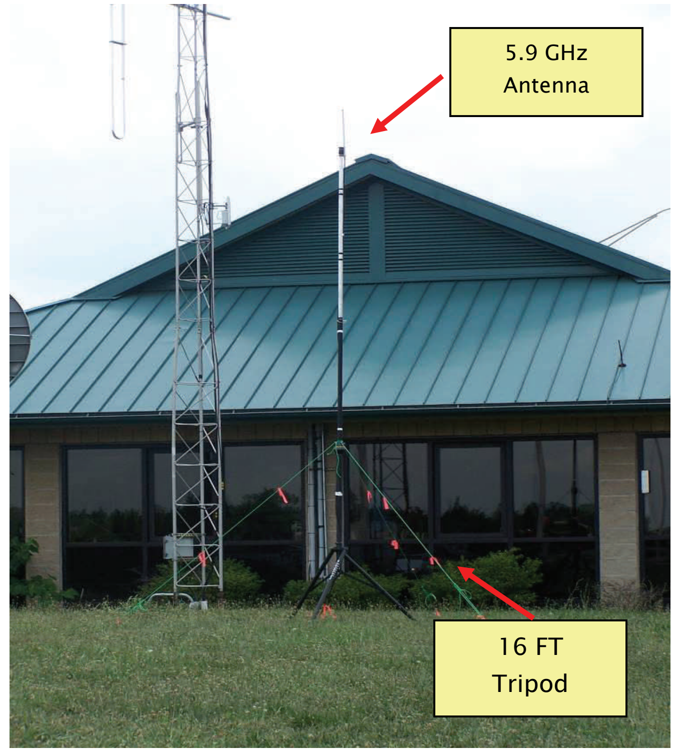

Figure 3. A 5.9 GHz antenna mounted on a 16ft tripod.

Following static tests, dynamic tests were conducted. SDMS transmission from the instrumented truck (Figure 2 and 3) to a fixed roadside unit and a mobile enforcement vehicle (MEV) was tested at various relative speeds. Tests were performed at 2.4 GHz as well as 5.9 GHz, and two different antenna types (dome and stick) were used. Results showed that files were successfully transferred at various speeds (up to 55 mph). This was done with the test vehicle in motion to a fixed roadside site and to a mobile enforcement vehicle traveling at the same speed as the test vehicle and at various closing and departing speeds.

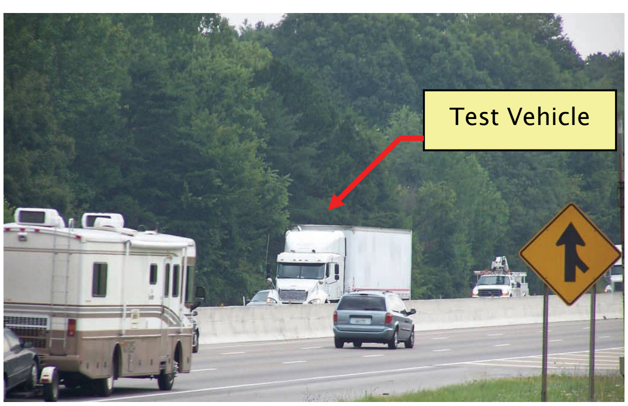

Figure 2. Test vehicle being inspected as it passes by static MEV located East-Bound on I-40.

Conclusions

This proof-of-concept test demonstrated the feasibility of a wireless inspection method. The SDMS was successfully created and transmitted from both a tractor-trailer and a motor coach to an active CMV inspection station and to a MEV. A decision was made to proceed with the Pilot Test.

Next Steps

PHASE 2 - PILOT TEST: Further transceiver testing will be conducted along with the integration of safety system sensors and back-office systems. Phase 2 planning is underway with testing set for the summer/fall of ’08.

PHASE 3 – FIELD OPERATIONAL TEST (Proposed): This testing will involve multiple fleets using a variety of off-the-shelf electronic technology interacting with infrastructure in a multi-state corridor.

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