Center for Transportation Analysis

Infrared-Based Screening System (IBSS)

The low number of safety inspections of in-service commercial motor vehicles (CMVs) compared with the number of CMVs on the road necessitates a high efficiency of safety inspections. Improved efficiency in identifying and placing unsafe vehicles out-of-service (OOS) can be achieved using technologies which can pre-screen vehicles for suspected safety defects. One such technology is based on the thermal sensing of the temperature of certain safety-critical components on vehicles, in which either underperforming or overworking components are identified. These thermal-based systems integrate infrared (IR) sensors or cameras, video images, and vehicle position sensors, and are generically known as infrared-based screening systems (IBSSs). Early IBSSs were manned systems, and required a dedicated operator to identify and select CMVs for subsequent inspection, using their judgment to identify a potential problem. Recently, automated unmanned IBSSs have been developed, which incorporate algorithms to identify wheel-based defects (weak or overworked brakes, overheated tires and/or wheel bearings). Automated IBSSs are expected to further improve the efficiency of screening and selecting potentially unsafe vehicles. One such automated system has recently been evaluated by the Oak Ridge National Laboratory (ORNL), and the potential for use in enforcement was confirmed.

Background — Since 2007, ORNL has been involved in data collection efforts involving an IBSS developed by a third-party via a research grant from FMCSA. During the period since 2007 testing has included proof of concept testing, pilot testing, and an extensive field operational test in which the IBSS under test was used by law enforcement personnel to screen for vehicle brake, tire, and bearing defects in a real-world environment. ORNL has recently published a report of its findings from the FOT. Table 1 shows the summary of the FOT results and Table 2 shows the summary of flags generated by IBSS during this FOT.

Table 1 – Summary of IBSS FOT Results

Total Vehicles Scanned by SIRIS	384
Total Vehicles Flagged by SIRIS	36 9.38%
Flagged for Brakes	33
Flagged for Tires	3
Flagged for Bearings	0
Total Vehicles Subjected to Inspection	36
Total Vehicles Placed OOS for Reason Directly Related to SIRIS Flag	30 83.33%
Total Vehicles with any flaws found	31 86.11%

Research Areas

Freight Flows

Passenger Flows

Supply Chain Efficiency

Transportation: Energy Environment

Safety Security

Vehicle Technologies

Oak Ridge National Laboratory managed by UT-Battelle, LLC for the U.S. Department of Energy under Contract number DE-AC05-00OR22725

Center for Transportation Analysis

Table 2 – Detailed Summary of IBSS Flags

Type of Flaw Detected	Inspections	OOS	Related Issue or Violation	Nothing Found
Brakes	33	27 81.8%	1 3.0%	5 15.2%
Tires	3	3 100%	0	0
Bearings	0	0	0	0
Total	36	30 83.33%	1 2.78%	5 13.89%

Table 1 shows that using an IBSS type device, the OOS rate is more that double the national average from other pre-screening and screening technologies and methods.

The findings from the pilot test and the FOT have been used by ORNL to develop a set of functional performance specifications (FPS) for an IBSS that are "outcome-based" relative to the system's ability to determine defects from a given group of real-world vehicles.

These FPSs can also be used by jurisdictions to validate that an Offeror's IBSS meets the requirements of Federal funding for an IBSS system. The FPSs are separated into four areas as follows:

Detection Performance,
User Interface,
System Utility, Stability and Durability, and
Self-Certification.

The USDOT currently is planning to use these functional specifications to assist jurisdictions in purchasing IBSS technology via grant funding.

For more information please contact:
Gary Capps
(865) 946-1285
cappsgj@ornl.gov

Center for Transportation Analysis
2360 Cherahala Boulevard
Knoxville, TN 37932
865-946-1311
Website: cta.ornl.gov