COMMERCIAL MOTOR VEHICLE
ROADSIDE TECHNOLOGY CORRIDOR

October 2009
Issue #4

Technology Corridor News

Federal Motor Carrier Safety Administration

Office of Analysis, Research, and Technology

Brake Wear and Performance FOT

The Oak Ridge National Laboratory completed the Brake Wear and Performance Test (BWPT) field operation test (FOT) and data analysis in September 2009. This effort included assisting the Tennessee Department of Safety (TDOS) in the procurement and installation of a Performance-Based Brake Testing (PBBT) machine, training and certifying PBBT machine operators, conducting the 18-month BWPT FOT, and performing relevant analyses.

Four types of vehicles participated in the FOT: class-8 combination tanker, class-8 tri-axle dump truck, class-8 combination dry-box van, and class-8 motor coach. These vehicles were fitted with new lining, rotors, and drums and their other foundation brake components were inspected and repaired as needed to bring the vehicles to good serviceable condition.

The objectives of the effort were to:

- Quantify, using a PBBT, heavy vehicle braking performance of multiple vehicles over time in a real-world environment.
- Use the PBBT to detect a vehicle with a brake system failure or gross degradation (i.e., ruptured wheel seal, improperly functioning brake chamber, etc.).
- Monitor the operational issue, failures, and acceptance level of inspection personnel of an in-ground PBBT over time.

Initial Brake Lining Measurements are Collected for Dump Trucks.

New Linings are Installed on a Tanker Tractor Drive Axle.

- To measure the acceptance and operational ease of an in-ground PBBT by drivers over time.
- To measure the total wear of brake lining, drums, and rotors at the end of their normal life as a function of mileage.
- To explore brake drum ovality at the end of component life and explore possible correlation to PBBT ovality measurements.

During the FOT, the test vehicles logged more than 800,000 miles with the longest single vehicle miles traveled coming from the over-the-road tractor-trailers (174,000 miles), and the shortest vehicle miles traveled coming from the dump trucks (34,000 miles).

In 95 percent of the cases, there was an increase in brake efficiency in the first part of the brake's life cycle. The single axle brake efficiency information collected showed that within 5,000 miles of the initial test there were gains in brake efficiency of 17.5 percent, on average. In 96 percent of the cases, there was not a statistically significant degradation of the brakes during the FOT.

The main conclusion from the data collected in the FOT is that well maintained brakes result in consistently high performing brakes, even after a considerably large number of miles are logged.

The final BWPT report is expected to be released for publication in early 2010.

"In about 96 percent of cases there was not a statistically significant degradation of the brakes during the FOT."
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"Nearly 64 percent of vehicles flagged by SIRIS were placed OOS, and fully 77 percent were found to exhibit one or more safety flaws."
(Page 3)

Performance-Based Brake Tester Valuation Study Completed

With the recent addition of the Performance-Based Brake Tester (PBBT) machine (April 2008) to the Commercial Vehicle Safety Alliance (CVSA) out-of-service (OOS) criteria, the question of how best to utilize the PBBT machine within the current levels of North America Standard (NAS) inspections was raised by the Tennessee Department of Safety. FMCSA commissioned ORNL to conduct a series of short-term tests to address this question.

Testing was conducted from June 2 to July 13, and included the use of the PBBT in conjunction with Level-1, 2, and 3 inspections; as a potential substitute for the brake stroke measurements of the traditional Level-1 inspection; and as a standalone Level-4 special inspection. This study also explored how the use of an inspection pit instead of a mechanic's creeper affects the conduct of Level-1 inspections. During the course of these tests, 139 vehicles were contacted, 80 Level-1s were performed and 37 OOS orders were issued for various defects. Results of this preliminary testing indicate that for this short-term test, an inspection pit makes possible the identification of nearly twice as many defects as the inspector's access is not hindered by low aerodynamic fairings, suspension components, or drop-deck trailers.

The study found that the use of the PBBT as a substitute for the brake stroke measurement actually took longer than taking the physical measurements (provided a pit was used for the physical measurements). The OOS rate actually decreased with the use of the PBBT in place of the measurement as the PBBT's OOS determination is based on total vehicle performance and not individual wheel-end performance. Thus, if a vehicle has two failing brakes, it may still pass the PBBT but would not passa Level-1 inspection.

Table 1. Sample Use of CMV Enforcement Resourse Evaluation Worksheet

Inspection Type	Average Time (min.)	OOS Rate	Estimate for Inspection Period: CMV Contacts	Estimate for Inspection Period: CMVs/Drivers OOS
Level-1	45	26.6%	5	1
Level-2	20	22.4%	12	3
Level-3	15	9.2%	16	1
Level-4 Special: PBBT	1	24.4%	15	4
Level-2 + PBBT	31	34.5%	7	2
Level-3 + PBBT	26	29.5%	9	3
PBBT (Replace Brake Stroke in Level-1)	48	23.6	5	1

Estimates shown are based on a 4-hour inspection period using estimated times for Level-1, 2, and 3 inspections provided by CVSA, OOS rates from the 2009 Safety Check where available, and experimentally determined values from this study where national data were not available.

The timing and OOS information collected from this testing were used to prepare a CMV Enforcement Resource Evaluation Worksheet shown in the table below. The worksheet can be used to help determine the best use of personnel and the value of the PBBT as an investment at other inspection stations. The user can tailor the inspection period, average time, and OOS rates to their needs and the remaining fields will be updated automatically by the worksheet. Based on the results of this limited testing, the best inspection methodology using the pit would seem to be combining the PBBT test with the Level-2 or Level-3 inspection to optimize the CMV contacts and OOS rate for a given time period while including a driver inspection component.

Technology in Motion Vehicle Upfitted for Role as Outreach Tool

Modifications to the Federal Motor Carrier Safety Administration's (FMCSA) Technology in Motion Vehicle (TMV) were completed in August 2009. The TMV now has a pedestal-mounted laptop computer to demonstrate FMCSA software, a 32-inch plasma monitor to show relevant videos, and a stand-alone power system to allow the vehicle to operate these systems and various commercial motor vehicle (CMV) safety technologies for an extended period at indoor and outdoor venues.

The TMV has also been fitted with the first in a series of hands-on CMV safety technology demonstrations They are: Air-Weigh Corporation's on-board weighing system, MGM's brake stroke monitoring system, and ELSAG's U.S. DOT number reader.

Over the next several weeks, additional CMV safety technologies will be added to the TMV.

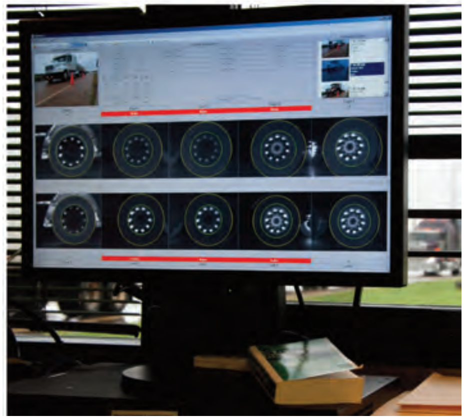
Technology in Motion Vehicle with Rear-Mounted Monitor Deployed.

The TMV will provide highway safety personnel, motor carriers, drivers and other stakeholders "hand-on" access to CMV safety technologies and help to increase awareness and adoption of these technologies to make our Nation's highways safer for all users.

Operational Testing Completed for Smart Infrared Inspection System

Operational Testing was conducted on The Smart Infrared Inspection System (SIRIS) for a 15-day period in July and August 2009 at the Greene County Commercial Motor Vehicle (CMV) Inspection Station. During the testing, SIRIS operated completely autonomously, evaluating vehicles as they passed through the ramp to the pit scale. The system alerted inspectors when a thermal anomaly was encountered with a vehicle's brakes, tires, or wheel-end bearings.

SIRIS evaluated a total of 4,373 CMVs during the operational test. A total of 355 (8.1 percent) of those evaluated were flagged for one or more thermal issues; with brakes comprising the largest portion of problems. All vehicles flagged by SIRIS were then subject to a North American Standard (NAS) Level-1 and Performance-Based Brake Tester (PBBT) test or a NAS Level-2 inspection. This resulted in a total of 276 Level-1 and PBBT inspections and 30 Level-2 inspections being performed. Of the 306 vehicles inspections performed, 194 vehicles were placed out-of-service (OOS) for a safety issues and an additional 42 inspected vehicles were found to have safety defects that were noted but did not meet OOS criteria.



Inside the scale house, the SIRIS user interface flags a vehicle by sounding an audible alarm, and flagging the wheel-end to indicate what problems were detected.

A vehicle approaches SIRIS.

SIRIS will return to Tennessee for permanent installation in the fall of 2009. FMCSA plans to conduct a 6–12-month field operational test (FOT) once the installation is complete in order to further test the systems performance and reliability. A set of functional specifications for an autonomous thermal inspection tool will be developed at the end of the FOT.

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Preparations for the Wireless Roadside Inspection Pilot Testing in 2010 Continue

As discussed in previous newsletters, the goal of the Wireless Roadside Inspection (WRI) Program Phase II Pilot Test is to validate various technology methods for wireless inspection of commercial motor vehicles (CMVs) and thereby assess the safety status of the driver, the vehicle, and the carrier. Additionally, Phase II will further refine the WRI Concept of Operations and the WRI Systems Architecture, and provide data and analysis to support a "go/no-go" decision for a WRI field operational test.

The State of Kentucky issued its initial Request for Proposals for the roadside equipment to be used to examine Universal Identification Platform methods to support roadside screening and inspections. The Commercial Vehicle Infrastructure Integration (CVII) project in New York ,which will focus on using 5.9GHz Dedicated Short Range Communications transponders to communicate between the trucks and the roadside for WRI and other applications, focused on its project management plan and technology selection. Oak Ridge National Laboratory prepared Memorandums of Agreement for the various telematics, fleet, and safety technology partners within the Commercial Mobile Radio Services Pilot Test Platform which will take place within the Tennessee-based CMV RTC. Volpe National Transportation Systems Center continued preparations for the pilot testing by drafting several key documents including the WRI Prototype Back Office System Concept of Operations. It is expected that the initial Interfaces for the Back Office System will be developed and ready for testing by August 2010, and the full Prototype will be completed by December 2010. The WRI System Requirements Document (Pre-Pilot Test Draft) is under internal review, and will be publicly available later in the year. Lastly, the WRI Pilot Evaluation Plan which includes testing scenarios and procedures was created and is being used to help finalize the Pilot Test activities that will be carried out to support the evaluation. It is expected that the Pilot Tests will be carried out from August through December 2010. During this time, various implementation and incentive policies for WRI will be explored and benefits and costs estimates refined.