



INNOVATIONS IN BRAKE TESTING

Dr. Mark G. Strauss

has degrees in biomedical and mechanical engineering. He has particular interest in instrumentation, measurement and testing techniques.

Dr. Strauss was instrumental in developing the electronic brake tester which is featured in this article. He has been involved in the measurement of the motion of a tire, maximum temperature of brake drums during downhill braking, acceleration on a human being, the bounce of a truck seat, the force on the hand required to shift gears and the forces of injury.

Dr. Strauss is also an accident reconstructionist, an associate professor of engineering at the University of Illinois, holds a CDL and is a member of an ANSI standards committee.



Ruhl Forensic, Inc. was recently asked to investigate a multiple fatality accident with national exposure involving a tractor-trailer and a passenger vehicle. When the various investigators, including Ruhl staff members and other trucking consultants arrived to inspect the vehicles, it was apparent that the air brake system on the tractor was damaged. For many forensic companies, this situation would have prevented accurate and meaningful brake system data from being obtained.

However, Ruhl Forensic's staff had created a system of fittings and regulators for situations like this, so the testing could go forward. The fittings and regulators allowed the brakes to be aired up individually and tested for their compliance with federal regulations.

In addition to our system of fittings and regulators, Dr. Strauss and other staff members have developed an electronic air brake tester that increases the quality and quantity of pertinent data that can be obtained from an air brake system evaluation. This was a culmination of Ruhl Forensic, Inc.'s sponsored graduate research that resulted in a published peer reviewed paper, SAE 1999-01-3782.

Key to the performance of any air brake system is the continual maintenance and adjustment of the components, proper operation of air valves and integrity of the air lines.

The brake system of a large truck is very different from that found on a car. One basic difference is that a car uses a liquid called brake fluid to translate the force and motion of the foot on the brake pedal into the force and motion of the brakes being applied at each wheel.

Air brake systems do not use brake fluid, but instead use air. Hence, the mechanical components of the truck brake system are different. For example, when the truck driver steps on the treadle valve (brake pedal), compressed air enters the air chambers located at each wheel. The compressed air expands and pushes a piston that causes a push rod to extend out of the air chamber.

Over a period of time, the brake linings wear and the push rod may move excessively, thus decreasing the braking ability of the truck. It is essential that this push rod travel be monitored regularly to maintain safety and to be in compliance with federal motor carrier safety regulations.

Traditionally, brake system checking has been limited to manually measuring the push rod stroke length during a treadle application, visual inspection, and listening for air leaks. With this type of check, the accuracy of the stroke measurement is dependent on the accuracy of the individual who is performing the measurement with a ruler.

To improve measurement accuracy and increase the amount of information that can be gleaned from the tractor-trailer's air brake system, Ruhl Forensic, Inc. developed the electronic brake tester. It consists of sensors that are attached individually to the push rod of each brake chamber. See Figure 1. These sensors send information via cables through a customized electronic box to a laptop computer. The computer runs a program that controls the system, and collects and stores the information.

While simultaneously improving the accuracy of push rod travel measurements to within hundredths of an inch, the brake tester also allows analysis of brake system timing, which can be a crucial element in many

Ruhl Forensic, Inc.'s staff provide expertise in: mechanical and electrical engineering, collision investigation and vehicle dynamics, biomechanics and human factors, heavy vehicle driving and mechanical systems, federal regulations and compliance, fleet safety, traffic engineering, construction zone safety, OSHA, graphic visualization, and other areas.

Our experts provide a continuum of service from initial on-site investigations through research, testing and reconstruction to courtroom testimony and presentation graphics and visualization.

We offer quick response to your investigation needs 24 hours a day. Contact us by calling 1-800-355-7800, 1-800-235-2808, or 1-800-278-4095.

Please feel free to call us with any questions that you may have and we will direct you to the appropriate individual within our firm.

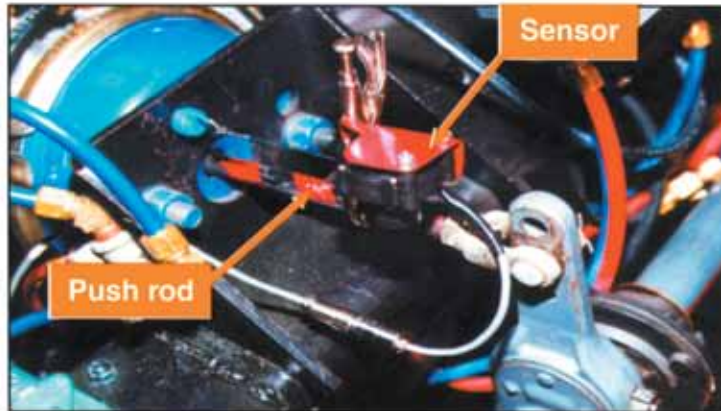


Figure 1. The sensor from the electronic brake tester is attached to the push rod. The amount of push rod travel can then be measured.

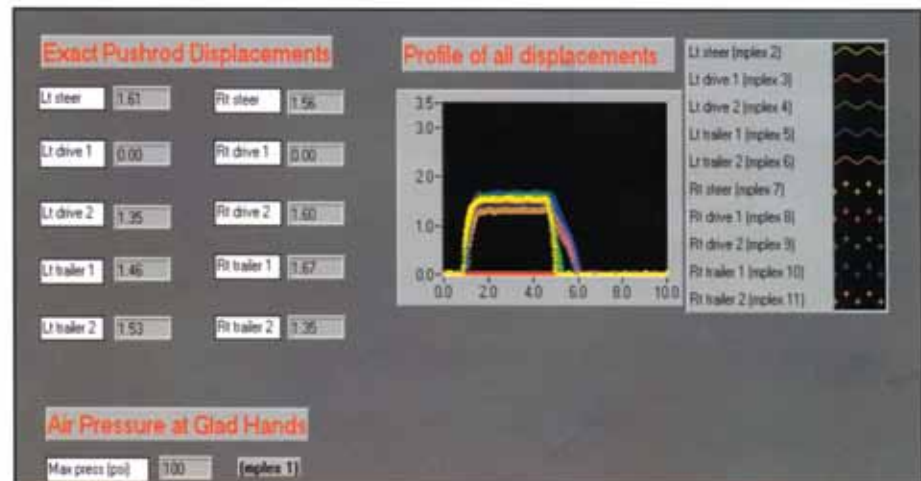


Figure 2. The output from the electronic brake tester captures the operational condition of the brakes.

loss-of-control situations such as jackknifing. It will also identify sticking valves and crimped air lines which still allow a brake to fully activate, but not in a timely manner. Neither customary measurement techniques nor a visual inspection of the system would necessarily detect these problems.

Another advantage of the electronic brake tester is that it provides a

permanent, objective and highly accurate record of the operational condition of the brakes. See Figure 2. This information can be used in a variety of situations.

For further information

For further information, contact Dr. Mark G. Strauss at Ruhl Forensic, Inc. by calling: 1-800-355-7800 or e-mailing ruhl@ruhl.com.