



Smart Infrared Inspection System Field Operational Test

INTRODUCTION

One of the main goals of the Commercial Vehicle Roadside Technology Corridor (CMVRTC) is to support and evaluate the use of innovative technologies that improve commercial truck and bus safety. The Smart Infrared Inspection System (SIRIS) was the first technology to be tested and evaluated in the CMVRTC. SIRIS is a tool designed to assist inspectors in determining which vehicles passing through the system are in need of further inspection. As a commercial motor vehicle (CMV) travels through the system, infrared cameras mounted on the roadside measure temperatures of the brakes, tires, and wheel bearings on both wheel ends of the vehicles. This thermal data is analyzed by SIRIS internally before being presented to law enforcement personnel on a user-friendly interface inside the inspection station. Enforcement personnel are automatically alerted when vehicles that are suspected to have a defect pass through the system. Since the first-generation prototype in 2007, SIRIS has been a valuable asset to the CMV community by accurately identifying vehicles that should be inspected by a trained CMV inspector.

FIELD OPERATIONAL TEST

The SIRIS field operational test (FOT) was conducted at the Greene County Inspection Station (IS), located on I-81 South in Greeneville, Tennessee for a period of 7 months. The main goal of this FOT was to collect data to evaluate the performance of the prototype system and to determine the viability of such a system for use in CMV enforcement.

In order to conduct an unbiased evaluation of the SIRIS technology, a test plan was created for enforcement personnel to follow during the FOT.

Additionally, to provide a representative sample of all vehicles traveling on I-81 South during the test period, vehicles were selected via a strict procedure that allowed for all vehicles on the mainline to be sampled (including electronic screening participants).

Once the vehicle was selected and driver information was checked, enforcement personnel directed the vehicle to the inspection pit in order to perform a Level-1 inspection. Following a complete inspection, the vehicle was directed to pull onto the Performance-based Brake Tester (PBBT), shown in Figure 1. A PBBT is a device that can evaluate the current brake efficiency of a vehicle by measuring brake forces developed as the vehicle engages in a braking event while stationed on the device. PBBT tests were performed last so that inspectors would not have any forewarning of possible brake defects when performing the initial Level-1 inspection.



Figure 1. Image. PBBT located at the Greene County Inspection Station.

After these inspections were complete, inspectors recorded all inspection numbers, times and general vehicle information on the log sheet provided.

Level-1 inspection and PBBT were each used in tandem to identify brake system noncompliance among trucks flagged by SIRIS. Normal enforcement protocol was followed regarding any vehicle and/or driver found to have out-of-service (OOS) defects.

SIRIS software provided enforcement personnel with notifications when vehicles with the following conditions were detected:

- Unusually cool brakes.
- Overheated brakes.
- Overheated tires.
- Overheated wheel bearings.

ANALYSIS OF COLLECTED DATA

During the test period, 413 vehicles were randomly selected from the mainline and 384 were scanned by SIRIS. As shown in Table 1, 36 of the selected vehicles were flagged by SIRIS as possibly having a brake or tire violation (in no case did SIRIS flag for both brake and tire). All 36 of those vehicles were subjected to a Level-1 inspection, resulting in 30 (or 83.3 percent) vehicles being placed OOS for a related violation, and 31 (or 86.11 percent) of the total vehicles having a flaw of some type related to brakes, tires, or wheel bearings.

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%)

Table 1. Summary of SIRIS FOT results.

During the course of the FOT, there were 12 recorded instances where SIRIS became inoperable or performed in a manner that made it unusable by IS personnel. Most of the problems recorded by IS personnel were similar in nature and easily corrected with a system reboot. The major problem with SIRIS throughout the FOT, however, was the effect of weather on the image quality and functionality of the system. It should be noted that enforcement personnel typically do not inspect vehicles in harsh weather; therefore, weather anomalies did not negatively affect the results of the FOT.

CONCLUSIONS

The SIRIS device developed and tested during this project proved to be a viable screening tool for the detection of vehicles with brake defects when one excludes the stability and operational issues encountered during the data collection period.

The SIRIS device, if deployed, could focus the limited resources of commercial vehicle inspection agencies to inspect vehicles with a high probability of having a brake or tire defect. The inability of the current SIRIS device to remain operational within the ramp-side environment precludes its value to enforcement. Work must be done to overcome the stability and operational issues with the overall system for SIRIS to become a viable mainstream tool. Nonetheless, the current optical system and decision-making algorithm have produced results that could clearly have a positive effect on the OOS rates of commercial vehicles and the related crash rate.

NEXT STEPS

It is anticipated that States will begin to implement this type of technology at fixed and mobile inspection sites. FMCSA will develop and publish testing and performance requirements, which will provide States with guidelines for making funding decisions as additional manufacturers begin to offer the systems.

For more information, please visit:

<http://www.fmcsa.dot.gov/facts-research/art-public-reports.aspx>