



Automated Thermal Imaging Improves Highway Safety

Washington's Automated Infrared Roadside Screening System Uses Machine Vision to Check Truck Brakes

Commercial vehicle traffic is at an all-time high on America's highways, comprising over 30% of all interstate highway vehicle traffic. Each year there are hundreds of thousands of accidents that involve commercial trucks and the related number of deaths runs in the thousands annually. A significant portion of these truck accidents list faulty brakes as a contributing factor, so break inspection has become an important part of traffic safety enforcement policies around the US.

The Washington State Department of Transportation's (WSDOT) has therefore installed an Automated Infrared Roadside Screening (AIRS) system that utilizes a FLIR A315 thermal imaging camera to automatically detect defective breaks in trucks at several weighing stations.

Thermal imaging cameras like the A315 detect and display differences in temperatures by detecting the intensity of thermal radiation. The FLIR A315 thermal imaging camera can accurately measure the temperature of millions of separate points and export all of that thermal data to a computer for precise analysis.

Automatically detect malfunctioning brakes

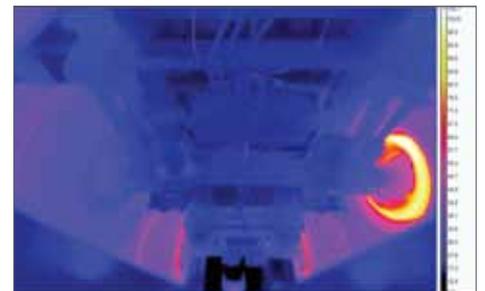
The FLIR A315 thermal imaging camera used for the AIRS system is installed in a protective enclosure and mounted

embedded in the entrance of a commercial vehicle weighing station. The camera provides detailed thermal images of the undercarriage of commercial vehicles as they enter the station. "AIRS automatically scans and assesses the underside of commercial vehicles for conditions such as malfunctioning brakes, overheated bearings and tire risks," project manager Victor Bagnall explains.

Once the vehicle has passed the camera, the AIRS computer analyzes the captured data and compares the signal patterns with



The FLIR A315 thermal imaging camera incorporated in the AIRS system automatically scans the underside of trucks for malfunctioning brakes, overheated bearings and tire risks.

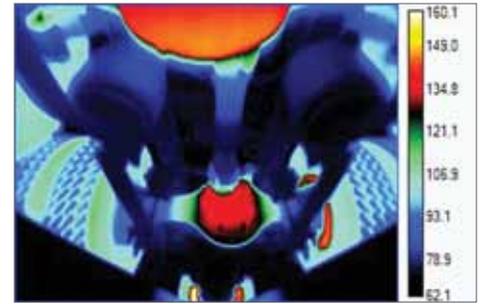
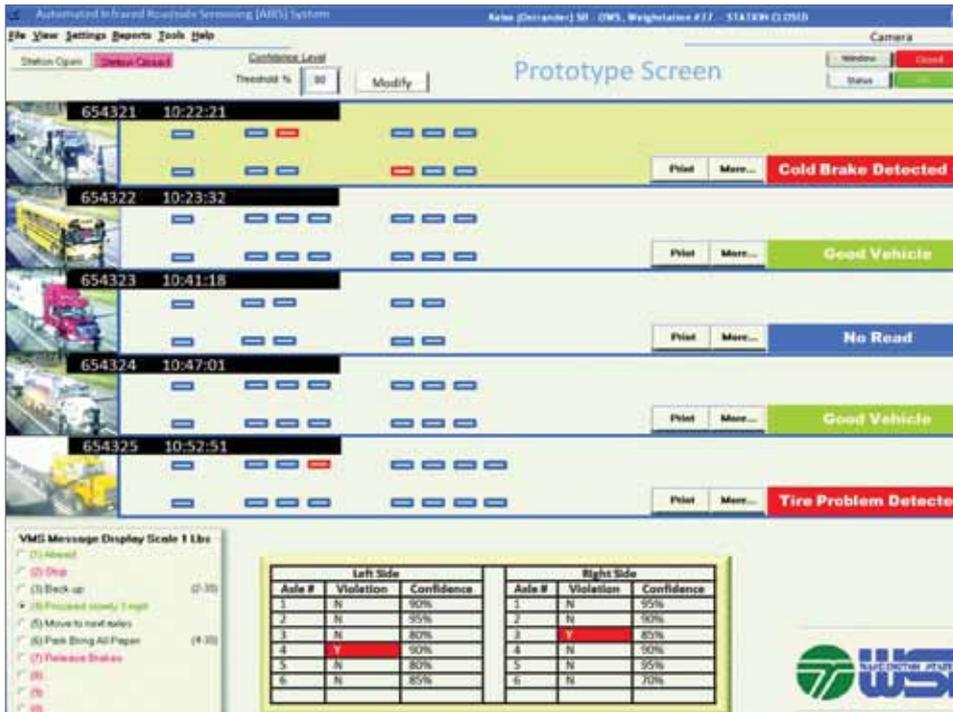


The warm brake on the right seems to function normally. The brake on the left shows up as cold in the thermal image, this indicates that it does not function properly.



Inoperable brakes are a leading cause of highway traffic accidents in the US.





AIRS detects inoperable brakes (left) on this commercial vehicle.

AIRS is designed to provide automated inspection data from multiple vehicles at once, and provide precise feedback regarding which parts of the vehicle are out of tolerance.

the system's predefined conditions. The computer creates a record of the vehicle, including all of the relevant temperature data and the thermal image of the vehicle. This record is displayed on the AIRS screen, alongside the records of other vehicles that come into the station before and after it. Records are deleted from the system once the truck leaves the station.

Defective brakes are typically colder than a vehicle's operational brakes. This difference is clearly visible on a thermal image. This enables the AIRS system to detect these defective breaks automatically.

Time-consuming manual brake inspections

"The human eye can't distinguish between a hot brake and a cold brake," explains Bagnall. "In order to detect improperly operating brakes without thermal imaging technology, the standard method is for

someone to physically touch the brake to see if it's hot or cold. The AIRS system automatically inspects both sides of every truck that enters the weighing station. The personnel only have to step in when the AIRS system gives them an alert."

The manual inspection technique that's currently the most common method is very time-consuming and because manpower is limited only a small number of vehicles are inspected at each station. Other thermal imaging inspections still require an officer to scan each brake visually on a monitor. Again, this is a hands-on task requiring personnel to take an active role in scanning each vehicle, so it is not widely used.

Fully automated brake inspection with thermal imaging

"AIRS is designed to be hands off and fully automated", Bagnall explains. "When a truck enters the weigh station and is within

view of the thermal imaging camera the AIRS system will detect the vehicle, initiate the automated scan as the truck passes overhead, and then analyze the data. If AIRS finds a problem during the scan it will alert station personnel, and show them which wheel location to inspect and what to look for."

AIRS is a standalone software application that controls the thermal imaging camera, a color camera, and all of the associated systems necessary for AIRS operation. AIRS can scan and analyze multiple vehicles in quick succession. The computer stores the data so that users can review and display multiple scans at one time.

'FLIR was very helpful in the development process'

Vic Bagnall is a contractor hired to develop and implement the AIRS product. "I can't say enough about how helpful FLIR has been in the AIRS development process," said Bagnall. "They were quick to offer their expertise and act as a sounding board to explore ways to get the most out of their thermal technology in this environment."

The AIRS system is installed in 11 weigh stations in the State of Washington, giving the state a valuable tool in the struggle to make its highways as safe as possible. And automated thermal imaging technology is pivotal to its success.



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