SOUTHERN TECHNOLOGIES CORPORATION

Benefits of Frauscher Wheel Sensors when used with the Southern Technologies SmartScanNG^2 Defect Detector

EXECUTIVE SUMMARY

The Frauscher Zero-Speed Dual Gating Wheel Detector Assembly is a rail-mounted device that generates precision wheel timing signals for the SmartScanNG^2 Defect Detector. The combination of inductive operating principles and the robust design of the Frauscher RSR110 sensors guarantee high reliability, even when subjected to extreme mechanical, electromagnetic, climatic, and environmental working conditions.

SmartScanNG^2

Southern Technologies has successfully deployed the Frauscher Wheel Sensor technology paired with the Southern Technologies dual gating rail mounting bracket at many SmartScanNG^2 defect detector sites. This paper provides data to illustrate the benefit of using the 2100-696 Frauscher Zero Speed Dual Gating Assembly for defect detection operations.

The Frauscher Sensors help solve two major problems that can be obstacles to accurate axle counting and defect detection for a train.

- Low or zero speed at the detector site
- Electromagnetic noise caused by locomotive traction motors

Test site and actual data demonstrate the ability of the Frauscher Wheel sensors to solve these problems as well as providing additional technological benefits.

CHALLENGE

Accurate detection of the wheels on railcars as a train crosses a site is foundational to the operations of a Defect Detector system. Announcements to train crews reference the location of detected defects by axle number. In addition, central office trending operations require accurate parsing of axle patterns to identify the individual vehicles that make up a consist. At low speeds, standard magnetic wheel sensors have trouble detecting wheels as they pass through the magnetic field generated by the sensor (a minimum velocity is required for the magnetic field to respond to the ferrous object that passes through it). At very slow speeds, wheels will be missed altogether.

Electromagnetic interference generated by locomotive traction motors can also negatively influence the ability of magnetic sensors to accurately detect passing wheels. This is especially true on sites that are on a grade which requires that locomotive traction motors be engaged as they pass over the site.

The Frauscher Wheel Sensors provide a solution for the slow speed problem as well as electromagnetic interference.

TESTING A NEW SOLUTION

In the course of its research, Southern Technologies chose to test and evaluate the performance of Frauscher's RSR110 wheel sensor in conjunction with their SmartScanNG² Defect Detector. The Frauscher RSR110 is an inductive sensor that is used to detect the flange of a passing wheel. It consists of two galvanically separated sensing systems that provide extremely reliable wheel detection, even at zero speed.

Southern Technologies maintains two test sites on mainline track that are close to their facility in Chattanooga, Tennessee. They began investigating the Frauscher RSR110 wheel sensor as a solution for the problems of low-speed detection and EMI. One test site is near a switching location, where very slow speeds are common. The test began by installing the Frauscher RSR110 wheel sensors at this site and connecting them to the SmartScanNG^2 defect detector at the location. The wheel sensors were connected to the Frauscher Signal Converter (WSC001) and attached to the rail using the Frauscher Rail Claw. This configuration operated at the test site for about six months with weekly visits to record site conditions and monitor the sensor performance. At this point in the test, the data showed a dramatic reduction in axle miscounts for slow trains when compared to the magnetic wheel sensors.

The Frauscher RSR110 appeared to be a viable solution to the problem of accurate axle counting; however, Southern Technologies wanted to take the solution a step further.

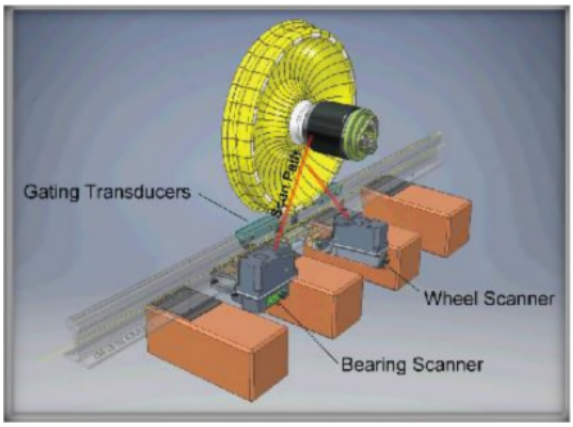
Hardware Modifications

Southern Technologies designed its SmartScanNG² detector with enough processing power to manage the analog signal data that is generated by the Frauscher RSR110 wheel sensor. The ability to process the Frauscher sensor signals gave Southern Technologies an advantage by using the RSR110 to report axle information more precisely.

Southern Technologies worked with Frauscher to integrate the technology from the Frauscher WSC001 Signal Converter directly into the SmartScanNG^2 hardware. Integrating the signal converter greatly simplified the interface between the Frauscher RSR110 wheel sensors and the NG^2 Defect Detector. The WCS001 technology embedded into the detector allows direct termination of the wheel sensors with no hardware middle layer.

The SmartScanNG^2 determines wheel position using two wheel sensors spaced 24 inches apart, also called the wheel gate. To facilitate the efficient and accurate installation of these sensors, Southern Technologies designed the 2100-695 Dual Gating Rail Bracket for the RSR110 wheel sensors. The 2100-695 provides for a single mounting point for both wheel sensors that are fixed precisely 24 inches apart. As a result, the sensors are installed in minutes without drilling the rail.

Additional Technological Benefits



Southern Technologies based its decision to utilize the Frauscher wheel sensor on several factors. One of the significant advantages of the RSR110 over the existing wheel sensor is the remote calibration capability. The user can calibrate the wheel sensors through a remote IP connection with the detector. Recalibrating the wheel sensors can sometimes correct a problem with wheel sensor alignment without requiring a visit to the site. Remote calibration can help minimize or delay site visits, in turn, reducing labor and increasing worker safety.

Along with the Frauscher integration, additional software changes made the Virtual Gate feature possible. The Virtual Gate allows the scanner to be mounted anywhere within 100 inches from the wheel gate, making site selection and scanner installation easier. The scanner offset uses the timing and processing power of the SmartScanNG^2 detector to calculate the location of each wheel during train passage. Instead of relying on a fixed value for the distance between the wheel gate and the scanner, the actual distance or offset measurement is programmed during installation.

Magnetic vs. Inductive

Magnetic wheel sensors still have a place on the railroad for wheel detection. When magnetic sensors are used on mainline detector sites that do not have a substantial grade, do not regularly see train speeds less than 7mph, and are not close to oiler locations, they can be very effective. However, magnetic wheel detectors do have an additional drawback of attracting metal shavings from the wheels. The metal shavings can build up over time, causing the wheel sensors to malfunction. Iron ore dust can also be attracted by and deposited on the magnetic wheel sensors, thus affecting their performance.

The Frauscher wheel sensor is an inductive device instead of a magnetic device, so it will not attract metal shavings from the wheels passing over it.

Real-World Testing

After the combination of the RSR110 sensors, NG^2 detector, and Dual Gating Rail Clamp were tested at the Southern Technologies test sites, they were deployed at several class 1 sites. The before and after results from the sites confirmed the Frauscher wheel sensors improved performance at detector sites.

The NG^2/RSR110 combination was installed at a site that had a history of slow trains and axle miscounts. The data reported subsequently from the site showed a significant improvement in performance over that shown by the magnetic wheel sensors previously installed.

The original magnetic sensors recorded 1,572 trains at a double-track site during a five-month period. There were 150 wheel detector miscounts recorded during this time frame.

After the installation of the Frauscher RSR110 wheel sensors at the same site, *2,272* trains were recorded with **zero wheel detector miscounts**.

At a separate active site, axle miscounts were skewing the trending data reported from the site. The site was upgraded to a SmartScanNG^2 utilizing Frauscher RSR110 wheel sensors, and the problem was solved. Data collected after the upgrade of this site, over eight days, showed that the system counted 37,201 axles with 100% accuracy. This included several trains recorded going 7mph or less. See **Table 1** for site data.

Detector Site Data			
	Number of Trains	**Number of Axles**	**Trains with Axle Miscounts**
Original Detector	**82**	**37,757**	**36**
SmartScanNG^2 with Frauscher	**70**	**37,201**	**0**

Table 1: Detector Site Data

IMPROVEMENTS AND MAIN TECHNOLOGY BENEFITS

Railroads are installing this technology and realizing benefits from it today. The Frauschers RSR110 wheel sensors paired with a Southern Technologies SmartScanNG^2 defect detector allow defect detection to be used on a wider variety of site types while providing more accurate axle information for all trains.

Feature	Magnetics	Frauschers
Accurate Axle Counts on Slow Trains	No	Yes
Ability to Locate Scanners Away From Wheel Sensors	No	Yes
Immunity from Traction Motor Noise	No	Yes
Remote Calibration of Wheel Sensors	No	Yes
Attracts Metal Shavings and Iron Ore	Yes	No
Built-In Interface on the SmartScanNG^2	Yes	Yes
Rail Clamp Mounting	Yes	Yes

Comparison Matrix