Trimble Beena Vision Solutions
TRIMBLE. INTELLIGENCE IN RAIL.
Changing Perspective

Wayside:
Monitoring
Measurement
Inspection
Beena Vision—A Trimble Company, is the leading manufacturer of automated vision-based wayside inspection systems for the railroad industry. Over the last twenty years, Beena Vision has pioneered and developed a number of innovative products using sophisticated machine vision and non-contact measurement technologies. These products are specifically designed to provide valuable information to effectively assess railcar components and track safety conditions.

The Trimble® Beena Vision® product line focuses on automatic wayside train inspection systems combined with sophisticated software applications for detector data visualizations and analysis.
Trimble Beena Vision wayside train condition monitoring systems are designed and manufactured for the most demanding applications with high levels of system accuracy, reliability, and availability. Beena Vision systems have a reputation for being tough and durable even in the heavy haul railway environment, as a result of years of design, testing, and field experience with close to 200 installed and operational systems worldwide.

Beena Vision has installed numerous systems at all major North American Class 1 railroads, including BNSF, Norfolk Southern, CSX, Canadian National, Union Pacific, and has worked closely with several rail operators and organizations to develop new products. Many Beena Vision systems are successfully deployed with major operators in Australia, such as Aurizon, BHP, Rio Tinto, FMG, and with multiple operators in Europe, China, South America, and the Middle East.

At the technology facility in Norcross, GA, USA, Beena Vision pursues its extensive R&D program to develop advanced systems for automatic monitoring of critical components of freight and passenger cars, bogies, and locomotives.

In February 2017, Trimble Inc. acquired Beena Vision and the addition of Beena Vision’s solutions to Trimble’s portfolio extends Trimble’s ability to deliver more powerful and robust rail solutions. In addition, Beena Vision can leverage Trimble’s broad portfolio of technology to even further strengthen solutions.

As part of Trimble, Beena Vision’s commitment to customers remains unchanged and Beena Vision will continue to deliver best-in-class solutions and services.

Kambiz Nayebi, Ph.D.
Director of Engineering
Vision Technology
Pioneer in the Railroad Industry
Automatic Train Inspection & Measurement Systems

WheelView  Wheel Profile Measurement
TreadView  Wheel Surface Measurement and Inspection
BrakeView-Shoe  Brake Shoe (Block) Measurement and Inspection
BrakeView-Pad  Brake Pad Measurement
BrakeView-Disc  Brake Disc Measurement and Inspection
TruckView  Truck (Bogie) Inspection and Measurement
AHView  Air Hose Arrangement Inspection
CouplerView-Pin  F-Type Coupler Securement Inspection
CouplerView-CrossKey  E-Type Coupler Securement Inspection
CSCView  Car (Wagon) Structural Component and Undercarriage Inspection
TrainView  Full Train Imaging, Inspection, and Measurement
AOAView  Angle of Attack and Back-to-Back Measurement

Software Products

WISE  Complete Wayside Detector Data Solution
TrainWatch  Virtual Train Inspection Software
Freight Train Inspection Technologies

- **AOAView**
  Angle of Attack and Back-to-Back Measurement

- **CSCView**
  Car (Wagon) Structural Component and Undercarriage Inspection

- **TrainView**
  Full Train Imaging, Inspection, and Measurement

- **TreadView**
  Wheel Surface Measurement and Inspection
Inspection and Measurement

WheelView
Wheel Profile Measurement

TruckView
Truck (Bogie) Inspection and Measurement

BrakeView
Brake Shoe (Block) Measurement and Inspection

CouplerView
E-Type Coupler Securement Inspection

AHView
Air Hose Arrangement Inspection

CouplerView
F-Type Coupler Securement Inspection
Passenger Train Inspection Technologies

- **BrakeView** | Shoe
  Brake Shoe (Block) Measurement and Inspection

- **BrakeView** | Disc
  Brake Disc Measurement and Inspection

- **BrakeView** | Pad
  Brake Pad Measurement

- **AOAView**
  Angle of Attack and Back-to-Back Measurement

- **CSCView**
  Car (Wagon) Structural Component and Undercarriage Inspection

- **WheelView**
  Wheel Profile Measurement
TrainView
Full Train Imaging, Inspection, and Measurement

TruckView
Truck (Bogie) Inspection and Measurement

TreadView
Wheel Surface Measurement and Inspection
Bogie and Axle Inspection Technologies

**BrakeView | Disc-Axle**
Axle Mounted
Brake Disc Measurement and Inspection

**BrakeView | Pad-Axle**
Axle Mounted
Brake Pad Measurement

**BrakeView | Pad-Wheel**
Wheel Mounted
Brake Pad Measurement

**BrakeView | Disc-Wheel**
Wheel Mounted
Brake Disc Measurement and Inspection

**WheelView**
Wheel Profile Measurement
BrakeView | Shoe
Brake Shoe (Block) Measurement and Inspection

TreadView
Wheel Surface Measurement and Inspection

CSCView
Car (Wagon) Structural Component and Undercarriage Inspection

TruckView
Truck (Bogie) Inspection and Measurement
# System Specifications

## Train | Wagon (Car) | Bogie (Truck) | Wheel Inspection Systems

<table>
<thead>
<tr>
<th>Function</th>
<th>WheelView F/I</th>
<th>TreadView</th>
<th>BrakeView Pad</th>
<th>BrakeView Disc</th>
<th>TruckView</th>
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<tbody>
<tr>
<td>Application</td>
<td>Wheel Profile Measurement</td>
<td>Wheel Surface Inspection</td>
<td>Brake Shoe (Block) Measurement</td>
<td>Brake Pad Measurement</td>
<td>Truck (Bogie) Inspection</td>
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<tr>
<td>• Freight (F)</td>
<td>• Freight</td>
<td>• Freight</td>
<td>• Freight</td>
<td>• Freight</td>
<td>• Freight</td>
</tr>
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<td>• Tram</td>
<td>• Tram</td>
<td>• Tram</td>
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<tr>
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## Installation Location

<table>
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<tr>
<th>Standard Operating System</th>
<th>WheelView F/I</th>
<th>TreadView</th>
<th>BrakeView Pad</th>
<th>BrakeView Disc</th>
<th>TruckView</th>
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<td>0–140 km/h</td>
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<td>• Depot (F)</td>
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<td>• Yard (F)</td>
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<td>0–140 km/h</td>
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<tr>
<td>• Indoors (I)</td>
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<td>0–140 km/h</td>
<td>0–140 km/h</td>
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<tr>
<td>• Tunnel (F)</td>
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## Parameters Measured/Inspected

<table>
<thead>
<tr>
<th>Standard Operating System</th>
<th>WheelView F/I</th>
<th>TreadView</th>
<th>BrakeView Pad</th>
<th>BrakeView Disc</th>
<th>TruckView</th>
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<tbody>
<tr>
<td>• Wheel Profile</td>
<td>Wheel Surface Condition</td>
<td>Shoe Thickness</td>
<td>Pad Thickness</td>
<td>Brake Disc Profile</td>
<td>Truck (Bogie)</td>
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<tr>
<td>• Flange H &amp; W</td>
<td>Shelling</td>
<td>Key Condition</td>
<td>Wear Trend</td>
<td>Brake Disc Thickness</td>
<td>Springs</td>
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<td>• Tread Hollow</td>
<td>Broken Wheels</td>
<td>Wear Condition</td>
<td>Disc Surface Condition (optional)</td>
<td>Springs</td>
<td>Friction Wedge</td>
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<td>Flats</td>
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<td>Bolster</td>
<td>Side Frame</td>
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<td>• Wheel Diameter</td>
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<td>Bearings Cap</td>
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## Standard Operating Temperature

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<th>WheelView F/I</th>
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<th>BrakeView Disc</th>
<th>TruckView</th>
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<tbody>
<tr>
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<td>–40°C to 55°C</td>
<td>–40°C to 55°C</td>
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<tr>
<td>L: –20°C to 55°C</td>
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<td>–40°C to 55°C</td>
<td>–40°C to 55°C</td>
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## Standard Power Requirements

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## Periodic Maintenance

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<td>Yearly Calibration</td>
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## Installation Position and Base

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## Remote Diagnosis

| Remote Diagnosis | Yes | Yes | Yes | Yes | Yes |

## Automated Health Reporting

| Automated Health Reporting | Yes | Yes | Yes | Yes | Yes |

## AEI / RFID Integration

| AEI / RFID Integration | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

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TRANSFORMING THE WAY THE WORLD WORKS
<table>
<thead>
<tr>
<th>AHView</th>
<th>CouplerView Pin</th>
<th>CouplerView CrossKey</th>
<th>CSCView</th>
<th>TrainView</th>
<th>AOAView</th>
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<td>Air Hose Inspection System</td>
<td>F-Type Coupler Securement Inspection</td>
<td>E-Type Coupler Securement Inspection</td>
<td>Undercarriage Inspection</td>
<td>Full Train Imaging &amp; Inspection</td>
<td>Angle of Attack &amp; B2B Measurement</td>
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<td>• E-Type Coupler Securement</td>
<td>• Brake Rigging</td>
<td>• Car Body</td>
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<td>• Coupling</td>
<td>• Coupler Pin Plate</td>
<td>• Cross (Draft) Key</td>
<td>• Structural Components</td>
<td>• Safety Appliances</td>
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<td>• Arrangements</td>
<td>• Plate Bolts</td>
<td>• Cutter Pin</td>
<td>• Components</td>
<td>• Reflectors</td>
<td>• Hunting</td>
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<td>• Securement</td>
<td>• Plate Condition</td>
<td>• T-Pin and Lock</td>
<td>• Undercarriage Components</td>
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<td>• Side and Roof Components</td>
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<td>• Yearly Service</td>
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<td>• Semi-Arrual Clean Up</td>
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<tr>
<td>Off Track/Tower or Pole on Concrete or Steel Base</td>
<td>In Track/Steel Sleeper (Tie)</td>
<td>In Track/Steel Sleeper (Tie)</td>
<td>In Track/Steel Sleeper (Tie)</td>
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</table>

*Specifications subject to change without notice.*
Trimble® WheelView® automatic wayside systems measure the wheel profiles of moving trains. These systems are used to inspect wheels for preventative maintenance, maintenance scheduling, derailment prevention, and to reduce track and rail damage caused by excessively worn wheels.

WheelView-F is a rugged system that operates in harsh environments as well as workshops, depots, and yards. It has an exceptionally robust design capable of operating without human intervention for extended periods. WheelView-F provides wheel diameter measurements at high speeds of up to 85 mph (140 km/h).

The other WheelView variants allow for operation in specific conditions and provide a variety of different measurements. WheelView-I is offered for indoors and low speed operations.

In production since 2000, different versions of WheelView including the standard version (WheelView-S) have been successfully deployed in many countries and is currently operational in some of the busiest freight and passenger corridors in the world, measuring over 50,000 wheels every day per system.
Inspections & Measurements

• Flange height
• Flange width
• Flange slope
• Tread hollow
• Rim thickness
• Full wheel profile
• Equivalent conicity
• Back-to-back
• Wheel diameter (F, I)
• Flange rollover (arris) and tread rollover
• Wheel diameter based on witness groove

Features

• Complete wheel profile measurement
• Speeds of 0 to 85 mph (140 km/h)
• Operating temperature: –40°C to 55°C
• Capable of operating in extreme environments
• Installed on custom steel tie (sleeper)
• Easy maintenance
• Air purge system for system cleaning
• Automatic alarm generation

Software Features

• Remote monitoring/control
• Digital image acquisition/processing
• Web-based database/visualization
• Automated reporting
• AEI (RFID) integration

WheelView is an effective system and quickly pays for itself by improving wheel maintenance practices and eliminating derailments due to worn wheels. It increases the efficiency of wheel maintenance by identifying proactive maintenance practices based on the application of wheel wear rates and early wheel defect detection.
The Trimble® TreadView® system is a sophisticated automatic non-contact optical wheel surface inspection product that inspects wheel tread surface, flange, and plate areas at mainline operational speeds, even in tough environments, day or night.

This system offers visual inspection of complete wheel tread and flange surface using optical imaging and 3D laser scanning. The objective of the system is to determine any surface abnormalities of the wheel that can be detected using high resolution images of the wheel and high density 3D data of the wheel surface.

TreadView deploys a unique state of art digital imaging and laser scanning technology for maximum data density, accuracy, and efficiency. The product benefits from a series of sophisticated image processing algorithms to assess wheel tread and flange surface condition from acquired multispectral multi-illumination images.

A major highlight of the system is that it operates at mainline speeds up to 60 mph (100 km/h) for greater utilization by rail operators. Another important advantage is that it can also operate at very low speed, where traditional “contact” impact and force measurement-based systems fall short of detecting wheel surface problems such as flats due to restrictive speed limitations.
**Inspections & Measurements**

- Flat wheel
- Shelled and spalled tread
- Shell size and depth
- Tread groove
- Shattered rim
- Broken/missing wheel sections
- Broken flange
- Significant spread rim and vertical split rim
- Built-up tread
- Wheel OOR (out-of-round)
- Hunting detection
- Back-to-back (axle wheel pacing)
- Flange height variations around the wheel
- Rim thickness variations around the wheel
- Tread hollow variations around the wheel
- Non-uniform axle wheel wear
- Major scrapes, dents and gouges
- Visible substantial fatigue cracks
- Substantial thermal crack
- Angle of attack

**Features**

- Highly sophisticated data collection system
- Speeds of 0 to 60 mph (100 km/h)
- Operating temperature: –40°C to 55°C
- Capable of operating in extreme environments
- Installed on trackside with no track interference
- Automatic alarm generation

**Software Features**

- Remote monitoring/control
- Digital image acquisition/processing
- Web-based database/visualization
- Automated reporting
- AEI (RFID) integration
Trimble® BrakeView®-Shoe wayside measurement system inspects brake shoes (blocks) at mainline operational speeds. This system is vision-based and uses a multi-camera high-speed imaging unit to take multiple images of every brake shoe for inspection and measurement.

BrakeView-Shoe provides a complete and reliable assessment of the brake shoe (block) condition by highlighting obvious shoe defects. The system is fully automated and can operate in extreme conditions—indoors and out. Enclosures are installed on two short towers, one on each side of the track, mounted on two concrete or steel footings. Cameras and illumination systems are installed at a safe distance from the center of the track. Since each brake shoe is viewed by two cameras, a complete and reliable assessment of the brake shoe condition is provided.

Brake shoes are viewed from top and bottom perspectives. Acquired images are processed by a set of sophisticated image processing algorithms. The imaging system and processing algorithms are insensitive to ambient light conditions and can operate day or night.

Brake shoe data is easily integrated into the Trimble WISE data management system which gives web-based access to data including images.
Inspections & Measurements

- Shoe detection
- Shoe thickness in top and bottom positions
- Shoe wear profile
- Shoe position with respect to the wheel surface
- Shoe securement such as key inspection
- Obvious shoe breakage
- Brake application status with thermal imaging of brake shoe & wheel contact area (optional)

Features

- Speeds of 0 to 85 mph (140 km/h)
- Operating temperature: –40°C to 55°C
- Capable of operating in extreme environments
- Installed on trackside with no track interference
- Easy maintenance
- Automatic alarm generation

Software Features

- Remote monitoring/control
- Digital image acquisition/processing
- Web-based database/visualization
- Automated reporting
- AEI (RFID) integration
Trimble® BrakeView®-Pad automatic wayside brake pad measurement system operates on passing trains at mainline operational speeds. It is a machine vision system which uses a high-speed digital imaging system to acquire images of every brake pad for inspection and measurement. The system is fully automated and can operate in extreme conditions—indoors and out.

BrakeView-Pad is installed on a steel tie (sleeper) provided by Trimble. Cameras and illumination systems are installed in sealed enclosures installed on the system tie (sleeper).

Brake pads are viewed from the bottom and the acquired images are processed by a set of sophisticated image processing algorithms. The imaging system and processing algorithms are insensitive to ambient light conditions and can operate day or night.

There are two versions of the BrakeView-Pad system—one is designed for axle mounted pads and the other for wheel mounted ones.

The number of cameras and exact design will depend on the rolling stock to be inspected. BrakeView-Pad utilizes both laser based structural light and other illumination to produce several images concurrently for reliable measurements.
Features

- Speeds of 0 to 85 mph (140 km/h)
- Operating temperature: –40°C to 55°C
- Capable of operating in extreme environments
- Installed on custom steel tie (sleeper)
- Easy maintenance
- Automatic alarm generation

Software Features

- Remote monitoring/control
- Digital image acquisition/processing
- Web-based database/visualization
- Automated reporting
- AEI (RFID) integration

Inspections & Measurements

- Pad detection
- Pad thickness in up to 3 positions
- Alarm on pad thickness levels
- Alarms on unequal wear of pads
- Visual image of the pad and surrounding area
Trimble® BrakeView®-Disc automatic wayside brake disc inspection system operates on passing trains at mainline operational speeds. It is a machine vision system which uses a high-speed digital imaging system to acquire images of every brake disc for inspection and measurement.

The system is fully automated and can operate in extreme conditions—indoors and out. BrakeView-Disc is installed on a steel tie (sleeper) provided by Trimble. Cameras and illumination systems are installed in sealed enclosures installed on the system tie.

Brake discs are viewed from the bottom and acquired images are processed by a set of sophisticated image processing algorithms. The imaging system and processing algorithms are insensitive to ambient light conditions and can operate day—or night.

There are two versions of the BrakeView-Disc system—one for axle mounted and one for wheel mounted discs. The number of cameras and exact design will depend on the rolling stock to be inspected.

The system utilizes both laser based structural light and other illumination to produce several images concurrently for reliable measurement and inspection.
Features

- Speeds of 0 to 85 mph (140 km/h)
- Operating temperature: –40°C to 55°C
- Capable of operating in extreme environments
- Installed on custom steel tie (sleeper)
- Easy maintenance
- Automatic alarm generation

Software Features

- Remote monitoring/control
- Digital image acquisition/processing
- Web-based database/visualization
- Automated reporting
- AEI (RFID) integration

Inspections & Measurements

- Disc profile measurement
- Disc thickness for up to 4 discs per axle
- Alarm on disc thickness levels
- Alarms on unequal wear of discs
- Visual image of the disc and surrounding area
TruckView

Wayside Truck (Bogie) Inspection System

Trimble® TruckView® wayside truck (bogie) inspection system operates on passing trains at mainline operational speeds, even in tough environments, day or night. It is a vision based system which uses high-speed and high-definition imaging to provide high resolution images of every truck for inspection and measurement.

Many truck related defects can cause serious short term and long terms problems and possible derailments. For a reliable and dependable inspection every truck is viewed from at least two angles—top and bottom.

TruckView inspects many features of bogies including fasteners, side frame condition, bearings and related components, friction wedges, springs, and more. Alarms are generated when issues are detected.

Examples are excessive wedge rise, spring condition to find missing and broken springs, and spring compression to detect imbalanced loads.
### Features

- Speeds of 0 to 60 mph (100 km/h)
- Operating temperature: –40°C to 55°C
- Capable of operating in extreme environments
- Installed on trackside with no track interference
- Easy maintenance
- Automatic alarm generation

### Software Features

- Remote monitoring/control
- Digital image acquisition/processing
- Web-based database/visualization
- Automated reporting
- AEI (RFID) integration

### Inspections & Measurements

- Fasteners
- Spring inspection to detect broken or missing springs
- Heavy load imbalance
- Bearing cap and cap bolts
- Side frame mismatch
- Bearing adapter
- Bearing adapter wear plate
- Bearing keeps
- Sand hose position and activators
- Wedge detection and height measurement
- Individual and average wedge rise measurement
- Hopper door
- Earth straps
- R-clips
- VTA valves
- Sliding wheel detection (optional)
- Truck type identification (optional)
Trimble® AHView wayside brake air hose inspection system operates on passing trains at mainline operational speeds. A vision based system, it uses a high-speed and high-definition imaging system to provide high resolution images of every air hose arrangement for inspection and measurement.

Air hose arrangements and their diagnosis is complex and an automated system is highly beneficial for rail operators as air hose separation is one of the leading causes of train stoppage in freight operations. AHView provides automated alarms based on the condition of the air hose arrangement and detects the ones that have the highest probability of separation.

AHView is designed to inspect many conditions of the air hose assembly and can detect defects like peaked air hose coupling, air hose height, glad-hand, air hose angle, coupling position, and more.
Inspections & Measurements

- Air hose orientation
- Air hose angle
- Air hose height from top of rail
- Glad-hand angle
- Coupling: peaked, horizontal, and U-shaped coupling
- Air hose support inspection
- Coupler shank movement
- Coupler height
- Air hose leak (acoustic option)

Features

- Speeds of 0 to 60 mph (100 km/h)
- Operating temperature: –40°C to 55°C
- Capable of operating in extreme environments
- Installed on trackside with no track interference
- Easy maintenance
- Automatic alarm generation

Software Features

- Remote monitoring/control
- Digital image acquisition/processing
- Web-based database/visualization
- Automated reporting
- AEI (RFID) integration
Trimble® CouplerView®-Pin is a machine vision wayside detection system that detects defects in F-type coupler securement mechanisms. It utilizes high-speed digital line imaging cameras to acquire multiple images of every coupler pin securement for inspection. The system works at mainline speeds, even in tough environments, day or night.

For F-type couplers, the system inspects the coupler vertical pin carrier plate, securement, and the corresponding fasteners. Different types of F-type securements, including ones with cushioning units, are handled as well.

If the coupler securement fails during train operation there is a high probability that the coupler will “pull out” of the car in a draft situation. In most cases this will result in the coupler falling between the cars and into the gauge of the track. If the train is operating at mainline speeds this can result in a derailment.

CouplerView-Pin is designed to operate on passing trains at mainline operational speeds up to 60 mph (100 km/h). The CouplerView-Pin system’s processing algorithm classifies couplers into E and F types before the securement processing and only F-Type couplers are inspected.

CouplerView-Pin systems are installed on steel ties (sleepers) supplied by Trimble. Cameras and the illumination system are enclosed in sealed steel boxes mounted on the gauge side of the supplied steel tie (sleeper). The securement component images are analyzed for possible failure, deformation, and missing fasteners, and plates.
Inspections & Measurements

• Missing coupler pin plate
• Missing horizontal securement bolts
• Leaning coupler pin plate
• Damaged, deformed or rotated pin plate, or securement bolts
• Missing fasteners

Features

• Speeds of 0 to 60 mph (100 km/h)
• Operating temperature: –40°C to 55°C
• Capable of operating in extreme environments
• Installed on custom steel tie (sleeper)
• Easy maintenance
• Automatic alarm generation

Software Features

• Remote monitoring/control
• Digital image acquisition/processing
• Web-based database/visualization
• Automated reporting
• AEI (RFID) integration
Trimble® CouplerView®-CrossKey is an automatic wayside detection system that is designed to inspect E-Type coupler securement components at mainline speeds. It uses a high-speed strobe digital imaging system to acquire multiple images of every cross key (draft key) and the surrounding area for inspection.

The system is used to inspect the cross key and its securement mechanism. Failure of such securement parts is a source of delay and derailments in freight operations. It operates on passing trains at mainline operational speeds up to 85 mph (140 km/h). All cross keys are imaged from both front and back—including the area under the center sill for proper E/F coupler classification.

The system’s processing algorithm classifies couplers into E and F types before the plate processing and only E-Type couplers are inspected. CouplerView-CrossKey systems are installed on steel ties (sleepers) supplied by Trimble. Cameras and illumination component are enclosed in sealed boxes mounted on the gauge side of the steel tie (sleeper). Images are analyzed for the existence of the cross key and its securement components.
Inspections & Measurements

- Classify E-type and F-type couplers
- Detect missing cross (draft) key
- Find missing retainer-pin (t-pin)
- Detect missing cotter key
- Find missing cross key retainer washer

Features

- Speeds of 0 to 85 mph (140 km/h)
- Operating temperature: –40°C to 55°C
- Capable of operating in extreme environments
- Installed on custom steel tie (sleeper)
- Easy maintenance
- Automatic alarm generation

Software Features

- Remote monitoring/control
- Digital image acquisition/processing
- Web-based database/visualization
- Automated reporting
- AEI (RFID) integration
Trimble® CSCView® system undercarriage imaging and automated inspection system produces high quality images of the structural components of railcars (wagons) and locomotives at mainline operational speeds. The system is highly effective for the inspection of all undercarriage components for passenger and freight trains.

CSCView automates the inspection of undercarriage components such as brake rigging components, center and side sill, couplers and coupler components, jacking plate, and more. The inspection of car (wagon) components which are only visible from the bottom has always been a challenge for railway operators. The system operates with line scan imaging technology and produces high resolution images of virtually all visible components under the car. It is installed under the track and is housed within steel tie (sleeper) structures.

CSCView uses multiple cameras to capture different areas of the car undercarriage with different angles of view. Specially designed lighting systems are deployed with the system to provide ample illumination and withstand the harsh railroad track environment.
Inspections & Measurements

- Couplers
- Brake hose
- Brake rigging components including brake beam
- Coupler securement
- Draft gear carrier
- Axle surface
- Locomotive gear case
- R-clips
- Hopper doors
- Center sill
- Side sill
- Cross bearers
- Body bolster

Features

- Speeds of 0 to 60 mph (100 km/h)
- Operating temperature: −40°C to 55°C
- Capable of operating in extreme environments
- Installed on custom steel tie (sleeper)
- Easy maintenance
- Automatic alarm generation

Software Features

- Remote monitoring/control
- Digital image acquisition/processing
- Web-based database/visualization
- Automated reporting
- AEI (RFID) integration
Trimble® TrainView® full scale train imaging, 3D scanning, and inspection system consists of multiple imaging and scanning units that provide images of the train at mainline speeds with high resolution.

The system is designed to provide data of all externally visible components of a rail vehicle. The images and data are then assigned to individual cars based on the AEI data so that car components are then ready for viewing and analysis.

The system uses multiple sensors and algorithms to pinpoint axle position, car beginning and car end positions, car components such as safety appliances, hand brake wheels, car identifiers, load limit identification, reflectors, car body condition, structural gauge and high-wide load detection, car load profile, load securement conditions, load carry back detection, etc.

Benefits to rail operators includes assisting Carmen’s visual inspection process and providing timely maintenance alerts for defective car components. While most of the inspection process is automated, the Trimble TrainWatch sophisticated train viewing software can be used to perform a complete virtual train visual inspection as well.

TrainView is also of relevance in the security industry where the detection of foreign objects on trains is becoming a critical issue for the rail transportation industry.
Inspections & Measurements

Automated condition monitoring of many train components:
- Side walls condition
- Car ID and OCR
- Car load limit identification
- Reflector conditions
- Car structural gauge and profile
- High-wide detection
- Car load profile
- Load securement
- Gauge reading
- Load profile
- Load carry back
- Foreign object detection
- Rocking and leaning cars

Safety appliances such as:
- Hand brake wheel
- Running boards (long and latitudinal)
- Roof hatches
- Ladders and handholds
- End platforms
- Sill steps

Features

- Speeds of 0 to 60 mph (100 km/h)
- Operating temperature: –40°C to 55°C
- Capable of operating in extreme environments
- Installed on trackside tower with no track interference
- Easy maintenance
- Automatic alarm generation

Software Features

- Sophisticated GUI software for train viewing and car inspection (Trimble TrainWatch software)
- Remote monitoring/control
- Digital image acquisition/processing
- Web-based database/visualization
- Automated reporting
- AEI (RFID) integration
AOAView is a wayside angle-of-attack (AOA) measurement system that is designed to measure AOA on both wheels of a wheelset simultaneously. Since AOAView is installed on a tie (sleeper) between the rails, it provides a reliable AOA measurement as track fluctuations due to dynamic loads do not affect where the measurements are performed. Also, AOAView provides extremely accurate measurements of back-to-back distance of wheel sets with multiple measurements from both wheels of an axle.

AOAView is also capable of measuring tracking position and axle back-to-back dimension. The system is installed between the rails and has sufficient clearance with respect to the rail for most rail grinding machines and other track maintenance equipment to pass through the location without interference.
Inspections & Measurements

- Measure AOA on both wheels of an axle
- Measure B2B in two sections of the wheel
- Axle lateral position
- Identify warped trucks
- Detect hunting railcars (if three units are installed)
- Wheel plate type recognition (if applicable)

Features

- Speeds of 0 to 85 mph (140 km/h)
- Operating temperature: −40°C to 55°C
- Capable of operating in extreme environments
- Installed on custom steel tie (sleeper)
- Easy maintenance
- Automatic alarm generation

Software Features

- Remote monitoring/control
- Digital image acquisition/processing
- Web-based database/visualization
- Automated reporting
- AEI (RFID) integration
Data generated by wayside detection and monitoring systems is highly beneficial for prioritizing train maintenance and derailment prevention. As more systems are deployed, the management and effective use of gathered detector data becomes more challenging. Also, the correlation between data generated by different detectors provides additional opportunities to analyze and understand the condition of any individual rolling stock or the whole fleet.

Trimble® WISE (Wayside Inspection System Environment) software is a condition monitoring data management platform. It provides a comprehensive unified web-based interface to all wayside data that has been produced. Data from all types of wayside detectors including systems provided by Trimble and systems from other suppliers can be seamlessly integrated within WISE. Current system data streams that can be integrated include wheel profile and brake shoe measurements, wheel impact detectors, hot bearing detectors, and acoustic bearing detectors.
WISE

Complete Wayside Detector
Data Solution
WISE is a single point of access to all condition monitoring data with the advantage of a customizable search functionality across the entire database. WISE consolidates all vehicle exceptions across installed monitoring systems to facilitate the analysis and efficient planning of required maintenance activities for a train.

WISE also integrates to SAP and other enterprise resource planning systems to create maintenance notifications. It is based on a SQL backend that houses all the data from all detector systems.

**Software Features**

- **Detector Status**: Status display for real time indication of wayside detector health
- **Train Listing**: Trains listed by detector site and number of alarms
- **Wagon History**: Historical data and images for all wagon history
- **Query Generator**: Generic query generation tool capable of simple through to complex composite queries
- **Alert Generator**: User customizable alarming tool based on predefined conditions such as trended or absolute measurements
- **Reporting Functionality**: Customizable reports for consist alarm notifications

**General Features**

- Capable of importing all wayside detector data
- Can be hosted either within a customer IT infrastructure or in the cloud
- Integration with Windows Active Directory to manage user access control
- Backend SQL database can be replicated to interface with other customer business systems
- Can be integrated with enterprise resource planning software (e.g. SAP, Maximo etc.)
- Automated defect reporting via email, SMS, SNMP etc

**Support for Complicated Composite Queries**

Immediate defect reporting using e-mail, SMS, etc.
Trimble® TrainWatch software is a powerful virtual train inspection portal. It provides a comprehensive environment where a train inspector can inspect a full train using data gathered by wayside equipment.

The environment is designed to provide different modes of inspection like animation, car based and/or component based.

The advanced technology utilized in TrainWatch works with one operator with multiple monitors where the content of each monitor can be customized by the user according to the inspection routine to be followed by the inspector.

TrainWatch users benefit from automated car component detection and segmentation algorithms running in the background to help simplify and speed up the inspection process.
Existing Trimble automated inspection algorithms are also supported within the TrainWatch environment. This allows required inspections to be managed using automated algorithms making the virtual inspection process even faster.

TrainWatch provides versatile reporting capabilities to facilitate train condition reporting, including cropping images of relevant sections directly into the report, adding comments, automatic identification of the car (wagon) that components belong to, and more. This innovative technology can link directly to Trimble WISE software for data display.

TrainWatch supports image data from all Trimble wayside detectors including the Trimble TrainView, TruckView, and CSCView systems, together with data display from other detector technologies such as impact detectors, hot box detectors, and acoustic bearing detectors.
Software Features

Inspections Mode

• **Animation**: Train motion is simulated at a desired speed
• **Car Mode**: Car by car data access with AEI identification attached
• **Component Mode**: Access and navigate through certain components
• **Mixed Mode**: Mix different modes of operation in a predefined form

Display Mode

• **Synchronous**: All displayed data are synchronized in time and location
• **Asynchronous**: Different customized cameras/cars/components display

Navigation Guide

• Graphical interface to view the camera orientation
• Assign cameras to display windows
• Navigation bar to show the current car position within the train
• Car list available for inspection

General Functions

• Customize all displays
• Audio support
• Image cropping for reporting purposes
• Adding comment windows throughout markers and tags on the train, car, components, etc.
• Excel report generation for train/car/component
• AEI (RFID) integration
• E-mail generation
Trimble. Intelligence in Rail.

Trimble’s rail solutions combine the latest in sensors and monitoring technologies with customized software and wireless communications to quickly and accurately capture the data needed to maintain and construct rail infrastructure or to manage rail transport assets. Trimble’s rail asset lifecycle management products manage the lifecycle of rail transport assets from operation through maintenance and repair.

In 2014, Trimble acquired Nexala of Dublin, Ireland, providers of data aggregation and analytics tools for engineering and operations of rolling stock. In 2017, Trimble acquired Beena Vision of Atlanta, Georgia, a manufacturer of vision-based automatic wayside rail inspection systems.

Using this comprehensive portfolio of on-board and wayside condition monitoring solutions, rail companies can improve operational efficiencies, manage service levels and reduce costs, while ensuring that service is maintained to the highest level.

Customers using Trimble solutions include major freight operators such as BNSF, Aurizon, Norfolk Southern, and Canadian National as well as many passenger operators such as South Western Railway, Eurostar, SNCF, Irish Rail, the Go-Ahead group, Arriva, and Greater Anglia among others.

For more information, visit:
rail.trimble.com
www.trimble.com/beenavision
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