



Rail Asset Lifecycle Management Solutions

Trimble Manages

THE COMPLETE RAIL ASSET LIFECYCLE

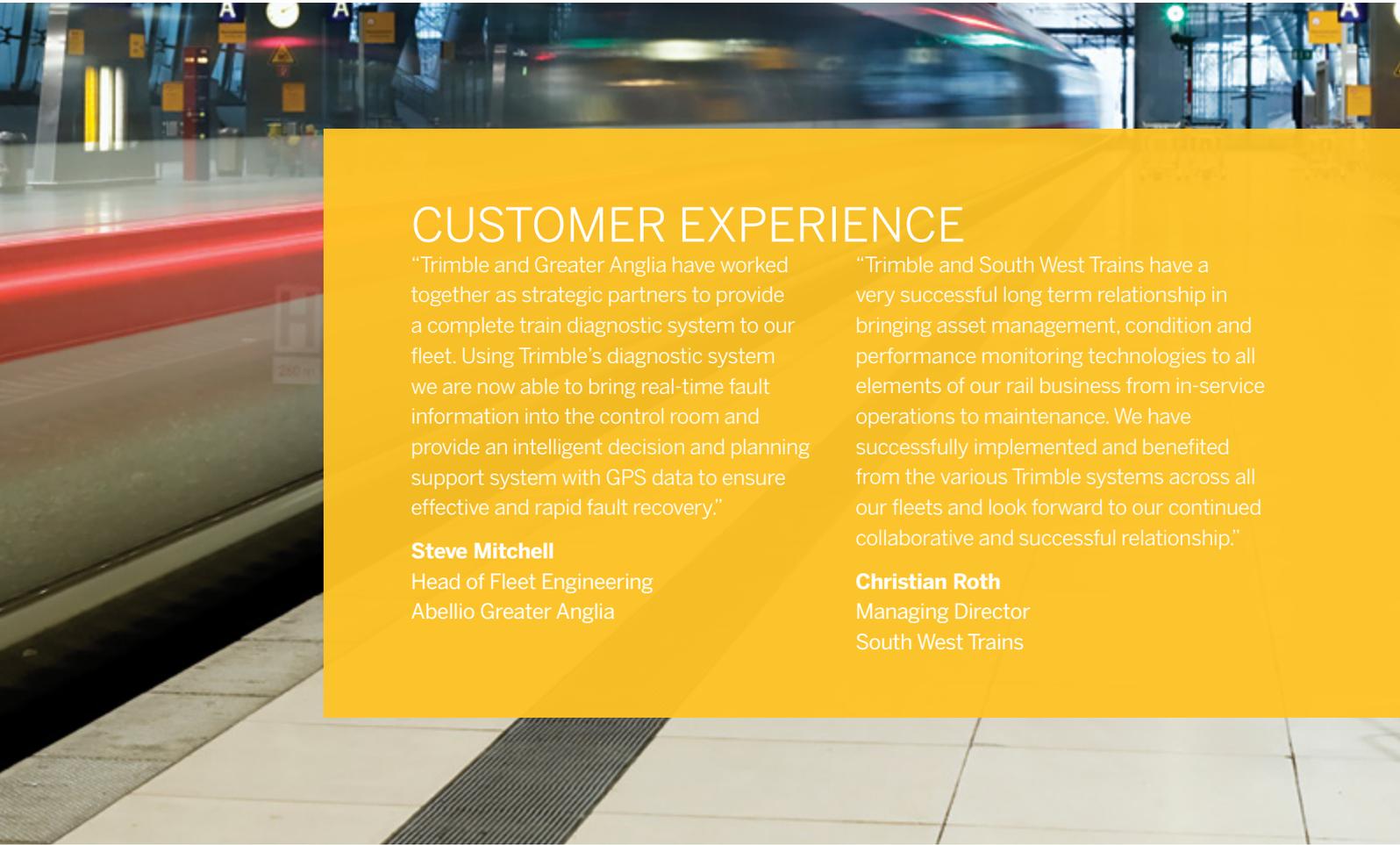


WHAT WE DO FOR YOU

Informed by years of experience in the industry, Trimble has developed an integrated suite of products specifically addressing the needs of the rail transport sector. A strong focus on research and innovation has enabled us to develop a product range with an extensive breadth and depth of functionality. Our portfolio addresses everything from full fleet maintenance, real-time remote vehicle diagnostics, and in-service vehicle performance, through to driver performance management and timetable adherence.

INTEROPERABLE AND FLEXIBLE

The Trimble® suite of rail asset lifecycle management products will allow you to develop a seamless solution across component and fleet types. Our flexible approach means we can tailor our systems to meet your exact needs.



CUSTOMER EXPERIENCE

“Trimble and Greater Anglia have worked together as strategic partners to provide a complete train diagnostic system to our fleet. Using Trimble’s diagnostic system we are now able to bring real-time fault information into the control room and provide an intelligent decision and planning support system with GPS data to ensure effective and rapid fault recovery.”

Steve Mitchell
Head of Fleet Engineering
Abellio Greater Anglia

“Trimble and South West Trains have a very successful long term relationship in bringing asset management, condition and performance monitoring technologies to all elements of our rail business from in-service operations to maintenance. We have successfully implemented and benefited from the various Trimble systems across all our fleets and look forward to our continued collaborative and successful relationship.”

Christian Roth
Managing Director
South West Trains

WE TAKE CARE OF TECHNOLOGY INFRASTRUCTURE

Trimble rail asset lifecycle products are delivered as software as a service (SaaS) solutions and are accessible through mobile devices, including iPhone, iPad, and Android systems, kiosks, touch-screen equipment, and standard PC workstations. This minimizes your data storage and hardware investment.

INTERNATIONAL REACH AND SUPPORT

Trimble has operations worldwide with a committed and experienced team offering global support and service.



Complete Solution

INTEGRATED PRODUCT SUITE



Trimble R2M System

REAL-TIME REMOTE DIAGNOSTIC MONITORING

The Trimble R2M system combines shore-based software and on-train equipment to deliver alerts of faults as they occur for effective condition based maintenance. Communicating with the maintenance depots in real time, it allows for efficient fault diagnostics, and work scheduling by the maintenance team. Furthermore, by analyzing irregularities of individual components and their behavior across the entire fleet, it allows maintenance actions to be performed to potentially avoid future failures.



Trimble E2M System

ENGINEERING MAINTENANCE MANAGEMENT

The Trimble E2M system is an enterprise-wide engineering, asset, and maintenance management system. It is designed to control assets, manage stock, streamline procurement, schedule workshop operations, and plan maintenance, in order to achieve optimum asset availability and labor utilization.



Trimble C2M System

COMPONENT CONDITION MONITORING

Trimble's C2M system combines trackside and handheld measuring devices with software analytics to proactively monitor wheels, brakes, pantographs, and other key components for wear and defects. By detecting and analyzing anomalies, it provides predictive advice of maintenance requirements and automates maintenance planning.



Trimble P2M System

IN-SERVICE PERFORMANCE PLANNING AND MANAGEMENT

The Trimble P2M system uses timetable, actual vehicle location, and real-time diagnostics information to help identify the root cause of delays and plan journeys for optimum timetable adherence. Through a combination of journey planning and improved driver awareness, it also maximizes energy/fuel efficiency, and helps manage driver behavior. P2M also provides the operations teams with in-service recommendations when fleet failures occur to reduce delays and penalties. And P2M provides notifications of potential in-service failures likely to occur across the entire fleet.

Trimble R2M System

REAL-TIME REMOTE DIAGNOSTIC MONITORING



Using a combination of shore-based software and on-train hardware **Trimble R2M** processes diagnostic data from rail vehicles in real time. It provides a comprehensive view of overall fleet status including specific vehicle faults and identifies potential faults that may arise.

It analyses and detects anomalies in on-vehicle component behavior to identify the status of component health and the possible impact this behavior may have on the vehicle and to the overall fleet. Also it can replay the events and behaviors that led to faults or incidents.

Benefits

- ▶ Increases mean time between faults reducing maintenance and running costs
- ▶ Immediately identifies faults and prevents potential faults improving fleet safety
- ▶ Pinpoints areas of difficulty for the vehicle operator (WSP, sanding, and overhead line voltage) enhancing infrastructure management
- ▶ Refines maintenance diagnosis and reduces “no fault found” outcomes lowering maintenance costs
- ▶ Lowers time between failures and decreases time taken to address faults optimizing maintenance programs
- ▶ Improves fleet reliability and availability

EXAMPLE SIGNALS AND SUBSYSTEMS

- ▶ TMS (Train management systems)
- ▶ Event recorders/OTMRs
- ▶ Power pack/traction
- ▶ Brakes/doors/batteries/HVAC
- ▶ Safety systems (e.g., AWS/TPWS)
- ▶ PA/PIS

Features

- ▶ Works with existing on-board event recorders and train management systems
- ▶ For older fleets additional sensors can be added as part of routine maintenance and included in the system automatically
- ▶ Facilitates interactive and predictive fault detection
- ▶ Rules engine functionality automates data processing by defining data values required to cause an alert to be fired triggering action
- ▶ New rules and alerts can be defined and added to the system without affecting vehicles in service
- ▶ Real-time cross fleet performance monitoring identifies trends as they occur within a fleet
- ▶ Displays real-time schematic view of key subsystems as trains are in service
- ▶ Tracks vehicle and fleet location through mapping software
- ▶ View cab equipment in real time from the control room to understand the driver’s experience
- ▶ Replay fault events to accurately diagnose root cause and repair actions during maintenance
- ▶ Recommends maintenance repair actions to the fleet maintainer based on the data received from on board systems



Trimble E2M System

ENGINEERING MAINTENANCE MANAGEMENT



Trimble E2M is an engineering asset and maintenance management system. Designed specifically for the rail sector it manages and controls assets and components, streamlines parts and materials usage, and oversees resource and procurement processes.

It allows your organization to maintain and manage the cost effectiveness of your assets by improving asset reliability, resource and capacity planning, and work utilization while reducing operating costs.

Benefits

- ▶ Prevents assets being unavailable for service because of repeat defects by tracking asset defect history over time improving asset availability
- ▶ Monitors stock usage over time and automatically defines parts reorder levels to ensure stock levels meet demand assuring stock availability
- ▶ Reduces repeat defects by identifying true causes minimizing labor costs
- ▶ Provides the fitment/receipt date, serial number, and complete history for every warranty claim raised so less are contested increasing successful number of claims
- ▶ Defines central stores to manage stock for satellite stores facilitating controlled centralized procurement
- ▶ Plans maintenance to identify opportunities and safeguards depot resources and infrastructure capacities are not exceeded so assets are maintained on-time in accordance with the maintenance schedule optimizing maintenance management

Features

- ▶ Efficient workshop management and defect reporting
- ▶ Cost jobs and book labor
- ▶ Set up campaigns and special checks
- ▶ Manage resource scheduling, training, and competency
- ▶ Plan maintenance across depots, resources, and material requirements
- ▶ Define asset hierarchy to manage assets
- ▶ Swap and track components across assets
- ▶ Plan and define exams
- ▶ Manage and procure stock with full stock check and component history support
- ▶ Supplier and warranty management
- ▶ Tools management
- ▶ Interfaces to finance systems

MOBILE APPS

- ▶ Trimble E2M Workshop app puts E2M functionality in the hands of your depot workforce wherever they need to be
- ▶ Trimble E2M Defect Reporting app means your staff can send reports direct to the Trimble E2M system from their phone or tablet

Trimble C2M System

COMPONENT CONDITION MONITORING



Trimble C2M provides full condition monitoring identifying the condition of all the key components being monitored and reports on defect identification, wear detection, and automates maintenance planning. The system utilizes a combination of shore-based software and interfaces to track side devices and handheld measuring devices. It proactively analyses and detects anomalies with particular component behavior and uses this information to identify the impact on maintenance and service for the entire fleet.

Benefits

- ▶ Tracks rogue behavior and determines proactive maintenance actions maximizing component life
- ▶ Plans efficient component maintenance improving fleet availability
- ▶ Understands ongoing component condition and utilization optimizing procurement
- ▶ Constantly monitors safety related component conditions improving safety

TRIMBLE WITH OUR SOLUTION PARTNERS PROVIDE A NUMBER OF TRACKSIDE SOLUTIONS FOR COLLECTING DATA

- ▶ BeenaVision (WheelView)—Trackside Wheel Profile
- ▶ NextSense (Calipri)—Handheld Wheel Profile
- ▶ Lloyds Register (Gotcha)—Trackside Wheel Impact Detection
- ▶ Lloyds Register (Gotcha APMS)—Pantograph Condition
- ▶ Track-IQ (RailBAM)—Trackside Hot Axle Box Detection
- ▶ Greenwood Engineering (Miniprof)—Handheld Wheel Profile
- ▶ Hegenscheidt (Lathe)—Wheel Turning Machine
- ▶ Sculfort (Lathe)—Wheel Turning Machine
- ▶ Talgo (Lathe)—Wheel Turning Machine

Features

- ▶ Integrates with trackside and depot equipment including wheel lathes, trackside measuring devices, handheld measuring devices, and on-train devices
- ▶ Provides a fleet summary view of the entire fleet identifying immediate problem areas (e.g. wheelsets, axles, brakes, shoe-gear, and pantographs etc.)
- ▶ Interactive and up-to-date condition monitoring and detection through the definition of rules and alarms using an intuitive graphical user interface
- ▶ Warning and danger level thresholds are specified for key measurements and the system automatically identifies and generates alerts when these thresholds are exceeded
- ▶ A procurement plan can be generated for each component type based on the typical replacement life of the component calculated by the system
- ▶ Interfaces to asset maintenance management systems for automatic inspections and repair scheduling



Trimble P2M System

PERFORMANCE PLANNING AND MANAGEMENT



The **Trimble P2M** in-service performance planning and management system uses timetable, actual vehicle location, and real-time diagnostic information to identify the root cause of delays and to plan journeys for optimum timetable adherence. Through a combination of journey planning and improved driver awareness, it also maximizes energy and fuel efficiency, and helps manage driver behavior. It also provides the operations team with in-service recommendations when fleet failures occur to reduce delays and penalties.

Benefits

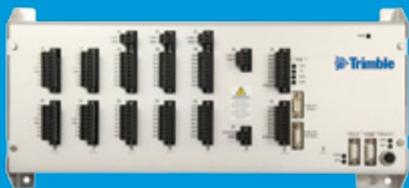
- ▶ Alarms and alerts in real time with recommended actions to rectify problems reducing in-service delays and performance penalties
- ▶ Analyzes in service performance constantly maximizing energy and fuel consumption
- ▶ Optimizes maintenance scheduling
- ▶ Uses timetable, location, and on-train diagnostic data improving service punctuality
- ▶ Minimizes timetable revisions by monitoring detailed route timing points and fleet location for greater timetable conformance
- ▶ Intelligently calculates optimal driving patterns reducing energy and fuel costs
- ▶ Correlates real-time on-train diagnostic data with delay information improving delay attribution

Features

- ▶ Identifies faults and patterns of faults using a detailed vehicle performance monitoring and recovery system to prevent in-service problems
- ▶ Graphical in-service fault finding guide
- ▶ Knowledge based fault recovery
- ▶ Tracks vehicle and fleet location through mapping software
- ▶ View cab equipment in real time from the control room to understand the driver's experience
- ▶ Facilitates interactive and predictive fault detection through the definition of rules and alarms using an intuitive graphical user interface
- ▶ New alerts and rules can be defined and added to the system without affecting the vehicles in service
- ▶ Real-time cross fleet performance monitoring identifies trends as they occur within a fleet
- ▶ Integrates with control room and maintenance depot
- ▶ Analyzes timetable performance
- ▶ Section delay analysis
- ▶ Real-time delay information and root cause analysis

Trimble NCU Control Unit

ON-BOARD CONDITION MONITORING



The **Trimble NCU control unit** is a rail industry approved on-board condition monitoring device that can connect to a large number of on-board train signals and systems. Extremely configurable and designed specifically to work with the Trimble R2M remote diagnostic system the control unit complies with the railway standard EN50155 for electronic equipment on rolling stock.

Features

The Trimble NCU control unit provides:

- ▶ A modular and expandable design, with a configurable number of digital and analog input signal modules
- ▶ Support for an on-train system architecture with multiple Trimble NCUs, connected through Ethernet or Wi-Fi, with data communications through a master Trimble NCU control unit
- ▶ Timestamp and GPS position stamping of all monitored data
- ▶ On-train data buffering when communications link is not available
- ▶ Remote monitoring and management of software and system configuration
- ▶ Seamless integration with the shore-based telemetry service
- ▶ Handles the transmission of large volumes of data
- ▶ Support for user requested downloads from TCMS, OTMR, and component controllers

SYSTEM INTERFACES AND COMMUNICATION MODULES

- ▶ IntegrDigital/Analog I/O Modules
- ▶ GPS
- ▶ 10/100 Base-T Ethernet (via M12 connector)
- ▶ Modbus TCP/IP
- ▶ RS232/RS485
- ▶ Isolated RS485
- ▶ 3G modem for data communications
- ▶ 802.11 b/g Wi-Fi

OPTIONAL MODULAR EXPANSION

- ▶ Profinet
- ▶ CANopen
- ▶ MVB (Type EMD)
- ▶ LONWorks
- ▶ 5 port Ethernet switch (M12 connector)



On-board & SaaS Technology

ON-BOARD TIMETABLE ADVISORY SYSTEM

Trimble CAB advisory is an on-board system that informs the driver about on-train performance and adherence to timetable. The system is designed for use on a tablet PC (iPad, iPad mini, or Android tablets) and can also be installed on an in-cab computer. The system also advises the driver in the event of a fault on the best recovery actions and advice to keep the train in-service.

Benefits

- ▶ Improves timetable conformance
- ▶ Reduces delay penalties
- ▶ Advises driver of in-service failures so corrective action can be taken
- ▶ Give drivers the ability to log defects when in service improving maintenance

Features

- ▶ Informs the driver of performance against the timetable identifying delays and also advising on recovery times
- ▶ Notifies on the overall journey performance and timetable adherence
- ▶ Advises the driver about energy and fuel usage and best driving style
- ▶ Informs the driver of in-service recovery options in the event of a fault
- ▶ Allows the operations team to communicate with the driver
- ▶ Supports electronic submissions by the driver to report faults and failures directly into the maintenance system

SAAS SERVICE AND MOBILE SUPPORT

All of Trimble's rail asset lifecycle management products are cloud-based software as a service (SaaS) solutions. This enables easy adoption without the need for a large IT infrastructure investment and the associated maintenance costs.

All products are fully web-enabled and accessible through mobile devices such as Apple iOS (iPad, iPhone), Android tablet PCs, touch screen kiosks, and any browser-based PC or device.

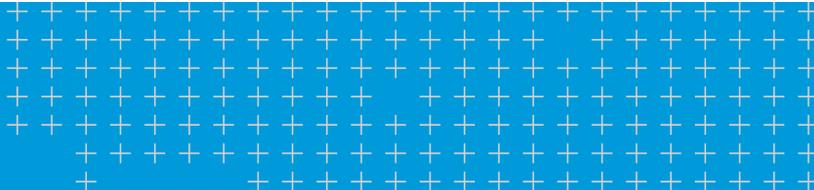
Benefits

- ▶ No upfront investment, use your current Internet enabled devices to access the Trimble suite of products immediately
- ▶ Reduces IT management and associated labor costs
- ▶ No infrastructure maintenance and backup costs
- ▶ Seamless upgrades and system maintenance

Features

- ▶ System can be scaled easily to meet increased demand and number of users
- ▶ Accessible through existing web-enabled devices
- ▶ Data archiving, backup, and system management
- ▶ Failover and multi-site security for disaster recovery
- ▶ 24 x 7 phone and email support





About Trimble's Railway Solutions

Trimble's railway solutions combine the latest in GPS/GNSS, optical, imaging, scanning, and monitoring technologies with customized software and wireless communications enabling users to quickly and accurately capture the data needed to provide clients with actionable deliverables to maintain and construct railway infrastructure or to manage rail transport assets. Trimble's solutions use integrated processes and workflows for complete railway infrastructure and asset lifecycle management. The solutions streamline operations to keep railway projects on time and costs on target.

Trimble's rail asset lifecycle management products are an integrated suite of on premise and software-as-a-service

(SaaS) solutions that manage the lifecycle of rail transport assets from operation through maintenance and repair.

These solutions allow rail companies to plan for the future, improve operational efficiencies, manage service levels, and reduce costs, while ensuring that the service they provide is maintained to the highest level. Customers using Trimble solutions to manage the lifecycle of their rail transport assets include South West Trains, Eurostar, SNCF, Irish Rail, the Go-Ahead group, Siemens Transportation, Alstom, and Abellio Greater Anglia among others.

For more information:

www.trimble.com/rail-assets

www.trimble.com/rail



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