

TRIMBLE. INTELLIGENCE IN RAIL.

# TRIMBLE CUSTOMER EXPERIENCE | NS GROEP N.V.



## Real-time monitoring enables efficient maintenance workflows

“Using the Trimble real-time remote monitoring system, the biggest benefit is that trains can be taken to the workshop before a break down, engineers know exactly what must be done, and what parts they need. As a consequence, trains can be put back into service quicker,” says Falco Mooren, Project Manager for Real Time Monitoring at the technical division of NS.

### Solution

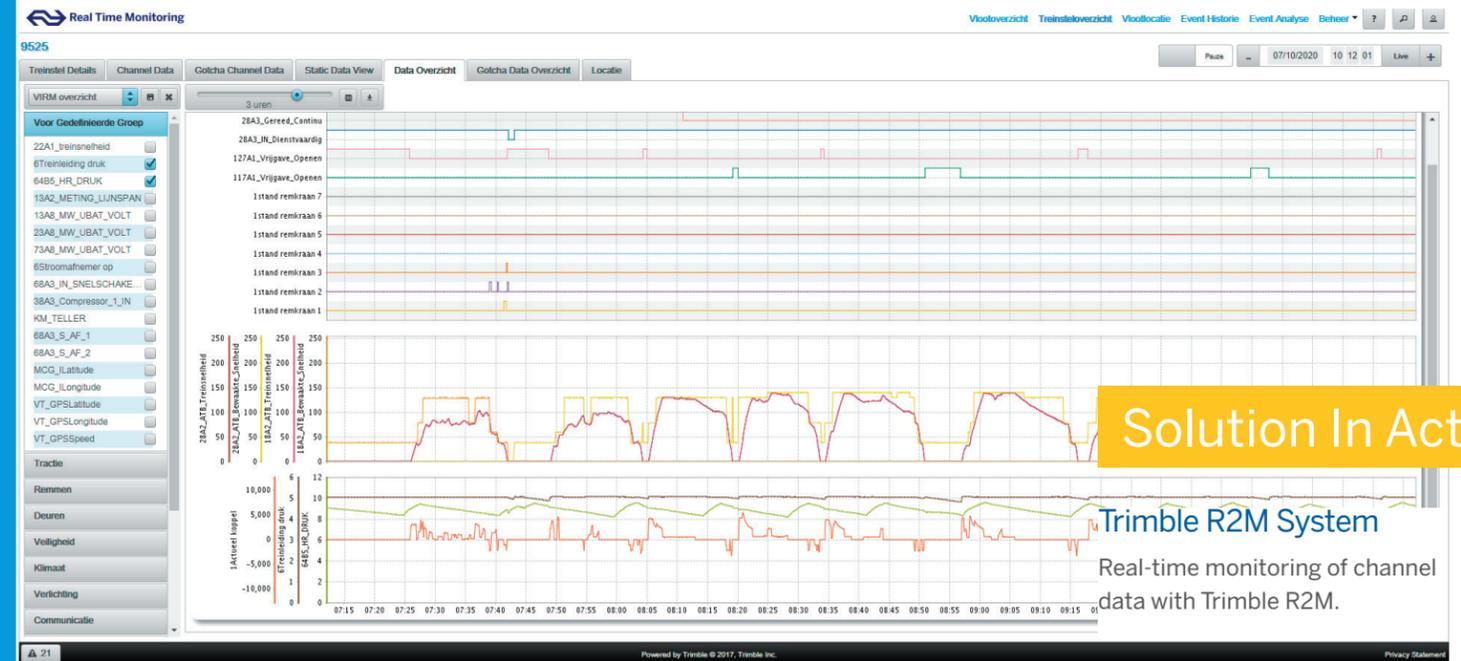
#### Trimble R2M System

Trimble's real-time remote diagnostic monitoring solution provides a comprehensive view of fleet status and identifies specific faults and potential faults that may arise.

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# Real Time Monitoring

NS Groep N.V. (NS), the Dutch state-owned rail company, has deployed the Trimble® R2M real-time remote diagnostics system as a core component of their overall real-time monitoring architecture. The system allows railway operators to streamline business processes, specifically target maintenance interventions, and significantly reduce costs, whilst increasing overall reliability and availability.



## CHALLENGE

In a modern train such as those used by NS, there are thousands of sensors that collect billions of pieces of data every day. This sensor data provides on-board systems' status but much more can be done with the data, such as preventing defects in service or minimizing the time to fix those that occur.

NS has a large and diverse fleet of more than 800 trains deployed to support one of Europe's most intensive train operating schedules. The size and complexity of their fleet and timetable requires highly reliable maintenance processes. Unexpected defects can cause serious disruptions that affect the timetable of multiple trains. For NS, there was a need to implement a software solution to reduce the amount of in-service failures and organize maintenance as effectively as possible to optimize processes to meet current and future demands. To maximize availability, it is crucial to detect defects in real time.

A standard part of the existing NS maintenance regime are manual technical inspections. Engineers carry out a (mainly) visual assessment of each train's technical status every 48 hours on every train in the fleet. Manual assessment however has its limitations. It is time consuming and the limits speed at which information can be transferred to depots or mobile engineers for action. The dependency on the time and location of trains presents logistical challenges as the train must go to a particular service location which may present capacity issues. Also, it is difficult to inspect below and above the train, meaning issues may be overlooked and several components cannot be effectively assessed visually.

To address these limitations and to improve fleet availability and increase customer satisfaction, NS sought to develop, test, and validate a maintenance process based on a semi or fully automated inspection system that needed to be more reliable than manual inspection alone.

"We needed to implement a system to help make the right diagnoses and to support train personnel to solve defects and we were aware that you can do an incredible amount with the train data," explains Falco,

## SOLUTION

At NS, the initial plan to use train data for maintenance and repair emerged in 2016. What made the plan innovative was the development of an agnostic solution for all trains and vehicles, regardless of manufacturer.

"Prior to implementing the Trimble system trains would go in for maintenance at regular intervals. In the interim we would only respond in a reactive way to complaints by staff or passengers when defects occurred. We can now be much more proactive and resolve issues before they affect our operation and can minimize the impact when they do occur", says NS Fleet Analyst Marco Schulte.

NS concluded it was impossible to adapt an existing system. "Every supplier has their own solution, but we have hardware from seven different manufacturers", says Marco. "It would be impossible to work with seven different systems so in 2016, NS launched a European tendering process for an overarching system to meet our maintenance needs and the contract was won by Trimble. We worked with existing components of the Trimble R2M solution as much as possible and where necessary components were specifically enhanced for NS and the first trains were coupled to the system in 2018."

Trimble R2M processes diagnostic data from rail vehicles in real time and provides a comprehensive view of overall fleet status including specific vehicle faults. The system also identifies potential faults that may arise while analyzing and detecting anomalies in on-vehicle component behavior and health and the possible impact this behavior may have on the vehicle and overall fleet.

Internal to NS the Trimble R2M implementation is called the Real Time Monitoring (RTM) system. With the Trimble R2M software, NS are able to aggregate data from a range of on-train and wayside sources and provide real-time information to the NS Control Room Helpdesk to monitor fleet status. Information is also available to other NS staff to support the in-service recovery process in real time. It enables NS staff to prioritize actions based on the flow of incoming data, provides a detailed overview, helps deal with large numbers of incoming alerts, and supports the repair process with real-time information for maintenance staff.

## RESULTS

### Fleet Wide & Manufacturer Agnostic

Since initial go live in 2018 the Trimble R2M solution has been rolled out across the NS mixed fleet consolidating data so that NS can maximize data use and optimize their maintenance processes. As of 2020, the system monitors 428 trains, from multiple manufacturers, with the ability to add more trains, from various manufacturers over time. Ultimately the entire fleet of 800 trains will be monitored.

### Benefits Across Entire Maintenance Workflow

#### Control Room Helpdesk

Within the control room, there a number of large screens showing the Trimble R2M system fleet summary data (traffic light coloring, fleet location etc.) and additionally the control room staff have Trimble R2M on their desktop.

As a result, staff can see in real-time when a fault or warning occurs. Depending on the configuration of the business rules written by NS an acknowledgment of an alert may be required which means that staff must to review the event and ascertain if remedial action is required (e.g. contact driver, raise a service request, dispatch mobile engineer etc.).

Staff can also see high-level information and drill into specific units, events, systems, sub-systems, and channel settings to investigate events further. Trimble R2M interfaces with the NS asset management system and displays information such as next exam due or outstanding/historical defects.

In the near future, each fleet will have a Trimble R2M Cab View screen. This can be used to assist with issue resolution or to recommend next steps (e.g. door isolation).

"The helpdesk for train personnel, now sees the same messages train drivers see. Train staff no longer need to send us an image of the defect as we can remotely check possible defects ourselves and give instructions remotely to get trains moving again or to ensure they do not continue if the defect is serious," says Marco. "In the past, we had to wait until an engineer got on board. Problems

only came to light during maintenance, or when reported by train personnel. When we developed this system we spent a lot of time mapping out business processes, so that we could streamline maintenance and deliver other services too. This process mapping allowed us to truly work out what data was relevant for train maintenance and repair."

#### Work Order Planner

As business rules are configurable in Trimble R2M depending on NS's preferences, service requests can either be automatically raised by the system or raised by the helpdesk and these requests are then pushed to NS's asset management system for the Work Order Planner to review.

The business rules are linked to faults which in-turn includes the fault description including the reason the event was triggered (i.e. thresholds breached, sensor data settings) and guidance on remedial action required.

#### Mechanics

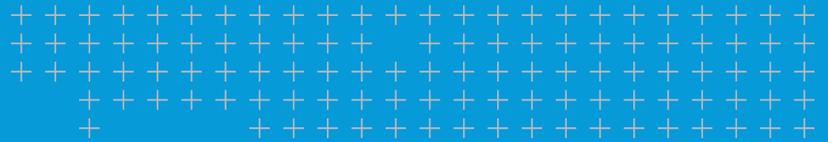
Mechanics have access to fault descriptions (data, remedial action, etc.) in the NS asset management system. With the R2M 'playback' functionality they can review a replay of the channel data leading up to an event and can further diagnose issues using event history and event analysis functionality.

#### Maintenance Engineers

NS Maintenance Engineers use full Trimble R2M functionality including channel data views and event analysis. Reviewing channel data from a specific point in time or over a defined period helps identify trends leading up to failures, recurring faults, or warnings. They can then develop or enhance business rules or take remedial action to prevent failures from re-occurring.

#### Technical Specialists

For technical specialists, the main benefit of the system is that they are no longer reliant on a second-hand description of defects— saving them lots of time. They no longer needs to go to a stranded train on location to determine where it is, whether it can be repaired, or if it needs to be towed away.



Using the system technical specialists from the NS fleet team can see the train maintenance history and past defects. According to NS technical specialist, Yunus Toy, who uses the system daily, there is often a pattern of recurring defects. He says, "We can rewind to look at behaviors of a train to see what happened when a defect first occurred. Now we do not need to ride the train to see how it behaves or to take measurements."

Now thanks to the Trimble R2M system when Yunus goes to a train he already knows what the problem is, so he can bring the right tools and parts with him. "People sometimes joke, saying I have half a train in my van, but that is more or less the case. Everything can break and if you do not have the right part with you, valuable hours can be wasted."

BENEFIT AREA	NS GROEP N.V.   REAL WORLD EXAMPLE BENEFITS
Customer Satisfaction	<p>Air conditioning problems can be detected and fixed before the heat of summer begins and targeted for repair. This has prevented the need to take trains out of service due to a malfunctioning air conditioning system on hot days.</p> <p>Early detection of issues such as blocked toilets. Previously passengers would use an alternative toilet and we would only be alerted if the other toilet would run out with water. We now see immediately when an issue occurs so it can be repaired in advance to avoid passengers being inconvenienced.</p>
Punctuality	<p>Thanks to remote driver support, when a train breaks down faulty sub-systems can be isolated to ensure the service can continue. This prevents the need for a full train reset that can take 10 minutes and easily result in tenfold of consequential delay of other trains.</p> <p>Delays are avoided through in time detection of increased temperatures due to clogged up traction filters. Early detection prevents the automatic switching off traction systems because of overheating.</p>
Infrastructure	<p>Early detection of infrastructure defects related to automatic train protection. This assists the infrastructure provider to have them repaired quicker with less delay minutes as a result.</p>

## CUSTOMER EXPERIENCE

"After a comprehensive tender evaluation process, the Trimble R2M system was a clear winner for us," said Falco Mooren, Project Manager for Real Time Monitoring for NS, the Dutch state-owned railway. "Trimble's rail industry experience and real-time monitoring solutions are extremely impressive and we are happy to have partnered with them to implement the system to improve service for our passengers."



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