

Operator Interface (HMI)

The Operator Interface is a web service based interface. The T&IMP server acts as a web server so any authorised Operator can access it using a standard browser. The Operator Interface collects all information, diagnostics and alarms received from the various WTMS and WIMS installed and displays them to Operator Interface HMIs at the Control Centre. All information provided to the Operator Interface HMIs is shown by train and by specific infrastructure.

The system authenticates each Operator through a Username and Password. The authentication provides different operator profiles, e.g. 'View Only Operator' (operator can only perform alarm recognition) or 'System Administrator' (typically sets the authentication and profile for all other operators).

The Operator Interface performs these functions:

- Highlights any alarm with a visual and acoustic (if required) warning signal
- Displays alarm details
- Manages alarm recognition
- Maintains a log of the Operators' activities
- Stores alarm information
- Displays a list of past and present transits with detailed data (including images whenever provided by the relevant sensor)
- Displays the system diagnostic status (for each subsystem)
- Allows the activation/deactivation of each subsystem
- Displays information and gives reports of statistics and trend analyses.

Train and Infrastructure Monitoring Platform

An integrated data collection platform that optimises planning and resources.

The Train and Infrastructure Monitoring Platform collates and analyses data from Wayside Train and Infrastructure Monitoring Systems.

The specific measurements collected are correlated with the corresponding train, vehicle and trackside infrastructure which enables operators working remotely from monitoring locations to identify, verify and make decisions whenever monitored parameters fall outside 'normal' ranges.

Information in the HMI screen

Schematic display of the selected transit

General information of the last transit

Key to search historic transits

Transit details

List of transits

Reflexion	Axe	Description	Vel. (m)	Vel. (mi)	Acc. (m/s²)	Vel. (mi/h)	Details
1		EMD SD70ACS-92165 Locomotive	22.63 m	4.95 mi	0	186.1	Details
2		EMD SD70ACS-92165 Locomotive	22.63 m	4.95 mi	0	186.1	Details
3		EMD SD70ACS-92165 Locomotive	22.63 m	4.95 mi	0	186.1	Details
4		Suphur Wagon	15.14 m	.00 mi	0	71.881	Details
5		Suphur Wagon	15.14 m	.00 mi	0	71.881	Details
6		Suphur Wagon	15.14 m	.00 mi	0	71.881	Details
7		Suphur Wagon	15.14 m	.00 mi	0	71.881	Details
8		Suphur Wagon	15.14 m	.00 mi	0	71.881	Details
9		Suphur Wagon	15.14 m	.00 mi	0	71.881	Details
10		Suphur Wagon	15.14 m	.00 mi	0	71.881	Details
11		Suphur Wagon	15.14 m	.00 mi	0	71.881	Details
12		Suphur Wagon	15.14 m	.00 mi	0	71.881	Details
13		Suphur Wagon	15.14 m	.00 mi	0	71.881	Details
14		Suphur Wagon	15.14 m	.00 mi	0	71.881	Details
15		Suphur Wagon	15.14 m	.00 mi	0	71.881	Details



Integrated Platform enhances Operational Safety, Availability and Efficiency.

The Train and Infrastructure Monitoring Platform (T&IMP) collects, analyses and delivers data sent from Wayside Train and Infrastructure Monitoring Systems to operators working remotely from monitoring locations.

It can manage several Wayside Train Management Systems (WTMS) and Wayside Infrastructure Management Systems (WIMS) from a single control centre. This means the individual diagnostic systems deployed over hundreds of kilometres of railway line can be integrated and full command and control capabilities achieved, in one single platform that supervises all of these subsystems.

An operator can access the data through a single user-friendly operator Interface that has an Internet connection, using the appropriate client authentication credentials.

The T&IMP collects all data received from the WTMS relating to:

- Train approach and exit from the site where WTMS and WIMS have been installed
- Measurements of parameters
- Alarms generated
- Radio-frequency identification (RFID) of trains
- Diagnostic states of WTMS and WIMS equipment
- Intelligent Maintenance through statistical and trend analyses.

The Train and Infrastructure Monitoring Platform provides a number of advantages:

- Increased operational safety – use of remote controlled interlocking and centralisation of operational control instead of manual inspection of passing trains and station infrastructure
- Increased availability of freight corridors - use of preventive recognition of upcoming fault status allows immediate interaction, minimising disturbances in traffic flow
- Improved maintenance – data available from the information storage and distribution platform supports the provision of reliable data to potential user groups.

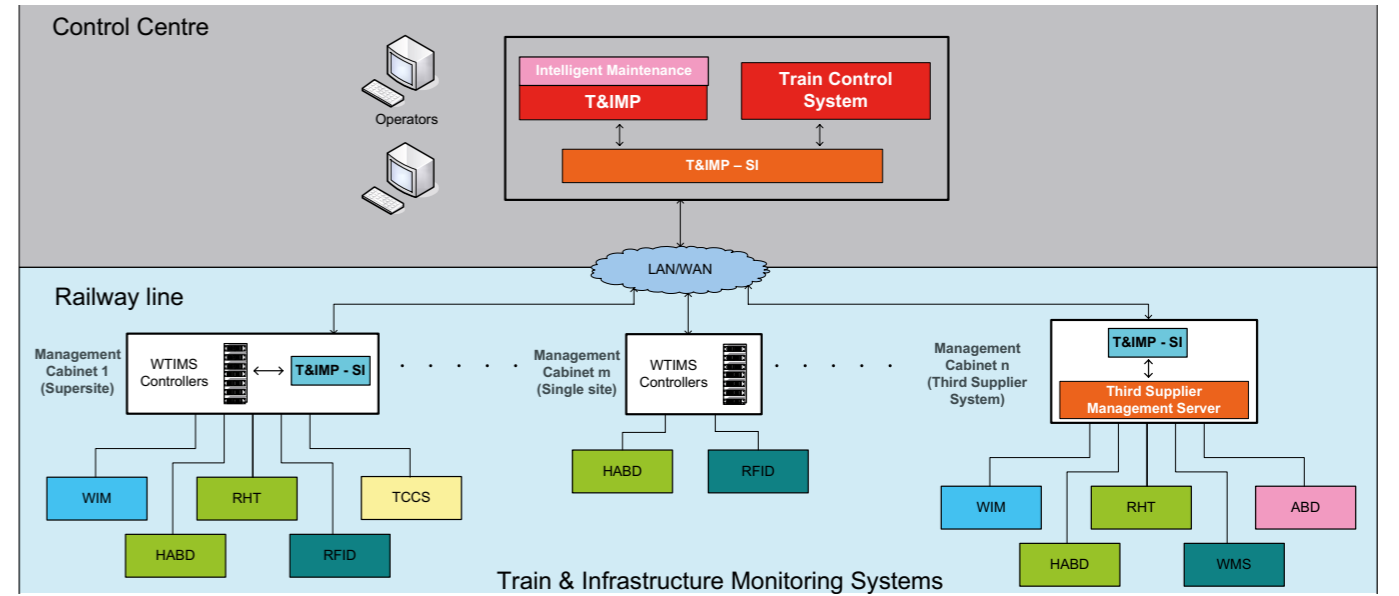
Architecture

The T&IMP architecture consists of:

- **WTMS and WIMS**
Such as the trackside installation of a Train Conformity Check System (TCCS), WIMS, Hot Axle Bearing Detector, Acoustic Bearing Detector, Rail Heat Temperature etc.
- **Management Cabinet**
Manages and processes the information received from WTMS and WIMS sensors.
- **T&IMP System Integrator (SI) Module**
Takes all information received from WTMS and WIMS, processes it, and produces normalised data. It also correlates measurements and diagnostic information to each train, vehicle and axle for each type of infrastructure. Sub point of T&IMP Systems Integrator (SI) Module. The T&IMP can be installed in the control centre and/or in the railway line. To be presented as either:
 - **Control Centre**
Can be installed in the control centre if all WTMS and WIMS installed near management cabinets are standalone.
 - **Railway Line**
Can be installed in the railway line if there is more than one WTMS and WIMS installed near the management cabinet, and there is only one management cabinet with WTMS and WIMS.
 - **Control Centre & Railway Line**
Can be installed in both the control centre and railway line if there are several WTMS and WIMS distributed in the railway line and installed near management cabinets.

- **T&IMP**
Stores data received from the T&IMP-SI and displays to operators in a user-friendly man machine interface (MMI).
- **Intelligent Maintenance System**
Collects all processed information from the T&IMP-SI and applies statistical processing algorithms to support preventive and predictive maintenance, improve maintenance planning etc..

The T&IMP modular architecture is open to enable the integration of pre-existing WTMS and WIMS. Additionally one or more WTMS and WIMS systems can be added at a later date.



T&IMP Architecture

Installation Sites

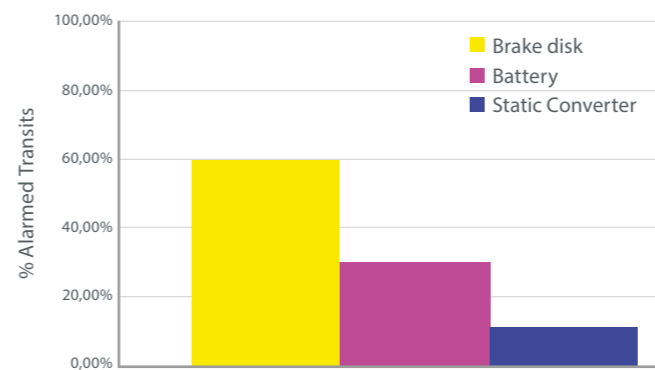
A single site has one WTMS system installed, while a supersite has several WTMS and WIMS. If there are supersites in the railway network, the T&IMP provides two levels of management of information:

- Site-based or Global where operators are able to monitor the entire rail network.

Intelligent Maintenance Systems

The Intelligent Maintenance System (IMS) collects and analyses information received from the various WTMS and WIMS via the T&IMP-SI.

This information is collected over time and analysed for use in predictive condition monitoring, contributing to improvements in maintenance planning.



Component	n. of Alarmed Transits	% Alarmed
Brake disk	4	57,14%
Battery	2	28,57%
Static Converter	1	14,28%

Regular monitoring reduces the number of train and infrastructure failures which in turn increases track availability and reduces maintenance costs.

This is achieved through the use of analysed data to reduce the frequency of unnecessary maintenance on vehicles and infrastructure. Using the HMI, the Operators can query the system to investigate the performance of the trains, vehicles, and components that are monitored by WTMS and WIMS.

The system develops regular reports (frequency defined by the user) or the Operator can access the system and create reports as required. The system allows different kinds of Operators to be configured e.g. Standard Operator (view information using default filters); Specialized Operator (can create new filters).

Interface with other Systems

T&IMP can be interfaced with other systems, such as:

- Train Control System (TCS): Measurements, alarms and diagnostic data received from the WTMS and WIMS is sent to TCS
- Signalling Control System (SCS): HWD, HABD and DED data is sent to the SCS
- Radio Block Centre (RBC): Alarms generated by Wheel Impact Load Detection, Hot Axle Bearing Detection and Hot Wheel Detection systems are sent to RBC via TMS. The RBC informs the Train Driver of the alarms received
- SCADA: Measurements, alarms and diagnostic data received from the WTMS and WIMS are sent to SCADA
- Maintenance Management Information System (MMIS): Measurements, alarms and diagnostic data received from WTMS and WIMS is sent to MMIS.