

Weigh In Motion (WIM) Wheel Impact Load Detector (WILD)

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Main Features

It was designed to detect automatically the load weight of a moving train, the load imbalances and the overloads.

Also, the system is able to monitor the rolling surface of any wheel in transit along the rails, measuring the impact load on the rail of each wheel and detect any type of defect, such as: wheel flats, out of roundness, polygonisation.



Advantages

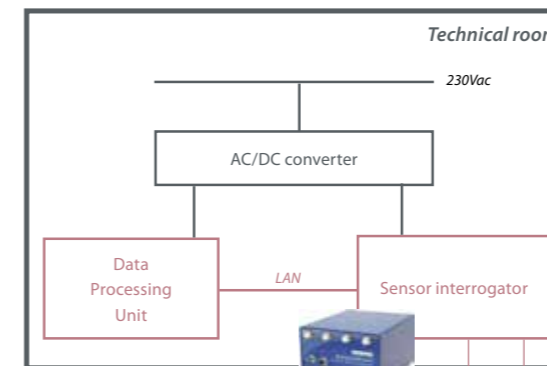
The actual mounting takes only few minutes and no special preparation of the rail is required (no rail drilling and no installation platform). The installation doesn't require modification of existing track structure and no specific foundation is needed. For this reasons, the system ensure a fast and easy installation on existing standard rails.

The innovative technology and design of the fibre optic sensor give the measure point several advantages:

- reduced overall dimensions and minimal impact on the track
- no modification of the structural or physical characteristics of the rail (no rail drilling and no installation platform required, therefore rail "changes" are not at all required)
- ease of installation and removal
- no electric/electronic circuits along the rail
- fibre optic cables (electric cables are not used)
- electromagnetic immunity of the equipment
- no power supply required, therefore all insulation specifications are met
- wide working temperature range (-40 ÷ 85 °C)
- robust construction for operation in harsh conditions
- WIM&WILD sensor has been tested and certified in railway applications in compliance with European Norm EN50125-3 and IS402.



Typical System Installation Layout



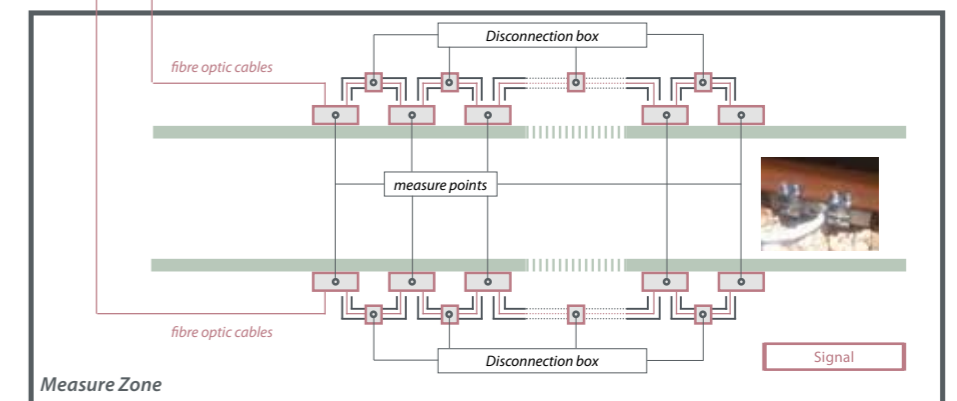
The WIM & WILD system sensors are set in parallel along the two rails.

Every WIM & WILD sensor is fitted with fibre optic cables provided with proper connectors in order to implement the connection between two successive sensors. This connection is implemented via an adapter of the same type compatible with connectors.

An IP67 box referred to as "Disconnection box" shall be used to protect fibre optic connectors and adapter.

Technical room
Technical room near the "Measure Zone" in which processing units and sensor interrogator are located.

Measure Zone
Track section equipped with fibre optic sensors anchored to the rail foot by means of clamps.



Functions

The system performs the following main functions:

- Transit Train Detection
- Weight Measure Calculation
- Wheel Impact Load Measures and Wheel Defect Detection
- Load Imbalance/Overload Detection and Alarm Generation
- Train Consist Recognizing.

The output measures for each transit are reported in a files, which is stored on disk and is available to operators. Measure results and alarms can be used for statistical analysis.

Transit train detection

When a train passes in the measure zone, regardless of the running direction, any one sensor detects its transit. The system requires no remote “transit announcement” sensor.

Sensor data storing is incremental and is considered as completed when the last wheel of the train leaves the measure zone. Transited trains are univocally identified by transit date and time, contained in the data file name.

Weight measure calculation

The system, for each train transited in the “Measure Zone”, determines the following data:

- direction of transit
- average transit speed
- total number of axles
- gross weight of wheel
- gross weight of axle
- gross weight of bogie
- gross weight of wagon
- total train weight
- total train length.

System accuracy is 2%.

Load imbalance/overload detection and alarm generation

Weight measure values are compared to threshold values to check the presence of the following alarms:

- axle overload
- transverse axle imbalance
- transverse wagon imbalance
- longitudinal wagon imbalance.

Alarm thresholds for the different measures can be configured by the operator.

For each generated alarm, the following data will be provided:

- the type (axle overload, transverse axle/ wagon imbalance, longitudinal wagon imbalance)
- the involved vehicle
- the axle / side of the vehicle involved in the alarm
- the read value exceeding the threshold values.

Wheel impact load measures and wheel defect detection

The system monitors the entire rolling surface of each wheel and provides the following impact load measurements:

- average wheel impact (Qstatic)
- peak wheel impact (Qmax)
- dynamic load (Qmax – Qstatic)
- dynamic ratio (Qmax/Qstatic)
- identification of defected wheel.

The analysis software identifies a defected wheel and distinguishes the type of defect (wheel flat, out of roundness and polygonisation). The defected wheel is signalled to the operator by the user interface.



Train consist recognizing

The system recognizes the vehicle types of the train that is transited in the “Measure Zone”, using the axle distance measurements and comparing them to the structural vehicle information recorded in a database.

For this function, the system must be initially configured for the characteristics of the cars that operate on the rail network. The system input data will include car’s identity and structural data (number of axles, axle spacing, maximum design axle load, etc).



Integration

RFID

WIM&WILD optionally includes a tag reader to enable Automatic Vehicle Identification using RFID tags. The tag information are correlated to the WIM&WILD data output. The antenna reader is interfaced via LAN.

T&IMP

WIM&WILD system can be integrated to the Train and Infrastructure Monitoring Platform (T&IMP). It sends all the information (measurements, alarms and diagnostics) to the T&IMP via LAN.

Calibration

The system is automatically calibrated using vehicles of known weight. Alternatively the average weight of engines passing the site can be used.

The system must be re-calibrated yearly, or more often, depending on the specific operating conditions.

Auto-Diagnostics

The system is equipped with auto-diagnostic tools which routinely check the operating conditions of the individual components of the system and detect automatically the following failures:

- sensor failure or sensor acquisition chain failure;
- measure equipment failure.

In the event of a failure to certain components, the system will operate in “degraded” mode, highlighting its condition together with the weight measures of the transited train.

General features

Product name: WIM & WILD

Power Supply

Outdoor equipment [W]: power supply not required

Indoor equipment [W]: 125

Mechanical features

Individual sensor size (l x h x d) [mm]: 200 x 150x100

Installation: fibre optic sensors anchored to the rail foot, installed on a track section and parallel-distributed along both rails.

Environmental and climatic features

Outdoor equipment [°C]: -40 ÷ 85

Indoor equipment [°C]: -20 ÷ 60

Connector box IP degree: 67

Humidity [%]: 0 ÷ 95

Electromagnetic interference: immune

Performance

WIM accuracy: 2%

Operating speed [Km/h]: > 2 km/h for WIM functionality
> 25 km/h for WILD functionality

Typical train length [km]: 3.2

WILD resolution [N]: 50

Defects recognized: flats, out of roundness, polygonisation

Regulations and Norms

EN 50125-3, EN 50121-4

The above technical features may be changed with no advance notice.



Human Machine interface (HMI)

The processor acts as a web server and, any HMI workstation can access the data stored by the processor with the help of a standard internet browser.

This means that a Controller/Operator or Maintainer may access the data via their workstation or laptop if the computer is linked into the rail operator's network (TCP/IP protocol).

The HMI provides the following functionality:

- Highlight alarms with a visual and acoustic (if required) warning
- Display alarm details
- Manage alarm recognition
- Maintain a log of Operator activities
- Store, alarm, vehicle related data and, diagnostic information
- Display a list of past and present train movements and consist data
- Display the system diagnostic status (for each item of equipment).

The system authenticates an operator using Username and Password credentials. The authentication provides different operator profiles, e.g.: "view only operator" (in this case the operator can only perform alarm recognition) or "System Administrator". A nominated operator, (i.e. System Administrator) typically sets the authentication and profile for all other operators.

The WIM & WILD system output data is typically provided to the relevant Train Control Centre for display and storage into database.

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

Order	Equipment	Length	Speed	Direction	Time	Track	Details
1	END 0270AC3-92185 Locomotive	22.83 m	4.95 m/s	6	18:11	Details	
2	END 0270AC3-92185 Locomotive	22.83 m	4.95 m/s	6	18:11	Details	
3	END 0270AC3-92185 Locomotive	22.83 m	4.95 m/s	6	18:11	Details	
4	Sulphur Wagon	15.14 m	.00 m/s	4	71.88%	Details	
5	Sulphur Wagon	15.14 m	.00 m/s	4	71.88%	Details	
6	Sulphur Wagon	15.14 m	.00 m/s	4	71.88%	Details	
7	Sulphur Wagon	15.14 m	.00 m/s	4	71.88%	Details	
8	Sulphur Wagon	15.14 m	.00 m/s	4	71.88%	Details	
9	Sulphur Wagon	15.14 m	.00 m/s	4	71.88%	Details	
10	Sulphur Wagon	15.14 m	.00 m/s	4	71.88%	Details	
11	Sulphur Wagon	15.14 m	.00 m/s	4	71.88%	Details	
12	Sulphur Wagon	15.14 m	.00 m/s	4	71.88%	Details	
13	Sulphur Wagon	15.14 m	.00 m/s	4	71.88%	Details	
14	Sulphur Wagon	15.14 m	.00 m/s	4	71.88%	Details	
15	Sulphur Wagon	15.14 m	.00 m/s	4	71.88%	Details	

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