move SOLUTIONS

SMART RAILWAY MONITORING

The all-in-one system for **Railway** Monitoring

The complete solution for **Static SHM**, **Dynamic SHM** and **Geo-environmental monitoring**

Track monitoring • Ballast void • Rail Bridges • Subways • Track monitoring • Ballast void • Rail Bridges • Subways • Track monitoring • Ballast void • Rail Bri

Track conditions

Vertical Deflection, Cant and Twist

Ballast Void

Ballast conditions, Settlement of the track, dynamic displacement and Frequencies

Slope stability

Slope angle variations, Groundwater level and Weather conditions

Railway bridge

Oscillation and Vibration peaks, Modal analysis, Deck deformation, Span stability, Joint behaviour

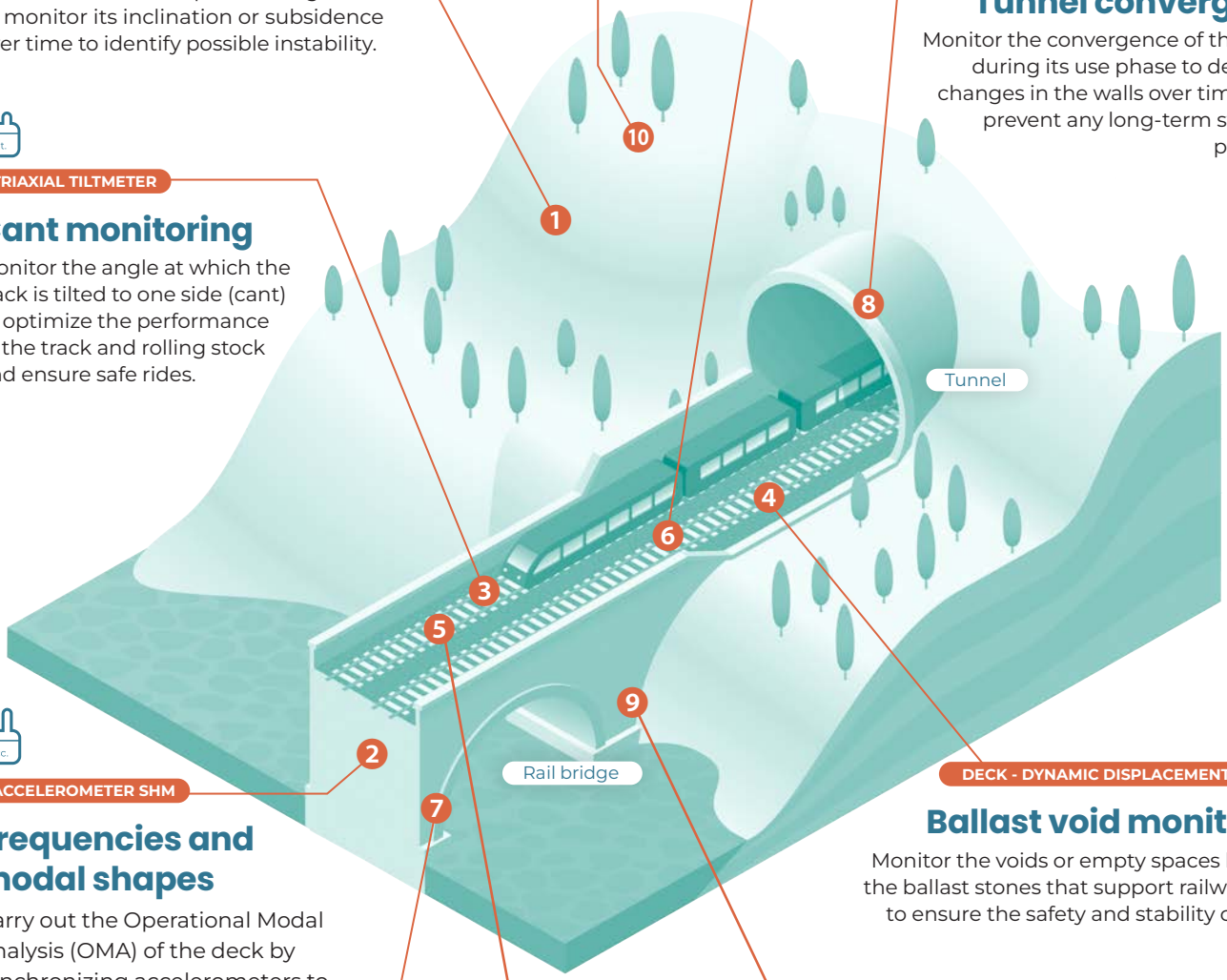
Railway tunnel

Convergence, Longitudinal settlement, Deformations and Cracks

www.movesolutions.it

✔ Enhance safety ✔ Increase productivity ✔ Improve decision-making

Smart Rail Monitoring
with Dynamic and Static Wireless IoT Sensors



TRIAXIAL TILTMETER

Twist monitoring

Monitor the expansion of the bridge joints to ensure that they expand and contract within acceptable limits.

GATEWAY PRO

TRIAXIAL TILTMETER

Slope monitoring

Install tiltmeters on a post in the ground to monitor its inclination or subsidence over time to identify possible instability.

TRIAXIAL TILT-BEAM

Tunnel convergence

Monitor the convergence of the tunnel during its use phase to detect any changes in the walls over time and to prevent any long-term structural problems.

TRIAXIAL TILTMETER

Cant monitoring

Monitor the angle at which the track is tilted to one side (cant) to optimize the performance of the track and rolling stock and ensure safe rides.

ACCELEROMETER SHM

Frequencies and modal shapes

Carry out the Operational Modal Analysis (OMA) of the deck by synchronizing accelerometers to identify relevant vibration modes and their evolution over time.

DECK - DYNAMIC DISPLACEMENT SENSOR

Ballast void monitoring

Monitor the voids or empty spaces between the ballast stones that support railway tracks to ensure the safety and stability of railway tracks.

SINGLE CHANNEL NODE + CRACKMETER

Bridge joint monitoring

Monitor the expansion of the bridge joints to ensure that they expand and contract within acceptable limits.

TRIAXIAL TILT-BEAM

Vertical settlement

Monitor the downward movement of the track and its supporting structures for early detection of uneven tracks.

SINGLE CHANNEL NODE + PIEZOMETER

Water pressure and level

Monitor the interstitial water pressure and changes in groundwater level to detect changes in the surrounding soil and potential hazards to the railway.

Wireless sensors for railway monitoring

• Track monitoring • Ballast void • Rail Bridges • Subways

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ACCELEROMETER SHM

It measures acceleration (*mg*) and frequency (*Hz*) on three axes, and it can be synchronised to other **accelerometers SHM** for **Modal Analysis**.

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DECK DYNAMIC DISPLACEMENT SENSOR

It measures the dynamic amplitude of the displacement (mm) and the vibration frequency through an **FFT algorithm**.

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TRIAXIAL TILTMETER

It measures triaxial tilt changes, with a resolution of 0.000015° (0.00027 *mm/m*) and the option to be synchronized to other **tiltmeters**.

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SINGLE CHANNEL NODE

It makes **geotechnical and environmental probes** suited for wireless communication, sending alarms when a certain **activation threshold** is exceeded.

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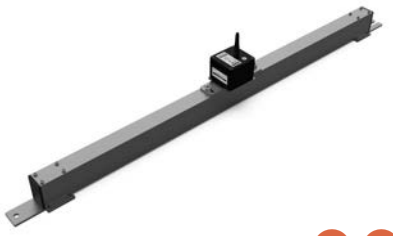
GATEWAY PRO

It acts as an intermediary, using **LoRaWAN** communication to collect data measured by the sensors and transmitting them to the **Cloud Platform** where they can be processed and analyzed.



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TRIAXIAL TILT-BEAM

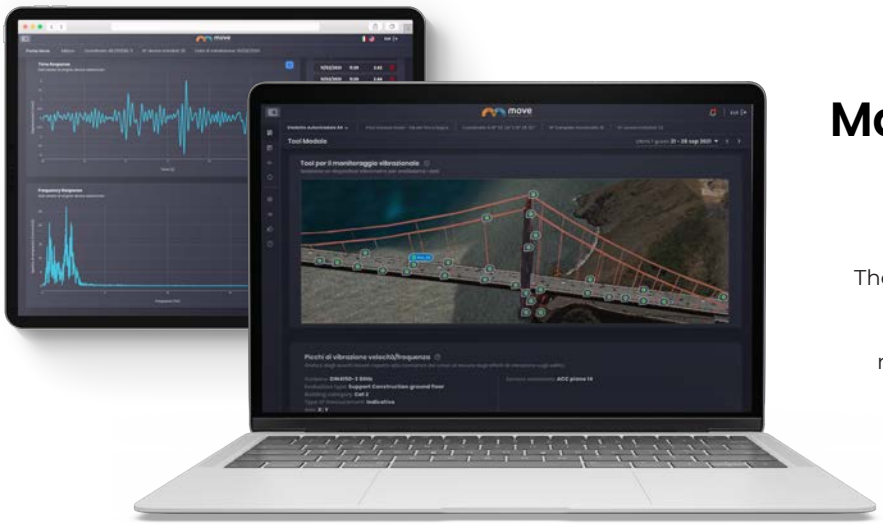
It consists of a series of **tiltmeters** attached to a bar, which is then affixed to the structure to measure the degree of slope or tilt over a large area.

All our sensors are **battery powered** and they also measure **temperature**.

CASE STUDY

Railway Bridge • Casella, Italy

Located on the Scrivia river, the bridge is about 160 meters long and is divided into 7 spans with lowered arches, in reinforced concrete. Move Solutions wireless SHM sensors were used to monitor the health of the structure; a **Deck** (dynamic displacement sensor) was installed on the intrados of the arch and on the piles to record all the dynamic events caused by the passage of the train at high speeds, and a **triaxial tiltmeter** was used to monitor the inclination of the structure.



IoT Data Management
Make decisions based on clear information

The **Move Cloud Platform** offers a single workspace to monitor and manage infrastructure project data. Automate the processing and diagnosis of data by receiving accurate and timely information about the health of a structure.

Cant along the tracks

The **Cant** is the transversal inclination of the railway expressed as the height difference in millimeters between two rails.

The Cant is estimated using the angles provided by the **tiltmeters** installed on the sleepers.

Twist along the tracks

The **Twist** is the difference between two transversal levels measured separately at a predefined distance.

To calculate Twist it is necessary to process the data collected by two consecutive **tiltmeters** on the sleepers.

Vertical Settlement

The **Vertical Settlement** graph shows the deformation profile of the track on the vertical plane.

Each point of the chart corresponds to the displacement values in millimeters provided by each sensor that forms the **tilt-beam chain**.

Learn more about all the tools of the **Move Cloud Platform**
www.movesolutions.it

Smart Structural Health Monitoring
A comprehensive solution

Our Smart Structural Health Monitoring (SHM) system offers a complete solution that helps detect potential issues before they become critical, ensuring the safety and longevity of structures.

Wireless system

Avoid expensive and complex installations thanks to battery-powered, LoRaWAN-based and long-lasting devices.

Remote monitoring

View all sensor-collected data on our Cloud Platform, accessible from any computer at any time.

Threshold setting

Configure sensors according to your needs to receive automated alerts of threshold breaches.

Static SHM

Static structural health monitoring measures slow-varying parameters over a long period of time, such as inclination, rotation, static displacement, and crack monitoring. This type of analysis is appropriate for structures that are subject to gradual load changes.

Dynamic SHM

Dynamic structural health monitoring is used to handle dynamic loading, such as frequencies, dynamic displacement, modal forms, vibrations and accelerations. This type of analysis is suitable for structures subject to fast impacts involving frequencies and vibrations.

Geo-environmental

Geo-environmental monitoring refers to the process of monitoring environmental factors that can impact the stability of a site, such as soil movement, groundwater levels, and changes in the soil's chemical composition.

SMART RAILWAY MONITORING

✔ Enhance safety ✔ Increase productivity ✔ Improve quality

move
SOLUTIONS

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