INTEGRATED MONITORING SYSTEM (IMS) FOR SLEEPERS

State-of-the-art track and sleeper design requires exact knowledge about the impacts caused by the railway operation. RAIL.ONE's Integrated Monitoring System (IMS) allows obtaining the real loads and deformations, and thus stresses, occurring in sleepers directly in the track. The system can be installed in any kind of sleeper and it allows collecting data in all types of tracks, from heavy haul traffic to urban transit.

System description

The loads from railway operation are longitudinally distributed by the rails and transferred to the sleepers at the rail seat areas. The resulting deformation can be measured by sensors placed on the sleeper surface and/or embedded into the sleeper body (see Figure 3 and 4). From the obtained results, the real stresses in the sleeper can be determined. The IMS consists of two measuring units which can work together or separately.

ADVANTAGES & BENEFITS

- Quick installation in natural operational down times
- Removable and exchangeable without affecting the railway operation
- Long-term durability
- Simple calibration
- Possibility to analyze the evolution of track parameters and boundary conditions over time (sleeper life time)
- Suitable for all fastening systems and rail types as well as for all speed and tonnage ranges
- Unlimited and flexile measurement time
- Suitable for use in new sleepers and/or under certain conditions in sleepers already installed in track

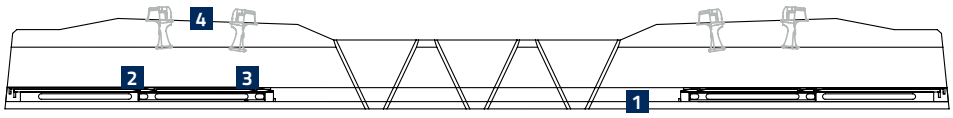

Figure 1: Sleeper with IMS installed in rail seat area

1 Steel pipe embedded into the sleeper body
2 Precision steel pipe with IMS
3 Laser-sensor set for measurement of deformations at rail seat area
4 Sensor integrated at rail seat for load measurement

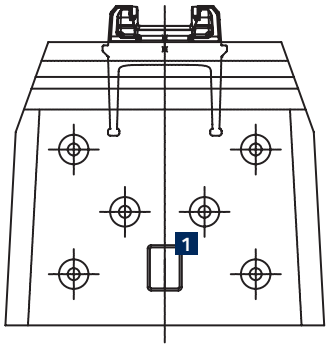

Figure 2:
Side view of sleeper with IMS

1 Steel pipe embedded into the sleeper body

Sensor-laser technology to register deformations

Sets of lasers and sensors are positioned in the sleeper body under the rail seat areas and/or in the center section at the level where the maximum deformations occurs. They are installed in removable housings, which can be temporarily installed and exchanged between sleepers (see Figure 1). The wheel loads of the passing trains cause deflection of the rail and of the sleeper and displace the laser light spot proportionally to the bending moment.

Intermediate rail pads to register loads

Static and dynamic wheel-rail forces are obtained by the use of rail pads containing a special sensor (see Figure 5). The sensors are able to record on one side information about the rolling stock, like loads introduced in the rail seat, vehicle data, dynamic behavior of the passing trains, etc. On the other side all relevant information about the superstructure, like load distribution, non-supported sleepers can be evaluated as well.

For the noise and vibration considerations the introduced frequencies can be detected additionally. The pads are removable and exchangeable. Their geometry and stiffness is accordingly adjusted to the used fastening system.

INNOVATIONS

- Monitoring of various parameters in the track and sleeper (load distribution, non-supported sleepers, level of ballast pressure, etc.)
- Detection of load-deformation correlation in the sleeper
- Sleepers and monitoring system are independent
- Usable without affecting the railway operation

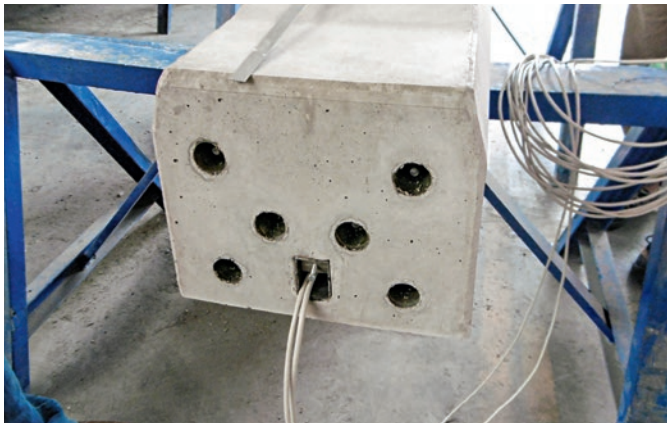

Figure 3: Sleeper cross section with IMS embedded into the sleeper body

Figure 4: sensors on top of the sleeper center

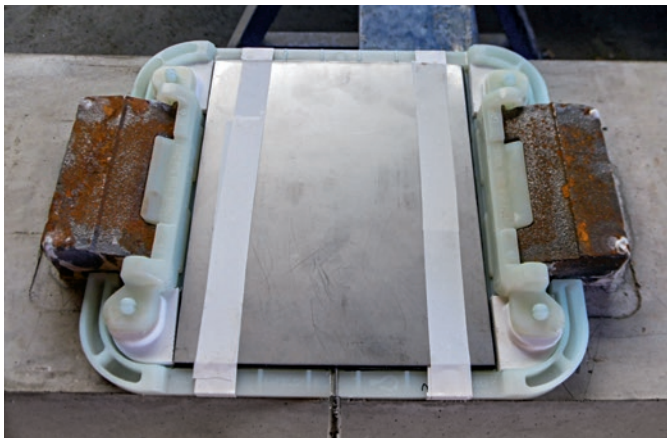

Figure 5: Intermediate pad with sensor at rail seat