# Tunnel & Clearance Measuring Systems

TUNNEL & CLEARANCE

Advanced and Accurate
Tunnel & Clearance Inspection

The swelling or subsidence of the ballast or the presence of objects infringing the train's clearance profile pose dangerous hazards for rail vehicles.

Increasing availability of railway systems requires improved safety features as well as introducing a cost-efficient way for infrastructure operators to monitor and maintain their lines.

The successful execution of this task strictly depends on the appropriate choice of diagnostic tools and methods. Railway operators looking for improving the safety of their networks have to carry out regular inspections to avoid accidents.

MERMEC group

# T·SIGHT 5000

## High Performance Clearance Gauge and Tunnel Walls Inspection System

T·SIGHT 5000, based on optical triangulation technology, is the integrated multipurpose vision solution for performing the inspection and automatic analysis of the infrastructure's status. The overall solution has been designed for seamless integration and perfect interoperability of the two main components, Clearance Gauge and Tunnel Walls Inspection. Nevertheless, the two systems are modular and can be installed separately. The combined action of the systems enhances inspection capability and advanced analysis of not only tunnels, but also bridges, underpasses, pylons, walls and any other obstacle which can cross the clearance profile.

> **4 Million points/s measured**
> **80 Mpixel/s data images acquired**
> **2760 laser emitters**

T·SIGHT 5000 uses an accumulated image during the integration time. All the objects inside the cross section are scanned by the laser beam and reflected inside the camera. As the object moves through the laser beam, contour slices are generated and the complete object shape is reconstructed by uniting all the acquired sections.
The visual information coming from the Tunnel Wall Inspection System is used to automatically evaluate the surface conditions of the tunnel walls, indicating possible cracks and other damages in the structure itself.

### Main functionalities of T·SIGHT 5000

〉 Clearance profiles acquisition
〉 Objects' position detection
〉 3D Ballast profile acquisition and analysis referenced to the sleepers
〉 Deviation from a theoretical 3D profile in fixed location (e.g. wooden structures or sleepers)
〉 Detection of abnormal swelling or subsidence of the ballast
〉 Tunnel wall inspection in order to automatically detect and classify cracks and swelling
〉 Distance measurement of neighbouring tracks
〉 All measured parameters are referenced to the track's centre, track geometry data and kilometric progressive
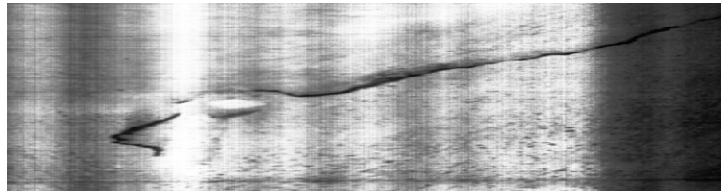
Example of Acquired Image

### Technical Specifications

| | |
|---|---|
| Measurement Speed | 0 - 200 km/h |
| Operating temperature range | -15° to +50 ℃ |
| **Clearance Gauge Measurement** | |
| Field of view | circle with 8m radius from the track center |
| Acquisition frequency | 800 Hz (profiles/second) |
| Measured points | 5000 points/section |
| Sampling step | depends on measurement speed |
| Longitudinal Resolution | depends on vehicle speed (e.g. 7 cm at 200 km/h) |
| Measurement Accuracy | between 1 mm and 10 mm depending on the distance |
| **Tunnel Wall Inspection System** | |
| Field of view | tunnels up to 8 meters wide from track center |
| Acquisition frequency | 4000 Hz |
| Sampling step | depends on measurement speed |
| Resolution | 2 mm @ 30 Km/h |
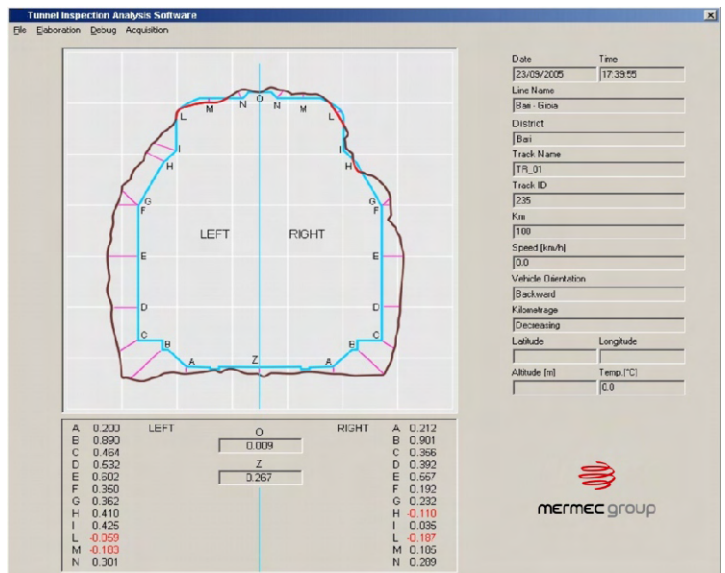
# LINESCAN 100

## Standard Performance Clearance Gauge Measuring System

The LINESCAN 100 is the MERMEC Group's laser scanner standard solution proposed for clearance gauge monitoring.
This system automatically measures the clearance gauge of railway structures, such as tunnel and bridges, and checks the compliancy of train's clearance.

The system continuously scans a 360° radius of the transversal profile of the railway line, so that violations with respect to the admitted profile are detected and alarm reports with the anomalies are sent to the maintenance staff.
The operator can select a control profile inside the library of all the possible profiles. The system will automatically setup the selected profile and will compare it with the acquired profiles so as to mark eventual obstacles with the control profile.

Moreover, the LINESCAN 100, thanks to its modular design, can be easily integrated with the MERMEC Group's Video Surveillance System in order to provide the users with digital acquisitions of the line, or parts of the same, where the line parameters exceed the control thresholds.



| Technical Specifications | |
|---|---|
| Dynamic measurement field | 0.5 m - 25 m |
| Acquisition frequency | 175 kHz - 625 kHz |
| Reflectivity range (albedo) | 2% - 100% |
| Resolution | ≤ 3 mm |
| Linearity error | ≤ 3 mm |
| **Range noise at 10 m** | |
| Reflectivity 20% (dark grey) | ≤ 1.6 mm rms (root mean square) |
| Reflectivity 100% (white) | ≤ 1.0 mm rms |
| **Range noise at 25 m** | |
| Reflectivity 20% (dark grey) | ≤ 4.4 mm rms |
| Reflectivity 100% (white) | ≤ 1.8 mm rms |
| Range drift over temperature | ≤ 1 mm |
| Scanning Frequency | 100Hz |
| Sampling step | to be defined based on measurement speed |
| Laser safety class | 3R (DIR EN 60825-1) |
| Operating temperature range | -15° to +50 °C |

Evaluation of Distances Referred to the Track Centre Line
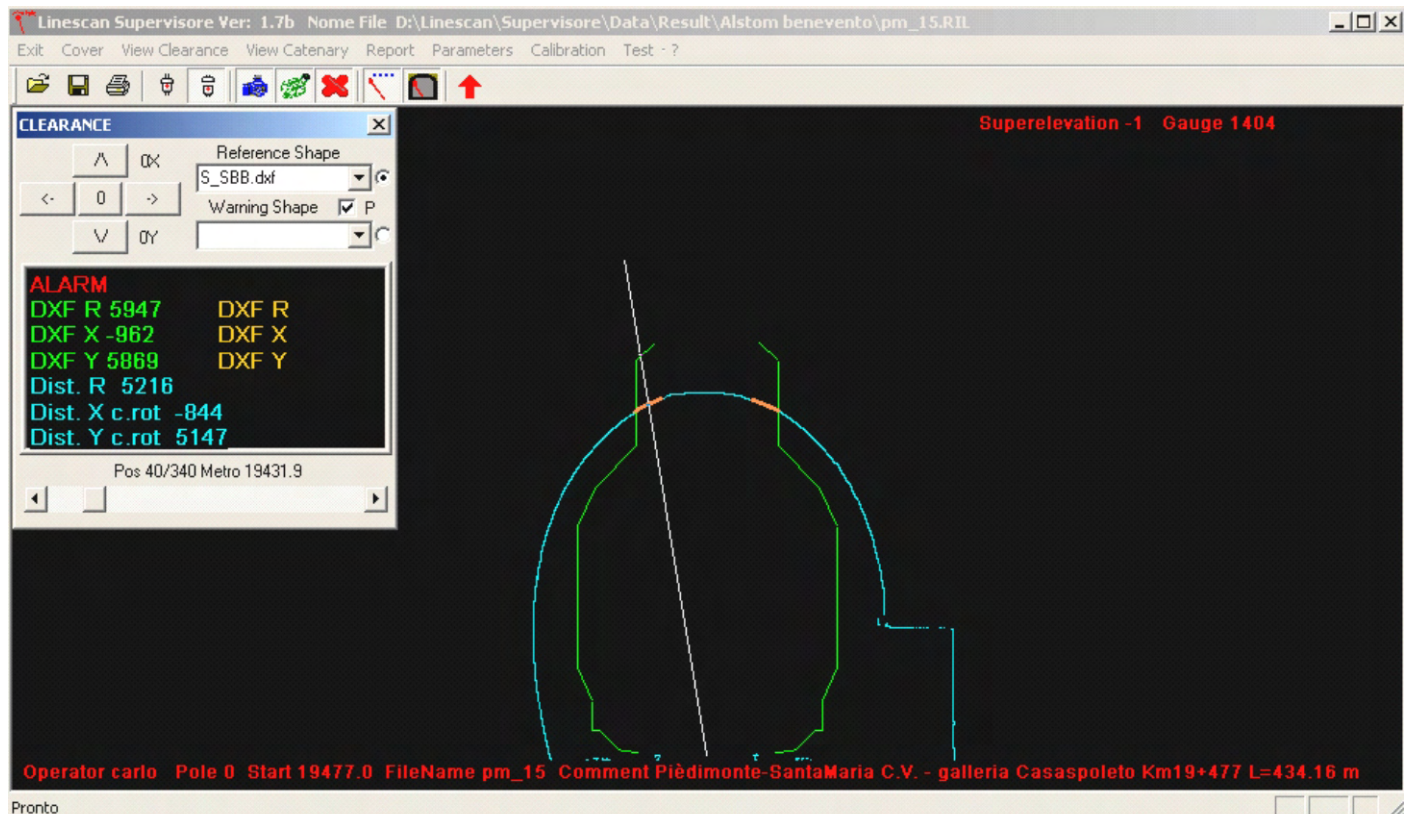
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