

# TMS TURNOUT MEASUREMENT SYSTEM

## Turnout geometry measurement in motion

The efficient and detailed inspection of track condition is carried out since many decades using the track recording cars with instrumentation on-board that generates an efficient, quantitative statement of known track conditions. Their equipment changed with time, reflecting the new data collection systems available - from the purely mechanical contact systems to the contemporary non-contact systems with the real time computer measurement data analysis.

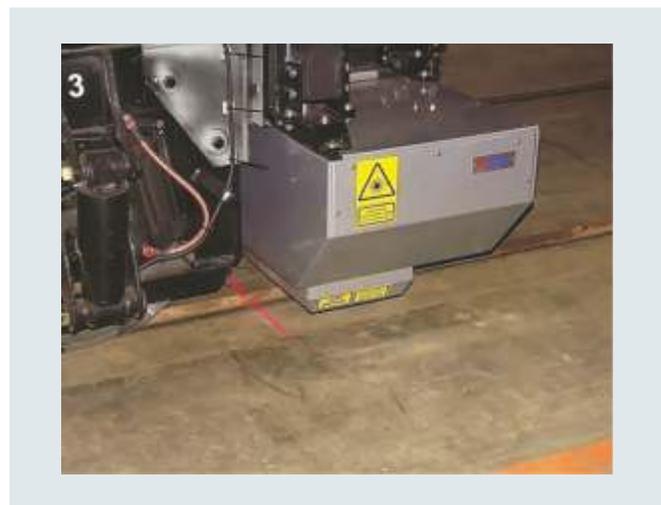


The state-of-the-art inspection cars are equipped with the on-board measurement and geographic reference data systems being the main and productive tool for safety inspectors. Measuring the track geometry provides information about their current condition, yet direct access to historical data is needed to make efficient detection of potential accident-causing hazards possible. However, no geometry car could take measurements of the turnout geometry so far, and usually the readings collected by the geometry cars passing the turnout zones were masked and not taken into account in the track assessment procedure, as they would reduce the track condition evaluation results. Therefore, the important permanent way elements - turnouts - highly affecting train operation safety, were not measured automatically so far, and the safety inspectors had to rely on manual measurements in selected characteristic points only. Yet - "a switch is a track" (J. Tiecken, Volker Rail), so its detailed measurements at points located as densely as possible along the turnout appears to be the novel approach to improvement of train operation safety. GRAW, Poland, responded to this need, developing in cooperation with Volker Rail (The Netherlands) and LAP GmbH (Germany) the self propelled inspection vehicle with the following systems:

- optical laser measuring system for track and turnouts
- navigation - Differential Global Positioning System (DGPS) to determine precisely location of turnouts, track defects and other reference points
- visual track inspection

The autonomous TMS system is capable to take measurements in the turnout zone at 60 km/h with the measuring increment of 3 cm, as required by pertinent regulations. Rail types are automatically recognised, which makes it possible to evaluate their wear. Turnout types are read from the GeoTEC database, according to the actual vehicle position.

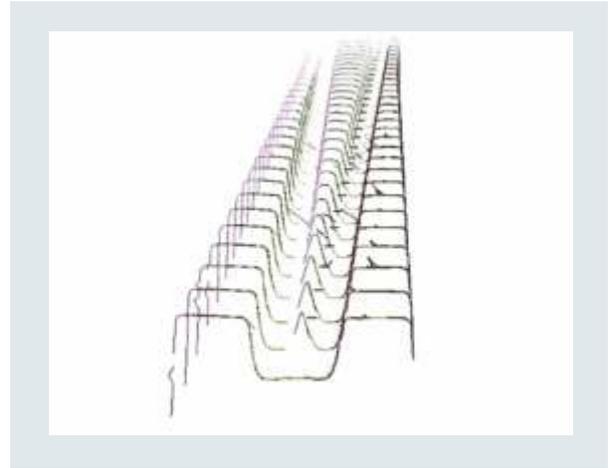
Turnout geometry condition is assessed according to the approach already in use in The Netherlands since 2002, based on GRAW TEE-1435 track and turnout trolleys implemented at that time; moreover, measurement of profiles is carried out now also using the virtual templates with the shapes specified by the pertinent local regulations.



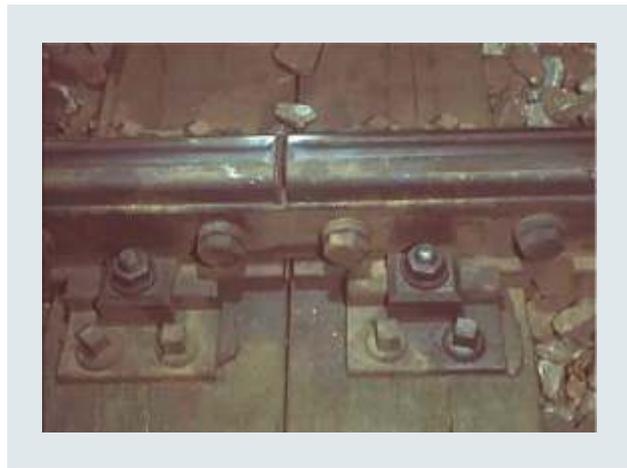
Laser optical measurement module



Common crossing



Common crossing as measured and analysed by TMS

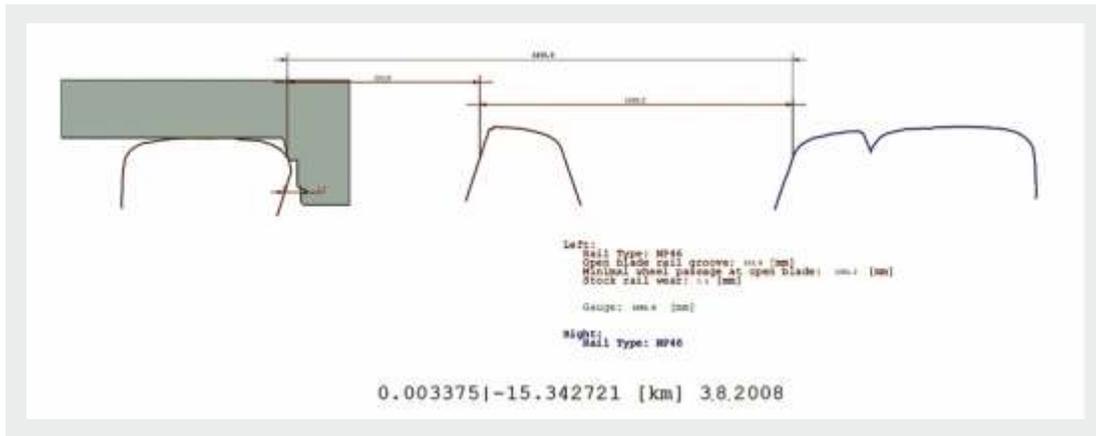


On-board visual inspection system stores images of tracks and turnouts

Measured parameters	Switch	Track	Crossing
Rail slope			
Profile measurement			
Vertical wear			
Horizontal wear			
Percentage of the rail head wear			
Gauge			
Stock rail wear			
Blade wear			
Measurement of flangeways			
Gap between open blade and stock rail			
Check rail gauge			
Cant			

TMS system measures the following parameters:

Nearly entire Dutch railway network definition is stored in GeoTEC system, so new measurement data can be automatically assigned to the track segments or turnouts identified by their geographical position. Remote access over GPRS/EDGE/UMTS to the vehicle's measurement system supports remote software maintenance and/or access to the measurements currently carried out. The system operation is fully automatic, as it finds its location after turning power supply on and next it begins measurements switching between the measurement modes.

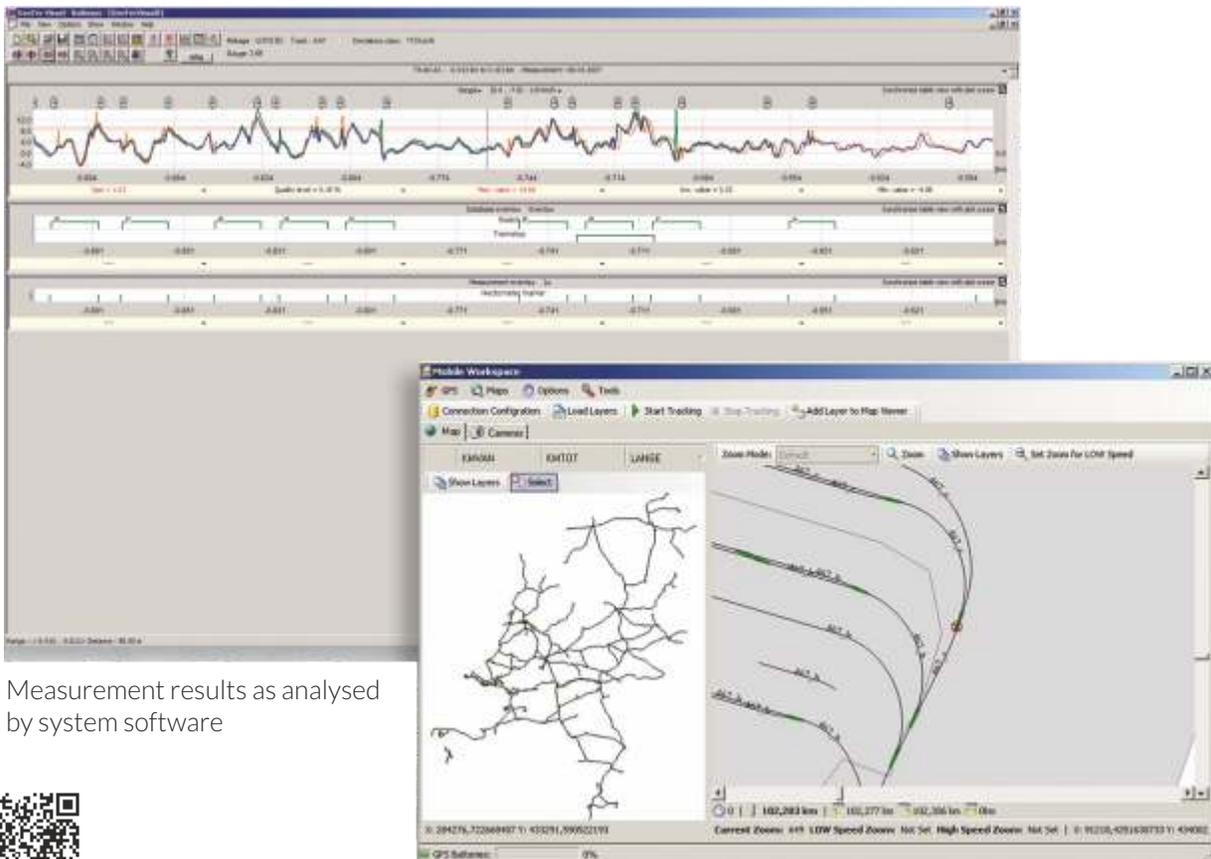


Example of turnout geometry analysis using MAL-1 template



Example of the measured turnout geometry analysis made with TMS software

The system can generate measurement reports, lists of defects to repair, and verify quality of maintenance work carried out. Employment of the TMS system is a breakthrough in turnouts condition assessment cutting time between consecutive measurements, their analyses and upload their results to the main database for use in track and turnouts improvements and repairs.



Measurement results as analysed by system software

Dutch Railways network schema parsed by moving TMS in service





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