

RTRI Develops Onboard Track Patrol Support Application “Train Patroller®”

The Railway Technical Research Institute (RTRI) has developed Train Patroller® (hereinafter “the application”), an onboard track patrol support application that assists railway staff in inspecting track conditions while riding in the cab of commercial trains.

1. Background

Railway operators routinely perform “onboard track patrols” to monitor the conditions of track and changes in the surrounding environment. These patrols require staff to ride in the cab of commercial trains and judge conditions primarily by visual observation and ride feel, which is labor-intensive and leads to variability between individual inspectors. While digital technologies offer a way to address these issues, many regional railway operators and infrastructure managers face financial constraints and therefore require low-cost systems based on general-purpose technologies.

2. Overview of the application

The application has been designed with regional railway operators and infrastructure managers in mind and uses an off-the-shelf smartphone as the measurement platform. The data acquired can be used not only for checking track conditions during onboard track patrols, but also for managing train ride quality. By digitizing inspection items that are conventionally checked by visual observation and ride feel, the application enables staff to assess track conditions from locations such as office facilities away from the line. Because it leverages commercially available smartphones, the system can be deployed at low cost (see Figure 1).

By standardizing measurements, the application eliminates differences in judgment between individual staff members and promotes the deskilling of onboard track patrol work.

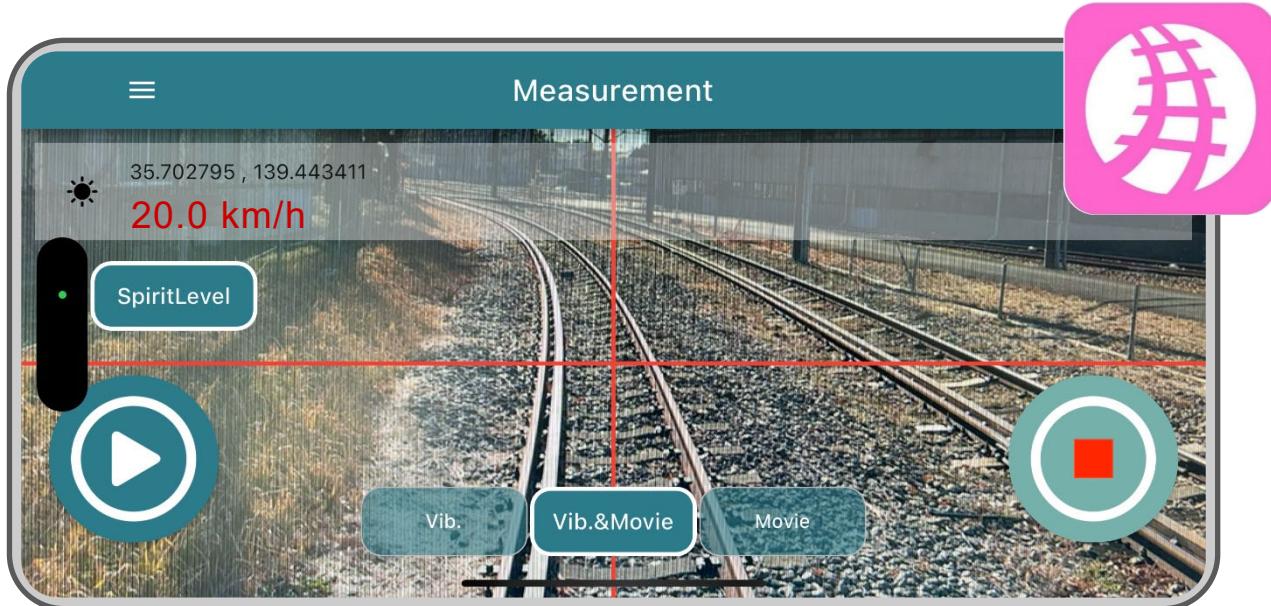


Figure 1: Measurement screen and application icons for the onboard track patrol support application Train Patroller®

3. Main features and benefits

The main features of the application are as follows:

(1) Multiple measurement modes

The application offers several measurement modes with different measurement items, such as "Vibration" and "Vibration & Movie," which can be selected according to the purpose of use (see Table 1).

(2) Easy installation in the cab

The smartphone can be quickly installed in the cab of a commercial train using a suction-cup fixture, allowing measurements to start within a short time (see Figure 2).

(3) Linkage with LABOCS® for synchronized data analysis

Data measured by the application can be processed using LABOCS®, a track maintenance database system developed by RTRI, which links vibration waveforms with track kilometrage with an accuracy on the order of several meters and can overlay subtitle information such as train speed and vibration values on forward-view images (see Figures 3 and 4).

(4) Support for track maintenance planning

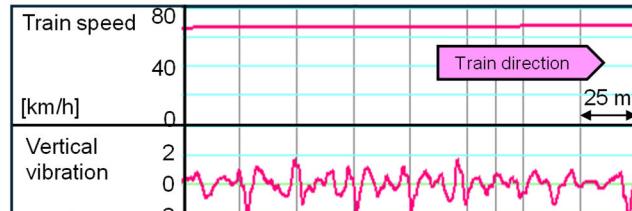
By analyzing historical records of train vibration values and reviewing corresponding forward-view images, railway operators and infrastructure managers can monitor how track conditions change over time and examine the appropriate timing and scope of maintenance in line with actual track conditions (see Figure 5).

Table 1: Main measurement items in Train Patroller®

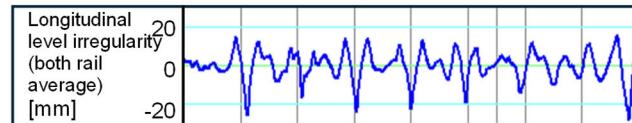
Measurement item	Sensor	Measurement mode			Sampling etc. (File format)
		Vibration	Vibration and Movie	Movie	
Train speed	GPS receiver	✓	✓	✓	1 Hz (txt file)
Latitude and longitude		✓	✓	✓	
Train vibration	Motion sensors	✓	✓	-	100 Hz (txt file)
3-axis angular velocity		✓	✓	-	
Movie	Rear camera	-	✓	✓	10/20/30/60 fps VGA/Full HD/4K (mp4 file)
Sound	Microphone	✓	✓	✓	44.1 kHz (m4a file)



Figure 2: Example installation of a smartphone in a revenue train cab (mounted using a suction-cup fixture)



(a) Train vibration measured by the application



(b) Longitudinal level irregularity measured by a dedicated track geometry car for the same section

Figure 3: Example of measured vibration waveform and track irregularity waveform using the application

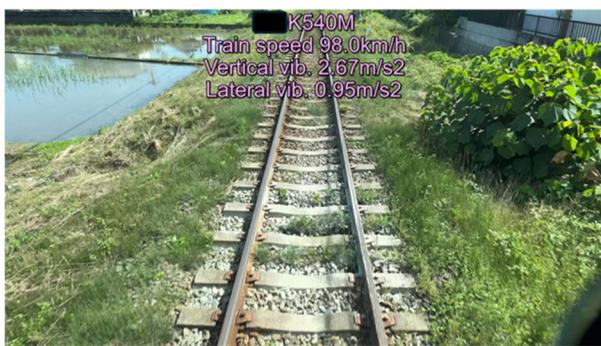


Figure 4: Example of forward-view image with subtitle information overlay

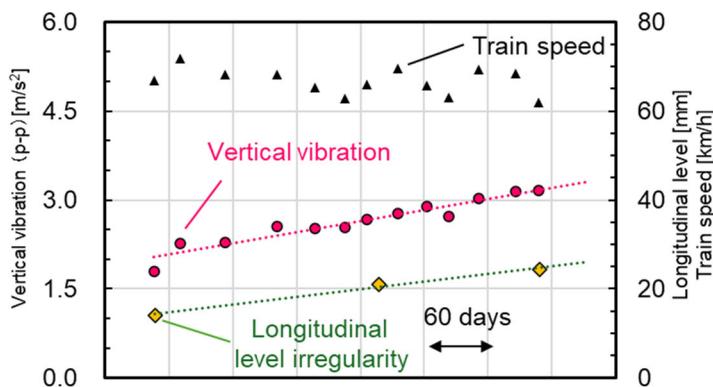


Figure 5: Example of transition in vertical vibration and longitudinal level irregularity at rail joints showing correlation with longitudinal level irregularity measured by a track geometry car

4. Additional Information

- (1) Since April 2025, Train Patroller® has been in practical use at a railway company for train vibration management and is also being trialed to promote digital transformation (DX) of onboard track patrol operation.
- (2) To enable automatic post-processing of the application's measurement data and to use it not only for supporting onboard track patrols but also for quantitative assessment of track conditions, RTRI is developing a dedicated web-server system with part of this work being financially supported by the Ministry of Land, Infrastructure, Transport and Tourism of Japan.
- (3) The application was developed under a joint research project with Professor Tomonori Nagayama and Associate Professor Di Su of the Graduate School of Engineering, The University of Tokyo, on low-cost onboard track condition monitoring systems.
- (4) Provision of the Train Patroller® service, in collaboration with SMARTCITY RESEARCH INSTITUTE, Co., Ltd., began in April 2025.
- (5) "Train Patroller®" and "トレインパトローラー®" are registered trademarks (Registration Nos. 6799359 and 6799360).
- (6) "LABOCS®" is a registered trademark (Registration No. 5858115).
- (7) The application will be exhibited at Mass-Trans Innovation Japan 2025 (the 9th Railway Technology Exhibition), held at Makuhari Messe from November 26 to 29, 2025.