July 11, 2022

# RTRI Develops Ballast Inspection System Using transmitted Sounds

**RTRI developed a ballast inspection system. With this system, ballast conditions can be evaluated by analyzing the sound transmitted through ballasted trackbed (Fig. 1). This system makes it possible to judge the necessity of ballast replacement based on scientific indices and it is expected that the efficiency in track maintenance will be improved.**

## 1. Background

One of the factors which induce subsidence of ballasted trackbed is deterioration of ballast (Reference photo). Ballast is worn out and the trackbed deteriorates by repeated train running and tamping work. In the past, maintenance persons visually checked increase in the amount of fine particles filling ballast and had to make judgment on the ballast conditions by experiece. In order to judge the necessity of maintenance work including ballast replacement more efficiency, more objective and labor-saving assessment methods have been required.


Reference photo Fouled ballast

One of the objective methods to assess ballast conditions is to sift ballast with different sizes of sieves of and to calculate the ratio of particle of different sizes. Although this method is effective as a local evaluation method, limited areas of trackbed, it took too much cost and labor to apply to assessment of the entire revenue-service lines.

## 2. Outline

Patterns of sound transmission through ballast change depending on the deterioration levels of ballast. This inspection system analyzes the transmission patterns and checks ballast conditions efficiently based upon the objective data (Fig. 1) .

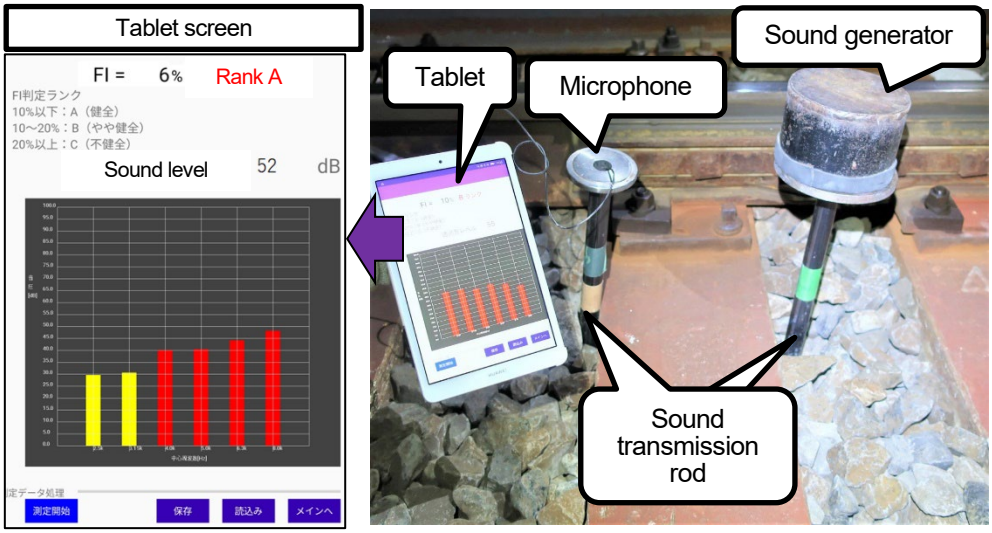


Fig. 1 Measuring with the ballast inspection system

【Details】

- This system consists of a sound generator, microphone, sound transmission rod and a tablet equipped with an application (Fig. 1).
- When ballast is worn out and the fine particles fill the space in between ballast gravels, the ballast does not transmit sound well compared to the ballast in better conditions. This system measures the sound transmission levels in the ballast (Fig. 2).
- Noise is generated from one of the two hallow rods stuck in the ballast at both sides of a sleeper. The volume of transmitted sound (transmitted sound level) is measured with a microphone placed on the top of another rod (Fig. 3).
- The transmitted sound levels are recorded and analyzed, and then FI, the index to show the ratio of different sizes of ballast particles, is estimated with the application for smartphone (Fig. 4). If the value of FI exceeds 20%, track subsidence is highly likely to advance and it is determined that the ballast needs to be replaced.
- This system can be easily placed on the track and its measuring process is simple. The results can be obtained in one minute and the number of workers can be reduced to less than half of the workers required for existing inspection methods.
- Available for judging conditions of ballast mixed with dirt flowing from outside by disasters such as flooding.

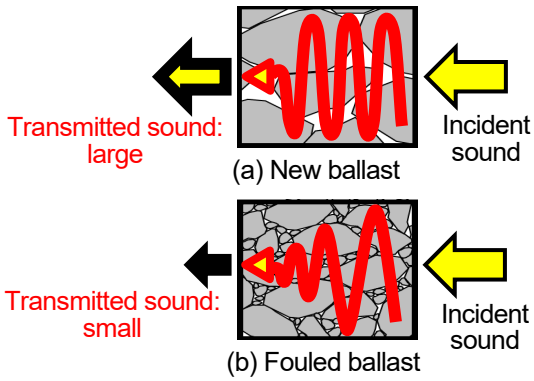


Fig. 2 Sound transmission through ballast

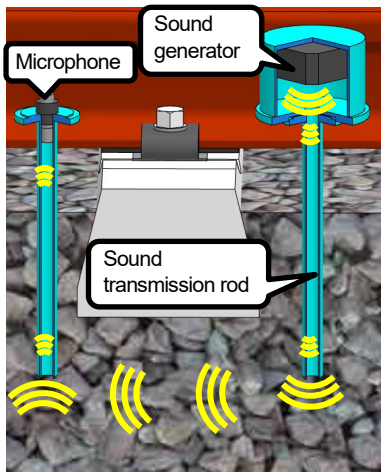


Fig. 3 Sound transmission measuring device

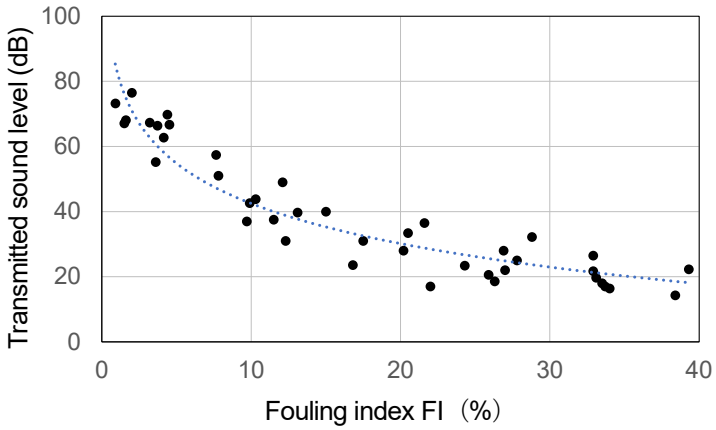


Fig. 4 Correlation of ballast fouling and sound transmission levels

### 3. Scheduled release date

This inspection system including the application will be released by the JR Souken Information Systems Co., Ltd. in August this year.