Development of Portable Trolley for Continuous Measurement of Rail Surface Roughness

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1. Introduction

Rail corrugation that occurs mainly on rails in curved sections due to train passage typically consists of periodic and minute surface roughness of 1 mm or less amplitude. Since the corrugation causes noise and vibration, it needs to be controlled appropriately. Furthermore, the increase of operations of luxurious tourist trains in recent years requires closer control with a view of improving comfort on the train. To this end, we have developed a portable trolley for continuous measurement of rail surface roughness such as corrugation from the ground, as shown in Fig. 1.

2. Overview of portable trolley for continuous measurement of rail surface roughness

The features of the developed trolley include: 1) a trolley can be easily carried to the measurement site, 2) capability of continuous measurement of rail surface roughness by manually pushing the trolley after it is mounted on the rails, 3) a non-contact laser displacement sensor that allows measurement that is independent of the travel speed of the trolley, 4) a sensor that is movable in the cross sectional direction of the rail allows surface roughness measurement in gauge corners, and 5) a PC with special software that allows measurement results to be assessed and analyzed on the spot. The trolley uses the asymmetrical chord offset method for sensor layout, which allows high-precision measurement of rail surface roughness with a wavelength of approximately 26 to 700 mm.

3. Applications and future development

Figure 2 shows an example of rail corrugation. Since the occurrence of corrugations cannot be eliminated, the surface roughness is usually controlled by grinding the rail using a rail grinding car after the corrugations occur. We measure rail surface roughness(RSR) using the trolley before and after grinding the rails, and example measurement results are presented in Fig. 3. Since the presence of rail surface roughness can be checked on the spot, it is possible to decide the grinding range and working pass in advance for efficient rail grinding work by conducting measurements before grinding the rails. By conducting measurements after grinding the rails, the user can check for surface finish conditions.

Since the trolley allows the occurrence of rail corrugation to be accurately checked, we expect it will help in understanding the mechanism that causes rail corrugation as well. We are also tackling the challenge of understanding this mechanism by using simulation technologies.

Fig. 2 Examples of rail corrugation (left: low rail on ballasted track; right: high rail on ballastless track)

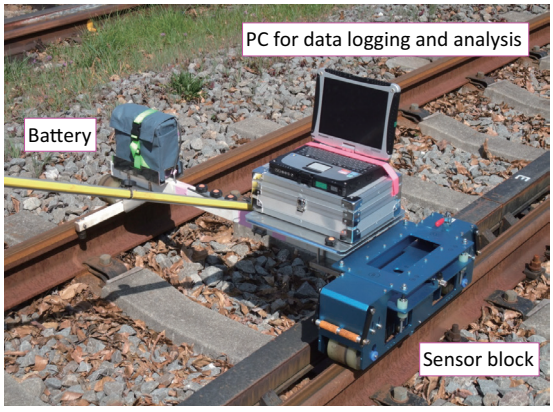

Fig. 1 External view of developed trolley

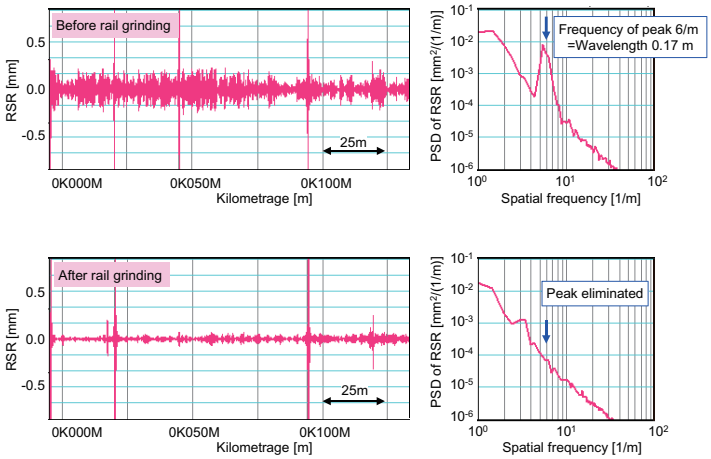

Fig. 3 Example of continuous measurements of rail surface roughness before and after rail grinding