Development of Improved Method for Predicting Noise along High-speed Railways

Yukie OGATA
Senior Researcher, Noise Analysis, Environmental Engineering Division

1. Introduction

When a train runs, noise generated from the train is transmitted to the area along the railway line. Reducing such wayside noise is important task. To reduce the noise from sources, it is necessary to improve the accuracy of noise prediction and to develop more effective measures. Thus, we are developing a noise prediction method that considers the various conditions along the wayside that affect noise propagation. This method is based upon the existing noise prediction methods for Shinkansen, but it is more applicable to actual wayside conditions.

2. Overview

When a Shinkansen train runs, the major sources of Shinkansen noise are considered to consist of four components: noise from the lower parts of vehicles such as rolling noise; aerodynamic noise from the upper parts of a vehicle; pantograph noise; and bridge noise (Fig. 1). The wayside noises are affected by sound attenuation in distance, reflection, diffraction and other factors of sound transmission from sound sources to sound receiving points. Accordingly, we evaluated the effects of the conditions surrounding railway lines on the noise transmission using an acoustic test with scaled models and developed the prediction method by using the test results. Our efforts so far have made it possible to predict train noise as affected by the surrounding conditions, such as the buildings and bridges around railway lines, cut sections, and tunnel portals.

3. Example of prediction result

Whenever a road bridge crosses over a railway line, the wayside noise level caused by a running train is affected by the underside of the overbridge and it is changed in the area around the overbridge. Figure 2 illustrates the basic principles of a noise prediction method for the area along a Shinkansen railway by considering reflections from the underside of the overbridge. Figure 3 shows an example of the prediction result and indicates that the wayside noise is locally increased due to the noise reflections on the underside of an overbridge. Thus a quantitative evaluation of the noise increase caused by an overbridge and the affected area enables appropriate and efficient noise control measures to be taken.

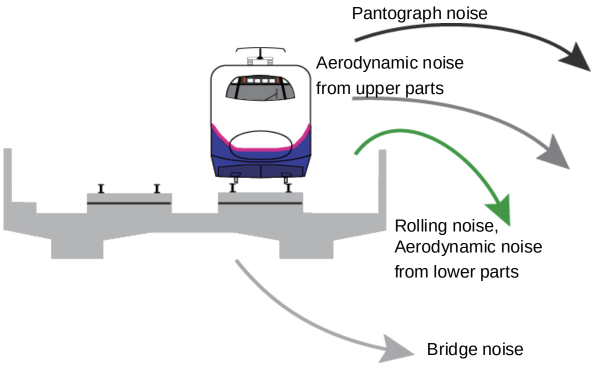

Fig. 1 Shinkansen Noise Sources

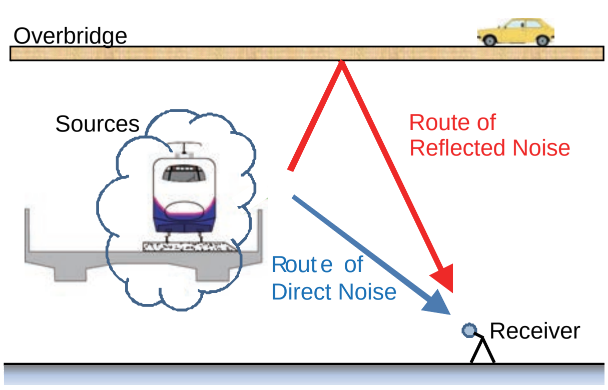

Fig. 2 Prediction Model for Sound Reflection on Undersurface of Overbridge

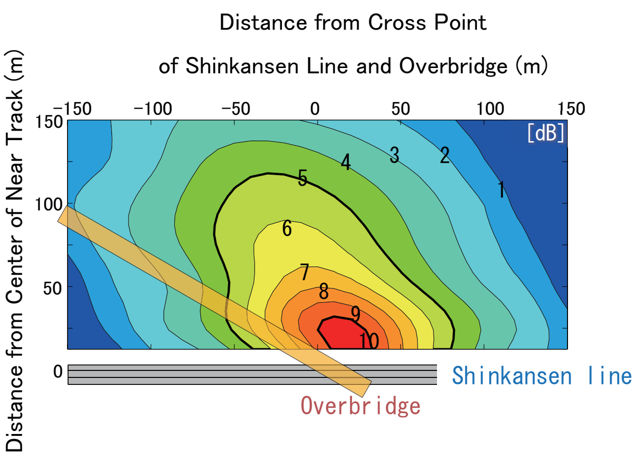

Fig. 3 Noise Difference of Sound Reflection on Surface of Overbridge (Train Speed: 300km/h Train runs on far track.)