Study of the Strengthened Hybrid Structure Renovated from Railway Steel Bridge

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Summary

This research offers a new composite revamping method for railway bridges by assuming composite remodelling process of existing steel bridges having no specific fissure damages or serious corrosions and effectively making use of relatively new materials to it. Effects of noise reduction and improved stiffness were further confirmed through hammer impact tests (vibration measurement tests) and loading tests in order to prove the efficacy of the composite remodelling.

Keywords: Railway Steel Bridge; Hybrid Structure; Composite revamping

Abstract

There has recently been a requirement for constructive structures to be efficiently maintained and managed. Specifically, steel bridges for railways, many of which are past their design service life, often continue to be used as matters now stand. While steel bridges in main routes already in maintained services that elapsed the nominal aging limits may sometimes be renewed through replacement, those existing structures in local lines with less profitability are required just to prolong their lives also at as low cost as possible. As another big issue for steel bridges in railways, on the other hand, there is a subject on how to suppress acoustic noises as well as the life prolongation. Steel bridges for railways, mostly having open grating structures without floor panels, may develop larger vehicle-noises on train-passage than other road-bridges or concrete bridges because acoustic noises emitted from the rails (rolling noises) and the vehicle itself are directly transmitted to the outside further in addition to noises caused by the steel-members.

As a countermeasure for life-extension and noise-reduction of such structures, revamping of existing steel bridges into composite structures is now under investigation. A shift to a composite structure is to proceed with an action to place a complementary member such as a concrete panel on to the existing steel girder for the purpose of preventing it from having corrosion, improving the beam stiffness, reducing the stress-amplitudes at the time of a response to active forces, and consequently prolonging the fatigue life. Furthermore, consolidating the steel and concrete, on the other hand, acoustic noises caused by the steel member can also be reduced at the same time.

Therefore, this research offers a new composite-revamping method for railway bridges by assuming composite remodeling process of existing steel bridges having no specific fissure damages or serious corrosions and effectively making use of relatively new materials to it. Furthermore, it was confirmed by the construction tests using actual steel bridges that the switching work can be performed well even under strict limitation. Moreover, effects of noise reduction and improved stiffness were further confirmed through hammer-impact tests (vibration-measurement tests, Figure 1) and loading tests (Figure 2) in order to prove the efficacy of the composite remodeling.

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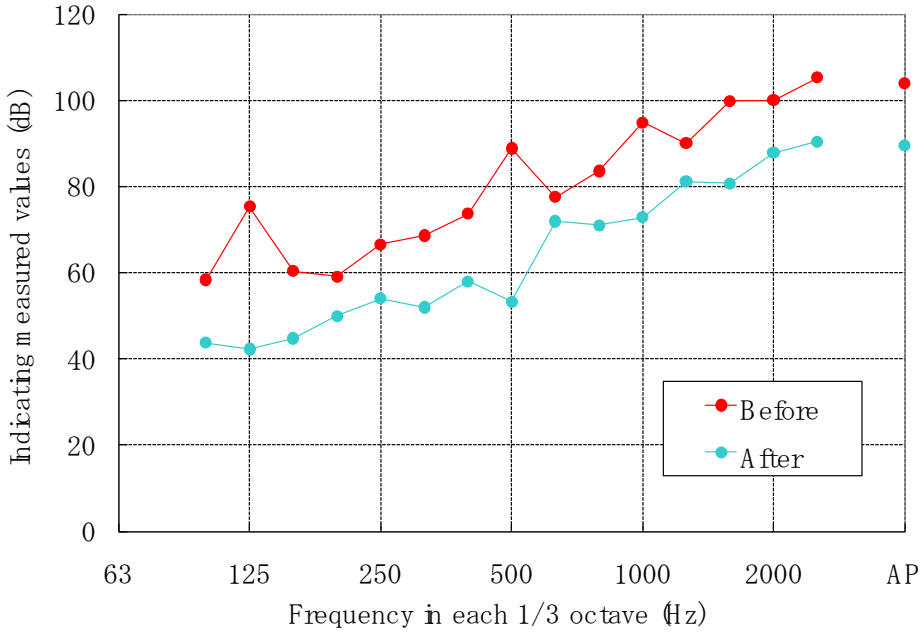

Figure 1. Results of the average of the measurements

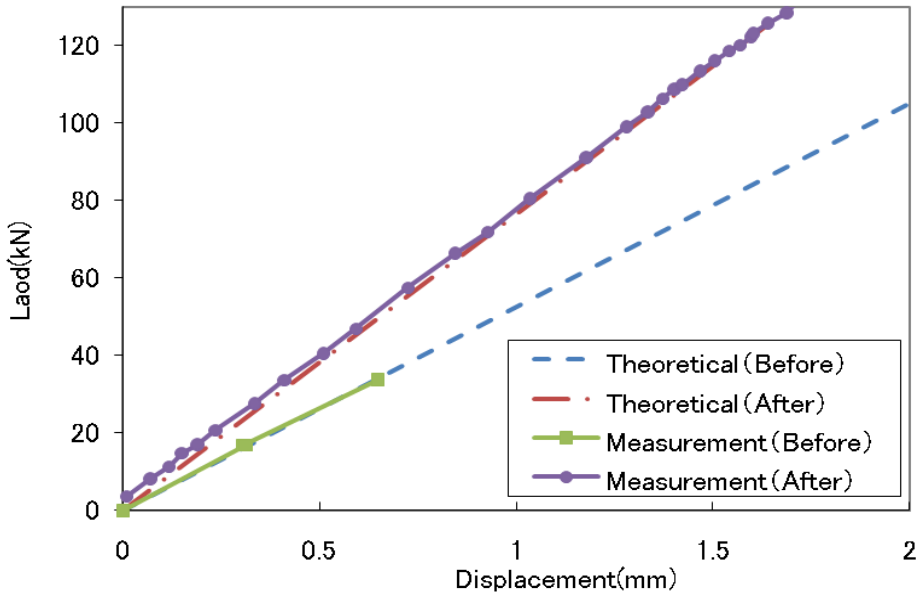

Figure 2. The load versus displacement relationship