An Examination on Hybrid Structures Renovated from the Old Railway Steel Bridges with Polymer Cement Mortar

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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

1. Introduction

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 backboned 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. 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[1].

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 onto 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.

2. Summary of Hybrid Structure

Figure 1 shows the outline of the composite structuring of steel bridges to railways to be proposed in this study. In the composite structuring, although various techniques can be considered, the authors proposed the one illustrated in Fig. 1 from the viewpoint of construction characteristics, preventing corrosion and minimizing related effects on existing steel bridges. This composite structuring is characterized by not performing remodelling work such as drilling or welding and by the utilization of existing tracks in their intact form. In the composite structuring structure, the following comparatively new materials are used: (1) rubber latex mortar (for coating), (2) FRP

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