Seismic Reinforcement Method for Deteriorated Steel Bridges Developed and Used on a Commercial Line

RTRI Developed an aseismic reinforcement method for steel bridges integrating steel girder, abutment and embankment (Fig. 1) and it has been applied to a commercial railway bridge. This method is particularly effective in reinforcing deteriorated steel bridges in urban areas where only little work space is available. Since this method does not require construction of a temporary track and only minimal under-bridge space is occupied during the reinforcement work, high seismic performance can be attained with a shorter construction period and smaller cost.

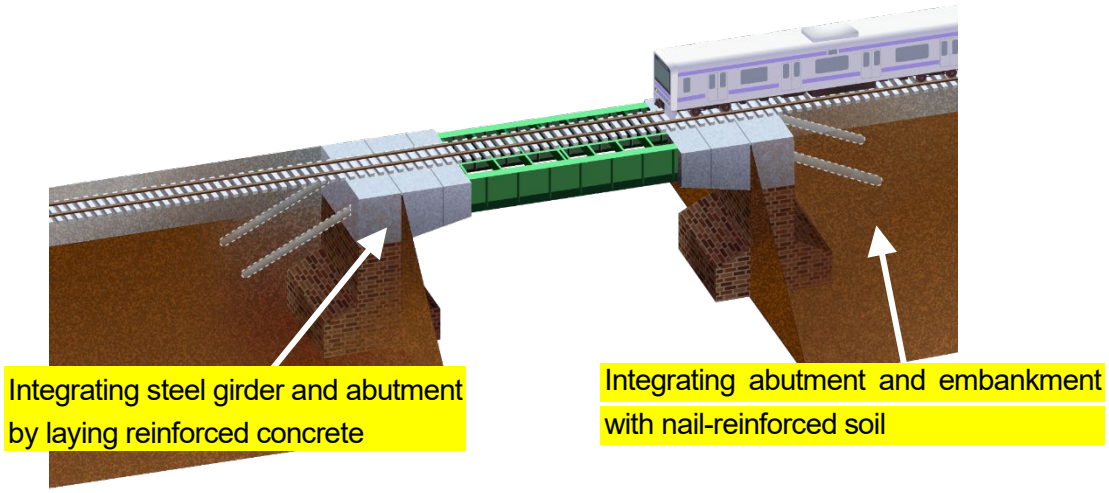


Fig. 1 Bridge reinforcement method integrating steel girder, abutment and embankment

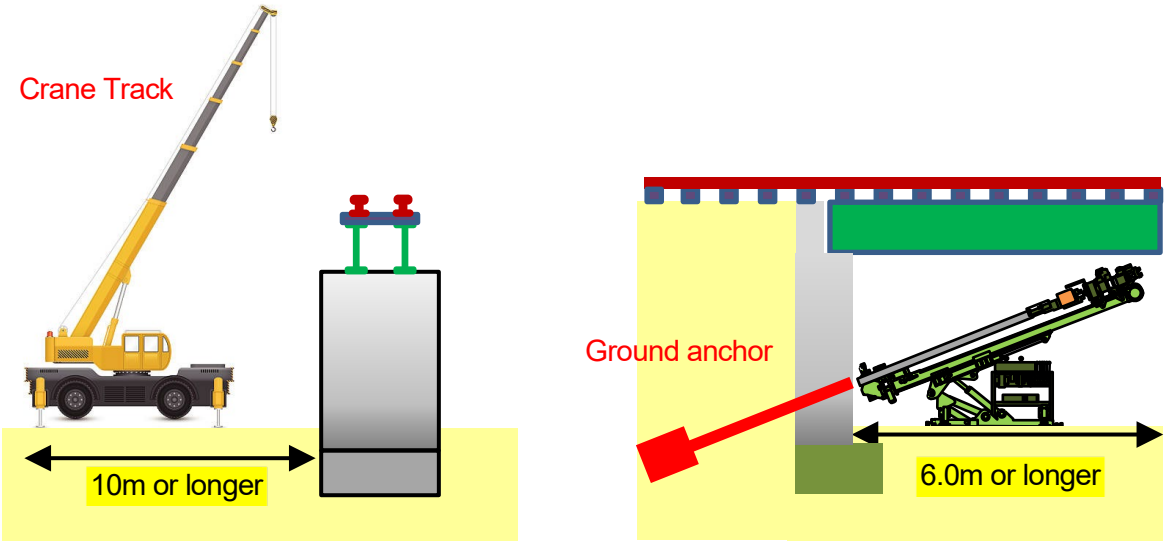
【Background】

Some of the existing steel bridges constructed before 1970's need to be reinforced to improve their seismic stability, as seismic designs were not well introduced by before those past decades. When replacing a deteriorated bridge with a new one, the space for a crane track and a temporary track is necessary. (Fig. 2 (a)). Reinforcing abutment also requires a heavy construction machine to install ground anchors. (Fig. 2 (b)). Either of them takes a lot of work time and costs. In urban areas, in particular, it is difficult to transport and use large and heavy construction machines or to ensure adequate space for a temporary track. Furthermore, deteriorated steel bridges require a lot of maintenance work including corrosion measures for girders and supports.

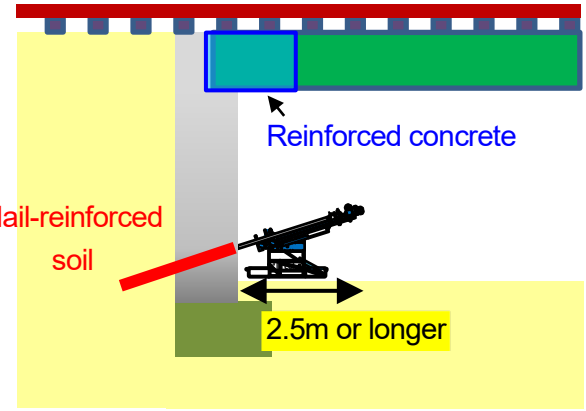
【Outline of the method】

- The entire performance of a steel bridge is improved by integrating abutment and embankment with nail-reinforced soil, by connecting the steel girder and abutment with reinforced concrete.
- The entire stability of a bridge is enhanced by integrating abutment and embankment with nail-reinforced soil, those works can be handled with a small-sized machine. (Fig.2 (c)). In addition, the integrated bridge does not have the bearing connecting steel girder and abutment, the maintenance work for such section including corrosion measures becomes unnecessary.

・ As this method does not require any work with a large and heavy machine from the front side of abutment (from the under-bridge section), the time and space occupied during the work can be largely decreased and the work time and cost will be reduced up to 50 %.



(a) Existing method of bridge replacement　　(b) Ground anchor installment



(c) Ground reinforcing with the new method

Fig. 2 Reinforcement work

【The bridge reinforced with this method】

This method was used for the first time to reinforce a commercial railway bridge on the line of the Odakyu Electric Railway Co., Ltd. As this steel bridge, constructed in 1927, is surrounded by roads and houses, this method was applied. (Fig. 3).

Part of this research was implemented with the railway technical development grants by the Ministry of Land, Infrastructure, Transport and Tourism.

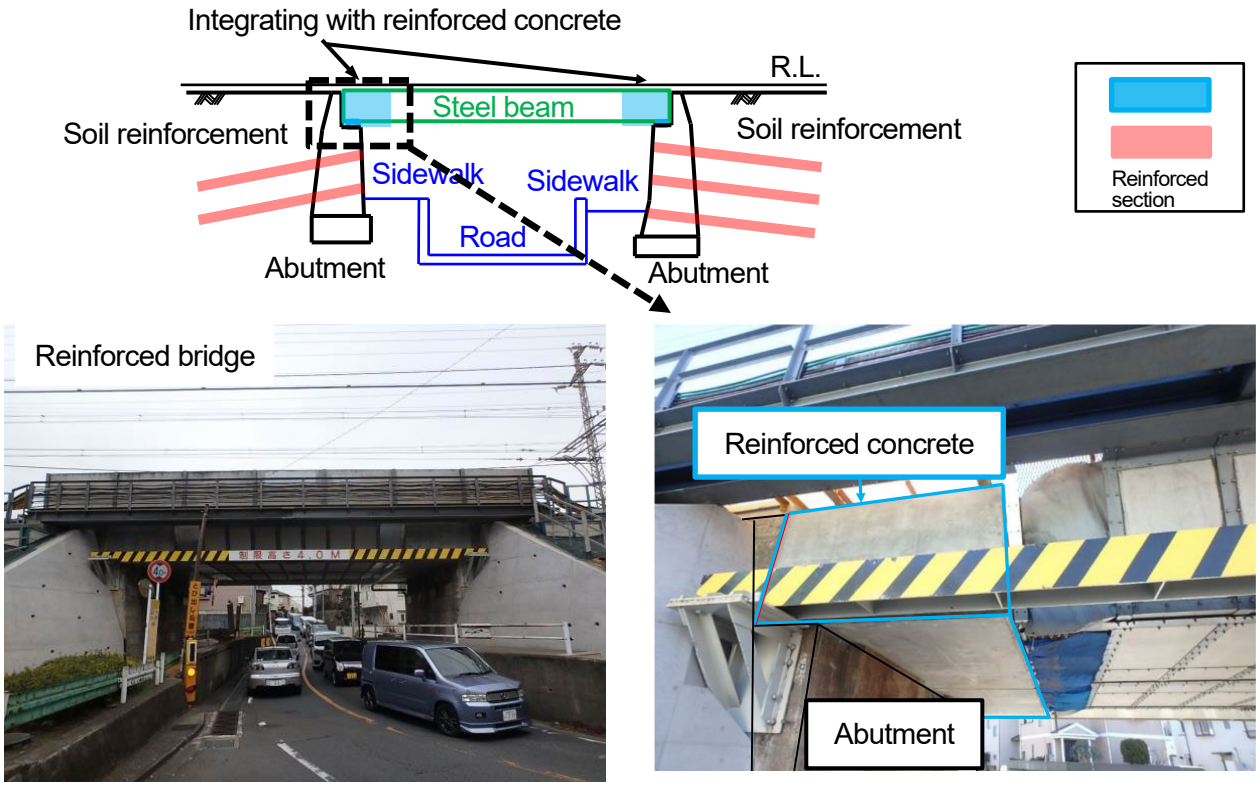


Fig. 3 A bridge on Odakyu Line reinforced with this method