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A suggestion of health monitoring for road bridge shoes

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Abstract

In recent years, the number of old bridges has remarkably increased in Japan. A periodic monitoring of them is necessary in order to confirm their security. This monitoring can lead to early warnings and prediction of potential problems and help in the planning of the necessary maintenance interventions and enables the damage assessment after earthquakes. Deterioration of shoes of bridges becomes remarkable recently. The shoes are a part absorbing the expansion and contraction of the bridges by the temperature change. When the shoes do not function, various problems appear on supporting beams and floor. In this paper, we describe about the shoe measurement results at the actual field.

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Keywords: bridge; shoe; masurement; monitoring; sensor

1. Introduction

The number of bridges which are longer than 2.0m in length is approximately 700,000 in Japan. Most of them are going to reach the design life of 50 years. Therefore, the malfunctions of the bridges constructed in the 1970s are to be concerned. Accordingly, Japanese government obligated bridge inspections at every five years by the law in July, 2014. The inspection items are mere visual and hammering observations. However, not all malfunctions of the bridges can be found by these inspections. Concerning the shoes of bridges, a lot of malfunctions have been reported in particular. The shoes are installed at the joint parts of the bridges and are often exposed to rainwater.

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As Japan is an island country, there are many bridges near the sea. Furthermore, salt is sprayed on roads as a cryoprotectant in the winter season. Therefore, the deterioration of the shoes caused by the corrosion may progress with increasing speed. The malfunctions caused by the corrosion can be found even by the visual inspections. The movement of the shoe is one of the important parameters which affect the soundness of the bridge. The important function of the shoe is to absorb the displacement of the bridge smoothly. Generally, it is very difficult to detect the extraordinary displacements of the shoes only by the visual inspections. Accordingly, appropriate measurement methods for the shoes have been required recently. On this background, we have developed a measurement method for the shoes and evaluated the integrity of the shoes through two times of continuous monitoring for 24 hours on an actual bridge.

2. Monitored road bridge

The structural drawing of the monitored bridge is shown in Fig.1. The bridge is 63.0m in length and has two continuous spans supported by three piers. The bridge has a skew angle of 60 degree. The shoe on the central pier is fixed and right and left side shoes are movable. The bridge consists of five main beams, and five shoes are installed on each pier. Two shoes ‘A’ and ‘B’ on the left side pier were monitored as shown in Fig.1.

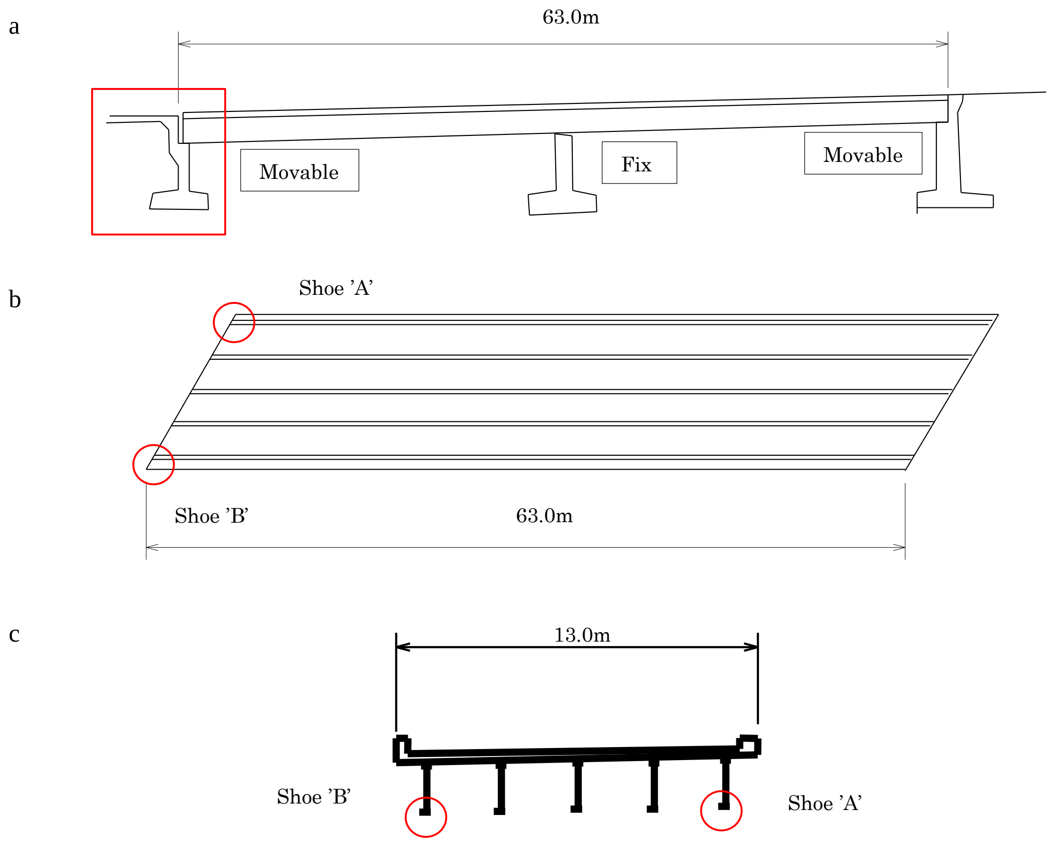

Fig.1. Structural drawing of the bridge (a) side view; (b) plan view; (c) cross view.