

Sensitivity Analysis for Deteriorating Bridges using Bus Acceleration Sensors

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Summary

Because many infrastructures such as bridges will entrance their last stage of designed durability in Japan, it becomes much more important to judge whether replace them or use them continuously over their designed durability while doing maintenance. An old bridge should be inspected much exactly by expert engineers rather than at its initial stage of lifetime. Now, the structural health monitoring (SHM) technique makes it possible to gather more and more useful data to investigate damages. Whether inspection by expert engineers or SHM, the cost problems for sustainable bridge maintenance should be solved first. In this paper, a concept of detecting damage signs in long-term service bridges using acceleration response of running bus on the bridges. The conclusions of this paper will give good references to develop a creative useful method for sustainable bridge maintenance.

Keywords: Detect Damage Signs, Bridge Maintenance, SHM, Bus, Acceleration.

1. Introduction

Many infrastructures will go into their last stage of designed durability in Japan, especially many bridges which were constructed in high economic growth period will be soon over their designed durability. It becomes urgent to judge whether replace them or use them continuously over their designed durability while doing maintenance, and those maintenance works were done by expert engineers usually. Because a last stage bridge will be exposed danger situation by usual action, generally many expert engineers, long time, enough budget are required for those works. However, it is known that the budget and expert engineers are not enough to finish those hard works soon and it is also no time to wait now.

Some technologies are developed in all over the world now, and one of these technologies is “structural health monitoring (SHM)” that gives us much more useful data to investigate damages automatically. Many sensors have been applied and researched to monitor static or dynamic behavior of bridges, for example, accelerometers, strain gauges, deflection transducers, optical fibers, corrosion sensors and so on. As we know, the developed technics of SHM are still not enough to solve initial and running cost problem for sustainable bridge maintenance. Now, many sensor’s life time is shorter than service time of the bridge, therefore, the installed sensors in a bridge should be changed periodically, and the power supply problems for the sensors are also need to be solved.

A reasonable method was studied for detecting a bridge structure with a severe damage in a local area. A creative idea of detecting damage signs in long-term service bridges by using an accelerometer installed on bus and its response is proposed here. In this paper, the experimental investigation of a normal RC bridge by a local bus was performed, and it showed that monitoring a bridge vibration by the bus running on the bridge is possible. Next a sensitivity analysis for deteriorating bridges using a bus acceleration response by applied “Substructure Method” is done, and a new reasonable method for detecting the severe damage on a bridge for the sustainable bridge maintenance is built in this paper.