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Bridge Monitoring Using a Digital Camera: Photogrammetry-based Bridge Dynamics Monitoring

Project 1873
October 2019

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Source: Pixabay

Monitoring the health of bridges using various sensors and techniques has been a hot topic in transportation research. Traffic loads cause vibrations of which the magnitude of the vibrations are is a good indicator of a bridge's condition, safe accessibility and reliability for pedestrians and motorists. In this study, an off the shelf digital single reflex camera (DSLR) camera is used to sense and measure small vibrations from traffic on bridges.

The common procedure for monitoring a bridge's condition is by visual inspection and hands-on techniques that can disrupt the condition further. Visual inspections tend to be labor intensive in nature. Proper structural evaluation of bridges will determine when improvements are necessary to prevent accents caused by the natural occurrences and unstable shifting of the bridge.

Study Methods

This study examines the structural integrity of three Fresno City bridges by using indirect methods to facilitate monitoring of the vertical vibration. Photo were taken of the bridges using a Sony RX10 DSLR camera on a stable and level location nearby. The camera images were adjusted in order to detect alignment errors in pixel through lens calibration. This obtained the most accurate and precise data and is attainable through advanced camera technology. Simple computations and post processing of the images to measure magnitude and frequencies of the

bridge's vibration were computed. Compared to the other traditional methods, the camera system provides an effortless and cost-effective way to monitor bridge vibration. Camera based vibration studies are few in number due to the precision limitations. However, recent advancements in DSLR cameras make vibration analysis possible and simple. Here, a simple method to measure bridge vibrations is introduced. Uses of cameras are changing from taking portraits to other functional uses. These are beneficial to various fields of engineering by reducing time, quality of the measured data, and creating a more cost effective remotely sensed process.

Concluding Remarks

Today, digital cameras are available to everyone at a decreased cost and increased capability. Remotely sensing bridge vibrations is beneficial for time efficiency, quality of data, and cost efficiency. Many previous studies have had to use sensors mounted directly to the bridge structures, subject to more than just bridge vibration. With the ability of the DSLR cameras to record such small movements remotely, the need for physical direct measure sensors are reduced. A shake table was used to test and determine the camera's precision for capturing small movements. Camera results show a less than 0.3% error. Vibration levels of three bridges were measured and determined to be within the safe range of recommended vibration by the American Association of State Highway and Transportation Officials (AASHTO).

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To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/project/1873.

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