Experimental assessment of high sampling-rate robotic total station for monitoring bridge dynamic responses

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Experimental assessment of high sampling-rate robotic total station for monitoring bridge dynamic responses

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Abstract: High sampling-rate robotic total stations (RTS) are emerging tools for monitoring both semi-static and dynamic displacement responses of bridge structures, due to rapid advancements in data sampling rates and tracking speeds. However, the dynamic measurement accuracy of the RTS needs to be fully assessed, especially for different sighting distances. To this end, groups of static and dynamic evaluating tests were carried out on university campuses, and a further in-situ performance assessment with RTS was performed for monitoring dynamic responses of a long suspension bridge in Changsha, China, with a central span of 328 m. A standardized procedure was developed to process these RTS measurements. The background noise in RTS measurements for sighting-distances varying from 25 m to 400 m only results in minor errors which mainly distribute in a frequency range of less than 0.1 Hz. The vibration displacements of an oscillating platform between the RTS and an accelerometer are compared in both horizontal and vertical directions to demonstrate the sufficient accuracy of the RTS measurements. The in-situ experiment also leads to a similar conclusion. This study confirms that the feasibility of using high sampling-rate RTS for monitoring dynamic responses of bridges.

Keywords: Measurement; Robotic total station; Dynamic response; Displacement; Accelerometer