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The Role of LiDAR in the Realm of Bridge Assessment

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1 Abstract

Remote sensing is widely viewed as a potentially disruptive technology in the realm of bridge engineering, especially as it relates to assessment and forecasting of future performance. Initial applications for LiDAR in bridge engineering were limited to measuring large-scale dimensions such as span length and clearance, underutilizing the vast majority of the data gathered. Improvements in data processing and proper manipulation open the possibility of exploiting LiDAR for estimating smaller dimensions which have direct relevance on structural capacity estimation. Furthermore, the comprehensive nature of LiDAR datasets allows calculating global displacements, warping, and deformations caused by local loads or damages at any desired point of the scanned structure. To investigate the practicality of this potential, a suite of LiDAR scans was carried out during a destructive test on a heavily skewed steel multi-girder bridge. Displacement results drawn from the point cloud were between 9% and 12% less compared to the displacements gathered from conventional sensors. In addition, the progression of girder warping was also registered and quantified by the LiDAR dataset. This study provides a detailed accounting of the current state of LiDAR as a potential bridge assessment tool compared to more conventional sensing and visual inspection approaches.

Keywords: bridge assessment, structural health monitoring, remote sensing, structural assessment.

2 Introduction

Light Detection and Ranging (LiDAR) sensors have proven an ability to efficiently and gather in short periods of time a large amount of high quality spatial data, compared to the surveying capacity of the theodolite and total station [1]. Attracting the attention of investigating the use of LiDAR as a means to support structural assessment activities. Key benefits of LiDAR over conventional approaches in this application area include (a) a more complete and measureable record of geometry that may be used for future shape change detection [2], (b) providing a platform that allows to explore the full field behavior of the bridge [1], (c) reducing the potential for documentation errors [3], and (d) helping to standardize the inspection process and reduce the dependence of qualitative and subjective information [4].

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