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Documentation of Bridges by Terrestrial Laser Scanner

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Abstract

Bridge structures are subjected to deterioration due to excessive usage, overloading, and aging material. For the last two decades, a significant amount research has been developed for collecting data for structural health monitoring. Yet, visual investigation with an on-site inspector remains the predominant method. This is true despite the highly subjective and time consuming aspects of this approach. Alternatively, terrestrial laser scanning can acquire surface details of structures quickly and accurately and is, thus, an emerging means to overcome the shortcomings of direct visual inspection. This paper presents a procedure for data collection for bridge inspection documentation and proposes a "cell-based method" for determination of structure deterioration (involving vertical deformation and lateral distortion), as well as surface loss due to corrosion. The Guinness Bridge built in 1880s located in Dublin council, Ireland is selected as a case study to illustrate the efficacy of the proposed method.

Keywords: Terrestrial Laser Scanning, Point Cloud, Historic Mental Bridge, Deflection, Lateral Distortion, Volume /Surface Loss, Damage, Documentation

1 Introduction

A bridge's performance life can be reduced unintentionally by excessive loading and environmental impacts. To counter this, knowledge of a bridge's performance level is needed to schedule timely and sufficient maintenance; otherwise catastrophic damage may occur, particularly for aging bridges. The predominant inspection method is visual, as it has the advantage of being simple [1]. However, the process is subjective and highly dependent upon an inspectors' experience, especially when working in adverse conditions (whether and access) [2]. Visual inspection may also require rather heavy logistics and bridge closure [2]. Thus, obtaining the relevant information for bridge assessment is complex and time consuming when using traditional methods [3].

The current generation of terrestrial laser scanning (TLS) is a non-contact method that has the capability of rapidly acquiring high data density describing the surface topology of structural members at millimeter accuracy. TLS has been used in various related civil engineering applications including biological crust monitoring [4], damage detection [5], structural analysis [6], excavation wall monitoring and general deflection measurement under static loads [7]. This paper proposes a method for post-processing TLS data to estimate deformation (vertical displacement and lateral distortion) and surface loss due to corrosion.

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