APPLICATION OF TERRESTRIAL LASER SCANNER IN BRIDGE INSPECTION: REVIEW AND AN OPPORTUNITY

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Abstract:

Heavy traffic and aggressive environmental conditions can cause unexpected bridge deterioration. Traditional condition evaluation is expensive. An alternative is Terrestrial laser scanning (TLS) which is a non-contact approach that safe, fast, and applicable to a range of weather conditions. This paper reviews applications of TLS on bridge measurement involving geometric documentation, surface defect determination, and corrosion evaluation, and crack identification. Currently, most post-processing of TLS is manual or within third party software. This paper discusses potential approaches to automatic post-processing.

Keywords: LiDAR; Terrestrial laser scanning; point cloud; bridge inspection; bridge clearance; bridge deflection; surface defects

1. INTRODUCTION

Knowledge of a bridge's condition is needed to establish a maintenance and replacement schedule. This requires surveying the physical condition to assess any deterioration, which can be time consuming [1] and typically requires at least partial bridge closure. A non-contact alternative that is gaining popularity is terrestrial Light Detection and Ranging (LiDAR), also known as terrestrial laser scanning (TLS), which enables data acquisition about an object's surfaces at a rate of a million points per second and with a millimetre level accuracy. This paper reviews recent applications of TLS in bridge engineering involving collection of a bridge's geometry to reconstruct models and to compute beam deflection, vertical clearance, and surface defections. In addition, two additional TLS workflows for crack detection and dynamic deflection measurement were also proposed.

2. PRINCIPAL OF TERRESTRIAL LASER SCANNER

TLS uses either ranging or triangulation scanners [2]. With ranging, the distance between the transmitter and reflecting surface is computed either as the time of travel between signal transmission and reception called the time of flight (ToF) of a laser pulse or the phase difference between the transmitted and received wave, which is referred to as the phase comparison method. The latter one uses a transmitting device and a charge-coupled device sensor to detect the laser spot

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