Forensic investigation in the age of the internet of things'

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Summary

Time is of the essence during the data acquisition phase of a forensic structural investigation; the preservation of post-failure site conditions may be limited and access to the site may be restricted. The acquisition of accurate and timely information from the field is a vital component of every forensic structural investigation and often occurs during limited time frames. Laser scanners and vibration sensors are becoming ubiquitous on construction sites. Collection and processing of laser scan data, correlated with vibration and other sensors, can be effective for assessing the condition of an existing building or for collecting forensic information after a failure or collapse. The automatic collection of data creates new challenges: how to effectively sift through the wealth of information provided by the scanning and sensing devices. A good engineer in the field can accurately describe a structure with only hundreds of measurements. A laser scanner on the other hand takes thousands of points of information. Case studies of forensic investigations that have used laser scan technology and vibration sensors will be presented along with ideas for how to enrich our forensic tools with the growing wealth of available devices.

Keywords: 3D Laser Scanner; Scans; Software for point cloud data; Vibrations Sensors.

1. Introduction

Forensic investigations are fundamentally different from new design or peer reviews because engineers have access to the actual physical structure. The more as-built information engineers gather the more comprehensive and accurate the conclusions of their investigation and any prescribed repairs can be. Vibration sensors can confirm the global behaviour of the structure or assembly, while laser scanners capture the geometric details of a structure and record any superficial damage.

Vibration monitors capture the dynamic behaviour of an object. For a building scale structure the first fundamental modes and the damping are most clearly captured. The mass of a structure is usually confirmed through the shop drawing and construction administration phases. While the material is a large component of the cost of the structure, the stiffness is estimated from models that usually include little more than the bare steel, concrete frame or shear walls. The partition walls, cladding and other finishes can have an appreciable impact on the actual stiffness of a building [3]. For forensic investigations, the dynamic behaviour of the structure provides an overview of how the structure has changed before and after an event; a significant shift in a structure's frequency or even damping can be cause for alarm [1],[5].

Laser scanning is a method for accurately capturing the dimensions and position of any object. It provides an accurate record of the as-built conditions of a structure or assembly. Portable laser scanners in particular are becoming powerful forensic tools. The laser scan data enables the engineer to capture the site and chronicle any damage or deformation precisely. This allows the

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