



3D scanning applications in structural design

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Abstract

The 3D scanning of existing structures has become easily available nowadays for practicing structural engineers. The number of specialised companies to perform this service is in a constant rise, while the financial burden of the service is considered to be good value for money. The current study aims to present different methods of using 3D scanning in structural design processes, showing the importance of integrating innovative and new technologies in the day-to-day life of structural engineers. The presented applications of 3D scanning in structural design include load evaluation of existing structures, in order to determine the real loading or load carrying capacity reserves; measuring the construction imperfection and execution errors; mapping the surroundings of new constructions, if these are connected to non-uniform surfaces of existing structures; damage evaluation of steel elements in the aftermath of a fire, in order to determine the elements that could be reused during the rehabilitation process of the structure. The authors present real life examples from their structural design practice, concerning evaluation of different existing structures and rehabilitation projects of historical monuments.

Keywords: 3D scanning; structural refurbishment; imperfection evaluation; execution errors.

1 Introduction

The principle behind the term 3D scanning is a simple one: a laser beam is projected onto a point of a surface, from a stationary position, the distance between them, together with the horizontal and vertical angles being measured and stored. Multiply this by several hundred points, from different locations around the object and one can obtain a realistic three-dimensional virtual model of the outer surface of the object, built up of thousands of points, which can be easily turned and analysed on a computer. The 3D model is able

to show the accurate state of the object at the given moment, when the point cloud was created.

The 3D laser scanners have a history going back to the 1960s. Nowadays, they are used for a large array of applications, ranging from animation industry, to medical applications or even law enforcement [1]. The 3D scanning of an object can be easily linked with a 3D printing machine, in order to recreate an existing object.

Currently there are freely available datasets, containing more than ten thousand 3D scans of real objects, which can be used for any purpose. One