# Change Detection and Assessment of Fire-Damaged Concrete Using Terrestrial Laser Scanning

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## SUMMARY

Fire is one of the serious potential hazards to most structures and damage assessment is the first and the most important job for structural safety evaluation of a structure subjected to fire. The extensive use of concrete as a structural material has neccessitated an investigation into more robust and cost-effective techniques for the assessment of fire-damaged concrete using terrestrial laser scanning. Although concrete is known to be a fire resistant structural material, it undergoes severe changes when exposed to elevated temperatures and this can affect the load bearing capacity of structural bearing elements in several ways. Apart from spalling, there can be a permanent loss of strength in the remaining material. In the aftermath of a fire on a structure, various workers get involved in a variety of response and recovery from disaster operations. Furthermore, following a catastrophic failure of a structure after a fire, rescue workers and emergency responders may be required to enter the fire-damaged structure which can be risky and so an assessment method which has the potential to improve safety was investigated.

Within the field of structural and civil engineering, the methods employed in assessing fire-damaged concrete involve both field and laboratory investigations to determine the extent of fire damage in order to design appropriate and cost effective repairs or to decide whether to demolition the structure. Concrete structures show significant loss of strength when heated above 300ºC. This study aimed at investigating whether terrestrial laser scanning can be used to detect fire-damaged concrete using specimens heated up to 1000ºC as it is important to estimate the maximum temperature attained in a fire. The results obtained from the study clearly demonstrated the feasibility of using terrestrial laser scanning to detect fire-damaged concrete via modelling and analysis of laser returned intensity. Laser scanning has emerged as a complementary assessment method of fire-damaged concrete with a couple of advantages in that the whole concrete element can be scanned and an average intensity value over the area concerned can be determined which

would represent the whole element overcoming the challenge of some traditional methods where cores are drilled in limited areas. Scanning is rapid with millions of points measured in a few seconds. Laser scanning of the fire-damaged structure can be done from a distance without having to enter the structure and this improves safety. Laser scanning is a novel non-destructive technique for detecting fire-damaged concrete.