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# Diagnostic Assessment Considering Complex Damage to Fire-Damaged Structures

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## Extended Abstract

Generally, building fires cause direct damage to human lives and property, and can also result in indirect damage due to the absence of residential and work spaces during the recovery process. Various preliminary studies have been conducted to minimize the direct damage caused by building fires, resulting in the improvement of design methods, enhancement of material performance, and legal supplements that are being applied in construction sites. Furthermore, minimizing indirect damage can be achieved by applying appropriate recovery measures through rational and prompt diagnostic procedures. However, research on rapid and rational diagnostic procedures for damage recovery has been relatively insufficient.

Building fires cause phenomena such as deformation, cracking, spalling, accelerated carbonation, deterioration of material performance, and reduction in residual strength of structural members, leading to complex damage rather than damage by a single factor. Therefore, the diagnostic process of fire-damaged buildings requires a thorough investigation of the damage scale by setting all chemical and physical phenomena occurring in fire-exposed structures as evaluation items, and deriving diagnostic results based on the investigation content. However, existing diagnostic methods for fire-damaged buildings cannot combine the damage of all evaluation items such as deformation, spalling, cracking, carbonation, and heating temperature. It can only present damage grades for each item, making it impossible to derive a rational diagnostic result for fire-damaged buildings. Additionally, the method of estimating heating temperature, which is the most crucial factor in diagnosing fire-damaged buildings, has limitations. It involves visual assessment of concrete discoloration, deformation or melting states of finishing materials, along with various non-destructive testing methods that can yield results significantly different from the actual heating temperature. Estimation results of heating temperatures with large deviations from the actual fire temperature can lead to entirely different evaluations of the fire damage scale. Different results depending on the diagnostician can significantly expand the damage scale.

Therefore, this study aims to propose a rational diagnostic method that overcomes the problems of existing diagnostic methods by minimizing the empirical judgment process of evaluators and performing diagnostics by comprehensively assessing the complex damage items caused by fire. Additionally, to ensure consistent diagnostic results, even when different evaluators perform diagnostics on fire-damaged buildings using the proposed method, the study aims to secure reliability through rational case studies and verification processes for each evaluation item.

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