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# Potential Insights from Performance-Based Design of Fire Protection in Tall Buildings

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## 1 Abstract

Analysis of the structural performance under realistic fire scenarios makes Performance Based Fire Engineering (PBFE) particularly suited to design fire protection of tall buildings. In this paper, the impact of using the PBFE method is studied using a standard tall building as an example. The parametric temperature-time curves recommended in Eurocode 1 are used to define the fire loads. The thermal and mechanical response of the building to the imposed fire loading is subsequently analyzed by means of a finite element model of the mixed-use tower. Particular care is devoted to analyzing the performance of a steel truss at a transfer level, to study potential global effects of a local fire, effects that are not studied or understood within the prescriptive design framework.

**Keywords:** Performance Based Fire Engineering, Tall Buildings under Fire Loads

## 2 Introduction

The recommendations mandated by prescriptive fire protection design result from laboratory tests performed on individual structural elements under unrealistically intense temperature-time curves. Tall buildings often have special structural features to distribute the significant gravity loads and express their architectural aesthetic concept. Analysis of the global behavior of these structures is crucial to fully understand their performance under fire loadings. Performance based fire engineering brings fire science to the design of the system's fire protection and allows for quantifying the performance of the structure in the fire scenarios

In this study, a PBFE approach is employed on a mixed-used tall building structure. Various fire rating assignments are explored in order to gain a quantitative insight of the structural performance under realistic fire conditions and and alternative fire protection levels to compare the PBFE approach to the prescriptive method.

## 3 Building and Fire Scenarios

### 3.1 Building Description

The PBFE framework is here adopted to analyze the performance of a generic 50-story mixed-use tall


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