

Editorial

# Special Issue on “Buildings and Structures under Extreme Loads”

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## 1. Introduction

Exceptional loads on buildings and structures may have different causes, including high-strain dynamic effects due to natural hazards, man-made attacks, and accidents, as well as extreme operational conditions (severe temperature variations, humidity, etc.). All these aspects can be critical for specific structural typologies and/or materials that are particularly sensitive to unfavorable external conditions. In this regard, dedicated and refined methods are required for their design, analysis, and maintenance under the expected lifetime. However, major challenges are usually related to the structural typology and materials object of study, with respect to the key features of the imposed design loads. Further issues can be derived from the need for the mitigation of adverse effects or retrofit of existing structures, as well as from the optimal and safe design of innovative materials/systems. Finally, in some cases, no appropriate design recommendations are currently available in support of practitioners, and thus experimental investigations (both on-site or on laboratory prototypes) can have a key role within the overall structural design and assessment process. This Special Issue presents 19 original research studies and two review papers dealing with the structural performance of buildings and structures under exceptional loads, and can represent a useful answer to the above-mentioned problems.

## 2. Contents

A first set of papers reports on earthquake structural design of structures and buildings [1–5]. Various kinds of structures have been considered under the effects of seismic loads, including steel frames [1], liquid storage tanks [2], and an experimental prototype of atrium-style underground metro station [3], but also existing masonry structures [4] or new timber buildings [5], presenting a perspective review on their seismic design. Among others, an extreme natural event is certainly represented by windstorms. In this Special Issue, wind load modelling and design is mainly addressed by [6–8], while [9] describes the results of a visual test carried out on a suction caisson that support offshore wind turbines. Finally, the last natural hazard analyzed in the Special Issue is snowdrift. Actually, the effects of snowdrift and snow loads in cold regions have been investigated by [10] and [11], with the proposal of a novel calculation approach and a case-study application, respectively.

The knowledge of material properties and characteristics, as known, represents the first influencing parameter for the load-bearing performance assessment of a given structure. In this regard, the knowledge on the topic has been improved by two interesting research contributions focused on composite concrete-steel shear walls [12] and structural glass members [13], respectively, with the support of laboratory/on-site experiments and numerical analyses.

Another interesting group of papers dealing with soil properties and structures–soil interaction phenomena further extends the research fields covered in this Special Issue. In particular, [14] deals

with the determination of Young modulus in bored piles, while [15] presents an investigation on the horizontal axis deviation of a small radius Tunnel Boring Machine (TBM). In this context, it is important to also mention the study in [16], and reporting on the friction resistance for slurry pipe jacking. Finally, an interesting analysis on the effects of derailment and post-derailment of trains is presented in [17], with the support of full-scale testing.

In conclusion, it is known that both man-made attacks and accidents can yield to explosions and fire loads that could push the constructional materials, and thus the structures, to their capacity limits. Blast loads analyses, in this regard, are reported in [18–20], while fire effects on a tunnel structure are analyzed in [21].

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