



ICCECIP 2019

International Conference on Central European Critical Infrastructure Protection

Budapest, 18-19 November 2019

Abstract book

ÓBUDA UNIVERSITY,

**Donát Bánki Faculty of Mechanical and
Safety Engineering**

Edited by Dr. Zoltán Nyikes, nyikes.zoltan@phd.uni-obuda.hu

Conference logo is designed by - Attila Molnár, attila.molnar@softpress.hu

Printed by Óbuda University,

Hungary, Budapest 2019

ISBN 978-963-449-173-6

This abstract book is the printed version of the pdf form identified by ISBN below

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Protecting soft targets with glass: design strategies and challenges

Abstract

Glass facades and systems are generally intended as static partitions and assemblies in buildings, aimed to separate the occupants from the environment, or to act as non-structural, secondary components. However, especially under the action of extreme design loads, glass structures require specific design concepts voted to protect the building occupants for possible risks. This is also the case of terroristic attacks and accidents, where the intrinsic fragility and vulnerability of glass components, thus the propagation of possible shards and fragments, should be properly taken into account. Following earlier research efforts, this paper aims at emphasizing the role of glass in buildings, in the form of several load-bearing components. Major design issues and challenges of such as versatile but vulnerable material are then pointed out, with a focus on extreme loading configurations. The potentials of innovative design concepts, strategies and trends for the mitigation of glass structures under exceptional events are then discussed. Among others, it is shown that the development of a distributed-Tuned Mass Damper (TMD) system (that takes advantage of the added mass/stiffness of glass components in buildings) can be extremely efficient for multi-storey buildings. Comparative numerical simulations are then presented for a case-study building, so to assess the feasibility and possible benefits of this technique, towards further developments and more refined investigations.