DELIVERABLE REPORT

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TITLE:	PREDICTION OF POSSIBLE IMPACTS ON BUILDINGS, ASSETS AND PEOPLE

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Executive Summary

According to various sources (for example the report of the intergovernmental panel on climate change [89], or the Munich Re NatCatService [90]), the chance for climate-induced manifestation of natural hazards (like flooding, storms and droughts) has dramatically increased during the last decades and there is strong evidence for this trend to be continued. In addition, parts of Europe are also exposed to hazards based on geophysical events like earthquakes and volcanic eruptions (for example the earthquake around L'Aquila, Italy, 2009). Apart from natural disasters, Europe has also faced terroristic attacks like bombing or arson (for example train bombings in Madrid, Spain, 2004).

The loss generated by the events was always a combination of damages to persons, buildings and infrastructures. In most cases it can be shown that damages are mitigated if critical infrastructure is rendered resilient regarding the corresponding hazards (fewer fatalities in earthquake-resistant buildings, less damage to buildings with smoke sensors and a proper fire alarming system, prevention of terroristic attacks by intensified security inspections etc.) Therefore, the overall aim of this work is to describe hazards and possible counter-measures and how these measures can be integrated into a best practice approach for the erection of new buildings and infrastructures. To do so, the consideration of hazards should already be integrated into early stages of planning. A result of this project will be the provision of tools to assist this process, in particular, the integration of hazards and their counter-measures into pan-European planning standards like an enhanced BIM (building information modelling) and the development of a hazard-aware building management system (BMS).

In order to prepare the implementation of tools and the codification of new standards, we examine in this reports hazards, which are significantly relevant for the construction and operation of larger building complexes embedded into an urban infrastructure. While the results in this report are valid for a variety of buildings, the consortium has agreed upon a specific showcase (multifunctional office complex in the city centre of The Hague), which we bear in mind when looking closer at some specific aspects of the hazards. The overall objective of our work is to identify and standardize measures, which allow us to maintain the building or urban infrastructure (at least as long as required to ensure safe evacuation of all occupants). We evaluate how down-time after disasters in urban and building infrastructures can be minimized through increased resilience or means of fast recovery (cf. Figure 1). We propose a classification scheme, which allows the prediction of disaster impact (by category) and thus provides basis for recommendations on how to improve resilience sensor-based building management systems (BMSs). This new type of BMS will be used for an experimental performance analysis of multifunctional sensing elements regarding relevant loading scenarios (defined by the consortium).

WP3: Design for safe operations:

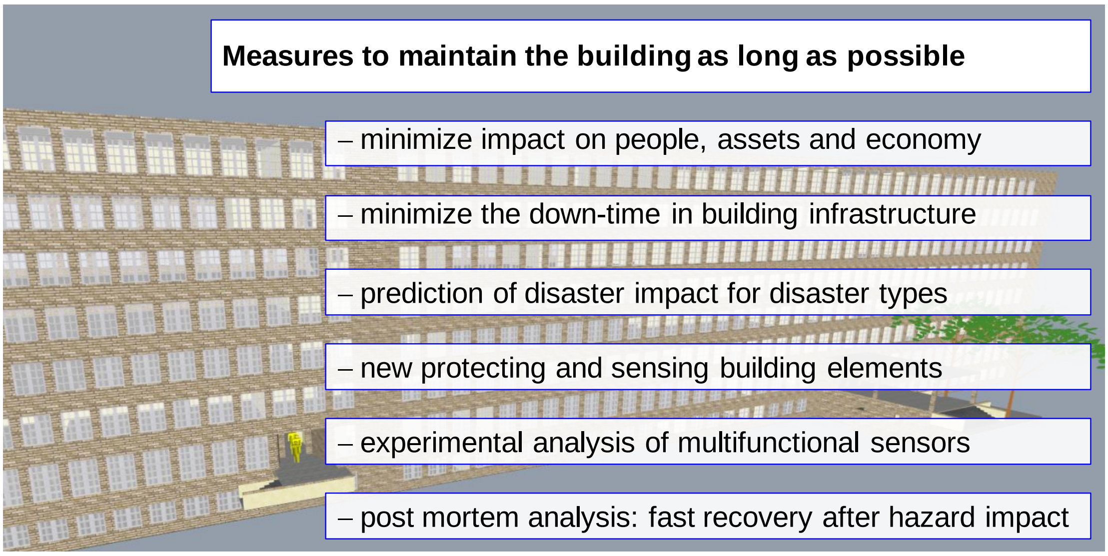


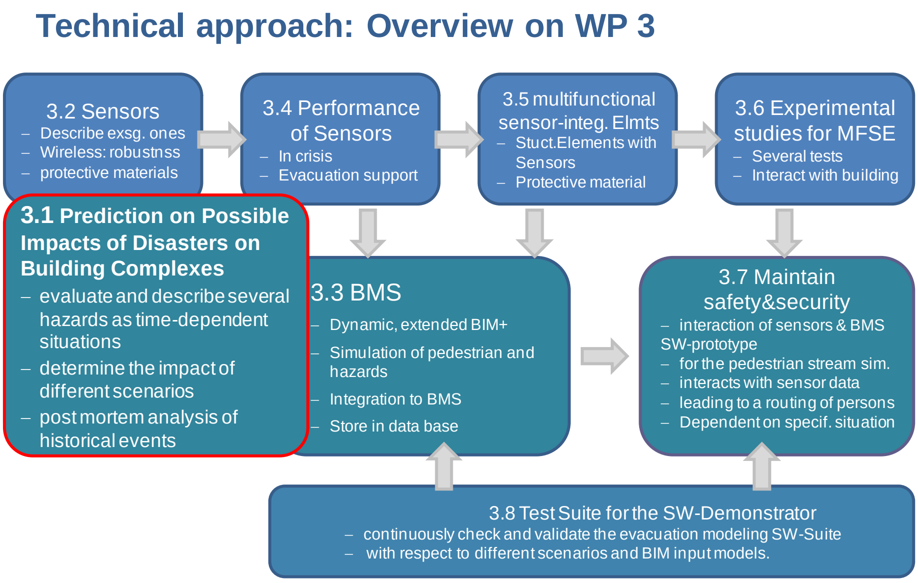
Figure 1: Overview on the main activities in work package 3

Concerning work package 3, we generate a solid base for the top-level activities (like the development of the BMS). We analyzed each of the five hazards (earthquake, high wind load, flood, fire and emissions, as well as explosion scenarios) relevant for the BMS in detail. Every subsection 2.n of the hazard is ordered is a similar manner: Besides the definition and categorization of events (section 2.***n***.1 and 2.***n***.2, this includes a detailed description of the overall manifestation process of the hazard (2.***n***.3) and an analysis of historic events (2.***n***.4). Most important for the development of resilient infrastructures is the knowledge about the impact of hazards on people, buildings and system. This will be discussed in detail in sections 2.***n***.5. Once the impacts are known and well-defined, measures to prevent or mitigate the hazards will be explored and standardized (2.***n***.6). The results of these investigations will be included into a simulation model, which prepares the consideration of hazards in computer programs, particularly the building management software.

Apart from the chapter about the hazard analysis, this report consists of three parts: in the first part, a table will give a short overview on specific hazards in each row vs. their impacts on people, assets, system and structure of the building (in each column). In addition to this short overview, each cell of the table will be explained in more detail in the chapter mentioned above. A similar structure was chosen for the second part of the report, where a short table will give an overview on different scenarios (rows) vs. their risks and impacts on urban infrastructures, building infrastructures and systems (per row), again followed by a detailed description. Part three will describe a concept to store event data in a database, which will be an integral part of the BMS.

Note that the original work package description planned for four parts. However we decided to merge the post-mortem analysis into the chapter about the hazards, since this increases the awareness for their significance, and therefore consolidates the overall set-up of the report.

Most of the pages contribute to the first part, the description and analysis of hazards and their integration into planning systems. The second part, scenario definition is an extension of the results of work package 1. Therefore, a detailed description of this part can be found in the reports on work package one. In order to avoid duplicates, we restrict ourselves to extensions of the scenarios, which enable their experimental evaluation with the building management system. This comprises particularly a concretization and instantiation of the more abstract concepts, which have been elaborated in work package 1. An important link to the work package on multi criteria analysis (MCA) constitutes the last part on the employed data model. This data model will be used as an output format of the BMS systems, particularly of the pedestrian stream simulation. Later on MCA can be performed on the stored data.



Legend: Tasks performed essentially by EMI, by Siemens and as a basic SW-library

Figure 2: Figure of Tasks in work package 3, highlighted the actual task 3.1 analyzed here

As one can derive from Figure 2, this report on task 3.1 serves as base for the succeeding development of Hardware and Software for the Building management system (BMS).

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http://cordis.europa.eu/fp7/cooperation/home_en.html

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