



Places and Technologies 2015

# KEEPING UP WITH TECHNOLOGIES TO MAKE HEALTHY PLACES

Nova Gorica, Slovenia, 18.–19.6.2015

# PT2015

## BOOK OF CONFERENCE PROCEEDINGS

*A healthy city is one that is continually creating and improving those physical and social environments and expanding those community resources which enable people to mutually support each other in performing all the functions of life and developing to their maximum potential.*  
*Health Promotion Glossary (1998)*

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**Places and Technologies 2015**

**KEEPING UP WITH  
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BOOK OF CONFERENCE PROCEEDINGS

**Editors:**

Alenka Fikfak, Eva Vaništa Lazarevič,  
Nataša Fikfak, Milena Vukmirović, Peter Gabrijelčič

Nova Gorica, Slovenia

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## TOWARDS INCLUSIVE FIRE SAFETY DESIGN

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### ABSTRACT

*Fire safety's main goal is to guarantee fire prevention and safety of all occupants in a building in the event of an emergency.*

*The application of inclusive design to fire safety does not impact the approach to fire prevention and protection of buildings as regards plant and construction related aspects (e.g., structural fire resistance, compartmentation etc) yet it changes the approach to the design of egress systems.*

*Just to give an example, it is not always possible to hypothesize immediate egress of persons with disabilities, in conformity with current procedures.*

*Italian building regulations, in accordance with the European ones, provide for the adoption of various solutions, like progressive horizontal evacuation, which consists of moving occupants from an area of the building that has become dangerous to a safe place, while waiting to be rescued: such places commonly include Areas of Refuge and emergency elevator systems, which operate like mechanical tools capable of functioning even during an emergency in order to let people egress safely from the building.*

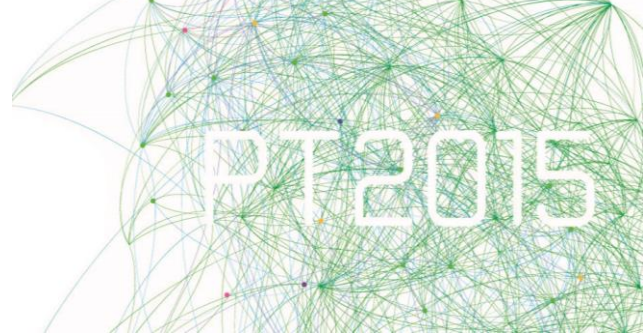
*Such devices and approaches, although present for years by now in the building codes, are in fact still not particularly used and, especially, almost unknown by the end users, as demonstrated by recent research conducted in Italy and abroad.*

*Scientific literature actually focuses on the importance of letting everyone know what to do in case of fire and on being informed on the principles of the building's emergency and evacuation plans that should be designed for all buildings of medium and high complexity.*

*The purpose of this paper is to discuss the tools currently available to ensure inclusive fire safety, through the analysis of the latest international experiences on*

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<sup>1</sup> Corresponding author



*this issue, in order to contribute to a deeper understanding on the part of designers and the scientific community.*

**Keywords:** *fire safety, inclusive design, evacuation strategy for disables people, area of refuge.*

## INTRODUCTION

Fire safety for people with disabilities aims to protect occupants in the event of a fire, in addition to allowing safe accessibility to public and private buildings for anyone.

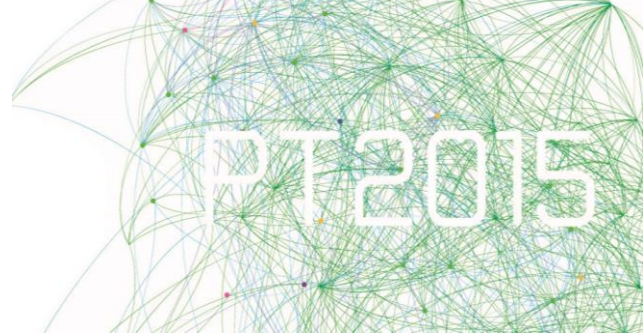
The general principles on which fire protection measures are structured, in order to cope with an evacuation, rely on a procedure that is thought to allow people to get out of the building and, simultaneously, let rescuers get in “in order to let occupants, who may be everywhere in the building, reach a place of safety and allow rescue squads to get inside of the building, to explore it and get out of it” (Council Directive 89/106/EEC, 1994).

From a fire safety point of view the presence of people with disabilities in buildings, whatever their occupancy type, forces us to take into consideration that not all the solutions adopted to allow evacuation can be actually valid for 'all' and that they rather may prove to be little or not suitable for 'few'.

In particular, all the measures concerning to the task “reach a place of safety” in the past have been oriented towards the realization of the complete evacuation of buildings, mainly through horizontal and vertical exit paths and stairs that lead occupants actually outside of the building. Such an assumption may not always be effective in case of people with permanent, and even temporary, motor impairments. Instead, it could even prove not to be functional for people with other kind of disabilities (e.g. visual and auditory) in the event alarm and signage systems, and a specific emergency plan, are not properly designed.

The evolution of the concept of “inclusive design” earlier (J. Clarkson, R. Coleman, 2013) and of today’s “inclusive fire safety design” (a new definition that is proposed here to identify the subject matter) has led to the development of better solutions to ensure the possibility of autonomous or assisted evacuation, temporally articulated, through devices and strategies that can make buildings safer for everyone. Provided that the occupants are aware of the existence of these devices and know how to use them.

Ensuring Inclusive Fire Safety is here considered a paramount factor since it may have significant repercussions on the quality of people’s lives, both in terms of personal autonomy and opportunities for socialization, contributing to a real culture of inclusion where *all* people can take their part and act as citizens to all effects.



However, a building's compliance with a code may not be the only issue when it comes to reaching such a goal. We also need to make sure that occupants and rescuers know how to behave, and use fire safety devices, in the event of an evacuation.

### **INCLUSIVE EGRESS STRATEGIES**

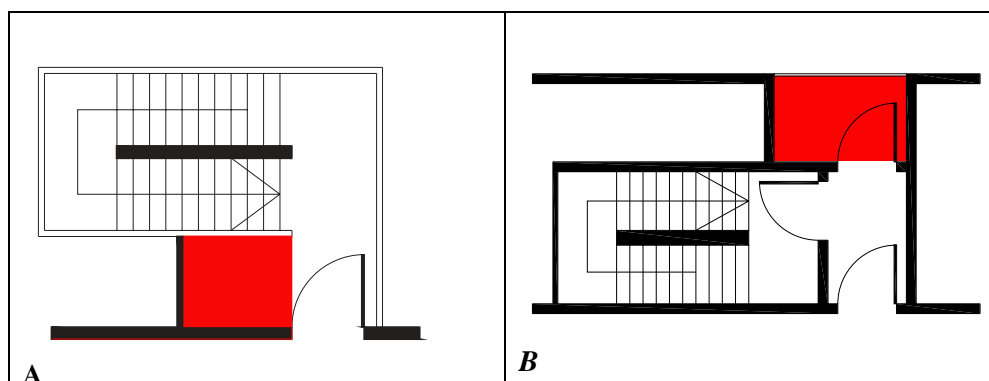
In Italy the first operational indication to ensure a safe evacuation from multi-storey buildings for persons with disabilities dates back to 1994 and is located in a technical regulation for the design of tourist and hotel accommodation. In such buildings the realisation of an "area of refuge", defined as a "safe static place contiguous and communicating with a vertical escape route or inserted therein", was requested by the regulations.

This space should not hamper the usability of escape routes and be such as to ensure the permanence of people with reduced or impaired motor skills while waiting to be rescued". (D.M. 9.4.1994, Approvazione della regola tecnica di prevenzione incendi per la costruzione e l'esercizio delle attività ricettive turistico - alberghiere).

This device, according with what is requested from other European regulations (eg BS 5588-8: 1999, ISO / TC 59 / SC), consists of a space where those who cannot leave the building immediately can stay and wait for help. The Area of Refuge should be located on each floor, so as to be independently accessible and be preferably clearly identifiable and marked on the emergency stair landings, rather than in specific and confined areas, although 'contiguous and communicating' with an emergency exit path.

Indeed, closed and confined rooms, even if marked with specific signage systems, may be difficultly identifiable by the occupants. Research on wayfinding in complex environments, for example, has demonstrated that code complying emergency exit signs cannot always be enough to direct people to a safe place (Carattin, 2011). In addition, as regards areas of refuge, it could result very uncomfortable for the people to stay there even if accompanied by another person.

From a fire safety management perspective, on the other hand, when dealing with buildings in which autonomous egress is almost impossible, such as hospitals and kindergartens, progressive horizontal evacuation is expected to adopt. With such a method people can move (or be moved) in an adjacent compartment, able to contain them and protect them until the fire has been extinguished, or until it becomes necessary to proceed to a subsequent evacuation to a safe place (D.M. 18.9.2002, Approvazione della regola tecnica di prevenzione incendi per la progettazione, costruzione ed esercizio delle strutture sanitarie pubbliche e private).



**Figure 1: Schematic representation of possible locations of the Area of Refuge.**

**Variant A:**

Area of Refuge inserted inside of an emergency exit stair's compartment.

This AR is usually designed by dimensioning the landing connecting the building and the vertical escape route, using as a safety element the characteristics of the compartment required by the regulations.

Advantages: the person who stays in this AR is directly in contact with other occupants and assists at the evacuation, understanding the times and the operational modalities.

**Variant B:**

AR adjacent to an emergency exit stair's smoke compartment.

This AR is designed as a special compartment, compartmentalized and separated from the rest of the building and from the vertical exit pathway through a smoke compartment.

In multi-storey buildings an alternative to the use of emergency stairs, which can be difficult or impossible to use either alone or with the help of trained staff, is represented by appropriately designed elevators, such as egress elevators and firefighter elevators (Kuligowski, E., 2003).

As regards egress elevators, thanks to their plant engineering and structural characteristics, they can be used in case of fire for assisting the evacuation of people with reduced or impaired motor skills. The latter, instead, are for use by rescue teams and, possibly, for the emergency evacuation of the occupants.

These, as a whole, are the prevailing strategies to ensure the evacuation in case of danger for all. Anyway, it is paramount that all considerations to ensure accessibility, such as obstacles-free and appropriately indicated paths (e.g. steps and gradients), must be taken into account.

The process of evacuation of people with disabilities is specifically related to the users' different physical and sensory characteristics. Generally speaking, there are many similarities with the evacuation models adopted for high-rise buildings. When performing these models, in fact, it is currently difficult to figure out a





complete and immediate evacuation of all occupants through the only use of exit stairs.

The main egress strategies can be summarised into four main approaches, namely: total evacuation, phased evacuation, defend-in-place and delayed evacuation (Ronchi, E. & Nilsson, D., 2013). All of these require the use of many egress components, such as stairs and evacuation elevators.

The delayed evacuation approach is intended for people with disabilities and in such a case, in addition to areas of refuge, refuge floors (that are already mandatory in buildings with more than 25 floors in some regulations) are also used (Hong Kong Building Department, 1986; Williamson, BJ & Demirbilek, N., 2010). Anyway, in general, the evacuation approach to be used depends on the severity and specificity of the event, not on the type of people present in the building. Refuge floors, for example, are safe places that may be used by everyone while waiting for their turn to use the elevators or stairs, not only by people with disabilities. This is actually what the authors mean with “inclusive approach”.

#### **THE END USERS' KNOWLEDGE ABOUT THE DEVICES FOR INCLUSIVE EVACUATION**

The tools and management approaches adopted in Italy for the evacuation of people with disabilities are similar to the ones present in other countries, especially in England and the United States which were the first countries in the world that introduced the concept of Area of Refuge as a means to let people egress through distinct evacuation phases, in addition to other specific solutions for people with disabilities and for other occupants who may be interested in such solutions.

Anyway, are the end users aware of the presence of such devices and of the related egress procedures? Scientific literature on this topic is still scarce, with only few case studies (one of them is about to be concluded by the authors in Italy).

In the UK in 2008, the Department for Communities and Local Government has undertaken a survey (D.C.L.G. 2008) with the aim of figuring out how to improve evacuation procedures for people with disabilities and to check the effectiveness and weaknesses of the current guidelines on emergency egress. The research was carried out in order to find out the end users' perspective of both the workers and people with disabilities. As regards the workers, 35 professionals involved in emergency procedures have been tested. The researchers themselves admitted this sample is enough to provide a range of opinions, yet not statistically significant.

The most interesting considerations emerged from the question "How does a disabled person get from a fire refuge to a place of safety?" The answers referred to many possibilities, e.g. Assistance & Evacuation Chair: 25%; Assistance (Trained): 24%; with Personal Emergency Evacuation Plan: 13%; Lift /



Firefighting lift: 6%. This various range of responses demonstrates that even specialists may not clearly be aware of the procedures.

It was also asked to indicate the main problems of an evacuation system based on fire refuges and, in this case, the participants highlighted that the main factor of success of the evacuation depends on human factors, such as: the possibility that the people in charge of assisting the disabled persons are out of the office or have hurted themselves, malfunction of the management system or lack of proper training.

The University of Ulster in Belfast (UK) has conducted a research by sending questionnaires by mail to 300 people with multiple sclerosis and subsequently focusing on a focus group of 12 people chosen among all responders (McConnell, N. Boyce, K. 2012).

In particular, the results relating to the level of knowledge and understanding of the use of Refuge Areas are very interesting: half of the respondents said they had never heard of Refuge Areas and 60.4% of respondents felt that they would not be comfortable remaining in a refuge area for more than 10 minutes without further assistance. In addition, respondents declared very little knowledge also about other systems that may be of help in an egress, such as evacuation lifts or evacuation chairs. For example, 80.7% had little or no awareness of an evacuation lift and many said they would be afraid to use it since they are concerned that it might stop at a floor invaded by smoke or fear of being trapped inside. In particular, this last sentence demonstrates that users do not know all the characteristics of an evacuation lift and highlights the importance of focusing on proper communication and training in order to let people effectively use it.

People with disabilities have been claiming for decades the right to live and move autonomously in buildings and cities, and this goal has been largely achieved. Today a person with disabilities can move on the streets and have access to public and private buildings. On the other hand, this higher level of accessibility may paradoxically become a new element of concern, if these people are not prepared to deal with emergency situations, using the egress systems and devices that are designed for them.

## CONCLUSIONS

- There is still a gap between the aim of the standards, research and reality. Specific surveys show that the end users do not know about the devices and methods of evacuation that regard them directly. This is a serious problem because in case of real danger these devices, like refuges, could prove completely useless.



- Everyone should have the same right to evacuate safely from a building.
- There is currently the need to improve the preparedness of professional and end users through the use of an approach based on better communication (Carattin, E.; Labate, E.; Meneghetti, C.; Pazzaglia, F.; Tatano, V., 2012).
- Inclusion should be taken into account from the decision-making process first. In this regard, it could be useful to think about setting a participatory process to revise objectives and functions of the devices prescribed by the regulations as relates to evacuation.

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