

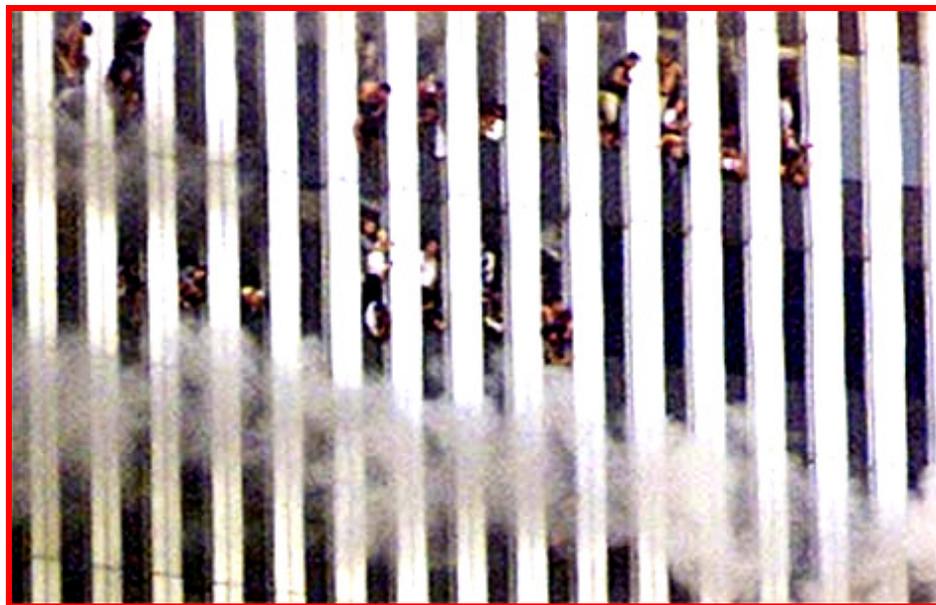
CIB W14 WG V: Buildings & 'Fire Incident Human Behaviour, Abilities & Perception'

CIB

International Council for Research and Innovation in Building and Construction

CIB W14: 'Fire Safety'

Working Commission 14 is an international, multi-stakeholder, transdisciplinary, pre-normalization forum for discussion and action, on research and innovation in Fire Science and Engineering for the design, construction and operation of a Safe, Resilient and Sustainable Built Environment.



9/11

WTC

Does the International Fire Science & Engineering Community understand what it feels like to be left behind, perhaps to die, in a fire incident ?

0 CIB W14 Reflection Documents

A Reflection Document is not an academic or a scientific paper, but a document intended to open up a sensitive aspect of fire engineering for wider discussion, re-examination, and re-imagining ... to propose a framework for future progress and, if necessary, to posit some immediate solutions. It is a document written in a simple, generic language in order to be equally accessible to diverse design disciplines and interested groups.

This is the second Reflection Document issued within CIB Working Commission 14: 'Fire Safety'. The first, back in April 2012, dealt with the subject of **'Structural Reliability & Fire-Induced Progressive Damage'** ... very necessary in the light of a determined reluctance on the part of jurisdictions around the world to effectively implement the 2005 & 2008 National Institute of Standards & Technology 9/11 WTC Recommendations. But already those safety-critical recommendations have become dated. After the Mumbai Hive Attacks in 2008 and the similar type attacks in Paris earlier this year (2015) ... NIST's focus on only 4 High-Risk Building Types is no longer adequate.

1 This Reflection Document – Introduction

Traditionally, buildings have been designed, constructed and operated on the basis that, in the event of a fire incident, everybody will eventually 'escape' ... whether that be within 2.5 minutes (time required to play a national anthem?!?), or the large part of a day (1993 WTC Bomb Attack in New York City). Many people, most especially vulnerable building users, are injured or die in such an obsolete 'escape' scenario.

Where some people remain in place during a fire incident, the consequences for building design, construction and operation have not yet been properly understood or taken into account. And where some jurisdictions have considered the fire safety of people with activity limitations in buildings – **Fire Safety for All** - their efforts have tended to be tokenistic. Such disingenuous efforts ... technically flawed, blatantly discriminatory and, now, a violation of human rights ... are no longer legally acceptable.

The specific purpose of this CIB W14 Reflection Document is to examine building-related fire safety, protection and evacuation for people with activity limitations ... to propose an overall framework which will facilitate future progress in person-centred design ... and to update current fire engineering practice. It is also intended to encourage discussion about fire engineering's traditional tenets ... and our profession ... in a time of rapid transformation towards a more collaborative, transdisciplinary approach in the design, construction and operation of a **Safe, Resilient and Sustainable Built Environment**.

2 Building Performance, Accessibility for All & Usability

A **Building** is a permanent construction ... comprising structure, essential electronic, information and communication technologies (EICT's), and fabric (non-structure) ... having a minimum life cycle of 100 years ... and providing habitable, functional and usable interior space(s) for people, which comply with basic performance requirements.

Basic performance requirements for buildings include: structural reliability in ambient and fire conditions; fire safety for all; accessibility for all; energy conservation and efficiency; hygiene; good indoor air quality; protection against noise; and sustainability, etc. See **Appendix II** – Annex I of the European Union Construction Products Regulation 305/2011 - for a good example of these requirements.

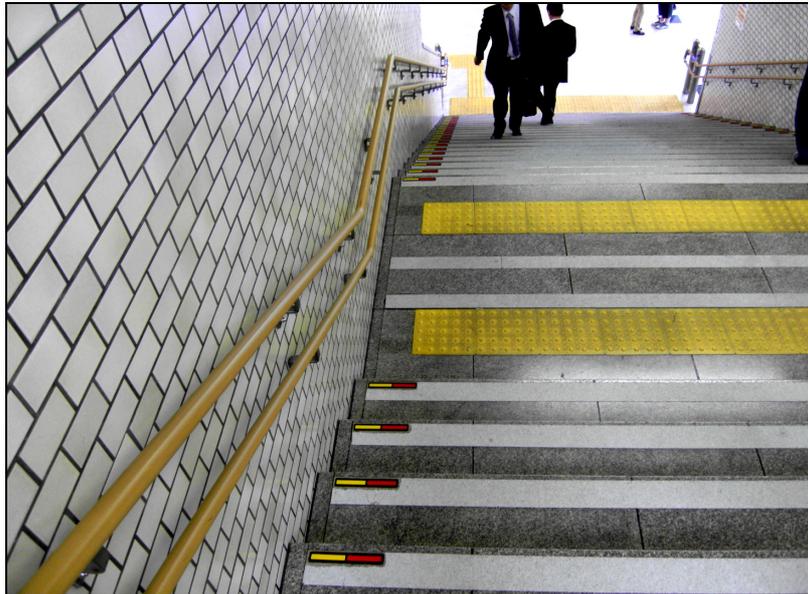
2.1 Accessibility & Fire Safety for All

"In its simplest form, architecture is rooted in entirely utilitarian considerations" (Walter Gropius, architect). Accessibility and Fire Safety for All are two such considerations ... and are a basic feature of good, i.e. high quality, user-friendly building design ... an essential attribute of a Sustainable Building and a Sustainable Built Environment.

Building Accessibility – a dynamic, evolving concept - encompasses the complete cycle of independent use, in a dignified manner and on an equal basis with others ... and includes the approach, entry and use of a building and its facilities, egress during normal conditions and removal from its vicinity ... and, most importantly, **safe evacuation** during a fire incident to a **place of safety** which is remote from the building and reached by way of an accessible route.

An Accessible Building is safer, easier to use and more convenient for ALL building users and occupants. Why would any person wish to design a building which is user-hostile ??

Contrast this Public Staircase in Japan ...



... with this very worrying, 'user-hostile' scene in Ireland ...



If **Accessibility for All & Usability** are properly considered at Building Design Stage:

- Buildings are easier to understand (intuitive) during a Fire Evacuation ;
- Fire Evacuation Routes are easier to find (obvious) and to use ;
- Everyone can safely evacuate a Building on Fire – with no more tragic tales about people with disabilities being left behind in multi-storey schools or offices.

Unfortunately, this is not how the subject of 'Accessibility for All' is either communicated or taught to students of building design, construction and operation ! And even more unfortunately, this is not how 'Accessibility for All' is either communicated or promoted to society generally !!

2.2 Building Occupants & Users under Stress

The people who use and occupy buildings are individuals. They are different from each other; they each have a different range of abilities, behaviours and ways of perceiving their environment. Two apparently similar people will also show variations in how they react to and behave in any specific situation. **Ability/Disability is a continuum ...** a gentle gradient on which every person functions and acts at different levels due to personal and environmental factors.



In situations of severe stress, e.g. a real fire incident in a building, with a lack of preparedness for such an event, a lack of familiarity with evacuation routes, a lack of information, a lack of strong leadership and clear direction, and the presence of smoke ... panic attacks exist ... standard movement times do not exist. In 2005, the National Institute of Standards & Technology (USA) stated that the average surviving occupant in the New York World Trade Center Towers, on 11 September 2001, descended stairwells at about half the slowest speed previously measured for non-emergency evacuations.

Based on the fire research work of Tadahisa Jin, in Japan, it is known that a small but significant number of people **will not** approach, enter or pass through smoke ... more people **cannot** do so, for example, those with respiratory health conditions.

Extracts from 2 Presentations of **Columbia University's 2001 WTC 9-11 Evacuation Study**, given by Robyn R.M. Gershon, MHS DrPH - Principal Investigator, on 29 March 2006 and 2 March 2012 ...

Emergency Preparedness of 1,444 Surviving Occupants/Users

Had NEVER exited the building as part of a drill: 94 %
Reported NO plans regarding where to gather AFTER evacuating: 84 %
NO plans for head count: 84 %
NEVER provided with evacuation plans: 82 %
Had participated in fire drills: 81 % (of these, only 11% had ever entered a stairwell)
Were NEVER provided with written fire safety instructions: 74 %
Were NOT familiar with who was in charge: 33 %

Health Status of 1,444 Surviving Occupants/Users

Disability or Medical Condition: 23 %
Including ...

- Asthma: 28 %
- Mobility: 21 %
- Mental Health: 15 %
- Heart Condition: 12 %
- Other (pregnancy, illness): 15 %
- Vision: 5 %
- Hearing: 3 %

Said their Disability affected ability to walk down a large number of stairs: 16 %



Delaying Activities (Interior) of 1,444 Surviving Occupants/Users

Once they Decided to evacuate, but BEFORE they began ...

- Gathered personal items: 40 %
- Sought out friends/co-workers: 33 %
- Searched for others: 26 %
- Made phone calls: 18 %
- Shut down/personal computer related: 8 %
- Waited for direction: 7 %
- Gathered safety equipment: 5 %
- Changed shoes: 3 %
- Tried to obtain permission to leave: 1 %

Injuries of 1,444 Surviving Occupants/Users

Physical Injuries: 37%

Including ...

- Surface trauma: 12 %
- Smoke inhalation: 11 %
- Orthopaedic injury: 7 %
- Eye injury: 4 %
- General trauma: 4 %

Psychological Injuries: 25 %

Severity ...

- Sought medical attention: 63 %
- Hospitalized: 7 %



Long-Term Injury Patterns of 1,444 Surviving Occupants/Users

Reported at least one long-term injury: 15.4 % (some reported more than one)

- Mental health: 53 %
- Respiratory: 24 %
- Orthopaedic: 12 %
- Medical: 7 %
- Cardiac: 2 %
- Vision/hearing: 2 %

Delaying Activities (Exterior) of 1,444 Surviving Occupants/Users

Did not immediately leave the area: 50 %

- Stopped to see what was happening: 36 %
- Looked for friends/co-workers: 26 %
- Looked for a phone: 15 %
- Did not know where to go: 14 %



Being physically capable of independently leaving the final exit of a burning building is not an indicator of a survivor's health status !

Many long-term health studies on people who survived the WTC 9-11 Incident, including firefighters, rescue workers, non-WTC workers, and local residents, etc., are still in progress. Below, are some of the **Key Findings (2008) from the New York City WTC 9-11 Medical Working Group ...**

Physical Trauma & Respiratory Health

- 2,751 people were killed in the WTC attack. Other victims were treated for burns and injuries, some of which have substantially affected the quality of their lives since.
- In the first months after 9-11, respiratory symptoms were common among people who breathed in the dust, smoke and fumes released by the WTC collapses.
- Clinical studies of exposed rescue and recovery workers show that respiratory symptoms subsided over time for many workers, but have persisted for others. While nearly all responding New York City (NYC) firefighters experienced respiratory symptoms on the day of the WTC attack, symptoms have persisted for approximately 25% of firefighters two to four years later. Prior to 9-11, fewer than 5% of NYC firefighters had chronic respiratory symptoms.
- In surveys conducted two to three years after 9-11, rescue and recovery workers, Lower Manhattan residents and area workers all reported levels of new asthma that were two-to-three times higher than national estimates.
- For several worker groups, pulmonary function tests have documented decline in lung function or high prevalence of abnormal lung function after 9-11.
- Compared to pre-9/11 levels, new diagnoses of sarcoidosis (an inflammatory condition of lung and often other organs) or sarcoid-like lung disease were elevated among NYC firefighters in the first year after the disaster. Since then, rates have subsided to pre-9/11 levels.
- Gastroesophageal reflux (GERD) symptoms are common among WTC-exposed populations, especially in conjunction with upper and lower respiratory symptoms, but it is difficult to draw conclusions about the relationship between GERD and WTC exposure because GERD occurs frequently in the general population.

Mental Health

- Post-traumatic stress symptoms and disorders were common in the first six months after 9-11 among people both directly and indirectly exposed to the WTC disaster.
- Early symptoms of post-traumatic stress resolved quickly for most people, particularly for those who were not directly exposed.
- However, among directly exposed populations, rates of PTSD were elevated two-to-three years after 9/11: 12% of rescue and recovery workers and 13% of Lower Manhattan residents reported symptoms of PTSD, which is three times higher than would be expected if the WTC attack had never occurred.
- In the general New York City population, rates of depression and abuse of alcohol or other substances are not persistently elevated as a result of the WTC disaster.
- Among groups directly exposed to the WTC disaster, depression and substance abuse have not been well studied.

Other Physical Health & Mortality

- A small number of studies on women pregnant on 9-11 have suggested that exposure to the disaster may have impacted birth outcomes, such as increased risk of lower birth weight or shorter length at delivery. These impacts were small in magnitude and of unclear clinical significance. No studies to date have identified if these birth outcomes had subsequent clinical implications, such as developmental delays.
- One national study of individuals not in physical proximity to the 9-11 attack showed that those who experienced acute stress as a result of the attack were at increased risk for new onset hypertension and heart problems.
- Many studies have been initiated to examine the possibility of WTC-related cancers and to measure overall patterns of mortality among people exposed to the collapses.

2.3 2012 Fire at a Sheltered (Disability) Workshop in Germany

The following are selected extracts from local news reports ...

'A source close to Caritas, the Catholic Church Welfare Agency which runs the workshop, said there were 50 or 60 people aged between 20 and 65 in the building when the blaze broke out. In total, the workshop employed some 120 people with disabilities.'

'The source said the majority were mentally disabled workers who were manufacturing wooden decorations for Christmas as well as other electrical and metal goods.'

'The building was relatively modern and **fully respected the fire regulations**, this source stressed.'

'Religious Welfare Agencies enjoy many privileges. They are subject to virtually no control, enjoy substantial tax privileges, and ban their employees from unionizing.'

"We are dealing here with people who of course do not react rationally", local news agency DPA quoted Local Fire Chief, Alexander Widmaier, as saying.



*14 Dead, including 1 Carer & 10 Seriously Injured.
This Fire Incident required 300 Very Well Resourced Firefighters !*

Despite the valuable survivor information gathered after the 9/11 Attacks in New York City, for example, far too little is still known about human behaviour, abilities and perception in real fire situations. Current research in this area tends to be aimed at simplistic rationalization and quantification for the purpose of developing computer models which focus solely on death, incapacitation and time required during the 'escape' of able-bodied users from a building. This is no longer adequate, or ethically acceptable.

All potential building users must be considered in the development of a Fire Defence Plan, and reasonable space must be provided for their **protection** and **safe evacuation**. Circulation spaces in buildings must be designed for **contraflow**. All building users, where practicable, must be **skilled** to undertake safe, independent evacuation to a Place of Safety which is remote from a fire building and reached by way of an accessible route. **This is Fire Engineering in its appropriate and proper architectural context.**

3 U.N. 2006 Convention on the Rights of Persons with Disabilities

Adopted by the United Nations General Assembly (A/61/611) on 13 December 2006, the Convention (UN CRPD) has now been ratified, which is an entirely voluntary process, by 115 Countries, and been formally confirmed by 1 Regional Integration Organization, i.e. the European Union. The CRPD's Optional Protocol has been ratified by 88 Countries.

' Full and effective accessibility of the Human Environment (social, built, virtual, economic and institutional) is a fundamental human and social right, i.e. a basic need, for **people with activity limitations** – it is an essential prerequisite for the safe exercise and enjoyment of those rights, protections and freedoms set down in the 1948 Universal Declaration of Human Rights and subsequent international rights instruments ... and crucially, for their **health**, participation, inclusion and development in all communities.'
[Principle 1, 2015 Dublin Declaration on 'Fire Safety for All' in Buildings]

In order to understand the scope of the human rights and fundamental freedoms to be exercised and enjoyed by individuals with activity limitations, **and groups**, who use the Built Environment ... and to ensure that appropriate and effective fire engineering strategies are considered when developing a Fire Defence Plan for a building ... it is necessary to examine selected extracts from the Convention and its Optional Protocol ...

Preamble Paragraph (g)

Emphasizing the importance of mainstreaming disability issues as an integral part of relevant strategies of sustainable development,

[Under social aspects of Sustainable Human & Social Development, **Accessibility for All**, including Fire Safety for All, is an essential attribute of a Sustainable Built Environment. In Sustainable Fire Engineering ... Fire Safety for All is a priority design objective.]

Preamble Paragraph (v)

Recognizing the importance of accessibility to the physical, social, economic and cultural environment, to health and education and to information and communication, in enabling persons with disabilities to fully enjoy all human rights and fundamental freedoms,

[Health, as defined by the World Health Organization, is a state of complete physical, mental and social wellbeing, and not merely the absence of disease or infirmity. This concept must be understood and fully accepted within the International Fire Science & Engineering Community. People who stagger out of a building on fire are not 'healthy'.]

Article 1 – Purpose

The purpose of the present Convention is to promote, protect and ensure the full and equal enjoyment of all human rights and fundamental freedoms by all persons with disabilities, and to promote respect for their inherent dignity.

[Consistent with Article 1, people with activity limitations must be positively encouraged to participate in fire safety preparatory planning and regular evacuation practices from buildings ... and, without exception, must be consulted and included in **all** activities concerning their own evacuation. During practice and 'real' evacuations, **people must retain possession** of their personal facilitation aids and devices, e.g. a wheelchair, in order to travel independently, with dignity, to a place of safety remote from a building.]

Article 4 – General Obligations

1. States Parties undertake to ensure and promote the full realization of all human rights and fundamental freedoms for all persons with disabilities without discrimination of any kind on the basis of disability. To this end, States Parties undertake:

(b) To adopt all appropriate legislative, administrative and other measures for the implementation of the rights recognized in the present Convention; To take all appropriate measures, including legislation, to modify or abolish existing laws, regulations, customs and practices that constitute discrimination against persons with disabilities;

(c) To take into account the protection and promotion of the human rights of persons with disabilities in all policies and programmes;

(d) To refrain from engaging in any act or practice that is inconsistent with the present Convention and to ensure that public authorities and institutions act in conformity with the present Convention;

[Consistent with Article 4.1(b) ... the use of person and/or location specific Personal Emergency Evacuation Plans (PEEPS) in an accessible building is discriminatory. They must never be used to limit or restrict access to any part of a building and its facilities.]

Article 9 – Accessibility

1. To enable persons with disabilities to live independently and participate fully in all aspects of life, States Parties shall take appropriate measures to ensure to persons with disabilities access, on an equal basis with others, to the physical environment, to transportation, to information and communications, including information and communications technologies and systems, and to other facilities and services open or provided to the public, both in urban and in rural areas. These measures, which shall include the identification and elimination of obstacles and barriers to accessibility, shall apply to, inter alia:

(a) Buildings, roads, transportation and other indoor and outdoor facilities, including schools, housing, medical facilities and workplaces;

(b) Information, communications and other services, including electronic services and **emergency services**.

2. States Parties shall also take appropriate measures:

(a) To develop, promulgate and monitor the implementation of minimum standards and guidelines for the accessibility of facilities and services open or provided to the public;

(b) To ensure that private entities that offer facilities and services which are open or provided to the public take into account all aspects of accessibility for persons with disabilities;

(c) To provide training for stakeholders on accessibility issues facing persons with disabilities;

(d) To provide in buildings and other facilities open to the public signage in Braille and in easy to read and understand forms;

(e) To provide forms of live assistance and intermediaries, including guides, readers and professional sign language interpreters, to facilitate accessibility to buildings and other facilities open to the public;

(f) To promote other appropriate forms of assistance and support to persons with disabilities to ensure their access to information;

(g) To promote access for persons with disabilities to new information and communications technologies and systems, including the Internet;

(h) To promote the design, development, production and distribution of accessible information and communications technologies and systems at an early stage, so that these technologies and systems become accessible at minimum cost.

[There are no references to either 'fire' or 'safety' in Article 9. Initially, the only approach open to the issue of Fire Safety in Buildings – a situation of serious risk - was by way of Article 11. More recently, however, international attention has been drawn to the urgent necessity of developing that Article. It is appropriate, now, since the publication of ISO 21542 in December 2011 with its comprehensive definition of Building Accessibility ... that Fire Safety for All be fully integrated into Article 9 ... **in exactly the same manner**

that fire safety is integrated into mainstream building use, building codes and standards. **N.B.** As management systems and fire protection measures in buildings are never 100% reliable, people with activity limitations must be positively encouraged to be self-aware in situations of risk, and facilitated in learning the **skill** of self-protection.

Concerning 1(b) above ... [emergency services](#) and the accessible forms and formats of communication with the public which they must facilitate ... refer to [Article 21](#) below.]

Article 10 – Right to Life

States Parties reaffirm that every human being has the inherent right to life and shall take all necessary measures to ensure its effective enjoyment by persons with disabilities on an equal basis with others.

Article 11 - Situations of Risk & Humanitarian Emergencies ...

States Parties shall take, in accordance with their obligations under international law, including international humanitarian law and international human rights law, all necessary measures to ensure the protection and safety of persons with disabilities in situations of risk, including situations of armed conflict, humanitarian emergencies and the occurrence of natural disasters.

[Not all emergencies are the same, and measures necessary to ensure the protection of people with activity limitations will differ from one situation of grave risk to another. Concerted international action on risk and damage reduction must focus on the following: Extreme Man-Made Events (e.g. 2001 WTC 9/11 & 2008 Mumbai-2015 Paris Hive Attacks); Hybrid Disasters (e.g. 2011 Fukushima Nuclear Incident); Severe Natural Events (e.g. Earthquakes, Floods, Landslides, Typhoons & Tsunamis); Complex Humanitarian Emergencies (e.g. Mass Refugee Migrations & Regional Famines) ... all within a context of Accelerating Climate Change & Variability. Transformative societal adaptation must be directed at the realization and maintenance of a Safe, Resilient and Sustainable Human Environment.

N.B. Because of the time-lag before local emergency services can be brought into action and protection measures deployed, people with activity limitations must be facilitated in learning the **skill** of self-protection until assistance arrives.]

Article 19 - Living Independently & Being Included in the Community ...

States Parties to the present Convention recognize the equal right of all persons with disabilities to live in the community, with choices equal to others, and shall take effective and appropriate measures to facilitate full enjoyment by persons with disabilities of this right and their full inclusion and participation in the community, including by ensuring that:

- (a) Persons with disabilities have the opportunity to choose their place of residence and where and with whom they live on an equal basis with others and are not obliged to live in a particular living arrangement;
- (b) Persons with disabilities have access to a range of in-home, residential and other community support services, including personal assistance necessary to support living and inclusion in the community, and to prevent isolation or segregation from the community;
- (c) Community services and facilities for the general population are available on an equal basis to persons with disabilities and are responsive to their needs.

[Consistent with Article 19, the goal of **Fire Safety for All** must be to facilitate independent evacuation to an accessible place of safety remote from a building. All lifts/elevators in buildings must be capable of being used for evacuation. During practice and 'real' evacuations, therefore, the necessary assistance to be provided to people with activity limitations by other building users, or firefighters, will be limited.]

Article 21 - Freedom of Expression & Opinion, and Access to Information

States Parties shall take all appropriate measures to ensure that persons with disabilities can exercise the right to freedom of expression and opinion, including the freedom to seek, receive and impart information and ideas on an equal basis with others and through all forms of communication of their choice, as defined in Article 2 of the present Convention, including by:

- (a) Providing information intended for the general public to persons with disabilities in accessible formats and technologies appropriate to different kinds of disabilities in a timely manner and without additional cost;
- (b) Accepting and facilitating the use of sign languages, Braille, augmentative and alternative communication, and all other accessible means, modes and formats of communication of their choice by persons with disabilities in official interactions;
- (c) Urging private entities that provide services to the general public, including through the Internet, to provide information and services in accessible and usable formats for persons with disabilities;
- (d) Encouraging the mass media, including providers of information through the Internet, to make their services accessible to persons with disabilities;
- (e) Recognizing and promoting the use of sign languages.

Article 24 – Education

1. States Parties recognize the right of persons with disabilities to education. With a view to realizing this right without discrimination and on the basis of equal opportunity, States Parties shall ensure an inclusive education system at all levels and lifelong learning directed to:

Article 27 - Work & Employment

1. States Parties recognize the right of persons with disabilities to work, on an equal basis with others; this includes the right to the opportunity to gain a living by work freely chosen or accepted in a labour market and work environment that is open, inclusive and accessible to persons with disabilities.

Article 31 - Statistics & Data Collection

1. States Parties undertake to collect appropriate information, including statistical and research data, to enable them to formulate and implement policies to give effect to the present Convention.

2. The information collected in accordance with this article shall be disaggregated, as appropriate, and used to help assess the implementation of States Parties' obligations under the present Convention and to identify and address the barriers faced by persons with disabilities in exercising their rights.

Article 32 - International Co-Operation

1. States Parties recognize the importance of international co-operation and its promotion, in support of national efforts for the realization of the purpose and objectives of the present Convention, and will undertake appropriate and effective measures in this regard, between and among States and, as appropriate, in partnership with relevant international and regional organizations and civil society, in particular organizations of persons with disabilities. Such measures could include, inter alia:

Article 33 - National Implementation & Monitoring

2. States Parties shall, in accordance with their legal and administrative systems, maintain, strengthen, designate or establish within the State Party, a framework, including one or more independent mechanisms, as appropriate, to promote, protect and monitor implementation of the present Convention. When designating or establishing such a mechanism, States Parties shall take into account the principles relating to the

status and functioning of national institutions for protection and promotion of human rights.

UN CRPD's Optional Protocol ...

Article 1

1. A State Party to the present Protocol ('State Party') recognizes the competence of the Committee on the Rights of Persons with Disabilities ('the Committee') to receive and consider communications from or on behalf of individuals or groups of individuals subject to its jurisdiction who claim to be victims of a violation by that State Party of the provisions of the Convention.
2. No communication shall be received by the Committee if it concerns a State Party to the Convention that is not a party to the present Protocol.

4 Fire Safety for All – Selected Terms & Definitions

So many diverse design disciplines and interested groups are involved in the realization and maintenance of an Effectively Accessible Built Environment, which is Fire Safe for All, that the use of simple, easily assimilated language and precise technical terminology must be widely exercised. And concerning fire engineering ... it is not clear when the practice began, but defining a concept simply in terms of performance in a 'standard test' fire is inadequate, and fails to explain the actual meaning of the concept.

Area of Rescue Assistance: A sufficiently large, monitored building space directly adjoining, and visible from, a main vertical evacuation route - robustly and reliably protected from heat, smoke and flame during **and** after a fire - where people may temporarily wait with confidence for further information, instructions, and evacuation assistance or rescue, without obstructing or interfering with the evacuation of others.

Building Adaptability: The extent to which a building is designed when new, or is capable of being easily modified at any later stage, to meet the changing life and living needs of the broad range of potential users, who may or may not have activity limitations or develop a health condition during the life cycle of that building.

Building Flexibility: The extent to which a building interior is designed, when new, to be capable of being easily modified at any later stage during the life cycle of that building - with minimal cost and user inconvenience - because of a person's changing life, living or work needs.

Built Environment: Anywhere there is, or has been, a man-made or wrought (worked) intervention in the natural environment, e.g. cities, towns, villages, rural settlements, service utilities, transport systems, roads, bridges, tunnels, and cultivated lands, lakes, rivers, coasts, and seas, etc ... including the Virtual Environment.

Contraflow Circulation in a Fire Building: Emergency access by firefighters or rescue teams into a building and towards a real fire ... while building users are still moving away from the fire and evacuating the building.

Design Fire: A fire with specified exposure data intended for use in connection with structural fire engineering calculations.

Commentary: A design fire may either be representative of the thermal exposure

described by the standard 'time-temperature-pressure' relationship in an International / European / National Standard, or some non-standard exposure intended to simulate particular fire exposure conditions.

Disproportionate Damage: The failure of a building's structural system: (i) remote from the scene of an isolated overloading action; and (ii) to an extent which is not in reasonable proportion to that action.

Evacuation from a Fire Building: To withdraw, or cause to withdraw, all users from a building which is on fire ... in pre-planned and orderly phased movements to an accessible place of safety remote from the building.

Experimental Test Fire: A full or reduced scale fire in a test laboratory, with specified and controlled characteristics.

Fire Compartmentation: The division of a building into fire-tight compartments by fire, smoke and heat resisting elements of construction, in order to ...

- a) contain an outbreak of fire, including any smoke and heat generated by the fire ;
- b) prevent damage, within the building, to other adjoining compartments and spaces ;
- c) protect the building's interior from external fire attack, e.g. fire spread across the building's facade or from an adjacent building ;
- d) minimize adverse, or harmful, environmental impacts outside the building.

Commentary: A Sustainable Building may only be partially compartmented.

Fire Defence Plan: A pre-determined and co-ordinated use of available human and material means in order to maintain an adequate level of fire safety and protection within a building and, in the event of an outbreak of fire, to ensure that it is brought speedily under control and extinguished - with the aim of minimizing any adverse or harmful environmental impacts caused by the fire.

Fire-Induced Progressive Damage: The sequential growth and intensification of structural deformation and displacement, beyond fire engineering design parameters, and the eventual failure of elements of construction in a building - during a fire and the 'cooling phase' afterwards - which, if unchecked, will result in disproportionate damage, and may lead to total building collapse.

Fire Resistance: The inherent capability of a building assembly, e.g. a doorset, or an element of construction, e.g. a wall or a floor, to resist the passage of heat, smoke and flame for a specified time during a fire.

Commentary: This term should no longer be used in connection with any aspect of structural performance in fire. See the preferred term below: **Structural Reliability**.

Human Health: A state of complete physical, mental and social wellbeing, and not merely the absence of disease or infirmity.

Informed Consent: Consent freely obtained - without threats or improper inducements - after appropriate disclosure to a person of relevant, adequate and easily assimilated information in a form (e.g. oral, written, braille) and language understood by that person.

Life Cycle Cost: The social, environmental, economic and institutional costs, both qualitative/quantitative and direct/indirect, of the inputs, outputs and usefulness of a product (and/or service) system throughout its life cycle.

Maximum Credible Fire Scenario: A representation, and/or depiction, of fire and operating conditions in a building which are severe, but reasonable to anticipate ... including those conditions related to building construction, occupancy, ventilation, fire loads, ignition sources, building space geometry, and fire control measures.

People with Activity Limitations (E) / Personnes à Performances Réduites (F): Those people, of all ages, who are unable to perform, independently and without aid, basic human activities or tasks - because of a health condition or physical / mental / cognitive / psychological impairment of a permanent or temporary nature.

Commentary: The above Term, in English and French, includes ...

- wheelchair users, and people who experience difficulty in walking, with or without a facilitation aid, e.g. stick, crutch, calliper or walking frame ;
- the very young (people under the age of 5 years), frail older people, women in the later stages of pregnancy, and the visually and/or hearing impaired ;
- people who suffer from arthritis, asthma, or a heart condition ... or any partial or complete loss of language related abilities, i.e. aphasia ... or who have a cognitive impairment disorder, including dementia, amnesia, brain injury, or delirium ;
- people impaired after the use of alcohol, other 'social' drugs e.g. cocaine and heroin, and some medicines ... or following exposure to environmental pollution and/or other irresponsible human activity, e.g. war or terrorism ;
- people who experience a panic attack in a real fire situation or other emergency ;
- people, including firefighters, who suffer incapacitation as a result of exposure, during a real fire, to smoke and poisonous/toxic substances and/or elevated temperatures.

Place of Safety:

- Any accessible location beyond a perimeter which is [100] metres from the fire building or a distance of [10] times the height of such building, whichever is the greater ; **and**
- Where necessary triage can safely be rendered ... and from where effective medical care and supervision can be organized and provided within one hour of injury (the 'golden hour') ; **and**
- Where people can be identified.

Commentary: If there is a risk of an explosion associated with a fire, the numbers in square brackets should be multiplied by a factor of 4.

Proprioception: The perception by a person of stimuli relating to his/her position and movement in space, and his/her posture, equilibrium, and internal condition.

Commentary: Proprioception is the sixth human sense. It is also the sense which transmits information concerning the position of a person's limbs relative to his/her torso.

Real Fire: A fire which develops in a real building, and is influenced by such factors as the type of building and its occupancy; the combustible content (fire load); the ventilation, geometry and thermal properties of the fire compartment, or building space (should no fire compartmentation exist); the fire control measures in the building, and the actions of the emergency fire services.

Commentary: A real fire is a complex phenomenon. Consequently, in structural fire engineering, an idealized version of a real fire - a design fire - is used as the basis for design calculations.

Realistic End Condition: A real fire in a real building, which is used by real people with varying abilities in relation to self-protection, independent evacuation to a place of safety

remote from the building, and participation in the fire defence plan for the building.

Commentary 1: The realistic end condition is **not** a standard test fire, an experimental fire in a laboratory, or a design fire in a computer model, even if it is verified/validated.

Commentary 2: A standard test fire in a laboratory, involving exposure of a test specimen or prototype to standard test fire conditions, gives only a limited indication of: (a) the likely performance of a particular product, material or component when exposed to 'real fire' conditions; and (b) the suitability of a product, material or component for a particular end use.

Resilience: The ability to function reliably during normal conditions, to withstand, adapt to or absorb unusual disturbance, disruption or damage, and thereafter to quickly return to an enhanced state of function.

Skill: The ability of a person - resulting from proper training and regular practice - to carry out complex, well-organized patterns of behaviour efficiently and **adaptively**, in order to achieve some end or goal.

Social Environment: The complex network of real and virtual human interaction - at a communal or larger group level - which operates for reasons of tradition, culture, business, pleasure, information exchange, institutional organization, legal procedure, governance, human betterment, social progress and spiritual enlightenment, etc.

Social Wellbeing for All: A general condition - for every person in a community, society or culture - of health, happiness, creativity, responsible fulfilment, and sustainable development.

Sterile Space (Fire): An open building space of sufficient and appropriate extent - retaining an exceptionally low level of fire hazard and risk, and 'intelligently' fitted with a suitable user-friendly fire suppression system, e.g. water mist - designed to resist and control, for a specified time during a fire, the advance of heat, smoke and flame.

Structural Fire Engineering: Those aspects of fire engineering concerned with structural design for fire, and the complex architectural interaction between a building's structure and fabric, i.e. non-structure, under conditions of fire and its immediate aftermath, including but not confined to the 'cooling phase'.

Structural Reliability The ability of a structural system to fulfil its design purpose, for a specified time, under the actual environmental conditions encountered in a building.

Sustainable Design: The creative and ethical design response, in resilient built and/or wrought form, to the dynamic concept of Sustainable Human & Social Development.

Sustainable Human & Social Development: Development which meets the responsible needs of this generation - without stealing the life and living resources from future generations, especially our children, their children, and the next five generations of children.

Commentary: Responsible needs are defined and elaborated in the 1948 Universal Declaration of Human Rights, subsequent International Rights Legislation, and the United Nations 2015 Sustainable Development Goals & Performance Targets.

Virtual Environment: A designed environment, electronically generated from within the built environment, which has the appearance, form, functionality and impact - to the person perceiving and actually experiencing it - of a real, imagined and/or utopian world.

5 Sustainable Fire Engineering's Core Concepts

5.1 'Reality'

The **Realistic End Condition** – complex and still difficult to understand in many cases – is a real fire in a real building involving real people. This must be clearly distinguished from the range of simplistic simulations of 'reality' which are routinely carried out in a fire test laboratory, or on a computer. And it is necessary to be aware that some manufacturers, advised by competent people, specifically shape the design and development of their fire safety related building products and/or systems to pass these simulated tests ... while purposefully ignoring 'reality'. An obvious example of this is a fire resisting doorset fitted with a keyhole, at or around door handle height, which is open from one side of the door leaf to the other, i.e. a person can see through it.

5.2 'Reliability'

At any time in the very long life cycle of a building ... its fire protection measures, both passive and active, will never be 100% reliable. This fact will have been considered in a competent **Fire Defence Plan**, but it is critical where some people will be expected to remain in a building during a fire incident. **For reliability, good workmanship is essential.**

Again, taking the example of a fire resisting doorset (comprising a door leaf, door frame, fire and smoke seals, necessary ironmongery, e.g. hinges), properly fixed to surrounding fire resisting construction ...



The door leaf, in the photograph above, has been propped open using a portable fire extinguisher. It may not be obvious to the people using this building, however, that in a real fire incident large quantities of smoke, flames and heat will pass unhindered through the door opening, threatening the important protected area of their lift/elevator shaft and staircase. In other words, the doorset is no longer fire resisting.

And it will not at all be obvious to building users, if the following 'hidden' details of this doorset, and workmanship, i.e. the quality of its installation, are also in doubt ...

- the doorset's fitness for purpose, i.e. whether or not it has been properly fire tested ;
- installation of the complete doorset, e.g. important doorset components may have been omitted, e.g. a door hinge, or the fire and smoke seal at the top of the door leaf ;
- fixing of the doorset to the wall, e.g. not enough fixings have been used, or the wrong type of fixing has been used, e.g. aluminium instead of steel ;

- the gap (required for installation) between the doorset frame and the wall ... may not have been sealed to prevent the spread of fire, smoke and heat ;
- the fire resistance rating of the timber panelling above the doorset, shown above, is inferior to the fire resistance rating of the doorset itself ;
- openings in fire resisting construction in the ceiling cavity directly above the doorset and/or the floor cavity directly below may not have been fire, smoke and heat sealed.

5.3 'Redundancy': Lean is Mean - Lean is Not Sustainable !

Some people may have to remain in a building during a fire incident. Depending on the location of the building ... it will take a certain amount of time, give or take a few minutes, for the emergency services to arrive at the scene ... some more time to carry out a reconnaissance ... and still more time before they are prepared to enter the building in sufficient strength to be effective. More time will be required to search the building, and to establish whether or not there are any people waiting in **Areas of Rescue Assistance**. If the building's management system is inadequate, or has failed altogether ... more time will be required by firefighters to assist with their rescue.

Building legislation may indicate that fire resisting doorsets in this building should have a fire/smoke resistance rating of 30 minutes ... but a prudent decision may be to install fire resisting doorsets which have a rating of 1 hour. Yes, in a **benign design fire** scenario we may be looking at a redundancy of 30 minutes ... but in a **malign real fire** scenario, and given the time uncertainties outlined above, that additional 30 minutes will provide a reasonable factor of safety. **For redundancy, good workmanship is essential.**

5.4 'Resilience'

The life cycle of a building is very long. It is expected that the minimum life cycle for a Sustainable Building will be 100 years. During all that time ... will a fire resisting doorset, for example, be designed to withstand normal building use, normal abuse and normal maintenance ? As fire science and technology develops, will it be easy to upgrade ? And after a real fire incident, will it be relatively quick and easy to repair or replace ?

In other words, will that fire resisting doorset perform as expected ... at any time during a building's long life cycle ? **For resilience , good workmanship is essential.**

6 Fire Safety, Protection & Evacuation for All in Buildings

It is not intended, here, to regurgitate fire engineering's fundamental tenets ... except for one very important principle, which must be applicable in the case of **ALL** building users: **everybody must have a clear (intuitive and obvious), alternative and safe means of evacuation leading directly to the exterior**. Consistent with this principle, building cores, comprising lifts/elevators, evacuation staircases and service ducts, etc., must be designed away from the centre of buildings, and towards their periphery.

Similarly ... it is not intended, here, to reproduce the fire safety texts and figures already contained in the International Standard **ISO 21542 (2011): Building Construction – Accessibility & Usability of the Built Environment**, but to build on that foundation. Its safety-critical texts must now become mandatory. A detailed key must be added to Figure 62, showing a Fire Evacuation Staircase. Examples of the essential relationship 'Staircase'-'Area of Rescue Assistance'-'Lift/Elevator' must be shown in new figures. References to firefighters, because of their role in assisting evacuation, must be included.

As already discussed above, there are major gaps and ambiguities in the United Nations Convention. See **Appendix III: 2015 Dublin Declaration on 'Fire Safety for All' in Buildings**, which deals with some of those defects and creates an essential framework in support of independent fire evacuation for people with activity limitations.

An updated and comprehensive presentation of a dynamic, evolving concept - 'Accessibility for All' - and its relationship with the related concept of 'Usability', i.e. user-friendliness, must be elaborated and agreed at international level. Confusion and a lack of understanding about these concepts, combined with a determined reluctance to implement the UN CRPD and/or incompetent implementation, are all too evident in most countries. Best practice examples tend only to be implemented in isolation, disconnected from a necessary enveloping environment which must also be accessible.

The toilet cubicle in the photograph below complies with accessibility-related legislation ... but is it 'accessible' or 'usable' in a proper sense ?



Particularly when dealing with **Fire Safety for All in Buildings** ... the use of simple, easily assimilated language and precise technical terminology must become the norm. See **#4** for terms. The World Health Organization's 2001 International Classification of Functioning, Disability & Health (ICF) must be the common foundation for this language. Where a person's health and safety in a building on fire is concerned, the confusion and misunderstandings caused by political correctness cost lives and cannot be tolerated.

Accessibility for All is an evolving and dynamic concept. A critical detail of accessibility in a train station, for example, is the gap between the train and the platform, which for safety reasons alone must be small and constant throughout. The train's approach to the station must, therefore, be considered from a distance of at least 1 Km before the station. Similarly, a place of safety for building users during a fire incident must be 'safe' and 'accessible' ... beyond the space required for emergency service personnel to operate effectively with their vehicles, and beyond the range of building collapse and flying debris.

Building Circulation - access/egress/evacuation/rescue, including the approach to and removal from the building - is a continuum for users, i.e. workers, occupants, visitors, residents, service and maintenance personnel, cleaning contractors, and firefighters, etc.

Tokenism can take many forms. The Area of Rescue Assistance in the photograph below complies with legislation ... but it is not 'fit for purpose'. Furthermore ... this is a multi-storey, third level educational establishment. There is only one Area of Rescue Assistance in the whole multi-storey staircase shown, because the top landing offered the only easy/cheap opportunity to provide one. At a technical level, this approach is deeply flawed. It puts people with activity limitations on other floors at grave risk during a fire. It is also blatantly discriminatory and, now, it is also a violation of human rights.



People with Activity Limitations have the right to receive equal treatment with other building users concerning their health, safety and welfare during and after a fire incident.

Passive and Active **Fire Protection Measures**, and Building **Management Systems** ... are **never 100% reliable**. Competent fire engineering aims at an appropriate assembly of protection measures and management systems which will ensure an adequate level of effective safety, which includes a redundancy factor, in a completed/occupied building.

Fire Safety Objectives in Legislation are, necessarily, limited in scope to the protection of public safety. Property protection beyond that relevant to building user safety, and business continuity, are not usually within the scope of traditional legislation. Fire Safety Objectives should not be confused with the **Project-Specific Fire Engineering Design Objectives** which must be developed by a competent building design team, in consultation with the client or client organization. Where building legislation does not refer to the fire safety of people with activity limitations, or deals with it in an inadequate or tokenistic manner, this neglect must be made good by the design team.

When people are seeking protection in a residential building complex on fire, or people with activity limitations are waiting during a fire incident in any building ... **Structural Reliability** during and after the fire is safety-critical. More precisely, the building must remain **structurally stable and serviceable** ... throughout both of these distinct periods. And before directing/recommending/suggesting that people wait or seek protection within a building during any stage of a fire incident ... the people having direct control over that building must fully assure themselves and the people who will be waiting or seeking protection therein that the building will remain structurally stable and serviceable.

Fire Evacuation Strategies must be safe and, practically speaking, implementable. An evacuation may be carried out in a **single stage, or phased over a number of stages**. Preference is for Multi-Stage Evacuation, but this strategy can only be operated if it is considered at the beginning of the building design process ... and built-in !

Single Stage Evacuation is necessary in existing buildings, or new buildings, which have not been designed for Multi-Stage Evacuation. Pre-incident preparation, planning and liaison with local fire services, and a building user population which is skilled for evacuation will ensure a calm and confident atmosphere **for all** during a real fire incident. In some limited circumstances, however, the threat to health and safety may be so severe and immediate that it is necessary to evacuate all building users in the shortest practicable time. Evacuation procedures must be developed, long before any such incidents take place, which ensure that people with activity limitations will not be left behind. Draft International Standards dealing with Immediate 'All-Out' Single Stage Evacuation, which includes the use of all lifts/elevators in a building, are overlooking this important issue.

Multi-Stage Phased Evacuation is the preferred option. It is very damaging to the reputation of a Luxury 6 or 7 Star Hotel, for example, if all guests have to be evacuated in the middle of the night because of a tiny incident in one small part of a very large building. Initially, multi-stage evacuation is horizontal ... involving movement beyond the Buffer Zone (see definition in ISO 21542:2011) surrounding a Compartment which is on fire, i.e. a Place of Relative Safety (see definition in ISO 21542:2011). In this case, two vertical layers of fire (rated for integrity only) and smoke resisting construction separate building users from the fire. If the fire or smoke spreads beyond the Fire Compartment, i.e. the compartment of fire origin, horizontal evacuation progresses as required. At a certain stage in the development of a building fire, however, it may be necessary to evacuate vertically towards ground level ... and this can mean either down or up ! With a proper emphasis on design for emergency evacuation today, rather than on access in 'ye goode old days', competent design practice now dictates that Cores (comprising lifts/elevators, staircases and service ducts, etc.) are moved away from the centre of a building/building complex towards its periphery, and that they are built using heavy concrete construction. Lightweight core construction, e.g. plasterboard/drywall, is no longer either adequate or acceptable ... in any geographical location !

With the increased use of heavy electric wheelchairs (too heavy to be lifted manually on a staircase) and expensive manual wheelchairs which have been specially adapted to an individual person's needs (too valuable to be left behind) ... all lifts/elevators in a building must be capable of facilitating safe evacuation for all. If, however, a conveniently located/adjacent **accessible lift/elevator** is out of service ... or there is no lift available for evacuation ... some people will have to wait in an Area of Rescue Assistance, which in addition to the fit-out described in ISO 21542, must be constantly monitored.

The difference between a **Place of Relative Safety**, where waiting may only be a fleeting experience, and an **Area of Rescue Assistance** (located in a building core with a lift/elevator adjacent), where waiting may be prolonged and the evacuation of other building users is taking place right in front of the people having to wait ... is as follows: an Area of Rescue Assistance must be of sufficient size to service the reasonably expected needs of building users with activity limitations (see Principle 7, 2015 Dublin Declaration on 'Fire Safety for All' in Buildings); the second vertical layer of construction, i.e. that actually enclosing the Area of Rescue Assistance, must be fire (**rated for integrity and insulation**) and smoke resisting; and the structure for the Area of Rescue Assistance must be robust heavy construction, e.g. concrete, which has been designed to resist Fire-Induced Progressive Damage and Disproportionate Damage. See definitions in **#4** above.

Accessibility-Related Construction Products & Facilitation Aids must be well-designed, taking into account normal use and abuse, properly tested by independent accredited test laboratories, and fully shown to be 'fit for their intended use'. Easily assimilated instructions for use must always accompany such products and aids. These requirements, usually legal, are widely disregarded in Accessibility Design & Management.

Assisted Evacuation & Rescue Equipment must be well-designed for realistic end conditions, properly tested, and fully shown to be 'fit for their intended use'. Users of such equipment and their 'assistants', including firefighters, must be skilled in the safe and efficient operation of all evacuation and rescue equipment in a building. It should always be remembered that long distances may have to be travelled within a building ... that it may sometimes be necessary to go up a staircase in order to reach ground level ... and that long distances will have to be travelled, externally, in order to reach an accessible 'place of safety' which is remote from the building. These requirements, usually not understood, are widely ignored in Accessibility Design & Management.

Existing approaches to the '**Buddy**' System are inadequate and discriminatory. For greater reliability and effectiveness, each 'buddy' unit must comprise a minimum of three people, and the system must be operated throughout a full building user population. Except in the case of the most simple, low-rise (1 and 2 storey) projects ... circulation space in buildings must be designed, throughout, to accommodate the **Contraflow Movement** of firefighters accessing and people evacuating during a fire incident.

The Fire Services have two functions: fighting fires and assisting evacuation when building management systems fail. Much more can and must be done, therefore, to consider firefighter safety in building design. Heavily equipped firefighters must not be expected to move rapidly up or down staircases of more than 10 stories in height. And no matter how well designed and managed, it is not acceptable for people with activity limitations to be marooned in an Area of Rescue Assistance on the 69th Floor of a building. Furthermore, fire suppression systems, e.g. sprinklers, are never 100% reliable. For these reasons ... every 20th Floor in a High-Rise, Tall, or Super-Tall Building must be designed and managed as a Sterile Space (see #4) – **Floor of Temporary Refuge** - serviced by firefighter lifts/elevators which are accessible for all, and can be used for evacuation. **Firefighters must have a clear, alternative means of access to attack a fire.**

Existing Buildings will usually not have been designed to facilitate the phased, multi-stage evacuation of all users. In that case, the design principles outlined in this Reflection Document, including its Appendices, must be suitably adapted by a competent person and applied to fit the local context. Where interventions are proposed for reasons of accessibility and/or fire safety in **Buildings of Historical/Cultural/Architectural Importance**, the integrity of those buildings must be protected. The International Council on Monuments & Sites (ICOMOS – www.icomos.org) **1964 Venice Charter** sets out 16 Articles/Principles which must be regarded as mandatory on all projects. As a final outcome, it may be necessary to restrict building access to a maximum number of people at any one time, or to restrict access to specific parts of the building, or a combination of both. Access restrictions must not discriminate against people with activity limitations ... and safe evacuation for all must be assured.

Independent Monitoring of Accessibility & Fire Safety for All Projects must become the norm ... **Benchmarking** must be initiated, and **Performance Indicators** developed !

Finally ... it is well worth repeating that, to be effective, Fire Safety for All texts must be fully and properly integrated into all Mainstream Fire Safety Building Codes/Regulations and Standards at international, national and regional levels around the world.

7 Sustainable Fire Engineering

Every year ... **Fire** is the cause of enormous direct and indirect losses which amount to a very significant percentage of Gross Domestic Product (GDP) in all economies, whether rich or poor ... and also results in enormous environmental damage and social disruption. Some losses have not yet been fully identified, e.g. in the case of environmental damage ... and others are not yet capable of being fully quantified, e.g. business interruption and brand damage. Current fire statistics are unreliable. In all situations, however, the waste of valuable human and natural resources caused by fire is unsustainable. Refer to the recent (2015) [Tianjin Fire Disaster in China](#).

The Aim of Sustainable Fire Engineering is, therefore, to dramatically reduce all fire losses in the Human Environment and to protect and preserve the Natural Environment.

Towards Zero Preventable Fires in the Built Environment !

In essence ... Sustainable Fire Engineering heavily front-loads Fire Prevention and Fire Protection Measures – far beyond the levels required by Building Codes/Regulations and Standards - in order to reduce direct and indirect fire losses in the Built Environment.

Sustainable Fire Engineering, a quantum leap in the evolution of fire engineering design philosophy, is ...

- **Reliability-Based** - has an empirical, rational and scientifically sound basis ; and
- **Person-Centred** - 'real' people are placed at the centre of creative endeavours and due consideration is given to their responsible needs, and their health, safety, welfare and security in the Human Environment.

Sustainable Fire Engineering Solutions are ...

- **Adapted to Local Context**, e.g. geography, climate extremes and variability, social need, economy, and heritage ; and
- **Resilient**. See definition in **#4** above.

The **Sustainable Fire Engineer** ... working in an ethical, professional and collaborative manner with other design disciplines as part of a team ... elaborates **Project-Specific Fire Engineering Design Objectives** which properly protect the interests of society and his/her clients or client organizations ... with the overall aim of realizing and maintaining a **Safe, Resilient and Sustainable Built Environment**.

8 This Reflection Document & Your Comments

This Reflection Document has been written in a language which is intended to facilitate easy assimilation by diverse design disciplines, interested groups and the general public ... most especially by the International Fire Science & Engineering Community and the International Disability & Accessibility for All Community. Client organizations, facilities managers, firefighters and manufacturers have also been considered.

I wish to sincerely thank those individuals and organizations who have contributed to the work of this CIB W14 Research Working Group.

All comments and suggestions are very welcome ... and they should be e-mailed to: fireox@sustainable-design.ie

C.J. Walsh, FireOx International - Ireland, Italy & Turkey.
Chair, CIB W14 Research WG V

APPENDIX I

[See separate PDF File]

'Fire Safety for All' Matrix

Are we considering every person with an activity limitation ?
Are we considering all impairment categories ?
Are we considering the rest of the built environment, besides buildings ?

Useful Supporting Information:

CEN/CENELEC Guide 6 : 2014

Section 7 – Human Abilities & Characteristics

[Not included here]

APPENDIX II

[See separate PDF File]

Basic Requirements for Construction Works

Example of Annex I

E.U. Regulation No. 305/2011 of the European Parliament
and of the Council, of 9 March 2011,
Laying Down Harmonized Conditions for the Marketing
of Construction Products
and Repealing Council Directive 89/106/EEC

[Complete Legal Instrument]

APPENDIX III

[See separate PDF File]

2015 Dublin Declaration on 'Fire Safety for All' in Buildings

A Call to Action and Successful Implementation !

An Essential Framework Document Supporting
Independent Fire Evacuation for People with Activity Limitations
& Dealing with Defects in the UN CRPD

Adopted in Dublin, on 10 April 2015

APPENDIX IV

Some Definitions of 'Disability'

Why is there such a wide variety of definitions, and so many differences in approach ?
Could there be financial and/or political reasons ?

SOME DEFINITIONS

European Disability Forum (EDF) Website

'Agreeing on a common definition of disability is not an easy task. Several attempts have taken place in the past years, at various levels. At present, there is no one unique and agreed definition of disability. The lack of a clear definition partly explains the lack of statistics and figures on disability in Europe.'

Ireland's 1998 Employment Equality Act

Disability:

Means -

- (a) the total or partial absence of a person's bodily or mental functions, including the absence of a part of a person's body;
- (b) the presence in the body of organisms causing, or likely to cause, chronic disease or illness;
- (c) the malfunction, malformation or disfigurement of a part of a person's body;
- (d) a condition or malfunction which results in a person learning differently from a person without the condition or malfunction; or
- (e) a condition, illness or disease which affects a person's thought processes, perception of reality, emotions or judgement or which results in disturbed behaviour, and shall be taken to include a disability which exists at present, or which previously existed but no longer exists, or which may exist in the future or which is imputed to a person.

Ireland's 2005 Disability Act

Disability:

In relation to a person, means a substantial restriction in the capacity of the person to carry on a profession, business or occupation in the State or to participate in social or cultural life in the State by reason of an enduring physical, sensory, mental health or intellectual impairment.

Assessment:

Means an assessment undertaken or arranged by the Executive to determine, in respect of a person with a disability, the health and education needs (if any) occasioned by the disability and the health services or education services (if any) required to meet those needs.

Executive:

Means the Health Service Executive.

Ireland's Building Regulations, Part M: Access for PWD's

People with Disabilities:

Means people who have an impairment of hearing or sight or an impairment which limits their ability to walk, or which restricts them to using a wheelchair.

This limited definition has been removed from Ireland's current version of Part M ... which contains no reference to 'disability'.

USA Census Bureau – Household Economic Studies 2010 Americans With Disabilities

Disability in the Communicative, Mental, and Physical Domains

This report categorizes types of disabilities into communicative, physical, and mental domains according to a set of criteria described here. While the characteristics of individuals with disabilities in a domain may be heterogeneous, the domains may group individuals with some common experiences. Because people can have more than one type of disability, they too may be identified as having disabilities in multiple domains. For the purpose of this report, disability among children aged less than 15 years are not categorized into one of the three domains. Furthermore, it is possible for adults to have a disability for which the domain is not identified.

People who have disability in the communicative domain reported one or more of the following:

1. Was blind or had difficulty seeing.
2. Was deaf or had difficulty hearing.
3. Had difficulty having their speech understood.

People who have disability in the mental domain reported one or more of the following:

1. Had a learning disability, an intellectual disability, developmental disability or Alzheimer's disease, senility, or dementia.
2. Had some other mental or emotional condition that seriously interfered with everyday activities.

People who have disability in the physical domain reported one or more of the following:

1. Used a wheelchair, cane, crutches, or walker.
2. Had difficulty walking a quarter of a mile (approximately 400m), climbing a flight of stairs, lifting something as heavy as a 10-pound bag (approximately 4.5 Kg) of groceries, grasping objects, or getting in or out of bed.
3. Listed arthritis or rheumatism, back or spine problem, broken bone or fracture, cancer, cerebral palsy, diabetes, epilepsy, head or spinal cord injury, heart trouble or atherosclerosis, hernia or rupture, high blood pressure, kidney problems, lung or respiratory problem, missing limbs, paralysis, stiffness or deformity of limbs, stomach/digestive problems, stroke, thyroid problem, or tumour/cyst/growth as a condition contributing to a reported activity limitation.

World Health Organization (WHO)

Disability

This term should now only be used generically, where reference to the three dimensions of the 2001 United Nations World Health Organization (WHO) International Classification of Functioning, Disability and Health (ICF) - *Body Functions & Structures, Activity and Participation* - is intended.

Rather than a dichotomous concept ... disability, here, is a gradient on which every person functions and acts at different levels due to personal and environmental factors.

APPENDIX V

[See separate PDF File]

Example of Disability Statistics

Mandated by UN CRPD - Article 31: Statistics & Data Collection

USA Census Bureau – Household Economic Studies

2010 Americans With Disabilities

[Complete Report – Issued July 2012]