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ScienceDirect

Energy Procedia 134 (2017) 787–796

Procedia Engineering

www.elsevier.com/locate/procedia

9th International Conference on Sustainability in Energy and Buildings, SEB-17, 5-7 July 2017, Chania, Crete, Greece

The 'Safety Gap' in buildings: Perceptions of Welsh Fire Safety Professionals

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Abstract

This paper presents evidence of a 'Safety Gap' in buildings for fire performance and reviews different approaches to achieving Fire safety in England and Wales, UK, for a Research & Enterprise Innovation Funded project at Cardiff Metropolitan University. One aspect of the safety Gap is for potential defects in construction from incorrect installation, missing, inappropriate or defective components, that make up compartmentation, fire stoppings and workmanship errors, to enable rapid smoke spread across compartments, so preventing the safe evacuation of occupants. A questionnaire survey was conducted with fire rescue and safety professionals in South Wales, UK in 2016. Results show that more than 75% of the respondents think that in-built performance of fire safety measures including compartmentation are difficult to assess during fire risk assessments and fire risk audits, using current visual inspection methods. The majority of the participants agreed that a non-intrusive and non-destructive test method could help in ascertaining the integrity of building compartmentation and in-built performance of other fire safety measures and to ensure the safety gap is not present. It is discussed that these findings give fire industry backing for the non-destructive test, measurement and reporting protocol that the first two authors of this paper are developing for assessing the effectiveness of active and passive fire protection systems in buildings. This paper will be useful for academics, building owners and landlords, developers and fire and rescue services investigating and involved in ensuring the fire protection of buildings and of the health, safety and wellbeing of their occupants.

Peer-review under responsibility of KES International.

Keywords: Safey Gap; Fire safety measures - Compartmentation; Fire risk assessment & fire risk audit; Occupant safety and wellbeing.

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1876-6102
Peer-review under responsibility of KES International.
10.1016/j.egypro.2017.09.586

1. Introduction

In the UK, 76% of fire related fatalities occurred in dwellings in 2015/2016 [1]. Non-fatal casualties in dwelling fires were 76% while in other buildings it was 14% [1]. In England in 2014/2015, 40% of fire-related deaths were caused by 'gas or smoke' while 'burns' caused 33% of fatalities and another 20% by both 'burns and gas or smoke [ibid]. Fire development inside buildings is generally divided into four stages: growth stage, flashover stage, post flashover stage and decay stage. The fire starts with a growth period which either changes to a rapid flashover stage or starts to decay. If flashover happens, the fire grow into fully developed stage before it starts to decay [2, 3]. Smoke generated during fire can contain dangerous gases such as carbon monoxide, hydrogen cyanide, hydrogen chloride, hydrogen fluoride, carbon dioxide and poses threat to life of occupants and fire-fighters [4]. Sometimes, smoke deposits and their subsequent odour damages the building to an extent where it has to be demolished [5].

The integrity of passive fire protection measures, such as compartmentation (separating walls, floors and ceilings) are not always assured. In 2010, the Department for Communities and Local Government (DCLG) found that in some of the real fires incidents in building's compartmentation could not restrict the spread of smoke into adjoining dwellings, or through hidden cavities [6]. These hidden cavities also have the potential to affect unwanted air leakages impacting upon sound pollution and heat loss. An investigation carried out by the UK's Building Research Establishment (BRE) on fires in different types of building reported to the DCLG between 2003 and 2013 [7,8] found that 32% of inspected fires had issues of fire spread due to either defects in compartment construction details or inadequate or poor condition of fire stoppings. The main problems identified were voids in roof compartmentation and issues with cavity barriers in concealed spaces [ibid]. These findings coincide with the results of the case studies from Littlewood and Smallwood (2015) and (2016) [9, 10]. In 2015/2016, 31% of building fire audits carried out by fire and rescue services using current methods revealed that fire protection measures (passive and active) are not satisfactory in the investigated buildings in the UK [1]. Thus, there is an urgent need to investigate the extent of these fire and smoke spread issues within new and existing dwellings in the UK and also identify further improvements in the legislation to ensure the in-built performance of fire safety measure in buildings. This is particularly important in Wales, since the Welsh Government have recognized that citizens should be able to live and work in cohesive communities that are healthy, safe and resilient through their Well-being of Future Generations (Wales) Act (2015) [11].

This paper examines the currents approach of England and Wales in the UK towards achieving fire safety in buildings and the implications of potential failure of fire protection measures including compartmentation, which could also affect acoustic and thermal performance. Further, the paper presents the results of a preliminary study of the perception of fire and rescue experts in Wales, toward the effectiveness of compartmentation in resisting the spread of smoke and fire and whether fire audits of buildings under construction and those already constructed should include a test methodology to demonstrate compliance with Fire Performance Legislation and Regulations.

2. Fire safety approach in buildings in England and Wales

People spend much of their time in buildings and as such the term fire safety is referred to as preventing fire, restricting the spread of smoke and fire, and extinguishing a fire, and providing quick and safe evacuation [12]. In England and Wales, current fire safety design has developed from two legislations; i) The Building Regulations ii) The Regulatory Reform (Fire Safety) Order 2005 (Fire Safety Order). Approved Document B (Volume 1) of the England and Wales Building regulations provides basic guidance to achieve compliance for fire safety in dwellings. Fire safety in buildings is achieved by providing fire protection measures (active and passive) which include for example fire doors, fire alarms, and compartmentation between units for restricting the spread of smoke and fire for minimum 30 or 60 minutes depending upon the type of building. An alternative design approach is available in BS 9999:2017 'Fire safety in the design, management and use of buildings. Code of practice' [13] applicable to both new and existing buildings which takes into account the management of fire safety in buildings and the control that can be achieved through management processes to ensure a reasonable and, perhaps, more flexible approach to fire safety. BS 9999:2017 determines the fire safety solution based on the overall building risk profile taking into account the occupancy characteristic and fire growth rate. BS9991:2105 'Fire safety in the design, management and use of residential buildings. Code of practice' [14] for residential buildings including specialised housing providing care