**CODE 261**

# DOES THE FINAL FLOOR HEIGHT OF AN EXISTING DOMESTIC BUILDING INFLUENCE THE FATALITY RISK WITH REGARDS A FIRE. A STUDY OF THE LONDON BOROUGH OF LAMBETH

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## ABSTRACT

This paper analyses the relationship between the final floor height of existing buildings and the related means of escape from fire, to assess the potential fatality risk in low rise domestic dwellings. Aim of this research is to improve rehabilitation measures, as well as maintenance and management strategies of existing buildings. Recent UK Government guidance has focused on high rise residential buildings following the Grenfell Fire disaster that occurred on the 14th June 2017 and was reported by all main international media. In such occasion, a fire started in a tower block of flats in North Kensington, West London (UK) and led to the death of 72 people. This tragedy highlighted serious failings of the regulatory system in England. As a consequence, the UK government is introducing far reaching regulations to improve building and fire safety, so that people will be and will feel safer in their homes. Part of these regulations, however, focus on 'higher risk buildings' which is any building that is at least 18 metres or 6 storeys tall and contains either 2 or more dwellings or student accommodation. Consequently, little attention is paid on the potential risk for domestic buildings with less than 6 stores where fires can still lead to high fatalities. This paper provides an overview of the literature available on the topic, including the statistics associated with fires in domestic buildings, the recent UK Government guidance on fire safety to buildings, the Regulatory Reform (Fire Safety) Order and compliance. Primary research is based on data for existing and proposed UK Government guidance on the fire safety of occupants in domestic buildings, and data on fire incidents in domestic dwellings in The London Borough of Lambeth. Analysis of data from London Fire Brigade Incident Reporting System demonstrated that the height of a residential building does not always influence the fatality risk associated with building fires.

**KEYWORDS**: Regulatory Reform (Fire Safety) Order 2005; relevant floor heights; The Building Safety Bill 2020; The Fire Safety Bill 2020

## 1. INTRODUCTION

The fire that erupted in Grenfell Tower in the Royal Borough of Kensington and Chelsea, in west London on 14th June 2017, is widely acknowledged to be the worst experienced in the UK since the Nineteenth century. It is confirmed to have resulted in 72 casualties and 70 physically injured. It has also left a community physically and emotionally scarred. The shock caused by such event was such that the UK Prime Minister at that time, Theresa May, swiftly established a public inquiry which is ongoing and anticipated to stretch well into 2022. [1]
In addition to the public enquiry, the Government commissioned an independent review of English Building Regulations related to fire safety in buildings. Dame Judith Hackitt a former Chair of the UK

Health and Safety Executive, lead this review that produced an *interim* report in December 2017 called 'Building a Safer Future, Independent Review of Building Regulations and Fire Safety'[2] of which the key finding was that the current regulatory system for ensuring fire safety in high-rise and complex buildings is not fit for purpose.
This conclusion applies throughout the life cycle of a building, from construction to occupation, and is due to both, the culture of the construction industry and the effectiveness of the regulations. Reasons for such conclusions were the facts that:

1) the current regulations are unclear and complex (i.e. the definition of 'high rise' is unclear');
2) clarity of roles and responsibilities is poor;
3) the competency of key people is inadequate;
4) compliance and enforcement are weak;
5) resident concerns are not heard;
6) product testing and quality is not clear.

To address the issue highlighted, the report put forward 53 recommendations.

In May 2018 the final report was published [3]. Section 1.3 of the document states that '*it is most relevant to target the more intensive regulatory framework*' [3], on new and existing high-rise residential properties which are 10 storeys high or more. The rationale behind this choice is that the likelihood of fire is greater in purpose-built blocks of flats of 10 storeys or more compared to those with fewer storeys, because '*the rate of fatalities is greater in such buildings*'. Authors of this report do recognise that fire fatality risk is primarily associated with demographics and behaviour rather than type of building (e.g. very elderly people are at greater risk of dying in a fire than young adults), but they also point out that the risks associated with fire are much greater in multi-occupancy residential buildings than in smaller buildings, such as single residential dwellings.
Two points of this report are particularly relevant: 1) that ' higher risk residential buildings' or HRRBs are identified as buildings of 10 storey or more (according to Land Registry and Ordnance Survey information, there are an estimated 2,000 to 3,000 HRRBs in England [3]), and (2) that the report recognises that 'low rise buildings' can be at greater risk due to the demographics and behaviour.

In July 2021, the Building Safety Bill was introduced to Parliament to alter the regulatory framework for those developing, designing, building and managing residential flats, hospitals and care homes over 18 metres high. This Bill aimed at introducing a tighter regime for buildings above 18 metres which include:
1) a new Building Safety Regulator;
2) mandatory reporting of structural and fire safety events;
3) new responsibilities on Clients, Principal Designers and Principal Contractors to consider specific 'Gateway points' at all stages in the development of buildings;
4) the introduction of an Accountable Person and Building Safety Manager;
5) criminal liability for both parties and their directors for breaches with unlimited fines and imprisonment for up to 2 years.
Building from the conclusion of the report produced by Dame Judith Hackitt, the Bill defines a 'higher-risk building' as a building which satisfies the height condition (i.e. 18m) and contains: two or more dwellings (i.e. house, flat or serviced apartment), two or more rooms for residential purposes (e.g. supported accommodation), or student accommodations.
Furthermore, the height condition is that: a) the floor surface of the building's top storey is 18 metres or more above ground level (ignoring any storey which is a roof-top plant and machinery area or any storey consisting exclusively of plant and machinery rooms), or (b) the building contains more than 6 storeys (ignoring any storey which is below ground level).
To avoid the lack of clarity of former regulations, the Bill specifies that "Room for residential purposes" means a room (other than in a dwelling) which is used by one or more persons to live and sleep but excluding a room in a residential care home, secure residential institution (e.g. prison, detention centre), and temporary accommodation (e.g. a hotel, hostel, guest house, hospital, hospice).
Overall, the Bill has widened the use class of buildings and therefore it will have major impacts on fire safety in high risk buildings. [4] This is generally accepted as a positive step forward towards a safer

modern built environment. However, it is quite clear that, despite the recognition from Dame Judith Hackitt's report that 'low rise buildings' can be at greater risk due to the demographics and behaviour, the new regulations pays little attention on the potential risk for domestic buildings with less than 6 storeys, where fires can lead to high fatalities. To have a better understanding of the risk associated to these buildings, it is important to examine the fire and rescue incident statistics in England, the current regulations related to low rise buildings, and the fire and rescue statistics of one of the most densely populated places in the country: Lambeth Council.

## 2. PAPER

### 2.1. English fire and rescue incident statistics

Accidental fire-related deaths and injuries in dwellings are a major public health problem in England. Because of this, since 1994 and the introduction of the Fire Data Report (replaced in 2009 by the Incident Recording System) all Fire and Rescue Services (FRSs) must collect detailed data on the fires attended in the authority. The Home Office publishes a quarterly release on fire and rescue service statistics which is a collection of national statistics on fire, casualties, false alarms and non-fire incidents attended by the FRS in England. This study will focus on only accidental dwelling fires and not fires deliberately started, known as *arson*.

The Incident Recording System categorises fires as Primary, Secondary and Chimney fires. Primary fires (that are focus of this paper) are those that meet one of the following criteria:

- occurred in a (non-derelict) building;
- vehicle or outdoor structure or involved a fatality;
- casualty or rescue or were attended by five or more pumping appliances. [5]

In the year ending December 2020 there were 64,066 primary fires. This was a 7% decrease compared with the previous year (69,184), a 10% decrease compared with five years ago (71,126) and a 37 per cent decrease compared with ten years ago (101,159). Compared with last year, there were decreases of 4% in dwelling fires, 11% in other buildings fires and 12% in road vehicles fires, and an increase of 3% in other outdoor fires. Of the 27,482 primary dwelling fires attended by FRSs, 74% were in houses, bungalows, converted flats and other properties, whilst 26% were in purpose-built flats. When looking at fires in purpose-built flats in more detail, 16% of primary dwelling fires were in purpose-built low-rise (1-3 storeys) flats/maisonettes; 7% were in purpose-built medium-rise (4-9 storeys) flats and 3% in purpose-built high-rise (10+ storeys) flats. [5] Comparing the 16% of fires in low-rise flats to 3% in high-rise, questions arise on why the Government intervention is focused on high rise residential buildings.

### 2.2. Current Government fire legislation associated with existing domestic buildings in England

Before the Building Safety Bill was introduced, fire safety, in the United Kingdom was covered by about 70 pieces of legislation related to existing buildings, the principal ones being the Fire Precautions Act 1961 and the Fire Precautions (Workplace) Regulations 1997/1999. Because of this in 2001 it was decided that the legislation needed to be simplified. In England and Wales this was achieved with the Regulatory Reform (Fire Safety) Order 2005 (RRO) that became effective on the 1st October 2006. The Order applies to all occupied buildings other than private homes (but included the common parts of flats) and it requires that a responsible person must undertake risk assessments to remove or reduce risks. On 19 March 2020 the UK Government introduced The Fire Safety Bill to improve fire safety in buildings in England and Wales. The Fire Safety Bill amends the RRO to define that the responsible person for multi-occupied, residential buildings must oversee and minimize the risk of fire for the structural elements and external walls of the building, including cladding, balconies and windows, as well as for entrance doors to individual flats that open into common parts. This authorises the fire and rescue service to take enforcement action for non-compliance. [6]

The Housing Act 2004 deals with Houses in Multiple Occupation (HMO's). These are houses where that at least 3 tenants live together forming more than 1 household, share a toilet, bathroom or kitchen

facility with other tenants. All HMO's must comply with The Management of Houses in Multiple Occupation (England) Regulations 2006.
The UK Government's principle legislation associated with fire safety to domestic buildings is the Building Regulations 2010. However, this legislation deals with new build construction or where a building is undergoing a material alteration. Therefore, currently there is no legislation for fire safety to private flats in high-rise or low-rise buildings. In terms of fire engineering, single-family homes such as detached or semi-detached houses do not typically require much in the way of input from specialist designers. However, when it comes to the design of multi-unit buildings such as high-rise blocks of flats, detailed fire engineering input is often required, including the consideration of the internal arrangements of the dwellings. For example, previous work published by National House-Building Council (NHBC) for life safety of occupants in open-plan flats (Report NF19) [7] adopted probabilistic computational fire and smoke modelling coupled with evacuation modelling to assess the performance of different fire safety provisions. In relation to temporal factors, the NF19 study also considered whether a fire occurred during the day or at night, as well as which room within the flat the fire occurred. This paper therefore pays particular attention to fires in flats, due to the increased likelihood of involvement by fire safety designers for this type of dwelling. [8]
The fire engineering analysis is often undertaken in high-rise blocks of flats which is understandable due to time taken escape the building, however, is total evacuation of the building always the best solution with the introduction of sprinkler systems and high levels of compartmentation. Section 3.17 of the British Standard 9251:2014, Fire sprinkler systems for domestic and residential occupancies-Code of practice deals with residential occupancy for multiple occupation not exceeding 20m in height, with a maximum individual room size of 180m², such as apartments, residential homes, houses of multiple occupancy (HMOs), blocks of flats, boarding houses, aged persons homes, nursing homes, residential rehabilitation accommodation and dormitories. The standard suggests that where multiple occupation buildings exceed 20m in height, special circumstances need to be considered and the authority having jurisdiction should be consulted. However, this occupancy classification is not suitable for secure accommodation, asylum centres and large, open, communal dormitories or equivalent hazards. (BS9251:2005)
Looking at the literature it is important to point out that Hopkin and Spearpoint [8] in their study on 'Internal door closing habits in domestic buildings' found that when respondents were asked if they believed that the type of property they lived in influenced their door closing habits, 69% of respondents did not feel that this was the case, while 15% did and another 15% were uncertain. Of those who noted that it did change their habits, multiple respondents referred to safety provisions and the arrangement of the house, such as "*primary bedroom provided with large window at a height circa 3 m therefore, doors are rarely closed as comfortable with window escape*".

### 2.3. The London Borough of Lambeth

The London Borough of Lambeth is located in the Greater London, England, south of the Thames. Nearly a third of a million people live in this borough that, despite having one of the largest geographic areas of any inner London borough, is one of the most densely populated places in England with over 100 people living in each hectare (i.e. more than twice the London population density). Lambeth is the 8$^{th}$ most deprived borough in London and 22$^{nd}$ most deprived in England, this is an improved relative position since 2010 when Lambeth was ranked as the 14$^{th}$ most deprived authorities in England. The borough has a complex social and ethnic mix, with large African and Portuguese populations, and is an important focus for the UK black Caribbean population. Lambeth has a relatively young age profile, although male and female populations have different age profiles. The young working age population is roughly even between males and females. For all ages over 50, there are slightly more females than males. The relatively young age is likely due to the fact that, although it is a largely residential borough, it is a destination for young working age people, rather than families and this reflects the national trends.
The borough houses about 136,000 households and if current trends continue, the number of households will rise by 30,000 by 2031. Around 65% of households live in rented accommodation, and a third own their own home. Just under one in five households rent from the council, and around 16% rent from other social landlords. Just under one in three households are privately rented. Over 70% of

households in Lambeth live in flats, either purpose built or converted houses. Just over 10% of households live in detached or semi-detached houses. On the 1 April 2017 there were estimated to be 1,200 mandatory licensable HMOs in Lambeth and an estimated 1,900 in total [10].

## 3. FIRE AND RESCUE STATISTICS FOR THE LONDON BOROUGH OF LAMBETH

London Fire Brigade is the busiest fire and rescue service in the country and one of the largest firefighting and rescue organisations in the world. [11] The Borough of Lambeth has 5 fire stations based in Brixton, Clapham, Lambeth, Lambeth River and West Norwood. London Fire Brigade publish their reported fires as part of the Incident Reporting System, and these are publicly available on their website.

Data on fire and rescue activity used in this research was gathered from the 26th June 2018 to 10th June 2021 focusing on residential accidental fires in Lambeth area. The total number of fires attended during this period was 49. The use class of the reported fires included dwelling houses, maisonettes, converted flats, flats bungalows and student accommodation. London Fire Brigade at Lambeth also carryout fire safety audits of buildings that need to comply with the RRO. For purpose-built flats greater than 4 floors and houses converted to a flat, in 2018/19 157 audits were undertake, in 2019/20 76 audits were undertake and in 2020/21 188 audits were undertaken on these property types. This recent increase in audits is likely due to the global pandemic and the need to stop infection through contact. From this data it is possible to calculate that, on average, 173 audits are undertaken each year. The borough has an estimated 1,200 mandatory licensable HMOs, not to mention the 707 of households that live in flats with common parts. Therefore, a simple question arises: how often are buildings being audited by The Fire and Rescue?

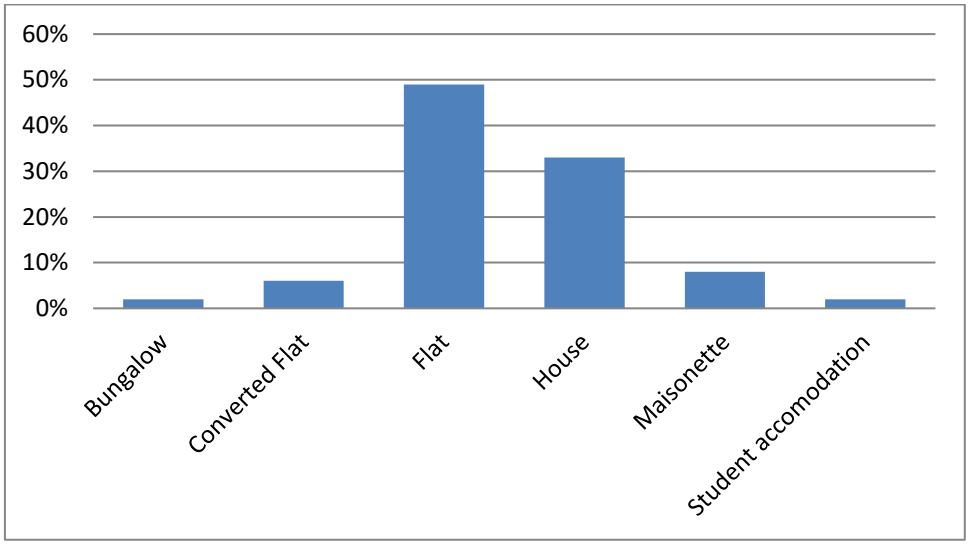


Figure 1: Percentage of fires attended in the London Borough of Lambeth from the 26th June 2018 to 10th June 2021, divided by use class

Figure 1 shows that the majority of fires attended are to flats (24 fires) and houses (16 fires), this does not correspond with statistics for England where the majority of fires within the same period occurred in houses, bungalows, converted flats and other properties. A possible reason for such discrepancy is the fact that Lambeth has a very high density with over 100 people living in each hectare.

Figure 2 shows data on where the fire was located in the building. Out of a total of 21 fires in flats, 18 (86%) were located in floors below 6 storeys. Consequently, these flats will not have to follow the

proposed legislation in The Building Safety which targets 'higher risk buildings' (i.e. buildings with 6 storey or more).

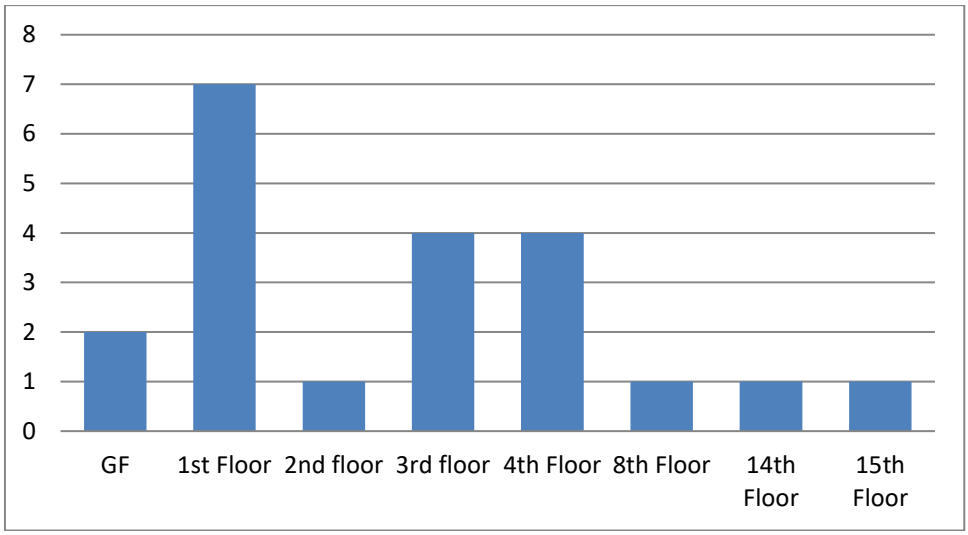


Figure 2: : Number of fires attended in flats in the London Borough of Lambeth from the 26th June 2018 to 10th June 2021, divide by story heights of buildings where fire was located

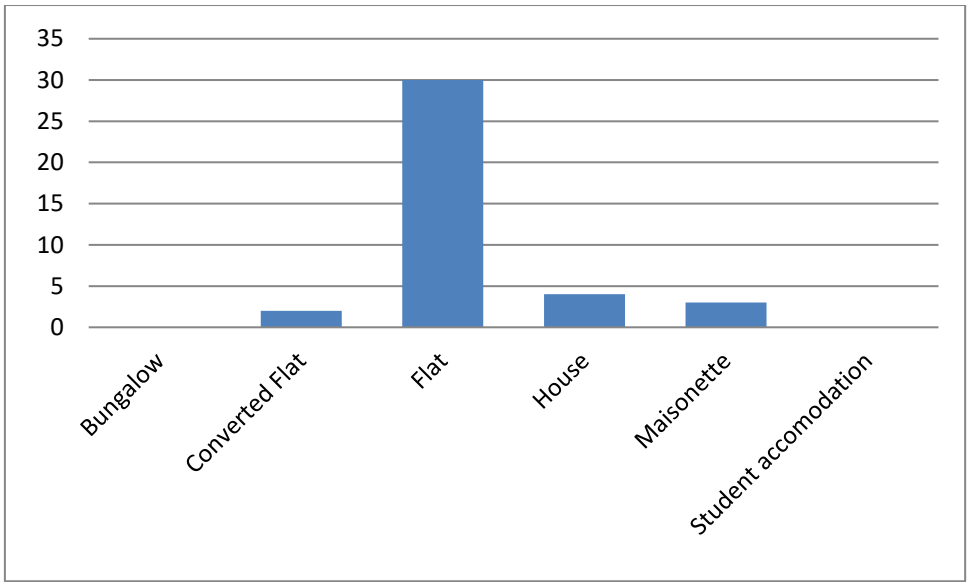


Figure 3: Number of people injured during fires in residential buildings in the London Borough of Lambeth from 26th June 2018 to 10th June 2021

Figure 3 shows that most injuries occurred in fires are likely to be in purpose-built flats with 30 out of a total of 39 people. This figure needs to be investigated further as 18 of these injuries occurred in 1 building on the 27th June 2020 at 12:31 in Kennington. Eight fire engines were required to put out the fire with 60 fire-fighters in attendance. The cause of the fire was unsafe handling of smoking materials on a balcony. The nature of the injury was smoke inhalation. Therefore this 1 fire has greatly increased the actual number of people injured in this period. It is worth pointing out that the source of the fire was located on the first floor. From the 26th June 2018 to 10th June 2021 there were 2 actual fatalities and both deaths occurred in flats. On the 26th January 2019 in Clapham at 19:13 a woman died in her 1st floor flat, the actual cause of the fire is still under investigation. The building was a converted

flat/maisonette with 3 or more storeys. The second fatality to occur in this period was on the 3rd January 2020 in Vauxhall and occurred at 19:48 on the 1st floor flat, yet again the actual cause of fire is still under investigation.

## 4. DISCUSSION AND CONCLUSIONS

The proposed Building Safety Bill is the next step in a large overhaul to fire safety legislation in England and Wales. The Bill aims to provide greater accountability and responsibility for higher risk buildings. However, considering the detailed statistics on fires, questions arises such as: should this bill target all residential buildings and take a more focused approach on the management of the building and its occupants? The RRO with the compliance of fire risk assessments and associated audits by the local Fire and Rescue service, are these buildings being inspected at regular programmed intervals?
Following the Grenfell fire disaster, the UK Government needs to implement changes to the current legislation so that a tragedy of this magnitude should not happen again. The Government is pinning its strategy on The Building Safety Bill which specifically targets 'higher risk buildings' defined as residential buildings with over 6 storeys or 18 metres whichever is the greatest. However, Dame Judith Hackitt's report recognises that fire fatality risk is primarily associated with demographics and behaviour rather than type of building (e.g. very elderly people are at greater risk of dying in a fire than young adults), and the results of this research focussed on one of the most densely populated London borough confirms that fatalities in fires can occur on all floors. Therefore, targeting only buildings of 6 storeys and above will not eliminate the problem although it is obvious the higher the floor level the greater the travel distance will be to exit a building or to be rescued by the fire and rescue service.

## 5. ACKNOWLEDGMENTS

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## 6. REFERENCES

[1] Macleod G. The Grenfell Tower atrocity. Exposing urban worlds of inequality, injustice, and an impaired democracy., 22:4, 460-489, DOI: 10.1080/13604813.2018.1507099

[2] Hackitt, J. (2017). Building a safer future: Independent review of building regulations and fire safety: Interim report: Cm 9551. UK: Her Majesty's Stationery Office: UK Government. [Google Scholar]

[3] Hackitt, J. (2018). Building a Safer Future: Independent Review of Building Regulations and Fire Safety: Final Report, Cm 9607, HMSO, London. [Google Scholar]

[4] https://www.gov.uk/government/collections/building-safety-bill, 29/10/2021

[5] Home Office, Publishing Incident Recording System data on the fire and rescue service at an incident level: Dwelling Fires Dataset guidance, Fire Statistics Team, December 2020. Published 13 May 2021

[6] RR(FS)O 2005 is Regulatory Reform (Fire Safety) Order. (2005). Available at: http://www.legislation.gov.uk/uksi/2005/1541/contents/made. [Google Scholar]

[7] Fraser-Mitchell J, Williams C (2009) Open plan flat layouts—assessing life safety in the event of fire, NF19 CD-Rom. IHS BRE Press on behalf of the NHBC Foundation, Berkshire Google Scholar

[8] Spearpoint, M., Hopkin, C. A Study of the Time of Day and Room of Fire Origin for Dwelling Fires. Fire Technol 56, 1465–1485 (2020). https://doi.org/10.1007/s10694-019-00934-5

[9] British Standard, BS 9251:2005 (2015) Fire Sprinkler systems for residential and domestic occupancies: code of practice. BSI Standards Publication, London

[10] https://beta.lambeth.gov.uk/your-community/facts-figures/borough-neighbourhoods-wards

[11] https://data.london.gov.uk/dataset/london-fire-brigade-incident-records. 17th June 2021