The Fire Risks of Purpose-Built Blocks of Flats: an Exploration of Official Fire Incident Data in England

Interim Research Findings

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Front cover photo:Stretford House, Greater Manchester

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1. Introduction

Following the 2017 Grenfell Tower fire in West London that killed 72 people and left 201 households homeless, and subsequent fires to tower blocks and other multi-occupancy residential buildings, the safety of high-rise living has become the subject of national and international debate. This report sets out interim findings from a research project, funded by Research England, that aims to support evidence-based policy-making that will improve residents' safety in blocks of flats. The introduction first places the high-rise safety debate in context before summarising the findings.

1.1. The high-rise safety debate

While multi-fatality fires like Grenfell are thankfully rare, there have been long standing concerns about high-rise safety in the UK that date back to at least the 1968 Ronan Point disaster in Newham that killed five people, and more recently, the 2009 Lakanal House disaster in Southwark that killed six people. These concerns rest on the simple equation that the larger or taller a residential building, and the more dwellings and people living in it, the greater the likelihood of serious harm from either structural failures - as seen most recently in the June 2021 Miami condominium collapse in the USA that killed 97 people - or from the dangerous spread of flames, heat, and toxic smoke as at Lakanal and Grenfell.

A recurrent theme of the high-rise safety debate has been the conflicting perspectives over what advice and help should be given to residents in the event of a fire.

Prior to Grenfell, government policy and housing sector guidance in England stated that for residents in a purpose-built block of flats[1], it would normally be safer for those not in the immediate vicinity of a fire to 'stay put' in their own flat rather than evacuate during a fire. This advice rested on the assumption that both the individual dwellings and the common parts of such buildings, including the means of escape, would have adequate fire-resisting construction - known as compartmentation - as required by building regulations dating back to at least the early 1960s.

However, as Phase 1 of the ongoing Grenfell Tower Public Inquiry has conclusively demonstrated, the fire at Grenfell Tower did not behave as expected due to catastrophic failures in the building's ability to resist the spread of fire and toxic smoke. These compartmentation failures, primarily caused by the Tower's unsafe refurbishment between 2014 and 2016, allowed a small kitchen fire to break out of a window on the fourth floor and rapidly climb up the 24-storey building's east face before consuming most of the building within hours.[2]

Tragically, the Public Inquiry has also found that a major factor in the unprecedented death toll was the faith-like belief in compartmentation held by the London Fire Brigade (LFB) and those responsible for managing the fire risks to the residents such as the local authority landlord and its fire risk assessors. This meant that residents were wrongly told to stay put in the burning building instead of evacuating when they had the chance.

While the Public Inquiry's findings to date have been widely accepted, there has nevertheless been reluctance by government and the housing sector to implement its main interim recommendation

[1] A purpose-built block of flats is a building built specifically for residential living as opposed to a building converted from its original purpose such as an office, factory, or school.

[2] Grenfell Tower Inquiry (2019), Phase 1 Report of the Public Inquiry into the Fire at Grenfell Tower on 14 June 2017. October [URL]

- to legally require building owners to plan complete building evacuations and create Personal Emergency Evacuation Plans (PEEPs) for residents unable to leave unaided. Opponents of PEEPs see them as impractical and unnecessary, arguing that Grenfell was an anomaly in terms of fire spread and the scale of fatalities, and that it is rare for flat fires to kill, affect other flats, or necessitate evacuation. In other words, high-rise is not high-risk, and the 'stay put' principle remains safe.

The government's initial proposals for PEEPs - set out in a 2020 consultation on changes to The Regulatory Reform (Fire Safety) Order 2005[3] - would have limited their legal requirement to a small minority of high-rise buildings (18 metres+) with a waking watch in place. Following the threat of legal action by family members of deceased Grenfell residents, the government issued new proposals in June 2021 that would mandate PEEPs for every resident in a high-rise residential building who self-identifies as unable to self-evacuate.[4]

The debate over stay put or evacuation - and whether or not PEEPs should be mandatory in high-rise flats - is fundamentally about whether, in the event of a fire, high-rise buildings are safe enough for those not in the vicinity of the fire to remain in their flat whilst attending Fire and Rescue Services (FRS) tackle the fire. This judgement call rests on having confidence in the effectiveness of compartmentation, the means of escape, and firefighting infrastructure in an individual building when contemplating the much longer intervention times for FRS to blocks of flats compared to other types of dwelling. It involves assessing the fire risk to people, combining the likelihood of a fire occurring and the consequences to the safety of people from that fire.

Post-Grenfell revelations about the scale of combustible cladding and other fire safety defects on high-rise buildings, as well as evidence from previous and subsequent dangerous fires, suggest there are real risks of death and injury from a presumption in favour of the stay put approach. However, there remains no comprehensive research or evidence base about the fire safety of blocks of flats to inform this policy debate.

1.2. About the research

To address this evidence gap, we set out to explore what official fire incident data can tell us about the fire risks in blocks of flats, the possible role of building height and type, and the need for evacuation planning. In this report, we set out our interim findings from a forensic analysis of previously unpublished official incident-level data for all primary fires to dwellings and other residential buildings in England between 2010/11 and 2019/20 provided to us by the Home Office.

Our analysis specifically focused on exploring the possible relationships between different dwelling types and heights, the frequency of fire incidents, the floor of fire origin, the prevalence of delays to firefighting and unusual fire spread, the need for evacuations and rescues, and the risk of serious harm. We complemented this with evidence about the known risks associated with multi-occupancy residential buildings and high-rise blocks, and analysis of unusual and dangerous fires involving blocks of flats in the UK that we collated from various sources, to exemplify how various aspects of building design, construction, location, management and firefighting can contribute to increasing the risks from fire in such buildings.

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[3] Home Office (2020), *Fire Safety: Government Consultation*, 20 July [url]

[4] p.8, Home Office (2021), *Personal Emergency Evacuation Plans in High-Rise Residential Buildings – recommendations from the Grenfell Tower Inquiry Phase 1 report*. Government consultation, 8 June, [url]

1.3. Summary of main findings

Our overall findings from analysing dwellings fires between 2010/11 and 2019/20 suggest that there are increased fire risks to people in purpose-built blocks of flats compared to other dwellings.

- There was a clear downward trend over the decade in the number of fires attended by FRS to purpose-built flats. However, annual fires increased over the decade for flats at specific building heights - most notably for medium-rise flats between 11m and 18m high. This illustrates that overall trends and averages can hide increased fire risks for blocks of flats of certain heights.
- While residents of dwellings in blocks of flats appear no more likely to die or be injured than for any other dwelling type once a fire breaks out, when fire incidents are normalised by the estimated populations living in each dwelling type, flat dwellers are exposed to a much greater probability of their building experiencing a fire than those living in other dwelling types and are more than twice as likely to die and just under twice as likely to be injured in a fire.
- Analysing purpose-built flat fires by both height of building and the floor height that a fire originates on suggests there is positive relationship between increases in height and higher rates of fires resulting in a fatality or casualty. We found 113 combinations of building height and floor of fire origin where the average rate of fires resulting in a fatality or casualty exceeded the equivalent average for houses over the decade.
- Fires in purpose-built blocks of flats are in general much more likely to experience delays to firefighting than other dwelling types, and this likelihood of delay increases dramatically for high-rise buildings due to the specific difficulties faced by firefighters at this building typology. A high-rise flat fire is over six times more likely to experience a delay to the start of firefighting than fires to houses. Delays also increase the likelihood of a fire resulting in a fatality or casualty for purpose-built blocks of flats.
- Fires to purpose-built blocks of flats also exhibit an unexpected prevalence of significant fire spread either before firefighting commences or by the time the fire has been put out, indicating possible compartmentation failure. Significant fire spread effectively doubles the likelihood of a fire resulting in a fatality or casualty in flats.
- Finally, there is a higher likelihood of fires resulting in the need for the FRS to assist in evacuations and carry out rescues for purpose-built blocks of flats than houses. Almost 1 in 10 flat fires lead to a rescue of one or more people compared to around 1 in 16 house fires. Higher rates of FRS intervention to protect residents is a possible indicator that both stay put and self-evacuation are not working in a significant number of fires to purpose-built flats, especially in low-rise flats where a higher proportion of elderly and disabled residents are likely to live.

These findings question the previously optimistic assumptions about the fire-resisting construction of purpose-built blocks of flats, including high-rise buildings, that underpinned government guidance on fire safety management before the Grenfell Tower fire. Therefore, the mandatory requirement for PEEPS in high-rise residential buildings appears to be a sensible but essential precaution for those who cannot self-evacuate unaided. There is also evidence to support their wider use in buildings below 18 metres.

1.4. Report structure

The report is organised as follows. Section two offers a brief explanation of our methodology, detailing the data we have analysed and our analytical approach. Section three then discusses the policy and fire incident context for this analysis. Our findings are presented in section four and are summarised with brief recommendations in a concluding section five.

2. Methodology

The main aim of our project was to identify with more certainty what policy positions can and cannot be reliably supported by official fire incident data in relation to the debate on high-rise safety and evacuation planning. We were kindly provided with data by the Home Office Analysis and Insight Team responsible for producing fire incident statistics, and with guidance from the West Yorkshire Fire and Rescue Authority to better understand how fire incidents are recorded and firefighters' experiences of preparing for and tackling tower block fires.

The findings in this report rest on two main datasets, described in more detail below: the first is a previously unpublished version of fire incident data provided to us by the Home Office; and the second is a dataset of 31 fires to high-rise residential blocks of flats ten or more floors in height between 1986 and 2021 that we collated from various sources.

2.1. Home Office fire incident data

The Home Office has responsibility for FRS in England and collects detailed information on every fire incident they attend. Since April 2009, fire incident data has been collected via an online Incident Reporting System (IRS) that firefighters submit to as soon as is practically possible after the incident. The IRS contains over 160 questions about the incident, thus generating a rich dataset about each fire, which has become the primary source of government fire statistics and publications.[5]

Of particular relevance here are the annually-updated incident-level datasets published for dwellings and other buildings dating back to 2010/11. These contain a selected summary of the incident record for each fire attended, comprising over 40 fields of data including: the year and nature of the incident; resources used and actions taken by the FRS and others; the nature and extent of damage; details of rescues and evacuations; and whether there was a fatality or casualty. These published incident-level datasets do not allow the individual fires or specific locations to be identified.

Following a data-sharing request to the Home Office Analysis and Insight Team for more detailed incident-level data, we were granted access to approximately 24 additional fields that are not normally published as described in Table 2.1. These cover information relating to reasons for a delay to firefighting, observations about compartmentation and means of escape in common parts of some multi-occupancy buildings, more details about the spread of fire at FRS arrival and by the end of firefighting, whether active systems (i.e. sprinklers) were present in common parts affected by fire, reasons for delays to evacuation, and both the building height and the floor of fire origin for every incident.

[5] Online collection of Home Office fire statistics: https://www.gov.uk/government/collections/fire-statistics

Table 2.1: Data fields from the Home Office's fire Incident Reporting System (IRS)

Standard published fields		Additional fields provided by Home Office
Fire and Rescue Service	Building special construction	Multi seated flag
Financial Year And Month	Vehicles	How discovered description
Weekday/Weekend	Personnel	Building safety system compartmentation
Morning/Afternoon/Evening/Night	Response time	Building safety system means of escape
Dwelling / Property Type	Time at scene	Building occupied at time of incident
Building Special Construction	Fatality or casualty	Action taken by FRS
Occupancy type	Rescues	Action taken by non-FRS
Occupied normal	Evacuations	Were active safety systems present
Alarm system	Fire damage extent	Starting delay description
No alarm	Total damage extent	Cause substances dangerous
Alarm system type	Fire size on arrival	Cause where explosion involved
Alarm reason for poor outcome	Spread of fire	Cause substances explosion
Ignition to discovery	Other property affected at close	Cause explosion stage
Discovery to call	Rapid fire growth	Cause explosion containers
Late call		Building floors above ground
Accidental or deliberate		Building floors below ground
Cause of fire		Building floor origin
Ignition power		Building origin floor size
Source of ignition		Building origin room size
Fire start location		Fire size on arrival description
Other property affected on arrival		Building evacuation delay description
Item ignited		Building evacuation time description
Item causing spread		Fire size on arrival description

The provided dataset comprised all primary fires[6] to dwellings and other buildings where people may sleep overnight attended by the FRS between 2010/11 and 2019/20, a total of 364,345 fires as recorded in Table 2.2 below. Our report focuses mainly on the 302,130 **dwelling fires** - defined as those that occur in a non-derelict building that is a place of residence i.e. places occupied by households such as houses and flats, houseboats and caravans, but excluding hostels/hotels/B&Bs, nursing/care homes, and student halls.

[6] Primary fires are generally more serious fires that harm people or cause damage to property. Primary fires are defined as fires that cause damage by fire/heat/smoke and meet at least one of the following conditions: any fire that occurred in a (non-derelict) building, vehicle or (some) outdoor structures; any fire involving fatalities, casualties or rescues; and any fire attended by five or more pumping appliances. See: Home Office Fire Statistics Definitions.

Table 2.2: Primary dwelling and other residential fires attended by FRS in England, 2010/11 to 2019/20

Dwelling / Building	Total fires	% of total
All	**364,345**	**100**
House	167,890	46.1
Bungalow	17,244	4.7
Converted flat / maisonette	21,953	6.0
Dwelling - Multiple occupancy (HMO)	7243	2.0
Purpose-built flats	80,557	22.1
Hospital	5453	1.5
Hostel	1884	0.5
Hotel / Motel	3292	0.9
Medical care (not including Hospital)	1782	0.5
Nursing / Care Home	4069	1.1
Other Residential Home	1939	0.5
Other dwelling	24,299	6.7
Pre School / Nursery / Infant / Primary School	3111	0.9
Prison / Young Offenders Unit	8519	2.3
Residential (not a dwelling)	5607	1.5
Retirement Care Home	3517	1.0
Secondary School	1855	0.5
Sheltered Housing - not self-contained	1585	0.4
Student Hall of Residence	2546	0.7

For the quantitative data processing work, we used open-source Java programs to automate the process of generating single variable summaries for each field and selected count summaries from the source input data that cross-tabulated with different variables to explore relationships between them. The analysis was supplemented by using pivot tables in Excel. We were specifically interested in looking at associations between different dwelling/property types and the frequency of fire incidents, the relative rates of fire when adjusted for dwelling stock size, rates of fatality or casualty, height of building, floor of fire origin, fire spread and the effect of delays to firefighting on fire spread and risk of serious harm.

2.2.1. Data limitations

Due to the short timescales involved, we did not take up the offer of a data-sharing agreement to access more information about the number of people who died or were injured in each fire where a fatality or casualty was reported, the nature of injuries sustained, and who was affected in terms of age, gender, ethnicity, disability, and other protected characteristics. While this limits the analysis presented here, we could still use published Home Office data, and the unpublished data provided to us, to calculate and compare the likelihood of fires resulting in serious harm across dwelling/property types, heights, and other variables.

We also found data inconsistencies with how FRSs had recorded purpose-built building height categories for 8% of fire incidents (6455 fires) in the source input data. These incidents had been recorded as taking place in either a low-rise, medium-rise, or high-rise, but the floors above ground field or floor of fire origin had an entry that contradicted that designation. As it was more likely that the FRS had simply clicked the wrong property-type box rather than inputted the wrong height data, we made the decision to reclassify these fires using the floors above ground field as following: for high-rise fires, 381 became low-rise fires and 402 became medium-rise; for medium-rise, 3269 became low-rise and 303 became high-rise; and for low-rise, 2074 fires became medium-rise, and 15 became high-rise.

Furthermore, we found that in some cases, floor 0 was being used by firefighters to designate height when, according to the IRS methodology, there cannot be a floor 0. Accordingly, we assumed that all floor 0 entries were floor 1 and reclassified those. We also found that in 1 floor buildings, fires were being erroneously recorded as originating on the 2nd and 3rd floor and so reclassified those as 1 floor. This means that our sub-totals for fires at different building heights/floor of origins do not always perfectly match those in published Home Office statistics.

2.2. Collation of high-rise building fires data

As the IRS dataset contained mainly categorical or numerical data about each fire incident without an overall narrative of what happened, we supplemented our analysis with a more qualitative set of insights relating to building fires that have taken place in the UK in recent decades.

Using various search terms in the Lexis Nexis news database[7], we created a dataset of fires to high-rise and other blocks of flats between 1986 and 2021 that involved unusual and significant fire or smoke spread, failings in building safety systems, the need for evacuation and rescue, fatalities and/or casualties. We then conducted a more forensic online search for information about each fire, collecting reports and testimonies from coroners' inquests, FRS, and specialist firefighting and engineering websites such as https://eurofirefighter.com, www.highrisefirefighting.co.uk and the Institution of Fire Engineers (https://www.ife.org.uk/). This produced a subset of 32 fires to residential blocks of flats 10 or more floors in height set out in Table 2.3. below.

Our analysis of these fires revealed how various aspects of building design, construction, location, management and firefighting can contribute to heightening the risks to people, from fire, in such buildings. We draw on some of these examples to help put forward possible explanations of our findings in relation to the IRS analysis. We intend to publish this dataset in due course.

[7] See https://www.lexisnexis.co.uk/news-and-media-analysis

Table 2.3: Dangerous and unusual fires to high-rise residential buildings in the UK

Year	Building	Height (Floors)	Description
1988	Royston Hill, Glasgow	24	Fire gutted one flat and burned through two others. Aluminium sheet cladding with wooden battens and polystyrene behind it.
1990	Merry Hill Court, Smethwick	16	Structural defects caused rapid fire spread; the condition of the means of escape endangered lives and delayed and impeded rescue.
1991	Knowsley Heights, Liverpool	11	Fire travelled externally the full height of the building through the external wall system.
1997	Butler House, Essex	14	Fire to the top-floor flat caused uPVC window frames to melt and drip, which in turn caused some damage to cladding.
1997	Alpha House, Coventry	17	Flames travelled up the outside of the block from 13th to 17th floor.
1999	Garnock Court, Irvine	13	A disabled pensioner died and four other people were taken to hospital after fire ripped through 9 floors.
2001	Arlington House, Margate	18	Nine adults and a child were rescued from the 13th floor.
2001	Staner Court, Ramsgate	14	8 adults and 3 children trapped on floors above the fire made their way to the roof where they were rescued by an RAF helicopter.
2003	Petershill Ct, Glasgow	28	Six people - two women, two police officers and two firefighters - were taken to hospital.
2005	Harrow Court, Stevenage	17	Fire spread from the 14th to 15th floor; the means of escape was impacted by the spread of fire and smoke. Three people died.
2009	Lakanal House, London	14	Six people died, at least 20 were injured.
2009	Waddell Court, Glasgow	18	20 appliances attended and it took four hours to extinguish.
2010	Shirley Towers, Southampton	15	Two firefighters died, two were injured. Fire and smoke was experienced between the 5th and 10th floors.
2010	Madingley Block, Kingston-upon-Thames	15	Flames spread to the top four floors. Up to 100 firefighters attended.
2010	George Tilbury House, Essex	15	Firefighters thought they were dealing with fires on the second and ninth floors and at least 50 people were evacuated.
2011	Grainne House, Belfast	17	Residents were trapped on the top floor after a fire broke out while they were sleeping. Six people escaped injury in a dramatic rescue.
2011	Marine Tower, Deptford	16	Up to 50 firefighters tackled the flames on the top floor. Two people died, four were injured, six people were rescued. Defective fire doors contributed to fire and smoke spread.
2011	Salamanca House, London	15	9 people trapped on the 3rd and 4th floors were rescued using ladders.
2011	Mermaid Tower, London	16	Flames spread from a flat on the 11th floor into the rooms above. 7 people were hospitalised.
2014	Carolina House, Bristol	14	Around 40 fire-fighters battled the blaze. More than 100 residents were evacuated.
2014	Red Road flats, Glasgow	31	Residents were evacuated after a fire was discovered in the external cladding.
2015	Lomond House, Glasgow	20	Flames tore through 8 storeys – two years after improvement works.
2015	Adair Tower, London	14	16 people hospitalised, 50 rescued; absent or defective self-closing devices had caused smoke to compromise both staircases.
2016	Chartham House, London	16	Fire spread to the floor above, 50 residents evacuated.
2016	Shepherds Court, London	18	Fire spread to five floors, 50 residents evacuated.
2016	Handsworth House, Portsmouth	18	3 Near Miss events and 5 Causes for Concern reports identified; it took 45 minutes from 999 call for firefighters to enter the fire flat on floor 7

2017	Grenfell Tower, London	24	72 dead, 201 households made homeless; fire escapes kitchen on 4th floor into external cladding, rapidly consuming most of the building
2017	Beckett Court, Bedford	13	Smoke rose through the refuse chutes into the residential area above and subsequently smoke logged floors six to 11.
2017	Coolmoyne House, Belfast	15	16 tenants were unable to return to their homes.
2017	The Lighthouse, Manchester	21	The blaze spread to wooden balconies on several floors with 7 apartments affected.
2020	The Lighthouse, Manchester	21	Kitchen fire spread to wooden balconies on several floors leaving 3 flats uninhabitable.
2021	New Providence Wharf, London	19	100 firefighters attended, 40 people were treated by ambulance staff at the scene, 22 evacuation/smoke hoods were used; a faulty smoke ventilation system acted “like a broken chimney, leading to a potentially life-threatening situation”[8]

[8] London Fire Brigade (2021), 20 Pump Fire Preliminary Report: New Providence Wharf, 25 May [url]

3. Contextualising the high-rise fire safety debate

In this section, we provide a brief contextualisation of the debate about the fire safety of high-rise residential buildings. A first section introduces the overall context of falling numbers of dwelling fires, fatalities and casualties, but different outcomes for certain demographic groups and building typologies. A second section then builds on these differential risks to discuss the nature of fire risk in dwellings and the important distinctions between houses and blocks of flats. A third section explains the role of building and fire safety regulations in addressing the higher-risks from high-rise living. A final section sets out in more detail the debate relating to the catastrophic fire at Grenfell Tower, high-rise risk and evacuation planning.

3.1. The overall reduction in residential fire risk in England

After dwelling fires and associated deaths rose dramatically in the post-war period, overall residential fire risk in England has been on a long-term downward trajectory in recent decades. Figure 3.1 uses published Home Office statistics to chart a year on year decrease in primary dwelling fires requiring FRS attendance since their post-war peak at the turn of the 21st century.

Over the past two decades, annual dwelling fires have more than halved, from 58,280 in 1999/2000 to 28,494 by 2019/20. Fire-related casualties and fatalities have been on a similar downward trajectory over the same period: non-fatal injuries fell by over 55% from 11,578 to 5152, and there has been a 42% reduction in annual deaths.[9] These reductions in fire incidents and related harm to human life are impressive considering the growing population and household formation that saw England accumulate 3.5 million net additional dwellings over the period.[10]

These falling trends are generally mirrored for non-dwelling residential properties (like student halls or buildings where people may sleep overnight such as care homes, hotels, and hospitals), which experienced a 23.1% decrease between 2010/11 and 2019/20, an average fall of 2.7% per year. The main exception within this non-dwelling category is the number of fires occurring in prisons or young offenders units, which has more than doubled over the past decade.

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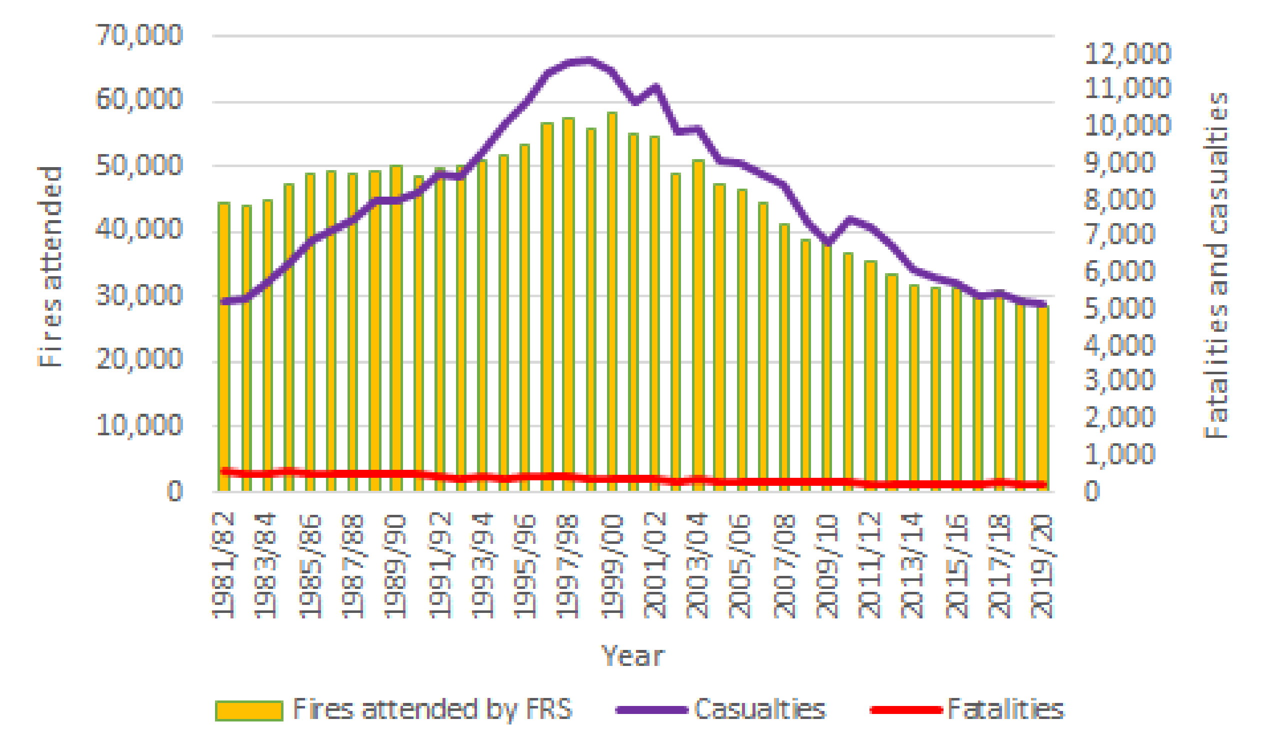
[9] Source: Home Office Fire Statistics Table 0202: Primary dwelling fires, fatalities and non-fatal casualties in dwellings by motive and fire and rescue authority England, February 2021 [url]. It is worth noting that dwelling deaths at one point reached upwards of 1000+ per year in the 1970s, but over the past decade averaged 221 per year. For point of comparison, deaths from road traffic accidents averaged 1476 per year in England over the same period (Department for Transport, 2021, RAS30038: Casualties by severity, region and local authority: England).

[10] MHCLG, Live Table 118: annual net additional dwellings and components, England and the regions, 2000-01 to 2019-20, 26 November 2020, [URL];

Figure 3.1: Primary dwelling fires attended by the FRS in England and related fatalities and casualties, 1980/81 to 2019/20[11]



Many factors have contributed to this significant reduction in reported fires, fatalities, and casualties in England, but some have arguably played a fundamental role: the banning of combustible polyurethane foam and ignitable coverings in new furniture in 1989 (The Furniture and Furnishing (Fire Safety) Regulation 1988), later extended to second-hand furniture in 1993 and landlords and rented homes in 1997; the introduction of hard-wired smoke alarms in all new dwellings and extensions under the Smoke Detectors Act 1991 and their subsequent widespread use; greater emphasis on fire safety and fire prevention education by FRS; improved safety and lower prevalence of cigarettes; changing lifestyles; and general improvement in fire safety awareness.[12]

Despite the falling trend in deaths and injuries, Home Office research shows there are clear demographic inequalities in terms of general fire fatalities and injuries mirrored in dwelling fires.[13] While older people are understandably more prone to death or injury, they are not benefiting from the same proportional decline in the likelihood of serious harm from falling fires and death/injury rates:

- The older you are, the more likely you are to die in a domestic fire: in 2019/20, 65 to 79 year olds experienced 8.4 fatalities per million, rising to 16.9 per million for those 80 years and over, compared to below 5 fatalities per million population for those 54 and under.

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[11] Source: Home Office Fire Statistics Table 0202 [url].

[12] p.43-44, Prosser, T. and Taylor, M. (2020) *Grenfell Tower Fire: Benign neglect and the road to an avoidable tragedy*. Pavilion Publishing and Media Ltd

[13] p.4, Home Office (2020), 'Detailed analysis of fires attended by fire and rescue services, England, April 2019 to March 2020', *Home Office Statistical Bulletin 28/20*, October. [URL]

- When age and gender are combined, the disparities are even starker: for people aged 65 to 79, the fatality rate was 10.6 per million for men, and 6.4 per million for women; and for those 80 and over, the equivalent rates were 22.6 per million and 13.1 per million.

These differential risks from fire are mirrored in terms of dwelling types, which we turn to next.

3.2. Understanding the different fire risks to different dwelling types

Understanding the risks of fire affecting people in their homes, or where they are residing, is a simple enough proposition: it combines the likelihood of a fire occurring and the consequences to the safety of people from that fire. The notion that different kinds of dwellings and building typologies can generate different kinds and degrees of fire risk is well established in building regulations. Here we identify three broad kinds of differential risk for those living in multi-occupancy buildings at height: the risks of more fires; the risks that those fires will impact more people; and the increased number of fire and fire-related hazards to building occupants and firefighters due to the nature of the building itself.

3.2.1. Greater risks of fires occurring in vertical communities

When a fire takes hold in a single-occupancy, low-rise dwelling such as a house, the assumed risks of extensive loss of life are far lower in comparison with a larger or taller building with multiple dwellings. This is because blocks of flats are the equivalent of 'streets in the sky' - vertical communities housed within a shared superstructure - thus creating a greater probability of fires breaking out that will, in turn, pose a greater risk of affecting more people should they spread. These risks further increase the taller the building due to the greater number of dwellings and people present.

The Ministry of Housin, Communities and Local Government (MHCLG) recently estimated that high-rise residential buildings (more than 6 floors or 18 metres) contain an average of 58 dwellings compared to an average of 19 dwellings for 11-18m buildings, with buildings greater than and equal to 30 metres having an average of 81 dwellings.[14] Based on the English Housing Survey's estimated average household size for occupied high-rise flats of 1.9, that would mean high-rise blocks of 30 metres or higher having an average population of 154 people.[15] The taller the building, the more dwellings and people: for example, Grenfell Tower is a 67.3 metre building and contained 120 dwellings with an approximate population of 340.

3.2.2. Increased risks to occupants and firefighters from fires in blocks of flats

These elevated risks of fire breaking out in blocks of flats are further compounded by the increased fire risks to occupants living at height due to the limited means to facilitate a timely and safe escape in such buildings.

A typical house will usually have at least six exit routes: should fire and smoke block normal exit routes from front and back doors, windows on ground and first floor will offer an alternative means of escape, with external rescue also normally possible from a first floor window or balcony.

[14] MHCLG (2020), Building Safety Programme Monthly Data Release England: 31 December 2020 [URL]
[15] MHCLG (2019), English Housing Survey Households Report, 2017-18. July, URL

In contrast, escape or rescue via windows or balconies in a block of flats cannot be relied upon more than a few floors above ground level. Although some FRSs may have access to a high-reach rescue appliance, access to the building may be restricted due to parked cars or the external layout. That means a flat dweller usually only has one means of escape in the event of a fire: through their flat front door, via a shared corridor or lobby, and down the stairway until the ground floor exit and a place of safety is reached.

Flat dwellers will also normally have much further to travel once out of their dwelling to reach safety than house dwellers. This escape route may in turn be hampered by hazards such as the high temperatures, reduced visibility caused by particulates in smoke, toxic gases, and irritants causing incapacitation as smoke propagates, reducing the survivability of escape routes.[16] Detailed evidence presented to Grenfell Public Inquiry by Professor David Purser, inhalation toxicologist and fire scientist, suggested that the majority of the 72 deaths at Grenfell Tower were caused by the "inhalation of asphyxiant gases".[17]

Finally, the presence of firefighters tackling a fire inside a block of flats may undermine residents' protected means of escape due to firefighters needing to use the stairs and prop open fire doors to pass hoses through them. This will potentially cause the stairs and lobbies to become smoke-logged or non-survivable, making them untenable for evacuation, and allow fire, heat, smoke, toxic gases and other products of combustion to spread to unaffected areas of the building, thereby increasing the risk to occupants.

3.2.3. The firefighting intervention timeline

This makes the timeline for firefighting intervention, set out in Figure 3.2. below, crucial to reducing the risks to life. The longer it takes for firefighting to begin, the more hazardous the situation caused by a growing or smouldering fire. A timely intervention will swiftly reverse the increasing risk faced by an affected person in the vicinity of a growing fire by rescuing any occupants, preventing further growth, and ultimately extinguishing the hazard.

Figure 3.2. The four stages of the firefighting intervention timeline

Stage	Name	Description
1	Discovery	the time taken to discover the fire
2	Raise the Alarm	the time taken to call the fire brigade
3	Response Time	the duration from calling 999 to the FRS arriving at the scene of the fire
4	Intervention Preparation	the time it takes from FRS arrival to the start of firefighting

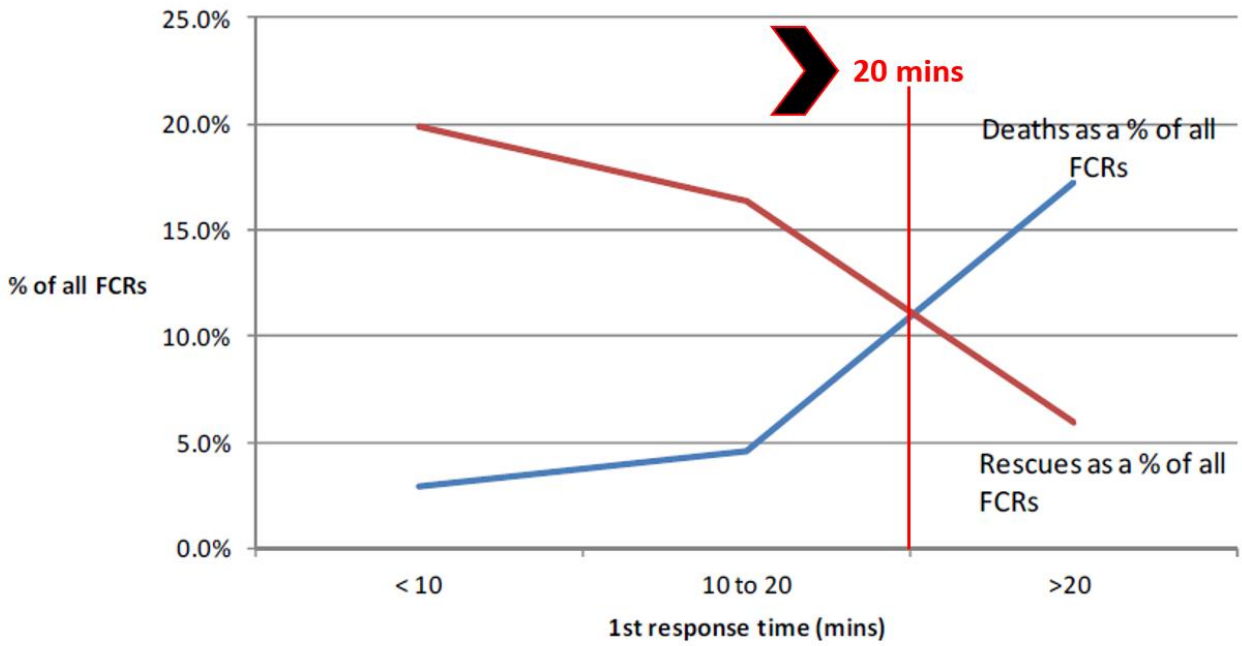
Government and academic research has conclusively demonstrated that the faster the response time by FRS to a fire, the greater the opportunity for the rescue and survival of persons involved,

[16] Fire Service Academy (2020), *Smoke propagation in residential buildings. The main report on the field experiments conducted in a residential building with internal corridors*. Arnhem: IFV

[17] Purser, D (2018), Effects of exposure of Grenfell occupants to toxic fire products — Causes of incapacitation and death. Phase 1 Report: General description of hazards excluding comprehensive references to individual occupants,5 December, [url]

while a longer response time correlates to a higher probability of fatality.[18] The government's own analysis of Home Office fire data found that the likelihood of victims being rescued falls at the same rate as the likelihood of fatality increases the longer it takes for the first FRS to arrive at the scene of the fire, as illustrated in the Figure 3.3 below.[19] Significantly, there is a step change once a response time hits the 16 minute point with a sharp deterioration in the likelihood of victim survival as the fire grows larger.[20] At the 20 minute point, we can see that the likelihood of death becomes higher than the likelihood of survival.

Figure 3.3[21]: Percent of Fatalities, Casualties (all grades) and Rescues (FCRs) that die versus percent that are rescued, against response time



Timely intervention is perfectly feasible in a house or bungalow fire as illustrated in Figure 3.4 below. Stages 1 and 2 of the firefighting timeline described in Figure 3.2 are assisted by the fact that house fires tend to be far more visible, allowing passers-by or neighbours to raise the alarm; stage 3 is helped by the fact that on a typical street or development, a fire engine can park a few metres away; and stage 4 is shortened by the ability of the FRS to start a rapid rescue or put water on the fire through a number of available door and window apertures, usually within two or three minutes of the first pump arriving. With the national average response time to dwelling fires currently 7 mins and 45 seconds[22], this points to a 9-10 minute intervention point for a bungalow or house fire.

[18] p.18, Home Office (2020), Response times to fires attended by fire and rescue services: England, April 2018 to March 2019. Home Office Statistical bulletin 01/20, 16 January [url]

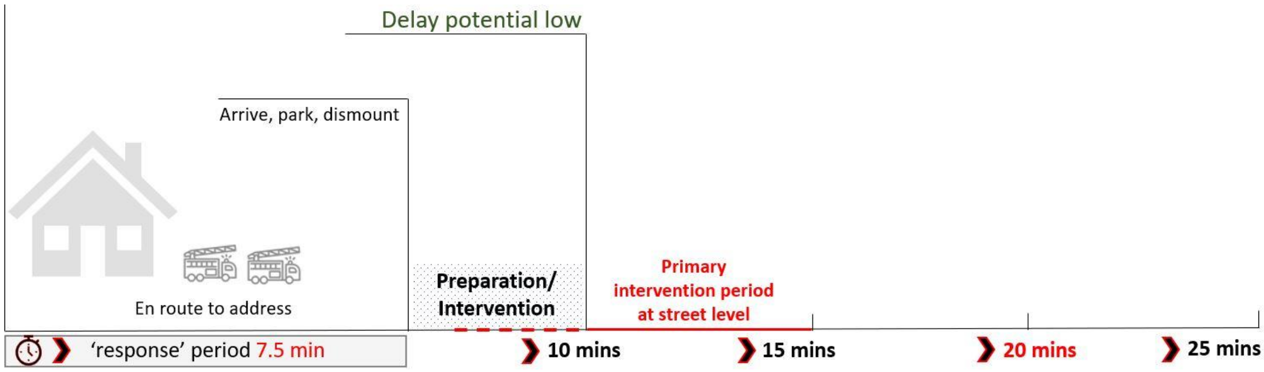
[19] Department for Communities and Local Government (DCLG) (2013), 2012 updates to the Fire Service Emergency Cover toolkit Special Service and fire fatality rate response time relationships, December, London: DCLG, [URL]

[20] Challands, N. (2010), 'The Relationships Between Fire Service Response Time and Fire Outcomes', *Fire Technology* 46: 665–676, [url]

[21] Adapted version of Fig. 15, DCLG (2013)

[22] Home Office (2021) 'Response times to fires attended by fire and rescue services, England, April 2019 to March 2020', *Home Office Statistical Bulletin 01/21*, 14 January, [url].

Figure 3.4: Firefighting response and intervention timeline for house fires

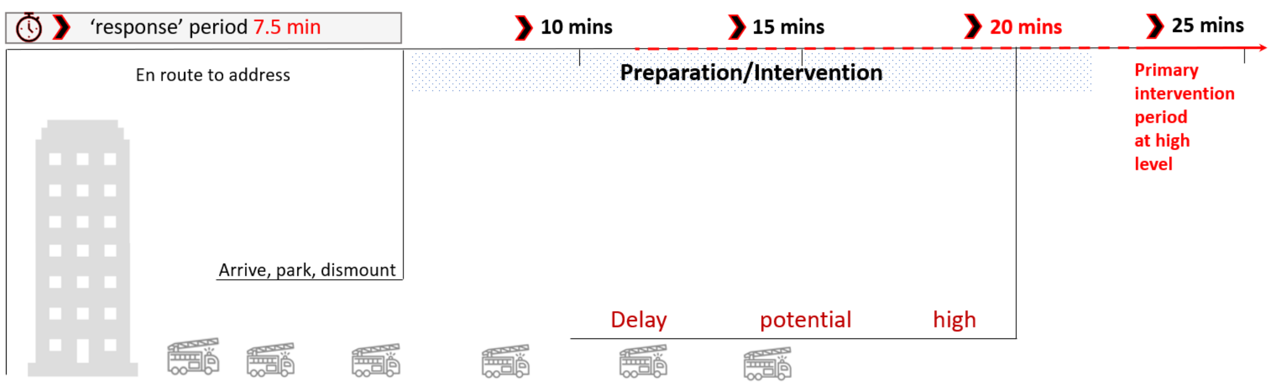


Timely intervention is far more challenging for blocks of flats primarily because the fire cannot normally be fought from the exterior of the building as service ladders and high-reach equipment have access and reach limitations. This means the FRS must enter the building to establish what is called a 'bridgehead', normally two floors below where the fire is, requiring the necessary equipment and personnel to be transported up the building. Where firefighting lifts are not installed, or are out of order, this has to be done via the stairs, adding more logistical difficulties, physical resources and time.[23] The higher up a fire is in a block of flats, the more remote it is from the arriving firefighting resources on the ground floor, and the point of safety for those affected, which is normally beyond the building at ground level. If the fire is at a high level, it may be necessary to establish one or more staging areas between the bridgehead and the ground floor.

Following the deadly fire in 2005 at the 18-storey Harrow Court tower block in Stevenage that killed a resident and two firefighters, Hertfordshire FRS undertook a series of exercises designed to test and practise their procedures for dealing with high-rise fires. They concluded that it takes 20 minutes from *arrival at the incident* to establish a bridgehead with the resources required to deal safely with a fire on the upper floors.[24]

Assuming an average national response time of 7.5 minutes, this points to an intervention point of 27.5 minutes for a block of flats (see Figure 3.5), way past the 20 minute point at which the probability of fatality overtakes the probability of a successful rescue.

Figure 3.5: Firefighting response and intervention timeline for fires to blocks of flats



[23] British Automatic Fire Sprinkler Association (BAFSA) (2012), *Safer High-rise Living: The Callow Mount Sprinkler Retrofit Project* (URL)

[24] p.32, BAFSA (2012)

Crucially, this intervention time is based on no delays during intervention preparations, which as we will discuss in section 4 of the report, are far more frequent at purpose-built flat fires than other dwellings. Common delays to the start of firefighting in blocks of flats include: physical obstacles to getting access to the outside and inside of the building such as parked cars, door-code entry systems, security grilles, and multi-lock door systems; parked vehicles on fire hydrants outside the building preventing water being fed into the building; faulty dry risers preventing water being fed up the building; and difficulties locating the incident and the extent of fire and smoke spread due to the complexity of fire and smoke behaviour in such buildings.

Steve Seaber OBE, who was the Chief Fire Officer at Hertfordshire Fire and Rescue Service at the time of the Harrow Court fire, has outlined the increased risks posed by such a time delay compared to a fire in a low-rise block:

> ...the time delay before firefighting can commence, clearly encourages significant fire growth, increases the risks involved for firefighters and residents, and leads to greater damage being caused, with consequential increased remedial and rehousing costs.[25]

3.2.4. Risks to firefighters in high-rise buildings

The unique challenges facing firefighters tackling fires in high-rise blocks of flats were clearly recognised and laid out in the government's (now withdrawn) operational guidance for FRSs published in 2014, *Generic Risk Assessment (GRA) 3.2 Fighting Fires – in High Rise Buildings*.[26] In addition to the significant time and resource demands of fighting fires and rescuing people at height, the guidance spelled out a long list of additional risks summarised in Figure 3.6 below.

Figure 3.6: The additional risks to firefighting in high-rise buildings

- Fire and smoke in high-rise buildings can spread upward, downward or horizontally and may be more rapid and less predictable than in other building types
- Heavy debris can fall onto those entering, exiting, or working outside, and compromise water supplies if the firefighting hose is damaged
- Lines of communication and radio reception can be affected by the considerable distances between the point of command and the fire level as well as interference from other systems
- Complex internal layouts can increase the risk of firefighters becoming disorientated in smoke
- There are risks of entanglement in displaced electrical or telecommunications cabling, and floor or ceiling collapse in individual dwellings with a 'maisonette' style construction
- Some buildings may have had unauthorised refurbishment or changes to use leading to insufficient resources being mobilised or deployed to inappropriate locations, causing a delay in firefighting
- Insufficient water supply can occur on upper floors due to the height of the incident, characteristics of the fire main and the limitations of fire service equipment
- Personnel may have to climb a number of flights of stairs or work in high ambient temperatures, which may lead to exhaustion, reduce the duration of respiratory protective equipment and increase the core body temperature of firefighters to dangerous levels
- Congestion can arise as personnel moving into the building encounter occupants evacuating, with firefighting operations in staircases and other parts of the building creating significant slip and trip hazards for firefighters and those evacuating, especially with only one staircase
- Lift failures can lead to firefighters and evacuees becoming trapped in a lift car and in turn affected by the spread of smoke, fire, heat and water from firefighting operations

[25] p.32, BAFSA (2012)
[26] DCLG (2014), *Generic Risk Assessment (GRA) 3.2 Fighting Fires – in High Rise Buildings.* London: Her Majesty's Stationery Office [URL]

GRA 3.2 also made explicitly clear the dangers posed by fire behaviour and development in these types of buildings, particularly from failures and breaches in compartmentation:

> Fire and smoke spread can develop internally by breaching compartments, travelling along shafts and ducting and externally when fire breaks out of windows and through failed wall panels. This can lead to rapid spread to other compartments and floors (above or below), due to the effects of thermals, movement of hot gases and wind speed/pressure. Air currents may lead to smoke within the building being drawn upwards or downwards… Fires may be encountered on more than one floor at a time... Burning material falling from upper floors or propelled by the wind can also spread fires and start secondary fires by igniting combustible materials through open windows, on balconies and around the base of the building... Undivided stairways in high rise buildings have the potential to act as chimneys allowing the products of combustion to rise, which increases the risk of fire and smoke spread to other floors… Fires in refuse or refuse containers can create extensive smoke spread through chutes, other shafts and voids...[27]

As we will demonstrate, our analysis of IRS data and our own dataset of 32 high-rise fires suggests that these are not hypothetical risks.

3.3. The role of building and fire safety regulations in addressing the higher-risks from high-rise living

These unique and elevated fire risks to both occupiers and firefighters in blocks of flats have long been recognised in local and national building regulations, codes, and accompanying guidance in England. Since at least the 1962 British Standard Code of Practice CP3, the principle of a maximum height (then 24.4 metres, currently 18 metres[28]) for external firefighting and rescue, plus known hazards from fire behaviour and development in certain types of tall buildings, have meant legal requirements for additional fire safety provisions to high-rise residential buildings.

In 2005, additional fire safety regulations in England were introduced for the common areas of multi-dwelling residential buildings used by residents and employees under the Regulatory Reform (Fire Safety) Order (RRFSO) 2005. This required the legally-designated 'responsible person' to "make a suitable and sufficient assessment of the risks to which relevant persons are exposed for the purpose of identifying the general fire precautions he needs to take to comply with the requirements and prohibitions imposed on him by or under this Order" (RRFSO 2005, Article 9). This includes recording and taking necessary action to protect "any group of persons identified by the assessment as being especially at risk" (RRFSO 2005, Article 9), specifically disabled people, those known to have special needs, and children.

Building and fire safety regulations have been aimed at ensuring that those living in blocks of flats have the same level of safety as those living in houses, reducing or managing the risks identified above in relation to three main areas: the means of escape; compartmentation; and firefighting.

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[27] p.9-10, DCLG (2014), *Generic Risk Assessment (GRA) 3.2 Fighting Fires – in High Rise Buildings. London: Her Majesty's Stationery Office, [URL]*

[28] It is important to note that 18 metres is no longer a tenable threshold for fire-fighting as today most fire brigade appliances only carry 13.5 metre ladders, which reach up just four storeys on average. As Scotland has recently recognised, a safe working height using a 13.5 metre ladder is 11 metres. It is also worth remembering that firefighters' training towers only normally reach four storeys. Fire services do have access to longer ladders such as turntable ladders that can reach to 32 metres, but these usually have to be requested by incident commanders to be brought to the scene, which may be a significant distance from where they are.

3.3.1. The means of escape

Buildings with a storey 18 metres or more above ground level have had to comply with stricter requirements based on the assumption that, as external rescue will be almost impossible, residents should be able to escape by themselves. This has led to restrictions in the use of combustible materials, requirements for cavity barriers in external walls, limits on flat size and layout to reduce the overall distance from furthest part of the flat to the front door, as well as protections for stairs, corridors, and lobbies, and other stipulations such as self-closing doors and escape lighting. Additional protection is needed where there is only a single stairway for normal entry and evacuation in an emergency, which is widespread in England as there is no legal requirement for a second means of escape in high-rise residential buildings if other measures are taken that can be demonstrated to provide equivalent safety.

3.3.2. Compartmentation

An equally important requirement stipulated in building codes is for a high standard of compartmentation in purpose-built multi-occupancy residential blocks of flats. Compartmentation is the act of subdividing a building into smaller compartments of walls and floors using fire resistant materials intended to ensure that a fire is contained within the flat of fire origin for a sufficient period of time to enable FRS to extinguish the fire, whilst allowing for a safe, protected means of escape for other occupants. The building's core structural elements should also be of sufficient fire resistance to prevent fire spread and structural collapse.

3.3.3. Firefighting

Building Regulations require all buildings over 18m in height to make provisions for special fire-fighting facilities for use by FRS. These normally comprise vehicle access for fire appliances and access for fire-fighting personnel, suitably protected stairways and lobbies, specially designed lifts for use by firefighters, rising fire mains by which the FRS can obtain water, and venting of heat and smoke. As these regulations are not applied retrospectively, it should be noted that some older buildings may have deficient or inferior systems or provisions for firefighting purposes.

3.3.4. The Stay Put principle

These stipulations governing the protected means of escape, compartmentation, and firefighting have underpinned the stay put approach at the heart of England's building regulations for blocks of flats since at least the publication of CP3 in 1962. 'Stay Put' rests on the idea that effective compartmentation should contain fire and smoke within the flat of origin adequately and for long enough to enable residents in other flats to either remain in their own flat, reach somewhere safe in the building, or to safely self-evacuate. The original strategy as set out in CP3 was to give residents a choice to stay put or get out by protecting the stairs for use by evacuating residents at any time, including during a fire:

> Owing to the high degree of compartmentation... the occupants should be safe if they remain where they are. Nevertheless, the possibility that individuals may seek to leave the building cannot be overlooked and provision should therefore be made for the occupant of

> any dwelling to do so by his [sic] own unaided efforts, using adequately protected escape routes within the building without outside assistance.[29]

What is critical to understand about this approach is that it rested on crucial assumptions about the integrity of fire resistance in post-war high-rise blocks made from reinforced concrete and local fire-fighting capacity. The most important of these are: that the compartmentation is sound and has not subsequently been breached by building works; and that there is only one fire in one compartment at any one time, or fire-fighting becomes extremely difficult as the dry riser in a high-rise buildings will only have the capacity to feed the water to fight one fire at a time and automatic ventilation systems are similarly designed with a capacity to work on only one floor effectively.

3.4. Grenfell Tower: an exceptional event or warning of wider failings?

A key question that this report addresses is whether Grenfell represents an anomaly that could not have been predicted and is unlikely to happen again, or is a stark warning of the potential risks to life from fires breaking out in high-rise residential buildings in the UK.

The 'Grenfell as an anomaly' perspective has been adopted by leading figures in the fire safety industry. In his expert witness report to the Grenfell Tower Inquiry, one of the UK's most influential fire safety figures, Colin Todd MBE, reiterated his long standing view that

> ...**high rise does not mean high risk**. After fire breaks out, there is no greater likelihood of a fatality in a high-rise block than a low- rise block or, indeed, a bungalow. This is because very few people die as a result of a fire in a neighbour's flat. Nearly all fire deaths in blocks of flats occur in the flat in which fire starts. The extent to which the Grenfell Tower fire was an exception to this experience is unique and, as it has commonly been described, unprecedented…[30]

Todd is a long-term advocate of the idea that it is generally safer for residents in high-rise flats to 'stay put' in the event of a nearby fire rather than to try to evacuate. His view rests on an unshakeable faith in the compartmentation design of purpose-built and high-rise residential buildings that should prevent the spread of fire and smoke. In this perspective, as high-rise blocks do not exhibit a high fatality rate in official fire incident statistics, the 'stay put' principle remains safe as it is rare for fires in blocks of flats to affect other flats or necessitate evacuation.

The mantra 'high-rise is not high-risk' was enshrined in the *2011 Fire safety in purpose-built blocks of flats* in England, written by Todd's consultancy practice C.S. Todd & Associates Ltd on behalf of the government and published by the Local Government Association (LGA) as the authoritative guidance for building owners and managers, landlords, and risk assessors. The LGA Guide, as it became known, was in place at the time of the Grenfell disaster. To understand its significance, it is important to explain the context in which it was commissioned and written.

3.4.1. The origins and significance of the 2011 LGA Guide

In July 2009, confidence in the fire safety of high-rise residential buildings was suddenly undermined with the Lakanal House fire in Camberwell, Southwark, that killed six people (see Box 3.1). Even before the Coroner's Inquest had concluded in 2013, it had become clear that a combination of

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[29] Foreword, BSI CP3 1962 Chapter 4, Part, p.5

[30] p.17, Todd, C. (2018), *Legislation, Guidance and Enforcing Authorities relevant to fire safety measures at Grenfell Tower: Report for The Grenfell Tower Inquiry*, March, [url]

combustible materials, defective refurbishment, the absence of sprinklers, and poor fire risk management by the local authority landlord were all contributory factors. Crucially, so too was the advice of LFB emergency call handlers during the fire to 'stay put' that contributed to the fatalities; those who survived mainly did so by self-evacuating.

Box 3.1: Lakanal House fire, July 2009

Lakanal House is a high-rise residential block containing 98 flats and maisonettes (dwellings over two floors) spread over 14 floors. On 3 July 2009 a fire broke out in a 9th floor maisonette and spread rapidly beyond the compartment of origin upwards to floors 10, 11 and 12 and downwards to floors 5 and 7. Within 30 minutes smoke had spread to involve floors 6 to 12 and smoke-logging affected large parts of the building, including the communal staircase, corridors and many of the flats. Six people died, including three children; 15 people were taken to hospital suffering from the effects of smoke inhalation and one firefighter was admitted for heat exhaustion. A total of 38 people were assisted out of the building or were rescued by firefighters and over 90 families had to vacate their homes as a result of the fire. More than 100 firefighters were in attendance at the height of the fire.[31]

While a rapid investigation into Lakanal by the government's Chief Fire and Rescue Adviser, Sir Ken Knight, found potential failings by the Responsible Person in relation to fire risk assessment and action plan[32], he concluded that the Lakanal fire was "[f]ortunately… a very rare event in England… The vast majority of fires in homes are contained within the compartment where the fire first starts in accordance with the design requirements of the building."[33]

It is worth noting here that while the death toll was unusual, this was by no means the first fire to a high-rise building that involved unusual fire spread involving combustible cladding or compartmentation failure with tragic or near-miss consequences. We found at least 10 dangerous fires to residential buildings of 10 or more floors in the UK prior to Lakanal (see Table 2.3). Box 3.2 below provides two examples of such fires.

Box 3.2: Arlington House and Staner Court fires, Kent 200134

Two major high-rise fires took place a few months apart in Kent in 2001, at Arlington House (18 storeys) in May and Staner Court (15 storeys) in July. These fires demonstrated the impact that natural external wind pressures can have following a failure of a window in the fire compartment, at height, subsequently compromising the internal compartmentation measures. The fire at Arlington House occupied 70 firefighters for four hours, during which one person died, 13 required medical treatment, and nine adults and a child were rescued from the fire floor after fire spread inwardly. At Staner Court, the single escape stairs became unsurvivable, necessitating the rescue of eight adults and three children from the roof using a Coast Guard helicopter, and 12 people were rescued by Turntable Ladder from windows and balconies. 10 people needed medical treatment and one person lost their life. The experience of Kent FRS at these fires led them to fundamentally overhaul their high-rise firefighting operational procedures so as to place more emphasis on protecting the means of escape for everybody, firefighters and residents, that might need to use it, including consideration for the total evacuation of the building.

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[31] p.73, Grenfell Tower Inquiry (2019) Phase 1 Report [URL]

[32] Knight, K. (2009), Report to the Secretary of State by the Chief Fire and Rescue Adviser on the emerging issues arising from the fatal fire at Lakanal House, Camberwell on 3 July 2009, 30 July [url]

[33] p.6, Knight (2009)

[34] See: BBC News Website (2001), Man killed in seafront fire, 23 May, [url]; BBC News Website (2001), Body found after tower block fire, 3 July [url]

Responding to concerns raised over failings by the Responsible Person at Lakanal House, the government commissioned - for the first time - "new definitive legal guidance" on managing fire safety in purpose-built blocks of flats in England. The 2011 LGA Guide took a clear position on the question of fire safety in purpose-built blocks of flats. While acknowledging that there were disproportionately more fire deaths in purpose-built flats compared to other dwellings, the LGA Guide asserted that this was simply because there were more fires due to the numbers of people living there:

> There is no evidence from fire statistics to suggest that those living in purpose-built blocks of flats are at greater danger from fire, once it breaks out, than those who live in houses... Once a fire occurs in a block of flats, the likelihood of a death is actually less than the likelihood of a death when fire occurs in a bungalow or a house. The lower frequency of deaths when fire occurs is paralleled by a lower rate of injury. One possible reason for this is that greater protection is afforded to escape routes in flats than in bungalows and two-storey houses...Therefore, as in all dwelling types, the risk to people from fire (ie risk of death or injury) in a block of flats is governed primarily by the likelihood of fire occurring and whether smoke alarms are installed, *rather than the type of dwelling in which people live, the height of the dwelling above ground or the architectural design of the block*".[35]

The LGA Guide stated that because the buildings were designed to be safe, the most significant influences on fire risk were "social and lifestyle factors" and advanced age:

> ...in a block of flats, each individual flat is totally enclosed in fire-resisting construction, the vast majority of fires are contained within the flat (and, in the majority of cases, the room) where they start. It is certainly rare for anyone, outside the flat where a fire starts, to die as a result of a fire in a flat…. This principle is undoubtedly successful in an overwhelming number of fires in blocks of flats. In 2009-2010, of over 8,000 fires in these blocks, only 22 fires necessitated evacuation of more than five people with the assistance of the fire and rescue service…[36]

The LGA Guide thus downplayed the risks of fires and need for evacuations in purpose-built blocks including high-rise buildings, dismissed the need for central fire alarms and sprinkler systems, and insisted that stay put should be the default "evacuation strategy" unless residents were directed to leave by the FRS. While it acknowledged that the needs of vulnerable residents such as the elderly and disabled may require particular consideration in the event of fire, it again downplayed expectations on the building owner or manager to make suitable adjustments and plans:

> ...the Building Regulations do not stipulate additional fire safety measures that must be provided as a consequence… In many circumstances, it will be impracticable to make special provision retrospectively, with regard to fire safety design in existing blocks of flats, to address the nature of the occupants.[37]

Finally, it suggested that building owners or managers should challenge decisions by enforcing authorities and fire risk assessors where stay put was abandoned in favour of simultaneous evacuation aided by fire alarms due to a lack of evidence about adequate compartmentation. The LGA guide implied that previous experience and fire statistics supported a more optimistic

[35] p.21, LGA Guide 2011
[36] p.20, LGA Guide 2011
[37] p.25-26, LGA Guide 2011

perspective on the likelihood of compartmentation and other fire safety measures in construction being adequate:

> Some enforcing authorities and fire risk assessors have been adopting a precautionary approach whereby, unless it can be proven that the standard of construction is adequate for 'stay put', the assumption should be that it is not. As a consequence, simultaneous evacuation has sometimes been adopted, and fire alarm systems fitted retrospectively, in blocks of flats designed to support a 'stay put' strategy.
>
> This is considered unduly pessimistic... [and] is not justified by experience or statistical evidence from fires in blocks of flats... [or] the principles of fire risk assessment… Accordingly, proposals of fire risk assessors, and requirements of enforcing authorities, based on a precautionary approach (eg abandonment of a 'stay put' policy simply because of difficulties in verifying compartmentation), should be questioned.[38]

The significance of the 2011 LGA Guide cannot be understated. The 192 page document asserted itself as the high-rise fire safety bible for landlords, fire risk assessors, and enforcement officers in fire and rescue authorities, offering the definitive interpretation of best practice fire risk assessment and the legal requirements for ensuring fire safety. It thus contributed significantly toward the entrenchment of 'stay put' as the only evacuation strategy pursued by building owners and/or landlords, with FRS instructed to follow its advice. It is the principal reason why, in 2017, Grenfell Tower, like virtually every high-rise building across the country at this time, had a 'stay put' policy in the event of a fire.

3.4.2. The Grenfell Inquiry's challenge to stay put

The 'stay put' approach has been directly challenged by the recommendations of Phase 1 of the Grenfell Inquiry: first, that the government should "develop national guidelines for carrying out partial or total evacuations of high-rise residential buildings" including procedures for evacuating disabled and older people; and second, that the owner and manager of every high-rise residential building should be "required by law to prepare personal emergency evacuation plans (PEEPs) for all residents whose ability to self-evacuate may be compromised".[39] These recommendations were based on evidence presented during the Inquiry about the total absence of evacuation planning for Grenfell's vulnerable residents.

Supporters of evacuation planning and PEEPS, such as Grenfell survivors and disabled resident action groups like Claddag[40], point to a recent Home Office report that found multi-dwelling residential buildings exhibit significantly higher rates of fire that result in a death or serious injury than single dwellings (i.e. houses) with the risk dramatically rising above 30 metres in height.[41] These higher rates are primarily understood as stemming from the higher numbers of people normally resident in high-rise buildings, increasing the risk of fires breaking out.

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[38] p.25, p.28, LGA Guide 2011

[39] Grenfell Tower Inquiry (2019), Phase 1 Report of the Public Inquiry into the Fire at Grenfell Tower on 14 June 2017. October [url]

[40] Claddag Leaseholder Disability Action Group is a campaign body of residents who are disabled or have health conditions and are living in homes affected by the cladding and building safety crisis: https://claddag.org/

[41] Home Office (2019), 'Detailed analysis of fires attended by fire and rescue services, England, April 2018 to March', Statistical Bulletin, 12 September. [URL]

However, having promised to implement the Inquiry's recommendations in full, the government's initial proposals for requiring PEEPS - set out in a 2020 consultation on changes to The Regulatory Reform (Fire Safety) Order 2005[42] - were very limited. They would only be required in high-rise buildings (18 metres+) with a waking watch in place, which equated with the highest-risk buildings with unsafe cladding or other fire safety issues, and where there would be personnel on site to assist in evacuation. For other high-rise, responsible persons would be required to pass details of people who self-identify as needing evacuation assistance to the fire service and keep them in a premises information box. Government regarded wider requirements for PEEPS as impractical due to "the lack of personnel available to assist during an evacuation; the complexity of any particular building and the roles of those responsible; high turnover of residents; and data protection concerns".[43]

At the same time, a new professional Code of Practice (COP) PAS 79-2, was published in December 2020 by the British Standards Institute (BSI) for all fire risk assessors and enforcing authorities like the FRS to guide risk assessments of residential high-rise buildings.[44] As with the 2011 LGA guide, it was authored by Colin Todd and reiterated stay put as the default evacuation strategy. Specifically, in response to the public inquiry's recommendations, the CoP stated that it is not "normally practicable" for a building owner or landlord to make special arrangements for evacuation of disabled residents in the event of fire and that it is "wholly unrealistic" to expect the housing provider to prepare and update PEEPS for such residents in the event that the fire brigade deems their evacuation to be necessary.

Following the threat of judicial review by bereaved family members of Grenfell victims, the government issued new proposals in June 2021 that would require the responsible person to "prepare a personal emergency evacuation plan (PEEP) for every resident in a high-rise residential building who self-identifies to them as unable to self-evacuate (subject to the resident's voluntary self-identification) and to do so in consultation with them".[45] After similar pressure was put on the BSI, PAS 79-2 was temporarily suspended and withdrawn from sale in March 2021 pending more consultation on the implications for disabled residents.

The debate over stay put or evacuation - and whether PEEPs should be mandatory in high-rise flats - is fundamentally about whether, in the event of a fire, high-rise buildings are safe enough for those not in the vicinity of the fire to stay put. It is about the effectiveness of compartmentation, the means of escape, and firefighting infrastructure in the building when faced with the much longer intervention times for FRS to blocks of flats at height.

Post-Grenfell revelations about the scale of combustible cladding and other fire safety defects on high-rise buildings, as well as evidence from subsequent dangerous fires suggest the risks of staying put have not been minimised. However, there remains no comprehensive research or evidence base about the fire safety of blocks of flats.

In the next section, we explore what official fire incident data can tell us about these risks.

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[42] Home Office (2020), *Fire Safety: Government Consultation*, 20 July [url]
[43] p.67, Home Office (2020) Fire Safety Consultation
[44] British Standards Institute (BSI) (2020), PAS 79-2:2020 Fire risk assessment. Housing. Code of practice. [url]
[45] p.8, Home Office (2021), *Personal Emergency Evacuation Plans in High-Rise Residential Buildings – recommendations from the Grenfell Tower Inquiry Phase 1 report*. Government consultation, 8 June, [url]

4. Identifying fire risks in purpose-built flats and high-rise residential buildings in official fire data for England

This section presents and discusses the main findings of our analysis of fire incident-level data for all primary fires requiring FRS attendance to dwellings (and where relevant, other residential properties) in England between 2010/11 and 2019/20. A first section sets out findings in relation to the overall trends in fires. The next section compares rates of fires, fatalities and casualties as a proportion of fires and by estimated populations across different types of dwelling. A fourth section explores the possible relationships between height of building and fire origin and purpose-built flat fires that result in a fatality or casualty. A fifth section explores the frequency and effect of delays to firefighting. A final section briefly discusses findings on evacuation.

4.1. Trends in fires

Headline findings: There is a clear downward trend over the decade in the number of fires attended by FRS to purpose-built flats, suggesting a reduction in fire risk. At the same time, annual fires increased over the decade for flats at specific building heights - most notably for medium-rise flats between 11m and 18m high. This illustrates that overall trends and averages can hide increased fire risks for blocks of flats of certain heights.

Table 4.1 breaks down the proportion of total primary fires to dwellings and other residential buildings by general property type for the start- and end-year of the decade. All broad property types saw a reduction in the total fires attended with an overall decrease of 22.3%; and the proportion of fires attended by property type remained largely unchanged, with house fires by far the single largest category due to the dominance of this property type in England's housing stock.

Table 4.1: Fires to dwellings and other residential buildings attended by FRS 2010-11 to 2019-20 by broad category

Dwelling / Property Type	2010/11		2019/20		Change in annual fires between start and end year (%)
	Fires	% of total fires	Fires	% of total fires	
All fires	**41,980**	**100**	**32,601**	**100**	**-22.3**
Houses	19,387	48.1	14,575	44.7	-24.8
Bungalows	1862	4.7	1578	4.8	-15.3
Purpose-Built Flats	9387	22.1	7521	23.1	-19.9
Converted Flats / Maisonettes	2195	6.0	2047	6.3	-6.7
HMOs	1052	2.0	629	1.9	-40.2
Other Dwellings	2728	6.7	2134	6.5	-21.8
Other Residential	8097	19.1	6251	19.2	-22.8

More detailed inspection of the data shows some variation in the rate of decrease for different property types compared to the overall decade reduction of 22.3%. While fires attended at houses, bungalows, purpose-built flats and other dwellings fell broadly in line with the overall reduction, fires attended at HMOs fell dramatically, by over 40%. The next largest fall belongs to house fires (25%). Within the Other Residential category, fires to Student Halls of Residence have fallen by 63.9%. At the other end of the scale, calls to fires in Converted flats/Maisonettes fell by only 6.7%.

Within the category of purpose-built flats, published Home Office statistics show a degree of variation to the overall decade reduction in fires of 19.9%: fires to low-rise blocks (floors 1-3) fell by 23.2%, medium-rise fires (floors 4-9) fell by 8.8% and high-rise fires (floors 10+) fell by 22.4%. However, when using our reclassified fire incidents (see section 2.2.1) based on how the height of buildings (floors above ground) was actually recorded by the FRS in the IRS, we found a much greater degree of variation as set out in Table 4.2. Fires to low-rise blocks appear to have fallen by over 29%, driven in particular by the large falls to single storey blocks, while medium-rise fires actually increased by 12.5% over the decade. High-rise fires appear to have fallen more slowly than previously thought (6.5%) with some building height categories increasing. This underlines the point that overall trends and averages can hide possible increases in the risk of fire for specific types and heights of building.

Table 4.2: Fires attended by FRS 2010/11 to 2019/20 by height of purpose-built dwelling - change over time

Building height (floors)	2010/11	2019/20	Change in annual fires between start and end year (%)
All Purpose-Built flats	9387	7521	-19.9
Purpose-Built Flats Low-Rise (1-3 Floors)	6885	4860	-29.4
Purpose-Built Flats Medium-Rise (4-9 Floors)	1691	1903	+12.5
Purpose-Built Flats High-Rise (10+ Floors)	811	758	-6.5
1	1705	587	-65.6
2	2888	2204	-23.7
3	2292	2067	-9.8
4	898	950	+5.8
5	294	398	+35.4
6	187	234	+25.1
7	91	110	+20.9
8	119	110	-7.6
9	99	101	+2.0

10	130	121	-6.9
11	68	94	+38.2
12	130	106	-18.5
13	70	75	+7.1
14	92	64	-30.4
15	83	66	-20.5
16	78	65	-16.7
17	39	33	-15.4
18	26	29	+11.5
19	23	21	-8.7
20	26	25	-3.8
20-43	46	59	+28.3

4.2. Comparing rates of fatality and casualty across different types of dwelling

Headline findings: Once a fire breaks out, residents in purpose-built block of flats are no more likely to die than residents of any other dwelling type, and are less likely to die or be injured than bungalow dwellers. However, bungalow fires are outliers due to the predominance of elderly and disabled residents who are far more vulnerable in the event of fire. A more meaningful comparison is with houses against which purpose-built flat fires have higher rates of casualty and casualties requiring hospitalisation, and high-rise flats have a significantly higher average annual rate of fatalities and casualties. When fire incidents are normalised by the estimated populations living in each dwelling type, residents of purpose-built and converted flats are exposed to a much greater probability of their building experiencing a fire than those living in other dwelling types, and consequently, are more than twice as likely to die, and nearly twice as likely to be injured in a fire. This supports the idea that dwellers of blocks of flats face increased risks of, and from, fire.

As we outlined in section 3, there is a clear downward trend in total fatalities and non-fatal casualties from dwelling fires attended by FRS during the decade. Overall fatality fell by 22%, mirroring the percentage fall in fires, and overall non-fatal casualties fell by 31.3%. At the same, the annual average rate of fatality from fire remained fairly constant over the decade at 69 deaths per 1000 fires (a reduction of 0.3%), while the average annual rate of non-fatal casualty fell by 11.7%, from 205 to 181 casualties per 1000 fires.

Our analysis of both published IRS data, and the unpublished IRS incident-level datasets, finds a similar downward trend for both the annual number of fires resulting in a fatality or casualty (down by 28.4% over the decade) and the proportion of fires resulting in either a fatality or casualty (falling from 15.7% to 14.4%). It is important to note that the annual fatality and casualty rate per 1000 fires and the annual average rate of fatality or casualty have been on a slight upward curve over the past few years.

Examining these general rates of fatality and non-fatal casualty by dwelling type in Table 4.3, we once again see both a general downward trend and some variation. It is worth noting that as fatalities are generally low, they are more prone to fluctuation on a year-by-year basis, and caution is needed in deriving meaningful trends.

Table 4.3: Fires to dwellings and other residential buildings attended by FRS 2010/11 to 2019/20

Dwelling / Property Type	2010/11		2019/20		% Change in annual fires between start and end year	
	Fatalities	Casualties	Fatalities	Casualties	Fatalities	Casualties
All	255	7498	199	5152	-22.0	-31.3
Houses	121	3711	96	2624	-20.7	-29.3
Bungalows	40	406	26	354	-35.0	-12.8
Purpose-built flats	57	2171	41	1381	-28.1	-36.4
Converted Flats / Maisonettes	9	431	12	321	33.3	-25.5
HMOs	8	291	7	142	-12.5	-51.2
Other Dwellings	20	488	17	330	-15.0	-32.4

Source: Home Office Table 205

Comparing the average annual rates of fatality by dwelling type using published Home Office statistics summarised in Tables 4.4, 4.5 and 4.6, we find that bungalow fires have by far the highest average annual rate of fatality (14.3 deaths per 1000 fires). This is double that of all other broad dwelling types. Bungalow fires also have the highest rates of general non-fatal casualty and casualties requiring hospitalisation, although these rates are much closer to other dwelling types.

Table 4.4: Fatalities from dwelling fires attended by FRS 2010-11 to 2019-20

Year	2010/11	2014/15	2019/20	Mean average over decade
Dwelling / Property Type	Fatalities per 1000 fires (rounded)			
Houses	6	6	7	7
Bungalows	22	12	17	14
Converted Flats / Maisonettes	4	5	6	5
All Purpose-Built Flats	6	5	5	6
HMOs	8	6	11	7
Other Dwellings	7	7	8	7

Source: Home Office Table 205

Table 4.5: Non-fatal casualties from dwelling fires attended by FRS 2010-11 to 2019-20

	2010/11	2014/15	2019/20	Mean average over decade
	Non-fatal casualties per 1000 fires (rounded)			
Houses	191	180	180	182
Bungalows	218	221	224	219
Converted Flats / Maisonettes	196	192	157	181
All Purpose-Built flats	231	200	184	201
HMOs	277	233	226	244
Other Dwellings	179	176	155	178

Source: Home Office Table 205

Table 4.6: Non-fatal casualties requiring hospitalisation from dwelling fires attended by FRS 2010-11 to 2019-20

	2010/11	2014/15	2019/20	Mean average over decade
	Non-fatal casualties requiring hospitalisation per 1000 fires (rounded)			
Houses	89	75	77	79
Bungalow	87	95	90	90
Converted Flat / Maisonette	94	84	87	89
All Purpose-Built flats	104	84	82	90
HMOs	76	63	111	118
Other Dwellings	63	59	58	62

Source: Home Office Table 205

These rates of fatality and casualty by the number of fires per dwelling type over the period 2010/11 to 2019/20 would appear to support the assertion made in the 2011 LGA Guide that, once a fire breaks out, residents of purpose-built flats are no more likely to die or be injured than those who live in houses, and are far less likely to die or be injured than residents of bungalows. However, this does not automatically mean that purpose-built flats pose similar or even lower fire risks than other dwelling types for three main reasons.

First, comparing overall fatality rates for purpose-built flats with bungalows is misleading due to the very different demographic profiles of these two dwelling typologies. As single floor dwellings at ground level, bungalows should be among the safest for occupants to escape from in the event of fire and would be expected to have the lowest rates of fire-related fatality. However, as Table 4.7

shows below using English Housing Survey data, due to their accessibility, bungalows are far more likely to house elderly households compared to all other dwelling types. We also know that households with one or more people with a disability or long term illness are twice as likely to live in bungalows as other households.[46] That means bungalows have higher concentrations of vulnerable households who struggle to escape in time should a fire break out, an assertion corroborated by the fact that most pedestrians over 65 are unable to cross the road in time at traffic lights.[47] This explains why the fatality rate is much higher than all other dwelling types.

Table 4.7: Type of homes by the age of the oldest person in the household, England

	All households (millions)	under 65 (millions)	%	65 and over (millions)	%
Houses	16.1	11.6	72	4.5	28
Bungalows	2.0	0.6	29	1.5	71
Flats	4.4	3.4	78	1.0	22

Source: English Housing Survey (2015) Housing for Older People, Chapter 2 Table AT2.1

Second, a far more meaningful comparison for fatality and casualty rates is between purpose-built flats and houses given the more similar demographic profiles of occupants. As we can see in the Tables 4.4 to 4.6 above, while average fatality rates per 1000 fires are slightly lower for purpose-built flats compared to houses, flat fires have higher rates of casualty, casualties requiring hospitalisation, and severe casualties requiring hospitalisation. We can also see, as per Table 4.8 below, that compared to house fires, high-rise flats had double the average fatality rate, and significantly higher rates of non-fatal casualties and severe non-fatal casualties requiring hospitalisation.

Table 4.8: Comparing decade average rates of fires resulting in fatalities and casualties

	Fatalities	Non-fatal Casualties	Non-fatal casualties Requiring Hospitalisation	Severe Non-fatal Casualties Requiring Hospitalisation
	Per 1000 fires decade average (rounded)			
Houses	7	182	79	13
All Purpose-Built flats	6	201	90	14
Purpose-Built Flats Low-Rise (1-3 Floors)	6	209	93	15
Purpose-Built Flats Medium-Rise (4-9 Floors)	4	172	83	9
Purpose-Built Flats High-Rise (10+ Floors)	14	217	90	20

Source: Home Office Table 205

[46] p.23, DCLG (2012), English Housing Survey: HOMES. Annual report on England's housing stock, 2010. DCLG: London, URL

[47] Asher, L. et al (2012), 'Most older pedestrians are unable to cross the road in time: a cross-sectional study', *Age and Ageing*, 41(5): 690–694, [url]

Finally, when fire incidents are normalised by the estimated populations living in each dwelling type, we found that residents of purpose-built and converted flats were exposed to a much greater probability of their building experiencing a fire than those living in other dwelling types over the decade. Specifically, we found that flat dwellers were almost three times more likely to experience a fire in their building than those living in houses, and that those living six floors or above were nearly twice as likely to experience a fire in their building than block below six floors, and nearly five times those living in a house

This finding draws on estimated dwelling stock and population data from the English Housing Survey (EHS), a continuous national survey commissioned by government about people's housing circumstances and the physical condition and energy efficiency of housing in England. These estimates are set out in Table 4.9 below. We use the mean average stock totals for each dwelling type for the period 2010/11 to 2019/20, and our own estimation of the population for each dwelling type, which we derived from extrapolating from the EHS. As the EHS and fire incident system (IRS) use slightly different dwelling typologies, we have had to merge some EHS dwelling categories and make assumptions about which IRS dwelling fields can be attributed to those merged categories.[48]

[48] Our results are based on extrapolating from estimated stock data in the English Housing Survey (EHS), using the mean average stock totals for each dwelling type for the decade; and from estimated household size data contained in the EHS dataset for 2017/18. The EHS publishes data for the following dwelling types: all terrace; semi-detached; detached; bungalow; converted flat; purpose-built flat, low rise (up to 5 floors) and high rise (six floors or higher). The IRS data records fires against the following dwelling types: Bungalow - single occupancy; House - single occupancy; purpose-built Flat; Converted Flat/Maisonette; HMO; Other Dwelling. As the IRS data and the EHS data use slightly different dwelling typologies, we have had to merge some categories of EHS and make corresponding assumptions about IRS dwelling fields to create equivalent dwelling types: houses comprise all terrace, semi-detached, detached and HMOs. As there is no equivalent field for Other Dwelling in the EHS (Caravan/mobile home, Castle, Houseboat, Self contained sheltered housing, Stately home and Tenement building), for the purpose of this analysis we have removed these fires - which totalled 24,299 over the decade - and assumed the remaining dwellings fires add up to 100%. To align the EHS height measures of purpose-built accommodation (5 floors and lower; 6 floors and higher) we used the 'floors above ground' field provided to us by the Home Office to attribute fire incidents for purpose-built flats into these two EHS categories. Populations for houses and flats were derived by multiplying the average household size for the two main dwelling types. The EHS refers to houses as encompassing bungalows and HMOs.

Table 4.9: Estimated average annual dwelling stock and population for England, 2010-20

Dwelling Type	Total annual average dwellings[49]	Proportion of total stock	Average household size (rounded)[50]	Total annual average population[51]	Proportion of total population %
All dwellings	**23,429,412**	**100**	**2.33**	**54,674,695**	**100**
All Houses[52]	**18,679,316**	**79.7**	**2.52**	**47,002,114**	**86.0**
Bungalow	2,085,414	8.9	1.50*	3,128,121	5.7
Houses	16,593,902	70.8	2.60*	43,063,733	78.8
All Flats	**4,750,096**	**20.3**	**1.79**	**8,482,841**	**15.5**
Converted Flats	915,035	3.9	1.79*	1,634,092	3.0
Purpose-Built Flats	3,835,061	16.4	1.79*	6,848,749	12.5
All Flats by Height	**4,750,096**	**20.3**	**1.79**	**8,482,841**	**15.5**
All Flats Low-Rise (up to 5 floors)	4,299,090*	18.3	1.77	7,626,072	13.9
All Flats High-Rise (6 floors +)	451,006*	1.9	1.90	856,769	1.6
Purpose-Built Flats by Height	**3,835,061**	**16.4**	**1.79***	**6,848,749**	**12.5**
Purpose-Built Flats Low-Rise (up to 5 floors)	3,379,717*	14.4	1.77*	6,157,023	11.3
Purpose-Built Flats High-Rise (6 floors +)	455,344*	1.9	1.90*	691,725	1.3

Table 4.10 sets out the proportion of dwelling type fires by both estimated housing stock and estimated population size. It shows that although bungalows and houses together account for nearly 80% of England's housing stock and approximately 83.8% of the population, they have less than two-thirds of dwelling fires; whereas flats in purpose-built blocks and converted buildings account for just over 20% of the housing stock and 16.2% of the population, but represent over a third of dwelling fires. In other words, flat dwellers are almost three times more likely to experience a fire in their building than those living in houses. The probability of fire requiring FRS attendance

[49] Average (mean) annual dwellings data comes from the EHS for all years 2010/11 to 2019/20 inclusive. An asterix against a total in this column indicates where we have used the proportions of households attributed to low- and high-rise flats in the EHS 2017/18 Households Report to make an estimate of the number of dwellings for each category.
[50] We have used the average household size data from the EHS 2017/18 Households Report to populate this column. The EHS report estimates average household size for All Houses (including Bungalows) and for All Flats (Purpose-Built and Converted combined) for 1-3, 3-5, 6-9 and 10+ storeys. An asterix against the average indicates where we have extrapolated from the EHS data to make our own estimated average household size.
[51] We have multiplied the average annual dwelling stock per dwelling type by the average household size to generate an estimated average (mean) total population per dwelling type over the decade. This assumes that each dwelling equates to a single household.
[52] Excludes Other Dwellings recorded in the IRS

diverges further by height of building. Those living in a purpose-built block of flats six floors or above are nearly twice as likely to experience a fire in their building than in an equivalent block below six floors, and nearly five times those living in a house.[53]

Table 4.10: Dwelling fires attended by FRS 2010-11 to 2019-20 by dwelling type and as proportion of English housing stock and population

Dwelling Type	As % of English Housing Stock using decade mean	As % of England's Dwelling Fires using decade mean	Fires attended per 10,000 dwellings of type	Fires attended per 10,000 people
All dwellings	**100**	**100**	**12.6**	**5.4**
All Houses[54]	**79.7**	**65.2**	**10.3**	**4.1**
Bungalow	8.9	5.8	8.3	5.5
Houses (including HMOs)	70.8	59.4	10.6	4.1
All Flats	**20.3**	**34.8**	**21.6**	**12.1**
Converted flats	3.9	7.4	24.0	13.4
Purpose-built flats	16.4	27.3	21.0	11.8
All Flats by Height	**20.3**	**34.8**	**21.6**	**12.1**
All Flats Low-Rise (up to 5 floors)	18.3	30.2	20.7	11.7
All Flats High-Rise (6 floors +)	1.9	4.6	29.9	15.7
Purpose-built flats by Height	**16.4**	**27.3**	**21.0**	**11.8**
Purpose-Built Flats Low-Rise (up to 5 floors)	14.4	22.8	19.9	10.9
Purpose-Built Flats High-Rise (6 floors +)	1.9	4.5	29.0	19.1

In general, as Table 4.11 shows, residents of blocks of flats have a far higher probability of dying (more than double) or being injured (nearly fourfold) from a fire to their building than for residents of houses. We did not have access to data to explore the relationship between individual fatalities and casualties, and height of building. The information provided relates to the number of incidents at which there were either a fatality or a casualty.

[53] It is worth noting here that most dwelling fires are not reported to the FRS: the EHS 2016-2017 found 75% were either extinguished by someone in the household or burning out by themselves. The relatively higher number of purpose-built flat fires attended by the FRS might be partly explained by the increased likelihood of occupiers to call 999 given the existence of one exit route from a flat, and the far more limited options to put out particular kinds of fire such as pan fires when house / bungalow dwellers can carry the pan out of a back door to a garden where it is allowed to safely burn itself out.

[54] Excludes Other Dwellings recorded in the IRS

Table 4.11: Average annual fire incidents resulting in fatalities and casualties in dwelling fires attended by FRS 2010-11 to 2019-20 as proportion of population

Dwelling Type	Average annual fatalities per 1,000,000 people	Average annual casualties per 1,000,000 people
All Dwellings	**3.8**	**102.9**
All Houses[55]	**3.1**	**86.0**
Bungalow	7.9	120.7
Houses (including HMOs)	2.8	75.1
All Flats	**7.2**	**237.4**
Converted Flats	6.8	243.7
Purpose-Built Flats	7.3	235.9

The higher rates of fire by dwelling stock and population experienced at blocks of flats are not simply due to the higher number of dwellings and residents in such buildings. Our analysis of the IRS data suggests that blocks of flats have multiple additional sites of vulnerability to a fire starting and thus increased risk of deliberate fires. In contrast with typical houses or bungalows, blocks of flats have multiple shared spaces, or common parts, such as entrance and exit doors, entrance and floor lobbies, stairwells, bin chutes, other service and utility shafts, refuse rooms, and underground or adjacent garages that residents and their visitors will frequently use or pass through. Such buildings tend to be far less secure than single-occupancy dwellings.

Using assumptions about which areas would normally be located inside and outside of a dwelling in a block of flats compared to houses and bungalows,[56] we found that just over 1 in 5 (22.7%) purpose-built and converted flat (20.6%) fires appear to start outside of the dwellings, and for high-rise purpose-built flats (10 floors or higher), this increases to more than one in three (37.7%) fires. In comparison, fires originating outside the dwelling only occur in 14.8% of house fires and 11.4% of bungalow fires. Purpose-built flats are also far more prone to deliberate fires than houses and bungalows with the former experiencing 16.5% of fires as arson, compared to 9.9% for houses and 6.3% for bungalows. When we cross-tabulate where the fire originated with whether it was deemed accidental or deliberate, the higher risks of deliberate fires being started somewhere in a purpose-built block of flats other than a dwelling becomes even clearer: only 6.1% of fires that started inside the dwelling were deliberate, compared to 41% of fires in blocks of flats that started outside of the dwellings. This compares to 7% and 26.4% for houses, and 4.5 and 20.3% for bungalows.

[55] Excludes Other Dwellings recorded in the IRS

[56] We have used different assumptions for single-occupancy houses and bungalows, and HMOs, given that most of the non-dwelling areas in blocks of flats would be considered part of, and accessible from within, a house or bungalow dwelling. We therefore attributed the following as possible non-dwelling locations, even though it would be likely that most could be inside the dwelling: External fittings and structures, Garage, Other, and Refuse Store.

4.3. The height effect

Headline findings: Analysing purpose-built flat fires by both height of building and the floor height that a fire originates on suggests there is positive association between increases in height and higher rates of fires resulting in a fatality or casualty. We found 113 combinations of building height and floor of fire origin where the average rate of fires resulting in a fatality or casualty exceeded the equivalent average for houses over the decade.

Table 4.12 shows that over the decade, purpose-built flats in 11 building heights had a higher average rate of fire resulting in a fatality or casualty than the average rate for houses (buildings that are 2, 3, 7, 9, 13, 14, 19, 23, 30 and 32 floors high). Fires originating from the 6th floor upwards were more likely to have a fatality or casualty than fires originating below the 6th floor, with a positive correlation between increased height and increased rates of fire with a fatality or casualty up to the 13th floor. Moreover, this increased probability rises significantly from floor 9 to floor 16, and again at floor 20.

Table 4.12: Dwelling fires in purpose-built flats attended by FRS 2010-11 to 2019-20 involving fatality or casualty by building height

Height (floors)	Fires	% with a fatality or casualty
Purpose-built flats - all height	80,557	15.6
1	8326	13.8
2	23859	18.7
3	22100	15.1
4	9537	13.5
5	3539	12.6
6	2185	5.7
7	975	14.2
8	1086	11.1
9	1055	14.8
10	1397	9.5
11	801	22.5
12	1131	9.8
13	664	21.4
14	841	16.1
15	774	12.1
16	587	11.2
17	319	10.7

18	295	11.9
19	200	18.5
20	306	6.5
21	109	11.9
22	135	8.1
23	67	23.9
24	91	5.5
25	54	7.4
26	31	0.0
27	12	8.3
30	11	36.4
31	17	11.8
32	10	20.0

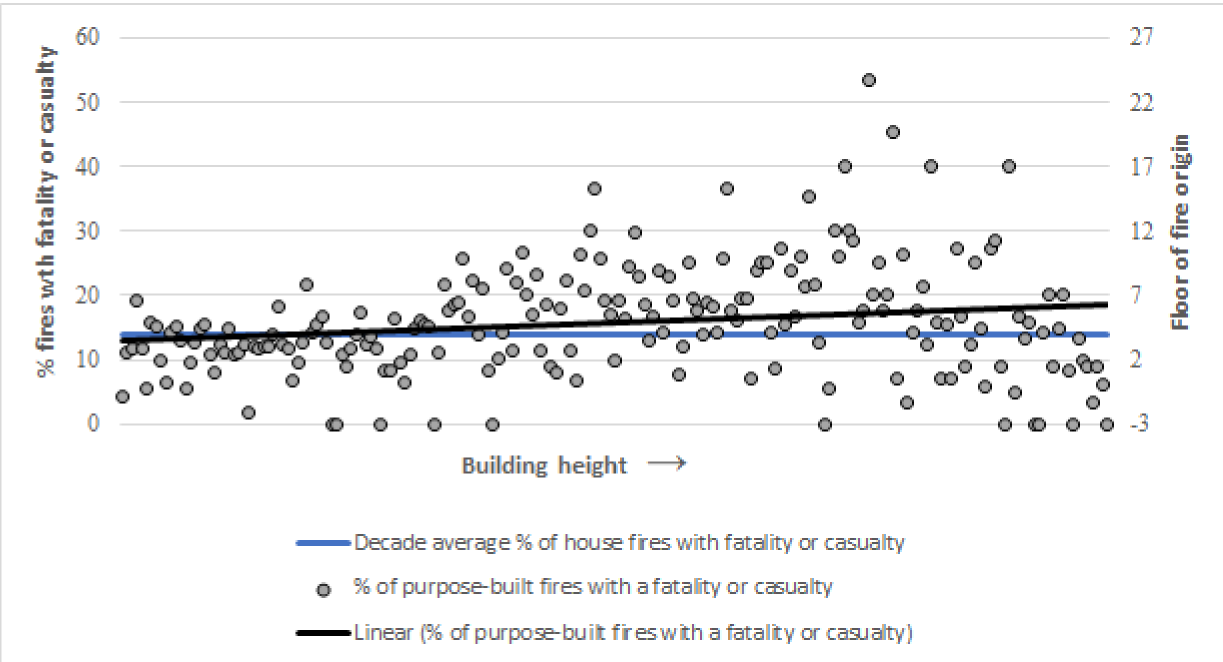
Table 4.13: Dwelling fires in purpose-built flats attended by FRS 2010-11 to 2019-20 involving fatality or casualty by floor of fire origin

Floor of fire origin	Fires	% with a fatality or casualty
Purpose-built flats - all height	80,557	15.6
-2	18	11.1
-1	629	7.3
1	52007	16.3
2	13040	14.8
3	5362	13.2
4	2368	11.7
5	1310	14.8
6	862	16.7
7	703	16.5
8	550	15.3
9	495	19.6
10	376	19.4
11	311	17.4
12	252	19.4

13	206	22.3
14	167	19.2
15	128	14.8
16	87	18.4
17	64	15.6
18	35	8.6
19	26	7.7
20	38	18.4
21	16	6.3

We next analysed the relationship between the floor the fire started on, the height of the building it was located in, and whether there was a fatality or casualty, and produced aggregate rates for each combination of floor of origin and building height. The results are graphed in Figure 4.1, which includes 113 combinations of Building Height - Floor of Fire Origin where the average rate of fires resulting in a fatality or casualty exceeded the equivalent average for houses over the decade. The graph also shows a positive trendline for these aggregated purpose-built flat fires, suggesting that the risk of a fatality or casualty increases the higher the building and floor of fire origin.

Figure 4.1: Fires involving either a fatality or casualty in purpose-built flats by building height-floor of fire origin combination



These findings correspond with a height analysis of the fatalities at Grenfell Tower. 11 victims lived on the 23rd floor, 14 lived on the 22nd floor, seven lived on the 21st floor; nine lived on the 20th floor and nine lived on the 19th floor; six lived on the 18th floor; seven lived on the 17th floor; two lived on the 16th floor; one lived on the 15th floor; four lived on the 14th floor; and two lived on the 11th floor. Nobody that lived below the 11th floor of Grenfell Tower died as a result of the fire that started on the 4th floor of the building.

4.4. Delays to firefighting

Headline findings: Fires in purpose-built blocks of flats are in general much more likely to experience delays to firefighting than other dwelling types, and this likelihood of delay increases dramatically for high-rise buildings due to the specific difficulties faced by firefighters at this building typology. A high-rise flat fire is over six times more likely to experience a delay to the start of firefighting than fires to houses. Further to this, delays do increase the likelihood of a fire resulting in a fatality or casualty for purpose-built blocks of flats.

As we discussed in section 3.2, while FRS response times are important to tackling all fires, in contrast to regular houses on regular streets, getting to the street address of a reported fire is not analogous to the actual time that firefighting interventions occur at blocks of flats, especially medium-rise and high-rise buildings. The FRS can be on site quickly, but can take up to around 20 minutes to start firefighting, depending on the floor of origin. Delays can occur to the start of firefighting for a variety of reasons and these inevitably shorten the window of opportunity in the fire development timeline, in which a fire can be contained, and the time available for residents to be safely evacuated or rescued.

Table 4.14 presents the frequency and reasons for delays to firefighting that were recorded in the IRS data for the period 2010/11 to 2019/20 for all dwellings and other residential property types. Overall, a relatively small proportion (4.7%) of fires experienced a delay to firefighting over the decade. The most common delay (35.2%) was caused by problems accessing the fire due to security doors or other security measures to the building, followed by the location of fire not being immediately evident (22.8%), vehicle access problems (16.3%), being sent to the wrong location (11.5%) and problems accessing the fire due to the particular type of building affected (10%).

Table 4.14: Fires to dwellings and other residential buildings attended by FRS 2010/11 and 2019/20 experiencing a delay to the start of firefighting and main reason

	Total	% of total fires
All fires	364345	
Fires with delays	18078	4.7
Primary reason for the delay to the start of firefighting		
Problems accessing fire - due to building type e.g. high rise building	1810	10.0
Problems accessing fire due to large site	516	2.9
Problems accessing fire due to security doors/other security measures	6365	35.2
Assault on Firefighters	110	0.6

Civil disturbance	138	0.8
Location of fire not immediately evident	4115	22.8
Sent to wrong location	2070	11.5
Vehicle access problems	2954	16.3

However, analysis of the distribution of delays by dwellings/property types set out in Table 4.15 shows that while fires to bungalows and houses experience a very small proportion of delays to the start of firefighting - below the overall decade average of 4.7% - one in every five fires in purpose-built high-rise flats of 10 floors or higher experience delays to the start of firefighting. In other words, a high-rise flat fire is over six times more likely to experience a delay to the start of firefighting than fires to houses or bungalows.

Table 4.15: Fires by dwelling type attended by FRS 2010/11 and 2019/20 experiencing a delay to the start of firefighting

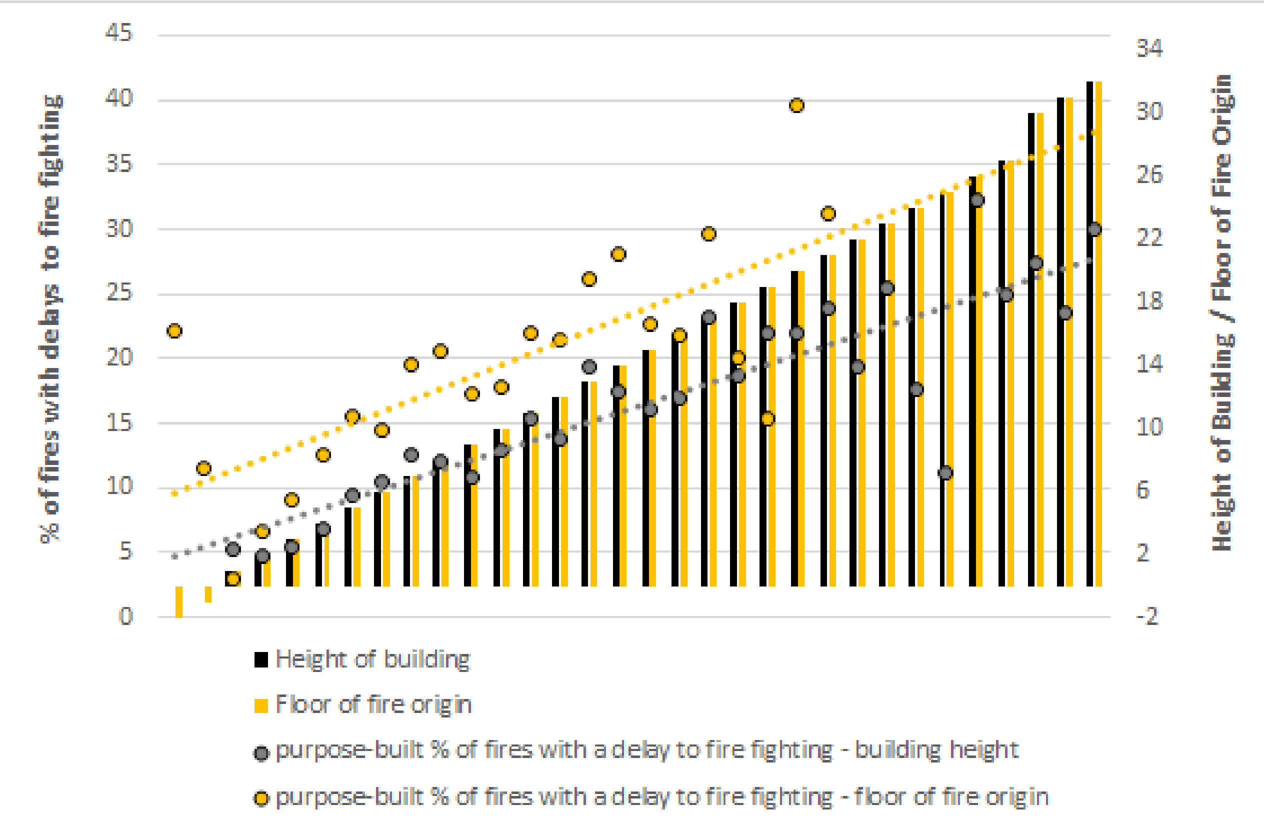
Dwelling / Property Type	**% of fires with delay to firefighting**
Bungalow	2.7
Houses (including HMOs)	3.0
Converted Flat/Maisonette	5.4
All Purpose-Built Flats	7.6
Purpose-Built Flats Low Rise (floors 1-3)	*5.4*
Purpose-Built Flats Medium Rise (floors 4-9)	*9.4*
Purpose-Built Flats High Rise (floors 10+)	*20.1*

The frequency of delays to firefighting increases the higher the floor origin of fire. This is illustrated in Table 4.16 and Figure 4.2, which look in closer detail at delays to firefighting in purpose-built blocks by fire floor of origin where there are 10 fires or more. There is a clear overall trend: fires starting on the 1st floor have a 2.9% rate of delays - very similar to bungalow and house fires - however this rises sharply to 14.5% for 6th floor fires, 17.8% for 10th floor fires, 20% for 18th floor fires, and peaking at 39.5% for fires on the 20th floor. When we cross-tabulate fires by building height and fire floor of origin, we see even higher rates of delays for specific height-origin combinations. For example, half of all fires that start on the top floor of 14-floor and 20th-floor buildings are affected by delays to firefighting.

Table 4.16: Fires to purpose-built flats attended by FRS between 2010/11 and 2019/20 experiencing a delay to firefighting by fire floor origin

Height	Fires at floor of origin	% of fires with a delay to firefighting	Height	Fires at floor of origin	% of fires with a delay to firefighting
-2	18	22.2	11	311	21.9
-1	629	11.6	12	252	21.4
1	52007	2.9	13	206	26.2
2	13040	6.7	14	167	28.1
3	5362	9.0	15	128	22.7
4	2368	12.6	16	87	21.8
5	1310	15.5	17	64	29.7
6	862	14.5	18	35	20.0
7	703	19.6	19	26	15.4
8	550	20.5	20	38	39.5
9	495	17.2	21	16	31.3
10	376	17.8			

Figure 4.2: Fires to purpose-built flats attended by FRS between 2010/11 and 2019/20 experiencing a delay to firefighting by height of building / floor of fire origin



Analysis of the reasons for delays to the start of firefighting for purpose-built high-rise reveals the fundamental role of building typology as summarised in Table 4.17 below. For low-rise buildings (bungalows, houses, and low-rise purpose-built flats), the most frequently given reason for delays to firefighting was from problems accessing the fire due to security doors or other security measures. In stark contrast, for medium-rise and high-rise purpose-built flats, the single most frequent reason given for delay was the type of building, accounting for over 60% of high-rise fires experiencing a delay to the start of firefighting.

Table 4.17: Main reasons for delay to firefighting for dwelling fires attended by FRS between 2010/11 and 2019/20

Dwelling / Property Type	Main reason given for delay to firefighting as % of building type fires with delays							
	Building type e.g. high rise	*Large site*	*Security doors / security*	*Assault on fire-fighters*	*Civil distur-bance*	*Fire location not immediately evident*	*Sent to wrong location*	*Vehicle access*
Bungalow	0.7	0.2	37.0	0.9	0.7	21.6	16.3	22.7
House (including HMOs)	1.5	0.6	25.5	0.7	0.8	25.0	16.9	29.0
Converted Flat/Maisonette	5.7	0.7	27.6	0.7	1.1	38.9	13.1	12.3
All Purpose-Built flats	23.9	1.6	30.6	0.7	0.0	22.9	11.1	8.5
Purpose-Built Flats Low Rise (1-3 floors)	4.3	1.1	41.8	1.1	0.9	25.3	14.2	11.2
Purpose-Built Flats Medium Rise (4-9 floors)	26.6	3.0	25.4	0.5	0.4	23.3	11.9	8.9
Purpose-Built Flats High Rise (10+ floors)	61.8	0.9	13.4	0.2	0.1	17.3	3.8	2.5

As expected, delays to firefighting correlate with a far greater likelihood of fire resulting in a fatality or casualty to purpose-built blocks of flats and especially high-rise buildings. High-rise dwelling fires overall had a 15.3% incidence rate of a fatality or casualty over the decade, but this rises to 21.5% where a delay to firefighting occurred. In contrast, house fires see only a slight increase in the rate of fatality or casualty from 13.7% to 14.2% while bungalows show a significant reduction when a delay occurs from 20.1% to 17%. In other words, delays appear to increase the likelihood of serious harm in high-rise blocks of flats than other types of dwellings.

Table 4.18: Proportion of fires where there was a delay to the start of firefighting by dwelling type and rates of fatality or casualty

Dwelling / Property Type	% of all fires with a fatality or casualty	% of fires with a fatality or casualty where delays to firefighting occurred
Bungalow	20.1	17.4
Converted Flat/Maisonette	14.2	14.5
Houses (including HMOs)	13.9	14.2
All Purpose-built	15.5	17.5
Purpose-built Low Rise (1-3 floors)	*16.5*	*17.5*
Purpose-built Medium Rise (4-9 floors)	*12.9*	*14.0*
Purpose-built High Rise (10+ floors)	*15.3*	*21.5*

This increased risk to life from delays to firefighting in high-rise blocks again rises with height. Table 4.19 compares the overall proportion of fires that result in a fatality or casualty where a delay to firefighting has occurred by floor of fire origin respectively. The results are unambiguous: there is an increased likelihood of a fatality or casualty at almost every floor where firefighting is delayed.

Table 4.19: Proportion of fires with a fatality or casualty in purpose-built flats where delays to firefighting have occurred by floor of fire origin

Floor of fire origin	% of all fires with fatality or casualty	% of fires with fatality or casualty where delays to firefighting occurred	Floor of fire origin	% of all fires with fatality or casualty	% of fires with fatality or casualty where delays to firefighting occurred
-2	11.1	25	11	17.4	23.5
-1	7.3	8.2	12	19.4	22.2
1	16.3	17.8	13	22.3	27.8
2	14.8	18.6	14	19.2	29.8
3	13.2	13.0	15	14.8	20.7
4	11.7	15.1	16	18.4	15.8
5	14.8	16.3	17	15.6	31.6
6	16.7	28.8	18	8.6	14.3
7	16.5	23.2	19	7.7	0
8	15.3	21.2	20	18.4	20
9	19.6	31.8	21	6.3	0
10	19.4	20.9			

4.5. Fire spread in purpose-built flats

Headline findings: Fires to purpose-built blocks exhibit an unexpected prevalence of significant fire spread either before firefighting commences or by the time the fire has been put out, indicating possible compartmentation failure. Significant fire spread effectively doubles the likelihood of a fire resulting in a fatality or casualty.

Fire spread is defined in the IRS data as “the extent of flame and heat damage” in two time periods: by the time fire-fighters arrive; and at the fire's stop. It is important to note that the data ``does not include smoke or other damage (such as water damage)” and thus does not capture the spread of deadly smoke and toxic gases. While published IRS data only includes fire spread and adjacent properties affected at fire stop, the data we were provided with contained both time periods. Table 4.20 below sets out the options for firefighters to record the extent of fire spread. However, the data field for extent of fire spread at fire stop is less detailed than for the fire spread on arrival, with two important fields merged - Affecting More than 2 Floors and Whole Building - so our analysis below might underestimate the incidence of fire spread.

Table 4.20: Options in the IRS for recording the extent of fire spread

Limited to item 1st ignited
Limited to room of origin
Limited to floor of origin (not whole building)
Limited to 2 floors (not whole building)
Affecting more than 2 floors (not whole building)
Whole building
Roof space only
Roof space and other floors(s)
External roof only
Whole Roof (including roof space)
Not applicable (smoke damage only on arrival)

The most obvious and commonly used indicators of fire spread are ‘Affecting more than 2 floors’ and ‘Whole Building’. For purpose-built blocks of flats, however, where additional fire safety measures are required to contain the fire to a compartment to protect the building’s occupants for a sufficient period of time to enable stay put, safe evacuation and firefighting, we regard the following as indicators of unusual fire spread and possible compartmentation failure:

- if, by the time the FRS has arrived on the scene, a fire has spread beyond the item 1st ignited, room of origin, or floor of origin, to either 2 floors, more than 2 floors, or the whole building, or from roof space to other floors, or from other floors to the roof or roof space;
- if, by the time the fire has been put out, a fire has spread further than the room or floor of origin or roof space compared to where the fire was recorded as having reached when the FRS arrived on the scene.

Using these assumptions, we identified a total of 1847 fires out of 80,557 involving purpose-built dwellings - 2.3% of purpose-built flat fires - that involved significant and unusual fire spread**,** either by the time the FRS arrived or by the end of firefighting. The positive story here is that 97.7% of fires to purpose-built blocks of flats over the decade did not spread unusually according to the IRS data. However, this small proportion still means that there was a fire with significant and unexpected fire spread **every two days on average over the decade**. Moreover, such fire spread incidents were associated with a marked increase in the likelihood of death or injury: 29.6% of these fires involved a fatality or casualty, compared to the overall rate of 15.5% for purpose-built fires.

Table 4.21 records the breakdown of these findings: 1168 fires had spread by the time the FRS had arrived on the scene, beyond 1st item ignited, the room or floor of origin to either 2 floors, more than 2 floors or the whole building, or from roof space to other floors, or from other floors to the roof or roof space; further detailed analysis found that an additional 679 fires had spread after the FRS had arrived and by the time the fire had been extinguished beyond room and floor of origin to two floors, to more than two floors or whole building, or were in the roof/roof space.

Table 4.21: Significant and unusual fire spread before and at the end of firefighting, in fires to purpose-built blocks of flats by broad height category between 2010/11 and 2019/20

Purpose-Built Flats Building Height	**Limited to 2 floors**	**More than 2 floors / Whole Building**	**From other floors to roof / roof space / Roof space and other floors**	**Total fires with unusual fire spread**
Fire spread by the time FRS arrived on scene				
Low-Rise 1-3 floors	426	209	216	**851**
Medium-Rise 4-9 floors	140	72	29	**241**
High-rise 10+ floors	36	36	4	**76**
Sub-total	***600***	***319***	***249***	***1168***
Fires that spread between FRS arrival and end of firefighting				
Low-Rise 1-3 floors	211	118	85	**413**
Medium-Rise 4-9 floors	108	67	28	**352**
High-rise 10+ floors	23	31	8	**62**
Sub-total	***342***	***216***	***121***	***679***
Grand Total	**941**	**535**	**370**	**1847**
% fires with fatality or casualty				**29.6%**

The figures on high-rise buildings (10+ floors) are striking: 138 fires over the decade exhibiting unusual and significant fire spread amounts to a potentially dangerous fire every 26.6 days. More than half of these fire spread incidents occurred before the FRS have started firefighting, every 48.7 days on average, over the ten year period.

It is worth briefly contextualising these fires with unusual fire spread by both the total number of fires and the estimated populations living in these different types of buildings by height. Table 4.22 shows the proportion of fire spread by total number of fires for each broad height category. It illustrates that there is a higher rate of fires that spread for medium-rise than either low or high-rise.

Table 4.22: Significant and unusual fire spread in purpose-built flat fires by height category, 2010/11 to 2019/20

Purpose-Built Flat Building by Height	Fires that spread	Fires over decade	Proportion of fires that spread unusually (%)
Low-Rise 1-3 floors	1264	54,293	2.3
Medium-Rise 4-9 floors	444	18,382	2.4
High-rise 10+ floors	138	7882	1.8

Table 4.23 sets out our estimate of the proportion of residents affected by unusual fire spread during 2019/20, based on Home Office estimates of dwellings and EHS estimates of household size.[57] This suggests that residents of medium-rise blocks of flats are over 50% more likely to experience a fire with unusual and significant fire spread than equivalent residents in high-rise buildings.

Table 4.23: Significant and unusual fire spread in purpose-built flat fires by height category and estimated population, 2019/20

Building height (floors)	Fires that spread unusually	Estimated number of dwellings of type	Per 1 million residents of dwelling type (estimated)
Purpose-Built Flats Low-Rise (1-3 Floors)	338	n/a	n/a
Purpose-Built Flats Medium-Rise (4-9 Floors)	87	1,420,000	164.6
Purpose-Built Flats High-Rise (10+ Floors)	27	691,000	105.1

[57] MHCLG estimated that, as of December 2020, there were 1.42 million dwellings in purpose-built blocks of flats between 11m and 18m or 4 to 9 floors approximately and 691,000 dwellings in high-rise blocks of 18m or above (10 floors+). We combined this with EHS estimates of average household size for high-rise of 1.9 (which probably underestimates medium-rise household size) to create an estimated total population of residents for medium-rise and high-rise categories, and then calculated the rates of fires that spread per million people living in these broad dwelling types using IRS data for 2019/20,

4.6. Rescues and evacuations

Headline findings: There is a higher likelihood of fires resulting in the need for the FRS to assist in evacuations and carry out rescues for purpose-built blocks of flats than houses. Almost 1 in 10 flat fires lead to a rescue of one or more people compared to around 1 in 16 house fires. Higher rates of FRS intervention to protect residents is a possible indicator that both stay put and self-evacuation are not working in a significant number of fires to purpose-built flats, especially in low-rise flats where a higher proportion of elderly and disabled residents are likely to live.

One of the statistical measures used by the 2011 LGA Guide to denote the low risks of high-rise fires was the number of fires that involved more than five people being evacuated with the assistance of the FRS. The LGA guide refers to data for the year 2009/2010 that shows that of over 8,000 fires to purpose-built blocks of flats, only 22 necessitated evacuation of more than five people with FRS assistance, which is just 0.3% of fires. It is not clear why the 'more than five people' measure is used instead of identifying all fires that required evacuation and/or rescue of one or more people as this would be a more accurate understanding of the frequency that flat fires put lives at risk. There is a further caveat that the IRS only measures evacuations assisted by the FRS and not self-evacuation by residents before FRS arrive.

Table 4.24 below sets out the results of our analysis of all fires at purpose-built blocks compared to houses using our reclassified fires (see section 2.2.1). It shows clearly that when looking at all evacuation and rescues, the overall likelihood of such outcomes is slightly higher for blocks of flats than houses. More striking is the frequency of FRS rescues: almost 1 in 10 purpose-built flat fires will require someone to be rescued by firefighters compared to around 1 in 16 house fires. When we break these purpose-built figures down by broad height category, we see that low-rise flat fires are by far the most likely to result in FRS assisted evacuations or rescues. This is probably because a higher proportion of elderly and disabled residents are likely to live here.

Table 4.24: Comparing evacuation and rescues in house and purpose-built flat fires over 2010/11 to 2019/20

Dwelling type	Total fires	Evacuations as proportion of total fires (%)		Rescues as proportion of total fires (%)	
		1-5 people	more than 5	1-5 people	more than 5
Houses	167,890	6.7	0.03	6.1	0.2
All Purpose-built Flats	80,557[58]	6.9	0.4	8.9	0.1
Purpose-Built Flats Low-Rise (1-3 Floors)	54,285	7.8	0.2	9.8	0.1
Purpose-Built Flats Medium-Rise (4-9 Floors)	18,377	5.4	0.5	6.6	0.1
Purpose-Built Flats High-Rise (10+ Floors)	7882	4.3	0.7	7.9	0.1

[58] sub-totals do not sum to 80,557 due to 13 null records on height

These findings are not surprising when considering the greater difficulties of evacuation faced by residents in blocks of flats. However, they also suggest that both stay put and self-evacuation are not working in a significant number of fires to purpose-built flats.

We can gain a real insight into how building failures can drive the sudden need for rescue at any height of a purpose-built block of flats through the following two examples from our dataset of fires.

Box 4.1: When building systems fail in purpose-built flat fires

Regents Quay is a seven storey residential building in Leeds where in December 2016 a fire was started in a flat, accidentally, involving a candle. The ventilation system failed in such a way that it became the passage for fire, heat and smoke to fully involve escape corridors on the 2nd, 3rd, 4th and 6th floors. Two residents tried to escape from their flat on the 6th floor, crawling on the floor with wet fabric covering their mouths, whilst receiving burns to their hands and hair. After abandoning their escape attempt and returning to their flat, the smoke they had inhaled caused them to pass out. They were subsequently rescued by firefighters that described the 'wall of flame' on the sixth floor corridor, four floors above the fire.[59]

As recently as 7th May 2021, the ventilation system at New Providence Wharf behaved, according to the LFB's provisional report, "like a broken chimney, leading to a potentially life-threatening situation".[60] 100 firefighters were needed to control the fire, 40 people were treated by ambulance crews, 2 of whom were hospitalised. 35 people were rescued, 22 of whom were with the aid of a smoke hood. To underline the perilous nature of this incident, New Providence Wharf is currently awaiting the remediation of combustible cladding and had a waking watch in place when the fire broke out.

[59] The Institution of Fire Engineers Incident Directory: 2016 - Regents Quay [url]
[60] London Fire Brigade (2021), 20 Pump Fire Preliminary Report: New Providence Wharf, 25 May [url]

5. Conclusions and recommendations

In this research report, we have set out six main interim findings from our exploration of official fire incident data for England covering the period 2010/11 to 2019/20:

- There was a clear downward trend over the decade in the number of fires attended by FRS to purpose-built flats. However, annual fires increased over the decade for flats at specific building heights - most notably for medium-rise flats between 11m and 18m high. This illustrates that overall trends and averages can hide increased fire risks for blocks of flats of certain heights;

- While residents of dwellings in blocks of flats appear no more likely to die or be injured than for any other dwelling type once a fire breaks out, when fire incidents are normalised by the estimated populations living in each dwelling type, flat dwellers are exposed to a much greater probability of their building experiencing a fire than those living in other dwelling types and are more than twice as likely to die and just under twice as likely to be injured in a fire;

- Analysing purpose-built flat fires by both height of building and the floor height that a fire originates on suggests there is positive relationship between increases in height and higher rates of fires resulting in a fatality or casualty. We found 113 combinations of building height and floor of fire origin where the average rate of fires resulting in a fatality or casualty exceeded the equivalent average for houses over the decade;

- Fires in purpose-built blocks of flats are in general much more likely to experience delays to firefighting than other dwelling types, and this likelihood of delay increases dramatically for high-rise buildings due to the specific difficulties faced by firefighters at this building typology. A high-rise flat fire is over six times more likely to experience a delay to the start of firefighting than fires to houses. Delays also increase the likelihood of a fire resulting in a fatality or casualty for purpose-built blocks of flats;

- Fires to purpose-built blocks of flats also exhibit an unexpected prevalence of significant fire spread either before firefighting commences or by the time the fire has been put out, indicating possible compartmentation failure. Significant fire spread effectively doubles the likelihood of a fire resulting in a fatality or casualty;

- Finally, there is a higher likelihood of fires resulting in the need for the FRS to assist in evacuations and carry out rescues for purpose-built blocks of flats than houses. Almost 1 in 10 flat fires lead to a rescue of one or more people compared to around 1 in 16 house fires. Higher rates of FRS intervention to protect residents is a possible indicator that both stay put and self-evacuation are not working in a significant number of fires to purpose-built flats, especially in low-rise flats where a higher proportion of elderly and disabled residents are likely to live.

These findings support the long-held view set out in section 3 of this report that there are certain physical characteristics associated with purpose-built blocks of flats and especially high-rise blocks that represent greater risks of and from fire than traditional low-rise, single occupancy houses.

These findings further suggest that the previously optimistic assumptions about the fire-resisting construction of purpose-built blocks of flats, including high-rise buildings, that underpinned government guidance on fire safety management prior to the Grenfell Tower fire, need to be reconsidered. The statistical evidence and the experiences of dozens of high-rise fires outlined here support the need for a recommitment to the precautionary principle in fire risk assessment guidance and for fire risk assessors to be provided with a more balanced understanding of the potential for building failures to undermine resident safety.

The particularly high fatality and casualty rates for bungalow fires merely serve to underline the increased risks faced by older and disabled residents from fire that are further compounded for such residents living in blocks of flats, especially above the ground floor. The shifting demographics in high-rise buildings, especially social housing blocks, means that general needs housing is becoming increasingly concentrated with vulnerable people. High-rise will always be much higher risk for vulnerable residents. Consequently, there will usually be someone who cannot evacuate unaided in the event of a fire, and in some social housing blocks of flats they will form a relatively high proportion. 52 of the 120 flats in Grenfell Tower housed disabled residents and 41% of disabled people that lived in Grenfell Tower died in the fire.[61]

When a single escape staircase becomes untenable for residents as a result of firefighting activity, it traps residents and exposes them to an unacceptable risk. In this regard, the overriding principle of 'do no harm' should be applied in so far as all necessary measures should be deployed to evacuate residents at risk to a place of safety in a timely fashion.

To that end, we believe that the proposed mandatory requirement for PEEPS in high-rise residential buildings is a sensible precaution for those who cannot self-evacuate unaided. Given that many disabled residents in the vicinity of the fire would be unable to travel down a single floor, we believe that an 18 metre cut-off for PEEPs makes no sense and should be for all blocks of flats of all heights. This is especially important given residents of medium-rise blocks of flats are over 50% more likely to experience a fire with unusual and significant fire spread than equivalent residents in high-rise buildings.

Finally, we believe that it is time for debates about high-rise safety to stop focusing on the total or average number of fatalities. Whilst historic numbers of fatalities might assist in estimating the general likelihood of future fatalities, they tell us nothing about the risks to specific people in specific contexts. Moreover, it distracts from considering the full range and scale of costs to individuals, families and communities affected from fire. The government estimated in 2004 that the average cost of a domestic fire was £24,900, which uprated by inflation would be around £40,000 in 2021.[62] In the aftermath of the fire at Grenfell Tower, more than 700 people needed ongoing mental health treatment at an estimated cost of £10 million in the first two years.[63]

[61] Disability Rights UK (2021), Grenfell Tower fire is 'a landmark act of discrimination against disabled and vulnerable people', 22 April, [url]
[62] Office of the Deputy Prime Minister (ODPM) (2006), The Economic Cost of Fire: Estimates for 2004, [url]
[63] BBC News Website (2018), Grenfell Tower fire mental health treatment 'to cost £10m', 12 June, [url]