REPORT ON THE FIRE WHICH OCCURRED AT THE RELAY BUILDING, LONDON, UK ON 7 MARCH 2022

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Introduction

1.1 On 7 March 2022, a fire occurred in a 22-storey high rise building in Whitechapel, London, United Kingdom (UK), which affected two apartments on the 17th and 18th floors in the south east corner of the building. Although the cause of the fire is still under investigation, it is known that it started inside a flat on the 17th floor and spread upwards to affect the one on the floor directly above after the glazing in the curtain wall system failed.

1.2 This is a preliminary report based on what is known so far and the facts which I have been able to establish through my own research and investigation. The aim of this report is to help those with an interest in building design, engineering and fire safety understand what happened and how the fire was able to spread as it did. Perhaps of most concern is the remarkable similarities between several of the issues arising from this fire and those which are relevant to the Grenfell Tower fire of 14 June 2017, in which 72 people died.

1.3 Fortunately, in this case, the fire did not result in any serious injuries or fatalities, although the occupant of the flat where the fire started had to be rescued by firefighters. It seems that the fire was successfully contained within one corner of the building and did not spread to the rest of the building; affecting only the flat of origin and the one directly above it on the 18th floor, although firefighters were at the scene for several hours. The building had a stay-put policy in place, so many of the occupants were able to remain in their flats, although a lack of understanding as to what this involved caused distress to some people.

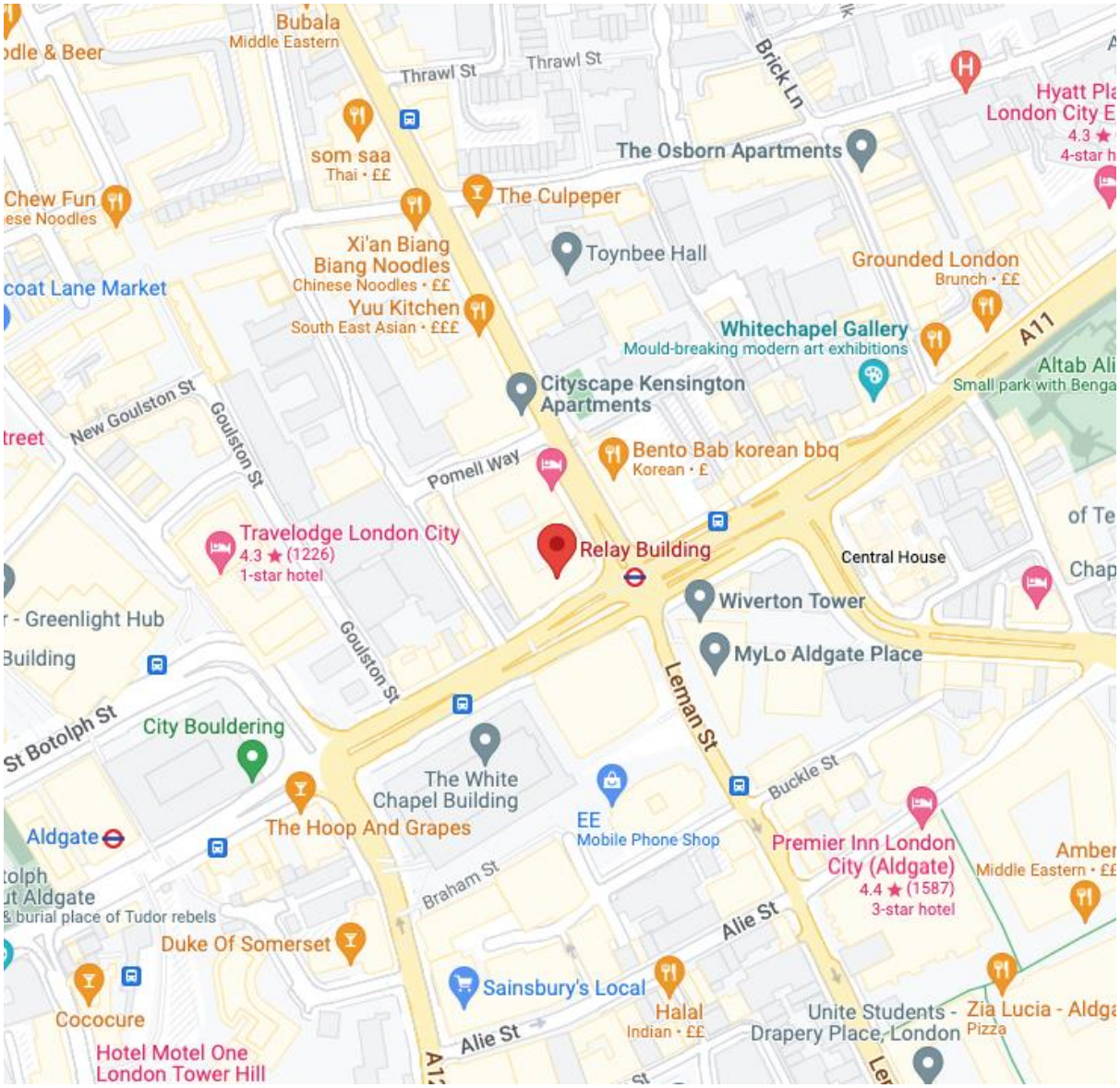
1.4 The fire sent parts of the façade crashing down into the street below, presenting a hazard to passers-by, evacuating residents and the emergency services, including firefighters. Such was the level of concern at one point, that an neighbouring building was completely evacuated.

1.5 Smoke seems to have been a significant issue because accounts from residents, members of the public who were in the area at the time, and firefighters refer to large amounts of smoke being present. The smoke seems to have made evacuation of the person from the flat

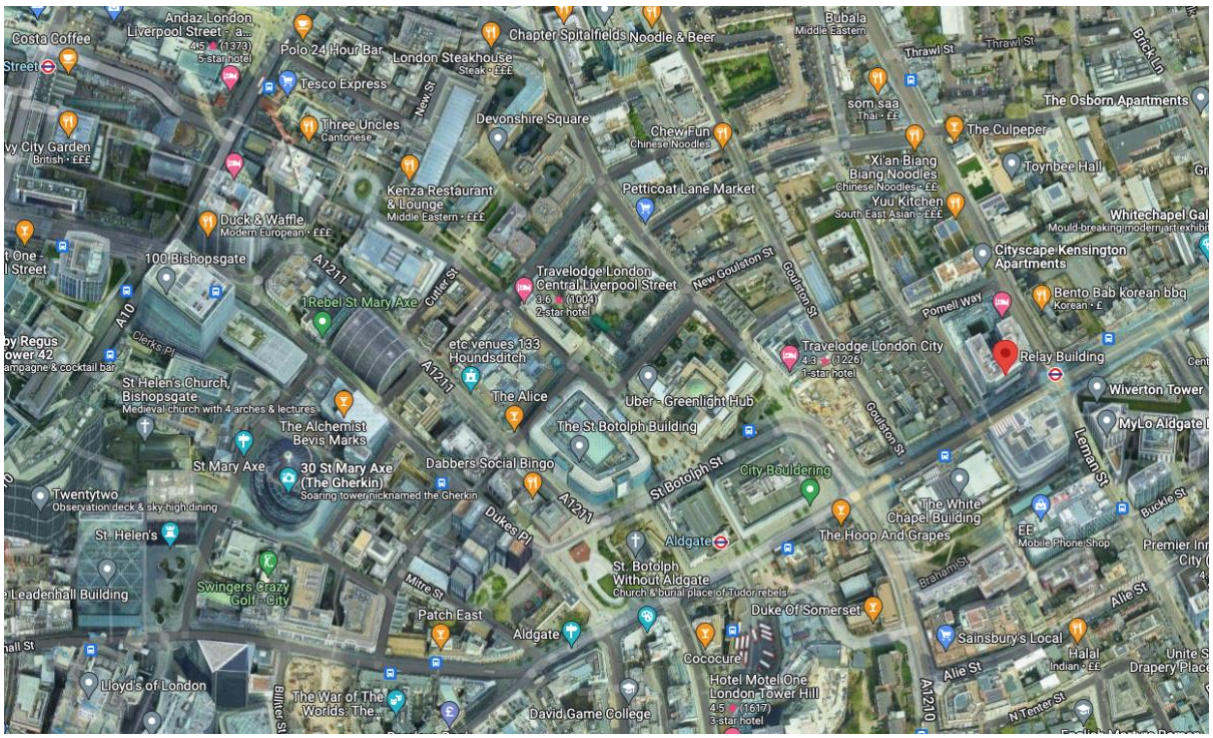
where the fire began, much more difficult, and questions must now be asked about the performance of the smoke control system, assuming of course that one was even present.

Building Description

2.1 Situated a short distance from renowned London icons, such as the Gherkin and the Leadenhall Building, is the Relay Building at No.1 Commercial Street (*Figs.1 & 2*). Allegedly, it has changed its postal address in recent years to No. 114 Whitechapel High Street, but to many it continues to be known as 1 Commercial Street. As the building sits at the corner where the two streets meet, it could theoretically assume a postal address in either of these streets.



2.2 The Google Street map above (*Fig.1*) and Google Earth aerial image below (*Fig.2*) shows the location of the Relay Building, which has an entrance to Aldgate East tube station beneath it. Directly opposite the Relay Building is the 16-storey Aldgate Tower where I attended an evening meeting in February 2020. Whilst waiting for the meeting to start, I gazed across the street directly into the offices on floors 1-6 of the Relay Building, of which there was a clear view. Some people were working long into the evening and, it seemed, that they would not be going home for some time. However, little did I know that just over two years later, the building would be affected by a major fire and would feature in my reports.



2.3 The building was first envisaged back in 2006 as a 17-storey office block, but the concept continued to evolve and it was eventually decided that it would be of mixed use and include several floors of residential accommodation too. This also meant that the building would be five storeys taller. Having started in 2007, construction had barely began when the economic recession hit, and work had to be suspended. The construction industry did not fare well, and many other projects at the time were either suspended or cancelled. When the building was finally completed, it had 22 storeys (Ground Floor + 21) as well as a basement. In 2014, developer Redrow transformed part of the building into upmarket apartments and renamed

it the Relay Building. The apartments do not come cheap and prices range from £500 000 to £5.5m for the penthouse.

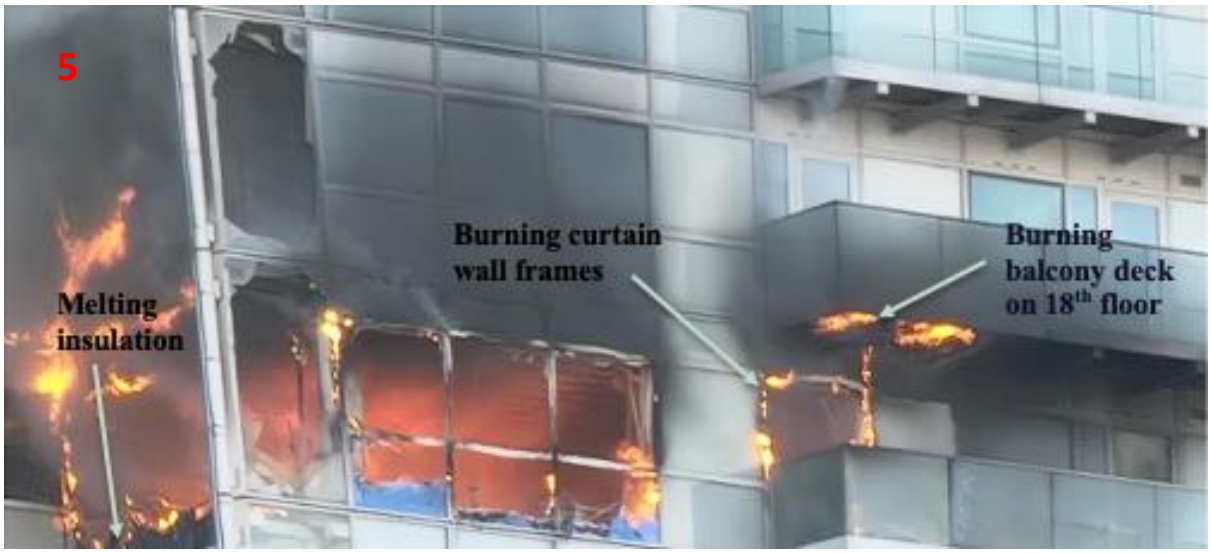
2.4 The usage of the building is as follows: the basement level is used for car parking, and the ground floor contains retail units and one of the entrances to Aldgate East tube station. From the first floor to the sixth floor, there are offices, and the seventh to the 21st floors are residential, with a total of 207 flats. There is also an element of affordable housing, which has its own name – the Houblon Apartments - and its own entrance (dubbed a "poor door" by campaigners), which is round the back in a narrow side road called Tyne Street. The segregation of rich and poor has been forcefully condemned, and the building has been the scene of several protests. Certainly in a day and age when equality is being promoted, it seems a very backward step for a building completed in the 21st century to be designed with separate entrances for those in the expensive flats and those in the affordable flats.

2.5 The separation of rich and poor is not the only controversy to surround the building, which was designed by the now dissolved architects' practice of Sigma Seifert and built by contractor, John Sisk & Son. Despite the designer's claim that the building resembled a shaft of light, critics did not agree and considered the building to be an extreme example of ugliness; so much so in fact, that in 2014 it was nominated for the Carbuncle Cup, which is awarded annually to the ugliest building completed within the previous twelve months. Ironically, just months later in November 2014, it was bestowed with the title of Best High-Rise Development in the UK for 2013-14! Now the building is at the centre of controversy once again, but for an even worse reason because on 7 March 2022, a serious fire occurred in a residential apartment on the 17th floor, the cause of the fire is not known at the time of writing.

The Spread and Development of the Fire

3.1 Although the actual cause is not yet known, one thing which is clear is that the fire started inside a flat on the 17th floor of the building. Footage and photographs I have obtained suggest that the window glazing in the apartment failed, allowing the fire to spread to a nearby balcony with a wooden deck, which then ignited. The fire then began to spread and

affect the floor above before it was finally extinguished. Such was the intensity of the blaze, that firefighters spent over three hours tackling it. The first call to the emergency services was received at 3.53pm and the fire was not finally put out until 7.07pm. At its height, there were 125 firefighters at the scene and a 64m ladder was used to gain access to the higher floors.



Figures 3 - 8 **are all in the public domain and were taken from articles published by the BBC, The Sun newspaper and the World Socialist Web Site (WSWS.org), via a Google-based search for images**

3.2 The apartment involved was not a housing association property, but one of the higher end flats created in 2014. The development of the fire is documented in the photos (*Figs.3, 4 & 5*) and paragraphs below. It began high up in a flat on the south-east corner of the building and developed rapidly, causing the glazing to fail on both the southern and eastern sides.

3.3 Once the glass failed, the curtain wall was opened up, allowing ventilation and a draw of air through the apartment. Being so high up, the wind speed was greater and this had an effect upon the fire; in *Figure 4* it appears that the flames are being blown around. This seems to have been noticed by observers on the ground, one of whom (Owen Wills) remarked, "*It's very windy, so it looks like the smoke and flames are blowing all over the place*."

3.4 As the flames spread further along on the eastern side, they reached the wooden-decked balcony of the flat affected by the fire. The heat caused a glazed panel overlooking the balcony to fail, giving the fire direct access to this and the one above. As the flames began to lick the underside the balcony on the floor above, its wooden deck readily ignited (*Fig.5*). The balconies are in a vertical stack arrangement, which allows easy fire spread from one to the next.

3.5 The balcony of the floor above (18th floor) is the one which actually bore the brunt of the fire, more so than the one on the 17th floor where the fire started (*Fig.5*). However, the 17th floor balcony was affected by the detachment of burning material from the building's façade, as well as debris which fell down from the 18th floor balcony above.

3.6 The flat on the 18th floor (directly above the one on the 17th floor where the fire started), was extensively damaged by the fire. This resulted from the impingement of flames which were venting out the windows of the flat below - the intense heat from which caused failure of the glazing, allowing the fire to enter the flat from the outside. This has echoes of Grenfell, where fire re-entered the building on other floors as a result of it spreading via the exterior. Although this building was not covered in ACM or any other type of combustible cladding, the vertically stacked balconies with timber decks and the flame impingement through failed glazing, both provided routes for the fire to spread from floor to floor via the exterior. In fact, external fire spread was more of a problem than internal fire spread, which, due to compartmentation, would have ensured containment within the apartment of origin for up to sixty minutes.

The Curtain Wall System

4.1 From the images above, it can be seen that the framework for the curtain wall system is burning readily, which is an indication that combustible materials are present (*Fig.5*). The common assumption is that curtain walls do not burn because they are constructed from glazed panels set within a steel or aluminium framework. However, this is a dangerous assumption to make, as this case illustrates remarkably well. A curtain wall system contains numerous components, including gaskets, sealants and membranes to seal in the panels and ensure that the façade is fully weatherproof. Some systems are pre-fabricated and are brought to site as sections which are then craned into place, whereas other types are assembled on site.

4.2 The latter include bolted glazing systems and what are known as "stick systems," so called because they use an assembled grid of transoms and mullions (ie. Sticks) as a framework. The glazing is held in place with pressure plates; specially designed metal pieces which are held with fixings specific for the purpose. The pressure plates are then capped with a cover to ensure that façade has a smooth and uniform appearance. Dry gaskets are incorporated into the frame to ensure that it remains weatherproof, but these are often made from combustible materials such as EPDM. An EPDM membrane was used to seal a gap at the window jambs at Grenfell Tower and contributed to the fire spread by providing no resistance due to its high level of combustibility. This created a path for fire around the window jambs, which allowed the fire to pass from the inside of the building to the outside, and vice versa, as well as into the cladding cavity. Stick systems may also include spandrel panels, which consist of an opaque glazed or metal panel, with insulation behind. The insulation is usually of foam based material such as polyisocyanurate (PIR) or polyurethane (PUR). PUR insulation was used in the rainscreen cladding system at Grenfell Tower and made a significant contribution to the fire.

4.3 Those systems which are manufactured off-site are modular and are assembled under strictly controlled factory conditions. They are known as Unitised Façade Systems (sometimes also called Panelised Façade Systems) and are complex in both their design and construction. It is because of this complexity that the product needs to be precision engineered, and therefore it can only be assembled in the factory and not on site. Each of the modular units

will be craned into position on site and manually fixed to brackets attached to the floor slabs at each level, from which they will be hung. Fire stopping at slab level is particularly important with this type of system in order to ensure that compartmentation is not compromised. In general, unitised systems contains fewer combustible elements than their on-site assembled counterparts due to the use of monolithic metal or glass, but are not entirely risk free. It is not unusual to find combustible insulation at the interfaces between the panels or in places where there might be an issue with thermal bridging.

4.4 Generally, most modern high rises will be constructed using a modular unitised construction, whereas older buildings or those which are of a lesser height will tend to have site-assembled systems such as sticks. The intensive workmanship and difficulty in ensuring the required tolerances in large structures, makes stick systems unsuitable. With both types, after a period of time the fire risk increases due to the loosening of the seals and fixings between the components, caused by the constant movement of the buildings in which they are fixed. The taller the building, the greater the movement. For example, London's Shard, at a height of 309.6m (making it a supertall skyscraper) is designed to move as much as fifty centimetres (twenty inches) in strong winds. I have visited this building on two separate occasions and the movement can clearly be felt on a windy day, although like all skyscrapers, it has been designed to accommodate such movement within its structure.

4.5 The question now, is what type of system did the Relay Building have? Was is a site-assembled system or a pre-assembled unitised system? At only 66m to the top of the upper most habitable floor slab, it is low compared to some buildings. It has 22 storeys, but was intended initially to have only seventeen, putting it at the lower end of what can be classed as a high-rise building. Therefore, it is not unrealistic to expect the building to have a stick system rather than a unitised façade system.

4.6 An examination of the components in the curtain wall provides evidence that building does indeed have a stick system, which is a plausible expectation for a structure of its size and height. Rather than unitised glazed panels which extend from floor to ceiling at each level, there are transoms and mullions present. Each level also has glazed spandrel panels which contain a type of insulation able to melt when exposed to heat (*Fig.5*), and in some of the video footage, molten material can actually be seen dripping downwards. As both PIR and

PUR have a tendency to char when exposed to fire, it appears that the insulation within these spandrels may by polystyrene and there appears to be some uPVC present in the frames around them. It is likely that weatherproof gaskets in the framework are made from EPDM and are also contributing to the fire, as is evident from the fact that the window frames were burning.

4.7 It is therefore hardly surprising that it took such a long time for the firefighters to get the fire under control, and that glazed panels came crashing down into the street below as the support structure around them burned and released its grip. Flaming debris arising from the combustible materials present in the façade also came down, presenting a risk to firefighters and the public, and resulting in the streets around the building having to be cordoned off.

The Stay-put Policy

5.1 In some respects the circumstances of this fire have echoes of Grenfell. According to an article which appeared in the BBC News the day after the fire, residents had raised concerns about fire safety for a considerable period of time before the blaze occurred. The building is managed by three different companies, each of which is responsible for a different aspect. Rendall & Rittner is responsible for the management of the interior, Network Homes is a housing association which manages the Houblon Apartments, and John D. Wood is the estate and letting agent for the luxury apartments. As was the case at Grenfell, residents were ignored and they were not listened to when they expressed concerns about fire safety. Andrew Meikle (aged 58) who lives on the 9th floor said, "*There have been complaints about fire alarms, the stay-put policy and the high risk of fires on wooden balconies – and guess what was burning? The wooden balconies*." Andrew also said that there had been previous fires in the building, which makes it all the more concerning that worried residents were not taken seriously.

5.2 The response of Rendall & Rittner (R&R) appears somewhat dismissive. It has confirmed that a stay-put policy was in place for the residential floors, and described this as an "*engineered principle based on the construction of the building and mitigating measures and*

arrangements agreed with the relevant authorities," assumingly meaning the London Fire Brigade. However, it appears that nothing has been done to reassure residents who seem unhappy and even frightened, given the tragic events at Grenfell, which also had a stay-put policy. This was not suspended until well into the fire, despite the compartmentation being breached in numerous locations from the outside of the building, resulting in lives lost which may otherwise have been saved. R&R goes on to state that "*It is for the fire brigade to decide on whether the building needs a full or partial evacuation, depending on the situation they find on arrival*." In this case, sixty residents were evacuated from the fire floor and those directly above it. The fire affected floors 17 and 18. Some residents chose to leave of their own accord after being alerted, whilst others stayed put, yet the fire was considered serious enough for a neighbouring building to be evacuated.

5.3 Fortunately, there were no fatalities or serious injuries, but the situation could have been very different considering that the building filled with smoke, which was even detected as far down as the platforms of the underground station. Sabrina Chevannes, who works in a neighbouring building said, "*the whole platform and underground was filled with smoke*." If a smoke control system was fitted, then there are issues surrounding its performance which need to be examined. The building did not have a sprinkler system either.

5.4 A female resident in the flat where the fire began required rescuing by the fire brigade, and such was the thickness of the smoke, that she had to be given a smoke hood to prevent her from inhaling toxic fumes whilst being lead out of the building via the internal staircase. This also has echoes of Grenfell, where residents were confronted with thick toxic smoke which stung their eyes and choked them as they struggled to evacuate down the stairs. The fact that the woman being rescued had to wear a smoke hood, suggests that the stairway – which should have been protected in a building of that height – had not remained smoke free.

5.5 At Grenfell, many of the residents were overcome by toxic fumes before they could get far enough down the stairs to exit the building. Many of those who succeeded in escaping, describe treading over the bodies of those who had collapsed and died without making it out of the stairwell. As it is the smoke which kills people in a fire and not the flames, the use of smoke hoods as a standard provision in blocks meeting certain criteria is a worthy consideration. A smoke hood (or fire escape hood as they are also known), offers up to fifteen

minutes protection from the most noxious fire gasses, including Carbon Monoxide, Hydrogen Cyanide and Hydrogen Chloride. The passage of these gases through the hood is blocked, although the hood does not supply the wearer with any oxygen.

5.6 As mentioned on the previous page, the residents had concerns about fire alarms, and this issue once again surfaced during the fire as something the residents were particularly concerned about. Most have stated that they heard no fire alarm, but as the building has a stay-put policy, there would be no alarms in communal areas and therefore it is likely that only those in, or close to the flat of origin, would hear an alarm. In buildings where a stay-put policy is in force, it is a requirement for the flats themselves to have fire alarms, but not communal areas. Helen Evans, Chief Executive of Network Homes, which has 74 apartments on the 7th and 11th floors, commented, "*like all other buildings with a stay-put policy, under current fire regulations, it does not have to have a fire alarm*."

5.7 R&R also confirmed that the building had no audible smoke alarms. However, this appears to have caused considerable distress to the residents during the fire. Lynn Ling (aged 25) who lives on the 20th floor with her husband, is one such resident. She described her experience: "*I did not hear an alarm. I think there was a fire alarm on the ground floor, but I could not hear it clearly on the 20th. I went out of my door, but I found there was smoke in the corridor, so I went downstairs. I forgot to take my coat. It was very scary*." The fire alarm that Lynn appears to have heard very faintly, is likely to have been in the flat of origin, three floors below her. The fact that she forgot her coat and described the situation as "scary," suggests that she felt threatened by her circumstances and wished to get out as soon as possible.

5.8 Like many other residents in the building, Lynn was alerted to the fire by other people. In her case, a friend outside on the street had noticed that the building was on fire and had called Lynn on her mobile phone. As Lynn descended to the 19th floor, she noticed a firefighter knocking on residents' doors and telling them to leave. Andrew Meikle, the 9th floor resident who had previously expressed concerns about fire safety in the building said, "*I can't believe we had to message each other on WhatsApp groups and knock on each other's doors just to tell each other that there was a huge fire in our own building*." Another resident who lives on the 7th floor and did not wish to be named, also voiced his concerns about not

hearing an alarm, "*If I didn't hear the persistent knocks of my neighbours, I would probably still be asleep*." He has lived in the building since 2012, and as has been the case with Andrew from the 9th floor, his complaints to the building management have been ignored. At the time of the fire, the 61-year-old man had been without electricity in his flat for eight weeks, and despite complaining several times, the supply had still not been restored. The same resident goes on to say, "*I can't understand why the alarms didn't go off. It's ridiculous. I had just come off a night shift and I was asleep – if it wasn't for the neighbours knocking on my door, I wouldn't have heard anything. I'm asthmatic and I live alone, so that's another concern. It's a miracle there were no fatalities*."

Fire Protection

6.1 This fire incident has exposed several serious fire safety issues where the Relay Building is concerned. Therefore, it is hardly surprising that residents are unable to sell their flats and insurance companies view them as a liability. Considering that some residents have paid millions of pounds for their apartments, the financial loss from property which is potentially now worthless, is substantial. It also shows that the building safety crisis knows no boundaries, and affects rich and poor alike. The parallels between this fire and Grenfell are uncanny and show that many of the lessons are yet to be learned.

6.2 The Relay Building has already been earmarked for remediation, although this only involves the decks to the balconies. This is an example of a building with a type of construction which prevents the external walls from being remediated because the removal of combustible materials would involve the entire curtain wall being taken apart and the building effectively being dismantled. Consequently, full remediation is impossible. As it is only the material on the balcony decks which is to be changed, this cannot really be referred to as remediation, and is in fact a mitigation measure instead. If no other fire safety improvements are being made, then the change of balcony deck material is not even part of a wider mitigation strategy in which safety measures are supposed to complement each other.

6.3 As it is only the balconies which are to be "remediated," rather than the building itself, it is necessary to develop an effective mitigation strategy with bespoke fire protection to reduce

the level of risk. With only the balconies "remediated," the fire risk from the curtain walling system will remain, even if the building is signed off as no longer being a risk, thus allowing residents to once again be able to sell their flats. It should be emphasised at this point that the balconies were not the only means of fire spread during this incident, and the curtain wall system itself had at least as much of a role in the fire, if not more so. Therefore, the risk of injury or loss of life will not be eliminated by the replacement of the balcony decks, and the level of reduction of the overall risk will not be reduced to an acceptable level.

Figure 6: The Relay Building after the fire has been extinguished, where there is damage to both the 17th and 18th floors.

6.4 Another thing worth noting here is the tendency for the fire to target architectural features even though the building does not have a façade covered in combustible cladding panels. The fire affected the projecting fin, through which it started spreading upwards (*Figs.6 & 7*). Although some of the effects and phenomena associated with shape, form and features* cannot occur on a building with this type of façade, the geometry can still have an influence, and with this in mind, it should be considered when planning mitigation or remediation work. At the design stage, it may be wise for architects and others to avoid such features, as well as vertically stacked projecting balconies if the curtain wall system is to include combustible materials within its structure.

**The effect of building geometry upon fire is described in detail in the report, "The Relationship between Building Design and Fire Spread: How the Shape, Form & Features of a building can influence the behaviour of fire."*

Figure 7: This is a repeat of *Figure 6*, but with the purpose of showing the various paths the fire took as it spread through the curtain walling system.

Figure 8 (p.16 above): The fire is in its dying stages, but flames can still be seen inside a glazed insulated spandrel panel. The insulation in these panels greatly contributed to the fire. A projecting glazed fin, attached to the building as a decorative feature is also badly damaged at the point where it connects with the two flats involved in the fire.

Smoke Control

7.1 As there is no information about the type of smoke control system in the building, it is not possible to make an accurate analysis of its performance. It can be assumed that in a building of that height with mass occupancy, there must have been a system in place, but whether it was working properly (or even working at all), and whether it was appropriately designed for that type of building, are issues which will all need examining thoroughly. Therefore, for the purposes of this report, an assessment of the various types of system available and how they may have performed (if they had they been in place inside the building), will be given.

7.2 Smoke control systems are considered a critical part of a building's fire strategy. Not only is the control of smoke necessary to ensure that the conditions remain tenable for evacuating residents, but also for firefighters, and therefore it will form an essential part of the firefighting strategy too. In buildings where the stay-put policy has been temporarily suspended in favour of one of simultaneous evacuation, particular reliance will be placed upon the smoke control system.

7.3 As mentioned previously, the purpose of a smoke control system is to keep the stairs – these being the main escape route – free of smoke. This is achieved using the principle of containment where the smoke will be confined to a specific area and prevented from entering the stairs. It is not the purpose of a smoke control system to clear smoke from the apartment which is affected by the fire.

7.4 Smoke control systems – guidance for which is given in BS 9991 and Approved Document B – generally conform to one of the three main types:

- Natural ventilation
- Mechanical ventilation
- Pressure differential

7.5 A *natural ventilation system* uses three types of vent; those which are permanently open (PV), those which are manually opened when there is a fire (MV) and those which open automatically in the event of a fire (AOV). In all cases, air will be drawn in through a vent at the bottom of the stairs and expelled through another vent at the top. The air which is drawn in through the inlet will be cool and more dense, and will displace hot smoke and gases from the fire. These rise upwards due to their buoyancy and leave the building via the exhaust at the top.

7.6 Natural ventilation systems, in particular, need to be very carefully designed to ensure that they function correctly. If the vents are not suitably sited, exposure to wind, cross ventilation from windows and interference from air conditioning units can all affect the performance of the system. A *mechanical ventilation system* is less susceptible to interference from the external environment, making it a more reliable, but slightly more expensive, alternative to a natural ventilation system. Regardless as to whether the system uses a smoke shaft which is naturally ventilated or mechanically ventilated, it is important to ensure that the ducting for the vents does not compromise the building's compartmentation.

7.7 *Pressure differential systems* work on the basis of changes in pressure in different parts of the building, and the flow of air between the various pressure zones controls the passage of smoke. The highest pressure is in the stairs, which decreases through the stair lobbies and into the corridors. As air flows from areas of high pressure to low pressure, it will ensure that the stairs and their protective lobbies remain free from smoke. All three methods rely on an effective flow of air through the relevant parts of the building.

7.8 The fact that the woman who was rescued had to be lead to safety wearing a smoke hood, is an indication that smoke had entered the stair shaft and that the objective of keeping the stairs free from smoke had failed. If the smoke control was by mechanical ventilation, the vents may not have opened, allowing smoke to accumulate in the stairway. If natural ventilation was in place, there may have been interference from air movement, especially as the fire occurred high up in the building where wind speeds are greater. As the glazing had failed, there would have been a draw of air through the windows which may have interfered, especially if the door leading from the flat to the communal corridor had been left open. Although it should have had self-closing devices to prevent this, these may have been

defective or missing altogether. It is therefore possible that the ventilation system may not have been able to cope, and indeed, a bystander described the conditions on the 17th floor as being windy (see *pages 7 and 8*). There is also a possibility that the vents were not positioned in the best places.

Possible Solutions

8.1 Here are some possibilities as to how the issues arising from this fire could be resolved, and therefore make the building safer. This is especially important because the façade cannot be remediated, as explained on *page 14*:

1. Install a façade based fire detection and fire alarm system (Intelliclad) which would warn residents of the first sign of fire affecting the balconies and/or curtain wall system.
2. Install a sprinkler system inside the building which would have an interface with Intelliclad through the building management system.
3. Improve smoke control measures.

8.2 It should be noted that none of these would be temporary measures. Given the fact that the external walls of the building cannot be remediated due to the method of construction, all of these measures would be vital for the long term safety of residents, and for that reason, they would need to be permanent.

8.3 A fourth possible solution would be to remove the decorative fin on the building completely, or else strip it back by removing all gaskets and glazing, leaving only the metal framework of transoms and mullions (sticks). These would be replaced with non-combustible equivalents, including glass which resists heat and fixings which do not promote fire spread. However, the costs of any structural remediation of this type would be costly, and the fire risk is probably not considered great enough to justify that level of intervention. Where the rest of the building is concerned; because the curtain wall is more than just a façade system and constitutes the external walls of the building itself, to remove all glazing, gaskets, insulation and other combustible components would result in a dismantling of most of the building structure. Therefore, the only way the risk can be reduced is through fire protection alone.

8.4 *Sprinkler systems:* Perhaps the most obvious solution is the installation of a sprinkler system. Given that the fire started inside the flat and then spread to the exterior of the building when the glazing failed and the curtain wall system then ignited, the logical solution would be fire suppression to slow its spread and development until it could be dealt with by firefighters. There is also the possibility that the sprinklers may even have been able to extinguish the fire had they been in place. In either case, the sprinklers would have made it harder for the fire to exit the building via failed glazing and breach the compartmentation of other flats from the outside.

8.5 *Fire detection and fire alarm systems*: Intelliclad, is a system which incorporates external detection and would give residents confidence and reassurance, as well as warn of a fire as soon as it began to affect the curtain wall. The Intelliclad sensors would be positioned in places where there is an increased fire risk, such as in areas adjacent to the balconies and where there are glazed spandrel panels containing combustible insulation.

8.6 As it is likely there would be a stay-put policy in place, it would not necessarily be desirable for the alarm to trigger a full building evacuation. Even if there had been a temporary change from stay-put to simultaneous evacuation, the building would be expected to revert back to stay-put once the risks had been reduced to an acceptable level. Therefore, the alert would be managed separately by an evacuation alert system which Intelliclad – although separate – would work alongside.

8.7 It would also be necessary to ensure that the residents are well informed about what a stay-put policy involves, and when they would be expected to hear an alarm and/or evacuate the building. This would help avoid the type of confusion and distress which affected residents on 7 March due to a lack of understanding of what a stay-put policy involved. Intelliclad is also able to warn residents via a smart phone app. This can be used as a means of reassuring residents who would otherwise become fearful due to not having been made aware of a fire in the building. Even with a stay-put policy in place, it would seem that most residents want to know if there is a fire in the building so that they can decide for themselves whether or not they wish to leave.

8.8 There is no "one size fits all" for evacuation in a building, and even if a stay-put policy is in place, each fire is an individual with its own characteristics which should be assessed according to the circumstances which prevail at the time. If these are such that most residents can stay safe by remaining in their flats, than that is what should happen, but if the circumstances change (eg. If the compartmentation is being breached on other floors via the exterior of the building), then simultaneous evacuation may be a better option. In any case, all residents should have the choice as to whether they wish to stay put or leave.

Summary of Issues

9.1 What must be considered now is how the fire risk to the building could be mitigated apart from the obvious solution, which is to remove the combustible timber balcony decks. In this context it is necessary to begin with a summary of the safety issues which have been exposed by this fire:

1. The building contains large amounts of combustible materials in the form of insulation and sealants, including some which were involved in the fire at Grenfell. The materials, which were present in the framework and as insulation in the glazed spandrel panels, burned fiercely and prolonged the fire.
2. The building has attached features which created ready paths for the fire to spread. In particular, the vertically stacked balconies promoted the spread of fire, as did the decorative glazed fin. The fin is an exposed section of curtain walling, attached to the main part of the building along one of its edges only, as an aesthetic feature to give the appearance of a shaft of light. As is the case with similarly exposed features on buildings with ACM cladding, the increased amount of oxygen and greater surface area encourage the development and spread of fire.
3. Compartmentation was breached from the outside of the building when the fire came out of the windows of the flat on the 17th floor where it started, and re-entered the building via the windows of the 18th floor flat directly above (*Fig.7*). Without the successful intervention of firefighters, the fire would have gone from floor to floor by exiting the building through failed glazing and re-entering the floor above once the glazing there failed too.

4. There is no sprinkler system in the building despite it being approximately 66m tall, measuring from the ground to the top of the uppermost habitable floor. To the top of the roof, the height is 70m and the architectural height, which includes service structures on the roof, is 81m. Although this was not a mandatory requirement at the time of construction, it is worth installing a system retrospectively to prevent a repeat of this type of incident.
5. The smoke control system – assuming the building has one – appears inadequate and not designed to cope with such a serious flat fire. Although the objective of a smoke control system is to keep the stairs free of smoke, the smoke on the floor where the fire started should not prevent occupants from leaving the building. The smoke was so bad, that a woman had to be rescued wearing a smoke hood. The smoke should not have been detectable on lower levels of the building, including the underground station at and below ground floor level. There is a possibility that smoke may have been drawn into the station's ventilation system and then expelled onto the platforms.
6. As was the case at Grenfell, residents who raised concerns on multiple occasions with the building's managers, were not listened to. It will soon be five years since the tragic fire at Grenfell Tower which claimed 72 lives, yet so many of the lessons are yet to be learned. At Grenfell, neither the Council nor its tenant management organisation would listen to the concerns of residents, including those raised about fire safety. Sadly their fears became a reality on 14 June 2017 and 72 people died. Nobody knows a building as well as the people who live in it. The managers are not residents and they do not experience these issues in their daily lives, which is why they *must listen* to what residents have to say.
7. As is the case in many blocks of flats, the residents in the Relay Building did not feel safe and were unsure as to what would happen if there was a fire. This is shown by the fact that they expected to hear a fire alarm, regardless as to where about in the building they were. They did not realise that with a stay put policy there are no alarms in communal areas and only the alarms in the flat (or flats) affected by the fire would sound. Consequently, many residents were worried for their safety and will now have even less confidence in the stay put policy then they had before.

8. There is an ongoing dispute at this building as to who should pay for the work. The management companies refuse to fund the safety work, stating that this is the responsibility for the owner. In the words of Network Homes, "*Overall responsibility for the building lies with the freeholder*." This is a common issue as there are many examples of other blocks which have been at the centre of funding disputes. Northpoint, a high rise building in Bromley, Kent, one such example of a building where there is currently an ongoing funding dispute.

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