Publishable summary

October 2021 – September 2022

Real fires project

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Prepared for the Building Safety Regulator

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Quality Management

Revision	Date	Comment	Author	Reviewer	Approver
D00	02/08/2024	Issued for BSR comment. following the issue of guidance in May 2024 giving direction to the investigators as to how the summary should be compiled. NB. An iteration of a publishable summary was provided to the BSR as part of the annual report issued in November 2022. Subsequently, the BSR investigated various approaches to best disseminate findings and recommendations into the public domain, culminating in this style of summary.	CDM	MS	RH
D01	24/10/2024	Updated following review and comments from the BSR.	CDM	DJH	RH
R00	10/12/2024	Updated following comments from the BSR	CDM	DJH	RH
R01	22/12/2024	Updated following minor grammatical corrections from the BSR	CDM	--	--

Contents

1. Annual report - publishable summary

1.1. What is the contract and how does it operate

The 'Real Fires' project is conducted on behalf of the Building Safety Regulator (BSR) for the purposes of informing positions on the effectiveness of the Building Regulations and associated guidance in England. The information collected is focused on building performance; its analysis includes discussion and conjecture which may not be directly relevant to all applications. This summary is provided for the purpose of learning and development.

Incidents are identified through media reports, contact from local fire and rescue services, or other government organisations. Therefore, recorded fires are selective, subject to reporting bias, and based on interest to the Building Regulations. The information and statistics should not be taken to provide a balanced or comprehensive list of all fire incidences.

OFR Consultants, in collaboration with DCCH Experts LLP, were engaged by the BSR to deliver the 'Real Fires' project in support of fire safety technical policy, which commenced on 22nd of October 2021, and runs for three years, until September 2024. The collaborators will be referred to as the investigators throughout this summary.

The views and opinions expressed in this report are those of the authors and do not necessarily reflect the official position, policies, or views of the BSR.

1.2.What incidents are recorded and investigated

Incidents are recorded in three different categories, according to features of interest to the contract, and are considered against predetermined criteria defined by the contract:

Category 3: Includes incidents happening in England that report minor damage to buildings, do not report injuries or loss of life outside the dwelling of fire origin, incidents in building types not addressed by Approved Document B – e.g. prisons, involve vehicle fires that had an impact on nearby buildings, involve temporary buildings/caravans/derelict buildings/buildings under construction, deliberate fire ignition, and incidents that are reported overseas. These are regarded as incidents of low priority and are not the primary focus of the project but serve to inform trends.

Category 2 and Category 1: Incidents that meet one or more of the following parameters will typically be escalated to either Category 2 or Category 1 incidents; these are higher priority incidents, either necessitating a follow-up (typically via telephone and/or email correspondence) with the local fire and rescue service (Category 2) or attendance on site (Category 1). The parameters dictating this escalation are:

- fatal fire incidents with multiple fatalities in dwellings;
- fatal fire incidents in non-domestic premises;
- particular difficulties with fire brigade intervention;
- any incident that meets the description of fire of specific interest as described in the Department for Levelling Up, Housing and Communities (DLUHC - original precuring department of the contract) statement of requirements;
- all fires relevant to the Building Regulations and/or Approved Document B (ADB);
- fire incidents involving 'fire engineered' buildings;
- fires with significant implications regarding the Fire Safety Order (FSO) and/or interactions with the Building Regulations and the FSO; and
- fires of national importance.

Over the course of this annual reporting period (22nd October 2021 to 30th September 2022) OFR have recorded 595 fire incidents. Of these, they were comprised of the following breakdown of investigation category:

- Category 1 – 2 incidents;
- Category 2 – 11 incidents; and
- Category 3 – 582 incidents.

As a reflection of the building type which typically records the highest number of fire incidents each year, fire incidents in residential dwellings reflected the purpose group that was the most commonly the subject of Category 1 and Category 2 incident investigations, in particular residential flats.

Listed below are the incidents that were followed-up as Category 1 and Category 2 investigations. To aid interpretation of the incidents listed below, buildings with a habitable floor up to 18 m above the fire and rescue service access level are described as low-rise, 18 m – 30 m above the fire and rescue service access level are described as medium-rise, and +30 m above the fire and rescue service access level are described as high-rise. The Category 1 and Category 2 investigations that the consortium has conducted in this reporting period for the BSR are:

Category 1 Incidents:

- Flat fire in a high-rise, mixed use building – Greater London; and
- Timber framed residential building – Greater London.

Category 2 Incidents:

- Flat fire in a high-rise, mixed use building – Greater London;
- Industrial building fire – Yorkshire;
- Multi-fatality, low-rise flat fire – Berkshire;
- Multi-fatality, house fire - Greater London;
- Multi-fatality, high-rise flat fire – New York, USA;
- Fire in a low-rise flat building – Essen, Germany:
- Flat fire in a high-rise block of flats – Greater London;
- Flat fire in a high-rise block of flats – Greater London;
- Fatal, fire in a low-rise block of flats – Bedfordshire;
- Flat fire in a high-rise block of flats – Greater London; and
- Flat fire in a high-rise block of flats – Avon.

2. Items identified to the investigators for monitoring by the BSR

This section provides a place for reporting, comment and update on fire safety aspects that have been identified to the investigators by the BSR as being of interest to them and items that the investigators consider should be of interest to the BSR as emerging hazards. The BSR has asked the investigators to look out for and consider the contribution of the fire safety aspects listed within Table 1, should they feature in any of the incidents identified in the reporting period.

Table 1 – Items of interest

Item	Fire safety aspect	Summary of incident(s) involving the item	Building regulation requirement	Hazards associated with the item	Prevalence of item in the reporting period
1	Plastic based landscaping and building products	The BSR (DLUHC at the time) brought to the investigator's attention a previous incident (April 2021) that was reported in BRE's final quarterly report (Reporting period 1st April – 30th June 2021. Report dated October 2021). The incident involved the ignition of an extensive run of fence panels reported to have been manufactured from recycled plastic. As the panels became involved, the fire spread rapidly horizontally and developed to a significant size leading to several adjoining properties being affected by the fire that spread from outside to in.	B3 to B5	From the incidents reviewed by the investigators and historically by the previous operators of the Real Fires project, the hazards associated with these incidents reviewed are: - Potential for rapid horizontal fire spread; - The vulnerability of the eaves of a property to thermal assault from external fire spread; - The potential for multiple properties to be affected either in a short period or simultaneously; and - The operational demands for the responding fire and rescue service of multiple properties being threatened	BRE kindly provided OFR with details from the responding fire and rescue service of another incident which was believed to have involved plastic based fence panels which occurred in May 2022. This incident was of a smaller scale and the fencing became involved because of a vehicle fire that spread. Beyond the incident identified above, the investigators identified no further incidents directly attributed to these types of products. **OFR will continue to monitor and report on any future incidents for any characteristics of interest.**

Item	Fire safety aspect	Summary of incident(s) involving the item	Building regulation requirement	Hazards associated with the item	Prevalence of item in the reporting period
				by the fire spreading or affected simultaneously where they may not typically have been expected to.	
2	Laminated glass	A fire in a mixed-use high-rise building (investigated as a Category 1) provided valuable insight into the performance of laminated glass in fire with relevance to balcony balustrades. It is likely the laminate material present in the glass was polyvinyl butyral (PVB), as this has been the most common material used for this type of application. Although the thermal effects of the fire could be considered to be relatively severe, it appears the laminated glass performed as might be expected: the glass shattered but held in place; areas of the laminate burned and/or melted but did not promote fire spread beyond a localised area; the presence of a channel to mount the glass may have mitigated any dripping of laminate to lower levels.	B3 and B4	Following the fire at Grenfell Tower the Building Regulations in England were changed to address fire spread over external walls of high-rise residential buildings. These changes resulted in there being an effective ban on the use of laminated glass for balcony balustrades in relevant buildings. The BSR are interested in fires in which laminated glass is present to assess whether this product contributes to the spread of fire. Spread mechanisms may include upward development via flame extension and/or downward spread through the dripping of burning laminate.	Other than the mixed-use high-rise building fire described herein, no further incidents in the reporting period have provided the same level of insight. The investigators remain vigilant for further incidents which may inform future discussions on the use of laminated glass in balcony balustrades for relevant buildings. **OFR will continue to monitor and report on any future incidents for any characteristics of interest.**

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3	Retrospective installation of spray foam roof insulants	The BSR (DLUHC at the time) have identified a trend of retrofitting dwellinghouses with spray applied roof insulation. Whilst potentially not building work in the context of the regulations, there is a concern that such products may worsen the fire performance of roofs, specifically with respect to Regulation B4(2). No previous incidents have been identified that have involved the retrofitting of spray foam insulation. NB: This topic is subject to a research project that has been reported on separately.	B3 and B4	The BSR relayed their observations that suppliers in industry were incentivising the use of retrofitted spray applied closed- and open-cell polymeric insulation to roof spaces, with the intent of improving thermal performance. As a retrofit, such works may be undertaken without needing to seek Building Regulations approval, as such activities may not constitute 'building work'. However, there is a concern that such a retrofit could constitute a worsening of the existing fire safety performance . This could be due to a change in the penetration performance of the roof (from outside-to-in) or through the introduction of additional (permanent) fire loading in the roof space.	No incidents directly attributed to these types of products. **OFR will continue to monitor and report on any future incidents for any characteristics of interest.**
4	Industrial and storage buildings	The BSR (DLUHC at the time) have a research stream focussed on fire resistance and compartmentation, led by BRE. Industrial buildings can often sit at, or sometimes beyond, the	B3 and B5	The observation that most of the incidents effectively resulted in a total loss of the premises is not unexpected. The reasons for the extent of the losses observed are considered to be a reality of the	68 incidents have been recorded in industrial buildings in the reporting period of which one was investigated as Category 2 at the request of the BSR. Storage buildings also

Item	Fire safety aspect	Summary of incident(s) involving the item	Building regulation requirement	Hazards associated with the item	Prevalence of item in the reporting period
		compartment limit recommendations in ADB, where multiple storeys are present. However, from what the Real fires project investigators can deduct from the information available, none of the incidents exhibited unusual characteristics for single storey premises with respect to fire behaviour or building design. Most of the incidents effectively resulted in a total loss of the premises. The current guidance in Approved Document B places no compartment size limits on single storey buildings considered to be of the 'industrial' purpose group, but single storey buildings considered to be of the 'storage' purpose group are recommended to be compartmented when the floor area exceeds 20,000 m^2.		guidance in Approved Document B on building subdivision for such uses and the general adoption of simultaneous evacuation strategies continuing to achieve life safety objectives. Approved Document B does not address property protection objectives directly and fire and rescue service intervention is often challenging due to: - The potential for the seat of the fire to be remote from the building perimeter; - The potential for there to be multiple mezzanine or storage levels within a so called 'single storey building'. This can increase the complexity of the design, potentially impacting the scale of any loss and affect the ability of the responding fire and rescue service to offensively fight a fire. - The use of any hardstanding around such premises for storage of materials and	have similar spatial and structural features. 41 incidents occurred in storage buildings in the reporting period. **OFR will continue to monitor and report on any future incidents for any characteristics of interest.**

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				products that impairs fire and rescue service access; and - The general absence of 'persons reported' scenarios in such incidents means that the motivation for the responding fire and rescue service to commit to entering such premises is diminished, with their focus often on containment to the building of origin.	
5	Lithium based battery incidents	The BSR (DLUHC at the time) have identified lithium based batteries as a potential hazard to buildings. The investigators have recorded several fires that involve rechargeable lithium based batteries in the reporting period which reflect an emerging trend in the increase of incidents as the number of appliances using lithium based batteries increases. Nowadays many consumer items contain lithium based batteries. OFR will continue to monitor the use of lithium based batteries and the incidents that they	B1, B3 and B5	From the incidents reviewed by the investigators, the hazards associated are: - The failure of a lithium based battery is often a rapid and potentially a violent exothermic event that can result in the rapid deterioration of conditions in the vicinity of the battery that has failed; - Lithium battery power devices such as e-scooters are typically stored in the entrance hall of dwellings or common areas in residential	Seventeen incidents have been recorded in the reporting period where the cause of the fire was attributed to lithium based batteries (including incidents attributed to batteries associated with e-bikes and e-scooters). Out of these, two incidents were investigated as Category 2. **OFR will continue to monitor and report on any future incidents for any characteristics of interest.**

Item	Fire safety aspect	Summary of incident(s) involving the item	Building regulation requirement	Hazards associated with the item	Prevalence of item in the reporting period
		have been reported to be a feature of through this project. Incidents where a lithium based battery has been attributed as the cause of the fire are often characterised by the sudden, rapid and energetic discharge of hot, toxic and flammable gases. These can ignite, resulting in a flame projecting from the battery pack or the rapid failure of the pack where components of the battery pack may be ejected, potentially aiding the spread of the fire. The rapid development of such incidents often results in occupants requiring assistance to leave a property or indeed rescue where their means of escape is rapidly obstructed by the resulting fire. Although fires involving these items is not currently explicitly addressed by the Building Regulations, or the guidance in the two volumes of ADB, there is considerable debate across the industry relating to the parking of alternative fuel vehicles (lithium battery based electric vehicles,		buildings. This presents the potential for a rapidly developing fire to immediately affect what is often the most familiar and only means of escape for occupants; - Some incidents have involved the lithium based battery device being charged in a communal area of flat type accommodation. In the event of a battery failure, this results in the common area being directly affected by the fire and combustion products; and - The less predictable fire behaviour of lithium based batteries can be a hazard to occupants and the responding fire and rescue service, both if the fire originated in a lithium based battery or has spread to involve a piece of equipment that uses a lithium based battery.	

Item	Fire safety aspect	Summary of incident(s) involving the item	Building regulation requirement	Hazards associated with the item	Prevalence of item in the reporting period
		hydrogen fuel cells, etc...) in locations in the vicinity of buildings. Various stakeholders are producing guidance and standards related to this aspect reliant on varying levels of scientific rigor. Where there may be more impact on regulation and building design is the proposal to include battery based (including lithium based batteries) energy storage systems into buildings. An example is the use of a battery pack connected to a solar energy recovery system. The investigators are aware that the Office for Product and Safety Standards are acting in response to lithium based batteries and accessories from a product standards enforcement perspective.		With the increased use of lithium based batteries, it is predictable that more fires are being observed in which they are involved. At this stage it is difficult to ascertain whether their involvement is disproportionate to the number of batteries in service, or whether the media has a focus on reporting these fires.	
6	External fires spreading to dwellings	OFR have noted several incidents where a fire has started externally within the grounds of a property, whether it be in vegetation surrounding a dwelling or in an outbuilding, that by virtue of it not being permanently occupied, heated, or being under 30 m^2 would not require Building Regulation approval.	B3, B4, and B5	This item has been observed to be characterised by a fire that is reported to have originated externally that has gone on to spread to involve multiple adjacent dwellings, often simultaneously.	13 incidents were recorded in the reporting period where a fire started externally and spread to involve a dwelling. **OFR will continue to monitor and report on any future**

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		Unless contained to the external area, these incidents can involve the spread of fire to multiple buildings and rapid external fire spread in the open. The investigators have also recorded one fire event in the South East of England that was described as a fire in the open that started in low level vegetation, crossing the rural-urban interface, resulting in multiple properties being fire affected in a short period of time. The fire seemingly bypassed the space separation and compartmentation provisions that would be considered the primary ADB mitigation measures against building-to-building fire spread. It is of note that a number of these types of incidents are originating and developing in proximity to permanent buildings in a suburban or urban setting and are not happening exclusively because of a rural fire crossing the rural-urban interface. Based on qualitative observation, the investigators consider the prevalence of home offices and lightweight structures erected by homeowners		The propensity for this type of fire to occur was seemingly exacerbated by the record high temperatures witnessed in mid July 2022, combined with limited rainfall. This indicates that the potential for such incidents will depend on weather patterns, but the general trend of a warming climate and reduced summer rainfall will increase the likelihood of similar incidents. These incidents highlight how: - As outbuildings and denser vegetation tend to be positioned in proximity to a property boundary, their involvement in a fire can also place them close to similar features on neighbouring land, and in proximity to adjoining dwellings. - A fire starting externally in the grounds of a dwelling, can develop to an extent that it can break into the dwelling, e.g., via openings in the external wall, such as by open windows, soffit vents	**incidents for any characteristics of interest.**

Item	Fire safety aspect	Summary of incident(s) involving the item	Building regulation requirement	Hazards associated with the item	Prevalence of item in the reporting period
		for people to meet externally during the pandemic may have led to proliferation of combustible structures being erected in domestic gardens. This serves to increase the fire load and ignition sources external to a property. This has resulted in incidents in most parts of England where a fire originating externally has spread to several dwellings simultaneously.		and timber in the eaves and soffits of roofs; - With sufficient fire load and (un)favourable weather, an external fire can overcome the mitigation measures recommended by both volumes of ADB, that generally serve to mitigate building to building fire spread across a relevant boundary; and - Responding fire and rescue services can be faced with the challenge of an extensive seat of fire externally, that can move rapidly if uncontained and affect multiple properties (both attached and detached structures).	

3. Recommendations to BSR

Table 2 sets out the recommendations made by the investigators to the BSR from analysing the incidents that occurred in the reporting period. The recommendations are presented in the purpose group(s) within which the incident(s) occurred. Several incidents investigated had a finding that was common to other incidents. Where these incidents resulted in a recommendation, it is only presented once in Table 2. Reference is made in column 3 of Table 2 where multiple incidents have resulted in a given recommendation.

This should not be taken to mean that the recommendation only relates to that purpose group. Judgement will need to be exercised by the reader as to the full extent to which the recommendation may apply to other purpose groups. Actors within the industry should be aware of the matters raised and consider how they affect the design, operation, management of buildings under their control, and fire and rescue service response.

Table 2 – Recommendations made to the BSR

Item	Building regulation requirement	Issue/Observation	Recommendation
Purpose Group(s): Residential 1(a)			
1	B1	A multi-fatality fire in an overseas, high-rise, purpose-built block of flats was investigated as a Category 2 incident. The building was provided with two stairs that were available to residents, but this provision alone did not avert several fatalities occurring in the incident.	A structured and thorough assessment is required to determine whether simply providing extra stairs is a benefit to fire safety in purpose-built blocks of flats. Any recommendation given to include a second vertical escape route should go hand in hand with guidance that considers how redundancy is achieved, how occupants and the fire service interact and how such a provision can support vulnerable occupants who might require assistance and, therefore, may not benefit from additional stairs.
2	B1 and B5	An incident involving a high-rise, purpose-built mixed use residential building was investigated as a Category 1 incident (other incidents also identified this hazard). The investigation identified that the wall mounted AOVs serving the dead-end portion of corridor associated with one of the building's two stairs were adjacent and in proximity to windows serving flats on the same building level. This presents the possibility of a wall mounted	It is recommended that additional guidance on this situation akin to that given in BS 9999:2017, Figure 23 is deployed, where the inside angle of the façade of the ventilated corridor relative to the opening in the façade of the dwelling is < 110°, separated by < 5 m should be

Item	Building regulation requirement	Issue/Observation	Recommendation
		AOV opening in the vicinity of a flat of fire origin. Should the glazing to the window(s) of flat of fire origin fail or be open, then a pathway for the re-entry of smoke and heat into the section of ventilated corridor is plausible. A further incident involving a high-rise, purpose-built residential building was investigated as a Category 2 incident. The building in question had a smoke shaft outlet on an inclined roof that was positioned in the vicinity and at a lower level to the AOV at the head of the stair. Again, the scenario for exhausted smoke to recirculate (internally) was not realised, but the pathway existed.	formed of fire resisting construction to reduce the potential for the recirculation of combustion products.
3	B1 and B5	An incident involving a high-rise, purpose-built mixed use residential building was investigated as a Category 1 incident. Each level of residential accommodation was accessed via two independent protected stairs. Had the flat of fire origin been accessed from one of the dead-end portions of common corridor then there was the potential for smoke and heat to have affected the stair. This potential outcome was highlighted in this incident owing to the entrance door to the flat of fire origin being propped open by the occupants following the start of the fire, as they evacuated (to allow a pet to escape). This allowed the unimpeded flow of heat and smoke through the flat entrance door and the effective double-sided exposure of that door to the fire whilst open. This resulted in the flat entrance door becoming ineffective in the later stages of the incident. Should the responding fire service have wished to have closed it, then the door would have been largely ineffective. A further incident involving a high-rise, purpose-built residential building was investigated as a Category 2 incident. The incident	Although the scenario described was not realised in first incident summarised, the investigators consider that mitigation of this hazard with regard to maintaining protection to the stair(s) could be achieved by the adoption of a non-residential firefighting shaft arrangement (akin to the layout shown in Figure 23 of BS 9999:2017), where two door separation between the firefighting stair and common corridor that gives access to the individual flats, is always achieved. This could also be a solution for existing buildings should concern be raised as to the protection of a single stair. The above recommendation is also considered to complement the general direction of fire safety measures mandated via planning policies. Specifically, to achieve the successful integration of evacuation lifts (as recommended by Section D12 of the London Plan), they may not be considered to achieve their intended benefit without the evacuation lifts being separated by

Item	Building regulation requirement	Issue/Observation	Recommendation
		building featured a dedicated stair lobby which appeared to have performed well adding support to this recommendation.	fire resisting construction from sections of corridor that give access to individual flats. Consultation may be beneficial / required with the National Fire Chiefs Council and the National Operational Guidance.
4	B1 and B5	An incident involving a high-rise, purpose-built mixed use residential building was investigated as a Category 1 incident. The infill point for the wet fire main tank was located on an elevation adjacent the main residential entrance. The façade with the main entrance was one of the elevations where double-glazed units became detached and fell c. 70 m to street level. In this incident the inlet points were sufficiently remote from the area affected by the falling glass and façade elements. The existing recommendations of both the 2006, and 2015 versions of BS 9990 note that inlets to fire mains should be located on the external wall of the firefighting shaft, or if the firefighting shaft does not have an external wall, then multiple inlet points are recommended. The investigators consider this advice to be sufficient to address falling debris that would present a hazard to firefighters and equipment, if applied consistently.	It is recommended that explicit guidance is given in Approved Document B regarding the positioning of fire main inlets as per BS 9990:2015. That is, "that inlets to fire mains should be located on the external wall of the firefighting shaft, or if the firefighting shaft does not have an external wall, then multiple inlet points are recommended." The guidance on positioning inlets is considered to be as relevant as the positioning of outlets, with outlets commented on in both volumes of ADB; whereas guidance on inlets is not. The recommendation is made for the purposes of offering protection to the responding fire and rescue service when operating outside a fire affected building.
5	B4	An incident involving a high-rise, purpose-built mixed use residential building was investigated as a Category 1 incident. This incident showed that the laminated glazing to both the balcony balustrades in the vicinity of the fire was heat affected and damaged to the extent the glass had shattered, and the scorching would suggest that some of the interlayer may have burned (and also some may have melted). However, the balustrade glazing had	There is considered to be scope for the government to re-evaluate the effective ban on the use of laminated glass in balcony balustrades for relevant buildings in the light of this incident and others discussed in the literature. The details of the incident have been shared with the team leading the balconies, spandrels and glazing research theme being conducted under the

Item	Building regulation requirement	Issue/Observation	Recommendation
		not fallen away and the extent of the scorching suggests the laminate has not promoted fire spread.	current technical review of ADB, where this issue has been explored further.
6	B3	An incident involving a low-rise purpose-built mixed use, timber framed residential building was investigated as a Category 1 incident. The external walls of the building were provided with fire resistance from inside to out. This was likely to a minimum of a 60 minutes loadbearing capacity. However, only nominal fire resistance was achieved from outside to in. Once the fire entered the cavity space within the external wall, structural elements were ultimately consumed leading to localised collapse. In the absence of fire resisting external cladding and fire stopping around window openings, external walls designed in such a manner will be vulnerable to fires originating outside of the building, or those where the flames from an opening penetrates the cladding and / or breaches a cavity barrier. The report highlights some ambiguity within the ADB recommendations for the fire resistance of external walls that may lead to interpretations where little if any fire resistance is achieved from outside to in.	In the investigator's view, loadbearing external walls are considered as part of the structural frame and therefore designed for fire exposure from both sides simultaneously. Additional guidance on this matter should be provided and expectations made explicit. This could be via a recommendation that all loadbearing elements should achieve fire resistance considering 'all exposed faces' or similar.
7	B3/B4	An incident involving a low-rise, purpose-built mixed use, timber framed residential building was investigated as a Category 1 incident. Owing to the building's proximity to the boundary, combustible insulation was likely in conformity with historic and current guidance at roof level. The insulation appeared to facilitate horizontal fire spread. However, the extent to which compartmentation was circumvented was likely due to a lack of dividing of the insulation over compartment walls within the build-up of the roof system. The continuation of the insulation over compartment walls may have been permissible under the guidance at the time and	The investigators consider there to be two aspects that this incident has highlighted which the BSR should review: 1. The terminology used in ADB with respect to "roof covering" and "deck", and how a roof build-up's BS 476-3 classification relates to its ability to prevent fire spread over a compartment line; and 2. The absence of the equivalent recommendation for "Thermoplastic insulation materials should not be carried over the wall" for "Any other building or compartment" (commentary in support of diagram

Item	Building regulation requirement	Issue/Observation	Recommendation
		currently, depending upon the measurement of building height and/or the intended definition of a roof covering vs deck. The investigators note that the scope of BS 476-3:2004 (Test 4) is to enable the measurement of the: • Capacity of a representative section of a roof to resist penetration by fire when the external surface is exposed to radiation and flame; and • Distance of the spread of flame on the outer surface of the roof covering under certain conditions. Albeit described as a roof covering test, it is noted that: "The specimens shall be representative of the complete "end use" roof construction including at least one specimen of any joints used in each of the materials to be tested." This implies that BS 476-3:2004 (Test 4) is a system test with no clear definition of what constitutes the covering vs the deck for which there are performance criteria in both of volumes of ADB current at the time of the design of the building and in the two volumes of the current editions of ADB. This suggests that clarification is needed on the relationship of the BS 476-3:2004 test specimen and the ADB recommendations for specific subparts of the specimen. This could be through a clear definition of what constitutes a "roof covering" and "deck". Current guidance within both volumes of ADB have a specific recommendation with respect to diagram 5.2 (b) and 8.2 (b) that for residential (dwellings) and residential (other) a maximum of 15 m high:	5.2 (a) and 8.2 (a) of the respective editions and volumes of ADB).

Item	Building regulation requirement	Issue/Observation	Recommendation
		"Thermoplastic insulation materials should not be carried over the wall" This is not explicitly recommended for "Any other building or compartment" (commentary in support of diagram 5.2 (a) and 8.2 (a) of the respective version of ADB).	
8	B5	An incident involving a low-rise, purpose-built mixed use, timber framed residential building was investigated as a Category 1 incident. The responding fire and rescue service noted that perimeter access via tall ladders was critical to their ability to control the fire. It is plausible that without perimeter access, more significant damage would have occurred. ADB does not make any specific recommendations for perimeter access when internal fire mains are provided.	It is recommended that guidance around perimeter access is reviewed, as it may be a necessary trade-off when combustible materials are adopted, particularly at roof level. This should be alongside appropriate provisions for internal access.
9	B3, B4, and B5	An incident involving a low-rise, purpose-built mixed use, timber framed residential building was investigated as a Category 1 incident. Regarding this incident, establishing storey height retrospectively proved challenging. This is because the top floor flats were multi-level and some ambiguity exists as to whether the internal floor of a multi-level dwelling constitutes a storey. As a result, provisions for this building appear to have been aligned with a topmost storey height of less than 18 m (when measured relative to lowest ground floor level), albeit internal floors within flats are potentially above 18 m.	Multi-level flats are not considered to be uncommon. Therefore, additional guidance should be provided in clarifying storey height, where multi-level flats exist.
10	B3, B4	An incident involving a high-rise, purpose-built mixed use residential building was investigated as a Category 2 incident. The incident started externally on what the investigators considered to be a terrace that was located on a roof (less that 70^{o} incline to	The investigators recommend that in consideration of the implications for specified attachments under the in-effect ban on combustible materials, the rate of vertical fire spread expected for staggered terraces vs.

Item	Building regulation requirement	Issue/Observation	Recommendation
		vertical). Finishes to the enclosing structure that formed the terraces allowed the fire to develop from a discarded cigarette. This subsequently led to the fire spreading externally to the roof of two flats. In the investigators view, such materials would be exempt from the in-effect ban on combustible materials owing to the stepped nature of the terraces meaning the arrangement could reasonably be treated as roofs based upon the ADB and Regulation 7 definition for external walls.	projecting vertical balconies would be worthy of investigation to ascertain an understanding of the relative hazard or a situation where materials are highly prescribed vs one that is less so.
11	B4	An incident involving a high-rise, purpose-built residential building was investigated as a Category 2 incident. From the information provided the external wall system was not considered to be in line with Regulation 7, comprised of a brick slip external surface and what appeared to be a grey coloured expanded polystyrene insulation behind. However, there appeared to be very little fire spread via the external façade as a result of the incident. This may have been as a result of limited exposure to heat, but could also be a result of the polystyrene insulation being treated with flame retardant and encapsulated behind the render, along with the fire occurring on the top floor with limited opportunity for external flaming to exert a thermal assault on expansive areas of the facade.	No recommendation, observation only.
12	B1	An incident involving a high-rise, purpose-built residential building was investigated as a Category 2 incident. The local fire and rescue service reported to the investigators that they were first alerted to the fire via a call from the local ambulance service. This notification was after the arrival of the police, and after one occupant had fallen from the building. This suggests to the investigators that the fire alarm system for the communal areas was not linked to an alarm receiving centre.	The investigators recommend, that subject to understanding the potential for false alarms (all types), additional guidance in the approved documents should be provided, that where a BS 5839-1 type fire detection and alarm system is installed within a purpose built block of flats, and there is not an onsite management presence, then the fire detection and alarm system should be connected to an alarm receiving centre via a monitored line. This is to ensure the fire and rescue

Item	Building regulation requirement	Issue/Observation	Recommendation
			service are alerted independently of anyone in or around a building as a fall-back provision in the event of those attending potentially assuming another person has notified the fire and rescue service of a suspected or confirmed fire incident.
13	B4	An international incident, investigated as a Category 2 incident, highlights the potential contribution to a fire of a balcony's materials of construction, configuration, and possibly contents. These elements are of current interest as part of BSR-sponsored research programme on the fire safety of balconies, spandrels and glazing.	The investigators recommend that the details of the incident are shared with the team leading the balconies, spandrels and glazing research theme being conducted under of the current technical review of ADB
14	B1, B3, B4, and B5	The international incident referenced directly above also illustrated how external wind conditions can have an influence on fire development and firefighting and this may point to the need for further research on this aspect in the future. In particular, for tall buildings where wind speeds could be more significant or buildings with exposure to regularly occurring strong prevailing winds (e.g., coastal regions).	The investigators recommended that the effect of high wind speeds (above prevailing) are investigated as to their propensity to exacerbate fire and smoke spread, and how this might undermine or impact current provisions in ADB.
15	B4, B5	An incident involving a high-rise, purpose-built mixed use residential building was investigated as a Category 1 incident. The incident resulted in c. 4 whole windowpanes falling from the flat above the flat of fire origin. The panes, c. 2 m^2 in area, became detached from the façade structure, likely as a result of the failure of the rubber gaskets and beading that would have secured them into the frame. Two of the intact panes fell in proximity to the façade line of the building of fire origin. Other screen shots from eye-witness video footage, show one windowpane hitting the ground in the carriageway on the opposite side of the road to the building of fire origin, c. 25m from the facade.	The investigators do not consider there to be an immediate solution to this hazard. However, the external wall system research project actively considered a mechanical fixing expectation / criterion for the BS 8414 test. The mitigation of this hazard will be investigated by that research project and reported on therein.

Item	Building regulation requirement	Issue/Observation	Recommendation
		It is noted that there is awareness of this hazard with respect to operational firefighting, as addressed by the National Operational Guidance, which makes the same points to those listed adjacent.	
16	B4	An incident involving a high-rise, purpose-built residential building was investigated as a Category 2 incident. The external wall system on the affected elevation did not promote or facilitate external fire spread. Based upon the images, the extent of involvement of the external wall system was limited to those areas upon which the external flaming directly impinged. This is in-line with the observations of Langdon-Thomas and Law in Fire Note 8 for Class 1 and 2 materials. The outer surfaces of the external wall system in this case was reported as achieving Euroclass B-s1,d0, with a separate assessment by the BRE concluding that such an EWS would likely satisfy the criteria of BR 135, based upon BS 8414 test data. The event indicates that such classifications can achieve outcomes whereby fire spread over the surfaces of external walls is seemingly sufficiently mitigated, particularly when applied to homogenous products and not multi-layer composite materials.	No recommendation, observation only.
Purpose Group(s): Industrial 6 and Storage 7(a)			
17	B5	An incident involving an industrial manufacturing building was investigated as a Category 2 incident. The actions of the responding fire and rescue service to fight the fire were hampered by combustion products issuing from the building, and externally stored materials and products associated with the facility.	The investigators recommend a review should be undertaken of minimum stand-off distance for perimeter access roadways for fire service vehicles to enable them to operate within site boundaries to mount effective firefighting operations and access the minimum percentage of a building perimeter.
18	B3, B5	An incident involving an industrial manufacturing building was investigated as a Category 2 incident. Given the propensity for a near total loss of the building, its contents, and in lieu of there not being a building wide automatic suppression system, then some	The investigators recommend that details of the incident should be shared with the consultants leading the structural fire resistance and fire separating

Item	Building regulation requirement	Issue/Observation	Recommendation
		subdivision of the volume would seem to be beneficial. It is noted that a compartment wall between the manufacturing facility and the office block appeared to mitigate the whole building from being fire affected. However, any such subdivision would have to be balanced with its potential impact on the function of the building.	elements research theme being conducted under the current technical review of ABD.

4.General observations from incidents recorded and investigated in the reporting period

As well as matters that may be of direct relevance to the Building Regulations and the guidance within the two volumes of ADB, the investigation of incidents also highlighted to the investigators aspects of fire safety that are not the primary interest of the project as they are not currently matters directly addressed via the Building Regulations and statutory guidance, but nonetheless, are considered noteworthy. This section reports on observations that those tasked with managing fire safety in existing buildings, those involved in building design, fire and rescue services, other first responder agencies, residents and fire safety practitioners may find of value and interest. These are set out in Table 3. There is no inference that observations on matters that are considered to be outside the scope of the Building Regulations and/or statutory guidance have been investigated in totality, nor if adopted would be applicable to all situations. Sound professional judgement should still be applied as to the relevance of any of the observations and associated recommendations reported in this section.

Table 3 – Recommendations from general observations

Item	Issue/Observation	Recommendation
1	An incident in England involving a high-rise, purpose-built mixed use residential building was investigated as a Category 1 incident. Also an international incident was investigated as a Category 2 incident. These incidents highlighted the following points with respect to occupant response: • Stay put guidance was likely misunderstood and not trusted by a proportion of occupants; • Occupant's did not understand the fire alarm cause and effect. They expected a building wide audible fire alarm to have sounded; • Confidence in the stay put fire strategy still appears to be fragile; and • There were witness accounts that suggested occupants of the fire affected building followed advice from other members of the public giving views and instruction via social media, direct messaging, video calls and the like over that of the responding fire and rescue service.	The investigators recommend that the following items are relevant to share with guidance writers, Responsible Persons, Accountable Persons and advisers who specialise in fire safety relating to purpose-built blocks of flats. Primarily, this relates to ensuring the provision of good quality information on fire safety to residents of purpose-built blocks of flats at the point of moving into a dwelling, and then periodically thereafter. For example, areas where information and/or additional guidance would likely continue to be beneficial are: • The rationale of the stay put guidance and the implication of the potential reality of the alternative to this. The intention being to improve understanding and confidence in the approach; • The rationale of the fire detection and alarm system and the associated cause and effect; • Warning of the potential hazard associated with following guidance of other members of the public over that of the responding fire and rescue service; and

Item	Issue/Observation	Recommendation
		• 'Upskill' occupants to enable them to make a more informed judgement on whether to evacuate a building or not depending on the location of the fire and its development. Especially, if receiving prompts from members of the public via social media, direct messaging via video calls and the like encouraging them to leave.
2	An incident investigated in the reporting period as a Category 2 incident in a high-rise residential building featured first responders (non-fire and rescue service), clearly acting out of good intent to alert occupants by going door to door. The first responders entered a fire affected building, in advance of the responding fire and rescue service, going flat door to flat door, alerting residents to a fire in the building. This was reported to the investigators to have been done irrespective of where the flats were relative to the fire. Such actions, albeit potentially lifesaving in some circumstance, could have a detrimental impact on the outcome of an incident for others. The investigators consider that although extremely well intentioned, such action can conflict with the general philosophy of the stay put strategy; potentially delaying the actions of the responding fire and rescue service if they are operating around a number of residents evacuating the building who are not in immediate danger, and it may also encourage occupants with a mobility impairment to attempt to evacuate outside any pre-arranged plans that could be a hazard to them in its own right e.g. attempting the descent of multiple floors via the use of a stair.	The investigators recommend that local fire and rescue services provide basic awareness training to other first responders to affirm the typical fire strategy for residential buildings and indicators that could mean alerting the wider building could be beneficial to the safety of occupants prior to the arrival of the responding fire and rescue service.
3	An incident involving an industrial manufacturing building was investigated as a Category 2 incident. The investigators noted that the actions of the responding fire and rescue service to fight the fire were hampered by combustion products issuing from the	Site operators, fire risk assessors and the local fire and rescue services should be alert to the potential for the practice of storing goods and materials externally to impede perimeter access. These can also be vulnerable to becoming involved should the fire spread beyond the building of origin.

Item	Issue/Observation	Recommendation
	building and externally stored materials and products manufactured at the facility.	
4	An incident involving an industrial manufacturing building was investigated as a Category 2 incident. The incident seemingly led to a near total loss of the building, inclusive of the products manufactured and stocks of raw materials intended for future manufacturing. It is expected that a large extent of demolition and rebuild will be necessary in advance of the facility being operational once again.	The details of the incident should be shared with the consultants leading the Property Protection and Business Continuity research theme conducted under the current technical review of ADB