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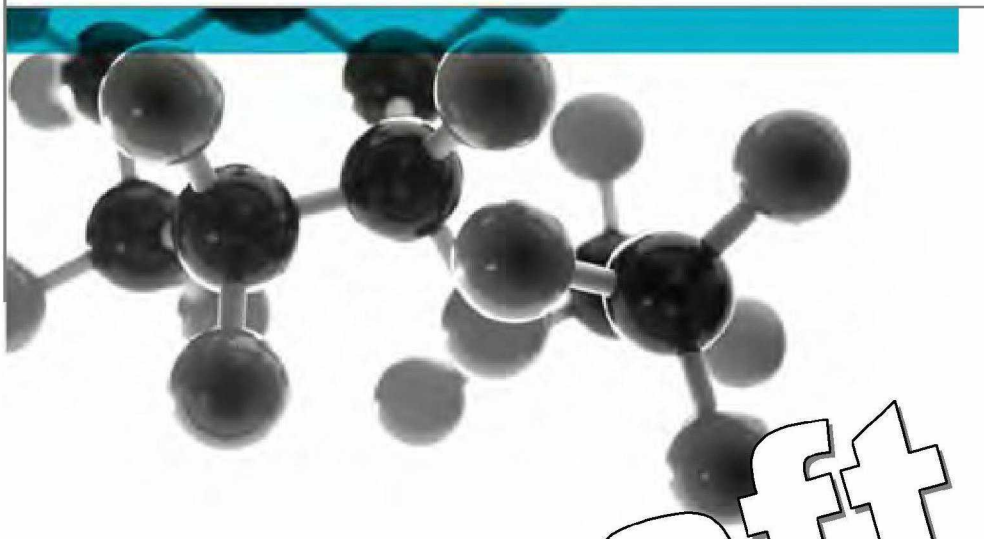
Existing Fire Safety Strategy Grenfell Tower Regeneration Project, London



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Draft

Validity

This report is formulated on the basis of the information and experience available at the time of preparation. It is applicable to the above-mentioned project only in accordance with the client's instructions. It is only valid provided no other modifications are made other than those for which a formal opinion has been sought and given by Exova Warringtonfire.

Contents

1 Introduction

Grenfell Tower is a 24 storey tower block In Kensington, West London built in the 1970s.

The building contains a basement level, and a mixture of uses to the spaces on the first 4 storeys including a boxing club, offices and nursery with residential apartments above. The building contains a total of 120 apartments, having 6 apartments on each floor from level 5 to 24 with rooftop plant.

This existing fire safety strategy covers the fire precautions in place in the existing building as built in the 1970s, drawn up from information gathered through a non invasive site survey, a desktop study of the original plans from the microfiche archive and the current fire risk assessment.

It is expected and therefore assumed that the existing building has been built to the prevailing standards of the day, thought originally to be the Building Regulations 1965 which did little more than require the structure of the building to have fire resistance (the design of the building predates the guidance of the 1971 Code of Practice CP3). The London Building Acts Amendments Act 1939 however required features to be included in the building which are very comparable with today's standards in terms of fire fighter access. The date of later developments is unknown.

It is assumed that the various provisions required by of the above legislation have been maintained since the building was constructed and subsequent amendments have been carried out with the approval of the regulating authority of the day.

As brief description of the layout of the building is detailed below.

LEVEL 1 / GROUND

The building can be entered at ground level on the South and North elevations, where access is available to the community areas / boxing. Separated at this level are external entries to the base of the refuse chute, substation, basement boiler house and an entry to the lifts serving the residential floors. The single stair to the residential floors does not connect with the basement and is separated from the ground level accommodation (to be confirmed). In the main core, only the lifts only serve this level, the walkway level and the residential levels. The residential stair base is found at the walkway level.

LEVEL 2 / MEZZANINE

The mezzanine level is accessed from 2 No stairs from the ground level. The accommodation to the North of the core looks into the ground level boxing club area. All accommodation on the ground and mezzanine levels are assumed to be under the same management. Escape is available in alternative directions via the 2 No stairs; an internal escape and an external stair which also serves other floor levels above the ground level.

LEVEL 3 / WALKWAY / DECK

The walkway level is located above the mezzanine level and is mainly open sided providing an external environment to areas around the main stair core, where the lobby is accessible from opposing elevations. A small amount of accommodation has been added to this level and an additional external stair has been added to serve the accommodation. This is assumed to be separated from the fire fighting lobby with 2 hour construction and 1 hour fire doors. This is the main entrance level to the residential floors and the stair serving all floors is available from this level. Raised walkways from the surrounding approaches lead onto the open pedestrian deck, which is also served by the external stair from the ground floor.

LEVEL 4 / OFFICES / FORMER DOCTORS SURGERY

Above the walkway level, there is a level which is currently used as offices, but was originally intended as a doctors surgery. There is access in the lobby area of this level into the service risers contained in the main core via a cleaners cupboard and store which contains the rising services and refuse chute. This

level appears to have undergone little alteration from the original design of the floor.

LEVELS 5 – 23 / RESIDENTIAL FLOORS

The residential accommodation starts at level 5, above the offices / doctors and continues to the top storey / level 23. Each level contains 6 No flats created around an entrance hallway. Each flat opens into the common single stair core which contains the stair, 2 No lifts in a common shaft, risers and refuse room, where the refuse chute is located. The chute communicates directly with the ground floor refuse chamber, which appears to form its own independent protected shaft.

LEVEL 24 / PLANT

The rooftop plant room is positioned on the roof deck and is covered by a lightweight weatherproof housing. The plant housing covers the central area with an external walkway created between face of the building and the plant room wall for external access to the roof, and this is continuous around the perimeter of the building.

2 Purpose Group

Many of the provisions within the current Regulatory guidance relate to the existing use of the building. The use classifications buildings are termed purpose groups and represent various levels of hazard. A building can consist of more than one purpose group provided that each is separated from the other by fire resisting construction.

As defined by current guidance in Approved Document B, there are three distinct purpose groups within the building.

Residential - Purpose Group 1a

Assembly –Purpose Group 5

Offices – Purpose Group 3

3 B1 Means of Warning and Escape

3.1 Requirement

"The building shall be designed and constructed to provide appropriate provisions for the early warning of fire and appropriate means of escape in case of fire to a place of safety outside the building capable of being safely and effectively used at all material times."

3.2 Means Of Warning

3.2.1 Levels 1 and 2

It is unknown whether the community areas and nursery are covered by an automatic fire detection system (AFD) or a manual system triggered by manual call points. The provision of AFD would not necessarily have been required at the time of construction, indeed today a manual system may be the minimum level required by the Regulatory guidance, as the travel distances to the closest storey / final exit from the building would comply with current permitted travel distances.

There is detection within the ground floor lift lobby. The provision of this detector would only serve to inform the management of the building of a fire and presumably disable the operation of the lifts.

3.2.2 Level 3

The walkway level forms the base of the core to the residential levels and is only covered by AFD for the operation of the smoke extract system. The activation of the detection on this level should also appear on the fire alarm panel.

3.2.3 Level 4

It is unknown whether the office / doctors levels are covered by AFD, again this may not have been required.

3.2.4 Individual Apartments

All apartments on the residential floors contain an entrance hallway. It is assumed that the apartments include smoke detection to at least the protected entrance hall, but it is unknown whether this is a mains operated AFD system.

3.2.5 Common Areas

An audible fire alarm is not required to common areas of residential buildings. Should there be an incident in the common areas, the fire resisting compartment enclosing each flat unit will provide an area of relative safety, and the fabric of the building is assumed to have been designed so that there is limited risk of fire spread. In accordance with BS 5588 pt 1, the risk of fire starting in corridors or stairways intended for use only as means of escape can be regarded as negligible as long as they are kept clear of obstructions and are not used for storage. Control of this is a duty of the management under the Regulatory Reform (Fire Safety) Order 2005.

Evacuation of flats beyond the dwelling of fire origin would be carried out under the control of the attending fire service if necessary.

3.3 Means Of Escape

3.3.1 Evacuation principals – Levels 1, 2 and 4

Evacuation strategies are based upon defined principals of the awareness, familiarity and mobility of the occupants of the building, or building part; and the geometry, use and internal layout of the space.

Within the non residential levels of the building, it can be assumed that the occupants are awake, but not necessarily familiar with the building layout and escape routes. The means of escape design is determined amongst other factors by:

- Means of warning and ability to be aware of a fire before escape becomes untenable,
- Limitation of the distance to exits for escape and a choice of routes where a single direction of escape is excessive,
- Adequacy of escape routes for the number of occupants present.

In this instance simultaneous evacuation of these levels is most appropriate.

3.3.2 Internal layouts – Levels 1 and 2

From levels 1 and 2, escape is available in alternative directions from the community areas, to external air on the ground floor. This area of the building is assumed to be under a single tenancy as community use, and therefore the control of the space would be managed by one organisation.

The boxing club on ground floor is approximately 180m^2, with a maximum occupancy based on a floor space factor of 1m^2 per person of 180 people. The room is served by a single exit door on the external elevation to the North elevation. Travel distances to the exit are within permissible single direction of travel of 18m. An additional exit would be required for an occupancy exceeding 60 people. The use of this room is therefore limited by the omission of an alternative escape route.

There is an open void above the boxing area, into the mezzanine above housing the nursery. A balcony connects the nursery on opposite sides of the central core. Escape can be made away from the void (unless on the balcony, where there is full vision into the boxing club) without having to pass within 4.5m of the opening.

3.3.3 Internal layouts – Level 4

Level 4 contains the office accommodation and is entered via the external escape stair and lift serving levels 1-4. There is no access to the stair or lifts in the central core shown on the original construction drawings, however lift landing doors appear to be shown on the existing drawings provided. It is assumed that AFD is present in the entrance lobby, open plan area and corridors as a minimum. The corridor off the open plan room continues around the North side of the central core and discharges into the entrance lobby.

If the accommodation communicates with the fire fighting shaft / lifts, then the core in this area should be protected to 2 hours fire resistance and 1 hour fire doors. As there is a single escape route from the building at this level, the exit should be lobbied to provide a minimum of 30 minutes fire resisting construction and there should be no combustible materials contained within the entrance lobby. It would also be beneficial to cover the risk rooms off the escape route with AFD, ie to include the refuse chute and cleaners cupboard and consider separation of these rooms from the entrance lobby.

Travel distances, as the layout offers escape in more than one direction back to the entrance lobby, provided the lobby is adequately protected, this would be satisfactory.

3.3.4 Evacuation principals – residential

The recommendations in the current guidance of Approved Document B support an evacuation strategy which is based upon the following assumptions:

- The fire is generally within a dwelling;
- There is no reliance on rescue for evacuation, other than via the main core;
- Due to an assumed high degree of compartmentation and therefore a low probability of fire spread beyond the dwelling of fire origin, simultaneous evacuation of the building is unlikely to be considered necessary; and,
- Although fires may occur in the common parts of the building, the materials and construction used there should prevent the fabric from being involved beyond the immediate vicinity.

It is recognised, however, that the occupants of neighbouring dwellings may feel a need to leave and will, in some circumstances, seek to find their way out of the building. For this reason, it is necessary to make certain provisions for securing the means of escape both within individual apartments and within the common circulation areas as a whole.

The requirements for residential property are sub divided into the common areas and flat internal layouts.

3.3.5 Internal layout - Apartments

The internal layouts of the existing flats are based around an internal corridor / entrance hall. This corridor need only be enclosed in materials affording 30 minutes fire resistance where the travel distance from the furthest point in the flat to the entrance door exceeds 9m. Doors leading into a protected corridor (ie where more than 9m) should be rated to a minimum FD 20 standard but need not be self-closing. The flat entrance door should offer a minimum of an FD30(s).

In accordance with ADB, the minimum standard fire alarm should comply with the current standard of BS 5839*: Fire detection and fire alarm systems for buildings, Part 6: Code of practice for the design and installation of fire detection and alarm systems in dwellings*[6] is to provide AFD to at least an LD3 system. Whether or not a mains fed fire alarm system is contained in the existing flats is unknown. It is recommended that the system is upgraded to incorporate this standard as a minimum.

3.3.6 Common Areas

The common area off the single stair is a lobby approach. Where apartment buildings are served by one common stair, the travel distances between the stair door and any entrance door should not exceed 7.5m and the lobby must be ventilated. The distance to the stairs from the flat entrance doors appears to be more than 7.5m from the flats with entrance doors to the North of the lift shaft, the maximum if which is approximately 8.3m (scaled from microfiche plans, to be checked on site). This excessive distance of less than 1m results in an increase in travel of less than 1 second and would be considered to be acceptable under current standards and risk assessment.

3.4 Smoke Ventilation.

From the information available it is assumed that the common area to each residential floor is ventilated via a smoke extract shaft and an adjacent fresh air riser, located on the North elevation of the core, between the core and 2 No flats. The openings into the shafts are at high level on each floor and both shafts appear to be closed at the base, which is in accordance with current guidance. The dimensions of the shafts are unknown; from the microfiche archive drawings they appear to be in the region of 400mm x 600mm each, between their internal walls. These measurements are not able to be precisely scaled and should be checked on site. The shafts appear to continue up to the roof of the plant housing, where they are terminated. The details of the shaft termination cowls / protrusions are unknown.

To meet with current standards, a naturally vented shaft would require a minimum dimension of 1.5m^2

and the vent into the shaft from the lobby should be a minimum of 1m^2. The existing shaft is clearly not providing an equivalent level of ventilation naturally and it is recommended that the shaft be ventilated via mechanical means.

The existing openings into the lobby areas of the residential floors to the smoke and fresh air ventilation shafts are controlled via mechanical dampers activated by a smoke detector in each lobby. It is assumed that the fire alarm panel is programmed to open the dampers on the fire floor and at the walkway level, creating a natural ventilation shaft for smoke extract from the internalised core.

It is understood, from the Aecom document detailing the upgrades proposed to the system, that there is a mechanical element to the smoke ventilation, which can be manually operated by the fire service on arrival to assist in the removal of smoke. It is understood that the fan(s) are positioned at the base of the shaft. It is unknown how the fresh air ventilation shaft operates in a fire condition (the rate of extraction the system currently achieves both naturally and mechanically). It is also not known how the existing system performs as a natural shaft for the purposes of escape prior to fire service intervention.

The existing system is unsatisfactory from a modern perspective, as the smoke extract shaft is significantly undersized (the shaft would also double as a fire fighting lobby, which requires a shaft area of 3m² under current guidance). An overhaul of the dampers and a change of the mechanical element to operate automatically is proposed, however, unless the existing fans are capable in automatic mode of producing the equivalent extract rates to that of a compliant modern system, the upgrade will not meet the aspiration of achieving current standards. This also casts into doubt the justification on grounds of escape time, the excessive travel distance as outlined in 3.3.6 above. As the ventilation provision is critical to the stay in place evacuation principle, it is strongly recommended that the performance of the automatic system of mechanical ventilation as existing and as proposed is assessed in order to ensure that a satisfactory level of safety is provided to the residents throughout the tower.

Ventilation of smoke is provided to the head of the stair via a weathered permanently open ventilator positioned on the roof of the plant room. The current guidance requires this vent to give a 1m^2 free area. The free area of the existing provision is unknown. Inlet air to the stair is provided by a louvred vent at the base of the stair at level 3, the walkway level.

4 B2 Internal Fire Spread (Linings)

4.1 Requirement

"To inhibit the spread of fire within the building the internal linings shall:

a) adequately resist the spread of flame over their surfaces; and

b) have, if ignited, a rate of heat release which is reasonable in the circumstances.

In this paragraph "internal linings" mean material lining any partition, wall, ceiling or other internal structure."

The interior wall and ceiling surfaces in a building can have a significant influence on how fast a fire may develop. It is particularly important that, in circulation spaces including staircases, where the rapid spread of fire is most likely to prevent occupants from escaping, surface linings are restricted by making provision for them to have low rates of heat release and surface spread of flame.

The wall and/or ceiling linings will satisfy the following classifications given in the ADB, when tested under either the National Classifications, in accordance with BS 476: Part 7 or under the European classifications in accordance with BS EN 13501: Part 1.

Location	National Classification	European Classification
Small rooms of area not more than $30m^2$ in non-residential accommodation	3	D-s3, d2
Other rooms	1	C-s3, d2
Circulation spaces	0	B-s3, d2

Table1: Classification of Surface Linings

The existing surfaces to the building are assumed to be satisfactory.

5 B3 Internal Fire Spread (Structure)

5.1 Requirement B3 (1) Load-bearing Elements

"The building shall be designed and constructed so that, in the event of fire, its stability will be maintained for a reasonable period."

The period of fire resistance required is linked to the purpose group for the building taking into account the height of the top floor, depth of any basement and whether the building is sprinklered or not.

Where any element supports another, the supporting element should possess at least the resistance of the other. In this instance, all load bearing elements of structure, such as the structural frame and floors, would currently require sprinkler protection throughout and a minimum of 120 minutes fire resistance. The existing building is not sprinklered and the fire resistance of the elements of structure are unknown but assumed to meet 2 hours. Whilst it is unlikely that the building would be acceptable under current standards, the requirement for residential buildings with floors more than 30m above ground level to have sprinkler suppression is a relatively recent requirement and would not have been a requirement at the time of the construction and is considered therefore to provide a satisfactory level of safety as an existing structure.

5.1.1 Protected Shafts

Shafts containing stairs and lifts, refuge chutes, risers etc. need to be protected in their entirety if they pass through compartment floors or walls. Table A2 indicates these should be to a 120 minute standard.

Any doors into protected shafts should normally be FD30S self-closing fire doors with smoke seals. This effectively gives the 60 minutes resistance from 30 into the shaft and 30 minutes out. Lift doors need not have smoke seals. Service shafts can either be enclosed as above or fire stopped at floor level. As all the risers appear to be contained within the fire fighting shaft, it is assumed that the level of fire resistance between the shafts and the risers, including the access doors / hatches achieve a 120 minute level of fire resistance or fire stopped to the same level at the penetrations through the floors. It is recommended that the provision of fire resistance is assessed and verified as achieving a satisfactory standard of fire resistance. Whilst the standard of fire resistance for means of escape may be lower than 2 hours, the 2 hour standard would have been expected at the time of construction under local acts and therefore is assumed to be in place.

5.1.2 Areas of Special Fire Hazard

Areas of special fire hazard (plant rooms) located in the basement are separated with construction and doors that will afford a minimum 30 minutes fire resistance.

5.1.3 Fire Stopping Within Concealed Spaces

"The building shall be designed and constructed so that unseen spread of fire and smoke within concealed spaces in its structure and fabric is inhibited."

There are limits to the extent to which any cavities can exist, for example between walls and cladding and between ceilings and roofs. Fire stopping via appropriate cavity barriers are assumed to be in place. These elements are not usually visible without invasive surveying and it is recommended that these elements are assessed within void flats to a level which would provide confidence in whether or not the provision is satisfactory.

6 B4 – External Fire Spread

The requirement of Regulation B4 is that the external walls of the building shall resist the spread of fire over their surface and from one neighbouring building to another.

6.1 General Philosophy

The objective of this requirement is to ensure that there is sufficient separation between buildings to prevent fire spread and to ensure that fire does not spread up the building façade.

6.2 External Wall Construction

The external surface of the building, which is more than 18m, should have a surface classification of Class 0 (national class) or class B-s3, d2 or better (European class). The external surfaces appear to be of concrete and glazed openings in metal frames, which would be satisfactory for the purposes of external fire spread.

6.3 Space Separation

The further apart that one building is from another, the lower the potential for fire spread. When evaluating the potential for fire spread, one would normally use either the distance from a building facade to the site boundary or where appropriate a relevant boundary such as the centreline of a public road.

With residential buildings, the spread of fire between buildings on the same site must be considered.

The Enclosing Rectangles Method (sometimes referred to as the Geometric Method) was used to assess the space separation requirements of the development. This technique in described in the *BRE publication 187, "External Fire Spread: building separation and boundary distances"*

To determine the minimum position of the boundary from the building, the unprotected area of the relevant compartment is projected on to a plane of reference. This unprotected area projection can be enclosed in an 'enclosing rectangle'.

It is both reasonable and recognised to assume that the size of a potential fire will depend upon the level of compartmentation provided within the building. It follows, therefore, that a fire may involve a complete compartment, but should not spread into adjacent compartments. This assumption is also supported in paragraph 14.2 of ADB.

The largest compartment is taken as the worst case scenario. This is the height and length of the building over levels 1 and 2 on the North elevation (elevation where the playgroup extends through to the underside of level 3). As level 3 (walkway) is assumed to be compartmented from the levels below. This gives a total façade rectangle of 22.4 x 5.22m and an enclosing rectangle of 6m x 24m. This gives a distance of 7.0m to allow 100% of the façade to be unprotected. The boundary distances around the building appear to be clear of any building to this distance and would therefore provide satisfactory distance to allow 100% of the façade to the unprotected.

7 Requirement B5 – Access And Facilities For The Fire Service

7.1 Provision Of Fire Mains

The height of the building means that a fire fighting shafts is required for the residential floors and one is provided (as stated in the current fire risk assessment). There should be a dry rising main within the fire fighting shaft and the outlets from fire mains should be sited within the fire fighting stair. The main is located in the lobby approach. This is an existing condition.

7.2 Vehicle Access and Hydrants

There should be access for a pump appliance to within 18m of each fire main inlet connection point. The inlet should be visible from the appliance. This is provided.

Vehicle access routes should meet the requirements of Table 21 in Approved Document B and turning facilities should be provided in any dead-end access route that is more than 20m long. This appears to be provided and is an existing condition.

Hydrants should be available within 90m of the inlet to the dry riser. As a urban area and existing building with many structures, it is assumed that sufficient hydrant supplies are available.

7.3 Fire Fighting Shafts

As the building height is greater than 18m a fire fighting shaft should be provided, which should contain a fire fighting lift. Fire fighting shafts should be located so that every part of every storey (other than fire service access level) is no more than 60m from the fire main outlet measured on a route suitable for laying hose, which is more than achieved. The fire risk assessment describes the provision of a fire fighting shaft and fire fighting / evacuation lifts with dry rising main. Current guidance would be for a wet rising main, as the building is over 50m in height. The provision of a wet main saves time in fire fighting operations due to the increased time for a dry main to be primed by the pumping appliance. The time delay in priming the dry riser is not considered to have an adverse effect on fire fighting operations due to the high levels of compartmentation and fire resistance of the building elements of structure.

7.4 Venting Of Smoke And Heat From Basements

The basement / boiler house level appears to be in excess of 200m² which could require venting of the basement, dependant on the availability of external walls and level of compartmentation within the basement area. Plans of the basement are not currently available. Further comment will be made when these become available. There is no communication between the stair or lifts with the basement area.

8 Conclusions & Recommendations

The existing building as constructed is assumed to meet the standards for fire resistance to the elements of structure and of the requirements for fire fighting facilities, however there are areas of the building design which reduce the level of safety to a level which warrants further investigation. These items have significant consequences in the event of a fire on the means of escape and the potential for breaches in compartmentation.

1. The performance of the smoke ventilation system

2. The separation of the risers and ancillary accommodation entered directly off the fire fighting shaft.

3. Separation of the residential accommodation and non residential accommodation via the central core.