



Co-op Live Operations Manual

OM S06.1 Supplementary Fire Safety Information

Design Principles

(Green Guide Reference 3.15)

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1.0 Fire Safety Design Strategy

The following sections should be read in conjunction with Buro Happold's Fire Safety Strategy Revision P08 dated 26 March 2021 and BH Response to queries raised dated 27.10.23.

The Strategy that has been developed and incorporated into the design, functionality and management of the Co-op Live Arena.

This document should also be read in conjunction with:

OM S01 Operations Manual Overview v1 dated 2.11.23

OM S06 Fire Safety and Contingency Plans for Fire Incidents v1 dated 2.11.23

1.1 Single Seat Fire Design Principle

The basis of design is a single seat of fire with 90 minute compartmentation between zones so for escape, only a single zone is anticipated be affected by fire.

2.0 Fire Safety

2.1 Fire Detection and Alarm

A fully addressable L1 standard protection of life safety fire detection system with an integrated PAVA system, generally complying with the requirements of BS 9999 will be provided in all accommodation.

There are two fire control panels one main on is located in the SCR for use in the Non-Event day Mode, the repeater panel is located in the ECR which is switched to the Event Day mode:

The fire alarm system has been designed with two modes:

- Non-event mode is a fully functional / active system including the Bowl aspirating system and fully automatic AFD system which broadcasts the pre-recorded emergency evacuation message on a 2nd Knock activation.
- Event mode: The Bowl's aspirating system is disabled (due to the risk of being activated by special effects such as pyrotechnics and a 'fire' watch from the ECR. 'Managed' emergency evacuations will be implemented.

Detection in the Arena is based on a double knock system. Upon activation of a first detector, management in the control room will review CCTV footage of the relevant area or contact stewards in the area to confirm a fire scenario and put the alarm system into full alarm initiating a building evacuation. If a second detector or manual call point is activated within the investigation period, this will immediately initiate the full alarm.'

2.2 AFD activations

Activation scenarios	1 st Knock	Second Knock
Smoke detectors In most instances	5 minutes investigation period	Confirmed fire incident
Heat detector	5 minutes investigation period	Confirmed fire incident
Aspirating system (Bowl): Non-event days	Confirmed fire incident	
Aspirating system (Bowl): Event days	➤ Switched to Event Mode in ECR (disabled) ➤ The Bowl is monitored from the ECR's observation window and from internal reports	
Sprinkler control valve alarm		Confirmed fire incident
Manual Call Point	Investigate	Confirmed fire incident
Simultaneous activation of a manual call Point + heat or smoke detector in close proximity, in the same fire compartment.		Confirmed fire incident
Simultaneous activation of 2 x smoke or heat detectors in the same fire compartment		Confirmed fire incident
Simultaneous activation of 1 x smoke and 1 x heat detectors in the same fire compartment		Confirmed fire incident
Simultaneous activation of 2 x manual call points in the same fire compartment.		Confirmed fire incident
Reported fire incident		Confirmed fire incident

2.3 Simultaneous AFD Activations in Multiple Fire Management Zones

If a fire activates the AFD system in a FMZ the cause and effect for this first activation will have initiated i.e. the Investigation Period.

If another activation occurs simultaneously in another FMZ whilst the other is still active both cause and effects will run for each area.

Only a physical reset from the panel will clear fire activation signals, but in doing so it will reset every current event.

Once reset, if one of the AFD activations has not reset for any reason it will re-activate the AFD system and start the cause and effect, Investigation Period, process again.

Co-op Live is advised that the smoke control systems will not operate in more than one area but only in the area of first detector activation.

2.4 Co-op Live Event Day Design Capacity

The following assumptions have been made by the Fire Engineers in determining design means of escape.

Fans:	25,300
Workers:	1,000
Total	26,300

2.5 Fire compartmentation

Fire compartmentation is provided within the public areas- these are considered as a single zone for the purposes of evacuation.

This fire compartmentation enables the smoke control systems to function effectively in only the fire compartment of origin and allows for progressive horizontal evacuation for disabled occupants to safely await evacuation via the fire-fighting lifts or others if available in the non-fire related compartment.

Ninety (90) minute fire compartmentation has been applied to a majority of areas:

- Bowl
- West Atrium
- North Level 1
- East Level 1
- South Level 1
- North Level 2
- South Level
- North Level 3
- East Level 3
- South Level 3

One hundred and twenty (120) minutes fire compartmentation has been applied to fire-fighting shafts, the ECR and SCR.

The ECR and SCR (also the GMF&RS fire control point) can continue operate during a fire incident until the building has been fully evacuated or the fire incident has been brought under control and the immediate risk to Fans and Workers is mitigated.

2.6 Wheelchair Users emergency egress

Adequate number of Refuges, located at all levels in and adjacent to protected stairs and lobbies in the fire compartment not affected by the fire incident, provides a space of : 1.4m x 0.9m per wheelchair user as follows:

Location	Wheelchair users	Companion seats	Additional information
GF	34	34	Direct horizontal access 50% north & 50% south to a Place of safety
L1	110	110	Direct horizontal access to a Place of Safety
L2 West	8	8	Contingency plan: Alternative lifts if available / safe to use
L2 south	5	5	
L2 north	5	5	
L3	8	8	
L3 upper tier	8	8	

2.7 Event Day Emergency Egress Strategy

Managed emergency egress of FOH areas will be undertaken in a majority of GA and Premium areas, subject to management intervention to acknowledge a first (1st) knock of the AFD within the prescribed Investigation Period for the location of the AFD activation.

A managed emergency evacuation of BOH areas does not necessitate the evacuation of FOH areas unless the safety of Fans and /or Workers is being compromised.

2.8 Non-Event Day Emergency Egress Strategy

Simultaneous emergency egress of the whole Arena will be implemented for any 2nd knock activation of the AFD system.

2.9 Investigation Periods for Fire Scenarios

At the time of drafting this Fire Safety Principles document a five (5) minute Investigation Period applies to a majority or areas within the Arena expect for the following areas:

- West Atrium 3 minutes except of a large bar fire on the ground floor under the void which is one (1) minute.
- North L3: 2.5 minutes
- South L3: 2.5 minutes
- East L3: 3 minutes
- Bowl 3 minutes with the exception for a large, fast growing centre stage/monster truck fire which is one and a half (1.5) minutes.

It should be noted that if a first (1st) knock activation of the AFD system is not acknowledged within the IP, the AFD system automatically defaults to a confirmed fire scenario and the pre-recorded emergency evacuation message is broadcast over the public address system.

2.10 Horizontal and vertical means of escape

Fans and Workers should be able to turn their back and walk away from the fire incident:

- Horizontal means of escape in one or two directions, then vertical means of escape from levels above the Level 1.
- Horizontal means of escape from the fire compartment into a protected staircase.
- In the lower part of the Bowl Fans are able to circulate and move around a walkway into adjacent fire compartments. In the upper Bowl although no walkway is provided it is possible to circulate along seat rows.
- The East Bowl seating is self-contained and therefore emergency egress is through the concourse as there are no other alternative option. (This is currently subject to a review by the fire engineers).

2.11 Places of Safety and Relative Safety

- Place of Safety: external areas
- Places of Relative Safety:
 - Fire compartments adjacent to the one affected by the fire incident.
 - 4 vertical protected escape stairs
 - 4 vertical fire-fighting stairs, lifts are provided with wheelchair user refuges (above GF level).

NB: northeast (2S) and southeast (15S) fire-fighting stairs and lifts discharge into the L1 concourse.

Therefore, the sections of the concourse in these areas leading to the final exit doors **MUST** remain completely sterile and void of any fire load i.e. flammable or combustible materials, and activations at all times to enable Fans to evacuate to a Place of Safety, outside, via the concourse.

2.12 Emergency Evacuation Zones

The Arena is to be split into a number of evacuation zones to minimise the impact of a fire in the back of house areas on the overall operation of the building and the number of occupants escaping at one time.

- Public Areas- Bowl, Atrium, Concourses, Clubs
- Basement including performers zone and Record Room
- Loading Bay
- Level 0 SCR / Fire Command Centre
- Level 2 East Staff Area
- Level 4 East Staff Area
- Level 4: ECR
- Roof

2.13 Fire Incidents in BOH areas

A fire alarm activation in BOH areas (Loading Bay, Performers Area, Back of House space at Level 2 and 4) or plant space at L5 may (or may not) initiate an evacuation of these areas following the

Investigation Period that the decision will be taken by the DVM subject to the risk mitigation measures identified in a dynamic risk assessment that may result in the area (or part of) being evacuated.

2.14 Lifts

The four (4) firefighting lifts are proposed for the evacuation of mobility impaired occupants when they not required by GMF&RS.

However, other lifts that are not located in the fire compartment affected by the fire may also be available if they are unaffected by the fire scenario or its cause and effect.

2.15 Emergency Egress Times

The emergency egress time is eight (8) minutes from the furthest seats that Fans' start moving from when they hear the emergency evacuation message to the point they leave the fire compartment into another unaffected by the fire incident (a Place of Relative Safety) or to outside the Arena (Place of Safety) at GF Level or Level 1.

A more onerous 8 minutes time to leave the building or enter a free-flowing protected escape stair has been the basis of the design of the exit widths.

In some specific instances the 8 minutes is exceeded by up to a further 6 minutes. The extended times only applying where occupants are away from the fire compartment i.e. in a Place of Relative Safety and its occupants are expected to continue moving towards the final exit (not expected to stop).

The extended time only applies to:

- A small extension (up to 1 minute) on the Ground Floor where occupants have left the Bowl (compartment of fire origin) and are queuing to leave through the main exit doors in the Atrium.
- A longer extension (up to 6 minutes) on Level 1 where there is a fire on one of the concourses (north, west or south) and Bowl occupants are required to circulate within the Bowl to avoid passing through the rear fire compartment. In this case the occupants will never be within the compartment of fire origin so the risk of panic is low.

2.16 Concourse densities

The concourses can accommodate 100% occupancy at a minimum density of .025m² per person except for the north Bowl seating concourse which can accommodate 97% at 0.33m²/person.

2.17 Sprinkler System

The sprinkler system is a fundamental aspect in maintaining the fire safety within the Arena and justifying the open concessions on concourses. The sprinkler system will function to limit fire growth and spread.

All areas, with the exception of the Bowl but including toilets, GF and L1 bars and Premium areas overlooking the Bowl are sprinkler protected.

Sprinklers typically reduce the growth rate i.e. from medium growth rate (2) to slow (1).

This allowance has not been taken to reflect the highly engineered nature of the arena, extended evacuation time and lack of sprinkler provision in the bowl. The use of sprinklers has been considered elsewhere in the fire strategy by limiting fire size, reducing smoke temperatures and increasing the overall level of fire safety in the building.

2.17.1 Sprinkler Control Valves

- The sprinkler control valves are currently provided within the sprinkler pump room.
- This room is accessible from external air via the loading bay to a protected corridor leading to the sprinkler plant room and separately via the firefighting shaft in the South through to this same protected corridor.
- The loading bay and performers area in the South are both sprinklered and smoke ventilated areas. These routes are considered diverse so this location is considered reasonable. This location has been agreed in principle with the approving authorities including the Greater Manchester Fire and Rescue Service.

2.18 Sprinkler System: Necessary Exceptions

Throughout the building there are plant rooms, etc, which may not be suitable to protect with a water sprinkler system. These have been reviewed on a case by case basis to review contents of space, linings, fire resistance of construction and risk of a fire in the space.

Sprinklers have been omitted from certain plant rooms, as identified in the suppression, detection risk assessment document BRA-BHE-ZZ-ZZ-RP-YD-0007. Construction separating these rooms from sprinklered areas will be a minimum of 60 minutes fire resisting. In some cases, as identified, additional 30 minute fire resisting lobbies have been provided to enhance the protection to public spaces. A sprinkler head will be provided in each of these lobbies.

2.19 UV Filtration System to Kitchen Cooker Hoods

UVC filtration system will be provided into cooker hoods.

This grease filtration system is intended to prevent grease entering the ductwork system and consequently impacting the performance of fire dampers.

The filtration system consists of:

- Grease separators integral to extract canopies;
- Grease coalesce filters integral to extract canopies;
- UV-C filters integral to canopies.

Grease sensors will be located within extract ductwork to monitor any residual grease build up adjacent to dampers.

A two-stage alarm will be linked to these sensors- an initial alarm to indicate cleaning required and if grease continues to build- up then the cooking and extract systems will shut down. The shut down limit will be at a point that dampers can still operate effectively.

The grease filtration UV lamps will also be monitored, with alarms and subsequent shut down if lamps fail and are not replaced. The cooking and extract systems will shut down before the point the performance of the filtration system may suffer.

2.20 Fire Incidents in BOH areas

- A fire alarm activation in BOH areas (Loading Bay, Performers Area, Back of House space at Level 2 and 4) or plant space at L5 initiate an evacuation of these areas following the Investigation Period and the DVM conducting a dynamic risk assessment.
- The evacuation of the whole building will be a management decision.

2.21 L3 Inner Rooms

- No full cooking permitted.
- Means of escape via the rear of the area or (with the exception of the east areas) along the bowl and via adjacent areas.

2.22 Horizontal Means of Escape Distances

These have been calculated in single and more than one direction:

Public concourses: 15.75m & 39.38m

Performance areas: 20m & 50m

Loading Bays & Plant Rooms: 20.7m & 51.8m

Staff areas: 22m & 55m

External Plant area: 60m & 200m

NB: GF extended travel distance of approximately 22m i.e. 2m beyond the recommended 20m

2.23 Overall Escape Times

- 8 minutes for the point that occupants start moving, after hearing an AFD alarm, and leave the fire compartment
- Some instances of an additional 6 minutes in a place of reasonable safety.
- 1 minute extension: on the GF where Fans have left the bowl and queuing to leave through the Atrium main exit doors
- 6 minute extension on L1 where. There is a fire in one of the concourses (north, west or south) and bowl occupants are required to circulate within the bowl to avoid passing through the rear fire compartment of the fire's location.
- An additional 2-4 minutes to clear the escape stairs.

2.24 Wheelchair User Refuges

Located in the 4 fire-fighting comprising:

- Minimum space 900mm x 1400mm do not impede the means of escape routes
- Adequate numbers of refuges provided in each area
- Refuge Points are located in protected stairs or lobbies.
- Final evacuation will be via fire fighting lifts

2.25 Podium

The Podium is designated as a Place of Safety.

It has been calculated that the first Fans will have entered the Podium via the exit doors and will have exited it after 84 seconds.

Between 84 and 205 seconds the number of Fans entering the Podium will be increasing to its maximum capacity.

At its peak the maximum density will be 0.41 m² per person and the flow rate reduced from a maximum flow rate of 1.3 persons / metre/second to 1.20 persons /metre /second.

The calculated time to clear the Podium is approximately 10.9minutes.

(these times can vary and are therefore only indicative)

The evacuation of wheelchair users has not been included in the timings shown therefore, it is likely that the clearance time will be longer as a result of their evacuation from upper levels via the fire-fighting lifts.

3.0 Event Control Room(L4)

The control room at Level 4 is intended for the management and monitoring of events in a non-fire scenario. In a fire scenario a fire alarm repeater panel is available in this room for the early management of a fire and evacuation prior to arrival of the fire service and for subsequent management from the fire control centre at ground floor level. At the request of OVG, 120 minutes fire compartmentation has been provided around this room and access to the room to enable management to remain in place for the duration of evacuation.

Structural support to this room is currently 90 minutes (in line with the fire resistance required for the risk profile). If this protection is also required structurally, this will have an impact on the structural fire protection required to a large portion of elements, reflecting the location on an upper level in the building. The final approach is to be discussed with OVG.

Signage and training will be provided to occupants of this highly managed space to ensure occupants are aware windows should be shut for a fire scenario in the bowl. The implications of windows being left open are also limited. Occupants have a protected route out of the back of the rooms to stairs (within limited travel distances) and the main control room is located on ground floor.

4.0 Emergency Lighting

Emergency escape lighting designed and installed in accordance with BS 5266 Part 1 (26) and with a secondary power supply of 3 hours duration will be provided in the following locations:

- all escape routes (staircases, lobbies, internal corridors, concourses).
- windowless accommodation (i.e. plant rooms, loading bay, store rooms, etc).
- open plan areas more than 60m²,
- externally over final exit doors.

Any areas of the building covered by a licence relating to the consumption of alcohol, will require an enhanced maintained installation (an upgrade in duration from 1 hour to 3 hours and luminaire in which emergency lighting lamps are energized at all times when normal or emergency lighting is required).

- Emergency illumination is provided outside the building and near to each final exit and to enable Fans to leave the immediate surrounds to reach a Place of Safety outside of the Arena.
- As Fans have to travel (leaving the Podium and crossing Sport City Way) this route will form an integral part of the escape route. This will include the routes immediately around site (i.e. Joe Mercer Way, Alan Turing Way, Sport City Way and Forge Lane Bridge) to ensure that occupants can move away safely and prevent any backing up in the building.

4.1 Emergency Escape Signage

the occupants can easily determine their most direct route to a place of safety in the event of an emergency. The system will be designed and installed in accordance with BS 5499: Part 1 (29) and BS ISO 3864 Part 1 (30).

Signs will be located above:

- final exits from the building;
- storey exits;
- changes in direction of the escape route;
- doors from rooms where more than one exit is provided.

Signs are not proposed over the door from rooms where only one exit is provided.

4.2 PAVA System Zones

The system is sub divided into the following zones:

- Staff Zones
- Public Zones
- Artist Zone
- Premium Fan Zones

- Stair Cores
- Bowl

4.3 CCTV System

An extensive CCTV system covers the inside and outside Co-op Live which, amongst other things, is used as a means for the ECR and SCR to continuously monitor for fire (and other crowd safety and security) incidents, particularly in the Bowl where the aspirating system is disabled during Event times, and will be used to investigate reports of fire incidents or any activation of the AFD system

4.4 Secondary Emergency Power Supplies

The following building systems have got a secondary / back up emergency power supply:

- Fire detection and alarm.
- Emergency voice communication systems (in refuges).
- Firefighters/evacuation lifts;
- Fire-fighting shafts (associated equipment and normal lighting);
- Fire-fighting intercommunications installations;
- Emergency lighting;
- Automatic opening doors used for escape;
- Fire and smoke curtains;
- Fire shutters;
- Smoke control systems;
- Automatic opening doors and similar vents used at inlet air for smoke control systems; and,
- Sprinkler installation.

4.5 Generator Support

In the case of a primary power failure and fire event in the building, the generator has been sized to accommodate all life safety systems required.

In addition to the life safety systems, the generator has been sized for the most onerous electrical load to facilitate with one of the below:

- Atrium smoke control +basement smoke clearance
- Bowl smoke control +basement smoke clearance. This is the highest load scenario.
- L3 Concourse smoke control +basement smoke clearance
- Loading bay smoke clearance +basement smoke clearance.

As the design basis is a single fire scenario, this single zone of smoke control extract is appropriate for the life safety phase of evacuation due to the 90 minute compartmentation between zones. For firefighting operations, the potential for compartmentation to be breached has been considered and both smoke clearance systems for the fire service can operate simultaneously. All firefighting shaft ventilation systems will also be available and supported by the generator

4.6 Emergency Communications Systems

- PAVA in the ECR and SCR will be used to broadcast emergency announcements to Fans/Workers.

- Emergency Voice Communications are provided between the fire-fighting stair lobbies and SCR, primarily for the use of GMF&RS, will be utilised to assist with the evacuation of wheelchair users.

4.7 Cause and Effects

- Lifts will be grounded.
- Plant will be shut down.
- Smoke/fire curtains and shutters will be deployed.
- Access Control: electronic door locks on emergency egress routes will be released.
- Open any automatic opening doors or shutters. Specified doors to the atrium and bowl and to external are required to open to provide escape and inlet air for smoke control systems;
- Activate flashing beacons where provided;
- Smoke ventilation and smoke extract system and specific external doors for smoke extract control will be deployed in the location of the fire.
- Held open doors will be released.
- Doors or shutters in the Atrium, Bowl and external areas which are required to facilitate emergency evacuation or provide air inlet for smoke control systems will open automatically.
- Gas supplies will be isolated.
- Air handling units not associated with smoke ventilation / control will be shut down.
- Smoke vents in the four (4) firefighting shafts will be deployed.
- The smoke control systems within the relevant zone of fire detection will be activated;
- Activate smoke curtains

4.8 Smoke Ventilation Systems Within Building

There are a number of smoke ventilation provisions within the building each of which serves a different purpose. The systems discussed in this section are:

- Basement smoke and heat ventilation – fire service smoke clearance system.
- Loading Bay – fire service smoke clearance system.
- Bowl Smoke Control – designed to assist with means of escape.
- Atrium Smoke Control – designed to assist with means of escape.
- Concourse Smoke Control – designed to assist with means of escape.
- Firefighting Cores- Lobby ventilation- designed to assist with firefighting activities
- Where inlet / make up air is required to pass through a door, louvre or other opening that opening will open automatically.

4.9 Fire/Smoke Curtain and Shutter Provisions

Activity	Provisions
Full cook units opening onto concourses or canteens	Fire Shutters are provided
Bars and areas where food is reheated / no full cooking	Fire shutters are not required
Atrium L2: Central bar	➤ Fire and smoke curtains will operate on automatic detection to prevent access from the Bowl. ➤ The curtains will drop to floor level to enclose the bar. ➤ The curtains will drop to 2m above head height for a fire incident in another part of the Atrium
L2 West: Emergency evacuation	Smoke (only) curtains are provided to protect Fans exiting from the Bowl pass close to the east side void as sections of the wall that are not fully glazed to the full storey height require smoke curtains
GF Bars open to the Bowl	Fire and smoke curtains provided with smoke seals to provide 30minute fire protection.

4.10 Locking Mechanisms (BH 6.4)

Where locking mechanisms are provided on doors to maintain security and restrict passage around the building such mechanisms must be easily deactivated in the event of fire when the public or staff wish to pass through them if these are specified escape routes.

Where the mechanism can be released by a simple handle no further action will be required (e.g. exiting a single room fitted with a mechanical code pad where the lock is disengaged by a lever handle or thumb turn- this only applies for occupancies less than 60).

Where the mechanism is electromagnetic, requires a number to be punched into a code pad or the use of a swipe card, override features must be provided to ensure that anyone without the code / swipe card can exit the building.

Locking devices on escape routes should deactivate:

- upon activation of the fire alarm system (confirmed fire);
- upon failure of the power supplies;
- by activation of local manual over-rides (green break glass);
- by activation of a manual call point.

These are the minimum requirements for building regulation compliance.

4.11 Hold-open Fire Doors

Doors will close on:

- On First knock, call point, AFD activation
- Mechanical damage to cables
- Power failure
- Activation of manual overrides (green break glass)

4.12 Automatic Opening Doors

This applies to doors that open in the opposite direction of escape:

- Main doors between the Bowl and Atrium at GF
- Exit doors from the bowl to the loading bay
- Doors from the Atrium to external areas (Places of Safety) at GF level (including exit gates)
- Doors from the Atrium to external (Place of Safety) areas at L1

5.0 GMF&RS Access and Facilities

5.1 Fire Control Centre

The main fire control centre will be accessed from external in the North of Level GF.

Access will be through the staff entrance. From here, access to the remainder of the building is via protected lobby. This room will be used as the main day to day control centre for the building management. The control room for event mode is provided on Level 4 with glazed overview of the bowl, but with the ground floor control room manned throughout. The systems for monitoring the building will be duplicated in both rooms and both will be provided with 2 hour fire resistance. A system for communication between the two rooms will be provided.

The fire control centre will contain the provisions identified in Section 24 BS 9999, 2017, in particular:

A 3 hr non- maintained system of emergency lighting supplied from a source independent of the normal lighting;

All control and indicating equipment for the fire detection and fire alarm and other fire safety systems for the building. This should include a facility to sound the evacuation signal in each evacuation zone throughout the building, with the ability to signal a total GA evacuation. A facility to cancel any automatic sequencing of phases of an evacuation procedure except for the initial phase should be provided;

- Control systems showing the location of the incident and status of all automatic fire protection installations and facilities;
- Override provision associated with all relevant automatic fire protection installations and facilities and air conditioning and ventilation systems (other than those that have to be located locally);

The fire service have advised they do not require override provision to the basement smoke clearance system.

- A communication system providing a direct link between the control room and all fire-fighting lobbies, fire and rescue service access points and refuges;
- Facilities to be able to give information via a public address/voice alarm system in accordance with BS 5839-8 to the occupiers of the building;

- Controls and monitor screens for video cameras that are provided for the control of evacuation;
- The fire emergency plan for the building;
- Floor plans of the building;
- Facilities for the control centre personnel to rest and refresh themselves

The main fire alarm panel will be located in the fire control centre. A repeater panel will be located in the event control room at Level 4.

5.2 Fire fighting access / facilities

- Access around the building and to within 18m of dry riser inlets: North core are accessed at GF level and South core at L1 from the Podium
- Hose laying are generally within 60m of dry riser inlets or access from external. (except the bowl at GF and some small extensions east and west.
- Hydrants are provided around the site in proximity to the GF main entrance points and within proximity to the dry riser inlets

5.3 Pedestrian / Emergency Services Vehicle Conflicts

There is a potential pedestrian/ vehicle conflict on the Level 1 Podium where access to the fire-fighting stairs and lifts is required.

Should the fire service arrive in the early stages of evacuation, management procedures will be required to clear a route for the fire service to pass through.

5.4 GMF&RS Access Points

The GMF&RS access points are provided:

- Into each fire firefighting core (Northwest, Northeast, South East, South West);
- Main entrance Northwest Level GF;
- Loading bay entrance Northeast Level GF;
- Hospitality entrances North Level GF;
- GA entrance Northwest Level 1;
- GA entrance South West;
- Level 1; Concourse doors South;
- Level 1 Lounge doors East Level 1;
- Southeast and Northeast corners L1 if these provide the most direct access to fires.

6.0 Co-op Live and Etihad Evacuation : Fire in Coop Live (4.11.1)

Fire in Co-op Live simultaneously with a post-match egress from Etihad Stadium.

Evacuation of Coop Live withing 20minutes following the end of an event in Etihad Stadium:

- OVG will manage the routes on Joe Mercer Way to prevent occupants from RS entering the section of road west of Coop Live
- Occupants from Coop Live will directed north only on Joe Mercer Way
- All other egress routes would be 'normal'.

6.1 Etihad Stadium Emergency Evacuation (4..11.2)

Co-op Live Fans will be held back to allow Etihad Stadium to be evacuated.

6.2 Charging Points (4.13)

The charging of buggies, security screening arches (in situ) usually away from emergency egress routes and combustible materials / storage.

6.3 Pre-recorded Emergency Announcements Event Days

Currently (November 2023) the strategy is for manual evacuation for all fire scenarios except for those set out below.

Automatic activation of a pre-recorded PAVA message is currently required in the following **critical scenarios**:

- Fire in the West Atrium (any level): If a fire scenario is confirmed in the west Atrium, occupants in the west upper bowl need to pass through the west atrium to escape in a timely manner (before the smoke control system can no longer maintain tenable conditions). In this fire scenario an automatic, pre-recorded escape announcement will be made in public areas instructing occupants to escape. This eliminates the risk of delay as this is a critical scenario.
- Fire in the North Concourse Level 3: If a fire scenario is confirmed in the north concourse L3, occupants in the north upper bowl need to pass through the north concourse to escape in a timely manner (before the smoke control system can no longer maintain tenable conditions). In this fire scenario an automatic, pre-recorded escape announcement will be made in public areas instructing occupants to escape. This eliminates the risk of delay as this is a critical scenario.
- Fire in the East Concourse Level 3 (and connection to L1): If a fire scenario is confirmed in the east concourse L3, occupants in the east upper bowl need to pass through the east concourse to escape in a timely manner (before the smoke control system can no longer maintain tenable conditions). In this fire scenario an automatic, pre-recorded escape announcement will be made in public areas instructing occupants to escape. This eliminates the risk of delay as this is a critical scenario.
- Fire in the South Concourse Level 3: If a fire scenario is confirmed in the south concourse L3, occupants in the south upper bowl need to pass through the south concourse to escape in a timely manner (before the smoke control system can no longer maintain tenable conditions). In this fire scenario an automatic, pre-recorded escape announcement will be made in public areas instructing occupants to escape. This eliminates the risk of delay as this is a critical scenario.

OVG have requested BH review these scenarios and run CFD to determine if these automatic links can be removed (and what the required management response time would be if so). OVG have indicated they require 2-3 minutes from activation of first detector before manual evacuation announcements will be made. This study is currently in progress. The preliminary review was set out in *230824 Evacuation Signal Timing – Cause and Effect*, issued by email on 25/08/23. Results presented on 01/11/23.

6.4 Fan Services GF

The construction of this space does not comply with the relevant British Standards. However, the low occupancy, limited travel distance, in two directions and AFD being provided mitigates the risks.

NB: These staff are expected to be made familiar with the space and have been provided with basic fire-fighting training.

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Co-Op Live CFD and Cause and Effect

October 2023



2 Pieces of Work

1. CFD re-run in the atrium

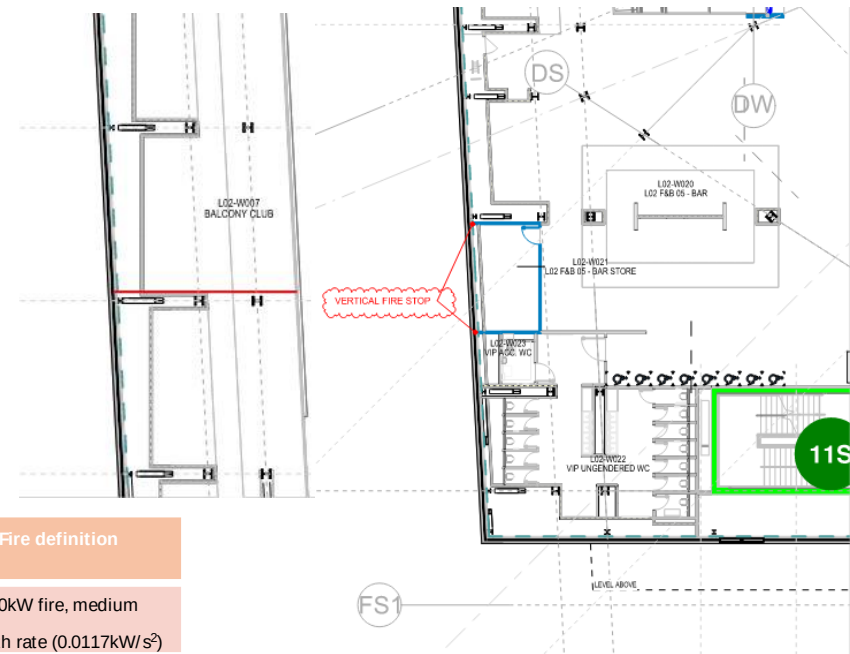
- *Outputs: CFD Input Brief, CFD Results Document*

2. Cause and Effect Review

- To determine required management response time to enable a fully manual evacuation strategy
- Involved reviewing all “time sensitive” areas:
 - West atrium (See 1. CFD re-run)
 - L3 East (CFD run)
 - L3 North and South (reviewed based on East results)
- *Outputs: Design Note Cause and Effect Review*

1. CFD re-run: Changes

- Changes:
 - Layout changes
 - Fire size updates
 - Adjustments after reviewing results



Scenario	Description	Level of Fire	Location of Fire	Original Analysis	Fire definition
FS0A-101	Concession	GF	Atrium- Single Height	N/A	750kW fire, medium growth rate (0.0117kW/s ²)
FS0A-102	Bar	GF	Atrium- Double Height	2.5MW fire, fast growth rate (0.0469kW/ s ²).	3MW fire medium growth rate (0.0117kW/s ²)
FS2A-101	Bar	2	Atrium- North	2MW fire, fast growth rate (0.0469kW/ s ²)	775kW fire, medium growth rate (0.0117kW/s ²)
FS2A-102	Bar	2	Atrium- South	N/A	950kW fire, medium growth rate (0.0117kW/s ²)
FS3A-101	Concession	3	Atrium- Single Height	N/A	600kW fire, medium growth rate (0.0117kW/s ²)
FS3A-102	Bar	3	Atrium Double Height	5MW fire, fast growth rate (0.0469kW/ s ²)	1.1MW fire, medium growth rate (0.0117kW/s ²)

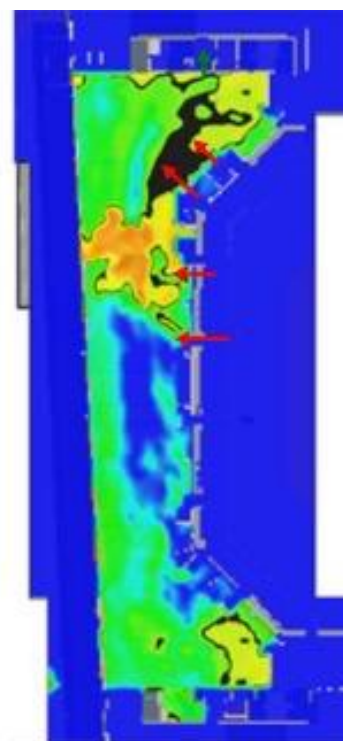
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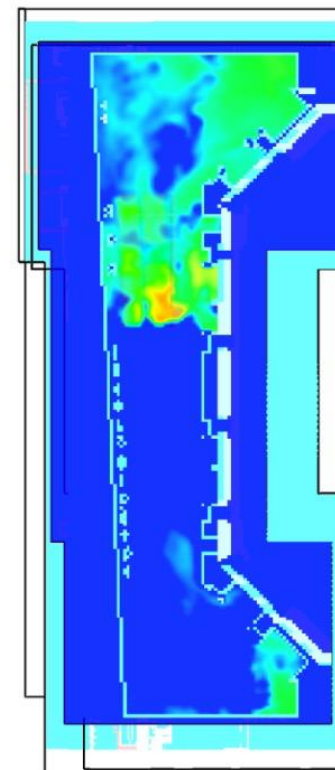
3

1. CFD Re-Run: Results

- **Level 2**
 - Results similar, minor improvements (not enough to support requested cause and effect changes).
- **Level 3**
 - Results similar, improvements in some areas and reduced time in other areas. (see right)
- **Re-ran level 2 with a new curtain strategy:** Results significantly improved.
- **Conclusion:**
 - **CFD still supports existing strategy.**
 - **CFD helps support Cause and Effect changes.**



Original GF Fire at
L3 630s



Updated GF Fire
at L3 620s

2. Cause and Effect Review

- Reviewing means of escape in “time sensitive” areas to determine the required **Management Response Time** if the automatic alarm scenarios are removed for a fire in:
 - West Atrium
 - L3 North
 - L3 East
 - L3 South

Summary of Terms

E: ASET (Available Safe Egress Time)

A:
Detection
Time 30s

B:
Management
Response
Time
Calculated.
 $E/1.2) - A - C$

C: Travel/Escape
Time

D: Factor of Safety set at
20% of $A+B+C$

$A+B+C$: RSET (Required Safe Egress Time)

Existing Strategy: Non-Time Sensitive areas

Event Day Scenario	Actions on first knock (first detector, manual call point activation)	Actions on second knock	OVG Management Actions	At end of investigation period
Existing Fire Strategy- Detector activates in any “non-time sensitive” area	First alert to control room. Investigation period is triggered 5 minutes	Smoke control systems activate, dampers close, relevant curtains/shutters drop, doors power open to provide inlet air. Second alert to control room.	Start investigating fire upon first detector activation. Either: Manually intervene and start evacuation as required. This will not happen automatically on second knock. Or: Dismiss alert as false alarm and reset system.	If alert is not acknowledged/ dismissed within investigation period, evacuation announcement triggered automatically

Existing Strategy: Time Sensitive areas

Event Day Scenario	Actions on first knock (first detector, manual call point activation)	Actions on second knock	OVG Management Actions	At end of investigation period
Existing Fire Strategy- detector activates in "time sensitive" area	First alert to control room. Investigation period is triggered 5 minutes	Smoke control systems activate, dampers close, relevant curtains/shutters drop, doors power open to provide inlet air. Second alert to control room. Automatic pre-recorded announcement made to relevant people to evacuate	Start investigating fire upon first detector activation. Either: Manually intervene and start evacuation as required if second knock has not yet activated. Evacuation announcement will be triggered automatically on second knock. Or: Dismiss alert as false alarm and reset system.	If there is no second knock and the first knock alert is not acknowledged/ dismissed within investigation period, evacuation announcement triggered automatically

Proposed Approach: All areas

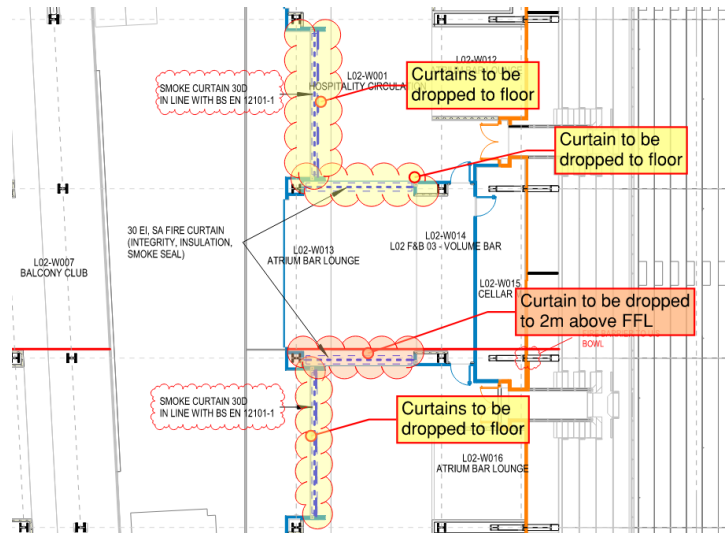
Event Day Scenario	Actions on first knock (first detector, manual call point activation)	Actions on second knock	OVG Management Actions	At end of investigation period
Proposed Approach-throughout	First alert to control room. Investigation period is triggered 5 minutes	Smoke control systems activate, dampers close, relevant curtains/shutters drop, doors power open to provide inlet air. Second alert to control room.	Start investigating fire upon first detector activation. Ether: Manually intervene and start evacuation as required. This will not happen automatically on second knock. Ensure public announcement is underway within required management response time (1-5 minutes) of first knock in fire scenario where evacuation will be required. Or: Dismiss alert as false alarm and reset system.	If alert is not acknowledged/ dismissed within investigation period, evacuation announcement triggered automatically

2. Cause and Effect: CFD Conclusions

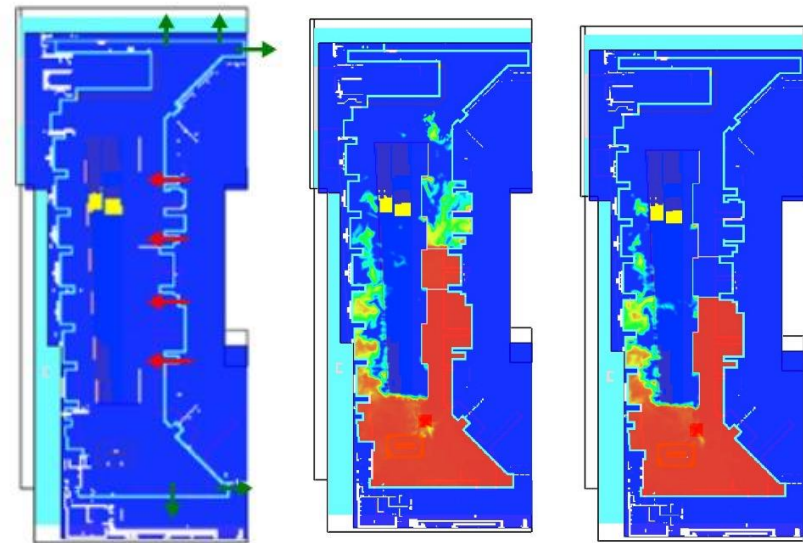
- Indicate that the existing evacuation strategy would still be suitable if desired (automatic link for atrium fire)
- We have made a change to try to facilitate the longer management response time and manual evacuation
 - Drop a curtain on L2 to floor- previously advised to drop curtain to 2m above floor level to allow evacuation underneath
 - Details on next slide
- With this change, all worst scenarios work with at least 3 minute management response time except for one. This scenario will need to be managed if manual evacuation is adopted.

Full Drop Curtain

- Benefits: allows the full requested management response time on L2
- Disadvantages: additional situation for stewards to manage- move people to other exits in bowl if exits are blocked by smoke.



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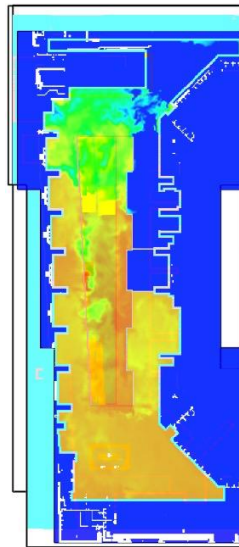


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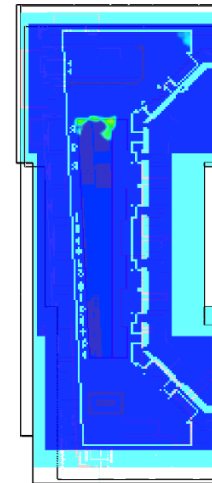
11

CFD results on Cause and Effect

L2, worst case fire, 3 minute Management Response Time



L3, typical worst case fire, 3 minute Management Response Time



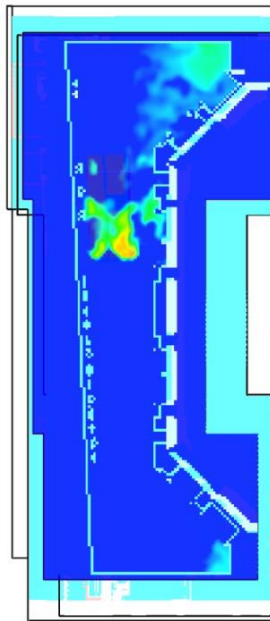
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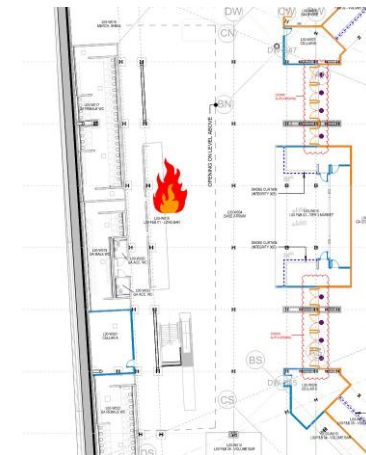
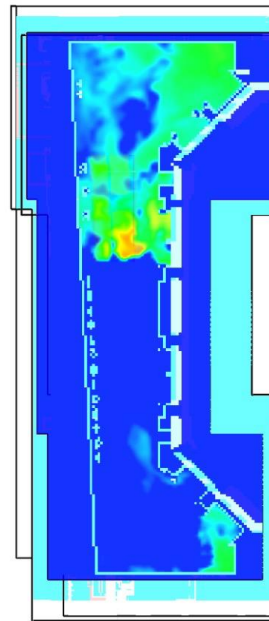
Level 3- Ground Floor Bar Fire

60s Management Response Time
Results at end of evacuation



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120s Management Response Time
Results at end of evacuation
(Want to avoid this scenario)



Note: This is a severe fire so management would become aware quickly and it will be clear that evacuation is required.

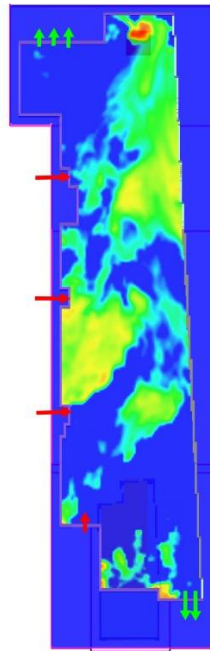
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Level 3 East Results

L3 East, 3 minute Management Response Time

Still to extract: time that first bowl exits
are discounted. Could require reduced
Management Response Time of 30-120
seconds



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Summary

Fire Location	Allowable Management Response Time	Exceptions	Changes Required
West Atrium	3 minutes	60s for large bar fire on GF under void	Curtain north of bar to full drop
North L3	2.5 minutes		
South L3	2.5 minutes		
East L3	3 minutes	TBC	Ensure doors at ground floor are opened for inlet when east bowl is occupied.
Bowl	3 minutes	90 seconds for large, fast growing central stage/monster truck fire	
All other areas	Acknowledge alert and take appropriate action within 5 minutes		

Conclusions

- Can accommodate increased management response time and manual approach if the following are adopted:
 - Specific scenarios have **reduced management response time**: Large stage/monster truck fire, ground floor long bar under double height space, potentially L3 East (TBC when slice is available)
 - Recommend **linking** video monitoring with fire alarm to provide automatic visuals of detection zone
 - Curtain **programming to be changed** to full drop
 - Stewards will need to understand strategy for their area

SD: Smoke detector
HD Heat detector
MCP: manual call point
SCV: Sprinkler control valve

1. As a general principle should evacuating a FMZ or the whole of the Arena in the event of an isolated fire incident that (a) has been contained and extinguished by the Fire & Safety Team or (b) extinguished by the activation of a SCV?

'Detection in the arena is based on a double knock system. Upon activation of a first detector, management in the control room will review CCTV footage of the relevant area or contact stewards in the area to confirm a fire scenario and put the alarm system into full alarm initiating a building evacuation. If a second detector or manual call point is activated within the investigation period, this will immediately initiate the full alarm.'

Does a fire incident in a BOH area, separated by fire compartmentation, require the evacuation of FOH areas.... The BH report states that it is a management decision?

2. The AFD system is configured for only one fire scenario / activation:

What happens:

If a simultaneous activation the AFD system occurs in another FMZ?

If there is a contained fire incident in one FMZ that doesn't warrant evacuating the Arena, how id the AFD reset?

3. Smoke / heat detectors / manual call points: the report states that a second knock occurs on activation of a second device..... it is not clear that whether this the second device is anywhere else in the FMZ, which appear to be quite large, or in close proximity which would be more appropriate as it demonstrates that a fire is developing
4. The evacuation / evacuation time is premised on the fact that there has been no activation of the sprinkler system. If there was a fire, will the sprinkler zone alarm will be treated as confirmed fire.
5. The cause and effect of the AFD Event mode is not clear. Apart from disabling the Bowl aspirating system what other systems are also disabled PAVA etc.?

Is the management of a AFD activation completely managed i.e. there are no automatically generated messages?

6. Would the activation of a MCP be treated as a second knock requiring immediate evacuation of the area affected immediately cancelling the investigation period and the actions of the Fire Safety Team that may have contained it?
7. The time line between an AFD activation leading to an evacuation would benefit the evacuation plan as it will identify the sequence of events.
8. There are a number of doors that are automatically opened on activation of the AFD system prior to an evacuation for a fire... is there a manual override in the event of an evacuation for other reasons or for normal egress.

9. The BH Fire safety report (3.3) states the Safe egress time is 8 minutes *‘from the point that occupants start moving when they hear the alarm to the point that occupants leave the fire compartment’*

It also states: *8 minutes to leave the building or enter a free flowing protected escape stair. Some specific instances this is exceeded by 6 minutes where occupants are located away from the fire compartment. (agreed with Building Control)*

Is the 8 minutes taken from the furthest seat?
Which one is correct?

10. BH s4.6.4.. has a communication system between the wheelchair user refuges and the bottom of the stairs been installed?
11. BH 6.10: Are the *‘UVC filtration system to cooker hoods as presented by ME Engineers (Design Note 39 referenced in Table 2-2)’* being provided?
12. Are the GMF&RS access points provided:
- Into each fire firefighting core (Northwest, Northeast, South East, South West);
 - Main entrance Northwest Level GF;
 - Loading bay entrance Northeast Level GF;
 - Hospitality entrances North Level GF;
 - GA entrance Northwest Level 1;
 - GA entrance South West
 - Level 1; Concourse doors South
 - Level 1 Lounge doors East Level 1.