



tenos

▀ Civic Halls
Wolverhampton

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Stage 3 Fire Strategy Report

for:
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In preparing this fire strategy report it has been assumed that all aspects of the design and construction will, unless stated otherwise in this report, be in accordance with the recommendations of Approved Document B, applicable British Standards and codes of practice.

This report relates only to statutory requirements when the building is completed. Additional fire safety measures may be appropriate during construction or for insurance, loss prevention or environmental protection purposes.

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This report relates to a project that is subject to third party approval. It must be ensured that the contents of this report are agreed with all relevant approval bodies prior to implementation.

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1 Introduction

- 1.1 This report presents the fire safety strategy for the Wolverhampton Civic Halls refurbishment project.
- 1.2 The strategy sets out the measures that are proposed to satisfy the functional requirements of the Building Regulations 2010^{12.1}.
- 1.3 This strategy does not in itself demonstrate compliance with the Regulatory Reform (Fire Safety) Order 2005^{12.2}. To comply with the requirements of the Order a preliminary fire risk assessment should be undertaken prior to occupation. This should be updated after occupation to identify any additional risks that may have been introduced. Subject to a suitable and sufficient fire risk assessment, additional physical fire safety measures should not be required unless high hazard materials or processes are introduced.
- 1.4 Legislation is concerned only with protecting the health and safety of people in and around a building and is not specifically intended to provide protection against damage or consequent financial losses. Whilst measures for life safety will often provide an element of property protection, it is recommended that consideration be given to a separate study regarding the limitation of direct and indirect losses that could occur as a result of fire damage.
- 1.5 The fire strategy report is a statement of why the building needs to be safe from fire and how that safety will be achieved. It sets out the scope of the fire safety considerations and the design objectives, which in this instance are driven by a statutory obligation to protect people in and around the building. It explains the combination of measures that will provide this protection, in other words the assumed fire safety management arrangements and the physical fire precautions (such as means of escape and protection systems). These have been determined through reference to codes and guidance documents, consideration of risk (i.e. hazards and consequences) and review of the building's performance requirements (i.e. what it needs to do and look like). The fire strategy report substantiates the preferred approach and in so doing provides the basis for its approval.
- 1.6 The fire strategy report is not a system design document, nor a detailed design specification. It is a statement of intent that signposts the fire protection measures (e.g. escape stairs) and their associated performance requirements (e.g. 30 minutes fire resistance). Detailed design (e.g. material and product specifications, fire alarm system, etc.) and implementation of the strategy rests with the relevant design disciplines (e.g. architect, structural engineer, mechanical and electrical engineer, etc.) and, ultimately the building user. Reference should be made to Approved Document B^{12.3}, applicable British Standards and other guidance in relation to all specifications and system design. Any query regarding the intent, recommendations or interpretation of the fire strategy should be referred to Tenos.
- 1.7 This review has been developed based on the drawings and other design information listed in Annex A1.

2 Brief description of the proposals

2.1 The Wolverhampton Civic Halls is a Grade II listed public building. It is an entertainment complex which consists of the Civic Hall and Wulfrun Hall. It currently hosts a variety of exhibition, conference and live performance events (including live music and sporting events).

2.2 The current layout of the building is as follows:

	Civic Hall	Wulfrun Hall
Level 3	Projector room & roof	-
Level 2	Gallery, bar and dressing rooms	-
Level 1	Dressing rooms and bar	-
Level 0	Stalls seating and entrance	Function room and chair store
Level -1 (B1)	Plant	Stalls seating and bar
Level -2 (B2)	-	WCs and dressing rooms

2.3 The building will undergo refurbishment and extension significantly increasing the spectator capacity by approximately 500 people.

2.4 Following the works, the building will have overall dimensions of approximately 92m by 42m and a footprint area of approximately 3,000m².

2.5 We understand that new structure (supporting the new gallery levels, see below) is proposed to be independent from existing elements of structure and, additionally, that the existing concrete floor/roof construction will be replaced with lightweight structure.

2.6 The existing building is generally of masonry construction and the new external elements proposed include curtain walling comprising a cast glass channel system.

2.7 The refurbished building will be used as a public building and will be classified in Purpose Group 5 (Assembly and recreation) as defined in Appendix D of Approved Document B^{12.3}.

2.8 The building appears to be located on an island site with vehicular access available to four sides.

2.9 The proposed works as specific to Civic and Wulfrun Hall are described below. The schematic plan and section of this building on the completion of the works are illustrated in Figure 1 and 2.

Civic Hall

2.10 Civic Hall currently comprises a ground floor viewing area (stalls seating) and gallery viewing area (circle seating) above. The proposals at Level 3 include a new viewing gallery and a new bar area.

2.11 The refurbishment works are extensive and include altering the layouts of the existing seating in the stalls and the lower gallery.

2.12 The building is located on a sloping site. The height of Level 3 from the adjacent external ground is between 9.3m at the east of the building and 11.8m at the west of the building.

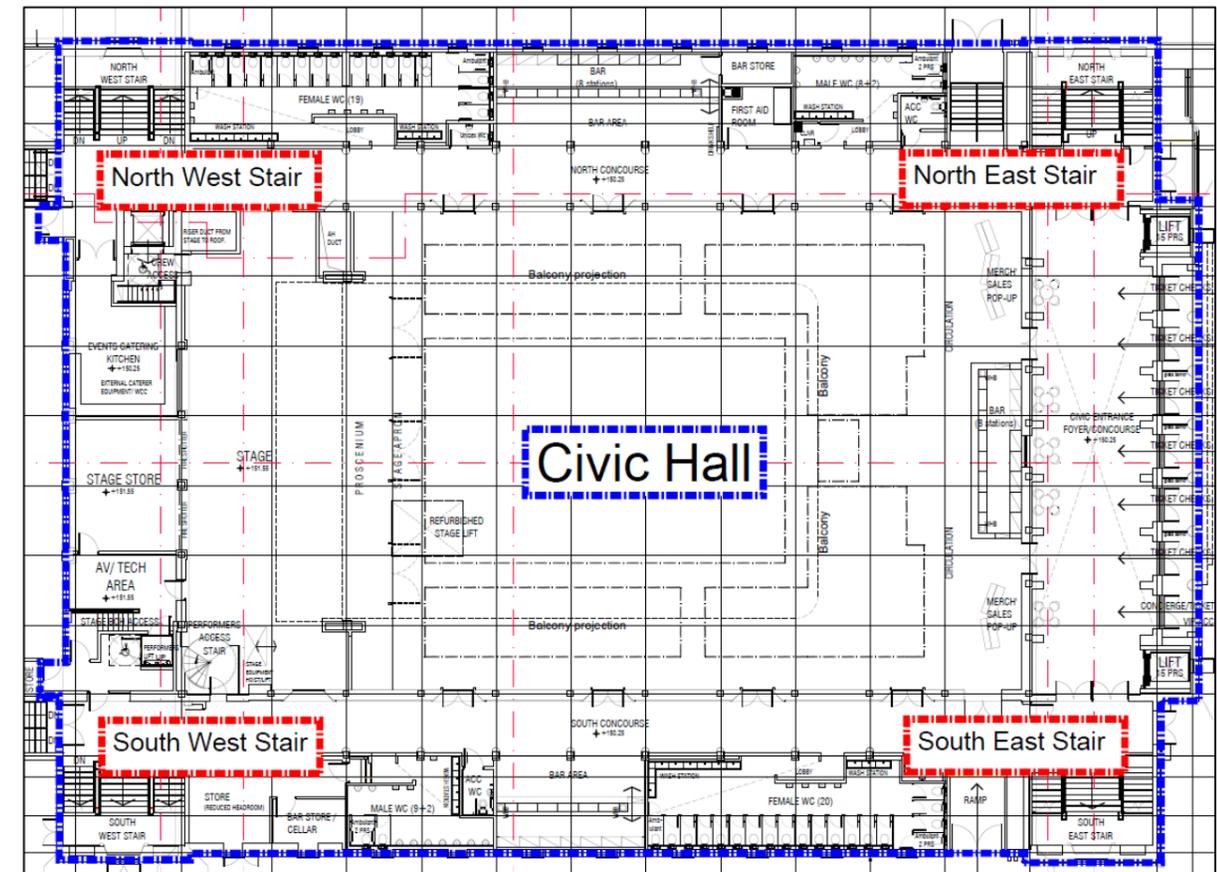


Figure 2.1: Schematic plan of the proposed ground floor (Civic Hall)

Wulfrun Hall

2.13 Wulfrun hall currently consists of a basement level and ground level.

2.14 The entrance will be extended to provide a VIP entrance and accessible entrance.

2.15 At Level 2 a new seating tier is proposed together with a bar area and sanitary facilities.

2.16 The refurbishment works are extensive and include altering the layouts of the existing seating in the stalls.

2.17 The height of the Level 2 seating tier from the ground floor level will be circa 8.7m.

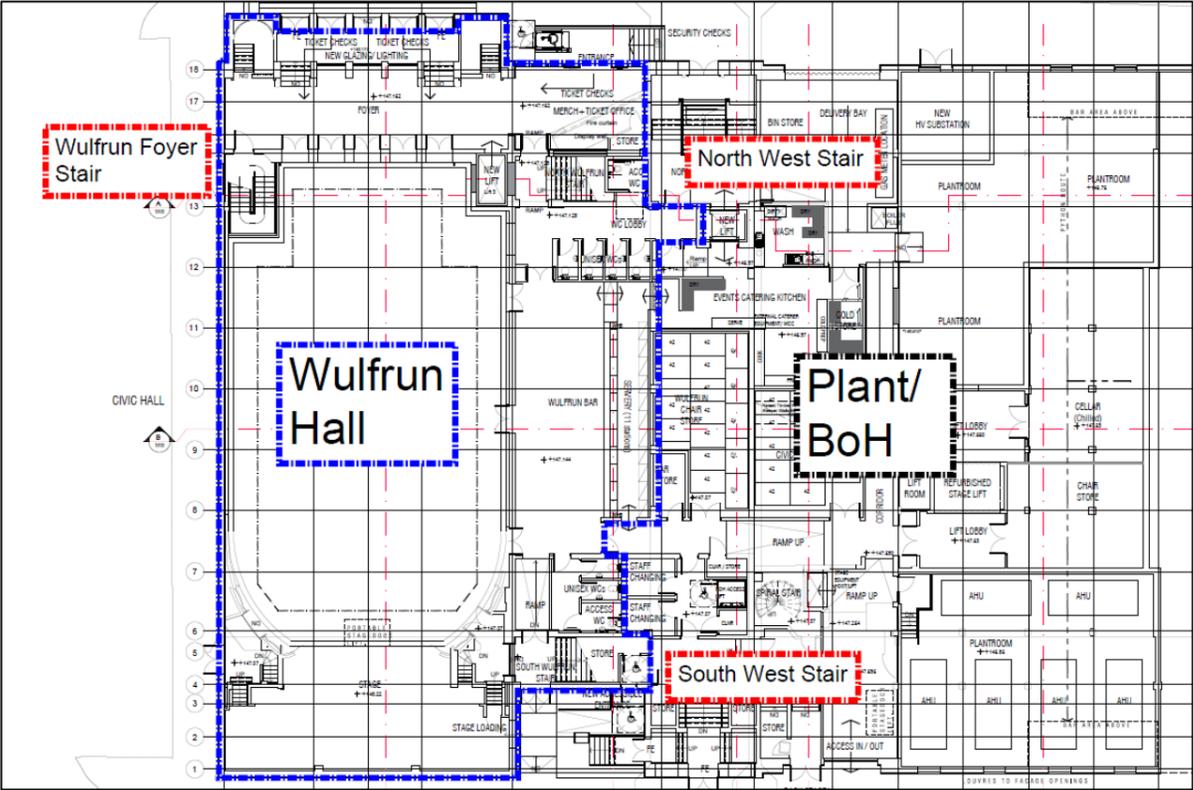


Figure 2.2: Schematic plan of the proposed lower ground floor (Wulfrun Hall)

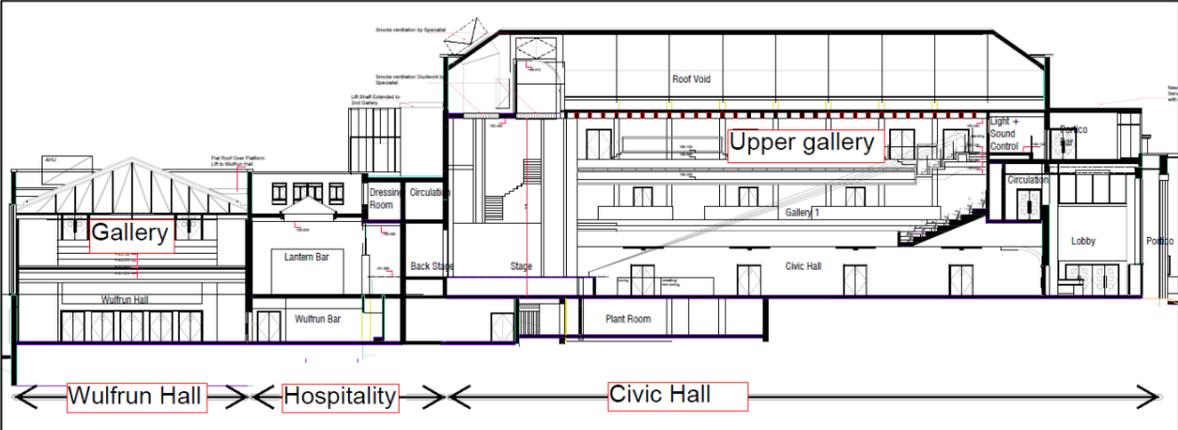


Figure 2.3: Schematic section of the Halls showing the proposed new tier at Level 3 in the Civic Hall

3 Statutory requirements

Building Regulations

Part B – Fire safety

- 3.1 The building will be subject to the provisions of the Building Regulations 2010, which are the primary basis for statutory control of building design in England and Wales.
- 3.2 For fire safety, the functional requirements of the Building Regulations are set out under the following headings:
- Requirement B1 - Means of warning and escape
 - Requirement B2 - Internal fire spread (linings)
 - Requirement B3 - Internal fire spread (structure)
 - Requirement B4 - External fire spread
 - Requirement B5 - Access and facilities for the fire service.
- 3.3 For ease of reference this report addresses each of these requirements in order.

Alterations to existing buildings

- 3.4 When the work comprises a material alteration (e.g. extension) to an existing building, Regulation 4(3), requires only that after completion of the works the building should be no more unsatisfactory in relation to a requirement than before the work was carried out.

Standard guidance

- 3.5 Guidance on compliance with the requirements of Part B of the Building Regulations is presented in Approved Document B^{12.3} (ADB). In some cases this guidance is replaced or supplemented by reference to other standards, such as the BS 5588 series of documents (e.g. BS 5588-6^{12.22} for places of assembly).
- 3.6 However, there is no obligation to adopt the recommendations given in ADB, or other guidance documents, if the functional requirements of Part B of the Building Regulations are met in some other way.

Regulatory Reform (Fire Safety) Order

- 3.7 Responsibility for compliance with the Regulatory Reform (Fire Safety) Order 2005 (FSO) will rest with the “responsible person”. In a workplace this will usually be the employer together with persons who may have control of other parts of the premises. In other cases, the person(s) who has control of the premises will be the “responsible person”.
- 3.8 The Fire Safety Order places specific duties on the “responsible person” such as carrying out a risk assessment and providing first-aid firefighting equipment. The main requirements of the Order are outlined in section 10 of this report and more detailed guidance is available in a series of Fire Safety Risk Assessment Guides published by H M Government^{12.7}.
- 3.9 Where building work and fire protection measures comply with Part B of the current Building Regulations and a suitable and sufficient fire risk assessment has been undertaken, additional physical measures should not normally be required under the FSO unless high-hazard materials or processes are introduced into the building.

- 3.10 Where provisions in existing buildings do not meet the functional requirements of Part B of recent Building Regulations, then notwithstanding compliance with Regulation 4(3) of the Building Regulations, the fire risk assessment may identify a need for additional physical fire safety measures.

Licensing Act 2003

- 3.11 The building is, and will be, used for the consumption or sale by retail of alcohol, the provision of entertainment and the provision of late-night refreshment and will be subject to the provisions of the Licensing Act 2003. It will therefore be necessary for the occupier to make an application to the local authority for a licence.
- 3.12 Where the provisions of the FSO are met, no additional fire safety measures would typically be placed on the premises by the Local Authority under the remit of the Licensing Act 2003. However, this should be confirmed with the licensing body (see also below).

Open stage – performance and set restrictions

- 3.13 Clause 13.1 in Section 5 of BS 5588-6 (Code of practice for places of assembly) states:
- Where the stage does not have a safety curtain, the licensing authority may limit the amount and type of scenery used. If there is no safety curtain, the need for higher standards of flame retarding may limit the materials used for the construction of scenery and may materially increase running costs whilst limiting the types of use: for example touring productions intended for separated stages may not be permitted.*

...the licensing conditions of the relevant authority should be consulted.

- 3.14 It should be confirmed whether a safety curtain and associated stage smoke ventilation is provided.
- 3.15 If not, the Local Authority acting in its capacity as the licensing body, may impose restrictions on the types of performance, set design, etc. permitted on the stage, in accordance with its local licensing procedures.
- 3.16 Guidance in this regard can be found in the Fire Safety Risk Assessment Guides published by HM Government, and in *Guide to Fire Precautions in Existing Places of Entertainment and Like Premises* (the ‘Primrose Guide’) published for the Home Office, as referenced by BS 5588-6.

Listed buildings

- 3.17 It is not permissible to carry out works affecting the special character of a listed building without consent from the Local Authorities.
- 3.18 Where there is a conflict between required fire safety precautions and English Heritage requirements a balance will need to be struck that satisfies the relevant requirements of the legislation.
- 3.19 The building’s listing does not take precedence over the life safety of its occupants, but the design fire strategy will need to be developed to accommodate the listed and retained features of the building wherever it is safe and practicable to do so.

Loss prevention

- 3.20 Legislation is concerned only with protecting the health and safety of people in and around a building and is not specifically intended to provide protection against damage or consequent financial losses. Whilst measures for life safety will often provide an element of property protection, it is recommended that consideration be given to a separate study regarding the limitation of direct and indirect losses that could occur as a result of fire damage.

4 Variations from standard guidance

4.1 Table 4.1 sets out the main non-compliances with standard guidance, e.g. ADB and BS 5588-6.

Table 4.1: Non-compliances with standard guidance

Item	Conflict with guidance	Comments
B1 Means of warning and escape		
Escape width (area, storey and final exits)	Means of escape routes will not be wide enough for the numbers of people expected to use them.	<p><u>Civic Hall</u> Existing final exits are sufficient for seated use of the Civic Hall. However, discounting escape via the main entrance lobby and for standing use – i.e. 2,233 people + staff – there is a shortfall of 783 people. We have undertaken an assessment using an alternative design code (BS 9999), see section 5.43 et seq.</p> <p>The final exits from the protected stairs are not as wide as the stair leading to them. In some cases, this is an existing issue which is made worse by the additional people discharging from the proposed Wulfrun and Civic Hall galleries.</p>
		<p><u>Wulfrun Hall</u> Existing final exits are sufficient for seated use of the Wulfrun Hall. However, discounting escape via the main entrance lobby and for standing use – i.e. 1140 people + staff – there is a shortfall of 414 people. We have undertaken an assessment using an alternative design code (BS 9999), see section 5.43 et seq.</p> <p>At Level 2, storey exits should be increased to at least 1050mm wide to provide capacity for at least 220 people.</p>
		<p><u>Lantern Bar</u> The existing lantern bar appears to be provided with insufficient escape capacity for the theoretical maximum occupancy.</p>
Travel distance	The dead-end travel distance limits recommended in ADB and BS 5588-6 are exceeded in the plant areas.	In some cases, this is an existing issue. The travel distances will either be subject to a specific risk assessment (e.g. for rooms containing only air handling plant) or alternative routes will be provided (e.g. for boiler rooms).

Item	Conflict with guidance	Comments
Escape through ancillary areas	Ancillary accommodation forms part of the only means of escape for the public.	<p>The means of escape from the new tier seating in Wulfrun Hall should be made possible directly into Stair 3 without needing to access the bar at this level.</p> <p>The ancillary area should be enclosed in fire resisting construction such that the routes are separated from each other and one always remains available.</p>
Stair escape route through foyer	Foyer areas used as escape routes contain accommodation that is not low-risk (i.e. should be limited to sanitary accommodation and cupboards enclosed in construction).	The high-risk areas (e.g. merch sales and bars) should be separated from the escape routes from the public areas as discounting all exits from stairs which pass through these areas would create a shortfall in exit capacity.
	The Civic and Wulfrun Hall will have escape routes through the same foyer, but the stairs will not be provided with lobby protection.	In the event of a fire in the foyer the proposed fire and smoke curtain will deploy and thereby separate the stairs.
B4 External fire spread		
Unprotected areas in external walls	Large areas of glazing are proposed which exceed the limitations of statutory guidance in their extent.	<p>The existing non-compliances in respect of unprotected areas will be reduced by enclosing the existing Level 2 bar areas in fire resisting construction (60 minutes).</p> <p>On this basis the proposed unprotected area will comply with the guidance in BR 187.</p>
B5 Fire service facilities		
Firefighting shafts	The proposed Civic Hall tier increases the area of the storey over 7.5m above fire service access level to greater than 900m ² . Firefighting shafts are not proposed.	<p>Complying with ADB would require at least 2no. firefighting shafts to be provided.</p> <p>However, the proposals marginally exceed the qualifying criteria and, subject to agreement with the fire and rescue service, firefighting shafts may not be required.</p>

5 Means of warning and escape

Evacuation strategy

- 5.1 We have assumed that the evacuation strategy is simultaneous on activation of the fire alarm.

Fire alarm and detection systems

Alarm

- 5.2 The electrical fire alarm system will be extended in to the new areas.
- 5.3 We understand that an existing Public Address Voice Alarm (PAVA) system is provided.
- 5.4 The extended system should therefore be in accordance with BS 5839-8^{12.10} incorporating sufficient speakers/sounders to be clearly audible and intelligible throughout the building. Flashing beacons will also be provided in areas where people with hearing impairment may be in relative isolation (e.g. toilets and dressing rooms) or where ambient noise levels are high (>90dbA).
- 5.5 In music venues where the sound pressure level of background noise is likely to be greater than 80dB(A), Clause 16.2 of BS 5839-1 recommends that the music system should be muted automatically on broadcast of the fire alarm signal. The fire alarm and response time is of critical importance in public buildings holding large numbers of people, and hence the fire alarm system shall be interfaced with the music/public address system (in accordance with BS 5839-1) as part of the works.
- 5.6 In new and remodelled areas, manual call points in accordance with BS EN 54-11^{12.12} will be provided adjacent to storey and final exits. Manual call points will be provided in suitable locations (or with suitable controls, such as key actuation) to prevent malicious or accidental operation from the public common areas. The operation of call points can be managed using CCTV monitoring and staff positioned at each level during an event to ensure that there is adequate surveillance of the entire premises in accordance with the recommendations of BS 5839-1^{12.9}.
- 5.7 **Design team note: To be reviewed with the operator.**

Detection

- 5.8 Automatic fire detection systems are not normally needed to comply with the recommendations of ADB for assembly and recreation premises.
- 5.9 However, an automatic fire detection system is provided in the building. We recommend that this is extended such that category L1 detector coverage (i.e. all areas) is provided as part of the refurbishment in accordance with the recommendations of BS 5839-1^{12.9}. Automatic detection is, in our view, necessary to assist in compensating for a number of design features, namely:
- ▶ inner rooms;
 - ▶ to alert staff and occupants of a fire in the neighbouring hall in the event that it is not occupied as the proposals include for the Civic and Wulfrun Halls sharing common escape routes (the North West Stair for instance); and
 - ▶ a shortfall in escape capacity (see *Design of horizontal escape routes* below).
- 5.10 The system will be of the analogue addressable type and the main panels will be installed at the main entrance to each building (i.e. the foyer to Civic and Wulfrun Hall).
- 5.11 The system will generally utilise optical smoke detectors but heat detectors will be installed where there is a potential for steam or fumes, etc., to give rise to unwanted alarms (e.g. in kitchens and bathrooms).

Cause and effects

- 5.12 The refurbished building will adopt a simultaneous evacuation strategy and we understand that a staged alarm is envisaged which incorporates an investigation period and this is to be agreed with the operator.
- 5.13 **Design team note: fire alarm cause and effect to be agreed with the operator.**

Occupant numbers

- 5.14 For the purposes of means of escape design, the maximum number of occupants in the refurbished building has been assessed on the basis of the following floor space factors:

Table 5.1: Occupant floor space factors

Use	Floor space factor (m ² /person)	Comment
General and non-public areas		
WC's and circulation areas	nil	
Bar areas (within 2m of serving point)	0.3	Standing spectator areas are dealt with below.
Bars without fixed seating	0.5	
Bar with seating	1.0	
Touring party, artist and venue guest lists and other staff	308 pers	This is based upon an email from City of Wolverhampton Council dated 22 January 2019 describing the event related occupancies.
Offices, tech and control rooms	6.0	
Storage & plant	30.0	
Civic Hall		
Auditorium with fixed seating	Stalls: 1561 Lower Gallery: 553 Upper Gallery: 322 2,436 in total	Based on the tabulated data in Space and Place drawings 3692-(20)-014 Rev. P04 and an email from City of Wolverhampton Council dated 08 February 2019 describing the standing occupancies.
Auditorium without fixed seating	Stalls: 2233 Lower Gallery: 737 Upper Gallery: 322 3,292 in total	These figures do not include staff.
Wulfrun Hall		
Auditorium with fixed seating	Stalls: 628 Gallery: 120 748 in total	Based on the tabulated data in Space and Place drawings 3692-(20)-015 Rev. P02 and an email from City of Wolverhampton Council dated 08 February 2019 describing the standing occupancies.
Auditorium without fixed seating	Stalls: 1140 Gallery: 120 1,260 in total	These figures do not include staff.

Bar areas

- 5.15 The means of escape assessment has been based on the assumption that the occupancy of the bar/ foyer areas and the auditoria is coincident – i.e. the two distinct areas will not be fully occupied simultaneously. Therefore, the population of the bar/foyer areas has been considered separately from the occupancy of the auditorium for the purposes of determining the required aggregate escape capacity.

Standing capacity (stalls)

- 5.16 The Civic Hall and Wulfrun Hall operates as standing spectator areas which will accommodate up to 2233 spectators plus staff (70 approximately) and 1140 spectators plus staff (27 approximately) respectively. Note that where there is a difference between the stated occupancy figures the greater has been adopted.
- 5.17 **Design team note: the occupancy of the Civic Hall for standing events is likely (including staff) to exceed a density of 0.3m² per person and therefore may need further consideration for reasons other than fire safety.**

Back of house and back stage

- 5.18 For the purposes of developing the fire safety strategy we have assumed a peak backstage occupancy of 308 people based on the information provided by City of Wolverhampton Council.
- 5.19 **Design team note: This should be reviewed with the operator as being consistent with their normal operational procedures.**

Overall design occupancy

- 5.20 On the above basis, the total maximum occupancy of the building will be approximately 4860 persons. Detailed occupancy calculations are presented in Annex A2.

Design of horizontal escape routes

Management and stewarding

- 5.21 The existing building includes several interlinking escape routes and points where a choice of routes is available to large numbers of public. However, this can present additional risks such as: inefficient use of the available escape routes; overloading of individual exits; and overcrowding at points where routes merge.
- 5.22 Therefore, effective management and stewarding procedures will be essential to ensure a safe and prompt evacuation in an emergency. See section 10.

Number and siting of exits

Areas with fixed seating (auditoria)

- 5.23 Travel distances within areas where there is fixed seating will be limited to 15m where escape is available in a single direction and 32m where escape is available in more than one direction (separated by at least 45°), in accordance with BS 5588-6.
- 5.24 The design occupancy of the Upper Gallery will not exceed 600 people, however access will be available to 4 storey exits.
- 5.25 The design occupancy of the new upper tier in the Wulfrun Hall is less than 600 persons, and, therefore, a minimum of two escape routes will be provided from this level.
- 5.26 The occupancy in all other levels in the Civic Hall and the stalls of the Wulfrun Hall exceed 600 persons and, therefore, a minimum of three escape routes will be provided from each of these areas.

Non-auditorium areas

- 5.27 All other rooms and sections of the building will have an occupancy of less than 600 people and will be provided with at least two escape routes except where the single-direction distance of travel is less than 18m (except the Wulfrun WCs, see 5.69) and the room or area has an occupant capacity of 60 or less. This is consistent with the recommendations of ADB.
- 5.28 Where escape is available in at least two directions the maximum travel distance to the nearest exit will not exceed 45m and is therefore consistent with the recommendations of ADB.
- 5.29 All doors on escape routes that accommodate more than 60 people will be hung to open in the direction of escape.

Inner rooms

- 5.30 All inner rooms with only a single escape route will accommodate less than 60 people and the dead-end travel distance will not exceed 18m. In accordance with the recommendations of ADB the access room will be provided with automatic smoke detection and a suitable alarm system to give immediate warning of a fire in the access room.
- 5.31 There will be no new inner-inner rooms.

Food and drink area

- 5.32 Ancillary areas for the consumption of food and drink (i.e. the new portico bar) will be provided with at least two escape routes leading directly to a storey exit without passing through a kitchen or other area of high fire hazard.
- 5.33 Although the alternative escape route from the existing canteen at Level 1 will be via the support kitchen, we understand that the refurbishment will not introduce high fire risk cooking (e.g. fat frying) and, therefore, this existing arrangement is considered to be acceptable.

Plant rooms

- 5.34 Existing plant rooms at lower ground floor are being refurbished as part of the works and the escape travel distances will generally not change. Where partitions are introduced, and this creates a dead-end, this will need to be considered in the context of the plant room use.
- 5.35 ADB and BS 5588-6 recommend the following travel distance limits: that contain only air handling plant
 - **Low hazard plant rooms:**
 - 9m where only a single direction of escape is available or
 - 35m where two directions of escape are provided.
 - **Higher-hazard rooms:**
 - 9m where only a single direction of escape is available or
 - 18m where two directions of escape are provided.
 - **Open air plant:**
 - 60m where only a single direction of escape is available or
 - 100m where two directions of escape are provided.
 - **Storage:**
 - 25m where only a single direction of escape is available or
 - 45m where two directions of escape are provided.

5.36 **Design team note:** There are areas where the above travel distances are not met (e.g. in the boiler room). This will need to be resolved as the design progresses (e.g. by providing a pass door into an adjacent area or by providing a door to outside).

5.37 The existing AHU plant room currently has a travel distance of the order of 25m to a point where another route becomes available. On the basis that this is only air handling equipment, compliance with other fire safety guidance documents (Health Technical Memorandum 05-02 for instance) would allow a 25m dead end travel distance. We recommend that this is reviewed by the operator as part of their fire risk assessment.

Subdivision of corridors

- 5.38 The Wulfrun dressing room corridor at Level -2 is more than 12m long and connects two storey exits. Therefore, it should be subdivided by self-closing fire doors located approximately half way between the storey exits.
- 5.39 **Design team note:** Although this is an existing issue which is not being affected by the proposals, the separation at this level will assist in ensuring that a fire below the stage does not impair escape from both the Wulfrun stage left exit and the escape route from the Wulfrun Bar.

Width of escape routes

- 5.40 Exit capacity calculations are presented in Annex A2.
- 5.41 Accessibility requirements are outside the scope of this report but it should be noted that wider corridors and doorways may be required to satisfy the requirements of Part M of the Building Regulations. Guidance is given in Approved Document M (ADM)^{12,6}.

General

5.42 The clear width of horizontal escape routes from the building will comply with the recommendations of Table 4 of ADB (except for standing spectator events, see *Escape from the stalls* below). In all areas needing to be served by two exits the exit capacity has been calculated assuming that the largest exit is unavailable.

Escape from the stalls

5.43 The standing occupancies described in Table 5.1 exceed the available escape capacity when calculated in accordance with Approved Document B. However, calculating the escape capacity in accordance with BS9999 (considering the fire safety enhancements, e.g. automatic fire detection together with public address voice alarm and greater ceiling heights) there may be sufficient escape capacity when calculated at 3.3mm of escape width per person.

Table 5.2: Escape capacity summary (standing)

Hall	Standing occupancy	ADB Escape Capacity	BS9999 escape capacity
Civic Level 0	2,303	1,520	2,303
Wulfrun Level -1	1,161	750	1,136 ^{Note 1}

Note 1 The escape width will need to be widened to accommodate all people at this level.

- 5.44 Although the application of the BS9999 code of practice may be one way of demonstrating compliance with the functional life safety requirements, this is not a new building and, therefore, broad compliance with other aspects of the guidance document cannot be guaranteed (and are not to be expected).
- 5.45 Therefore, we propose that fire and smoke modelling of fires in the auditoria is undertaken together with an analysis of the means of escape from the building to determine whether the proposed layouts and escape capacities are suitable.

5.46 Design team note: In terms of the auditoria occupancy, it is not clear how the existing building exits accommodate the numbers of people stated by City of Wolverhampton Council for standing events.

5.47 The fire strategy already identifies a significant shortfall in exit capacity for each hall. This could be considered acceptable (subject to widening some exits) on the basis of enhanced fire detection and the high ceiling in the auditoria and the application of the principles of BS9999.

5.48 We would therefore recommend that either:

- the exit widths are increased to accommodate the numbers of people in the building (however, see 5.45 and 5.46); or
- the occupancy of the Stalls is reduced to meet with the escape capacities; or
- the arrangement is supported by a detailed fire engineering assessment (e.g. modelling the evacuation computationally).

5.49 The last option may be of particular benefit, given the circuitous nature of many of the escape routes and some of the pinch points and merging flows involved. These are less of an issue when it can be demonstrated that the exit design works 'on paper' (i.e. provides sufficient capacity when assessed against ADB), but become greater factors when moving away from the guidance as is proposed.

5.50 This last option could also assist in stewarding and management training and potentially ease stewarding requirements (in our experience, evacuation modelling can be a very useful tool to assist event planning and steward placement).

Areas with seating in rows

5.51 Seating (number and spacing) and gangway arrangements within the auditorium will be sized in accordance with Section 8 of BS 5588-6^{12,22}.

5.52 The seatway width - i.e. the width along the row, between the back of one seat unit and the maximum projection of the seat unit behind (when in the up position where seats automatically tip up) - will be in accordance with Table 6 of BS 5588-6 (reproduced below).

Seatway width mm	Maximum number of seats in a row	
	Gangway on one side	Gangway on two sides
300 to 324	7	14
325 to 349	8	16
350 to 374	9	18
375 to 399	10	20
400 to 424	11	22
425 to 449	} 12	24
450 to 474		26
475 to 499		28
500 or more	Limited by the travel distance (see 6.5)	

Figure 5.1: Reproduction of Table 6 of BS 5588-6

5.53 Gangways from seating blocks which will accommodate not more than 50 people will have a minimum clear width of 900mm. Gangways serving all other seating blocks will have a minimum clear width of 1100mm.

5.54 The slope of the new tiers will not exceed 35° as recommended by BS 5588-6.

5.55 Balconies will be provided with protective barriers in accordance with BS 6180.

Open spatial planning

5.56 There is an existing void over the Civic Hall entrance foyer which is used as an escape route from the refurbished lower gallery. This requires the occupants to travel to within 4.5m of a void edge, however an alternative route is also available which is away from the void edge and this is consistent with the recommendations of clause 3.12 of ADB.

Vertical escape

Width of escape stairs

5.57 The means of escape from the building have been designed on the basis of simultaneous evacuation and therefore the stair capacity has been calculated on the basis of Table 7 of ADB.

5.58 Protected lobbies are not provided to the escape stairs and, therefore, it is necessary to discount a stair when assessing the available escape capacity.

5.59 The stair-width calculations are presented in Annex A2 and show that the existing and proposed stairs are wide enough for the anticipated occupancies.

5.60 Design team notes: Final exits from stairs should be at least as wide as the stair. There are existing situations where the final exit doors are much narrower than the exits leading to them.

Protection of escape stairs

5.61 All escape stairs will be enclosed in construction having a fire resistance of at least 30 minutes.

5.62 The existing north west stair connects to the Wulfrun kitchen via a protected lobby, but this is not we understand provided with 0.4m² permanent ventilation between the place of special fire hazard and stair.

5.63 Design team note: Although the existing arrangement is not being made worse, consideration should be given to providing a means of providing a source of natural permanent ventilation to this space.

Separation of escape stairs

5.64 The North West Stair and the Wulfrun Foyer Stair will both connect to the Wulfrun Foyer by way of a 1.2m wide fire exit door. This is necessary as the external doors from the North West Stair are 1.3m wide, whereas the North West Stair itself is 2.5m wide.

5.65 BS 5588-6 recommends that, where two protected stairways adjoin, they should be separated by imperforate construction, i.e. there should not be any openings, doors, etc. in the separating elements common to both stairs.

5.66 Therefore, as these stairs share the same exit discharge route, we recommend that a fire and smoke curtain having at least 30 minutes fire resistance and complying with BS 8524 Parts 1^{12,13} & 2^{12,14} is provided between these fire exits. A schematic of this arrangement is provided in Figure 5.2.

External walls of protected stairs

- 5.83 The extended Wulfrun Hall entrance foyer encloses the north west escape stair which previously projected from the building. It should be confirmed that the construction enclosing the stair is at least 30 minutes fire resisting from both sides.
- 5.84 Where new and extended stairs project above the adjacent roof structure it will also be necessary to protect these from a fire below, and given the proposed glazing in the façades of these stairs this will require fire resisting roof construction within 1.8m of the stairs.

Design of ramps and stairs

- 5.85 All new or modified ramps on escape routes will meet the provisions of Approved Document M (ADM)^{12.6}.
- 5.86 New stairs will be designed and constructed in accordance with ADM.
- 5.87 The design and use of other escape stairs in the building will not be affected by the proposed works.

External stairs

- 5.88 There are no new proposed external stairs. An existing external stair forms the relief route from the South West stair and this is not being altered by the proposals. However, the operator will need to include special fire safety management arrangements to ensure that it is always available for use when the building is occupied for events (e.g. including in inclement weather).

Lifts

- 5.89 New lift-wells do not connect separate compartments and therefore are not required to be constructed as protected shafts.
- 5.90 Although the building will be subject to simultaneous evacuation the location of the new lifts in the Civic Hall could prejudice access to the north west and north east stairs. Therefore, the lift well will be enclosed within a 30-minute fire-resisting shaft.
- 5.91 The existing lifts are proposed to be upgraded. The existing lift adjacent to the north west stair serves the lower ground (Level -1), however as this level is open to the atmosphere on two elevations it is not considered to be located within the basement.

Final exits

- 5.92 Final exits from Level 0 and from stairs are not of sufficient width to accommodate the number of persons expected to use them, i.e. for the current or proposed stair loading (see below).
- 5.93 Final exits are sited to ensure rapid dispersal from the building and be located away from openings to hazardous rooms such as transformer rooms, refuse or boiler rooms.
- 5.94 Where final exits serve a level or ramped escape route, a level threshold will be provided (see however, see 5.73).

Protection of external escape routes

- 5.95 Where external escape routes require occupants to travel within 1800mm of the face of the building, the external wall construction within 1800mm of the route will be provided with 30 minutes fire resistance (integrity only) up to a height of 2m above paving level along the route. (Note that a height of 1.1m above paving level is the minimum recommended by ADB – however, an increase to 2m is recommended where routes will be used by large numbers of members of the public).

- 5.96 This only affects the existing ramped escape route from the northeast stair and the external relief stair from the South West Stair.

North West Stair final exit

- 5.97 The North West Stair is 2.5m wide, but following the works the final exit from the North West Stair will be only 1.3m wide. Therefore, it is proposed to escape via the Wulfrun Hall Foyer by an additional 1.2m wide exit. This is shown in Figure 5.2.

South West Stair final exit

- 5.98 The South West Stair is 2.5m wide and is provided with two final exits as shown in Figure 5.3 which together will be at least as wide as the stair.

- 5.99 **Design team note: The dimensions of the final exits should be checked on site.**

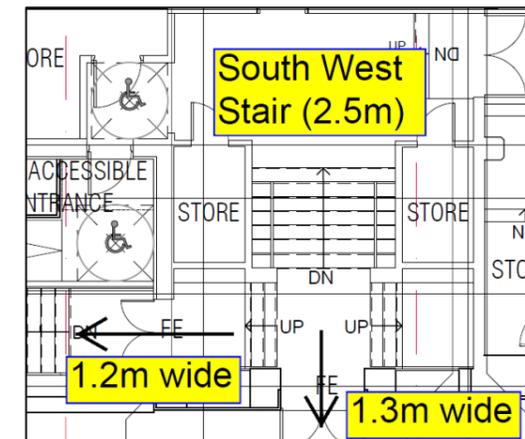


Figure 5.3: South West Stair final exits

North East and South East Stair final exits

- 5.100 The North East and West Stairs are each 2.5m wide, but the final exits to outside will be 1,050mm wide and 1,200mm wide respectively.
- 5.101 The foyer is provided with exits which total to 9.1m wide and we recommend that the foyer is used as the main escape route from the stairs as there will be sufficient capacity in these exits when used simultaneously by the escape stairs and the stalls exits at Level 0, see Figure 5.4.

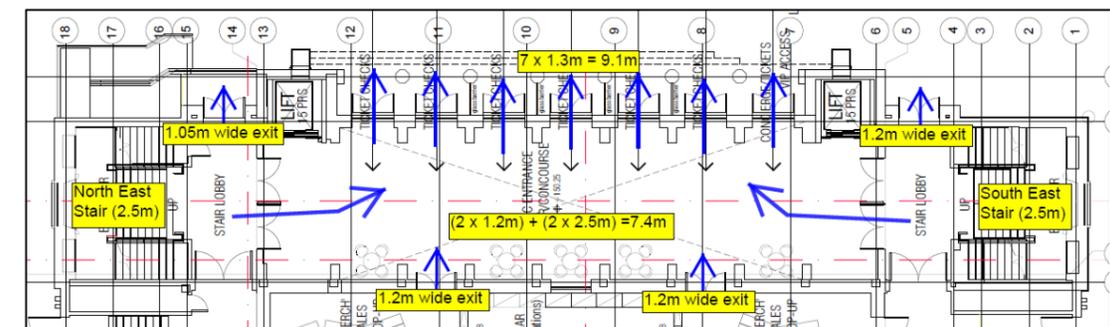


Figure 5.4: North East and South East Stair final exits

- 5.102 Escape through the foyer will be in accordance with 5.72 and BS 5588-6.

Level 0 stair (from stalls) final exit

- 5.103 The existing stair which serves as an escape route from the stalls is 2.2m wide whereas the final exit door is only 2m wide, see Figure 5.5.
- 5.104 The stair has riser and tread dimensions of 165mm x 305mm respectively and, based on the guidance in BS 7974 PD 6^{12.15}, the stepped route will have a flow rate which is only 84% rate on the level route (i.e. through the exit door).
- 5.105 The final exit door is 90% of the width of the stair, which is greater than 84% and, therefore, there should be no flow impairment at the final exit.

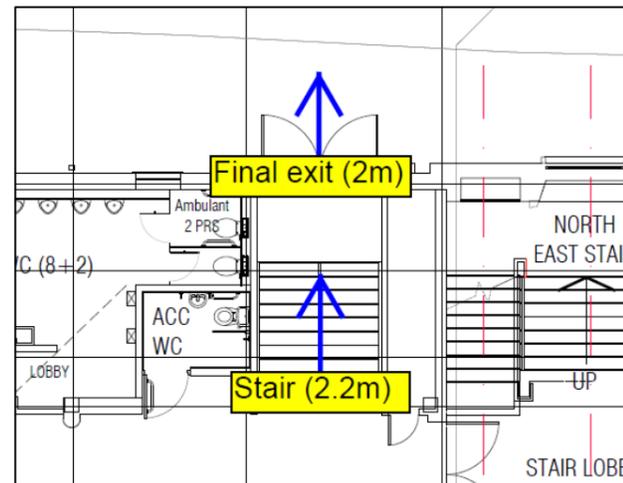


Figure 5.5: Level 0 final exit from the stalls

Lighting of escape routes

- 5.106 All escape routes will be provided with adequate artificial lighting, and lighting on escape stairs will be on a separate circuit from that supplying any other part of the escape route.
- 5.107 Emergency escape lighting in accordance with BS 5266-1^{12.16} will also be provided throughout all escape routes and the occupied areas of the building, as recommended in Table 9 of ADB. In an assembly building, escape lighting should also be provided to external escape routes
- 5.108 On power failure the emergency escape lighting will be capable of operating for 3 hours.
- 5.109 The public bars/restaurants and the auditorium will be provided with a maintained emergency lighting system in accordance with Clause 10.3.4 of BS 5266-1:2005.

Exit signs

- 5.110 Every escape route (other than those in ordinary use) will be marked by emergency exit signs complying with BS 5499-1^{12.18}. Emergency exit signs will be located to meet the requirements of the Health and Safety (Safety Signs and Signals) Regulations^{12.19,12.20} and the Regulatory Reform (Fire Safety) Order^{12.2}.
- 5.111 Refuges will also be identified with appropriate signage which will include a blue mandatory sign worded "Refuge - keep clear".

Mechanical ventilation and air conditioning systems

- 5.112 The existing mechanical ventilation systems and air conditioning systems are being refitted together with new systems. The provision of new and modifications to the existing mechanical ventilation systems will be designed so that they do not assist in transferring fire and smoke through the building in such a manner as to put protected escape routes at risk.
- 5.113 Section 6 of BS 5588-6^{12.22} recommends that separate ventilation systems be provided for public and non-public areas of assembly buildings. However, the commentary provided in BS 5588-6 accepts that the risk and impact of fire and smoke spread between such areas is reduced where appropriate fire and smoke separation is provided within the ventilation system, and where simultaneous evacuation occurs in the event of a fire in any part of the building. Therefore, where existing ventilation systems serve both public and non-public areas and will be retained, it is recommended that motorised fire and smoke dampers (operating on smoke detection) be provided where the system diverges between the public and non-public areas. This, in addition to category L1 automatic fire detection and a simultaneous evacuation strategy, is considered to meet with the functional aims of BS 5588-6.
- 5.114 Ventilation ducts supplying or extracting from a protected escape route will not serve any other areas. If escape stairs are provided with day-to-day ventilation, a separate ventilation system will be provided for each protected stairway.
- 5.115 Where ductwork penetrates fire-resisting walls it will be provided with fire dampers or suitable fire-resisting enclosures in accordance with the recommendations of BS 5588-9^{12.24}.
- 5.116 As part of the works, it is recommended that the mechanical ventilation system be interfaced with the fire alarm system to allow it to be automatically shut down on actuation of the fire alarm.

Access control measures

- 5.117 Measures designed to restrict access into or within the building for security purposes will not adversely affect the escape provisions. Where a door on an escape route needs to be secured when the building is occupied it will be capable of being readily operated, without a key, from the side approached by persons making their escape.
- 5.118 Doors across escape routes used by members of the public will either be unlocked when the building is in use, or be provided with panic fastenings (e.g. full-width panic bars) in accordance with BS EN 1125^{12.26}.
- 5.119 Further consideration of escape provisions will be necessary if electronic security measures are envisaged.

6 Internal fire spread (linings)

Linings

- 6.1 The wall and ceiling linings throughout the building should comply with either the national or European classifications given in Table 6.1 (see also Table 10 of ADB and clauses 8.5 and 8.6 of BS 5588-6). Additional recommendations given in section 4 of BS 5588-6 are in [square brackets]
- 6.2 We have not assessed the existing wall and ceiling linings (e.g. timber cladding on escape routes and around doors to the Civic Hall) which should be considered in the building's fire risk assessment.
- 6.3 New wall and ceiling linings throughout the new and refurbished parts of the Halls will need to comply with either the national or European classifications given in Table 6.1 below:

Table 6.1: Classification of wall and ceiling linings

Location	National class	European class
Walls and ceilings in rooms up to 30m ²	3	D-s3, d2
Walls and ceilings in other rooms (see also 6.4 and 6.5) [All other areas]	1	C-s3, d2
Circulation spaces [Auditoria and rooms which hold more than 50 people]	0	B-s3, d2

Auditoria

Seating

- 6.4 New seating will (and it is recommended that all seating should) satisfy the pass criteria for smouldering ignition source 0, flaming ignition source 1, and crib ignition source 5 when tested in accordance with Section 5 of BS 5852:1990^{12,27}.

Open stage

- 6.5 Given that the stage will not be separated from the audience by a proscenium arch and safety curtain, and will not be provided with smoke control or dedicated smoke clearance, the local authority may impose restrictions on the materials and set designs used on stage (see also 3.13 et seq.).
- 6.6 Guidance on restrictions which may be appropriate for an open stage arrangement is included in *Guide to Fire Precautions in Existing Places of Entertainment and Like Premises* (the "Primrose Guide")^{12,8} published for the Home Office. The key recommendations from clause 8.20 of the Primrose Guide state that the use of an open stage and any set should be limited to:
- ▶ non-combustible materials;
 - ▶ inherently or durably flame-retardant fabrics, or fabrics rendered and maintained flame retardant to a standard agreed with the licensing authority;
 - ▶ suitably treated (i.e. rendered flame-retardant) timber, etc.;
 - ▶ timber framing not less than 22mm thick*;
 - ▶ blockboard, chipboard, or plywood not less than 18mm thick*;
 - ▶ other materials (e.g. certain plastics) subject to a specific risk assessment.

**It is our recommendation that untreated timber or wood board of any thickness be restricted on an open stage, unless supported by a specific assessment.*

Smoke venting

- 6.7 **Design team note:** The proposals include for smoke venting in the roof of the building over the Civic and Wulfrun Hall stages. These are only normally required when installed together with a safety curtain or as a result of a specific fire engineering assessment, which we have not carried out.
- 6.8 **Notwithstanding that, we recommend that the provision of smoke ventilation be retained in the scheme at this stage to enable future flexibility over the design of these halls, as these may be necessary as part of the justification for the shortfall in escape capacity.**

Furnishings, fabrics and decorative features

- 6.9 Furnishings, fabrics and decorative features (which include drapes and artificial foliage) need to be of materials which in themselves do not present an unacceptable increase in the combustible materials within the building or which would cause rapid spread of fire or smoke generation if involved in a fire.
- 6.10 Accordingly, furnishings, fabrics and decorative features will either:
- ▶ be non-combustible;
 - or,
 - ▶ comply with the requirements for classification as type B in accordance with BS 5867-2:1980 after being subjected to the appropriate wetting or cleansing procedure described in BS 5651;
 - and,
 - ▶ will not be provided within enclosed escape routes (other than foyers) unless made from non-combustible materials.

- 6.11 Drapes will not be provided in front of exit doors or across escape routes.

Floor coverings

- 6.12 Textile floor coverings, together with any underlay, should, when tested in accordance with BS 4790, using the test procedure reflecting the method used for securing the floor covering to the floor, either:
- ▶ not ignite; or,
 - ▶ have effects of ignition on both the use-surfaces and under-surfaces not extending beyond a circle of radius 35 mm centred on the central point of application of the nut.

Plastic roof-lights, glazing and lighting diffusers, etc.

- 6.13 No plastic roof-lights are proposed.
- 6.14 Any new, glazing, suspended ceilings and lighting diffusers will comply with the recommendations of paragraphs 6.7 to 6.16 of ADB.

7 Internal fire spread (structure)

Loadbearing elements of structure

- 7.1 Table A2 of Approved Document B shows the appropriate standard of fire resistance for all load-bearing elements of structure to be 60 minutes.
- 7.2 All new structural elements (e.g. beams, columns, walls and floors) will need to be provided with at least 60-minute fire resistance to comply with the guidance in ADB, except for elements supporting only a roof. The structural elements supporting the portico bar area will need 60-minutes fire resistance.
- 7.3 Any alterations to existing structure should ensure:
- ▀ compliance with Regulation 4(3) of the Building Regulations, i.e. that the fire safety provisions are no less satisfactory – in relation to requirement B3 – than before the work was carried out; or
 - ▀ 60 minutes fire protection should be provided.
- 7.4 Note: This may require a survey of existing structural elements to establish their fire resistance

Compartment walls

- 7.5 ADB recommends that large buildings are subdivided into fire-resisting compartments with the objective of:
- a) preventing rapid fire spread that could trap the occupants;
 - b) reducing the chances of a fire becoming so large that it threatens fire service personnel and people in the vicinity of the building.
- 7.6 Fire-resisting or compartment walls may be needed to:
- a) comply with recommended compartment size limits;
 - b) separate adjacent buildings;
 - c) separate different purpose groups within the same building;
 - d) separate different occupancies;
 - e) provide for progressive horizontal evacuation;
 - f) enclose places of special fire hazard;
 - g) divide the building into separated parts;
 - h) reduce limitations on unprotected areas.
- 7.7 In this instance items (a), (c), (f) and (h) are applicable and are discussed below.

Limitation of compartment size

- 7.8 The footprint area of the building is approximately 3,600m², and Table 12 of ADB recommends a maximum compartment area of 2000m².

- 7.9 The S&P drawings indicate that the Civic Hall and Wulfrun Hall are divided into two separate compartments by construction having 60-minutes fire resistance; both have an area of less than 2,000m². Note that the existing construction has not been checked to confirm its fire resistance.

- 7.10 **Design team note: The separation between Wulfrun and Civic Hall should be checked on site. From a site inspection on 27th March 2019, it is apparent that the walls indicated as having 60 minutes fire resistance are provided with Georgian wired windows installed in timber frames (many of which are in a poor state of repair) which are indicative of only 30 minutes fire resistance.**

Separation of purpose groups

- 7.11 We understand walls separating the plant areas from the public areas at Lower Ground (Level -1) are designated as compartment walls.

Places of special fire hazard

- 7.12 The areas listed below are designated as places of special fire hazard and will be enclosed within a minimum of 30 minutes fire-resisting construction (walls, floors and doors) to comply with ADB.
- ▀ oil-filled-transformer and switchgear rooms;
 - ▀ boiler rooms;
 - ▀ storage for fuel or other highly flammable materials;
 - ▀ rooms housing fixed internal combustion engines.

- 7.13 As well as the areas above, due to the nature of the occupancy BS 5588-6 also recommends fire resisting enclosures around rooms containing high hazard ancillary accommodation. Except for the new high voltage substation, the proposals do not appear to include for new ancillary accommodation which would be considered a place of special fire risk, as listed in Table 9 of BS 5588-6. However, existing ancillary accommodation should be checked against the following recommendations.

- ▀ To be enclosed in robust construction having at least 30 minutes fire resistance:
 - Storage areas not greater than 450m²
 - Kitchens, staff restaurants and canteens
 - Transformer, switchgear, and battery rooms for low-voltage or extra-low-voltage equipment
 - Dressing rooms and changing rooms
 - Projection rooms for non-flammable film
- ▀ To be enclosed in robust construction having at least 60 minutes fire resistance:
 - Storage areas greater than 450m²
 - Covered loading bays
 - Boiler rooms
 - Fuel storage
 - Transformer and switchgear for equipment above low voltage
 - Rooms housing fixed internal combustion engines
 - Scene docks

- 7.14 Penetrating services to these rooms will be fire stopped and provided with fusible-link fire dampers as appropriate

Reduce limitations on unprotected areas

- 7.15 The proposed works include for large areas of glazed façade which is not fire resisting. To enable the use of these construction materials and to comply with the functional requirements of the Building Regulations, it is necessary to limit the extent of unprotected areas which are radiating simultaneously with the use of compartment walls. See the following section for a description of the provisions for space separation.

Construction of compartment walls

- 7.16 Compartment walls will extend to the soffit of the structural slab above (i.e. go from slab to slab) except at the top storey, where they will be continued through the roof space. Allowance will be made for structural movement and flexible fire stopping will be provided at the junctions between fire-resisting elements.
- 7.17 Where a compartment wall meets external glazing, the junction will be fire stopped with suitable materials (e.g. mineral fibre or a proprietary fire stopping system).
- 7.18 **Design team note: The separation was in a poor state of repair with a number of unsealed penetrations for services, missing bricks, etc.**

Compartment floors

- 7.19 Compartment floors may be needed to:
- separate different purpose groups within the same building;
 - separate different occupancies;
 - separate the ground floor from a basement;
 - separate each level in buildings exceeding 30m in height;
 - separate each level in institutional and residential buildings;
 - separate levels in deep basements (more than 10m deep);
 - facilitate phased evacuation;
 - reduce limitations on unprotected areas.
- 7.20 In this instance items (a) (c) and (h) are applicable and are discussed below.

Separation of purpose groups

- 7.21 The building accommodates uses in purpose groups 5 (Assembly and Recreation) and 7(a) (Storage and other non-residential) and these are not considered as ancillary to each other. We understand that the floor separating these uses between lower ground (Level -1) and ground (Level 0) is designated as a compartment floor having 60 minutes fire resistance.

Separation of basement

- 7.22 We understand that the floor over the basement levels is designated as a compartment floor having 60 minutes fire resistance, except for the floor over the toilets and the Wulfrun foyer which only contains sanitary accommodation.

Reduce limitations on unprotected areas

- 7.23 The proposed works include for large areas of glazed façade which is not fire resisting. To enable the use of these construction materials and to comply with the functional requirements of the Building Regulations, it is necessary to limit the extent of unprotected areas which are radiating simultaneously with the use of compartment floors. See the following section for a description of the provisions for space separation.

Sprinkler protection

- 7.24 We have been instructed by our client (Space and Place Architects) to design the fire safety strategy on the basis that sprinklers will not be provided as this is an aspiration of their client.
- 7.25 The building will not exceed 30m in height and the maximum compartment will not exceed the recommendations of Table 12 of ADB (i.e. 2,000m²). Therefore, sprinkler protection is not needed to comply with the recommendations of ADB in relation to life safety requirement B3.
- 7.26 However, given the nature and historic significance of the building, the operator may wish to consider fire suppression for reasons of property protection.

Protected shafts for services

- 7.27 Any new shafts for ducts or pipes which pass through compartment floors are considered to be protected shafts.
- 7.28 Therefore, any alterations, e.g. construction alterations or service penetrations, to all protected shafts will ensure that their fire resistance is maintained to a standard of not less than 60 minutes fire resistance. Any new or altered doors or hatches into the shafts will be locked shut and will provide a fire resistance of at least 30 minutes.
- 7.29 Shafts used for conveying oil or gas will comply with the recommendations of paragraphs 8.40 and 8.41 of ADB.

Concealed spaces (cavities)

- 7.30 Any new concealed spaces or cavities in the construction will be sealed and sub-divided to inhibit the unseen spread of fire and smoke.
- 7.31 Cavity barriers will be constructed of materials capable of providing a fire resistance of 30 minutes integrity and 15 minutes insulation and will be provided in accordance with Section 9 of ADB. This includes cavity barriers:
- at the edges of cavities and around openings penetrating them;
 - at the junctions between external cavity walls and compartment walls and floors;
 - at junctions between a cavity wall and every compartment or fire resisting barrier;
 - on protected escape routes, above and below any fire resisting construction that is not carried the full storey height;
 - above any fire doors provided in corridors to sub-divide escape corridors;
 - to subdivide any cavity (including roof spaces) so that the distance between cavity barriers does not exceed 20m (10m for any cavity other than a roof void that has surfaces in the void that do not meet at least Class 1 or Euroclass C).
- 7.32 Various exceptions and additions to the above can apply and therefore reference should be made to section 9 of ADB for specific guidance.
- 7.33 **Design team note: the recently updated version of Approved Document B also recommends the following in respect of external walls.**
- 7.34 In respect of external walls, surfaces which face into cavities should also meet the provisions of Diagram 40 of ADB and provisions in Section 9 of ADB.

Protection of openings and fire stopping

- 7.35 All penetrations through fire resisting separating elements (e.g. protected escape routes and compartment walls/floors) will be provided with fire doors, fire stopping, fire seals and dampers in accordance with the recommendations of section 10 of ADB and BS 5588-9^{12.24}.

Fire doors

- 7.36 Doors in compartment walls will have the same fire resistance as the wall in which they are installed but do not need to be smoke sealed unless they also support the means of escape. Doors to protected shafts will provide at least 30 minutes fire resistance. For further information on the recommendations relating to fire doors see Appendix B of ADB.

Fire stopping

- 7.37 Detailed fire stopping recommendations are given in Section 10 of ADB and some of the main provisions are summarised below.
- 7.38 Where cables, conduits, ducts or pipes pass through a fire resisting barrier the penetrations will be sealed with a fire resisting sealing system.
- 7.39 It is strongly recommended that fire stopping works be carried out by a third-party UKAS-accredited installer (e.g. FIRAS).

Protection of ventilation ductwork

- 7.40 **Design team note: The ventilation strategy should be confirmed to us as part of design development and the following recommendations can be tailored to proposals.**
- 7.41 Where ductwork penetrates fire resisting construction, securely fixed mechanical fire dampers will be installed within the thickness of the construction. The dampers will be installed so as to allow inspection, testing and maintenance of the damper and actuator.
- 7.42 Fire dampers will be classified to BS EN 13501-3 (or BS 476 Part 8^{12.37} or Part 22^{12.40}) and will have the same fire resistance (integrity) as the wall or floor they penetrate (subject to a minimum fire resistance of 60 minutes).
- 7.43 The installation of fire dampers or protection of ductwork will be in accordance with the recommendations of BS 5588-9^{12.24}. Some of the main recommendations are summarised below.
- 7.44 Where ductwork is used for kitchen extract purposes fire dampers will not be installed. Where a kitchen duct passes through another fire compartment the ductwork will be fire resisting or be enclosed within a fire resisting shaft.
- 7.45 Dampers will generally be activated by means of a thermal device that will cause damper closure at a temperature of approximately 74°C. However, in some circumstances the dampers will be closed automatically in response to the fire detection system as described in the following section.

Ductwork serving or passing through escape routes

- 7.46 Ventilation ducts and their associated plant serving protected escape routes will not also serve other areas.
- 7.47 Where a ventilation system serves more than one protected escape route or section of a protected route, smoke detector operated fire dampers will be provided to separate the protected escape routes. Where escape stairs are provided with day-to-day ventilation, a separate ventilation system will be provided for each protected stairway.

- 7.48 Any ventilation ductwork serving a protected escape route that passes through an accommodation space will be fire resisting (30 minutes fire resistance).

- 7.49 BS 5588-9^{12.24} recommends that any ductwork passing through a protected stairway, lobby or corridor, without ventilating that area should be fire resisting.

- 7.50 Dampers that are activated by the smoke control system will also incorporate a thermally activated release device (with a 74°C activation temperature).

8 External fire spread

- 8.1 The following recommendations relate primarily to new construction specified and installed as part of extension and refurbishment works described in this report.
- 8.2 Tenos has not carried out an assessment of the existing external wall construction, however we understand that this is primarily of masonry construction and glazing.

External walls

Fire resistance

- 8.3 External walls that are located more than 1m from the relevant boundary will be of fire-resisting construction providing 60 minutes integrity and 15 minutes insulation when tested from the internal face of the building, with the exception of allowable unprotected areas (see 'Space separation' below). Allowable unprotected areas need not be provided with any specific level of fire resistance (e.g. windows that are allowable unprotected areas may be glazed with non-fire-resisting glass).

Combustibility of external walls – Building with a top storey of less than 18m above ground level

- 8.4 The refurbished building will not have a storey (not including roof-top plant areas or any storey consisting exclusively of plant rooms) at least 18m above ground level.
- 8.5 Therefore, the building will neither: be classed as a 'relevant building' under Regulation 7(4) of the Building Regulations; or be subject to limitations on the use of combustible insulation products or filler materials in the external wall construction to accord with the current statutory guidance in ADB. The relevant guidance in section 12 of Approved Document B regarding the combustibility of external walls in buildings with a top storey of less than 18m above ground is presented in 8.7 – 8.9 below.
- 8.6 Notwithstanding the recommendations in Approved Document B described below, and because of the current concerns and changing requirements for external wall systems, it is strongly recommended that all materials specified and installed in the external wall and/or cladding systems be independently certified as being non-combustible (national standard – BS 476-4^{12.36}) or Class A1 (European standard BS EN 13501-1^{12.43}). This is with the exception of gaskets, sealants and similar, and of breather membranes achieving European Class B-s3, d0.

External surfaces

- 8.7 The external surfaces of walls should meet the provisions in Diagram 40 [of ADB – reproduced in Figure 8.1 below].

Cavities and cavity barriers

- 8.8 Cavity barriers should be provided in accordance with Section 9 [of ADB].
- 8.9 Surfaces which face into cavities should also meet the provisions of Diagram 40 [of ADB], and provisions in Section 9 [of ADB].

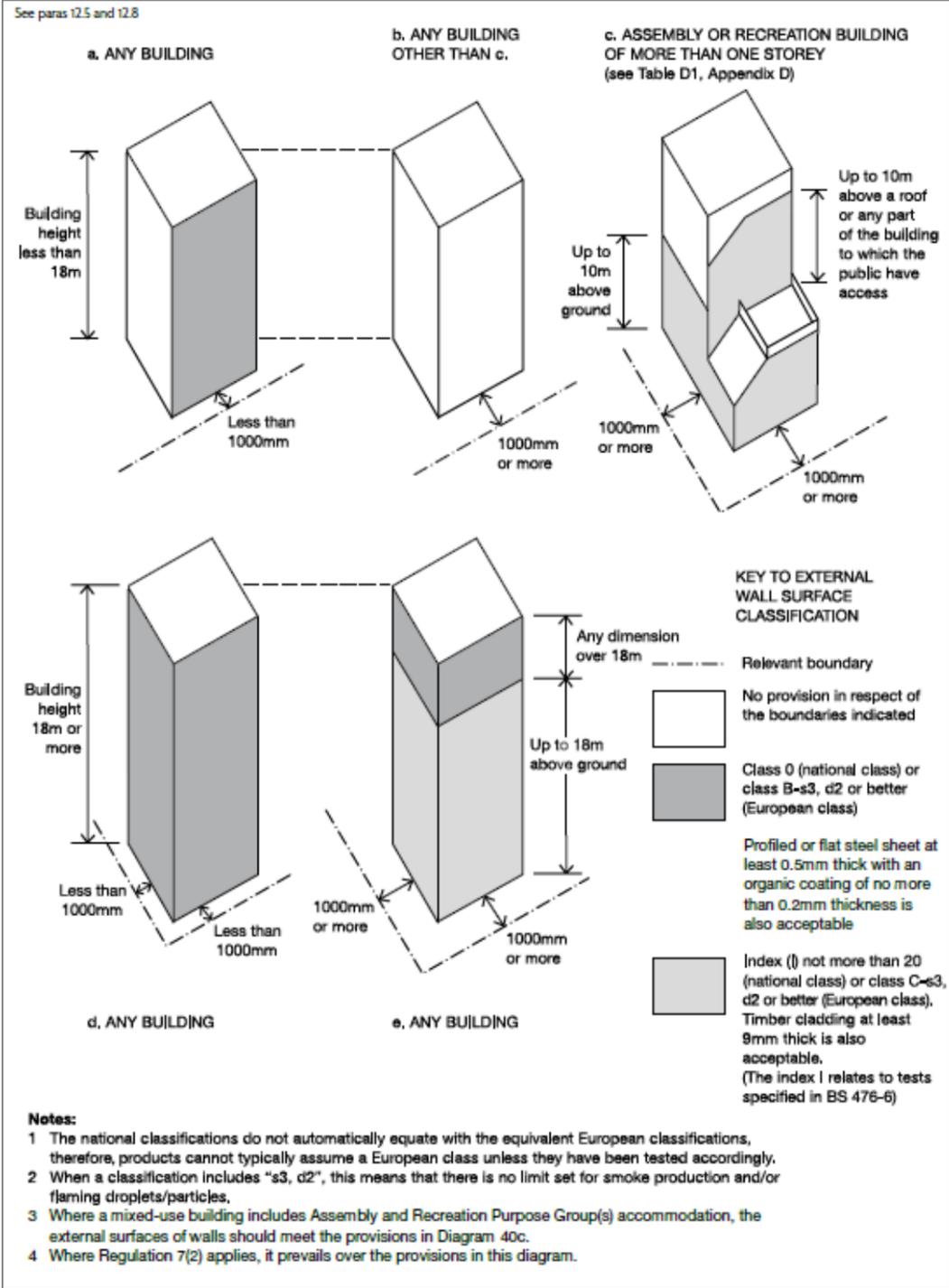


Figure 8.1: Reproduction of Diagram 40 (Provisions for external surfaces or walls) of Approved Document B

Space separation

- 8.10 The allowable unprotected areas (UPA) have been assessed using the enclosing rectangle method of BRE report BR 187^{12.30} and the relevant boundaries have been taken as the centre of the adjacent roads.
- 8.11 The calculations assume that the floors separating the public space (at Level 0) and the plant area (at Level -1) and separating the Wulfrun foyer (at level -1) from the new Wulfrun bar (at level 2) are constructed as compartment floors.
- 8.12 The full calculations are presented in Annex A3 and assume that the surfaces of external walls do not include combustible materials which would be considered to be UPA in accordance with ADB. The calculations indicate that the Mitre Fold and Corporation Street elevations incorporate UPA in excess of the limits recommended by the guidance in BR 187 as summarised in Table 8.1.

Table 8.1: Summary of excessive unprotected areas

Elevation	Boundary distance (m)	Allowable UPA %	Proposed UPA %
Corporation Street	5.2	26	35
Mitre Fold	5.6	28	42

- 8.13 **Design team note: the following paragraphs describe a way of complying with the functional Building Regulations requirements without limiting the proposed glazing at Level 3.**

TenRad assessment

- 8.14 The existing Corporation Street and Mitre Fold elevations have unprotected areas (i.e. glazing) covering between 15 – 20% of the elevation, i.e. within the limits described in Table 8.1 above.
- 8.15 However, the unprotected areas are widely spaced and, when using the enclosing rectangle method, this underestimates the intensity of radiation received. The existing bar areas at Level 2 exceed the UPA limits recommended by BR 187 if assessed in isolation (i.e. as a standalone area which is 100% UPA).
- 8.16 On this basis, we recommend that the fire resisting enclosure to these bar areas is increased to be at least 60 minutes fire resisting such that it can be assessed as a separate compartment.
- 8.17 In doing so, the radiation received across the boundary by the mirror image of the building would not exceed 12.6kW/m² (the limit recommended by ADB) as assessed using “TenRad” below.
- 8.18 TenRad is a software package^{12.50} developed by Tenos and which has been subject to 3rd party validation^{12.51}.
- 8.19 The software provides a means of evaluating space separation of complex geometries following the principles set out in ADB and its supporting document BR187.
- 8.20 The assessment has been carried out for the Corporation Street elevation only, i.e. not for the Mitre Fold elevation. This is because, based on the assessment carried out in Annex A3, these elevations are essentially identical except that the boundary distance on the Corporation Street elevation is marginally closer and, therefore, an assessment of this elevation will provide more conservative results.
- 8.21 The geometry for both the existing and the proposed Corporation Street façade is shown in Figure 8.2 left and right respectively.

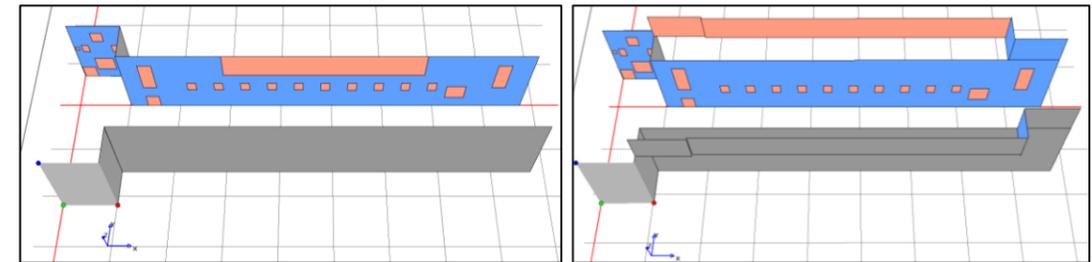


Figure 8.2: Model geometry - existing (left) and proposed (right), excluding Level 2 bar glazing

- 8.22 The blue panels indicate non-radiating walls, e.g. masonry walls, and the orange/red panels indicate glazing (unprotected areas). The grey panels are the receiving walls of the mirrored building. The unprotected areas have a radiation intensity of 84kW/m² in accordance with ADB and BR187.

Acceptance criteria

- 8.23 The principles of ADB have been developed on the basis that the building is separated from the boundary by at least half the distance at which the total thermal radiation intensity received from all unprotected areas in the wall would be 12.6kW/m² (“critical heat flux”).
- 8.24 Essentially this means that the radiation received by a mirror image of the building located on the other side of the boundary is less than this critical heat flux.

Existing elevation

- 8.25 An assessment has been carried out for the existing elevation (i.e. excluding the Level 3 glazing) and the results are presented in Figure 8.3.

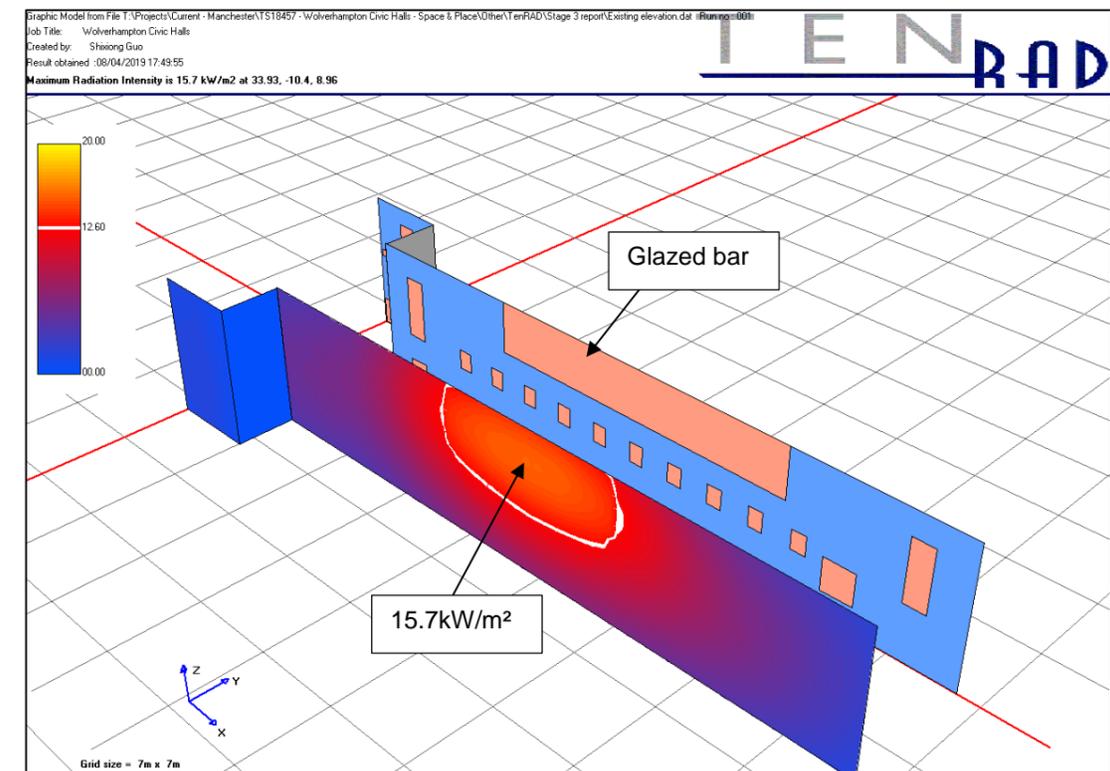


Figure 8.3: Heat radiation analysis - existing elevation

- 8.26 The results in Figure 8.3 above show the radiation received as a colour gradient from blue (cold) to yellow (hot) and the critical heat flux is marked in white.
- 8.27 The existing unprotected areas could result in a received heat flux of the order of 15.7kW/m² over the boundary.
- 8.28 It is proposed therefore to enclose the glazed bar in fire resisting construction, as the calculations presented in Annex A3 indicate this is a significant contributor to the heat radiation. Considering this as a standalone area (i.e. excluding the Level 3 glazing and other existing unprotected areas) an analysis of heat radiation has been undertaken and the results are presented in Figure 8.4.

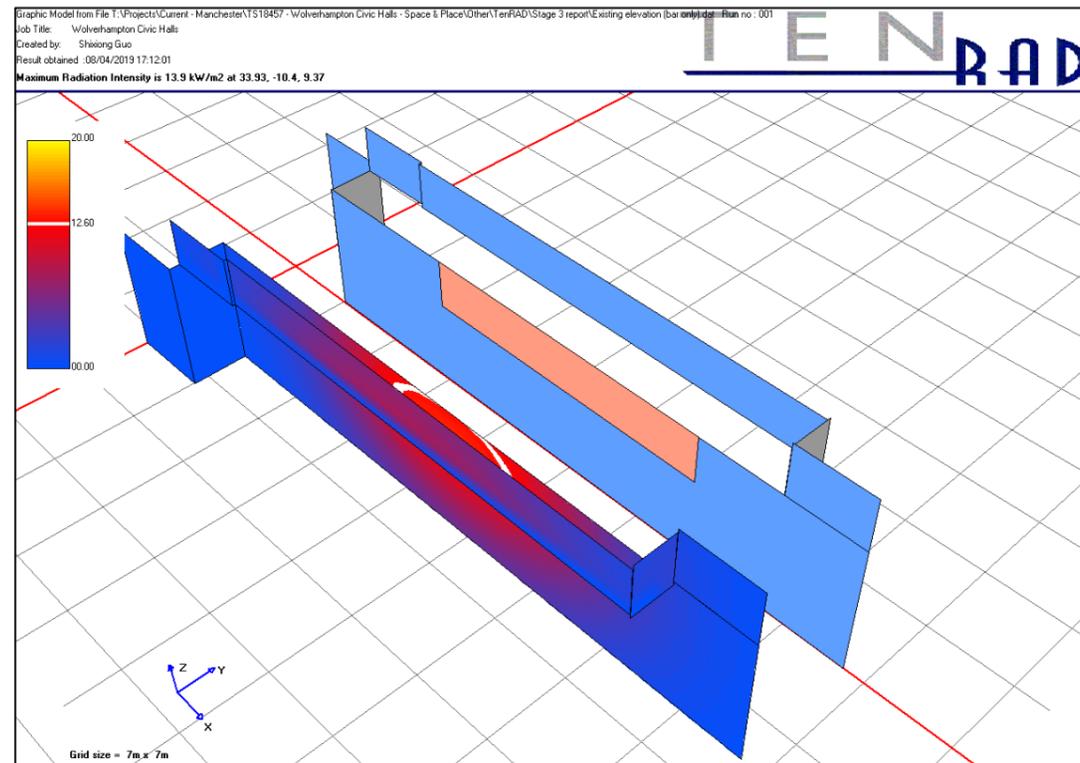


Figure 8.4: Heat radiation analysis - existing elevation (Level 2 bar only)

- 8.29 The above assessment shows that, even considering the glazed bar area in isolation, the critical heat flux is exceeded. However, this does reduce the received radiation over the boundary to 13.9kW/m², only 10% greater than the critical heat flux.
- 8.30 This is an existing condition which is being improved by the proposed works.
- 8.31 **Design team note: The operator may wish to consider impact of this further.**
- 8.32 The proposed Level 3 glazed curtain walling is also shown in Figure 8.4 and a fire in the Level 2 bar will not create an incident heat flux in excess of 12.6kW/m² on this mirrored façade.
- Proposed elevation**
- 8.33 An assessment has been carried out for the proposed elevation but omitting the existing Level 2 bar (i.e. excluding the Level 2 glazing as UPA) and the results are presented in Figure 8.5.

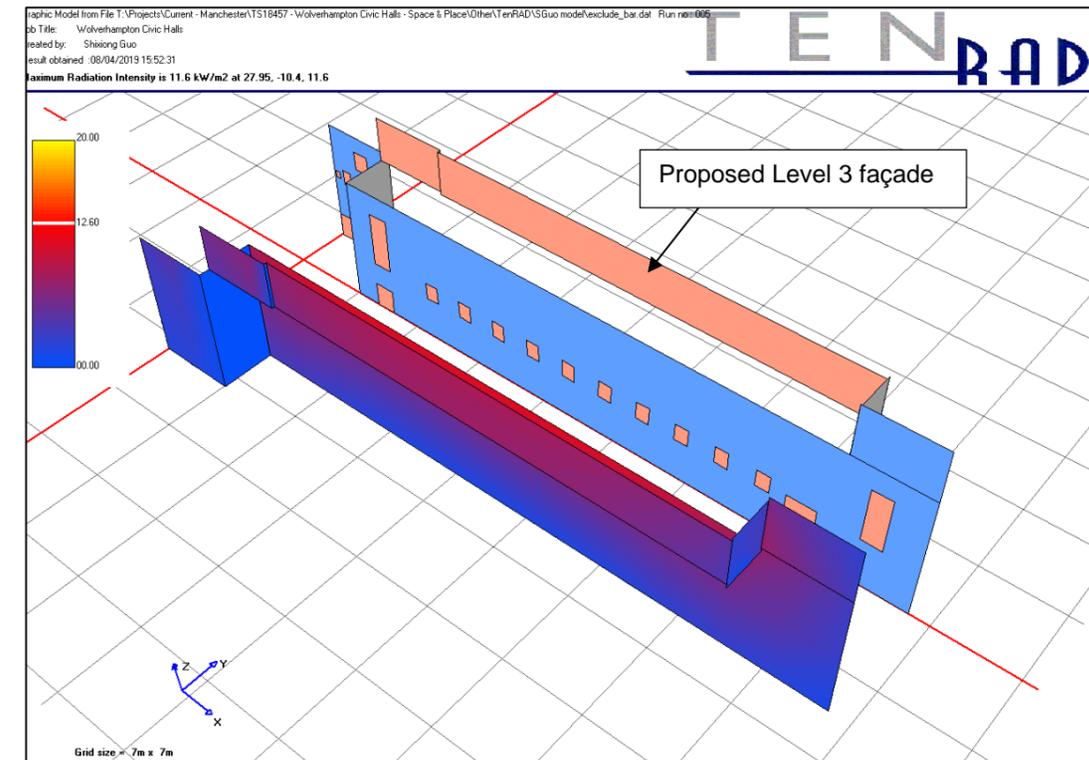


Figure 8.5: Heat radiation analysis - proposed elevation excluding the Level 2 bar

- 8.34 The maximum radiation received from the building over the boundary is 11.6kW/m², less than the critical heat flux and is therefore consistent with the guidance in ADB.

Conclusion

- 8.35 The analysis presented in this section indicates that the new proposals can, provided that the existing Level 2 bar areas are enclosed in 60 minutes fire resisting construction, comply with the guidance in BR187 and thereby meet with the functional Building Regulations requirements.
- 8.36 The existing Level 2 bar does not meet guidance but this condition is being improved by the proposed works, i.e. Regulation 4 (3) is satisfied in the building will be no more unsatisfactory than before the work was carried out.
- 8.37 As described above, this assessment applies to both the Corporation Street and Mitre Fold elevations.

Roof coverings

- 8.38 The minimum separation distance to any point on a relevant boundary is less than 6m and therefore in accordance with Table 16 of ADB all new roof covering materials will comply with the designation AA, AB or AC when tested in accordance with BS 476-3^{12.35} or classified as European class B_{ROOF(t4)} when tested in accordance with BS EN 13501.

Plastic rooflights

- 8.39 No plastic rooflights are proposed.

9 Access and facilities for the fire service

Vehicle access

- 9.1 The extended Level 3 of the Civic Hall will be between 9.3m (North Street) and 13m (Mitre Fold) above the adjacent fire service access level and the proposed floor area is approximately 910m².
- 9.2 This marginally exceeds the qualifying criteria for firefighting shafts, i.e. 7.5m and 900m².
- 9.3 However, more than half of the area is taken by escape stairs, circulation and sanitary accommodation, where the fire load is relatively low and sufficient perimeter access is provided (see paragraph 9.5) such that dedicated firefighting shafts, in our view, are not required to meet the functional requirements of the Building Regulations.
- 9.4 Additionally, the extended Level 2 of the Wulfrun Hall will be 8.7m above the adjacent ground level, but the floor area of this storey will be considerably less than 900m² and, therefore, firefighting shafts are not necessary to provide access for the fire and rescue service at this level.
- 9.5 The total floor area is approximately 8,000m². Based on the available design information, vehicle access is provided to at least 80% of the building perimeter, i.e. in excess of the 50% recommended in Table 19 of ADB for a building of this size.
- 9.6 Accordingly, subject to confirmation that perimeter access is sufficient for the fire and rescue service, firefighting shafts, together with fire mains, should not be required to meet functional requirements.
- 9.7 It should be checked whether the existing fire service vehicle access routes and hard standings are in accordance with paragraphs 16.8 to 16.11 of ADB.
- 9.8 The Corporation Street route is provided with an access gate and is used by the touring parties for parking, e.g. for coaches. The use of this space should be coordinated with the fire and rescue service such that the activities of touring parties do not adversely restrict access for the emergency services.
- 9.9 **Design team note: We understand that proposals exist to landscape and pedestrianise North Street. These plans should consider emergency service vehicle access to the surrounding buildings. And, although outside of the scope of this project, it should be ensured that access routes and hard standings conform with paragraphs 16.8 to 16.11 of ADB and are agreed in coordination with the fire and rescue service.**

Venting heat and smoke from basements

- 9.10 The existing building contains basement (Level -2) 2m below ground at the west elevation. This is more than 1200mm below ground, but has a floor area of less than 200m² and therefore no further provisions are required to comply with ADB.
- 9.11 The existing lower ground floor (Level -1) is also more than 1200mm below ground in parts. However, due to the sloping site, this is open to atmosphere on the east and west elevations and, therefore, smoke ventilation can be achieved by virtue of the external doors and windows.

Private hydrants

- 9.12 The building will be within 100m of an existing fire hydrant, located at the junction of Mitre Fold with North Street and additional provision for water supplies will not be required subject to the adequacy of the existing hydrant.

10 Regulatory Reform (Fire Safety) Order

First aid firefighting equipment

- 10.1 To comply with the Fire Safety Order, suitable portable fire extinguishers will need to be provided throughout the building in accordance with the recommendations of BS 5306-8^{12.46}. Consideration should also be given to the provision of evacuation chairs or other measures to assist in the vertical evacuation of people with impaired mobility.

Risk assessment

- 10.2 To comply with Fire Safety Order a fire risk assessment must be in place when the building is first occupied. It is therefore recommended that a preliminary risk assessment be carried out prior to occupation. This should then be updated after the building is occupied to identify any additional risks that may have been imported by the occupiers.
- 10.3 Guidance on the risk assessment process is given in a series of H M Government guides entitled Fire Safety Risk Assessment^{12.7}. Unless hazardous materials or processes are introduced into a building complying with the Building Regulations it should not normally be necessary to provide additional physical fire safety measures over and above those required to satisfy Part B of the Building Regulations (other than portable fire extinguishers).

Fire safety management procedures

- 10.4 This fire safety strategy has been developed on the assumption that the building will be properly managed. Once the building is in use the management regime should be maintained and any variation in that regime should be subject to a suitable fire risk assessment.
- 10.5 Procedures for the management of fire safety should be developed and documented in a fire safety manual. Guidance on fire safety management procedures is given in BS 5588-12^{12.25} and a typical fire safety manual might include:
1. Fire safety policy statement
 2. Fire safety management structure
 3. Coordination with other parties (e.g. in a shared building)
 4. Emergency response
 5. Evacuation of people with special needs
 6. Contingency and salvage plans
 7. Emergency responsibilities of designated staff
 8. Summary of fire safety strategy and plans for the building
 9. Fire risk assessment
 10. Procedures for dissemination of information
 11. Selection and control of materials
 12. Maintenance and testing of fire safety equipment
 13. Routine housekeeping (e.g. removal of combustible waste)
 14. Fire safety training
 15. Fire drills
 16. Decoration, alteration and building work
 17. Audit procedures and updating of the manual
 18. Fire safety records
 19. References.

- 10.6 When the building is in use a suitable fire safety management regime should be established and any variations to the procedures should be the subject of a risk assessment.

Project-specific management procedures

- 10.7 The nature of this project requires the adoption of some specific fire safety procedures that will need to be included within the fire safety management plan. Based on the current design proposals these items are summarised below:
- a) Design occupancy

The maximum occupancies – derived from the capacities of the available escape routes – will need to be documented in the operator's fire safety management plan and standard operating procedures.
 - b) Management and stewarding

The existing building includes several interlinking escape routes and points where a choice of routes is available to large numbers of public. This can present additional risks such as: inefficient use of the available escape routes; overloading of individual exits; and overcrowding at points where routes merge. Effective management will be essential to ensure a safe and prompt evacuation in an emergency. Nominated and suitably trained staff, with a means of emergency communication (e.g. portable radios), should be available to manage the evacuation and direct occupants along the appropriate designated escape routes.
 - c) Evacuation of PRMs

Not all areas of the building will have level access and, therefore, specific fire safety management procedures will need to be developed and implemented in order to ensure the safe evacuation of PRMs.
 - d) Use of the stage

A safety curtain and associated stage smoke ventilation, etc. is not currently provided and it is unclear as to whether it is possible to introduce a safety curtain as part of the works. Therefore, City of Wolverhampton Council, acting in its capacity as the licensing body, may impose restrictions on the types of performance, set design, etc. permitted on the stage, in accordance with its local licensing procedures. Likely controls are presented in section 6 of this report.
 - e) Existing external stair

The operator will need to include special fire safety management arrangements to ensure that the external stair forming the relief route from the South West stair is always available for use when the building is occupied for events (e.g. including in inclement weather).
 - f) Corporation Street parking

The Corporation Street route is provided with an access gate and is used by touring parties, e.g. for parking coaches. The use of this space should be coordinated with the fire and rescue service access such that the activities of touring parties do not adversely restrict access for the emergency services.
 - g) Access to and from the roofs

Access to the auditoria roofs and roof voids in any capacity should be controlled by a permit to work scheme. Consideration should be given to a means of immediately alerting roof void occupants of a fire in the building should be provided (e.g. personal pagers linked to the fire alarm system).
- 10.8 It is recommended that the above procedures are reviewed with the proposed building operator or their representative to ensure that they are consistent with their normal operating procedures.

11 Conclusions

- 11.1 On the basis of the fire safety strategy presented in this report, it is our opinion that the extended and refurbished building can satisfy the functional requirements of Part B (fire safety) of the Building Regulations.
- 11.2 **Design team note: There are a number of non-compliances in the proposed design which need to be resolved as the design progresses.**
- 11.3 To comply with the Regulatory Reform (Fire Safety) Order, the building user(s) will need to implement suitable fire safety management procedures and carry out a fire risk assessment prior to and shortly after occupation (see section 10). Subject to a suitable and sufficient fire risk assessment, additional physical fire safety measures should not be required unless high hazard materials or processes are introduced.
- 11.4 As the requirements of the Building Regulations and Fire Safety Order are set out in functional terms and can be interpreted in differing ways, it is essential that the recommendations of this report are agreed with the relevant approvals bodies prior to implementation.
- 11.5 Regulation 38 of the Building Regulations requires that fire safety information be given to the person responsible for the occupied building. Therefore, copies of the finalised fire strategy report and other relevant fire safety information (e.g. operation & maintenance manuals for all installed active and passive fire safety systems) should be issued to the responsible person.

12 References

- 12.1 The Building Regulations 2010 (as amended). SI 2010 No. 2214. The Stationery Office Limited. 2010
- 12.2 Regulatory Reform (Fire Safety) Order 2005, SI 2005 No 1541. The Stationery Office Limited. 2005
- 12.3 The Building Regulations 2010, Approved Document B: Fire Safety. 2006 edition incorporating 2007, 2010 and 2013 amendments. The Stationery Office Limited. 2013
- 12.4 The Building Regulations 2010, Approved Document J: Combustion appliances and fuel storage systems. 2010 edition incorporating further 2010 amendments. The Stationery Office Limited. 2010
- 12.5 The Building Regulations 2010, Approved Document K: Protection from falling collision and impact. 2013 edition. The Stationery Office Limited. 2013
- 12.6 The Building Regulations 2010, Approved Document M: Access to and use of buildings. 2015 edition incorporating 2016 amendments. The Stationery Office Limited. 2016
- 12.7 Fire Safety Risk Assessment, Series of guides published by H M Government 2006
- 12.8 Guide to Fire Precautions in Existing Places of Entertainment and Like Premises. ISBN 0 11 340907 9. The Stationery Office Limited. 1998
- 12.9 BS 5839-1:2002. Fire detection and alarm systems for buildings. Code of practice for system design, installation, commissioning and maintenance
- 12.10 BS 5839-8: 1998. Fire detection and alarm systems for buildings. Code of practice for the design, installation, commissioning, and maintenance of voice alarm systems.
- 12.11 BS 5839-9:2003. Fire detection and alarm systems for buildings. Code of practice for the design, installation, commissioning and maintenance of emergency voice communication systems
- 12.12 BS EN 54-11:2001. Fire detection and fire alarm systems, Manual call points
- 12.13 BS 8524-1:2013. Active fire curtain barrier assemblies. Specification
- 12.14 BS 8524-2:2013. Active fire curtain barrier assemblies. Code of practice for application, installation and maintenance
- 12.15 PD 7974-6:2019. Application of fire safety engineering principles to the design of buildings. Human factors. Life safety strategies. Occupant evacuation, behaviour and condition (Sub-system 6)
- 12.16 BS 5266-1:2005. Emergency lighting, Code of practice for the emergency lighting of premises
- 12.17 BS 5266-7:1999. Lighting applications - emergency lighting
- 12.18 BS 5499-1:2002. Graphical symbols and signs, Safety signs including fire safety signs. Specification for geometric shapes colours and layout
- 12.19 Health and Safety (Safety Signs and Signals) Regulations 1996. SI 1996 No. 341. The Stationery Office Limited. 1996
- 12.20 Safety Signs and Signals. The Health and Safety (Safety Signs and Signals) Regulations 1996. Guidance on Regulations. L64 (Third edition). Health and Safety Executive. 2015
- 12.21 BS 5588-5:2004. Fire precautions in the design construction and use of buildings, Access and facilities for firefighting
- 12.22 BS 5588-6:1991. Fire precautions in the design construction and use of buildings, Code of practice for places of assembly
- 12.23 BS 5588-8:1999. Fire precautions in the design construction and use of buildings, Code of practice for means of escape for disabled people
- 12.24 BS 5588-9:1999. Fire precautions in the design, construction and use of buildings. Code of practice for ventilation and air conditioning ductwork
- 12.25 BS 5588-12:2004. Fire precautions in the design, construction and use of buildings, Managing fire safety
- 12.26 BS EN 1125:1997. Building hardware. Panic exit devices operated by a horizontal bar. Requirements and test methods (*Incorporating Amendment No. 1 and Corrigendum No. 1*)
- 12.27 BS 5852:1990. Methods of test for assessment of the ignitability of upholstered seating by smouldering and flaming ignition sources
- 12.28 BS EN 12101-2:2003. Smoke and heat control systems. Specification for natural smoke and heat exhaust ventilators
- 12.29 BS EN 12101-3:2002. Smoke and heat control systems. Specification for powered smoke and heat exhaust ventilators
- 12.30 BRE Report (BR 187). External fire spread. Building separation and boundary distances. BRE 1991
- 12.31 BRE Report (BR 135). Fire performance of external thermal insulation for walls of multi-storey buildings. BRE 2003
- 12.32 BS 8414-1:2002. Fire performance of external cladding systems. Test methods for non-loadbearing external cladding systems applied to the face of a building
- 12.33 BS 8414-2:2005. Fire performance of external cladding systems. Test methods for non-loadbearing external cladding systems fixed to and supported by a structural steel frame
- 12.34 BS 3251:1976. Specification. Indicator plates for fire hydrants and emergency water supplies
- 12.35 BS 476-3:2004. Fire tests on building materials and structures. Classification and method of test for external fire exposure roof tests
- 12.36 BS 476-4:1970. Fire tests on building materials and structures. Non-combustibility tests for materials
- 12.37 BS 476-8:1972. Fire tests on building materials and structures. Test methods and criteria for the fire resistance of elements of building construction
- 12.38 BS 476-20:1987. Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles) (*Incorporating Amendment No. 1*)
- 12.39 BS 476-21:1987. Fire tests on building materials and structures. Method for determination of the fire resistance of loadbearing elements of construction
- 12.40 BS 476-22:1987. Fire tests on building materials and structures. Methods for determination of the fire resistance of non-loadbearing elements of construction
- 12.41 BS 476-23:1987. Fire tests on building materials and structures. Methods for determination of the contribution of components to the fire resistance of a structure (*Incorporating Amendment No. 1*)
- 12.42 BS 476-24:1987. Fire tests on building materials and structures. Method for determination of the fire resistance of ventilation ducts
- 12.43 BS EN 13501-1:2007+A1:2009. Fire classification of construction products and building elements. Classification using test data from reaction to fire tests.
- 12.44 BS EN 13501-2:2003. Fire classification of construction products and building elements. Classification using data from fire resistance tests, excluding ventilation services

- 12.45 BS EN 13501-5:2005, Fire classification of construction products and building elements, Classification using data from external fire exposure to roofs tests
- 12.46 BS 5306-8:2000. Fire extinguishing installations and equipment on premises, Selection and installation of portable fire extinguishers
- 12.47 BS 7273-4:2007. Code of Practice for the operation of fire protection measures. Actuation of release mechanisms for doors
- 12.48 BS EN 12845:2004. Fixed firefighting systems, Automatic sprinkler systems. Design installation and maintenance
- 12.49 BS 8519:2010. Selection and installation of fire-resistant power and control cable systems for life safety and fire-fighting applications – Code of practice
- 12.50 TenRAD v 2.41 - Software for Boundary Radiation Calculation. Tenos Ltd 2002.
- 12.51 Building separation calculations revisited using advanced fire models. R. Chitty and S. Kumar. Fire Research Station, BRE. Interflam 2004.

Approved Documents – note regarding technical specifications

When an Approved Document makes reference to a named standard, the relevant version of the standard is the one listed at the end of the publication, even where this standard has been superseded or replaced.

Therefore the British Standards referenced by this report are generally those referenced by the current publication of Approved Document B (and not necessarily the most recent version of the Standard).

Newer versions may be used as a source of guidance provided that they continue to address the relevant requirements of the Building Regulations.

13 Summary of fire safety provisions

13.1 The following table summarises the main fire safety provisions for the proposed extension and refurbishment works.

Table 13.1: summary of fire safety provisions

Provision	Comments
B1 - Means of warning and escape	
Travel distances	Travel distances from new areas appear to be compliant with BS 5588-6 and ADB.
Exit widths	Some existing means of escape routes are not wide enough for the numbers of people expected to use them. See section 5 and Annex A2.
Escape routes	Generally compliant with BS 5588-6 and ADB. Escape routes from the new tier in Wulfrun Hall only pass through the ancillary areas which BS 5588-6 recommends against.
Wheelchair refuges	A number of accessible viewing places are proposed, and wheelchair refuges will be of sufficient size to accommodate all people expected to use them. The communication systems or otherwise are to be determined as design progresses.
Electrical fire alarm system	To be extended throughout the new areas incorporating Public Address and Voice Alarm provisions of BS 5839-8.
Automatic fire detection system	We recommend that detection is provided throughout the building, i.e. category L1 coverage to BS 5839-1.
Escape lighting	To be provided throughout the refurbished areas in accordance with BS 5266-1.
Exit signage	To be provided in accordance with BS 5499-1 and the Safety Signs and Signals Regulations.
B2 - Internal fire spread (linings)	
Wall and ceiling linings	All new wall and ceiling linings to comply with Table 10 of Approved Document B and incorporate the additional provisions of BS 5588-6. See section 6
B3 - Internal fire spread (structure)	
Fire resistance of structure	60 minutes is recommended by ADB.
Maximum compartment size	Less than 2000m ² (subject to confirmation of fire resisting separation)
Compartment floors	Required to limit restrictions on unprotected areas, see sections 7 & 8.
Sprinkler system	Not required to comply with ADB with respect to compartment size. However, the client may wish to consider these for reasons of property protection.
Enclosure of places of special fire hazard	With the exception of the new HV room, the proposals do not appear to include new ancillary accommodation which would be considered a place of special fire hazard.

Provision	Comments
	Ancillary areas which present a fire hazard as listed in Table 9 of BS 5588-6 should be enclosed in fire resisting construction as part of the works.
B4 - External fire spread	
Unprotected areas	There are limitations on unprotected areas. See Section 8.
Roof coverings	New roof construction to be AA, AB or AC (national class) or B _{Roof(t4)} (European class).
External wall surfaces	See Section 8.
B5 - Access and facilities for the fire service	
Fire tender access	Perimeter access is provided to approximately 80% of the building perimeter which exceeds the 50% recommended in ADB.
Firefighting shafts	The new tier at Level 3 in Civic Hall meets the qualifying criteria for a firefighting shaft recommended in ADB. However, firefighting shafts may not be needed to meet the functional requirements.
Regulatory Reform (Fire Safety) Order	
Risk assessment	To be carried out by responsible person(s)

A1 Annex A1 - Drawings and information

A.1.1 The following information has been used in the preparation of this report:

Drawings

A.1.2 Drawings received from Space and Place Architects 1st April 2019:

-  3692 (20) 002 P02 Level -2 Plan AO
-  3692 (20) 003 P06 Level -1 Plan AO
-  3692 (20) 004 P05 Level 0 Plan AO
-  3692 (20) 005 P05 Level 1 Plan AO
-  3692 (20) 006 P05 Level 2 Plan AO
-  3692 (20) 007 P05 Level 3 Plan AO
-  3692 (20) 008 P04 Roof Plan AO
-  3692 (20) 014 P04 Civic Hall Event Layouts
-  3692 (20) 015 P02 Wulfrun Hall Event Layouts
-  3692 (21) 003 P02 Proposed Elevations 1- North Street
-  3692 (21) 004 P03 Proposed Elevations 2- Mitre fold
-  3692 (22) 001 P04 Sections A+B
-  3692 (22) 002 P03 Sections C+D

Information

A.1.3 Information, standing capacity for example, contained in Space and Place's Stage 2-3 planning presentation report.

A.1.4 Emails received 2nd April 2019:

-  Staff operating numbers
-  Hall occupancies

A2 Annex A2 - Means of escape calculations

A.2.1 This Annex sets out the analyses of the exit and stair capacities for the building.

A.2.2 Escape width assumptions are presented on the mark-ups submitted with this report.

Occupancy

A.2.3 The basis upon which the occupancy has been calculated is presented in Table 5.1 in Section 5.

A.2.4 The maximum occupancy of the building will be when the Civic and Wulfrun Halls are both used for standing events (3,292 pers and 1,260 pers respectively). Including the staff, touring party and guests, stated by City of Wolverhampton Council to be 308 pers, there will be 4,860 people in the building approximately.

A.2.5 The distribution of staff and other building users was not provided and the occupancy calculations in Table A2.2 use a staff to spectator ratio of 2% to distribute this. Note that 2% of the spectator numbers is equal to a staff occupancy of the order of 90 people which is consistent with the operator's stated staffing numbers.

Capacity of horizontal and storey exits

A.2.6 The capacity of horizontal and storey exits has been calculated assuming that the largest exit is blocked by fire and is therefore unavailable.

A.2.7 Exit capacities have been calculated on the following basis:

Table A2.1 - Capacity of escape routes

Maximum number of persons	Minimum clear width (mm)
60	750
110	850
220	1050
more than 220	5 per person

Note 1 – Gangways serving not more than 50 people will have a minimum clear width of 900mm; gangways serving more than 50 people will have a minimum clear width of 1100mm.

A.2.8 The following table sets out the exit width calculations for each level.

A.2.9 For standing occupancies there will be a significant shortfall in escape capacity, see Section 5.

Table A2.2: Occupancy/ Horizontal escape capacities

Level	Hall	Accommodation	Rooms	Area (m2)	No. Pers	Rooms/Storey exits	Capacity pers	Comments
Level 3	Civic	Seating	-	-	322			
		Bar	Portico	82	200	2 x 1250mm	250	Excl. terrace 0.5m2/pers (56m2) + 0.3m2/pers within 2m of servery (13m2)
		Staff	-	-	7			
		Total			329	1x400mm (NE Stair) 1400mm (SE Stair) 2 x 1200mm (Stair 1 & 2)	760	OK
Level 2	Civic	Seating (incl. standing)	-	-	737			Standing occupancy adopted for this assessment as the worst case
		Dressing rooms	-	64	64			Assumed 1m ² /pers.
		Bar	North	105	232	Doors swing against escape 3 x 1050mm	60	0.5m2/pers (88m2) + 0.3m2/pers within 2m of servery (17m2)
		Bar	South	110	243	Doors swing against escape 3 x 1050mm	60	0.5m2/pers (93m2) + 0.3m2/pers within 2m of servery (17m2)
		Staff	-	-	15			
	Total			816	1x600mm NW Stair 1600mm SW Stair 2 x 140mm (NE & SE Stair)	880	OK	
	Wulfrun	Seating	-	-	120			
		Bar	Wulfrun	95	200	2 x 850mm	60	0.5m2/pers (88m2) + 0.3m2/pers within 2m of servery (7m2)
		Staff	-	-	3			
	Total			123	2 x 850mm	110	X	
Level 1	Civic	Dressing rooms	-	30	30			Assumed 1m ² /pers.
		Control room	-	18	4			
		VIP Hospitality	-	63	63	Doors swing against escape 2 x 850mm	60	Assumed 1m ² /pers.
		Kitchen	-	30	5			
		Crew canteen	-	65	65			
		Office	Production	16	4			
Total			171	4 x 850mm	220	OK		
Level 0	Civic	Seating	-	-	2233			OK for seated occupancy
		Staff	-	-	70			Staff numbers stated by City of Wolverhampton Council
	Total (Civic only)			2303	1 x 2200mm (S elevation) 1 x 2000mm (S elevation) 1 x 1600mm (SW Stair) 1 x 1600mm (NW Stair) 2 x 1200mm (via Lobby)	1520	X	
	Wulfrun	Bar	Lantern	185	370	2 x 850mm	60	Use assumed to be independent of Civic Hall.
Total (Civic only)			370	2 x 850mm	110	X		
Level -1	Civic	Stores	Plant/Chairs/etc	850	29			OK based on exits provided
		Kitchens	External catering	78	11			
	Total (Civic only)			40	2 x 850mm	110	OK	
	Wulfrun	Seating	-	-	1140			OK for seated occupancy
Staff	-	-	27					
Total (Wolfrun only)			1167	1 x 1700mm (main exit) 1 x 1250mm (Stage left) 1 x 1250mm (Wulfrun Bar SW) 1 x 1250mm (Wulfrun Bar NW)	750	X		
Level -2	Wulfrun	Dressing rooms	-	75	45			Assumed 1m ² /pers.
		Total			45	2 x 800mm wide stairs	50	OK

A.2.10 Note that wider exits and corridors may be necessary to satisfy Part M of the Building Regulations.

Capacity of escape stairs

- A.2.11 The building has been designed on the basis of simultaneous evacuation and therefore the stair capacity has been evaluated on the basis of Table 5 of BS 5588-6
- A.2.12 Note that final exits from stairs have not been dealt with in section 5.
- A.2.13 Based on the assumed dimensions referred to in A.2.2, the stair which has the largest capacity is the NW Stair serving Level -1 to Level 2 and this also serves Stair 1 (NW) and Stair 4 (Wulfrun Hall). The stairs are not provided with lobby protection and, accordingly, the largest stair has been discounted from the means of escape calculations.

Table A2.3: Escape stair capacity calculations

Level	Hall	Accommodation	No. Pers	Stewards	Total loading	Civic Hall						Wulfrun				
						NE Stair (L3)	SE Stair (L3)	NE Stair (L0-L2)	SE Stair (L0-L2)	NW Stair (B1-L2)	SW Stair (B1-L2)	Stair 1 (NW)	Stair 2 (SW)	Stair 3	Stair 4	
3 (2nd Tier Gallery)	Civic	Seating	322	7	329	164	82	X	X	DISCOUNTED	X	DISCOUNTED	83	X	X	
2 (1st Tier Gallery)	Civic	Seating	737	15	816	Feed NE Stair	Feed SE Stair	272	272	DISCOUNTED	272	Feed NW Stair	Feed SW Stair	X	X	
		Dressing rooms	64	-		Feed NE Stair	Feed SE Stair	164	82	DISCOUNTED	83	Feed NW Stair	Feed SW Stair			
	Wulfrun	Seating	120	3	123	X	X	X	X	X	X	X	X	123	DISCOUNTED	
1 (Mezzanine)	Civic	Dressing rooms	30	-	171	X	X	78	93	DISCOUNTED	0	X	X	0	Feed NW Stair	
		VIP	63	-						DISCOUNTED						
		Canteen	65	-												Feed NW Stair
		Kitchen/office	13	-												
0 Ground level	Civic	Seating	See Note 4 & 5		320	X	X	X	X	DISCOUNTED	320	X	X	X	X	
B1 Lower Ground 1	Wulfrun	Seating	See Note 4		0	X	X	X	X	DISCOUNTED	X	X	X	X	X	
Total per stair						164	82	514	447	0	675	0	83	123	0	
Width (m)						1.4	1.4	2.4	2.4	2.5	2.5	1.2	1.2	1.1	1.1	
Flow capacity (pers)						280	280	480	480	500	500	240	240	220	220	
Holding capacity (pers)						0	0	90	90	90	90	45	45	0	0	
No. levels served						1	1	3	3	4	3	1	1	1	1	
Capacity						280	280	660	660	770	680	240	240	220	220	
Capacity exceeded?						OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	

- Notes:
- The calculations take into account a 2% staff loading based on the seating capacity.
 - Only the seating, staff areas (kitchen, offices, etc.) and the stage/event staff have been considered.
 - Bars have not been included on the assumption that their use will not be coincident with the seating areas.
 - Stair loading limited by the exit doors into the stair.
 - Assumed numbers based on exit widths into the stair at this level.

A.2.14 Note that wider exits and corridors may be necessary to satisfy Part M of the Building Regulations.

A3 Annex A3 - Unprotected area calculations

Unprotected area assessment

- A.3.1** The allowable unprotected areas have been assessed using the enclosing rectangle method of BRE report BR 187^{12,30}.
- A.3.2** The unprotected area evaluation is detailed below. The suffix (S) following the distance measurement means it is to a site boundary or centre of a road.
- A.3.3** We have assumed a radiative heat flux of 84kW/m² based on the assembly and recreation use of the building in accordance with ADB.
- A.3.4** The assessed elevations are shown in Figures A3.1 to A3.4. Existing UPA is shaded in pink and proposed UPA is shaded in blue.

Table A3.1 - Evaluation of allowable unprotected areas

Elevation	Boundary distance (m)	Dimensions of elevation* (w x h, m)	Enclosing rectangle (w x h, m)	Allowable % UPA enclosing rectangle	Proposed % UPA	Comments
North Street	13.3	40 x 16	30 x 12.9	100	62	UPA OK
Corporation Street (Civic)	5.2	77 x 20	60 x 15	26	35	AUPA exceeded
Corporation Street (Wulfrun)	This elevation is unaltered by the proposed works and therefore complies with the Building Regulations by virtue of Regulation 4(3).					
Mitre Fold (Civic)	5.6	52 x 15.7	52.9 x 14.7	28	42	AUPA exceeded
Mitre Fold (Wulfrun ground)	5.6	23.7 x 13.9	23.7 x 8.1	53	48	UPA OK
Mitre Fold (Upper tier)	5.6	23.7 x 13.9	23.7 x 4.5	91	44	UPA OK
Red Lion Street (Civic)	10	33 x 22	33 x 3	100	20	UPA OK
Red Lion Street (Wulfrun)	This elevation is unaltered by the proposed works and therefore complies with the Building Regulations by virtue of Regulation 4(3).					

- A.3.5** The boundary distance was measured to the centre of the adjacent road (see elevation titles).
- A.3.6** The above figures assume that the Civic Hall and Wulfrun Hall will be enclosed within separate compartments.

North Street elevation

- A.3.7** The North Street elevation includes the addition of the portico bar glazing at Level 3. The enclosing rectangle assessment indicates that the UPA will not be exceeded. Separate analyses of the unprotected areas for the large areas of glazing in isolation indicate that these are also compliant with the limits recommended in BR 187.

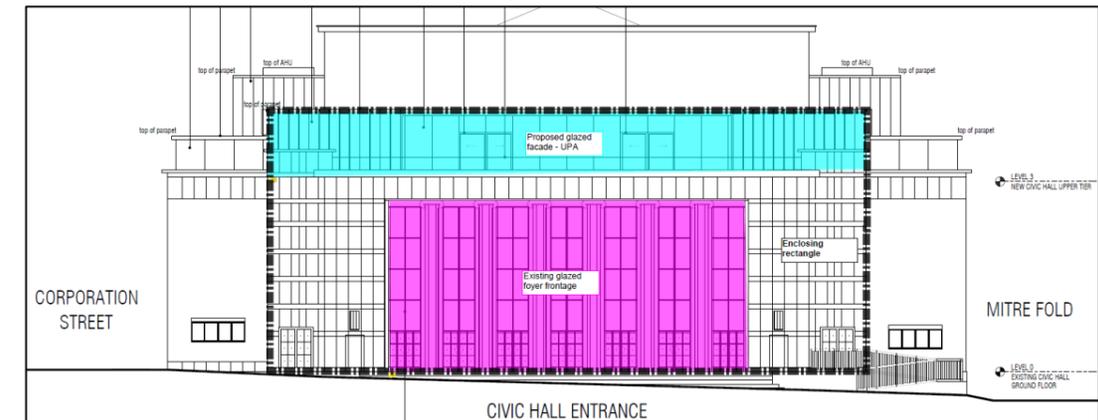
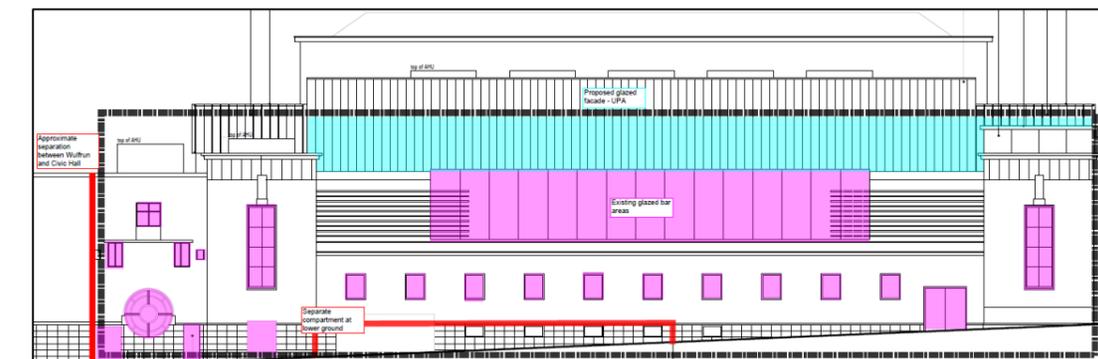


Figure A3.1: North Street elevation

Corporation Street elevation

- A.3.8** The Corporation Street elevation includes the addition of the Level 3 glazed façade.
- A.3.9** The enclosing rectangle assessment indicates that the UPA will exceed the limits recommended in BR 187. See section 8.



Mitre Fold elevation

- A.3.10** The Mitre Fold elevation includes the addition of the Level 3 glazed façade and the Wulfrun Hall entrance extension (also glazed).
- A.3.11** The enclosing rectangle assessment indicates that the UPA will exceed the limits recommended in BR 187 in the Civic Hall compartment. See section 8.

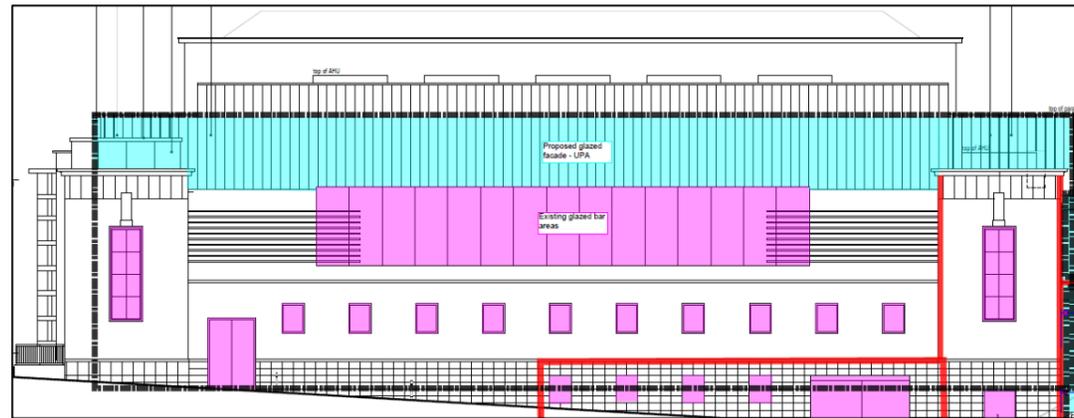


Figure A3.2: Mitre Fold (Civic) elevation

A.3.12 The enclosing rectangle assessment indicates that the UPA will not the limits recommended in BR 187 in the Wulfrun Hall compartment, provided that the new Wulfrun Hall bar at Level 2 is constructed as a separate compartment.

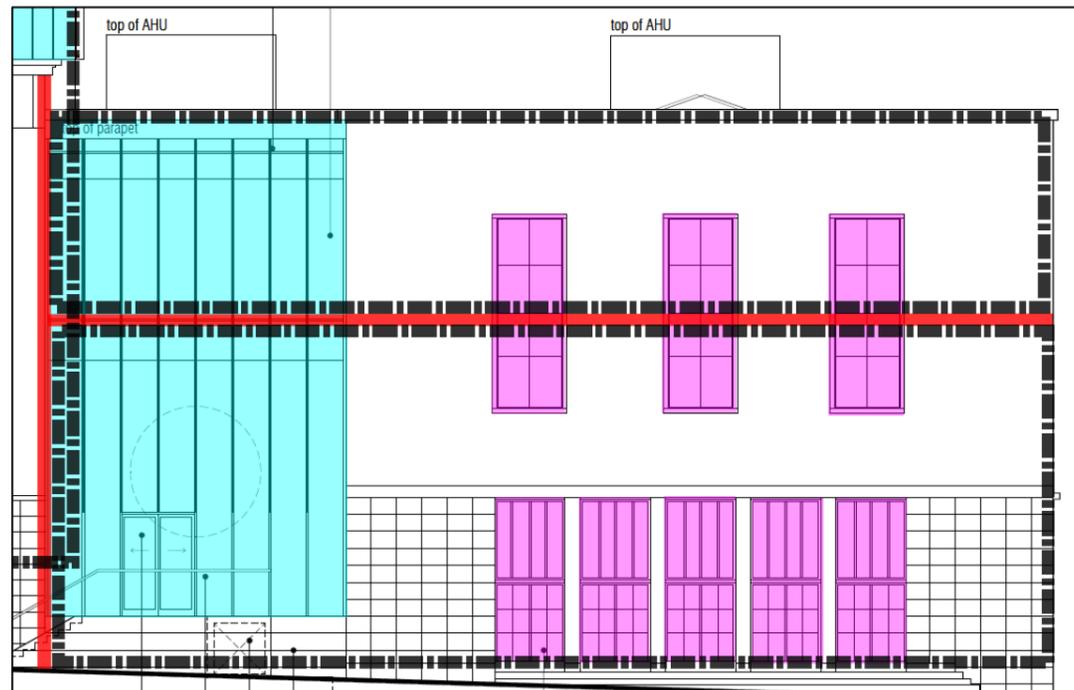


Figure A3.3: Mitre Fold (Wulfrun) elevation

Red Lion Street elevation

A.3.13 The Red Lion Street elevation includes the addition of the glazed façade at Level 3. The enclosing rectangle assessment indicates that the UPA will not be exceeded. The Wulfrun Hall elevation will remain unchanged.



Figure A3.4: Red Lion Street elevation

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