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Introduction

Scope

This guide is to be used in the design process for all new builds, changes of use and major refurbishments including property to be leased by the University. Content may also be used to advise design in minor works.

Aims

- To align the requirements of the Building Regulations, fire safety legislation and the University. There is potential conflict between these as the Building Regulations are generic and often prescriptive whilst fire safety legislation encourages creative solutions relative to actual use and management.

- To provide an indication of non-prescriptive preferred solutions and appropriate standards. The content is not a statement of requirements or intended to replace existing British or European technical standards or national guidance; reference to these will still be necessary.

- To facilitate high standards, best value and sustainability in terms of fire related issues in the design of buildings.

Consultation

Building Regulations require a suitable and sufficient fire strategy but are generic and tend towards prescription. Fire safety legislation encourages creative solutions relative to the use and management of a building and the wider University estate.

Without a clear understanding of the use of a building and the University's fire safety management practices, selection of appropriate fire safety precautions will often be problematic.

There is the potential to fail to meet the requirements of the Fire Safety Order resulting in unacceptable risk to employees, students and visitors or unacceptable on-going cost and managerial responsibility.

Addressing issues at a late stage is likely to cause conflict, delay, additional expense or management burden and have a negative impact on fire safety.

Effective consultation should ensure that the potential negative effects are mitigated and improvements can be considered for inclusion. Consultation should not cause any delay and is likely to reduce cost.

Early and comprehensive consultation with the University Fire Safety advisor is key to achieving good cost effective fire safety standards compliant with relevant legislation. The Fire Safety Advisor shall be consulted on all fire related aspects from conception to completion. The Fire Authority, Building Control Officer or Approved Inspector, Principal Contractor and other relevant persons shall be consulted on a regular basis throughout, in an open transparent manner.
**Design Strategy**

The fire safety design emphasis shall be on early detection, suppression and evacuation for the protection of life. The protection of property of national or historic importance, property of high importance to the University, business continuity and the environment shall also be considered.

Compliance with Approved Codes of Practice is expected where practical; however BS 9999 and Fire Engineering may be used where beneficial. Any variation from simple compliance with Approved Codes of Practice will require full explanation in the Fire Strategy or Fire Safety Manual including any implications for future changes in design or use.

The category of use for academic buildings will normally be either ‘Education Premises’ or ‘Large Place of Assembly’; sleeping accommodation will normally be ‘Student Accommodation’ or ‘Hotel’.

The design shall address all of the fire related challenges present, including:

- Multi use buildings often with content of national or historic importance;
- Common changes of use of space. IT, electrical equipment telephone lines etc. frequently added to or changed, breaching fire compartmentation;
- Inflated and often unpredictable occupancy due to open public access and difficulty in controlling entry;
- Extensive range of users including most disabilities, ages, cultures and religions, some with little English or appreciation of fire safety, often unfamiliar with the building;
- Frequent door wedging and use of corridors and common areas for displays etc. with no clear understanding of fire loading restrictions;
- Increasing use of headphones, resulting in not hearing fire alarm sounders;
- Large student bodies often working unsupervised; and
- Increasing use of buildings and facilities for 24 hours.

**Compartmentation**

**Provision**

Whilst compartmentation is a requirement of the Building Regulations in certain places, it has further benefits:

- It helps to prevent rapid fire spread within the building;
- It reduces the chances of a fire becoming large, on the basis that large fires are more dangerous to occupants, fire and rescue personnel and other relevant persons;
• It helps to reduce the risk of total loss of a floor or building thus reducing the impact on business continuity; and

• Provides the capacity for staged or progressive evacuation and refuge ‘spaces’.

• The following features should always be compartmented:

  • Escape routes;
  • Protected staircases or fire-fighting staircases;
  • Protected corridors for dead-end situations;
  • Vertically rising shafts that penetrate through the horizontal compartmentation (lift shafts, risers etc.);
  • Walls common to two or more buildings;
  • Premises with a sleeping risk;
  • Plant rooms and areas where intended activity or content involves a high risk of fire;
  • Areas where persons may be required to utilise some form of airlock or sterilisation system to make their escape; and
  • Separate domains (tenants etc.).

60 minutes fire resisting compartmentation may be required where there are business critical facilities, areas containing high value, or irreplaceable information etc.

**Sub-compartmentation**

Sub-compartmentation of a floor may well not be expensive or affect the design of the building. In buildings where alternative staircases are provided there is a requirement to separate the stairs and most building materials used to divide areas of floor space tend to provide a minimum of thirty minutes fire resistance.

By looking at the building design and creating a point where two of these walls are opposite each other on the corridor, the placing of the fire doors at this point would effectively provide a level of compartmentation that divides the floor space in half without causing too much hindrance or extra cost and allowing the design to meet the requirements of the Building Regulations. For more complex layouts this may take a little more design effort but the theory can be repeated.

Most University floor space could be classed in the purpose group for ‘Assembly and recreation, Shop and commercial’ where Building Regulations may allow a compartment size of 2000m². This is a substantial allowance such that a fire could effectively take out a large area. Sub-compartmentation of areas over 1000m² is to be considered. This can best be achieved by utilising the internal walls and corridors.
Doorways
Corridors that lead to alternative means of escape do not need to be protected corridors and thus the doors on these corridors (except cross-corridor and other specifically identified doors) do not need to be self-closing fire doors. In all other areas the risk of breaches due to fire doors being wedged open is considerable and will result in the additional cost of provision of required approved hold open devices.

Compartmentation should avoid crossing doorways wherever possible so as to reduce the number of doors required as fire doors.

Penetrations
Over time, for various reasons, the use of a building may change, and a need arises to put a breach through a fire resisting wall or floor. Whilst it is impossible to anticipate every possible reason for this being done there is one common reason which accounts for the vast amount of these breaches and that is the running of cabling or wiring. It is therefore, important to consider what passive fire protection can be included into fire compartmentation to pre-empt the need for future penetrations. The inclusion of devices such as fire sleeves to allow for the running of cables when installing fire compartment walls will provide the end user and future contractors with a quick and safe way of running cable through compartment walls.

Intumescent protection sleeves with internal smoke barriers shall be installed where cables pass through fire compartment walls. The sleeve should be of suitable size to allow for future extra cabling.

Where, during the process of refurbishing or upgrading existing buildings, the opportunity arises to inspect existing compartmentation the compartmentation shall be inspected and any deficiencies made good as part of the upgrading or refurbishment works.

In all cases, where there is a need to breach existing compartmentation, the Fire Safety Advisor shall be notified prior to any works commencing and on completion of the works.

Vertical service shafts etc.
60 minutes fire resisting compartmentation is required at all access points and where services leave shafts rather than at floor levels. Detection will normally be required at the top of shafts.

Ducts and dampers
Extraction ductwork should be non-combustible and vent externally. Ductwork should be enclosed in a minimum of 30 minute fire resistant material where present in an escape route. Automatic fire dampers shall be provided where it passes through fire resisting elements; access for maintenance must be provided.
Means of Escape

It is normal to make minimal allowance for the ‘evacuation of disabled persons’ however, there is also an ever growing percentage of the population who have impairments. Northumbria University’s policy is to include all users who may have difficulty evacuating. Ease of escape for such persons must be considered in the initial stages of the design process.

All escape routes should be designed to enable self-evacuation wherever practicable: steps should be avoided; slopes of no more than 1:20 are acceptable. Any requirement for evacuation assistance or equipment should be avoided where practical.

Final exit door should not lead people into an enclosed area from which there is no further escape.

Where a final exit leads to steps outside the building, care should be taken

Where Fire engineering is proposed for a specific means of escape solution the additional challenges of the University must be included in thorough sensitivity analysis testing. Where evacuation simulation models are to be employed, 3rd Party accreditation is obligatory.

Evacuation Strategies

Simultaneous Evacuation

The simplest escape strategy is to ensure that, as soon as a fire has been confirmed, all of the occupants leave the building simultaneously. The actuation of a call point or detector gives an instantaneous warning from all fire alarm sounders for an immediate evacuation.

Simultaneous evacuation is preferred in smaller buildings; however some situations require variations, for example: apartment buildings where a defend-in-place strategy is adopted by providing a high degree of fire protection, such as fire-resisting separation between individual dwellings

Staged evacuation

The operation of a call point or detector gives an evacuation signal on the storey or zone affected; an ‘alert’ warning signal may be given in other parts of the premises. The decision to evacuate the remainder of the occupants then rests with the management and/or The Fire and Rescue Service.

In large or complex buildings, a staged evacuation procedure may be preferred in order to provide manageable sized alarm zones and reduce disruption. This will require the alignment of fire compartmentation. It is essential that adequate means of communication between storeys or zones is provided; a public address system or voice alarm, instead of sounders, is the most suitable way to control the evacuation process.

Occupant capacity

Occupancy figures are often the deciding factor in regards to the width of escape routes, staircases and doorways. Although client specifications will be met there is often some spare exit width or occupancy capacity in completed designs which is not supplied. This information is crucial when considering changes of use, items to be placed in corridors etc.
Future flexibility of use and all restrictions must be considered and an exit capacity agreed with the University. Maximum capacities for each space, permitted by the finished design, shall be included in the Fire Safety Manual.

Where client specification or furniture plans do not indicate the number of people in office accommodation a figure of 10m² per person may be used.

Guidance recognises that where specific or comparative data are available to demonstrate the actual maximum occupancies, this may be used instead of the standard floor space factor.

**Exit routes**

Single direction escape routes and rooms within rooms should be avoided. Staircases and lifts should normally be installed at the extremities of buildings.

Travel distances will account for use by people with mobility impairments. 18m is the usual maximum acceptable single direction travel distance unless there are suitable compensatory features.

Display information and items are often required within corridors. Where this is the case, fixed encased display facilities are to be provided.

Where exit routes are through an open plan area, the floor surface should indicate the route and management policies should ensure that this is kept clear of any obstructions.

Access and security controlled locking systems on doors used on escape routes including automatic sliding doors that do not have a mechanical override in the direction(s) of escape, such as a normal latch with a handle operating an electrical strike plate, systems that rely on the release of Electro-magnetic locks or operate by a code, push button or reader to allow the door to open, will require special arrangements to ensure that they fail safe at all times in the event of an emergency.

Where electromagnetic locking devices fitted to doors on the means of escape do not have a manual override they shall fail safe to open:

- The locks shall release on operation of the fire alarm system;

- On the loss of electrical power;

- Suitable emergency disconnection arrangements shall be provided at each locked door on the exit route, this will normally be in the form of the operation of a ‘break glass’ unit positioned adjacent to the door.

- Each emergency break glass unit shall:
  - Be coloured green;
  - Be in a prominent position suitable for escape;
  - Be clearly labelled;
  - Be a double pole type that interrupts both lines of supply.
• It is important that the emergency door release is of the double pole type and is ‘in line’ so that escape cannot be prevented by:

• Failure of the control system;

• Earth or frame faults in the control circuit;

• Failure of relays through doors sticking in the closed position;

• Not re-lock the device until reset, e.g. upon replacement of the glass from the break glass unit.

**Exit widths**
Allowance may be required for client specified furniture, in break-out areas etc.

Allowance must also be made for the width of powered wheelchairs and take account of disabled persons who may need to go against the flow.

Spare exit width over the client occupancy specification permitted by the finished design shall be included in the Fire Safety Manual.

**Wayfinding**
Illuminated escape signage shall be utilised as far as reasonably practicable and shall augment emergency lighting. Non-illuminated signage should be photo-luminescent. All signage should be as large as practical to aid those with impaired vision.

Routes specifically for the use of people with mobility impairments (i.e. alternatives to staircases) should be indicated with the standard wheelchair user symbol in green; those not suitable with the same crossed through added to the standard ‘running man’.

There should be clear colour contrast of doorways, edge marking of stairs and steps etc. to aid those with impaired vision.

**Lifts**
All lifts are to be to evacuation standard unless use of an accommodation lift can be justified by risk assessment.

Lifts should carry standard ‘do not use in a fire’ signage supplemented with the disabled exit route sign where suitable.

**Emergency lighting**
In all new or completely refurbished properties, a fully monitored, addressable emergency lighting system is to be used to reduce maintenance costs and provide accurate records of maintenance required by statutory regulations.

In whole or part floor refurbishments, fully monitored, addressable emergency lighting systems are to be considered as part of the project and provided with capacity sufficient so that other parts of the building can be added as part of strategic maintenance funding in the future.
Consideration must be given to levels where hazards are present in respect of people with impaired vision.

**Doors:**
Final exit doors shall be fitted with single action locks and provide level exit or be ramped to 1:20 max.

All fire doors shall:

- Be fitted with intumescent strips and smoke seals;
- Be of contrasting colour to the walls or frame;
- Be provided with disabled friendly handles usable by a closed fist and one-handed operation;
- Be operable one handed with a maximum of 30kn force opening force;
- To allow flexibility in future usage. All room door sets, corridor fire door sets and partitions adjoining circulation corridors must be of a 1/2-hour fire resisting standard and capable of being fitted with self-closing devices.
- Each door must be marked and labelled as being of fire resisting construction.
- Where the fire risk assessment indicates a need for room doors to be designated as fire doors they must be marked ‘Fire Door – Keep Closed’ and be fitted with a self-closer,
- Mains powered free swing closing devices are preferred on room doors likely to be wedged open;
- Corridor doors are generally to be provided with magnetic hold open devices interlinked to the alarm system; where used at the junction of alarm zones they must release on activation of either zone;
- Where magnetic door locks are used at the junction of alarm zones they must release on activation of the alarm system of either zone;
- All electrical door closers, locks and hold opens must fail safe in the event of a power failure;
- All doors on an escape route and final exits that incorporate a magnetic security device or are automatic doors that require an access card or entry code must fail safe to the open position in the case of an alarm activation;
- All doors on an escape route and final exits that can be secured by a manual key lock must have a handle or other simple fastening that can be easily operated, without the need for a key or other specific technical knowledge, from the side approached by people making their escape;
• Mains powered tamper proof open door alarms are required on all student kitchen doors (proven extremely effective at reducing false alarms from cooking);

• Means of access to all rooms must be available to emergency personnel; and

• Access control systems must be programmed such that all escape routes serving areas which may be occupied are available should there be a fire. There should be no requirement to use a card, code etc. under these circumstances.

**Active Systems**

**Suppression Systems**
The installation of a suppression system can have many positive benefits:

• Greater flexibility in building design;

• The reduction, through risk assessment, of active and passive fire safety measures;

• Reduced disruption and business continuity risk;

• Reduction of insurance premiums; and

• Meeting environmental targets by a reduction in the risk of water pollution from firefighting, the amount of waste materials damaged in the fire going to landfill and the need for the use of raw materials for rebuilding purposes.

**Water Systems**
Water mist systems rather than sprinkler systems greatly reduce the risk of water damage and the spatial need for water storage tanks.

**Sprinkler or water mist suppression systems are to be seriously considered at initial design stage; where they are not to be provided a detailed explanation and justification will be required.**

Suppression systems shall be in accordance with the appropriate B.S.

**Gas systems**
Gas suppression systems should be used to protect valuable materials or equipment where they would not react well to water.

**Systems for kitchens (not accommodation)**
A suppression system which distributes a fine mist spray of a chemical designed to react with burning fat is required. These systems work by the chemical reacting with the oil to form a coating or crust over the oil which has both a cooling effect and also cuts off the oxygen supply thus extinguishing the fire.
Automated Fire Alarm Systems

System preference
New systems should be compatible with or match existing effective systems.

Standard
This may vary but in the main we expect L3 enhanced with detection in all rooms where the normal occupancy is over four persons, plant rooms, service ducts, lift shafts, air handling ducts and high risk areas;

The normal standard is L1 in sleeping accommodation with sounder beacons at all bed heads.

Monitoring
All detection and alarm systems shall usually be 24hr monitored at the Security control room, where zoned evacuation is required remote activation must be facilitated.

Zoning
Alarm zones may be required in large buildings and must be based on confirmed fire compartments, usually by floor level. They must include other compartments which provide single means of escape. The extremities of fire alarm zones shall generally be provided with a call point inside each exit from the zone.

Detection Specification
False alarms and changes of room use are common features so installations, detection and alarm equipment must be adaptable.

The specification should require addressable, open protocol, detector bases allowing the fitting of ancillary equipment such as sounder and beacon units.

Combined programmable rate of rise heat and optical smoke units are preferred.

Heat detection is generally slower to react to a fire but will be required in areas where smoke detection is likely to cause false alarms.

Where the risk of false alarms is during defined periods only, (i.e. commercial kitchens, some laboratories etc.), detection should be programmed to smoke outside of the risk periods. Student kitchens may be used at any time so heat detection only is appropriate.

Bedroom detectors must be positioned such as to reduce likelihood of triggering by aerosols, shower steam etc.

CCTV technology and the development of Infra-Red cameras can be beneficial in the early detection of a fire. Although IR cameras will not identify developing heat sources the cameras do give better night time vision thus allowing operators to more easily identify smoke and small fires. Most models also have the ability to swap from IR mode to normal mode when faced with a bright light. At night this has the potential to identify a fire in IR mode and switch to normal mode thus highlighting the fire against a dark background.
Where CCTV cameras are to be installed for security purposes, consideration shall be given to using enhanced IR cameras.

**Alarm equipment**

Voice alarm systems are preferred as they are proven to improve evacuation times.

Alarm sounders shall be enhanced with visual beacons such that a beacon can be seen in each room over 20sqm, toilets, plant rooms and other noisy areas and in all escape routes.

Sounder levels over the refuge spaces are to be reduced to allow for effective verbal communication. Sounder levels in bedrooms are to provide 75Dba at the bedhead.

Illuminated ‘Fire No Entry’ signs shall be provided outside each entrance to the building and to each alarm zone; these must continue to function after sounders are silenced until the alarm panel is reset.

**Cause and Effect**

Programming must be agreed with the University Fire Safety Advisor.

**Ancillary equipment**

Gas supplies and air handling systems must be interfaced to cut off on activation of the fire alarm and be provided with an automated reset. Computer server rooms may require specialised alarm systems. All such interfaced equipment must be provided with a key switch to allow independent testing of the system and equipment.

**Access and Facilities for the Fire Service**

Any locked equipment for fire service use shall be readily accessible by the fire service. This will include access gates and barriers, dry riser inlets and outlets, fire fighting lift controls, fireman’s switches etc.

A copy of the Fire Safety Plan Drawing shall be provided readily available at the entrance to the building for Fire Service use.

The location of electricity supply switches, gas shut offs and unusual or high risks to firefighters shall be indicated by appropriate door signage.

**Firefighting Equipment**

The University operates a general no fire-fighting policy; most staff and students are not trained in extinguisher use. Extinguishers provision will generally be lower than the usual standard; they shall be provided at the extremities of single direction escape routes and at the entrances to alarm zones. Fixed hose reels are not generally accepted.
Specialist extinguishers and suppression systems may be required in science laboratories, computer server rooms, kitchens and areas with valuable contents.

Fire Blankets shall be provided in kitchens and science labs.

**Fire Prevention**

The incorporation of fire prevention measures in the design stage can have significant benefits rather than attempting to apply such measures after completion. There may well also be cost benefits to designing in such features, not only in regards to installation costs but after completion in the form of reduced insurance charges. Input at the design stage from an experienced fire safety professional or fire engineer may well have significant benefits.

**Fire/Fuel Loading**

**Information:**

Consideration must be given not only to proposed use but also potential use in the future. With the need to create income by increasing student numbers there is likely to be pressure to increase the capacity of buildings above the original design in the future.

Clear explanations of fuel load limits imposed by the design must be supplied such that end users can interpret them; this is particularly important for escape routes and circulation spaces.

**Furniture and fittings**

Future potential furnishing and storage requirements should be considered, not least to discourage the practice of turning escape routes into storage areas.

**Waste materials**

In today’s proactive approach to environmental issues establishments are encouraged to provide various different receptacles for different materials. This can lead to waste being retained on site for longer, often in more bulk, as it takes longer to fill receptacles and lack of secure storage facilities for bulk waste receptacles resulting in an arson risk. External storage close to buildings increasing the risk of external fire spread.

The client must be consulted to gain information as to the amount of waste to be stored and the types and numbers of receptacles to be used.

The design should incorporate adequate secure storage for bulk waste and receptacles either externally at least 6m from buildings or in a 60min fire compartment within the ground floor only accessed via an external door.

**Storage**

Consideration must be given to the provision of lockable cleaner cupboards and storage areas not only for combustible materials but also bulky or temporary equipment and furniture to prevent the obstruction of escape routes.
In some instances storage space can be found in a vertical riser for pipe-work or cabling, however this should not be done unless they are designed or re-designed for such use and have suitable compartmentation and means of warning in case of fire.

**External Spread**

There should be no combustibles within 6m of the building. Where it is not possible to position a skip 6m from a building then lockable, enclosed skips must be provided. If the outside of the building may be used for display purposes such as large advertisement banners, small neon signs or external awnings, such items may present a risk that must be assessed.

**Location of High Fire Risk Areas**

Where practical, high fire risk areas should be located such that any fire arising in them would have the minimum impact for example locating science laboratories, kitchens etc. on the top floor. However, access for firefighting must be considered and additional compartmentation at ground floor level may present a more suitable solution.

Gas cylinders, hazardous chemicals and substances are necessary in some areas. As the Fire Service may decide not to enter such areas in a fire situation particular consideration is required. Suitable external storage (with piped supplies if gas) is preferred.

Highly flammable and oxidising materials – bulk amounts will require a blast proof fire compartmented and suitably vented storage area. The vent shaft or ducting should be fire resisting or compartmented to the same level as the storage area and it should vent as directly as possible to fresh air.

The venting for each store should be self-contained if it passes through a building, i.e. it should only ventilate that store and should not be used for venting of fumes from other areas or stores within a building. Where the vent shaft/ducting passes through a fire compartmented wall or floor fire dampers must be installed to prevent fire spread.

Compressed gas or liquid gas cylinders – all compressed gas cylinders have the potential to react or explode in a fire. Wherever possible all cylinders will be stored externally with the relevant gases being piped around the building. Where that is not possible only one cylinder of each substance should be stored internally with all others being stored in a secured external area. Where gases are stored internally, appropriate signage will be required at the external entrances into the building and on the door leading into the room where the cylinder(s) is kept.

In a fire situation, the fire service may prefer to remove the cylinders where it is safe to do so therefore consideration should be given as to the layout of a building where work areas will require cylinders. The higher up a building the cylinders are being stored the more difficult and time consuming it is for fire fighters to move the cylinders out of the building.

Where gases are required at higher levels then consideration must be given to the piping of gases from external storage.
Equipment, Plant etc.

Sufficient electrical sockets on sensitive RCD devices must be provided to negate the need for multi-point adaptors and compensate for the managerial limits on Pat testing. Easily accessible emergency gas shut-offs shall be provided in each room fed.

Automated cooking fume extraction sufficient to prevent operation of corridor smoke detection shall be considered.

Fire Safety Management Issues

Future management provision requirements

Fire Safety Management must be regarded as of equal importance to fire protection measures. Management issues must be considered throughout the design process and detailed in the Fire Safety Manual.

*The managerial burden should be reduced as far as is reasonably practicable. Engineered controls are preferable to those reliant on management.*

Expertise and training burden:

The future management of fire safety systems is a considerable burden which must be considered at design stage bearing in mind the ‘fire related challenges’ indicated earlier in this document.

The aim shall be to minimise the resources that will be required. Examples of how this may be achieved include:

- Small alarm zones, with compartmentation, such that those responding to alarms can also deal with evacuation and firefighting issues.
- Evacuation systems which negate or reduce the need for specialist equipment or assistance; allowing for Self-evacuation of disabled people for example.
- Systems which are common to other campus buildings as this can reduce the training requirements for all users.

Fire Engineering

Where fire engineering is proposed for a specific means of escape solution the additional challenges of the institution must be included in thorough sensitivity testing. Where evacuation simulation models are to be employed, 3rd party accreditation is obligatory.

Adequate safety margins must be built into evacuation time studies allowing for ‘fire related challenges’ in particular slow response times and the potential numbers of users who may have difficulty evacuating which will include staff and students with temporary issues as well as disabled persons.
A fire engineered solution that relies on level 1 or enhanced management as a component may require a management solution tailored specifically to the design of the building. This must be agreed with the University before the solution can be accepted.

**Responsibilities**

**Fire Safety Advisor (University)**

- Advise on all fire related issues in building design from inception to completion of projects. This will include agreeing:
  - The Fire Strategy;
  - The preliminary fire risk assessment in accordance with the Building Regulations, if it is to be used as part of the submission;
  - All variations from standard practice; and
  - Content of the Fire Safety Manual.

**Designer**

It is the responsibility of the designer, in the first instance, to initiate and create the fire safety manual for a project and populate it with the design information and fire strategy.

**Principle contractor**

Conduct a fire risk assessment and ensure that suitable control measures are implemented, supervised and monitored.

Ensure the University Fire Safety Advisor is consulted before implementing any changes which may affect the arrangements in respect of fire, during or on completion of the build.

Update the information in the fire safety manual with as built information before hand over.

**Fire Safety Manual**

Building Regulations, Regulation 38 and B.S.9999 Annexe H require the supply of information. This should be in the form of a ‘Fire Safety Manual’ which will contain design information and the fire strategy as M.S.Word documents supplemented with plan drawings in CAD format.

These shall be provided to the University, as designed or specified, during the early design stages, revised and completed during the project. The completed version shall be confirmed ‘as built’ before hand-over.

The required content is detailed in the Appendices.
Fire Risk Assessment preparation

All fire safety features, equipment, signage and the Fire Safety Manual shall be in place before handover. This is to facilitate completion of the Fire Risk Assessment by the University Fire safety Advisor which must be in place prior to occupation.

Before accepting a building for occupation it is essential that the safety of the staff and public (as well as that of construction personnel if the building is being completed in phases) is assured by ensuring that all safety systems are properly installed and operational. On completion of the fire safety system, the complete installation should be checked for conformity to the approved drawings and system design.

Sleeping Accommodation

These areas present the highest life risk therefore extra precautions are required. They are likely to be used both for student living accommodation and, effectively, as hotel accommodation outside term time. Use by people not familiar with the building will be common. Design based simply on student accommodation or flats is unlikely to be suitable. Installation of a sprinkler or mist system and bi-directional means of escape from all normally occupied rooms is expected.

Challenges

Design standards must account the following additional challenges:

- Increasing use for conference visitors and the public;
- Privately owned, designed and operated accommodation in the vicinity, often not to expected standards, resulting in pressure to cut cost;
- Limited supervision and enforcement of fire safety rules;
- Extremely varied and unpredictable sleep, work and social behaviour patterns;
- Inexperienced people cooking with unfamiliar equipment (cause of over 90% of fires in the sector);
- Extensive and often inappropriate use of electrical equipment commonly including items which do not conform to British Standards;
- False fire alarms; mainly due to cooking with the kitchen door open, steam from en suite showers and use of aerosols near detectors;
- Checking on evacuation is problematic and failure to evacuate is common, particularly in accommodation; and
- Although disabled accommodation is often provided separately, use of all areas by temporarily disabled students, staff and disabled visitors is common; means of escape from all areas must be suitable.
**Automatic Fire and Alarm Systems**

We require alarm sounders and beacons in all escape routes, common areas and normally occupied rooms. Sounders to be set at 75Dba measured at the bed head in bedrooms. There must be the facility to fit vibrating alarms for hearing impaired residents.

Cause and effect programming of detection and alarm systems is crucial.

False alarms caused by smoke detector activation by cooking fumes, shower steam and aerosol use are historically common. Systems should be designed to reduce these as far as reasonably practicable.

Manual call points should be sited on escape routes in secure areas (i.e. inside flat exits) rather than by final exits to reduce malicious activations when sited in common areas. Sufficient manual call points shall be installed to ensure that anyone leaving a room shall pass one on their escape. Alarmed covers and CCTV are likely to be required for any that have to be in common areas.

**Kitchens**

Communal kitchens in residential accommodation with single direction means of escape must be located at the furthest end from the exit to facilitate escape.

Measures to reduce fires caused by students cooking must be taken. These could include purpose designed water mist or other suppression systems, cookers with thermostats set below fat ignition temperatures, cooker timers which require manual reset after 15 minutes, automatic means for isolating power to the cooker if the temperature of the hob gets too high or is rising too quickly.

**Materials**

**Specification & Installation**

**General**

Passive fire protection systems if designed, specified and installed correctly will provide many years of reliable protection to the building. However, as they are part of the building, it is often considered that they can be installed by general builders with no specific training or competency. This can lead to incomplete or inappropriate installation.

In order to achieve the most effective and reliable fire protection, it is recommended that all passive fire protection products are third party certificated and that they are installed by contractors holding third party certification for that product type.

**Fire Resistant Glazing Systems**

Fire resistant glass should always be marked with a stamp to advise exactly what type and properties of fire performance the glass provides. If such a symbol is not clearly displayed then it will be assumed that the glass is not fire resistant.
Fire Design Guide

Fire resistant glazing systems have to be installed as tested, using the correct, supplier specified, compatible components. Any site application that deviates from the test, particularly those involving the installation of larger panes, must to be re-tested or assessed by a competent person.

The commonest fire resistant glass types provide integrity but no significant level of insulation protection; this cannot be used, for example, to protect a refuge area. Other types are available that provide either full insulation (same period of insulation as integrity) or partial insulation, e.g. the insulation value is approximately half the integrity value.

Security or safety glass cannot be expected to provide any tested fire performance unless expressly stated.

Expert advice and more detailed information on glazing systems can be sought from the Glass and Glazing Federation: www.ggf.org.uk

Fire Doors

A fire door ‘assembly’ is a system where all or several items (door leaf or blank, frame, glazing, hinges and other hardware) are sourced separately and typically assembled on site.

A fire ‘doorset’ is a door system where everything has been supplied from one source (typically a 3rd party accredited door manufacturer), partly or completely pre-assembled where all of the components are fire tested as a unit.

Pre-assembled doorsets are preferred as they are the best method of attaining fire compliant installations and can be more cost effective as they reduce installation time.

All fire doors must be fully 3rd Party Certified, will normally be identified by being plugged in accordance with the BM TRADA Q Mark Assurance scheme or carry the BWF Certificate label, backed by the manufactures Primary Fire Test evidence in accordance with BS476: Part22.

Fire door frames must be kiln dried to prevent non-compliant gaps through warping. The minimum density for FD30 frames is 500Kg/m3, either softwood or hardwood; for FD60 doorsets the minimum is 650Kg/m3 and the timber must be hardwood.

10mm lippings and bushed bearing hinges should be specified for high usage doors to reduce the likelihood of defects and maintenance burden.

Fire doors to a refuge area must have adequate seals to the threshold to ensure that the refuge area will actually perform as intended.

The FIRE SAFETY ORDER requires that fire doors “are subject to a suitable system of maintenance and are maintained in an efficient state, in efficient working order and in good repair”; they must be inspected and maintained by a competent person.
Firestopping and linear gap sealing

When firestopping around services a number of factors must be considered:

- Required period of fire resistance;
- Type, number and size of services contained within the aperture;
- How the fabric of the building will react in a fire;
- Later addition or removal of services;
- Load bearing or impact resistance requirements;
- Thermal movement or other ambient conditions; and
- Acoustic or other non-fire issues

Products should only be installed as fire tested and systems should not be mixed and matched as manufacturer’s products will vary and products from one manufacturer may not work with similar products from another manufacturer. Similarly seals damaged by the introduction of additional services should be repaired with the same product.

**Urethane foams are rarely tested or suitable for sealing service penetrations. They must not be used unless evidence is provided to confirm they are tested and certified as suitable for each application.**

The correct type of intumescent mastic must be specified for each application:

- Acrylic mastics are the most basic in terms of fire performance. 3rd Party accreditation is a key requirement;
- Silicone mastics are waterproof and generally more flexible, they should be used in cavity voids and other areas where thermal movement of the structure and moisture may occur.
- Graphite mastics generally have both a high expansion capability and the ability to exert pressure. They should be used around cables and small plastic pipes as they will displace and dam penetrations as such services melt.

Linear gaps occur where different components of a building interface. Firestopping requirements must be expertly determined, taking into account a number of factors such as the level of fire resistance required and how the interfacing components might behave in a fire in terms of expansion and deflection, to guarantee compliance. The attainment of fire compliant linear gap seals can be problematic if the passive fire protection of a building has been fragmented into different sub-contractor’s work’s packages. **The responsibility for the linear gaps must be unambiguously allocated by the Principal Contractor.**
Within a roof void, in addition to the installation of vertical barriers, firestopping should be carried over the full thickness of the wall and the roof covering is to be designated for penetration by fire spread of flame. If roof support members pass through the wall, fire protection to these members for a distance of 1500mm either side of the wall may be needed.

**Cavity Barriers**

Any voids within a building need to be effectively separated at determined locations with cavity barriers to limit the unseen spread of fire and smoke. Barriers for fire and smoke should provide at least 30 minutes fire resistance including insulation and integrity; those just for smoke require integrity only.

Where vertical fire separation is specified between floors, a cavity barrier to the required fire rating is necessary between floors and curtain walls or other adjoining substrates. They must be installed to the manufacturer’s fire test detail to ensure that wall deflection due to thermal movement and other factors, will not compromise effectiveness.

Suspended ceiling cavity barriers not forming structural fire separation are typically created by flexible ‘curtain’ products made from mineral wool or woven glass fibre fabric.

**Ducts and dampers**

In some situations, particularly in escape routes, there can be a requirement to fire rate ductwork to prevent fire from breaking out of or entering ducts in order to maintain compartmentation.

Fire dampers should be installed within ventilation ductwork in the following situations:

- **Unprotected ductwork.** Wherever ventilation ductwork passes through a fire-resisting wall or floor or any other fire-resisting division;

- **Ductwork in a fire-resisting enclosure.** At all points at which the ventilation ductwork passes through the fire-resisting enclosure; and

- **Fire-resisting ductwork.** Wherever the ventilation ductwork is penetrated by an unprotected branch, inlet or outlet.

Installations should always be in the plane of the fire resisting division, and not elsewhere in the duct.

Where ducts penetrate drywalls they must be framed with the studwork, lined with plasterboard and effectively sealed as per the board manufacturer’s detail.

All dampers must be accessible for future maintenance.

**Electrical cables etc.**

There is a tendency for cables to be run and installed throughout buildings in densities that cannot be effectively fire sealed. The use of fire tested transit sleeves, pre-installed to cater for such runs, should be seriously considered.

It should also be noted that BS 5839 precludes the use of plastic tie clips, cable ties or trunking where these products are the sole means of cable support. Electrical trunking boxes almost invariably have no external fire rating and should be fire-stopped.
Fire curtains and shutters
Care must be taken in ensuring that what is specified and installed provides the fire resistance required; for example if intended to create a 30 minute escape route then fire curtains must possess 30 minute insulation from excessive heat together with hot and cold smoke protection and not just fire integrity. Fire Shutters provide a similar function and are often used to provide 120min fire separation. Both products should only be installed and maintained by 3rd Party accredited installers.

Timber Frame Buildings
Timber frame buildings are unforgiving of poor passive fire protection. Softwood framework has very little fire resistance and relies mainly on plasterboard for protection. Unless expertly clad and sealed, adhering strictly to the board manufacturer’s instructions, there can be a risk of fire entering wall cavities where it can be extremely difficult to locate and fight. Any actions or changes to the building that might breach the internal cladding must be strictly managed.

Competent Installers
Under the ‘Fire Safety Order’ the Responsible Person is charged with ensuring that Competent Persons are used. It is therefore important to unambiguously specify the standard of workmanship required.

Quality Assurance
Third Party Accreditation
Although there is currently no legal requirement for 3rd Party Accreditation and Certification for structural fire safety components, Building Regulations state:

“Since the performance of a system, product, component, or structure is dependent upon satisfactory site installation, testing and maintenance, independent schemes of certification and registration of installers and maintenance firms of such will provide confidence in the appropriate standard of workmanship being provided. Third party accreditation provides a means of ensuring that installations have been conducted by knowledgeable contractors to appropriate standards, thereby increasing the reliability of the anticipated performance in fire”.

Installers should be third party certified to install the specific product / system when an appropriate scheme is available.

For example BRE/LPCB scheme LPS 1531 covers the requirements for the approval and listing of companies installing or applying the following passive fire protection products:
• Penetrations, Cavity Barriers and Linear Gap Seals;

• Fire Rated Board and Cladding to Steels;

• Intumescent Coatings to Structural Elements;

• Fire Rated Spray Materials;

• Fire Rated Ductwork Systems;

• Fire Resisting Dampers; and

• Fire Resistant Compartment Wall Systems

Very few if any companies are in the scheme for all types of products.

It should also be noted that this scheme does not apply to fire doors;

**Alternative**

The alternative to 3rd party accreditation schemes to guarantee competent installations is by using inspection and auditing services to guarantee that fire safety components are being installed competently to the required standard of workmanship. Suitable organisations include BRE, Warrington Certification, BM TRADA and the BWF.

In order to give confidence in performance, all fire protection products and systems shall be installed by adequately trained specialist installers, third party certified when an appropriate scheme is available.

Alternatively, complete installations may be third party certified by a suitable organisation. This is the preference for fire compartmentation.

**In house quality assurance checks**

This may be an option where a suitably competent person is employed and has access at relevant stages in the construction. Where used, proof of competence and a schedule of inspection must be provided.

**Planned Preventative Maintenance**

The future management of fire safety components is an important function that must be considered at design stage: a primary aim being to minimise the resources that will be required. The Responsible Person must ensure that all fire safety components, including compartmentation, are adequately managed and maintained.

A key aspect of this is ensuring that the workmanship and expertise on repairing and maintaining the various components does not fall below that employed at installation.
3. Party Certification warranties will be rendered invalid if they are not adequately managed and maintained.

**Appendices**

**Fire Strategy content**

The Fire Strategy document shall:

- Provide a full description of the assumptions and philosophies that led to the fire safety design, including explicit assumptions regarding the management level and designated use of the building, housekeeping and other management functions;

- Explain the nature of the fire safety planning, construction and systems designed into the building, and their relationship to overall safety, evacuation and management;

- Describe the basic fire precaution measures; and

- Provide information, etc., relating to other reasons for protecting the building – property, contents, fabric, heritage, environment, insurer’s requirements.

**Fire Safety Manual Content**

The Fire Safety Manual shall include:

- Fire Strategy;

- The design limits of the maximum numbers of persons who may safely use each space including escape routes, staircases, exits etc.;

- Design imposed restrictions not shown on the plan drawing i.e. fire loading etc.;

- Any pre-planned procedures agreed with the fire and rescue service;

- Documentation to describe the use, test, servicing and maintenance of the fire safety features and equipment;

- Detail the prevention and security measures (including measures for the prevention of arson);

- Detail the interactions with security, building management, other safety systems, etc.;

- A fire safety plan drawing will show all fire safety related features i.e;

- Escape routes indicating maximum as built capacity, minimum width to meet the client occupancy levels and any not suitable for disabled persons or specifically provided for them;

- Room use and maximum as built occupancy numbers;

- High fire risk areas;
• Hazardous areas and storage;
• Compartmentation including fire resistance of partitions, floors, fire shutters etc. All passive fire protection components and elements must be shown;
• Fire and final exit doors indicating securing, hold open or self-closing devices;
• Detection and alarm equipment including zones, ancillary and interfaced items;
• Emergency lighting units;
• Fire fighting equipment including hydrants, dry risers and items for Fire Service use;
• Electricity and gas supply cut-offs;
• Ventilation systems controls, ductwork and dampers;
• Fire related signage;
• Smoke control zones and equipment;
• Fire fighting and evacuation lifts and controls;
• Control points for any other fire related equipment (ventilation, gas, electricity etc.);
• Access (exterior and interior) for the fire and rescue service and hazards to fire-fighters (e.g. some types of sandwich panels);
• Fire refuges and specialist disabled equipment; and
• Assembly points and/or muster stations.

**CDM etc.**

Prior to any construction, refurbishment or installation works being undertaken, the extent to which the building’s fire safety arrangements that could be affected by the works must be established.

Notifiable Works i.e. any construction, alterations, conversions, fitting out, redecoration or other maintenance / installation works lasting longer than 30 working days and have more than 20 workers working simultaneously at any point in the project or exceed 500 person days.

The building’s fire safety arrangements under these works will form part of the appointed CDM Coordinator’s (CDM-C) role to provide all relevant information to the Principal Contractor as part of the Pre-Tender Safety Information Pack. The University's Project Officer will need to discuss, collate and provide all relevant information to the CDM-C as soon as they have been appointed, so that the fire control measures are in place before any works are started.

**Non-Notifiable Works** i.e. fewer than 30 days or 500 man-hours.
A CDM-C coordinator between the University and the Contractors will not normally be appointed. Therefore, the building’s fire protection and control measures will be undertaken by the universities Project Manager. The Project Manager is responsible for providing all relevant information to the contractors & design team, as part of the Pre-Tender Safety Information Pack.

The Fire Safety Legislation requires a fire risk assessment with suitable control measures by both the institution for their premises and the Principle Contractor for sites and those affected by site operations. Those projects where the building is occupied at the same time as construction works are being undertaken are of particular concern.

The aim shall be to protect the occupants, buildings and equipment from fire commensurate to the risks and size of the project or undertaking. Arrangements on site are the responsibility of the Principal Contractor but potential effects on others must be considered by the Fire Safety Advisor.

Due consideration must be given to the effect of work activity on existing fire safety arrangements. Permit to work schemes may prove invaluable for obvious risks such as disabling fire alarms and impeding means of escape.

**Construction Phase Safety Plan**

The Principal Contractor will be responsible for the site fire risk assessment and the implementation, supervision and monitoring of suitable control measures prior to and for the duration of the project.

Note: these documents may be requested by any authorised Fire Service Officer attending site.

The Safety Plan will include:

- The Fire Risk Assessment;
- Procedures for Serious & Imminent Danger;
- Records of monitoring, training, tests and checks etc.;
- Method statements, permits to work etc.; and
- The plan must be kept up to date and revised as appropriate.

The risk assessments and control measures must include consideration of the impact of the proposed works on the following areas:

- Prevention of fire and control of ignition sources.
- The Means of Escape for occupants to a place of safety; this includes the physical protection of routes, floor surfaces, locks & door furniture and emergency & safety lighting for escape routes etc.
- The building’s Fire Compartmentation to protect occupants and escape routes; this includes fire door management, demolitions, fabric removals, penetrations of fire
compartment walls & floors by services, pipe work and electrical & data cabling etc. The
provision of passive fire protection element of structure and to maintain fire
compartmentation.

- The storage and use of hazardous goods by contractors that increases the fire loading or
introduces hazardous materials to the site; which includes combustible waste removal,
storage and use of hazardous materials such as gas cylinders & flammable liquids and hot
works etc.

- The elimination of unwanted fire alarms caused by automatic fire detection being
contaminated due to dust, construction activities or works to the fire alarm system within
the site or the immediate project site boundaries.

These considerations should generate suitable control measures and documented arrangements
to protect all ‘relevant persons’. These control measures must be in place prior to works starting.