

Fire precautions in the design, construction and use of buildings —

Part 6: Code of practice for places of assembly

ICS 13.220.01; 91.040.10

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Fire Standards Policy Committee (FSM/-) to Technical Committee FSM/14, upon which the following bodies were represented:

Association of Metropolitan Authorities
 British Fire Services' Association
 British Gas plc
 British Retailers' Association
 British Telecommunications plc
 Building Employers' Confederation
 Chartered Institution of Building Services Engineers
 Chief and Assistant Chief Fire Officers' Association
 Consumer Policy Committee of BSI
 Department of Education and Science
 Department of Health
 Department of the Environment (Property Services Agency)
 Department of the Environment (Building Research Establishment) (Fire Research Station)
 Department of the Environment (Construction Directorate)
 Department of the Environment for Northern Ireland
 Electricity Industry in United Kingdom
 Fire Brigades' Union
 Health and Safety Executive
 Home Office
 Incorporated Association of Architects and Surveyors
 Institute of Building Control
 Institution of Fire Engineers
 Institution of Gas Engineers
 Institution of Structural Engineers
 London Fire and Civil Defence Authority
 Loss Prevention Council
 National Association of Fire Officers
 National Council of Building Materials Producers
 Royal Institute of British Architects
 Royal Institution of Chartered Surveyors
 Scottish Office (Building Directorate)
 Society of Chief Building Regulation Officers
 Timber Research and Development Association

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

Access Committee for England
 Association of British Theatre Technicians
 British Sports and Allied Industries Federation
 Cinema Exhibitors' Association
 Flat Glass Manufacturers' Association
 Hevac Association
 Intumescent Fire Seals Association
 National House-building Council
 Society of Fire Protection Engineers
 Sports Council
 Steel Window Association
 Theatres Advisory Council

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Foreword

This code of practice was prepared under the direction of Technical Committee FSH/14.

All matters dealing with fire safety management are now located in BS 5588-12.

The other parts which comprise BS 5588 are as follows:

- *Part 0: Guide to fire safety codes of practice for particular premises/applications;*
- *Part 1: Code of practice for residential buildings;*
- *Part 4: Code of practice for smoke control using pressure differentials;*
- *Part 5: Code of practice for firefighting stairs and lifts;*
- *Part 7: Code of practice for the incorporation of atria in buildings;*
- *Part 8: Code of practice for means of escape for disabled people;*
- *Part 9: Code of practice for ventilation and air conditioning ductwork;*
- *Part 10: Code of practice for shopping complexes;*
- *Part 11: Code of practice for shops, offices, industrial, storage and other similar buildings;*
- *Part 12: Managing fire safety.*

In this code a commentary on the relevant principles is followed by any recommendations that are made. The commentary is intended to provide an explanatory background to recommendations, especially if the recommendations might otherwise appear to be arbitrary.

NOTE Commentary text is printed in italics.

It has been assumed in the drafting of this code that the execution of its provisions will be entrusted to appropriately qualified and experienced people.

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

In particular attention is drawn to **3.3**.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 75 and a back cover.

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Sidelining in this document indicates the most recent changes by amendment.

Section 1. General

1 Scope

This code of practice provides guidance for designers and the building construction team in their task of incorporating into new buildings, or into alterations to existing buildings, measures that should, in the event of fire, safeguard the lives of the public, staff and performers in assembly buildings of all sizes and that may help to protect the building and its contents against the effect of fire.

NOTE 1 Guidance on fire precautions in existing places of assembly has been published by the Home Office (see Appendix A).

This code applies to buildings used for indoor entertainment and/or assembly, but does not apply to those areas of sports grounds covered by the Safety of Sports Grounds Act 1975. Assembly use may also intermingle with other uses, e.g. a dance area associated with a restaurant or a public house (shop use), and the guidance in this code should be applied to such assembly areas.

An assembly building may contain a number of different assembly type activities to which this code should be applied but, where parts operate in their own right as shops or offices, reference should be made to BS 5588-11 for those parts which should be provided with independent escape routes. Similarly, an assembly building may form part of a shopping complex, and it is particularly important where there is an entrance to an assembly building from a shopping mall that the guidance given in BS 5588-10 is followed.

This code deals with planning, construction and equipment for fire safety, and the provision of escape routes in case of fire, in new assembly buildings and in alterations and extensions to existing assembly buildings. It includes measures and equipment required to assist firefighting in buildings with upper storeys beyond the reach of mobile fire appliances operating outside the building. This code makes specific recommendations in terms of protection, number and position of exits, provides guidance on design principles for preventing the spread of fire, and indicates the fire precautions necessary in these buildings. Guidance for managers of places of assembly can be located in BS 5588-12.

In a building that has to have a fire certificate, the advice given may have to be varied in accordance with the conditions of the fire certificate. Guidance is also included to cover those cases where a building is in course of construction or alteration and is in part used.

This code is not intended to apply to buildings during the course of construction or alteration.

NOTE 2 The titles of the publications referred to in this standard are listed on page 73.

2 Definitions

For the purposes of this part of BS 5588 the following definitions apply.

2.1

access room

a room that forms the only escape route from an inner room

2.2

class 0 material or surface

either:

- a) composed throughout of materials of limited combustibility; or
- b) a material classified as class 1 when tested in accordance with BS 476-7, which has a fire propagation index I of not more than 12, and a subindex i_1 of not more than 6, when tested in accordance with BS 476-6

2.3

dead end

a place from which escape is possible in one direction only, or in directions less than 45° apart that are not separated by fire-resisting construction

2.4

depth (of a building)

the level of the surface of the lowest point of the floor of the lowest storey, measured at the centre of that face of the building where the measurement is greatest from the level of the footway or paving in front of that face, or if there is no such footway or paving, from the level of the ground

2.5**escape lighting**

lighting provided, for use when the supply to the normal lighting fails, to ensure that the escape routes are illuminated at all material times

2.6**final exit**

the termination of an escape route from a building giving direct access to a street, passageway, walkway or other open space sited to ensure the rapid dispersal of persons from the vicinity of a building so that they are no longer in danger from fire and/or smoke

2.7**fire door (assembly)**

a door or shutter provided for the passage of persons, air or objects which, together with its frame and furniture as installed in a building, is intended, when closed, to resist the passage of fire and/or gaseous products of combustion and is capable of meeting specified performance criteria to those ends

2.8**firefighting lift**

a lift designated to have additional protection, with controls that enable it to be used under the direct control of the fire service in fighting a fire

2.9**firefighting lobby**

a protected lobby providing access from a firefighting stair to the accommodation area and to any associated firefighting lift

2.10**firefighting shaft**

a protected enclosure containing a firefighting stair, firefighting lobbies and, if provided, a firefighting lift together with its machine room

2.11**firefighting stair**

a protected stairway communicating with the accommodation area only through a firefighting lobby

2.12**fire resistance**

the ability of a component or construction of a building to satisfy for a period of time some or all of the appropriate criteria specified in the relevant part of BS 476

2.13**fly gallery**

a narrow balcony or gantry, usually running from front to back of the stage on one or both sides and occasionally continuing across the back wall, used for securing suspension lines, loading counterweights and operating suspension lines, and occasionally for rigging lighting equipment

2.14**grid**

an open framework of beams over the stage which is used (primarily) for the suspension of scenery and lighting equipment or to provide a platform for access to the pulleys for such suspension systems

2.15**height (of a building)**

the level of the surface of the highest point of the floor of the highest storey (excluding any such storey consisting exclusively of plant rooms) measured at the centre of that face of the building where the measurement is greatest from the level of the footway or paving in front of that face, or if there is no such footway or paving, from the level of the ground

2.16**inner room**

a room from which escape is possible only by passing through another room (the access room, see 2.1)

2.17**material of limited combustibility**

either:

- a) a non-combustible material; or
- b) any material of density 300 kg/m^3 or more which, when tested in accordance with BS 476-11, does not flame and the rise in temperature on the furnace thermocouple is not more than 20°C ; or
- c) any material with a non-combustible core of 8 mm thick or more, having combustible facings (on one or both sides) not more than 0.5 mm thick

2.18**means of escape**

structural means whereby a safe route or routes is or are provided for persons to travel from any point in a building to a place of safety

2.19**non-combustible material**

any material capable of satisfying the performance requirements specified in BS 476-4, or any material which, when tested in accordance with BS 476-11, does not flame nor cause any rise in the temperature on either the centre (specimen) or furnace thermocouples

2.20**place of safety**

a place in which persons are in no danger from fire

2.21**protected lobby/corridor**

a circulation area consisting of a lobby or corridor enclosed with fire-resisting construction (other than any part that is an external wall of a building)

2.22**protected space**

an area, forming part of an escape route, separated from the remainder of the building by fire-resisting construction

2.23**protected stairway**

a stair discharging through a final exit to a place of safety (including any exit passageway between the foot of the stair and the final exit) that is adequately enclosed with fire-resisting construction

2.24**radial gangway**

a gangway at an angle to the rows of seating or a stepped gangway in tiered seating

2.25**seatway**

the distance between adjacent rows of seats

NOTE See Clause 8 for the determination of seatway width.

2.26**storey exit**

a final exit (see 2.6) or a doorway giving direct access to a protected space, protected stairway, firefighting lobby or external escape route

2.27**transverse gangway**

a flat gangway parallel to the rows of seating

2.28**travel distance**

the actual distance to be travelled by a person along an escape route to the nearest storey exit, having regard to the layout of walls, partitions and fittings

2.29**vent**

a window, rooflight, door, louvre, grille or other device either open, or capable of being opened, to permit the passage of air between a part of the building and the external air

2.30**working fly gallery**

a fly gallery, usually the lowest if more than one gallery is provided, which is likely to be occupied during performances by staff operating suspension lines

3 Use of this code**3.1 Safety measures**

The recommendations in this code are intended to provide safety from fire by promoting safe aspects of design, construction and management in the following areas:

- a) planning and protection of escape routes from any area that may be threatened by fire;
- b) construction, finishing and furnishing with suitable materials and embodying adequate fire resistance in the structure;
- c) segregation of higher fire risk areas;
- d) fire warning systems and, where appropriate, systems for the automatic detection of fire;
- e) the provision of firefighting equipment, whether for use by the staff in containing fire in its early stages, or by way of assistance to the fire service, or for automatically extinguishing an outbreak of fire;
- f) the provision of adequate and reasonable access to the building for the fire service, including facilities for the safe and rapid extinction of fire by the fire service and for the safety of fire service personnel when firefighting;
- g) effective management control.

3.2 Use of the principles and application of the recommendations

It is not possible to make comprehensive recommendations covering every possible risk, and an intelligent appreciation of the principles and applications of the recommendations of this code is therefore essential. The fire hazard of a particular building and its contents, and the kinds of occupant together with their likely state of awareness and/or distraction, have to be appreciated when designing an assembly building. To use this code effectively, the behaviour of a fire occurring anywhere in the building and the response from people thus put at risk has to be anticipated.

Individual recommendations of this code applied in isolation may give little or no benefit, and could even reduce the level of fire safety. For maximum benefit all the recommendations should be applied. Although the basic principles and recommendations for escape from assembly areas are described in Section 3, the most conscientious application of these recommendations would be undermined unless supported by the necessary measures relating to ancillary accommodation, construction, engineering services, and fire protection facilities set out in Section 4 to Section 7.

3.3 Relationship with statutory provisions**3.3.1 General**

It is important to appreciate the relationships between this code and the various statutory provisions relevant to the design and construction of new buildings and to the fire precautions to be provided in existing buildings. The relevant legislation indicated in general terms in **3.3.2** and **3.3.3** has to be complied with in the event of a conflict with this code. However, there are two main ways in which this code is intended to supplement the legislation. The first is that, since Acts and Regulations are necessarily drafted in broad terms and cannot deal in detail with a wide variety of different situations, one of the objects of this code is to provide guidance for building designers in matters not covered in sufficient detail by legislation. Secondly, because the objectives of the legislation are mainly concerned with the health and safety of the general public, this code is of wider scope and includes matters relevant to the protection of the building and its contents from fire as well as the safety of the occupants.

3.3.2 Building regulations

The design and construction of new buildings, and of alterations of existing buildings, are controlled by the following statutory provisions which are collectively referred to as building regulations in this code.

England and Wales: The Building Regulations;

Scotland: The Building Standards (Scotland) Regulations;

Northern Ireland: Building Regulations (Northern Ireland).

3.3.3 Legislation and other regulations for fire safety in buildings

In addition to the controls mentioned in **3.3.2**, fire safety and means of escape for a wide variety of buildings is dealt with principally under the following legislation.

England and Wales:

The Fire Precautions Act, 1971, as amended by the Health and Safety at Work etc. Act 1974 and the Fire Safety and Safety of Places of Sport Act 1987

The Building Act 1984

Theatres Act 1968

Cinemas Act 1985

The Cinematograph (Safety) Regulations 1955

The Cinematograph (Children) Regulations 1955

Licensing Act 1964

Gaming Act 1968

London Government Act 1963 (Greater London only)

Local Government (Miscellaneous Provisions) Act 1982

Scotland:

The Fire Precautions Act 1971, as amended by the Health and Safety at Work etc. Act 1974 and the Fire Safety and Safety of Places of Sport Act 1987

The Building (Scotland) Act 1959 (as amended)

Theatres Act 1968

Cinemas Act 1985

The Cinematograph (Safety) Regulations 1955

The Cinematograph (Children) Regulations 1955

Local Government (Miscellaneous Provisions) Act 1981

Civic Government (Scotland) Act 1982

Northern Ireland:

The Fire Services (Northern Ireland) Order 1984, the Miscellaneous Provisions (Northern Ireland) Order 1985 and the Health and Safety at Work (Northern Ireland) Order 1978

The Planning and Building Regulations (Amendment) (Northern Ireland) Order 1990

There are also a number of local Acts as well as entertainment and other licensing legislation which deal with fire safety and means of escape. The designer should consult the fire authority and building authority at an early stage to make certain the building as planned will meet the requirements those authorities may make, particularly if a fire certificate or licence may be necessary.

NOTE Under the Fire Precautions Act 1971, fire authorities cannot require structural or other alterations relating to escape from the premises as a condition of the issue of the fire certificate, or under an improvement notice, if the plans of the building comply with building regulations unless:

a) there are regulations made under Section 12 of the Act and it is necessary to make requirements in order to satisfy those regulations; or

b) the fire authority is satisfied that the means of escape in case of fire are inadequate by reason of matters or circumstances of which particulars were not required to be supplied to the local authority in connection with the deposit of plans for building regulation purposes.

3.4 Protection of property

Fire safety is often interpreted as meaning only the safety of persons (life safety), but also includes the protection of property (property safety). For property, a different level of protection is usually required than for life safety purposes alone where the evacuation time for persons to reach safety is as short as possible.

Fire safety requirements imposed in connection with building regulations are limited to life safety, i.e. The Building Regulations for England and Wales state that in connection with any requirement “No obligation imposed by these regulations shall require anything to be done beyond what is necessary to secure reasonable standards of health and safety for persons in or about the building and others who may be affected by any failure to comply with that requirement”. Even so, some life safety measures may also contribute to property protection.

Property protection includes the building and its contents, hence a higher level of fire-resisting separation and greater compartmentation than recommended in this code may be required to minimize loss or damage. As well as passive protection (see Section 4 and Section 5), active protection (see Section 6) should be considered. The level of active protection required will depend upon the nature and quantity of the contents and may contribute to life safety protection. Both passive and active protection will assist firefighters.

3.5 Diagrams

The figures in this code are intended to clarify concepts, and should not be taken as indicating the only acceptable forms of planning. Features not relevant to the concepts or principle(s) being illustrated are not shown.

3.6 Information to be given to clients

Designers are advised to inform their clients of the nature, function and capabilities of the fire precautions that have been designed into the building, and especially those whose nature may be less evident. This will enable a better understanding of the responsibility for ensuring that a high standard of safety is maintained.

| The advice given in BS 5588-12 is intended, not only as a guide to the management of fire precautions in a place of assembly, but also as a guide to the information concerning the fire precautions that have been designed into the building which designers are advised to pass to their clients.

Section 2. Analysis of the problem

4 Planning in relation to fire

4.1 Spread of fire

The only sound basis for designing means of escape from fire is to attempt to identify the positions of all possible sources of outbreak of fire and to predict the courses that might be followed by a fire as it develops, or, more particularly, the routes that smoke and hot gases are likely to take, including concealed spaces. Only against this background is it possible to design and protect escape routes with some confidence that they will be safe.

In assembly buildings designed, maintained and supervised in accordance with this code, the risk of fire starting in passages, lobbies or stairs intended for use only for access or means of escape may be regarded as low. It is also unlikely that fire will originate in the structure itself. Outbreak of fire is more likely to occur in equipment, furnishings, decorations or service plant in the building, and the point of origin is therefore likely to be in stage areas, lounge areas, store rooms, kitchens or offices, or possibly in the service installations.

When a fire occurs in an enclosed space, hot smoke-laden gases rise to form a layer which at first flows under the entire ceiling and then deepens to fill the whole space. The fire tends to grow in area, the flames spreading to nearby combustible furnishings, fittings, exposed papers, etc. The flames increase in height until they reach the ceiling where they are deflected horizontally and, radiating downwards, accelerate fire growth. If the ceiling is combustible, it may ignite and add to the volume of flame and speed of fire growth. If the space has insufficient openings to provide a continuing air supply, the burning rate of the fire will diminish as it draws on increasingly vitiated products of combustion, but the gases generated will then be extremely toxic.

Once ignited, upholstery, scenery, equipment and other products, particularly those wholly or partly comprising cellular plastics, burn rapidly giving off hot smoke-laden and toxic gases. The horizontal deflection and downwards radiation also occurs rapidly and, because of the extremely high temperature of the gases, other materials and products within the area of the fire will ignite more easily, further accelerating the progress of the fire.

It cannot be assumed that the effects of the fire will be confined to the space in which it originated. If the enclosing walls have no fire resistance or do not form a fire-tight joint with a fire-resisting floor (or ceiling) above, the fire will soon penetrate at ceiling level, where the attack from the flames or hot gases is most severe, to the adjoining space. Even with fire-resisting construction, the buoyancy and expansion of the fire gases can cause them to be driven out of the space to affect other parts of the building. If they penetrate into a vertical shaft, such as a stairwell, liftwell or duct, they will rise rapidly, attacking the top of the shaft and spreading elsewhere if there are any openings in the shaft. In such circumstances, if a substantial flow of air reaches the fire through, say, a window or door, the vertical shaft can act as a chimney and may greatly accelerate fire growth.

A fire occurring anywhere within a compartment of a building has, therefore, to be regarded as offering an immediate risk to all occupants within that compartment, even though in the initial stages of fire development it might seem that persons are well removed from immediate danger. It should also be realized that there may also be a risk to persons in other parts of the building.

4.2 Smoke

In the early stages of a fire, the most important effects will usually be those of smoke and other products of combustion. Often smoke will be the first evidence of fire detectable by the occupants and is thus likely to be the first cause of alarm. When first present, smoke tends (in the absence of any strong air currents) to collect at ceiling level, filling the space from the top downwards. When it extends down to head height it will produce discomfort to the eyes and difficulty in breathing, both of which will interfere with the efforts of occupants to find their way towards the exits. The extremely hot, smoke-laden and toxic gases, particularly those from burning cellular plastics, will add considerably to their difficulties. People who are prevented from escaping by dense smoke, or who are unduly retarded from escaping by it, may suffer from the toxic effects of the products of combustion that accompany the smoke, the asphyxiant effect caused by lack of oxygen or by the intense heat of the gases making up the smoke. Intoxication, incapacity, unconsciousness and possible death may result.

These considerations are particularly important when dealing with large numbers of persons, many of whom may be unfamiliar with their surroundings, and who may also vary widely in age and degree of mobility.

To facilitate escape it is necessary:

- a) that protected escape routes are safeguarded against the ingress of smoke;
- b) to regulate the distance people have to travel before they reach a storey exit or final exit.

A means of smoke ventilation may be necessary to assist the fire service and, if operated automatically, would also assist escape from the building.

After the outbreak of fire there may be only a short time during which the actions necessary for ensuring the safety of occupants can be carried out. This time will be sufficient only if all contributing factors, e.g. the design of the building, the materials at risk, the cooperation of the staff, the functioning of equipment, are planned and managed so as to be effective when the occasion arises.

4.3 Site planning

Siting may be dictated by restrictions imposed by urban development. These restrictions may produce conditions potentially dangerous from the point of view of fire spread from a building on fire to another exposed to its effects. Building regulations accordingly require adequate separation between the side of any building and its boundary. There are also legal requirements for access to buildings by fire appliances; these, together with the effect of car parking adjoining the building, have to be considered at the planning stage. A further site planning consideration is the safety of escape routes outside the building, and outside neighbouring buildings, from the effects of a fire in the building concerned.

4.4 Mixed user developments

The principles and recommendations of this code will apply straightforwardly where the entire building comprises a place of assembly. However, complications may arise where a place of assembly forms part of a mixed development. In such cases it is important to consider the effect of one risk on another. A fire in a place of assembly could have serious consequences for a residential or office user in the same building.

It is therefore important to consider whether completely separate routes of escape should be provided from each different use within the building or whether other effective means to protect common escape routes can be provided.

In reaching a conclusion, the following factors need to be considered in addition to items a) and b) of 4.2:

- a) the extent of a risk and its relationship to another;
- b) provision for giving warning in case of fire, including any automatic fire detection;
- c) the provision of sprinkler protection and smoke control arrangements;
- d) the management and control of the building or development, from a fire safety point of view.

The recommendations of the relevant part of BS 5588 or legislation appropriate to each use should be applied to the whole of any escape route which passes through a different use, right up to the final exit. Where different levels of protection could apply, the highest level of protection should be provided.

4.5 Internal subdivision

The internal subdivision of buildings into compartments is an effective means of inhibiting the spread of fire and is basically advocated by building regulations. Nevertheless, some assembly buildings, e.g. sports arenas, are likely to exceed the maximum compartment size specified but this may be accepted by a building authority where it is satisfied that such limitations are inappropriate. It will need to be shown that separations are provided where possible and that suitable measures will be incorporated in the design to inhibit the spread of fire (see Section 4, Section 6 and Section 7).

4.6 Ancillary accommodation and higher fire risk areas

Section 3 and Section 4 contain principles and recommendations for the planning and construction of those parts of the building used for assembly purposes and occupied by the public and staff. Other parts, ancillary to the main use, including any stage area, are referred to in this code as ancillary accommodation and are covered in Section 5.

5 Escape from fire

5.1 General

In an emergency there have to be sufficient exit facilities to allow all the occupants to reach an area of relative safety without delay. There should also be exit routes capable of allowing the occupants to continue to progress to a final exit.

NOTE Capacities of exits from assembly areas have been based on the assumption that a unit width of 500 mm permits a flow of 40 persons per minute. The time taken to travel to a protected escape route is controlled implicitly through the recommendations limiting exit capacity and travel distance (see Clause 6).

In assembly buildings, escape routes should be designed so that in the event of a fire they should be capable of enabling the occupants to evacuate the whole building. The actual method of evacuation in a building comprising a number of different assembly areas will depend upon procedures discussed in BS 5588-12.

5.2 Disabled persons

The Chronically Sick and Disabled Persons Act 1970 and the 1976 amendment, and for Northern Ireland, the Chronically Sick and Disabled Persons (Northern Ireland) Act 1970, require that buildings are designed so that they are accessible to disabled persons wherever this is reasonable and practicable. Building regulations also make requirements for access (and facilities) for the disabled.

As the design of escape routes and the organization of management procedures are particularly critical in assembly buildings, these considerations have often led to restrictions on the access of disabled persons, and one of the purposes of BS 5588-8 is to show that such restrictions are unnecessary. There are clearly problems in stepped auditoria, grandstands and similar buildings, but an aim of the designer should be to provide some, or indeed many, locations for disabled persons to be integrated with the assembly as a whole from whence they may be evacuated.

Normally the number of severely disabled persons in an assembly building is likely to be small, but in the event of a large group attending an event, it is sensible that the organizers of the group should discuss the arrangements with the management of the building.

So far as possible, wheelchair places should be accessible on the level direct from the street or by suitably designed lifts to level viewing positions. Where seating is provided on stepped tiers, the best wheelchair position is one directly accessible from a front, back or cross gangway leading to a suitable lift.

Together with careful planning goes the need for an effective management (see BS 5588-12).

5.3 Avoidance of manipulative apparatus for means of escape

Reliance for fire safety on manipulative apparatus for means of escape, or on external rescue from the lower storeys of a building by the fire service using mobile ladders, is not satisfactory. This code provides for the public and staff on any storey being able to escape safely from the building without outside assistance, should a fire occur.

5.4 Distances to travel

Some of the recommendations in this code include limitations on the distance of travel between two points: these are based on past experience and practice and represent the maximum distance a person can reasonably be expected to walk to escape from fire. Although it could not be said that a slightly greater distance would be so unsafe that it should under no circumstances be adopted, designers should aim to keep travel distances as short as possible, rather than designing to the maximum distance recommended.

Section 3. Planning of escape from public areas

6 Planning of escape routes

6.1 General

Planning of means of escape from each public assembly area involves consideration of a number of interrelated elements.

NOTE Public assembly areas include areas such as public changing rooms and multi-use areas (which might be used for transitory storage).

These elements will include the limitation on travel distance which will determine the position of exits, whilst the number of persons to be evacuated will regulate the size and number of exits and escape routes. The nature of escape routes also needs to be considered as they comprise two principal parts: the travel distance within an enclosed space and, if appropriate, within a protected space leading to a final exit.

If seating in rows or blocks is provided or exhibition stands are provided, the gangways may also have a bearing on the location of exits.

6.2 Separate accommodation for children

6.2.1 Commentary

Where accommodation is provided for children separately from their parents or guardians, the siting of such accommodation is important in relation to escape routes. It is important to ensure that the children's accommodation is sited adjacent to escape routes used by parents or guardians on their way out to avoid the clashing of streams of people as parents or guardians collect their children.

6.2.2 Recommendations

The following recommendations are applicable.

- a) Separate accommodation for children should be at or as near ground level (or the level at which the final exits discharge) as practicable. In no circumstances should the accommodation for children be:
 - 1) on a floor above the level at which their parents or guardians are accommodated, unless the escape route is through the upper level; or
 - 2) at basement level unless the children are adjacent to the accommodation for parents or guardians.
- b) The room for children should preferably be adjacent to an external wall and should not have fewer than two exits, one of which should be a final exit.
- c) If the room adjoins the parents' accommodation, the aggregate width of the escape routes from both areas (exclusive of any doors between such areas) should be sufficient for the total number of children and parents or guardians accommodated.

6.3 Escape routes within, and exits from, a storey

6.3.1 Commentary

Exits ought to be sited so that a person confronted by an outbreak of fire can turn and make a safe escape. To achieve this, two exits ought to be accessible in substantially different directions. Escape in one direction is, however, acceptable from small rooms, but in this case the distance of travel has to be restricted.

It is essential that ancillary accommodation does not form any part of an escape route for the public.

There may, however, be situations where escape routes for the public incorporate ancillary accommodation, such as bars, souvenir shops and fast food outlets. In such cases it is essential that either the areas of ancillary accommodation are separated from the escape routes to the appropriate standard of fire resistance, or other measures are taken, for example the provision of sprinklers and smoke control and fire shutters operated by smoke detectors, to ensure that an outbreak of fire can be rapidly brought under control or contained and the smoke produced reduced to such a level that the route remains usable.

An alternative approach would be to segregate the escape routes in such a fashion that, if a fire broke out in one escape route, the remaining escape routes would have sufficient capacity to allow for the total evacuation of the public area. In such cases it would not be necessary for the areas of ancillary accommodation (other than high risk areas such as kitchens) to be separated from the escape routes.

6.3.2 Recommendations

The following recommendations are applicable.

- a) Escape routes from public areas should give direct access to a final exit, or give access thereto only by way of a protected space or a protected corridor and protected space.
- b) Alternative escape routes should be so planned that it is not necessary for them to pass through the same protected space.
- c) Where an escape route contains an area of ancillary accommodation:
 - 1) the ancillary accommodation should be separated from the escape route by construction complying with the appropriate standard of fire resistance; or
 - 2) other measures should be taken (such as the provision of sprinklers and smoke control and fire shutters operated by smoke detectors) to ensure that the escape route remains available; or
 - 3) where escape routes are separated from each other by the appropriate standard of fire resistance and the capacity of all escape routes is sufficient to enable the total evacuation of the public area when one escape route is discounted, only areas of high fire risk such as kitchens need be separated from the escape routes by fire-resisting construction.
- d) Exits should be distributed uniformly.

6.4 Number of escape routes

6.4.1 Commentary

The basis of means of escape from assembly buildings is to provide a choice of escape routes leading to different final exits. The number of exits required interacts with a number of other factors, e.g. travel distance and capacity of routes, and is normally at least two. In assembly buildings where there is a heavy concentration of people, it is important to relate the number of escape routes to the number of people involved to avoid congestion and achieve wide dispersal. Assembly areas that are to be used with both open floor areas and seating in rows need to meet the recommendations for travel distance for both configurations.

Figure 1 — Deleted

6.4.2 Recommendation

The number of escape routes from any room, tier of seating or storey should be in accordance with Table 1, except that a single escape route is acceptable in the case of a room not comprising a whole storey accommodating not more than 50 persons in which the travel distance does not exceed that given in item a) of Table 2.

Table 1 — Minimum number of escape routes prior to discounting

Number of persons accommodated	Minimum number of escape routes
1 to 600	2
more than 600	3

Table 2 — Maximum travel distances

Available direction of escape	Areas with seating in rows m	Open floor areas m
a) In one direction only	15	18
b) In more than one direction	32 ^a	45 ^b
^a This may include up to 15 m in one direction only. ^b This may include up to 18 m in one direction only.		

6.5 Travel distance

6.5.1 Commentary

Travel distance needs to be limited as persons escaping may continue to be exposed to a fire risk until they have reached a storey exit. The recommended travel distances also take into account the standards of fire-resisting construction and surface spread of flame ratings required by building regulations as well as the recommendations of this code dealing with the heating, ventilation and electrical installations.

If escape is possible in two directions, these have to be significantly different directions, otherwise the routes will be close enough to become impassable at the same time. If two directions diverge by less than 45° and are not separated by fire-resisting construction, they are considered to provide escape in one direction only, and a situation in which this occurs is considered to be a dead end.

It is desirable that the direction of travel should be away from a stage (apart from any initial travel along a seatway).

It should be noted that travel distance is the actual distance to be travelled to a storey exit and this will be apparent at the outset where permanent provision is made for a closely seated audience. In the case of multi-purpose halls and, in particular in exhibition halls, the erection of display stands will create a greater travel distance than would be the case for an open floor area. Designers should bear this in mind and it is suggested that at the design stage the travel distance in open floor areas should be based on two-thirds of the distances given in Table 2.

There may be cases in arenas or exhibition halls where the travel distances in Table 2 will be unrealistically restrictive.

6.5.2 Recommendations

The following recommendations are applicable.

a) Either:

- 1) the travel distances within any storey or tier of seating to the nearest storey exit should not exceed the appropriate limits set out in Table 2; or
- 2) exits should be sited uniformly around the perimeter of the assembly area at intervals not exceeding 32 m, and either:
 - i) at least two subways should be constructed as protected routes leading from the central areas of arenas and exhibition halls to final exits and access to the subways should be carefully located (preferably at “D” ends of tracks in athletic arenas) to eliminate or reduce, as far as possible, excess travel distances and to avoid all courts and pitches in sports arenas; or
 - ii) a smoke control system complying with **30.2.3** should be provided.

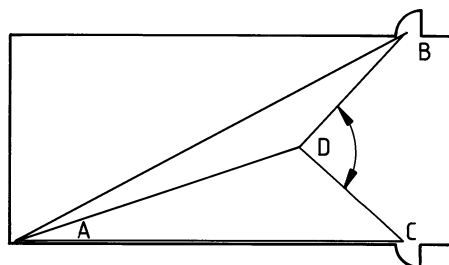
b) If travel is initially in one direction only then:

- 1) the travel distance to the point at which travel is possible in more than one direction should not exceed the appropriate limit given in item a) of Table 2; and
- 2) the total travel distance to the nearest storey exit (including that part in one direction only) should not exceed the appropriate limit given in item b) of Table 2.

NOTE If the nearest exit is unavailable then travel distances may be exceeded.

c) For travel to be considered to be in more than one direction, either:

- 1) the routes should be not less than 45° apart (see Figure 2); or
- 2) the routes should be separated from each other by fire-resisting construction.



$$\angle BAC < 45^\circ$$

$$\angle BDC \geq 45^\circ$$

Figure 2 — Divergence of alternative escape routes

6.6 Width of escape routes

6.6.1 Commentary

Every exit and escape route should be wide enough to enable the quick passage of all the occupants who may need to use it. Whilst it is convenient to consider the doorways as the narrowest element of an escape route, it needs to be borne in mind that the escape route will start at an occupied part of the building and its capacity is determined by the width of the narrowest part of the route.

Providing that all escape routes from an assembly building can be used in the event of fire, it is sufficient for the aggregate capacity of exits to be enough for the maximum number of occupants. This will often be the case in large assembly rooms with all exits discharging direct to open air (i.e. all exits are final exits).

However, since one cannot rule out the possibility of one escape route being made impassable due to fire, in most circumstances calculations will need to be made on the basis of discounting one exit. The risk is greater when only two exits are provided, or when some exits from the place of assembly are not final exits. If all exits from the assembly space are final exits, then the fire cannot affect any part of the escape routes outside the assembly space. As any fire should be visible to the occupants at an early stage, it is not considered necessary to discount one of the exits from such assembly areas if three or more exits are provided.

Where the number of occupants for whom provision needs to be made is not known, it may be estimated from the net internal area of the space available for a particular use or activity (exclusive of any area occupied by stair enclosures, lift wells, escalators, accommodation stairs and toilet accommodation) calculated on the basis of the appropriate floor space factors listed in Table 3. In seated areas, the number of occupants should be the number for whom seats are provided unless this is not known. Designers should consider using the most onerous occupancy factor to ensure that future use of a building is not restricted by the provisions for means of escape.

Whatever method is used for assessing the number of persons using any floor space, the appropriate authority will need to be satisfied that adequate exits and width of escape routes are provided for the number of persons actually using the premises when occupied.

Table 3 — Suggested floor space factors

Description of floor space	Floor space per person m ²
1. Individual seating	0.4 to 0.5
2. Bench seating	0.3 ^a
3. Dance area	0.5
4. Ice rinks	1.2
5. Restaurants and similar table and chair arrangements around a dance area	1.1 to 1.5
6. Bars without seating and similar refreshment areas	0.3
7. Standing spectator areas	0.3
8. Exhibition	1.5 ^b
9. Bowling alley/billiard or snooker hall	9.5
10. Museum/art gallery	5.0
11. Studio (radio, television, film, recording)	1.4
NOTE These floor space factors are for guidance only and should not be taken as the only acceptable densities. Where the number of seats is known this should be used in preference to the floor space factors.	
^a If the number and length of benches is known, a factor of 450 mm per person should be used.	
^b Alternatively, a factor of 0.4 m ² may be used over the gross area of gangways and other clear circulation space between stalls and stands.	

6.6.2 Recommendations

The following recommendations are applicable.

- a) The capacities of exits and escape routes within a storey should be calculated in accordance with Table 4. The capacity or aggregate capacity of exits and escape routes should be not less than the number of occupants of the storey. If two or more exits or escape routes are required, the capacity or aggregate capacity should be not less than the number of occupants of the storey when the capacity of each exit or escape route is discounted in turn.

NOTE The total number of persons which two or more available exits can accommodate is found by adding the maximum number of persons for each exit width. For example 3 exits each 900 mm wide will accommodate $3 \times 110 = 330$ persons (not the 540 persons accommodated by a single exit 2 700 mm wide).

- b) *Text deleted.*

- c) No escape route should have a clear headroom of less than 2 m (except doorways and other exits which should have a clear headroom of not less than 1.96 m) and there should be no projection from any wall (except normal handrails) or from the ceilings (including suspended ceilings) below this height which would impede the free flow of persons using the escape route.

Table 4 — Capacities of exits and escape routes

Maximum number of persons	Width mm
50	800
110	900
220	1 100
240	1 200
260	1 300
280	1 400
300	1 500
320	1 600
340	1 700
360	1 800

NOTE Capacities of other widths exceeding 1 100 mm may be obtained by linear interpolation or extrapolation.

6.7 External escape routes and stairs

6.7.1 Commentary

Wherever possible, escape routes for the public in assembly buildings should not be by way of a roof or an external stair. This does not preclude, however, exits being by way of a high level walkway or podium which acts as a street.

However, occasionally the planning of a building may be such that to satisfy travel distances it may be necessary to consider access on to an adjacent flat roof and thence to an external stair leading to a final exit.

External escape routes and stairs should, however, be protected from the effects of adverse weather conditions. It is also necessary to ensure that their use at the time of a fire cannot be prejudiced by smoke and flames from nearby doors and windows.

6.7.2 Recommendations

The following recommendations are applicable.

a) If more than one escape route is available from a storey, one of the escape routes from that storey may be by way of a flat roof provided that:

- 1) the roof is part of the same building from which escape is being made;
- 2) the route across the roof:
 - i) leads to a storey exit;
 - ii) is adequately defined and guarded with protective barriers in accordance with BS 6180;
- 3) such a part of the escape route and its supporting structure is constructed as a fire-resisting floor.

b) Where an escape route is in one direction only, any ventilation outlets or other extract system, and any doors, rooflights, or windows that are not fire-resisting, should not be sited within 3 m of such a route.

c) The route is roofed and at least partly covered in at the sides (depending on the degree of exposure) so as to ensure freedom at all times from the effects of adverse weather conditions.

NOTE Routes should also be provided with both normal and escape lighting (see 18.5).

d) Any wall (or portion) (other than more than 1.1 m above the top floor level of a stair not being a basement stair) within 1.8 m of, or within 9 m vertically below, any external escape stair, should be of fire-resisting construction that may contain non-opening fire-resisting glazed elements. The doors to the stair (other than the door(s) at the top floor level of a stair serving storeys above ground level) should be fire-resisting and self-closing.

6.8 Fire safety signs and notices

6.8.1 Commentary

The relevant authority should be consulted with regard to the siting and positioning of all relevant fire safety signs and notices.

Consideration also needs to be given to the advantages of a photoluminescent, or other luminous, wayfinding system of exit signs and directional markers on escape routes as a supplement to escape lighting (see 18.5). A luminous system of directional lines (on walls near floor level and/or on floors), arrows, maps, exit signs, handrails and on the edge of steps, can make a significant contribution to wayfinding by the public, staff and fire service in unfamiliar surroundings.

Guidance on the use of photoluminescent markings for escape routes is given in BRE Information Paper IP 17/89.

6.8.2 Recommendations

The following recommendations are applicable.

- a) Exits should be marked and be readily visible so that the occupants of a building can clearly and readily see where the exits are and where to go in an emergency at any time.
- b) Fire safety signs and notices should comply with the relevant requirements of BS 5499.

NOTE Stages, fly galleries and grids provided with non-maintained escape lighting should be provided with either self-luminous or maintained, internally illuminated exit signs.

7 Stairs and final exits

7.1 Protected stairways

7.1.1 Commentary

The fire-resisting enclosure of a protected stairway is provided to prevent smoke and heat entering the stair enclosure and rendering it impassable for escape purposes, and to prevent fire spreading from one storey to another.

It is also important to ensure that there are no fire risks within a protected stairway, although sanitary accommodation is permissible, as are properly enclosed built-in cupboards.

It is essential that the width of a storey exit onto a stair does not exceed the width of the stair if potentially dangerous bunching of escapees is to be avoided.

Where there is more than one doorway from an auditorium, the doorways need to be placed carefully so as to ensure a smooth escape flow, and consideration should be given to limiting wide stairs to serving one level only, as the flows into a wide stair at various levels could cause congestion. However, a stair serving a large auditorium may also serve an adjacent small auditorium.

7.1.2 Recommendations

The following recommendations are applicable.

a) The capacities of protected stairways should be calculated in accordance with Table 5, and the aggregate capacity of protected stairways, and of exits leading therefrom, should be not less than the number of occupants of the storey or tier of seating when, in turn, each protected stairway is discounted.

Unless each stair is approached through a protected lobby or is protected with a smoke control system using pressure differentials, in accordance with BS 5588-4, the capacity (or aggregate capacity) should be adequate when each stair is discounted in turn.

b) The width of a stair:

- 1) at any storey should be not less than the width of the widest storey exit at that storey; and
- 2) should not narrow in the direction of escape.

c) For the purposes of Table 5, the width of a stair is between the walls and/or balustrades and should be maintained clear for a vertical distance of 2.0 m, measured from the floor level or pitch line stringers, with the following exceptions:

- 1) strings, each intruding into the stair not more than 30 mm;
- 2) handrails, each intruding into the stair not more than 100 mm.

NOTE If a handrail intrudes more than 100 mm into a stair, for the purposes of calculating the capacity of the stair, the stair width should be regarded as reduced by the amount that the intrusion exceeds 100 mm.

d) A protected stairway may contain only the following:

- 1) sanitary accommodation or washrooms, provided that the accommodation:
 - i) is not used as a cloakroom;
 - ii) does not contain any portable heating appliances;
 - iii) does not contain any gas appliance other than a water heater or sanitary incinerator;
- 2) cupboards enclosed with fire-resisting construction.

e) 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.

f) Access from any point on a storey or tier of seating to separate protected routes should be so sited that it is not necessary to pass through one protected route to reach another.

g) If a protected stairway projected beyond, or is recessed from, the external enclosures to a building:

- 1) the distance between any opening in the external enclosure to the building and any opening in the enclosure to the stairway should be not less than 1.8 m¹⁾;
- 2) the enclosure within that distance and 9 m vertically below should be of fire-resisting construction that may contain non-opening fire-resisting glazed elements.

h) Stairs serving public areas should not serve ancillary accommodation except small areas of low fire risk.

¹⁾ The Technical Standards to the Building Standards (Scotland) Regulations require a minimum separation of 2.0 m.

Table 5 — Capacities of stairs

Number of floors served	Maximum number of persons accommodated on one stair of width:								
	1 000 mm	1 100 mm	1 200 mm	1 300 mm	1 400 mm	1 500 mm	1 600 mm	1 700 mm	1 800 mm
1	150	220	240	260	280	300	320	340	360
2	190	260	285	310	335	360	385	410	435
3	230	300	330	360	390	420	450	480	510
4	270	340	375	410	445	480	515	550	585
5	310	380	420	460	500	540	580	620	660
6	350	420	465	510	555	600	645	690	735
7	390	460	510	560	610	660	710	760	810
8	430	500	555	610	665	720	775	830	885
9	470	540	600	660	720	780	840	900	960
10	510	580	645	710	775	840	905	970	1 035

NOTE The capacity of stairs serving more than 10 floors may be obtained by linear extrapolation.

7.2 Basement stairs

7.2.1 Commentary

Areas below ground level are more likely to become completely filled with smoke and heat from a fire than are the ground and upper storeys. There is, therefore, a greater risk that a stair in a basement will become obstructed by smoke and heat, particularly in a fully developed fire. For this reason it is preferable that all stairs to basements be entered at ground floor level from the open air and only from such positions that smoke from any basement fire will not obstruct any exit serving the ground and upper storeys of the building. Nevertheless, for the purpose of normal circulation in a building, it may be necessary for some of the stairs from the upper levels to continue down to the basement. There is no objection to one-half of the stairs serving the upper storeys or tiers of seating continuing down to the basement, provided that each such stair is adequately protected from the ingress of smoke from the basement.

7.2.2 Recommendations

The following recommendations are applicable.

- Not more than 50 % of the protected stairways serving the upper storeys or tiers of seating in a building should continue down to basement level.
- Stairs which connect with basement levels should be separated from each basement level by a protected lobby in accordance with 7.3.2.

7.3 Access lobbies and corridors to protected stairways

7.3.1 Commentary

Because of the greater hazard to occupants of a high building than of a low one, the protection afforded to a stair serving high buildings should therefore be greater.

This can be achieved by the stair serving only one storey, or by providing access to the stair by way of a protected lobby or corridor. Where there is a high concentration of persons using the stairs, the former solution is to be preferred.

Ancillary accommodation of significant fire risk ought not to be accessible from public stairs.

Normal circulation demands that some stairs will need to connect with enclosed car parks and, in these cases, lobby (or corridor) protection to the protected stairway is necessary.