Bespoke Fire Safety Training

NOS-3

Evaluate Design Submissions Against Approved Document B

External Fire Spread

(slides)

Course code:

NOS-3

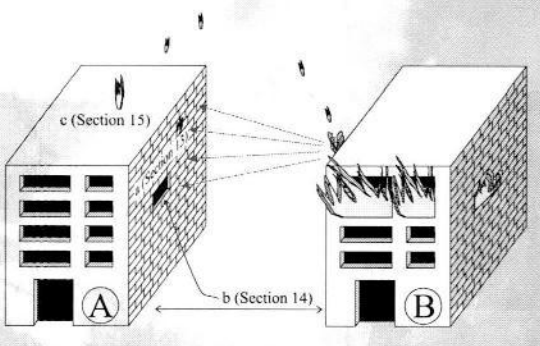
Course title:

Evaluate Design Submissions Against Approved Document B

Subject:

External Fire Spread

Requirement	Limits on application
External fire spread	
B4.-(1) The external walls of the building shall adequately resist the spread of fire over the walls and from one building to another, having regard to the height, use and position of the building. (2) The roof of the building shall adequately resist the spread of fire over the roof and from one building to another, having regard to the use and position of the building.	

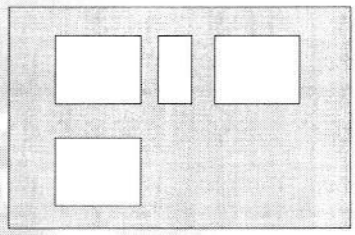


A. **External walls protected from the risk of ignition from an external source**

B. **Fire spread limited by restriction of unprotected areas**

C. **Roof is protected from ignition by an external fire source**

Fire resistance of external walls:



External wall is an element of structure, so....

It must have appropriate fire resistance, but....

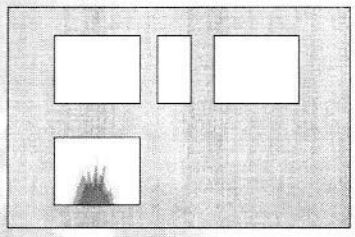
"Unprotected areas" are not considered to be part of the external wall, so....

They do not have to have fire resistance.

WALL is STRUCTURAL BUT ~~CO~~ COULD BE NON LOAD BEARING ie Roof supported by frame.

ie glass wall construction office block shop front.

Fire resistance of external walls (discussed in Section 14):

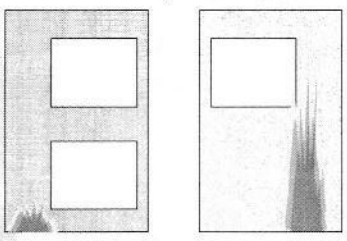


Fire resistance means resistance to penetration by fire

If external wall is more than 1000mm from the boundary, this resistance to penetration by fire only has to work with respect to fires *inside* the building

A fire could always break out through an "unprotected area", but the size of these is controlled

Combustibility of external walls (Section 13):



Combustibility is not the same as fire resistance

Combustibility is the ability to propagate flame

Provisions made to restrict the combustibility of external walls of buildings that are:

- **less than 1000mm from the relevant boundary**
- **high buildings, and**
- **buildings of the Assembly and Recreation Purpose Group.**

This is in order to reduce the surface's susceptibility to ignition from an external source, and to reduce the danger from fire spread up the external face of the building.

same as internal.
0 AND 1
extra outbuildings
~~15~~ 20
UNDER I

Combustibility of external walls:

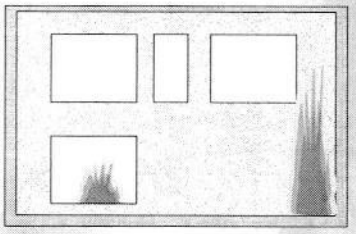
External surfaces

Paragraph 13.5 says that the combustibility of external walls should meet the provisions of Diagram 40, "*however, the total amount of combustible material may be limited in practice by the provisions for space separation in Section 14*".

But Section 14 covers space separation and fire penetration, so how can this influence the combustibility of the external walls?

Combustibility of external walls:

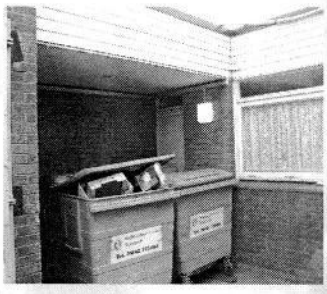
Answer



This wall is fire resistant, but combustible.

However 'in practice' such a situation is unlikely (or was at the time of writing)

Combustibility of external walls:

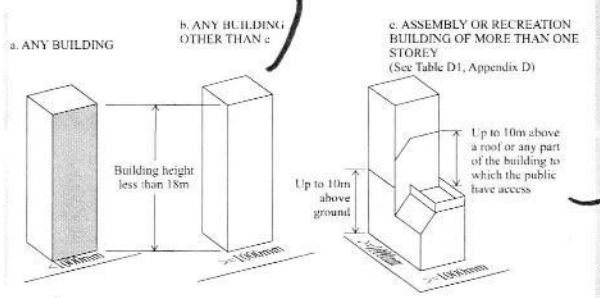


Rain screen cladding

Very good for misleading reasons.

More than 1m NO requirement

Provisions for the combustibility of external walls:

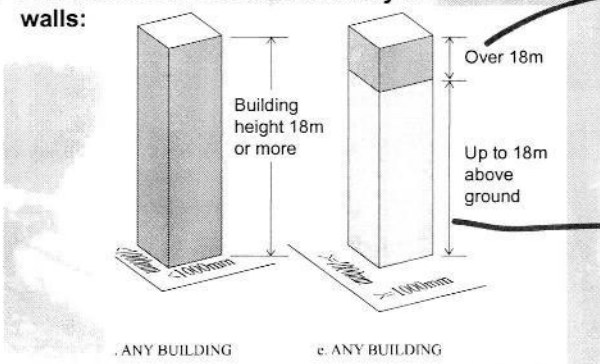


[ref: ADB Diagram 40]

MIDDLE GROUND.
See Page 89.

LESS THAN 1M to Boundary.
CLASS 0

Provisions for the combustibility of external walls:



[ref: ADB Diagram 40]

over 18m Class 0

UNDER I

Space separation and fire resistance (Section 14):

FPA

Space separation and fire resistance:

Assumptions

a. that the size of a fire will depend on the compartmentation of the building, so that a fire may involve a complete compartment, but will not spread to other compartments;

b. that the intensity of the fire is related to the use of the building (ie purpose group), but that it can be moderated by a sprinkler system;

c. that Residential, and Assembly and Recreation, Purpose Groups represent a greater life risk than other uses;

FPA

Space separation and fire resistance:

Assumptions

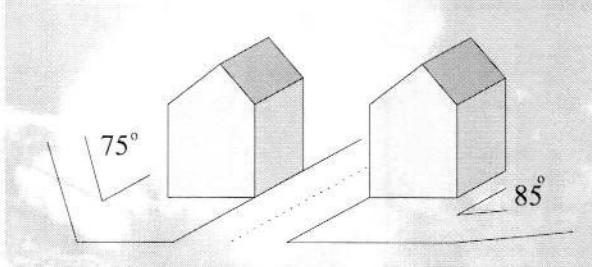
d. that apart from Residential, and Assembly and Recreation Purpose Groups, the spread of fire between buildings on the same site represents a low risk to life and can be discounted;

e. that there is a building on the far side of the boundary that has a similar elevation to the one in question, and that it is at the same distance from the common boundary;

f. that the amount of radiation that passes through any part of the external wall that has fire resistance may be discounted.

FPA

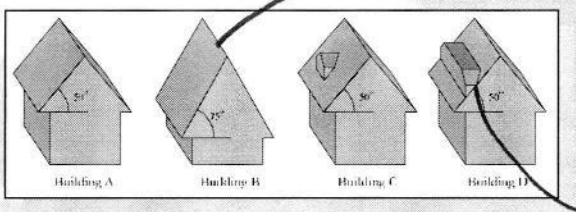
Relevant boundary:

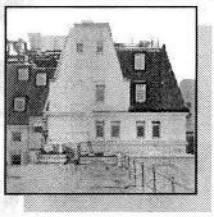


See item 14-4 Boundaries

A wall is treated as a facing Boundary if it makes an angle with it of ~~80°~~ 80° or less

Definition of walls:

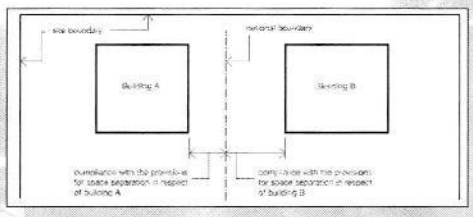




CLASSED AS A WALL over 75°

DORMER HERE IS A WALL, BUT "C" is too small

Notional boundary:



Paragraph 14.6:

Generally separation distance between buildings on the same site is discounted.

In some circumstances the distances to other buildings on the same site need to be considered.

This is done by assuming that there is a boundary between those buildings (A notional boundary).

NOTIONAL BOUNDARY for PURPOSE GROUPS 1-5.

Unprotected Areas:

Unprotected area In relation to a side or external wall of a building means:

a. window, door or other opening; and

Note: Windows that are not openable and are designed and glazed to provide the necessary level of fire resistance, and recessed car parking areas shown in Diagram E1, need not be regarded as an unprotected area.

b. any part of the external wall which has less than the relevant fire resistance set out in Section 13; (Appendix A, Table A2) and

c. any part of the external wall which has combustible material more than 1mm thick attached or applied to its external face, whether for cladding or any other purpose. (Combustible material in this context is any material which does not have a Class 0 rating).

[ref: ADB]

DIAGRAM 43
page 92

Status of combustible surface materials as unprotected area:

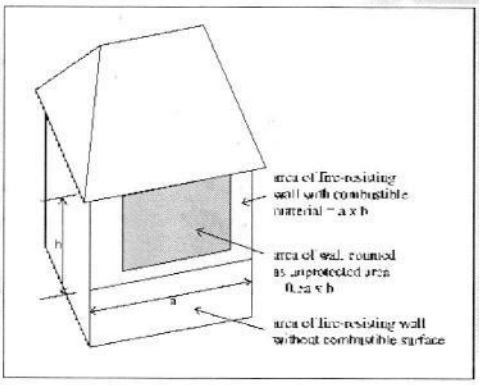
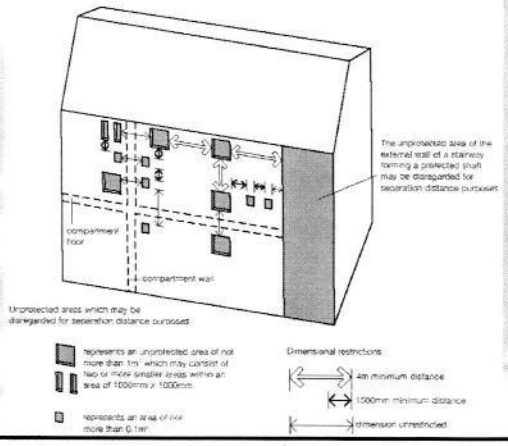


DIAGRAM 44
page 93

Allowable unprotected areas:



External walls within 1000mm of boundary:

WITHIN 1 metre

A wall which is situated within 1000mm of a relevant boundary will only be considered to meet the provisions for space separation if

- it is fire resisting **from both sides**,
- there are **no unprotected areas** (other than those which can be disregarded according to diagram 44)

A wall which is situated more than 1000mm from a relevant boundary, will only be considered to meet the provisions for space separation if

MORE THAN 1 Metre

- the wall is fire resisting **from one side only**,
- the **unprotected area does not exceed that given by one of the methods of calculation** (other than those which can be disregarded according to diagram 44).

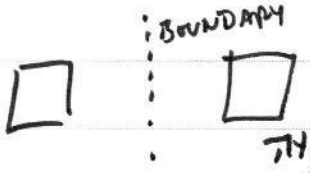
Do not confuse this with diagram 40. This is talking about fire resistance (fire penetrating the external walls). Diagram 40, is talking about ignitability and surface spread of flame over the external walls.

Calculation of unprotected area:

Minimum distance between side of building and relevant boundary (m)		Maximum total percentage of unprotected area %
Purpose groups		
Residential, Office, Assembly and Recreation	Shop & Commercial, Industrial, Storage & other Non-residential	
(1)	(2)	(3)
n.a.	1	4
1	2	8
2.5	5	20
5	10	40
7.5	15	60
10	20	80
12.5	25	100

Notes:
n.a = not applicable
a. Intermediate values may be obtained by interpolation.
b. For buildings which are fitted throughout with an automatic sprinkler system, see para 14.17.
c. In the case of open-sided car parks in Purpose Group 7(b), the distances set out in column (1) may be used instead of those in column (2).

DISTANCE ARE THIS BECAUSE.



AS ONE BUILDING MOVES AWAY

THIS ONE CAN MOVE as well.

Roof coverings (Section 15):

The performance of roof coverings is designated by reference to test methods specified in BS 476 *Fire tests on building materials and structures*, Part 3: 1958 *External fire exposure roof tests*.

- Under BS 476 Part 3, constructions are designated by 2 letters from A to D, with an A designation being the best.
- The first letter indicates the time to penetration, and the second letter a measure of the spread of flame.
- The notional performance of some common roof coverings is given in Table A5 of Appendix A of ADB, although only AA rated roof coverings are described.

FIRST LETTER RADIATE HEAT ON MATERIAL either A or B. (A Best.)

SECOND LETTER EDGE OF ROOF LIT. A or B (A best)

Roof coverings (Section 15):

Designation of covering of roof or part of roof	Minimum distance from any point on relevant boundary			
	Less than 6m	At least 6m	At least 12m	At least 20m
AA, AB or AC	☺	☺	☺	☺
BA, BB or BC	☹	☺	☺	☺
CA, CB or CC	☹	☺	☺	☺
AD, BD or CD	☹	☺	☺	☺
DA, DB, DC or DD	☹	☹	☹	☺

ONLY ONE UP TO BOUNDARY.

Bespoke Fire Safety Training

NOS-3

Evaluate Design Submissions Against Approved Document B

External Fire Spread

(handout)

Dave Sibert

FPA Trainer

B4 – EXTERNAL FIRE SPREAD
THE REQUIREMENT

Requirement	*Limits on application*
External fire spread	
B4.-(1) The external walls of the building shall adequately resist the spread of fire over the walls and from one building to another, having regard to the height, use and position of the building.	
(2) The roof of the building shall adequately resist the spread of fire over the roof and from one building to another, having regard to the use and position of the building.	

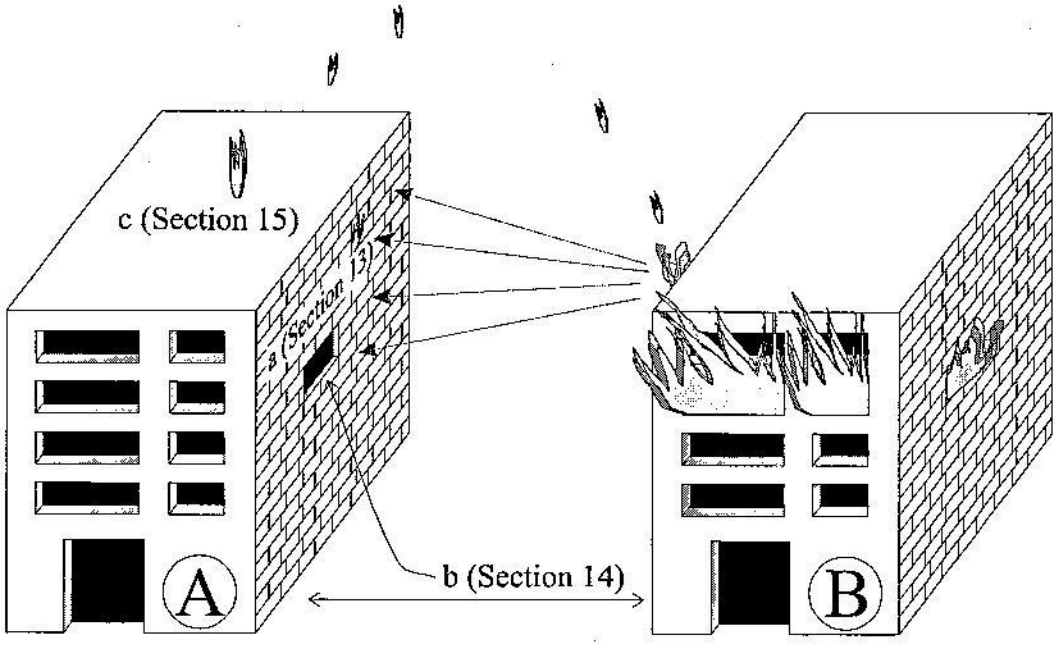
PERFORMANCE

In the Secretary of State's view the requirements of B4 will be met:

a. if the external walls are constructed so that the risk of ignition from an external source, and the spread of fire over their surfaces, is restricted by making provision for them to have low rates of heat release;

b. if the amount of unprotected area in the side of the building is restricted so as to limit the amount of thermal radiation that can pass through the wall, taking the distance between the wall and the boundary into account;

c. if the roof is constructed so that the risk of spread of flame and/or fire penetration from an external fire source is restricted.



Each of these provisions must work in both directions. For example, considering the diagram above, the unprotected area in both buildings must be restricted:

1. The unprotected area in building B is restricted to limit the amount of radiated heat escaping from building B in the direction of building A, and

2. the unprotected area in building A is restricted to prevent any radiated heat which is released from building B, from passing inside and starting a fire.

The limitations on these three factors, (external wall construction, space separation/unprotected area, and roof construction), are dependant upon the distance which the building is from its boundary, and, in some cases, the building's height.

B4 looks at each provision in a separate section:

Section 13: CONSTRUCTION OF EXTERNAL WALLS

Section 14: SPACE SEPARATION

Section 15: ROOF COVERINGS

SECTION 13
CONSTRUCTION OF EXTERNAL WALLS

Introduction

Most of B4 can be very confusing at first if the precise aspects of fire safety under consideration are not grasped. The first thing to do when reading B4, is to understand the relevance of some of the terms used:

- Loadbearing walls
- External walls
- Elements of structure
- Unprotected areas
- Combustibility
- Fire resistance

Appendix E states that a loadbearing wall, or the loadbearing part of a wall, is an element of structure. This would lead one to believe that the external walls of a steel framed building, for example, are *not* elements of structure (because they are not loadbearing).

However, Appendix D goes on to say that *any* external wall *is* an element of structure.

How does this help?

Table A2 describes the minimum periods of fire resistance of loadbearing walls, and external walls, based on the fact that they are elements of structure. So it would appear that the external walls of a steel framed building should have fire resistance of anything from 30 to 120 minutes, depending on the use, height and size of the building concerned.

So, why does paragraph 13.1 say that if the external walls are sufficiently far from the relevant boundary, "*it is possible for some or all of the walls to have no fire resistance, except for any parts which are loadbearing*"? And Diagram 40 shows a building with "*no provision*" for the external surfaces of walls in respect of the relevant boundary. If external walls are elements of structure, shouldn't they have fire resistance in accordance with Table A2? What is going on?

There are two separate answers to this question.

Fire resistance

In terms of **fire resistance**, unprotected areas are effectively *not considered* part of the external wall. Section 14 will explain that the further a wall is from its relevant boundary, the more unprotected area is allowed, until ultimately, 100% of the wall may be an unprotected area.

> An unprotected area being a window, door or other opening, any part of the external wall which has less than the relevant fire resistance set out in Section 13, or any part of the external wall which has combustible material more than 1mm thick attached or applied to its external face.

Effectively, an external wall can ultimately be 100% unprotected area. In this case, it is no longer an external wall, and table A2 does not apply!

Any external wall which is left (after the unprotected parts have been ignored), or any loadbearing part of the wall, must have fire resistance in accordance with Table A2. Not forgetting that Table A1 says that the fire resistance only need apply from the inside of the wall, if it is more that 1000mm from the relevant boundary.

Combustibility

The second part of the answer, is that fire resistance, and **combustibility**, are not the same thing.

Table A2 is describing the external wall's fire resistance, that is its loadbearing capacity, its integrity, and its insulation properties, when tested to BS 476 Parts 20 to 24 [1]. Diagram 40, and most of Section 13, is talking about the external wall's combustibility, and its ability to propagate flame, when tested to BS 476 Parts 5, 6, 7, or 11[2].

There is clearly a link between them, but fire resistance and combustibility are two completely different things. The fire resistance needs of external walls must be assessed using Section 14, then, totally separately, and in addition, combustibility needs of external walls must be assessed using Diagram 40, and Section 13.

Provisions are made to restrict the combustibility of external walls of buildings that are:

- less than 1000mm from the relevant boundary
- high buildings, and
- buildings of the Assembly and Recreation Purpose Group.

This is in order to reduce the surface's susceptibility to ignition from an external source, and to reduce the danger from fire spread up the external face of the building.

External surfaces

Paragraph 13.5 says that the combustibility of external walls should meet the provisions of Diagram 40, "*however, the total amount of combustible material may be limited in practice by the provisions for space separation in Section 14*".

This seems to mean the following:

According to Diagram 40 in Section 13, the external wall of a small industrial building which is 5m from its relevant boundary, requires no special provision for the combustibility of its surface. However Table 16 from Section 14 tells us, that only 20% of that external wall is allowed to be unprotected, the rest must provide 60 minutes fire resistance, in accordance with Table A2.

In theory, these two matters are unrelated. The fire resistance is only required from the

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[1] Part 20 Method for determination of the fire resistance of elements of construction (general principles)
Part 21 Methods for determination of the fire resistance of loadbearing elements of construction
Part 22 Methods for determination of the fire resistance of non-loadbearing elements of construction
Part 23 Methods for determination of the contribution of components to the fire resistance of a structure
Part 24 Method for determination of the fire resistance of ventilation ducts

2 Part 4: 1970 Non-combustibility test for materials
Part 6: 1981 or 1989 Method of test for fire propagation of products.
Part 7: 1971 Surface spread of flame tests for materials
1987 Method for classification of the surface spread of flame of products
1997 Method of test to determine the classification of the surface spread of flame of products
Part 11: 1982 Method for assessing the heat emission from building products

inside, so the inner face of the wall could be blockwork, with 20% of its area comprising of windows. However, the combustibility only applies to the outside, so the outer face of the blockwork could be covered in polystyrene tiles.

Paragraph 13.5 seems to be saying that in practice, this would not happen. If the "*provision for space separation in Section 14*" calls for 80% of the wall to be fire resisting from the inside, then the reality is that the outside face will be constructed of non combustible materials.

Alternative method

An alternative to meeting the provisions in Diagram 40 is said to be BRE Fire Note 9 *Assessing the fire performance of external cladding systems: a test method* (BRE, 1999).

This test method enables an assessment of the behaviour of non-loadbearing exterior wall assemblies including external cladding systems, rainscreen overcladding systems, external wall insulation systems and curtain walling when exposed to an external fire.

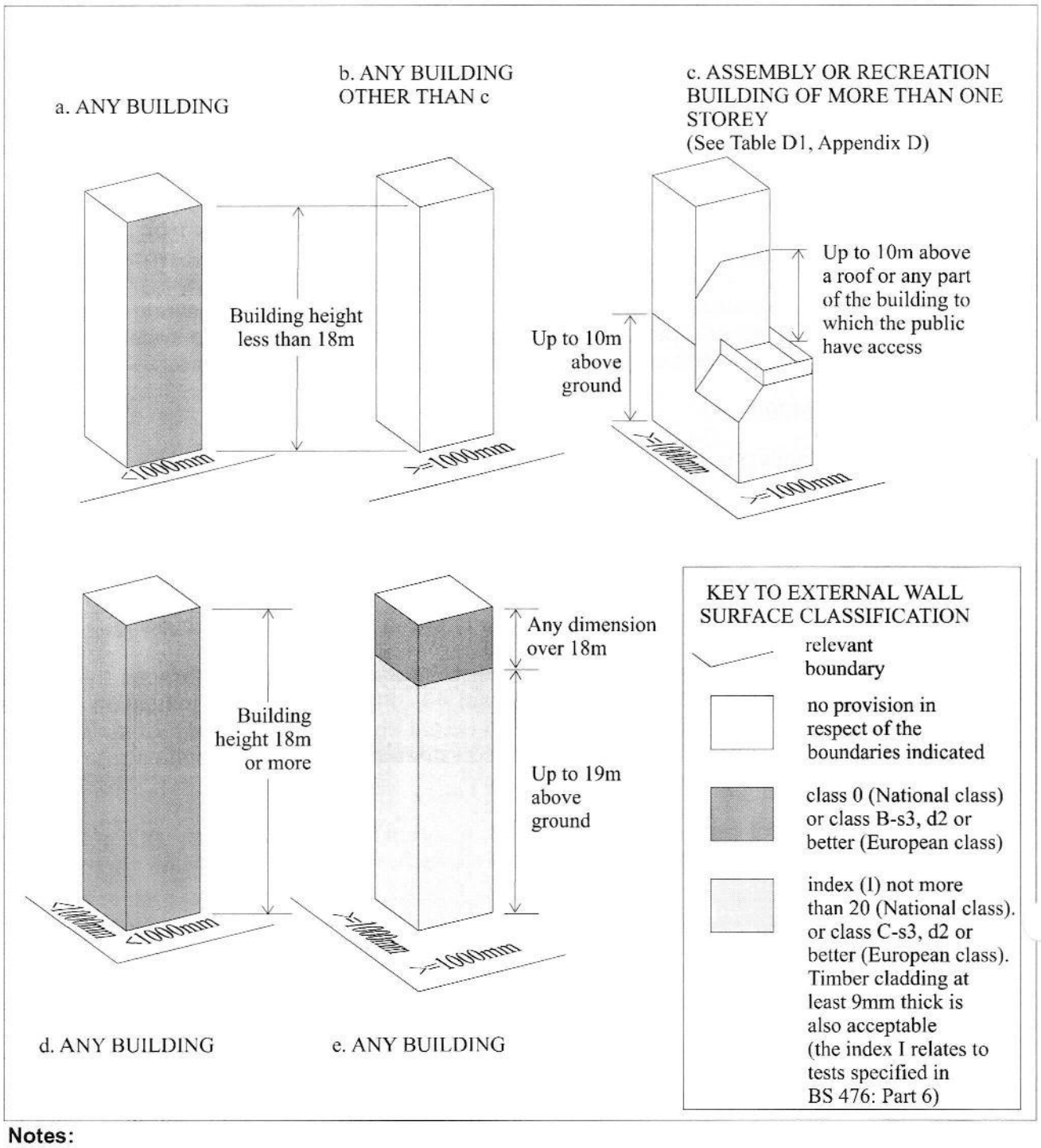
Rainscreen cladding

Rain screen cladding is a form of construction often used in refurbishment works to improve the weather resistance and thermal performance of the external walls of buildings. It has been used regularly to upgrade the performance of blocks of high-rise flats (often built in the 1960s), where an external weatherproof cladding is lined internally with combustible insulation and this is fixed to the outer surface of the external walls. There have been occasions when fire has occurred within the void space containing the insulation and fire has spread upwards within the cladding, eventually affecting the interior of the building.

Therefore, in such a system the surface of the outer cladding which faces the cavity should comply with the provisions of Diagram 40. Furthermore, any insulation used in the external walls of a building over 18m in height should be composed of materials of limited combustibility, although this restriction does not apply to insulation in masonry cavity walls.

Advice on the use of thermal insulation material is given in the BRE Report *Fire performance of external thermal insulation for walls of multi-storey buildings* (BR 135, 1988).

Diagram 40



Notes:

1. The national classifications do not automatically equate with the equivelant European classifications, therefore products cannot typically assume a European class unless they have been tested accordingly.
2. When a classification includes "s3 d2" this means that there is no limit set for smoke production and/or flaming droplets/particles.

Diagram 40 **Provisions for external surfaces of walls**

Diagram 40 is fairly self explanatory, as long as it is remembered that it is only talking about the combustibility of the exterior wall, and has nothing to do with fire protection, which is dealt with in Section 14.

Buildings a and d
Any external wall which is within 1m of a relevant boundary, must be constructed to class 0.

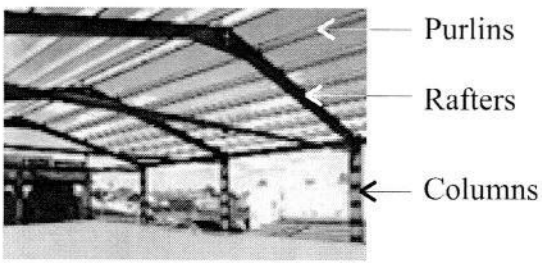
Building e
Any external wall which is more than 18m high, but which is *more than* 1000mm from a relevant boundary, must be constructed of materials with a fire propagation index of not more than 20 up to a height of 18m, and class 0 above that.

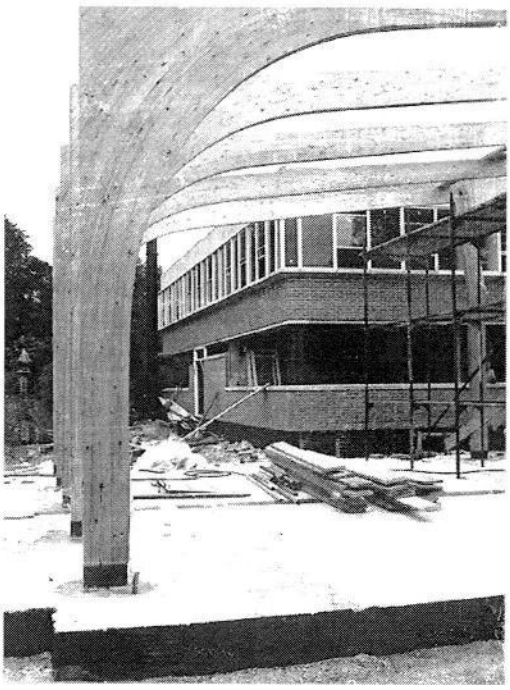
Building b
If the external wall is less than 18m high, then there is no provision for combustibility.

Building c
In the case of assembly or recreation buildings of more than one storey, if the external wall is more than 1m from the relevant boundary, then it must be constructed of material with a fire propagation index of not more than 20 up to a height of 10m above the ground, and 10m above any point to which the public have access.

This last provision was introduced into ADB following the Summerland Fire.

Portal frames

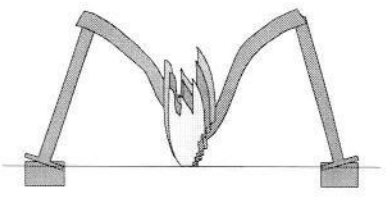




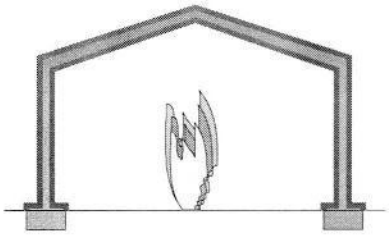
Portal framed buildings are usually single storey. As such, their elements of structure generally require 30 or 60 minutes fire protection, in accordance with Table A2. In addition, if an external wall is close enough to a relevant boundary, then that external will also require some (up to 100%) fire protection (from the inside) to the same standard.

Portal frames are generally of two types, reinforced concrete, or steel. Reinforced concrete portal framed buildings do not normally present a problem in the event of a fire. Reinforced concrete has a high degree of inherent fire resistance, and structural members will usually remain in place for the required period in the event of a fire. This means that any wall cladding or 'in fill' which gives the external wall its fire resistance, will remain in place, and do its job adequately.

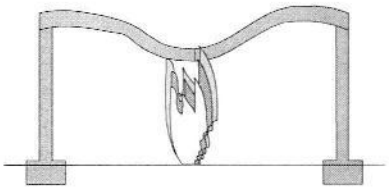
Steel portal frames are a different story. Columns are bolted to the foundations, and then rafters are bolted to the columns to form arches. A series of arches are then tied together with purlins. The rigidity of the whole structure then depends on the rigidity of every part. However, steel does not have any real inherent fire resistance. In a fire situation, collapse of a roof section may result in destruction of the walls, and fire spread beyond the boundary.



Consequently, in order for the external wall of a steel portal framed building to comply with B4, it would be necessary to provide a suitable level of fire protection to the whole structural frame. This would result in an uneconomic building which would defeat the object of using a portal frame.

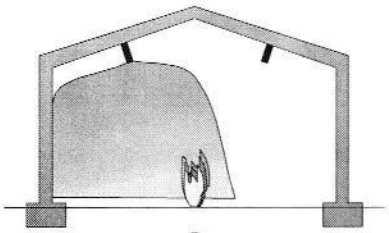


As an alternative, it has been found that it is economical to provided connections between the frame and its foundation which are sufficiently rigid to transfer the overturning moment caused by collapse, in a fire, of the rafters, purlins and some of the roof cladding. Making it feasible to remove the fire protection to the rafters and purlins while still allowing the external wall to perform its structural function.

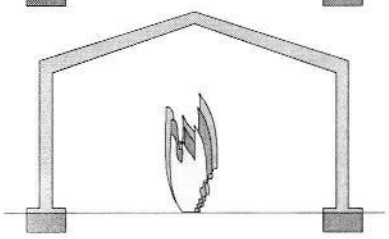


Notes

The recommendations in the SCI publication for designing the foundation to resist overturning need not be followed if the building is fitted with a sprinkler system meeting the relevant recommendations of BS 5306: Part 2 *Fire extinguishing installations and equipment on premises, Specification for sprinkler systems*, ie the relevant occupancy rating together with the additional requirements for life safety.

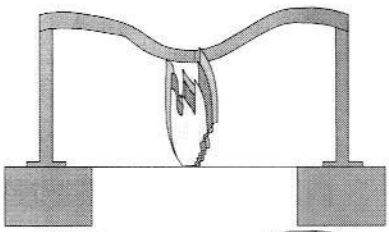


Normally, portal frames of reinforced concrete can support external walls requiring a similar degree of fire resistance without specific provision at the base to resist overturning.

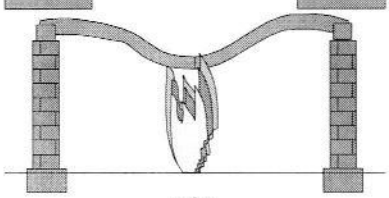


Existing buildings may have been designed to the following guidance which is also acceptable:

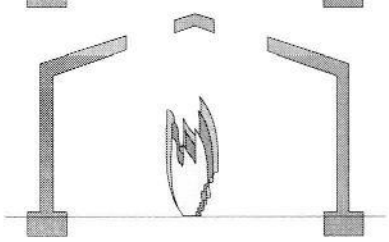
a. the column members are fixed rigidly to a base of sufficient size and depth to resist overturning;



b. there is brick, block or concrete protection to the columns up to a protected ring beam providing lateral support; and



c. there is some form of roof venting to give early heat release. (The roof venting could be, for example, pvc rooflights covering some 10 per cent of the floor area and evenly spaced over the floor area.)



SECTION 14
SPACE SEPARATION

Introduction

The importance of space separation to fire spread, has been well understood since the Great Fire of London. If fire is to be stopped from spreading between one building and another, they have to be built a long way apart.

Alternatively, there may not be enough room to construct one building a long way from another, (or the boundary of the property where another building may be constructed in the future). In this case, the wall which faces the neighbouring building or boundary could be either partly or wholly, constructed from imperforate fire resisting material.

Essentially, that is all Section 14 is about. It is only complicated by a few 'rules' which clarify terms like "*a long way apart*", "*wall*", "*neighbouring building*", "*partly or wholly*", "*boundary*", and so on.

Assumptions

Paragraph 14.2 list a series of assumptions on which Section 14 is based. Like the 'introduction', and the 'scope of the document', Paragraph 14.2 is the sort of paragraph that is often ignored when readers are seeking facts and figures from documents such as ADB, British Standards, and so on.

However, it is essential that they are read so that a full understanding can be gained of the principles on which the document is based. In the case of the assumptions listed in Paragraph 14.2, they need to be understood in order to be able to apply 'judgement' in cases where the Building Control authority may be considering relaxing conditions, for example.

Section 14 is based on the assumptions:

a. that the size of a fire will depend on the compartmentation of the building, so that a fire may involve a complete compartment, but will not spread to other compartments;

The significance of this is that "*where a reduced separation distance is desired (or an increased amount of unprotected area) it may be advantageous to construct compartments of a smaller size*". As stated in Paragraph 14.3. But conversely, where oversized compartments are allowed for some reason, then increased space separation (or a reduction in unprotected area) may be required.

b. that the intensity of the fire is related to the use of the building (ie purpose group), but that it can be moderated by a sprinkler system;

Section 14 assumes that the radiation intensity from a fire in Residential, Office or Assembly or Recreation building, is half that of any other building. Such buildings are therefore allowed to be twice as close together for any given unprotected area.

c. that Residential, and Assembly and Recreation, Purpose Groups represent a greater life risk than other uses;

d. that apart from Residential, and Assembly and Recreation Purpose Groups, the spread of fire between buildings on the same site represents a low risk to

life and can be discounted;

Usually, the distance between buildings on the same site is not an issue. Presumably the idea being that Building Regulations are there to protect people's buildings from their neighbours, not from themselves. The exception to this is Residential or Assembly and Recreation buildings, where separation is required, even if the buildings are on the same site.

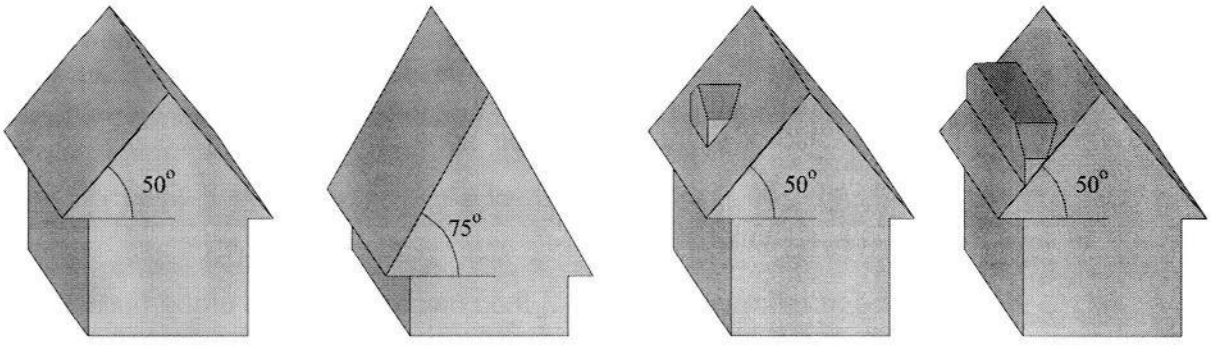
e. that there is a building on the far side of the boundary that has a similar elevation to the one in question, and that it is at the same distance from the common boundary;

Section 14 lays down rules for calculating the distance which a building must be from its boundary. Effectively this assumption is telling us that this distance is only *half* the distance required to prevent fire spread. The total separation distance required to prevent fire spread, will be made up by the distance from the boundary to the neighbouring building.

f. that the amount of radiation that passes through any part of the external wall that has fire resistance may be discounted.

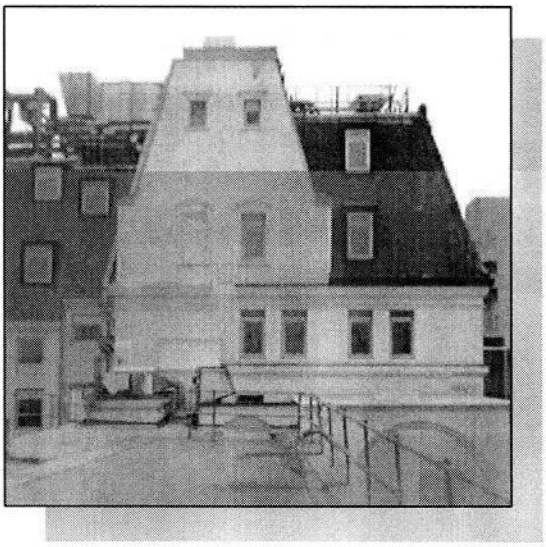
Clarification of terms

Roof



Building A Building B Building C Building D

This process of defining terms begins in Paragraph 14.1, which states that a roof may be considered as a wall, if its pitch is greater than 70°. That a dormer window in a true roof does not need to be considered as a wall, but that it is a matter of judgement as to whether a "continuous run of dormer windows occupying most of a steeply pitched roof" (presumably less than 70° though), should be considered as a wall.



In the diagram above, the roof of building A is not considered as a wall for the purposes of Section 14, whereas the roof of building B is. The single dormer window in building C is not considered as a wall. Any dormer window in a roof of pitch greater than 70° would be considered as wall, because the whole roof is considered as a wall anyway. It is a matter of judgement as to whether or not the continuous run of dormer windows in building D should be considered as a wall.

Relevant boundary

The provisions of Section 14, that is, the allowable amount of unprotected area of a wall, depends on the shortest distance between the wall in question, and the boundary. The boundary may be the actual site boundary, the centre line of a road, or a notional boundary. Either way, it is known as the 'relevant boundary' to the wall.

If a wall is parallel to a boundary, then it is fairly obvious which boundary is relevant, and how far the wall is from the boundary. See walls B and D in diagram 41.

Where the site boundary adjoins an area where further development is unlikely, such as a road, a railway line, or a canal, then the allowable amount of unprotected area is based on the distance from the wall to the centre of the adjoining area. See wall A in diagram 41.

(Without this exception, the fronts of nearly every high street shop would have to be almost totally bricked up! The front walls are coincidental with the premises boundary. By considering the distance to the boundary as being to the centre line of the high street, shops are allowed to have glass windows and doors.)

Finally, a wall is treated as facing a boundary if it makes an angle with it of 80° or less. Wall C in diagram 41 (reproduced below) shows this, but I have also drawn some other examples for clarity.

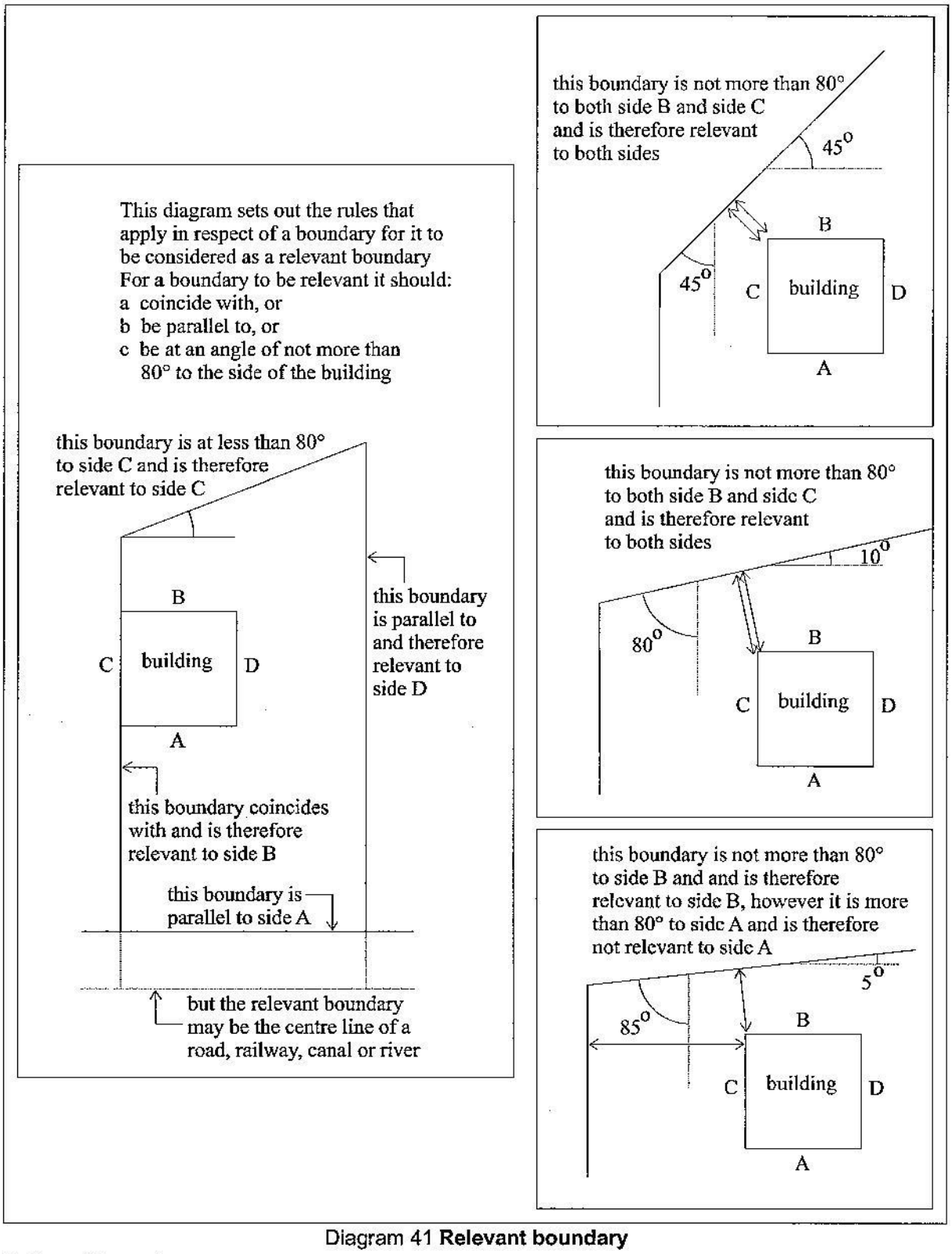


Diagram 41 **Relevant boundary**

Notional boundary

"*Generally separation distance between buildings on the same site is discounted*". This seems to assume that all of the buildings on one "site" are owned by one person, and if that person wants to run the risk of fire spread between buildings, then that is up to them.

In some cases though, the site owner does not have this option. If the buildings on the site are Residential or Assembly and Recreation Purpose Groups, then the buildings must be

separated from each other as if they were on separate sites. They are said to have a 'notional boundary' between them. See diagram 42.

This diagram sets out the rules that apply where there is a building of the Residential or Assembly and Recreation Purpose Groups on the same site as another building, so that a notional boundary needs to be assumed between the buildings.

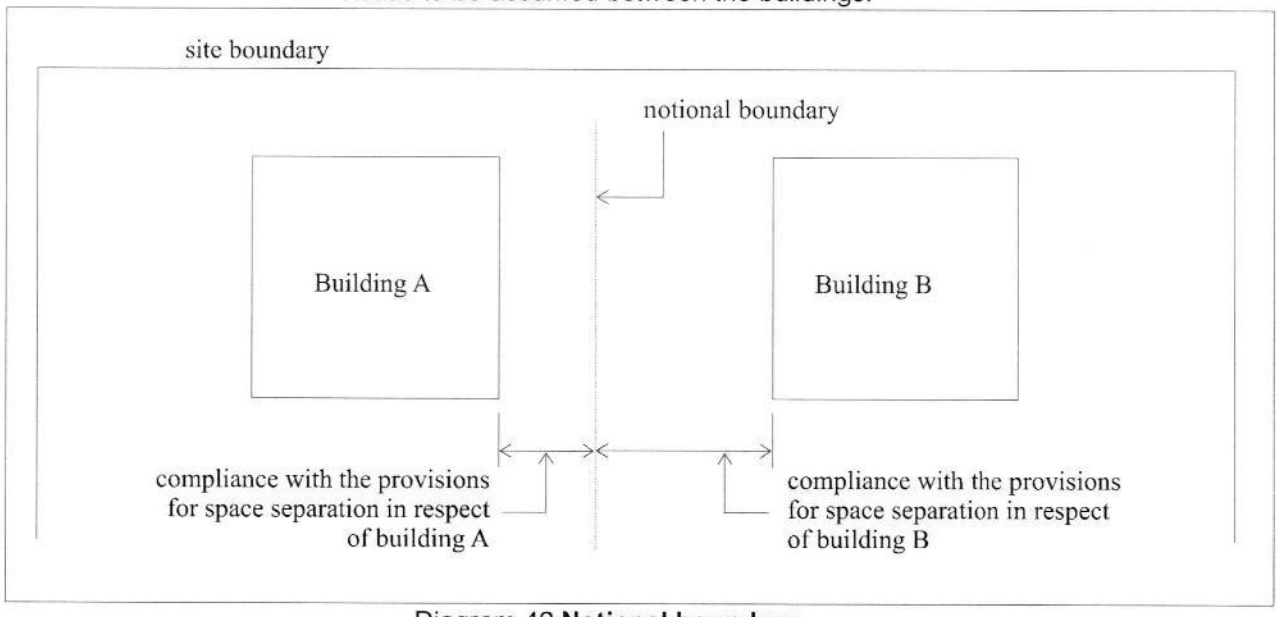


Diagram 42 **Notional boundary**

The notional boundary should be set in the area between the two buildings using the following rules:

1 It is only necessary to assume a notional boundary when the buildings are on the same site and either of the buildings, new or existing, is of Residential or Assembly and Recreation use.

2 The notional boundary is assumed to exist in the space between the buildings and is positioned so that one of the buildings would comply with the provisions for space separation having regard to the amount of its unprotected area. In practice, if one of the buildings is existing, the position of the boundary will be set by the space separation factors for that building.

3 The siting of the new building, or the second building if both are new, can then be checked to see that it also complies – using the notional boundary as the relevant boundary for the second building.

Unprotected area

Since the whole of Section 14 is about weighing space separation against unprotected areas, it is worth reproducing the definition of an unprotected area in full in this paper:

> ***Unprotected area*** *In relation to a side or external wall of a building means:*
>
> *a. window, door or other opening; and*
>
> ***Note:*** *Windows that are not openable and are designed and glazed to provide the necessary level of fire resistance, and recessed car parking areas shown in Diagram E1, need not be regarded as an unprotected area.*
>
> *b. any part of the external wall which has less than the relevant fire resistance set out in Section 13; (Appendix A, Table A2) and*

c. *any part of the external wall which has combustible material more than 1mm thick attached or applied to its external face, whether for cladding or any other purpose. (Combustible material in this context is any material which does not have a Class 0 rating).*

External walls of protected shafts forming stairways

The parts of an external wall which form the external wall of a stairway in a protected shaft, are excluded from the assessment of the amount of unprotected area.

Status of combustible surface materials as unprotected area

"*If an external wall has the appropriate fire resistance, but has combustible material more than 1mm thick as its external surface, then that wall is counted as* (having) *an unprotected area amounting to half the actual area of the combustible material, see Diagram 43.*"

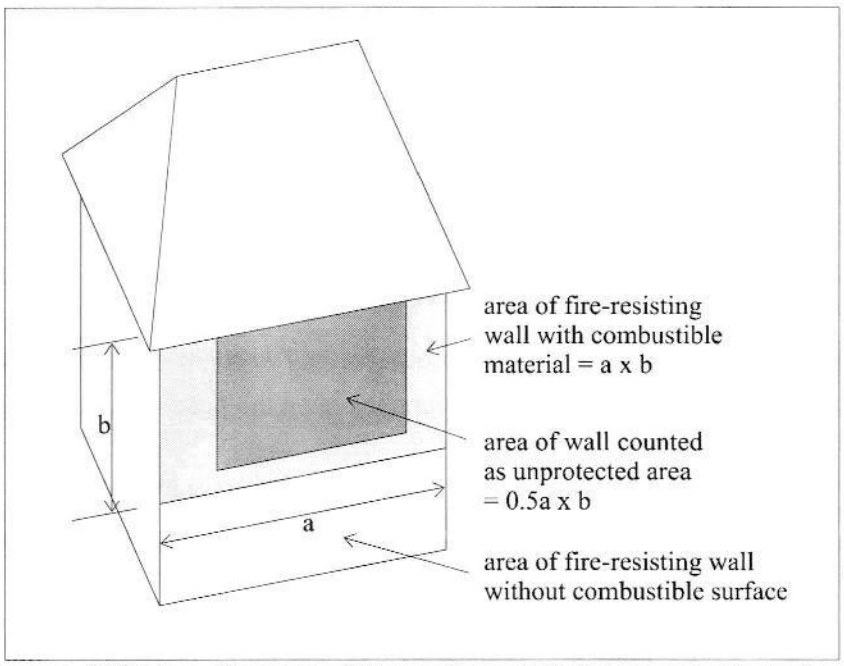


Diagram 43 **Status of combustible surface material as unprotected area**

There seems to be no practical reason for this provision. Why *half the actual area*? If Section 14 is about the prevention of fire spread between buildings, then it would seem that the proximity of combustible surface materials to openings, facia boards, and so on, would be of greater importance than the gross area.

Small unprotected areas

Small, well separated, unprotected areas in an otherwise protected area of wall are considered to pose a negligible risk of fire spread, and may be disregarded. See diagram 44.

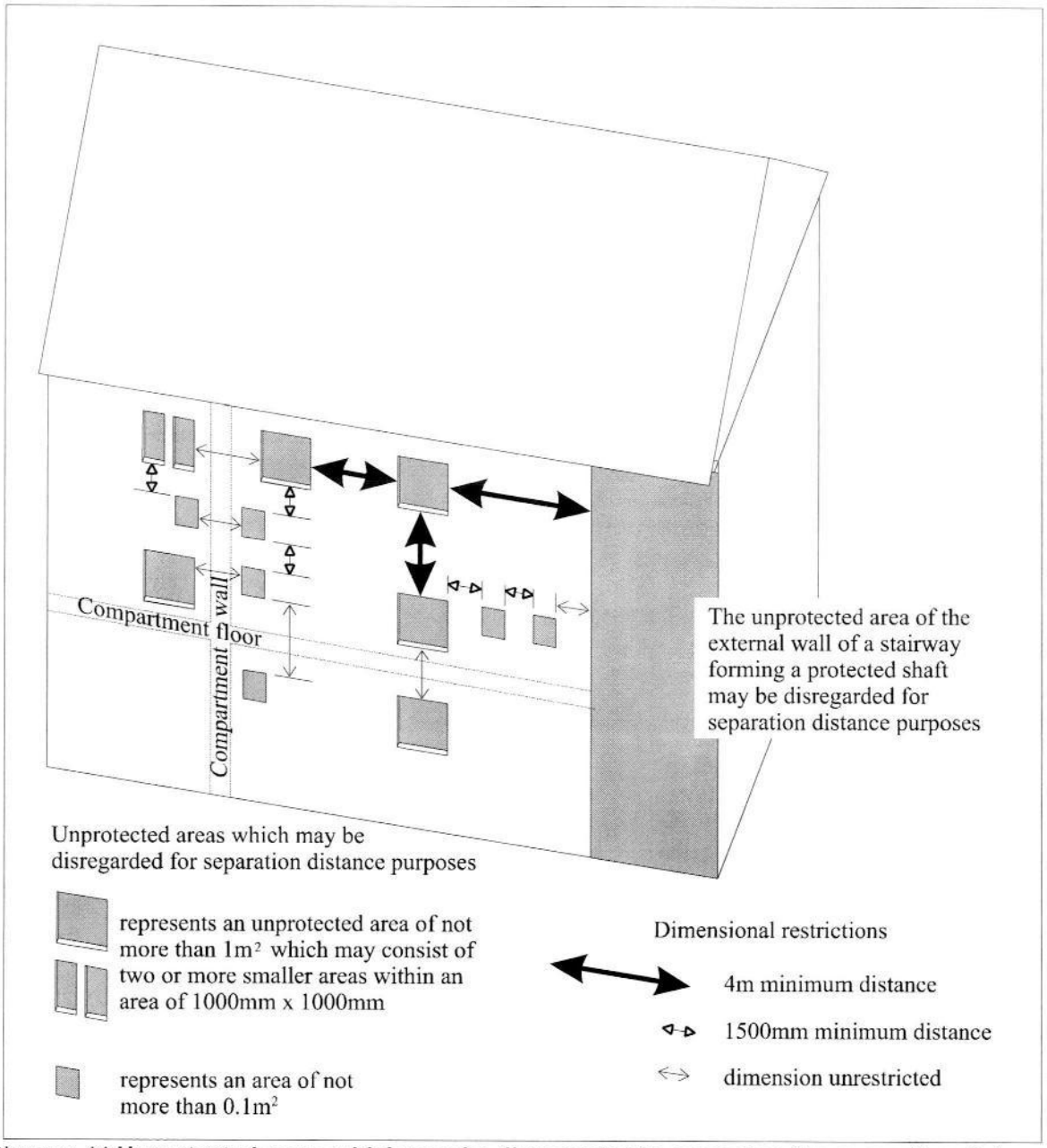


Diagram 44 **Unprotected areas which may be disregarded in assessing the separation distance from the boundary**

Canopies

Some canopy structures would be exempt from the application of the Building Regulations by falling within Class VI or Class VII of Schedule 2 to the Regulations (Exempt buildings and works).

Class VI: Small detached buildings

Detached single storey buildings of up to $30m^2$ floor area, with no sleeping accommodation. (Such buildings must either be situated more than 1m from the boundary, or constructed substantially of non-combustible material.

Detached fallout shelters of less than $30m^2$.

Detached buildings with a floor area of less than $15m^2$ and which do not contain sleeping accommodation (eg garden sheds)

Class VII: Extensions

Ground level extensions of up to $30m^2$ floor area which are greenhouses, conservatories, porches, covered yards or ways, or a carport open on at least two sides.

(Although a conservatory or porch which is glazed is not exempt from Part N).

Many others may not meet the exemption criteria and in such cases the leading edge of the canopy could be the nearest part of the wall to the relevant boundary. This would force the Building Control Officer to insist on the opening to the canopy being largely bricked up!

To get round this awkward situation, as long as the edges of the canopy are at least 2m from a relevant boundary, then separation distance may be measured from the wall of the building, rather than the edge of the canopy (see Diagram 45).

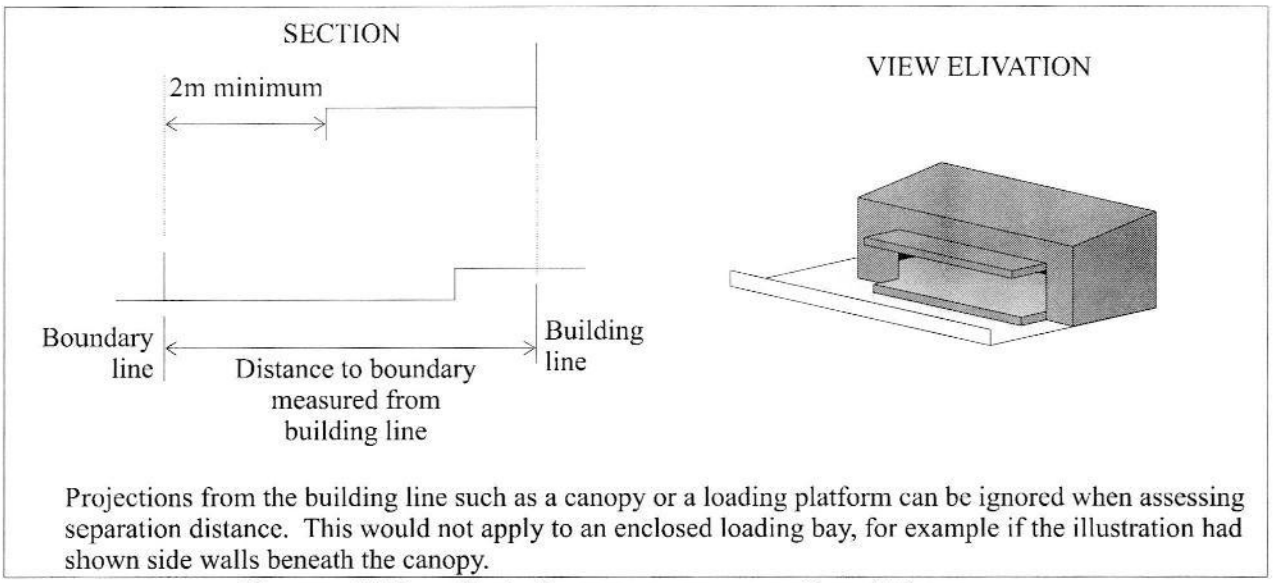


Diagram 45 **The effect of a canopy on separation distance**

"*In the case of a free-standing canopy structure above a limited risk or controlled hazard (for example over petrol pumps), in view of the high degree of ventilation and heat dissipation achieved by the open sided construction, and provided the canopy is 1000mm or more from the relevant boundary, the provisions for space separation could reasonably be disregarded.*"

Large uncompartmented buildings

Paragraph 14.12 states that "*Parts of the external wall of an uncompartmented building which are more than 30m above mean ground level, may be disregarded in the assessment of unprotected area*". It is not clear why this should be the case, particularly bearing in mind the assumption "*that there is a building on the far side of the boundary that has a similar elevation to the one in question, and that it is at the same distance from the common boundary*".

External walls within 1000mm of the relevant boundary

A wall which is situated within 1000mm of a relevant boundary, including a wall which is coincidental with a relevant boundary, will only be considered to meet the provisions for space separation if the wall is fire resisting from both sides, and if there are no unprotected areas (other than those which can be disregarded according to diagram 44, and other than those above 30m in an uncompartmented building).

Remember, do not confuse this paragraph (or the next one) with diagram 40. Section 14 is

talking about fire resistance (fire penetrating the external walls). Section 13, and diagram 40, were talking about ignitability and surface spread of flame over the external walls.

External walls 1000mm or more from the relevant boundary

A wall which is situated more than 1000mm from a relevant boundary, will only be considered to meet the provisions for space separation if the wall is fire resisting from both sides, and if the unprotected area does not exceed that given by one of the methods of calculation (other than those which can be disregarded according to diagram 44, and other than those above 30m in an uncompartmented building).

Methods for calculating acceptable unprotected area

ADB contains two tables for working out the permitted unprotected area in walls sited more than 1000mm from a relevant boundary.

One is for small residential buildings, the second is for all other buildings.

The tables are based on the assumption that the radiation intensity from each unprotected area is:

a. 84 kw/m^2, if the building is in the Residential, Office or Assembly and Recreation purpose groups, or is an open-sided multi-storey car park in Purpose Group 7(b); and

b. 168 kw/m^2, if the building is in the Shop and Commercial, Industrial, Storage or Other non-residential purpose groups.

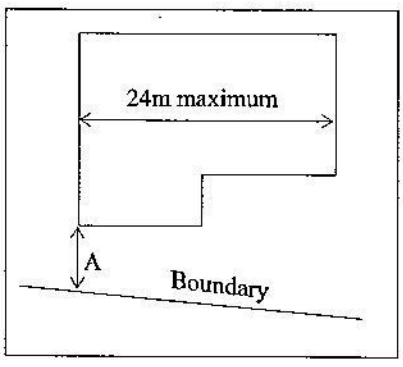
This is quite clearly a very broad generalisation, and is a perfect example of the limitations of a prescriptive code, as opposed to a bespoke engineered solution.

Sprinkler systems

If a building is fitted throughout with a suitable sprinkler system, the boundary distance may be half that for an otherwise similar, but unsprinklered, building, subject to there being a minimum distance of 1m. Alternatively, the amount of unprotected area may be doubled if the boundary distance is maintained.

Method 1 – Small Residential

This method (table) applies only to a building intended to be used as a dwelling house, or for flats or other residential purposes (not Institutional), which is 1000mm or more from any point on the relevant boundary.



Minimum distance (A) between side of building and relevant boundary (m)	Maximum total area of unprotected areas (sq.m)
1	5.6
2	12
3	18
4	24
5	30
6	no limit

Diagram 46 **Permitted unprotected areas in small residential buildings**

- The building should not exceed 3 storeys in height (basements not counted) or be more than 24m in length:
- Unprotected areas referred to in diagram 44, and those above 30m in an uncompartmented building, may be disregarded.
- The remainder of the wall must be fire resisting.

Method 2 – Other buildings or compartments

This method (table) applies to a building or compartment intended for any use other than 'small residential', and which is not less than 1000mm from any point on the relevant boundary.

- Other than for an open sided car park, the building or compartment should not exceed 10m in height.
- For any building or compartment more than 10m in height, the methods set out in the BRE Report *External fire spread: Building separation and boundary distances* can be applied.
- Unprotected areas referred to in diagram 44, and those above 30m in an uncompartmented building, may be disregarded.
- The remainder of the wall must be fire resisting.

Minimum distance between side of building and relevant boundary (m)		**Maximum total percentage of unprotected area %**
Purpose groups		
Residential, Office, Assembly and Recreation	Shop & Commercial, Industrial, Storage & other Non-residential	
(1)	(2)	(3)
n.a.	1	4
1	2	8
2.5	5	20
5	10	40
7.5	15	60
10	20	80
12.5	25	100

Notes:

n.a = not applicable

a. Intermediate values may be obtained by interpolation.

b. For buildings which are fitted throughout with an automatic sprinkler system, see para 14.17.

c. In the case of open-sided car parks in Purpose Group 7(b), the distances set out in column (1) may be used instead of those in column (2).

Table 16 **Permitted unprotected areas in small buildings or compartments**

Alternative methods

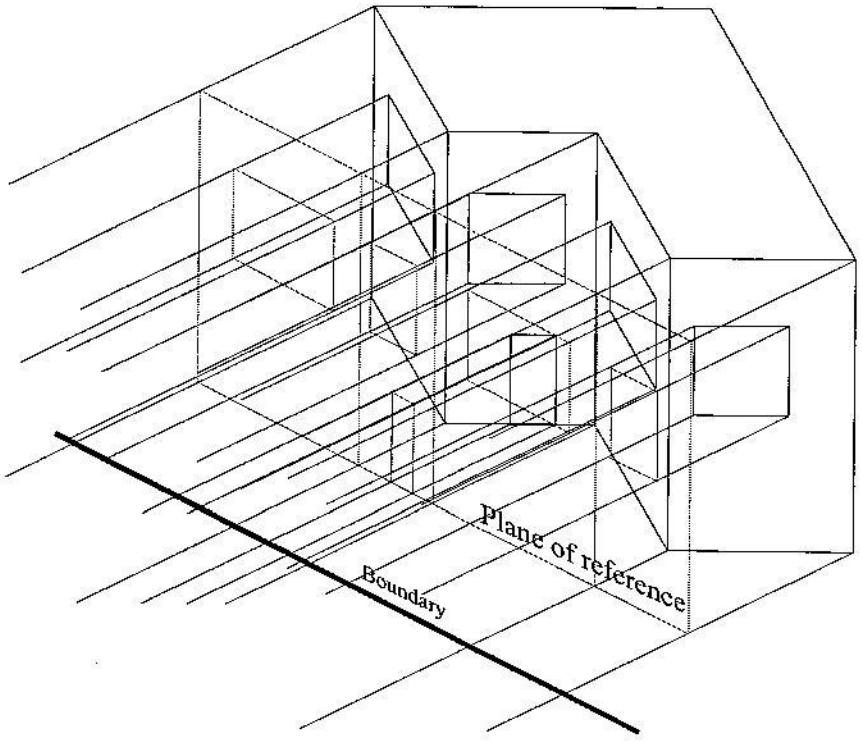
The method mentioned above for calculating the permitted unprotected area in buildings and compartments of greater than 10m in height (BRE Report *External fire spread: Building separation and boundary distances*), is a complicated calculation of the radiated heat from unprotected areas, worked out from 'first principles'. It is recommended that it is only attempted by qualified fire engineers.

Other alternatives to using the two tables above, are the "*Enclosing Rectangle*", and the "*Aggregate Notional Area*" methods.

Enclosing rectangle method

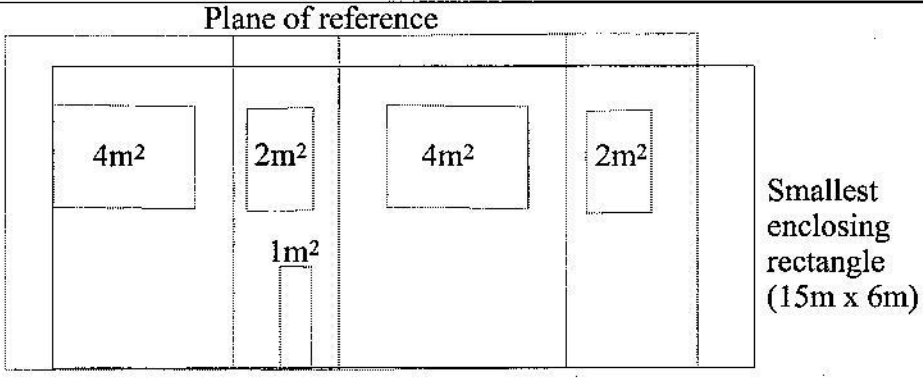
The enclosing rectangle method was included in the 1985 edition of ADB. It is not described in the current edition.

The first step when using this method, is to project the wall(s) in question onto a "plane of reference". This is a flat plane, usually parallel to the relevant boundary. Any walls which are less than 10° to the plane of reference are ignored.



Then, from a series of tables, a rectangle is selected which encloses all of the unprotected areas on the plane of reference. Notice that because a rectangle of pre determined size must be selected from the tables, it will almost always a rectangle which is larger than is absolutely necessary:

Height	Width (NL = No limit)																
3	3	6	9	12	15	18	21	24	27	30	40	50	60	80	NL		
6	3	6	9	12	15	18	21	24	27	30	40	50	60	80	100	120	NL
9	3	6	9	12	15	18	21	24	27	30	40	50	60	80	100	120	NL
12	3	6	9	12	15	18	21	24	27	30	40	50	60	80	100	120	NL
15	3	6	9	12	15	18	21	24	27	30	40	50	60	80	100	120	NL
18	3	6	9	12	15	18	21	24	27	30	40	50	60	80	100	120	NL
21	3	6	9	12	15	18	21	24	27	30	40	50	60	80	100	120	NL
24	3	6	9	12	15	18	21	24	27	30	40	50	60	80	100	120	NL
27	3	6	9	12	15	18	21	24	27	30	40	50	60	80	100	120	NL



The *projected* unprotected area is then expressed as a percentage of the enclosing rectangle.

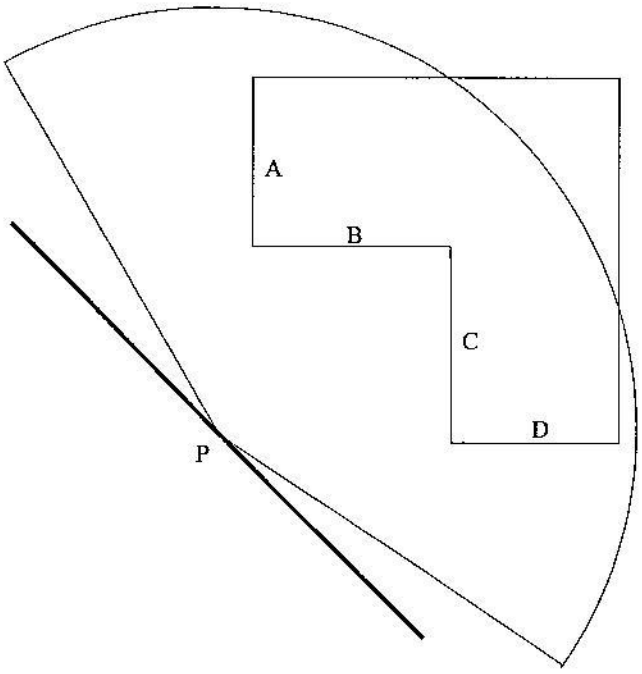
In this case, $13m^2$ as a percentage of $90m^2$ = 14%.

This result (14%) is then taken back to the tables, where it is found that for an enclosing rectangle of 15m × 6m, with an unprotected area of less than 20%, the wall must be at least 3m from the boundary, or at least 1.5m if it is a residential, office, or assembly building (because of course, fires in residential, office, or assembly buildings, are exactly half as big as fires in other buildings!).

Apart from the projection onto the plane of reference, this is a quick and simple method. If the walls are parallel to the boundaries, then it is certainly quick. However, the limited dimensions of rectangles in the tables, means that it is very 'rough and ready'.

Aggregate Notional Area

The aggregate notional area method attempts to model a fire more realistically. It calculates the effect of a fire at particular points on the boundary, and sets a limit for a worst case fire.



At regular points on the boundary (3m apart), a 50m radius arc is drawn. Any unprotected areas outside the arc, or at an angle of less than 10° to the point, are ignored. This is because the method is ignoring the effects of fire at a distance of greater than 50m, and on walls at a shallow angle to the fire, rather than the boundary.

In this case, openings on walls A and D would be ignored because they are less than 10° to point P, even though they are 45° to the relevant boundary.

The next step, is that the areas of the remaining openings, are multiplied by factors which mean that those which are close to the point P, are given more importance, while those further away, are given less.

Distance of unprotected area from point		
Not less than	Less than	Multiplication factor
1.0	1.2	80.00
1.2	1.8	40.00
1.8	2.7	20.00
2.7	4.3	10.00
4.3	6.0	4.00
6.0	8.5	2.00
8.5	12.0	1.00
12.0	18.5	0.50
18.5	27.5	0.25
27.5	50.0	0.10
50.0	NL	0.00

The table is based on the fact that the amount of heat caused by a fire issuing from an unprotected area will decrease in proportion to its distance from the boundary, in line with the inverse square law or radiation intensity.

Once the actual unprotected areas have been multiplied by the appropriate factors, they are added together to give the "aggregate notional area". The aggregate notional area should not exceed:

- $210m^2$ for residential, assembly, or office buildings
- $90m^2$ for shop, industrial, or other non residential buildings.

This method gives a much more realistic picture of the effects of fire, but the multiplication of each unprotected area makes it somewhat more complicated to apply.

It is interesting to note that architects are free to use whatever method they want to calculate an appropriate separation distance – whichever gives the shortest distance.

SECTION 15
ROOF COVERINGS

Introduction

This section limits the use, near a boundary, of roof coverings which will not give adequate protection against the spread of fire.

The term "roof" does not refer to the whole roof structure. This section is primarily concerned with the performance of the roof when exposed to fire from the outside, so it is only concerned with the outer surface of the roof. (although this may consist of one or more layers of material).

Note from 2003 supplement: Currently, no guidance is possible on the performance requirements in terms of the resistance of roof coverings to external fire exposure as determined by the methods specified in DD ENV 1187:2002, since there is no accompanying classification procedure and no supporting comparative data.

Classification of performance

The performance of roof coverings is designated by reference to test methods specified in BS 476 *Fire tests on building materials and structures*, Part 3: 1958 *External fire exposure roof tests.*

Designation† of covering of roof or part of roof	Minimum distance from any point on relevant boundary			
	Less than 6m	At least 6m	At least 12m	At least 20m
AA, AB or AC	☺	☺	☺	☺
BA, BB or BC	☹	☺	☺	☺
CA, CB or CC	☹	☺ (1)(2)	☺ (1)	☺
AD, BD or CD (1)	☹	☺ (2)	☺	☺
DA, DB, DC or DD (1)	☹	☹	☹	☺ (2)

See paragraph 15.8 for limitations on glass; paragraph 15.9 for limitations on thatch and wood shingles; and paragraphs 15.6 and 15.7 and Tables 18 and 19 for limitations on plastics rooflights.

† The designation of external roof surfaces is explained in Appendix A. (See Table A5, for notional designations of roof coverings.)

Separation distances do not apply to the boundary between roofs of a pair of semi-detached houses (see 15.5) and to enclosed/ covered walkways. However, see Diagram 28 if the roof passes over the top of a compartment wall. Polycarbonate and PVC rooflights which achieve a Class 1 Rating by test, see paragraph 15.7, may be regarded as Having an AA designation.

☺ Acceptable.
☹ Not acceptable.

1. Not acceptable on any of the following buildings:
   a Houses in terraces of three or more houses;
   b. Industrial, Storage or Other non-residential purpose group buildings of any size;
   c. Any other buildings with a cubic capacity of more than 1500m^3.
2. Acceptable on buildings not listed in Note 1, if part of the roof is no more than 3m^2 in area and is at least 1500mm from any similar part, with the roof between the parts covered with a material of limited combustibility.

Table 17 **Limitations on roof covernings**

Under BS 476 Part 3, constructions are designated by 2 letters from A to D, with an A designation being the best. The first letter indicates the time to penetration, and the second letter a measure of the spread of flame. The notional performance of some common roof coverings is given in Table A5 of Appendix A, although only AA rated roof coverings are described.

Separation distances

The minimum separation distance from the roof (or part of the roof) to the relevant boundary, depends on the designation of the covering. Table 17 sets out separation distances according to the type of roof covering and the size and use of the building. Note that there are no restrictions on the use of roof coverings designated AA, AB or AC.

The boundary formed by the wall separating a pair of semi-detached houses may be disregarded for the purposes of this Section (but see Section 9, Diagram 28(b), which deals with roofs passing over the top of a compartment wall).

Thatch and wood shingles should be regarded as having an AD/BD/CD designation if performance under BS 476: Part 3: 1958 cannot be established.

Plastics rooflights

Rooflights will typically be constructed of either:

- Plastics
- Thermoplastic materials
- Unplasticised PVC, or
- Glass

Plastics: Table 18 sets out the limitations on the use of plastics rooflights which have at least a Class 3 lower surface. Basically, table 18 says that higher standard plastics may be used as close as 6m from a boundary, but lower standard plastics must be at least 20m away. Also, plastic rooflights covering circulation spaces and rooms, must comply with diagram 47.

See the note to table 18 which includes "*None of the above designations are suitable for protected stairways – see paragraph 7.13*"

Thermoplastic materials:

A thermoplastic material means any synthetic polymeric material which has a softening point below 200°C when tested to the relevant British Standard.

Thermoplastic materials may be classified TP(a) rigid, TP(a) flexible, or TP(b)

TP(a) rigid:

i. Rigid solid pvc sheet;

ii. Solid polycarbonate sheet at least 3mm thick;

iii. Multi-skinned rigid sheet made from unplasticised pvc or polycarbonate,

iv. Any other rigid thermoplastic product, a specimen of which when tested to BS 2782 performs so that the test flame extinguishes before the first mark, and the duration of flaming or afterglow does not exceed 5 seconds following removal of the burner.

TP(a) flexible:

Flexible products not more than 1mm thick which comply with the Type C requirements of BS 5867 *Specification for fabrics for curtains and drapes* Part 2 *Flammability requirements* when tested to BS 5438 *Methods of test for flammability of textile fabrics when subjected to a small igniting flame applied to the face or bottom edge of vertically oriented specimens.*

TP(b):

i. Rigid solid polycarbonate sheet products less than 3mm thick, or multiple-skin polycarbonate sheet products which do not qualify as TP(a) by test. or

ii. Other products which, when a specimen of the material between 1.5 and 3mm thick is tested in accordance with BS 2782: 1970, has a rate of burning which does not exceed 50mm/minute (i.e. not as good as TP(a)).

Table 19 sets out the limitations on the use of thermoplastic materials with a TP(a) rigid or TP(b) classification. It seems to say that any thermoplastic rooflight must be at least 6m from a boundary, and that rooflights covering circulation spaces and rooms, must comply with diagram 47.

See the note to table 19 which includes "*None of the above designations are suitable for protected stairways – see paragraph 7.13*"

Unplasticised PVC: Paragraph 15.7 says that "*When used in rooflights, a rigid thermoplastic sheet product made from polycarbonate or from unplasticised PVC, which achieves a Class 1 rating for surface spread of flame when tested to BS 476 can be regarded as having an AA designation*"

Presumably this means that such a rooflight may in fact be considered as a part of the roof itself, rather than a rooflight, and there are no limitation on its siting, in accordance with table 17.

Unwired glass: When used in rooflights, unwired glass at least 4mm thick has an AA designation. As with unplasticised PVC, the implication is that there are no restrictions on the siting of such rooflights.

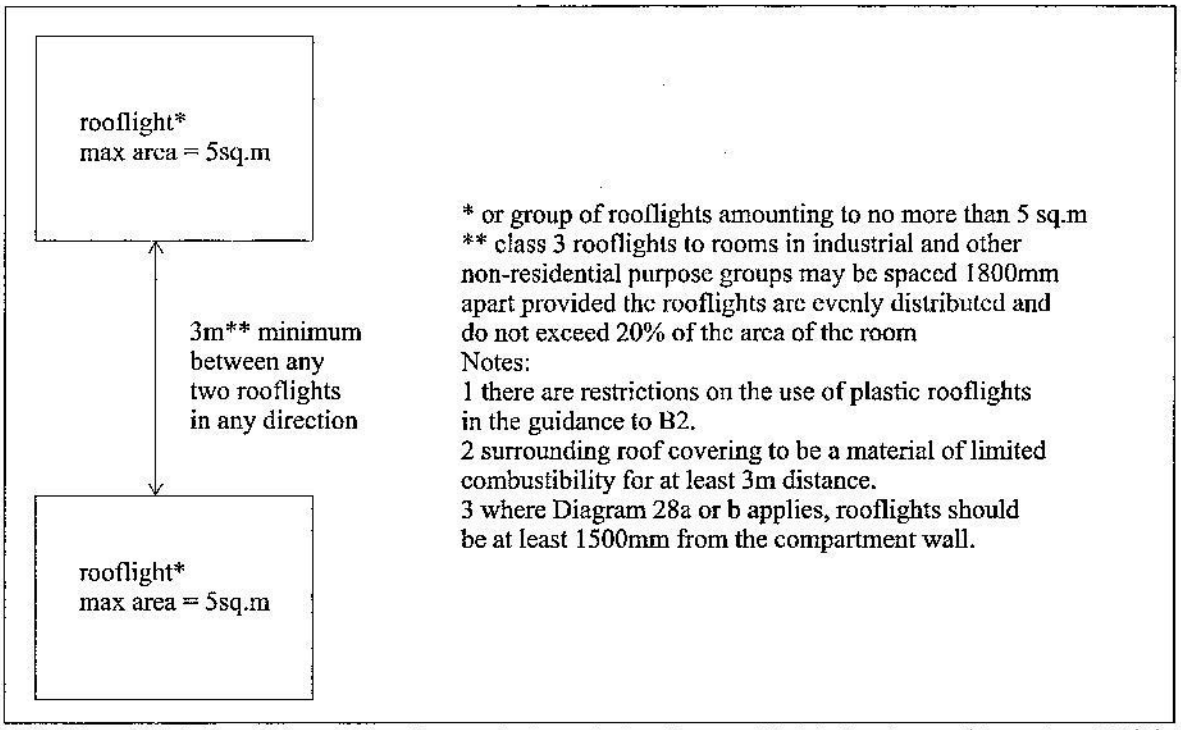


Diagram 47 **Limitations on spacing and size of plastics rooflights having a Class 3 or TP(b) lower surface**

Thatch and wood shingles

Consideration can be given to thatched roofs being closer to the boundary than shown in Table 17 if, for example, the following precautions (based on *Thatched buildings. New properties and extensions* [the "Dorset Model"]) are incorporated in the design:

a. the rafters are overdrawn with construction having not less than 30 min fire resistance;

b. the guidance given in Approved Document J *Combustion appliances and fuel storage* is followed; and

c. the smoke alarm installation (see Section 1) is included in the roof space