



Design guide to separating distances during construction

For timber frame buildings
Version 3.3 October 2017





PART 1

Foreword by the Health and Safety Executive, plus endorsement by CIREG

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Foreword by the Health and Safety Executive

HSE guidance HSG 168 is clear that fire is a hazard that needs to be controlled during all construction processes, and it is important that precautions are in place to both prevent fires and ensure that people can escape to safety if fire does occur. Finished timber structures meet all Building Regulation and fire protection requirements. However, during the construction phase, they are more vulnerable because the fire precautions for the finished building are not in place. HSG 168 & the Construction (Design & Management) Regulations 2015 require clients and Principal Designers to carefully consider neighbouring properties and activities very early in the design process.

The third revision of this STA document now applies to all sizes of and extends the guidance to a wider range of timber structured buildings. It builds on further scientific work undertaken by the industry and key stakeholders to understand fire behaviour in such structures, and on the experience of the industry applying the original guidance over the last 6 years. This guidance allows a sensible assessment to be made of specific proposals and sites at the earliest design stages to ensure that the appropriate category of timber frame is selected and that effective precautions can be taken to protect all stages of construction. HSE will continue to work with STA on this issue and endorses this guidance, as it follows a sensible and proportionate approach to managing health and safety

Peter Baker

Director of HSE Construction Division

September 2017

Endorsement by CIREG

We are pleased to endorse the Design Guide to Separating Distances during Construction for Timber Frame Buildings - Version 3, produced by the Structural Timber Association (STA), as Best Practice for managing fire risk during timber frame construction.

We also commend the STA for its efforts to improve fire safety of timber frame buildings during construction.

Ade Adeyemo

Chairman

The Construction Insurance Risk Engineers Group

July 2017





Scope

This guidance is intended to be used at the design phase of a building project. The use of this document is intended as the basis for the development of an off the site fire risk assessment plan, sufficient to address the design phase of a project.

The guidance can also be used during the pre-construction (procurement stages and pre-start onsite stage) as a check for separation distances or for optimisation of the risk mitigation process.

At the pre-construction phase the design team should be aware of what risk mitigation is required for the project, as appropriate to the scale and location of the site. At the construction phase it can be too late to incorporate risk mitigation unless it was part of the risk strategy as agreed at the design and pre-construction phase. It is not appropriate to enter the construction phase without an off the site fire risk assessment regardless of the scale and site location.

The guidance is aimed at the commercial construction market for example, classrooms, multiple terrace houses, flats, student accommodation and care homes. It can be used for housing and small developments.

Projects covered in this document are new timber frame buildings built near to properties where persons sleep or are areas of public gathering - such as schools, colleges, restaurants, night clubs, office space and light commercial properties, such as high street shops and factories. Projects with neighbouring buildings that are unoccupied buildings but do not contain storage of explosives, chemicals or combustible materials (for example tyres, wood, straw etc.) may use this guidance, or should be assessed using bespoke fire engineering principles.

Legal requirement

Type of development		Legal requirements for fire risk assessment	HSE Guidance
Private	Self-build houses	Construction (Design and Management) Regulations 2015 CDM 2015 ^{note 1}	HSG 168 Fire safety in construction second edition ^{note 2}
Commercial	Single house development		
	Multiple house development		
	Multiple occupancy project - for example: residential buildings, hotels, care homes, student accommodation		
	Public space buildings - for example: schools, centers, teaching, leisure, offices, shops, restaurants, hospitals, halls		

NOTE 1: Construction (Design and Management) Regulations 2015. Guidance on Regulations available from HSE website www.hse.gov.uk/pubns/books/1153.htm

NOTE 2: HSE 168 Fire safety in construction available from HSE website www.hse.gov.uk/pubns/books/hsg168.htm



Principal Designer

The Principal Designer shall consider the off the site risk assessment. There are a number of safety responsibilities which fall under the CDM 2015 Principal Contractor's construction phase duties. Fire safety starts with the choice of material and its application and this responsibility falls under the direction of the design team, led by the Principal Designer. The Principal Designer has ultimate responsibility to advise the Client of actions to take; for example off the site risk mitigation measures will be required that shall be included in the tender documents either as outline proposals for the contractor to complete or a full risk mitigation measures to price in the tender.

The Contractor

The Contractor shall consider the effect of fire on the site to the surrounding buildings and persons during the construction phase. An on the site fire risk assessment is a significant part of the CDM 2015 Principal Contractor's construction phase planning. In addition as part of the expertise of the Principal Contractor to undertake the work they shall ensure that there is a risk review for fire spread outside the site boundary and that this is addressed during the procurement phase; and where appropriate the sub contract structural timber building system supplier is complying with the fire risk assessment either through this guidance or competent alternative assessments.

Design and Build contracts: Under CDM regulations where a project is being run under a design and build contract, and the client's team has not chosen the material type and process, then the Principal Designer role in respect to the construction fire safety measures are transferred to the design and build company who will also cover the Principal Contractor role. The contract between the client and design and build contractor can be such that the Principal Designer's role is taken on by the Contractor.

Private self-build developments: Where a domestic client exists in a private self-build contract the contractor engaged to undertake the works takes on the duties of the Principal Designer and Principal Contractor. Refer to STA advice note 9.2. The self-build client can take back the responsibility of the risks including fire safety by managing the works themselves.

House building developers: The house builder may be the Principal Designer and Principal Contractor and will follow the same path as a design and build contract process

Complementary and alternative strategies

The procurement phase and construction phase will comply with the recommendations in this guidance or undertake as alternative a more detailed separation distance assessment using a knowledgeable and experienced person or firm to undertake the assessment. The STA have produced technical papers 1 to 3 for fire engineers to consider in any bespoke assessment.

STA members can adopt product paper 4 for solutions to achieve category B and C type frames note in this guidance and use Product Paper 5 for separation guidance for houses below 250m² total floor area.

Site Safe policy

Within the Site Safe strategy members of the STA have a mandatory obligation of membership, to follow what is called the STA Site Safe policy.

The Site Safe policy is an audited and proven industry approach to managing the communication process relating to roles and responsibility for fire risk assessments and actions between the structural timber building system supplier and the contractor adopting the build method. The STA member with Site Safe delivers the following key actions:

Communication of key documents and procedures to be part of the team to deliver a fire safe design check and fire safe site environment.

For projects larger than 600m² total floor area the STA member will action the NCFE - National Fire Chiefs Council Site Safe register, which links onward to HSE.

After handover of the structural timber building system the STA member will write to their customer to let them know of the ongoing fire risk mitigation strategy that falls under the responsibility of the principal contractor until completion of the building.

For more details of the Site Safe Policy consult the STA member.



Background

HSG168 "Fire Safety in Construction" published by the Health and Safety Executive (HSE) in October 2010, requires a site specific risk assessment to be undertaken to determine the impact of a site fire on neighbouring properties. CDM regulations 2015 – clause 29 also requires the effect of fire from the site to be considered. IN 2011 the UKTFA (now the Structural Timber Association (STA) undertook the task of preparing authoritative guidance in co-operation with a timber frame working party including the HSE, the Fire Protection Association (FPA), the Chief Fire Officers Association (CFOA) and the Fire Brigade Union (FBU).

The guidance within this document is a update of the guidance issued in 2011 and revision 2 in 2012. The basis of the work has not changed which was the result of extensive fire testing and expert input from the fire engineering community. The Association wishes to acknowledge the co-operation and significant input of the HSE and HSL along with FERMI, fire engineering consultants, and Martin Milner, Technical Consultant.

'Design guide to separating distances for timber frame buildings during construction' has a number of parts as follows:

Part 1	Background and introduction
Part 2	Standard timber frame and construction process mitigation
Part 3	Timber frame build methods to reduce the separating distances

The STA has developed supporting documents for the timber supply chain, product designers, fire engineers and fire test facilities. They provide background technical data and support the delivery of the solutions presented in this guidance. These supporting documents are available on the STA website www.structuraltimber.co.uk

Supporting documents - technical support

Technical Paper 1	Separating distances technical background report
Technical Paper 2	Summary of timber frame categories to reduce separating distances and information for fire engineering modelling and test compliance
Technical Paper 3	Product test methodology for category compliance

Supporting documents - product compliance

Product Paper 1	Flame retardant - FR Build product compliance
Product Paper 2	Insulation - FI Build product compliance
Product Paper 3	Sheathing and decking - FC Build product compliance
Product Paper 4	Product assemblies to achieve different categories of timber frame construction
Product Paper 5	Separating distances for small buildings below 250m ² total floor area - self-build and general housing developments



Introduction to Part 1

This guidance provides a consistent, appropriately conservative, methodology to assess the fire risk to neighbouring buildings should a fire occur in a timber frame building during construction.

Finished timber frame structures are fully compliant with Building Regulation fire performance and as such the assessment is confined to the period during construction prior to completion of fire resistant finishes.

The technical data in this guide is based on a conservative calculation model backed by test data to determine the exposure of neighbouring buildings to heat radiation during a site fire event. To keep the assessment process straightforward there are a number of underlying assumptions and simplifications. As an alternative to this guidance, a more precise assessment by a competent fire engineer can be undertaken. Technical Paper 1 and Paper 2 give information that will enable fire engineers to provide these assessments on a consistent basis.

Three generic categories of timber frame with increasing resistance to fire spread and associated reduction in radiant heat to neighbouring properties are presented. The guidance is based on the range of buildings as given in the scope. The three categories of timber frame allow the designer to select the appropriate frame specification to construct timber frame buildings on any site condition, relating to separating distances from 0 to infinity. The output from this process is intended to form the basis of the site fire safety risk assessment which will also include preventative measures as recommended in the STA Site Safe and 16 Steps guidance.

Limitations of the separating distance tables

Separating distance tables provided in Parts 2 and 3 assume that the neighbouring buildings contain combustible elements such as eaves or soffits which can be ignited and / or windows through which the contents of a room can receive radiant heat. Should the neighbouring building not contain ignitable materials or windows then a competent fire engineer could be engaged to reduce the separating distance. Where neighbouring occupancies are unable to evacuate the building, then a specific risk assessment by a fire engineer is warranted.

Where a neighbouring building use increases the risks beyond the domestic, hotel, student accommodation or school properties assumed by this guidance then a specific risk assessment by a fire engineer is warranted, e.g. chemical storage or external storage of unprotected flammable materials.

The guidance is focused on neighbouring buildings off the site (beyond the current construction site boundary - refer to the terminology section). For buildings within the site boundary, the guidance can be used to support determination of safe escape distances and fire spread across a site. Sites utilising a tower crane should carry out a specific assessment covering the evacuation of the driver and possible impact of fire on crane stability.

It is the principal contractor's responsibility to ensure that the fire precautions and recommendations are undertaken onsite. This guidance allows the project team to adopt the appropriate frame specification and/or construction process methods to mitigate fire risks; and permits designers to discharge their responsibilities under the CDM regulations by having the assurance that frame specifications can be selected for different site conditions without necessarily engaging external expertise.

The STA accepts no liability regarding the occurrence of fire or associated damage to property either on or off the site following the use of this guidance. Every site is unique and the preparation of appropriate risk assessments and the effective implementation of appropriate mitigation measures lie outside the Association's control.



General technical background

The purpose of the design guide is to reduce radiant heat emissions to acceptable levels; so that the risk of fire spread to neighbouring buildings is appropriately controlled in the event that a fire occurs during the construction process.

Where the available separation distances show that additional measures are required, a hierarchical approach should be adopted. As with all risk mitigation, minimising the underlying risk at source is preferred. Within this guidance the off the site fire risks are reduced, when necessary, by the use of frame/deck designs which reduce the potential for fire to develop and spread.

This guidance enables the designer to specify a type of timber frame system which may have inherent mitigation measures (i.e. Category B and C frames) or, where suitable, by adapting the construction process to allow the use of standard Category A frame.

The level of heat received by the neighbouring property is determined, in the main, by temperature and size of fire in the burning building and the separating distance that heat has to cross. In determining the acceptable threshold for radiant heat on a receiving surface the following factors have been taken into consideration.

1 The use of the neighbouring building

The factors affecting a typical fire risk assessment include consideration of:

- Occupant type - mobility of occupants, exit routes, risk of a fire during the night whilst occupants are sleeping and the experience of occupants to a fire warning
- Building usage - domestic, factory, storage and dangerous substances/usage
- A building under construction near to the building being assessed.

This guidance is based on the assumption that occupants may stay overnight in the neighbouring building which is referred to as “sleeping risks”. It is also assumed that evacuation can be reasonably achieved and that there are no additional extreme risks such as the presence of volatile liquids or explosives. The guidance is focused on neighbouring buildings off the site - that is beyond the current construction site boundary. Assessment of buildings on a site should be assessed using STA 16 Steps. Issues relating to radiant heat flux separating distances will be needed only for checking fire spread across a site, which would endanger a neighbouring building or reduce escape distances for the onsite labour.

2 The facade of the neighbouring building

The facade of the building being considered can also influence the risk of fire spread. The guidance tables assume that the facade includes combustible materials such as timber soffits and PVCu window frames (risk of melting). In addition where windows are present, the threshold level of radiant heat values is limited to prevent the risk of radiant heat igniting contents of a room such as curtains.

Where totally non-combustible facades are present without openings then the tables will be overly conservative and will not be appropriate.

3 The site conditions and wind

The assessment of wind influence on fires is very complex and this guidance reasonably accounts for the effects of wind by adopting a conservative level of radiant heat on a receiver surface.

4 The site terrain

The potential influence of site vegetation, including trees, is not considered in the tables. Where such influence is considered significant, suitable mitigation measures will need to be adopted.



5 Site operations

The fire risk assessment should consider the influence of site processes on fire risk as recommended in the STA 16 Steps and the Joint Code of Practice on the Protection from Fire of Construction Sites and Buildings Undergoing Renovation (published by the FPA. This would include the location of parked vehicles, any fuel/gas bottle storage, material stored before use, waste skips and the like. The information presented in this guidance assumes that site operations are compliant with these recommendations.

6 The growth of fire

The maximum radiant heat generated is dependent on the speed of fire development across a building, the emitter temperature and the extent of fire spread within the structure. This guidance is supported by test evidence on the timber frame categories (see later section on frame categories) where development time, extent of fire spread and heat flux output were measured.

The growth of a fire will be dependent on many factors including building layout, stage and condition of the frame installation, and the presence or absence of fire breaks. In developing the tables an appropriately conservative approach was used to arrive at predictions of fire behaviour up through a building and across internal walls. A summary of the fire growth assumptions is given in Technical Papers 1 and 2.

7 The acceptable threshold level of radiant heat on a given surface

The maximum acceptable radiant heat flux on a surface is taken as 12.6 kW/m². This is the value used for determining separation distances from finished buildings for compliance with Building Regulations. This level of radiant heat is sufficient to allow at least 10 minutes before exposed dry timbers would ignite with a pilot ignition (from flying brands etc.) when tested under laboratory conditions. It is acknowledged that some fire engineers may consider this value to be overly conservative for many building facades. It is also true that some common materials, including some PVC products and exposed fabrics such as curtains at open windows, can ignite at lower heat fluxes than dry timber. In view of the unpredictable nature of fire growth in real buildings the 12.6 kW/m² figure is considered appropriate by the HSE for the purposes of off the site fire risk assessment under HSG168. Some damage to buildings off the site (distortion of UPVC fittings, window glass breakage etc) can be expected if heat fluxes approach this level.

8 Building size

The tables are based on a standardised nominal storey height of 3m. It is very unusual for buildings to depart significantly from this floor to floor dimension.

For the purposes of simplicity the tables also take the worst case of either a 1m high parapet wall around the roof or a pitched roof which is equal to or less than 55 degrees. Significant variance from these parameters may require a specific assessment by a fire engineer.



Categories of timber frame types to address levels of risk mitigation

The tables are based on three principle calculation models that predict different fire behaviour, which in turn, indicates what the expected radiant heat output from such a fire would be. For timber frames to comply with the model's predicted behaviour there is a category of structural timber frame assembly that delivers the performance characteristics to match the calculation approach. The guidance provides the categories of timber frame with increasing resistance to fire spread and reducing radiant heat emissions.

Category A - Standard open panel timber frame

Category B - Reduced fire spread timber frame

Category C - Fire spread resistant timber frame

Please note that CLT / massive wood is dealt with in Part 4 of this guidance (separate document).

Contrary to common fire rating terminology and testing practice, the information presented in this guidance is based on holistic testing of building structures rather than component parts or materials. As such the guidance is relevant for the whole construction process from commencement to handover. A standard test method has been developed by the UKTFA (now STA) in conjunction with the timber frame working group and accepted by the advisory working group. Technical Paper 3 outlines the test methodology which will be used for future development work on this guide.

Determining the categorisation of timber frame types

The tables presented are based on a mathematical model that has been backed by scale tests. It is impractical to undertake multiple full scale tests of houses and apartment buildings, so a series of room scale tests of structures up to two storeys was undertaken by the timber industry, recording fire characteristics such as flame height, temperature and radiant heat flux. The results of these tests were compared against theoretical models and experience from real fires and found to be sufficiently representative of real site performance to enable the results from them to be used in the preparation of this guidance. In addition, ignition tests and small room tests have been developed and benchmarked against the larger scale tests to provide a repeatable test method to determine where a particular framing system could be classified under each of the three categories. Technical Papers 1 to 3 provide information on the tests and the frame categories. Supporting papers on product compliance (Product Papers 1 - 3) outline the required product specification to be used in compliant timber frame construction.

The STA has established a test and approval protocol for systems and product assemblies that has undergone the methodology described in Technical Paper 3. The list of products that have been reviewed for compliance to tests are available from the STA website. No products or components can be claimed to satisfy in full or in part the requirements of Category B or C until they are listed on the website. Product Paper 4, which is developed by the STA, is provided to assist the timber frame designers and fire engineers to deliver Category B or C type solutions.



Terminology and explanations (used in all parts of the guidance)

Any fire mitigation method which is not described in this guidance should be designed and justified by a fire specialist.

Emitter

The building being constructed and where the fire can be initiated. The length of the emitter facing the receiver is used in the guidance.

Fire shield / Fire curtain

Fire Shields are outside the scope of this guidance. Any risk mitigation strategy which considers fire shields shall have the approval of a fire engineer and structural engineer to consider the impact of support to the shield during a fire.

Fire curtain material is not included in the scope of this document and the HSE will require application testing together with a fire engineers report for any consideration of a fire curtain to be used as a risk mitigation measure.

Fire compartmentation

In the context of the building during construction the term fire compartmentation is used for vertical walls or horizontal decks installed as the building is erected and constructed so that they to act as a barrier to the spread of fire.

Vertical fire compartmentation may be required in Category B and C frames to limit the spread of fire across the building, reducing the maximum emitter length. These walls extend from the lowest timber frame level to the roof ridge line and have no unprotected openings in them. The requirements for fire compartmentation walls are described in Figure 3.2 in Part 3 of the guidance.

For Category C construction, vertical fire spread also needs to be controlled. The fire compartmentation preventing vertical fire spread through the floor is provided by floor assemblies that have passed the Category C criteria (given in Technical Paper 2) in the room test described in Technical Paper 3. A generic floor requirement for Category B and C is provided in Figure 3.2 in Part 3.

CLT / massive wood is dealt with in Part 4 of this guidance and provides vertical fire spread compartmentation during the construction process.

Fire doors

A self-closing fire door provides access though a fire compartment with a fire performance at least equal to the fire resistant wall of which it is a part.

Guidance tables

Minimum separation distances for a given emitter length approximately parallel to the receiver face (within 15°). For non-parallel conditions (more than 15°) see relevant section in Part 2 and Part 3 of the guidance.

Non-combustible boards and boards of limited combustibility

Boards that can be classified as such based on testing to EN standards, Euro class A1 and A2.

Receiver

Any surface of a structure, element or part of building that can be subject to radiant heat flux.



Separating distance

The distance between a receiver and emitter. This is to be taken as the nearest point between the two buildings (see below).

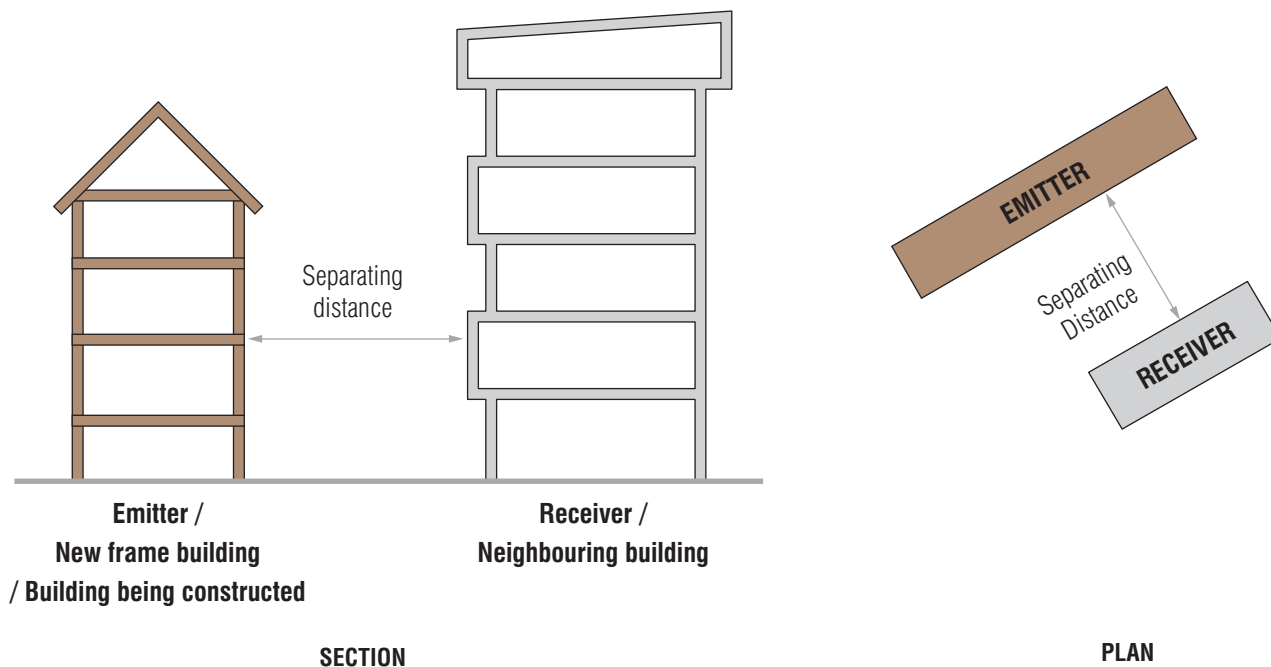


Figure 1.2 The separating distance is the nearest point between the emitter and receiver

Timber frame category

The tables are based on three model calculations that are based on an assumed spread of fire in an incomplete building of a specific type of timber frame construction; which are called categories of timber frame A, B or C. Each category of timber frame has a predetermined performance when exposed to a developed fire which has been derived by tests and assessments of real fires. The timber frame assembly corresponding to that fire behaviour is represented by the following:

Category A - Standard open panel timber frame

Category B - Reduced fire spread timber frame

Category C - Fire spread resistant timber frame

Category B frames are subdivided into three types - B1, B2 and B3 with increasing fire resistance matched to the calculation model that represents the type B fire behaviour.

Category C frames are subdivided into two types C1 and C2 with increasing fire resistance matched to the calculation model that represents the type C fire behaviour.

Please note that CLT / massive wood is dealt with in Part 4 of this guidance (separate document).



onsite and off the site definitions

The term off the site risk assessment is used to describe land and buildings beyond the site boundary that are out of the principal contractors control. The term onsite risk assessment is used to describe land and buildings, typically within the site boundary fencing, for which the principal contractor is responsible.

Note: Where a development programme includes the phased handover of buildings to occupants and used by persons not under the control of the principal contractor these buildings will be considered as off the site once they have been handed over.

The preparation of onsite risk assessments for separating distances between buildings is the responsibility of the principal contractor. Assessment of multiple buildings is to be undertaken to check that the site's build programme does not create conditions that can cause a fire to spread between the units, resulting in the adjacent new build timber frame adding to the original fire and increasing the amount of radiant heat that off the site risks may be exposed to.

It is the responsibility of the principal contractor to ensure that the means of escape and travel distances are appropriate. Guidance on this is provided in the STA 16 Steps publication.

The principal contractor may need to provide protection to the means of escape. The separating distance guidance contained in this publication can be used to assist the assessment of options for reducing the risk of these conditions.

Figure 1.3 and figure 1.4 present schematic illustrations of two sites where timber framed buildings are under construction. The diagrams show the difference between onsite and off the site separation.

Each new building, depending on the build sequence, requires its own risk assessment of the off the site separating distance. Once one of the new buildings is in place it can provide a shield to the neighbouring building if its elevation is non-combustible. Alternatively, each new build could provide a link to spread the fire and in turn require the separating distance to be calculated per new block or as a combined width depending on which elevation is being considered - see Part 2 for further explanation.

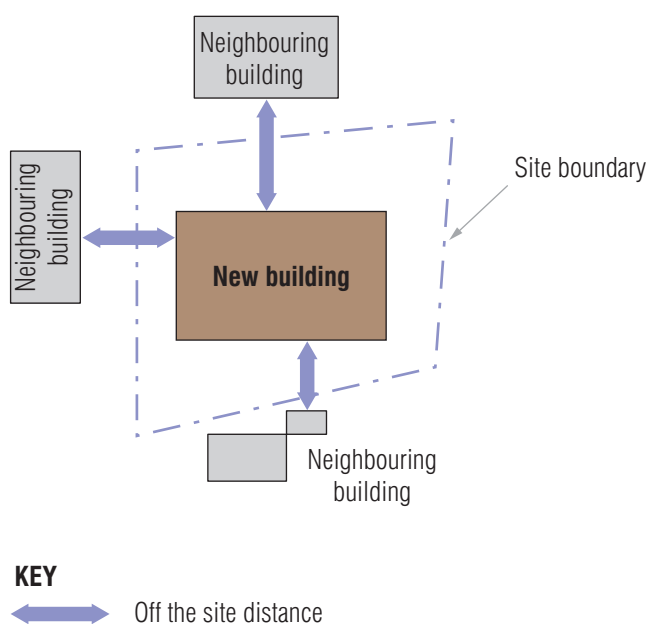


Figure 1.3

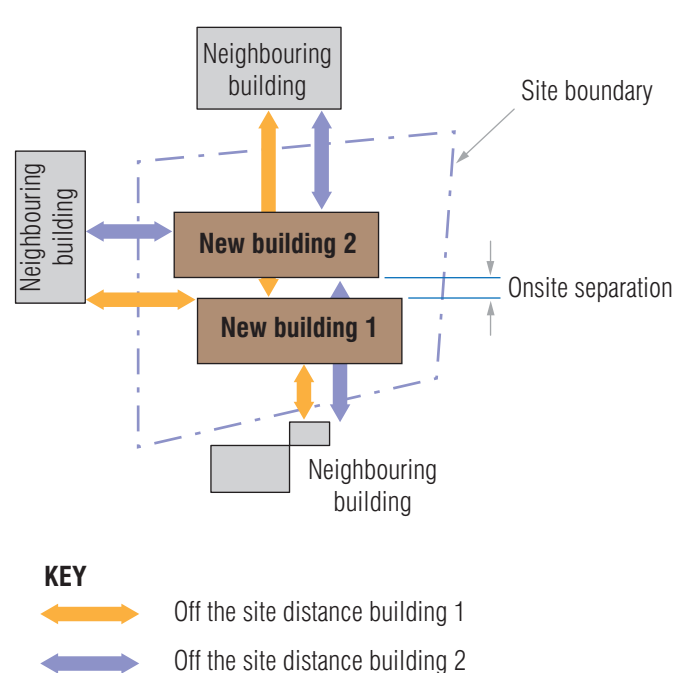


Figure 1.4

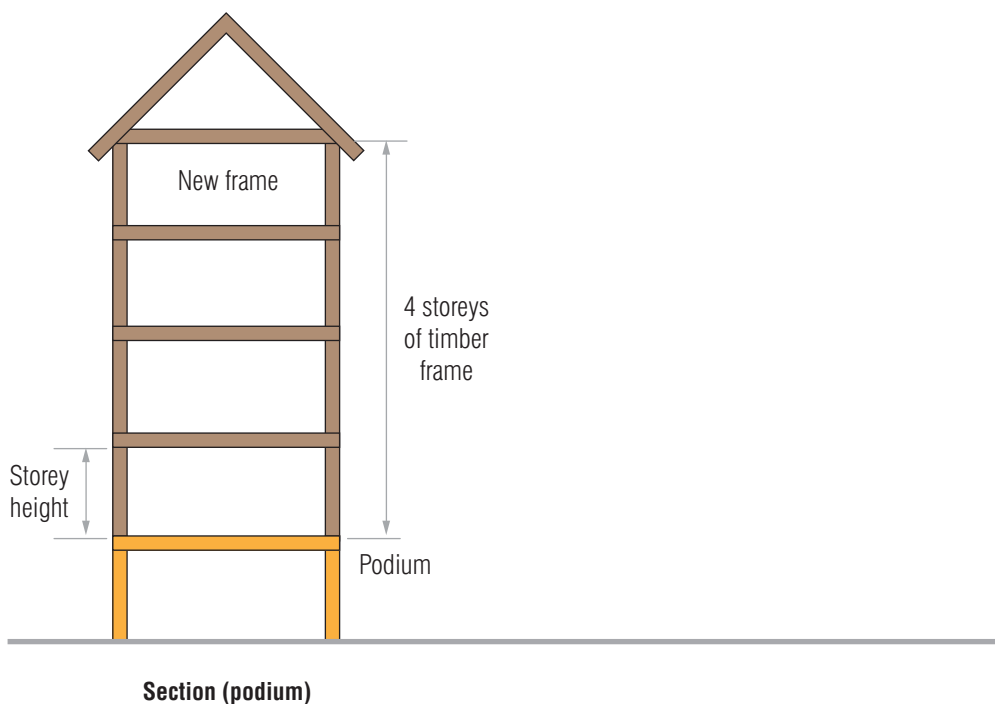


Podium and higher ground levels

The podium is taken as a non-combustible element of structure, e.g. a concrete structure and/or a steel structure with infill walls and non-combustible floors, however the floor can be a timber floor as in flats above garage structures (FR Build treatments dependent on the frame category selected).

Where a podium or higher ground levels are adopted then the actual number of timber frame storeys should be used in calculating the separating distance.

The podium level structure is omitted from the timber frame height providing the walls and floor of the podium is non-combustible or the external walls are Category B or C compliant timber frame.



Product STA website listing

All products listed on the STA website have been tested using the methodology described in Technical Paper 3 and their test performance has been reviewed by the Approval Committee of the STA. No products, components or systems can be claimed to satisfy in full or in part the requirements of Category B (B1, B2, B3) or C until they are listed on the website.



Part 2 - Standard timber frame and construction process mitigation methods

PART 2

Introduction to Part 2

Separating distances for standard timber frame

How to use the table

Examples of timber frame separating distance measurements

Construction process mitigation measures to reduce the separating distance so that $S_r < S_a$

Timber frame build methods to reduce the separating distances

Adopting the separating distance tables for buildings at angles to the new build

Onsite influences to offsite separating distances



Introduction to Part 2

This guidance provides a consistent, appropriately conservative, methodology to assess the fire risk to neighbouring buildings should a fire occur in a timber frame building during construction. Finished timber frame structures are fully compliant with Building Regulation fire performance and as such the assessment is confined to the period during construction prior to completion of fire resistant finishes.

Part 1 of the Design Guide provides the scope, background and introduction to the separating distance tables. Part 2 of the guidance provides information on the use of the separating distance tables with a specific focus on standard timber frame and construction process mitigation measures. Where assessment shows that the separating distances for standard timber frame cannot be met, the designer can adopt timber frame build methods to reduce the separating distances, which is presented in Part 3.

Separating distances for standard timber frame (Category A)

Table 1 for Category A - Timber frame separating distance (Sr) in metres

Number of timber frame storeys	Emitter length (eL)						
	≤5m	≤10m	≤15m	≤20m	≤25m	≤40m	>40m
1	5.5	7.25	8.25	8.75	9.5	10.25	10.5
2	7.5	10.5	12.75	14.25	15.5	18	20.25
3	9	13	16	18	20	23.25	28.5
4	10	15	18.5	21.25	23.5	28.5	35.75
5	11	16.5	20.5	23.75	26.5	32.5	41.75
6	11.5	18	22.5	26	29	36	47.25
7	12.25	19	24	28	31.5	39.25	52.5

Notes:

- 1 The data in this table is based on a nominal storey height of 3m.
- 2 The receiver height does influence the radiant heat on the surface of the building but for simplicity this aspect is removed from the table and assumes that the receiver is 3 or more storeys in height. No reduction is given for lower receiver heights.
- 3 Should a podium or higher ground levels be adopted then the actual number of storey levels of timber frame is used in the table.

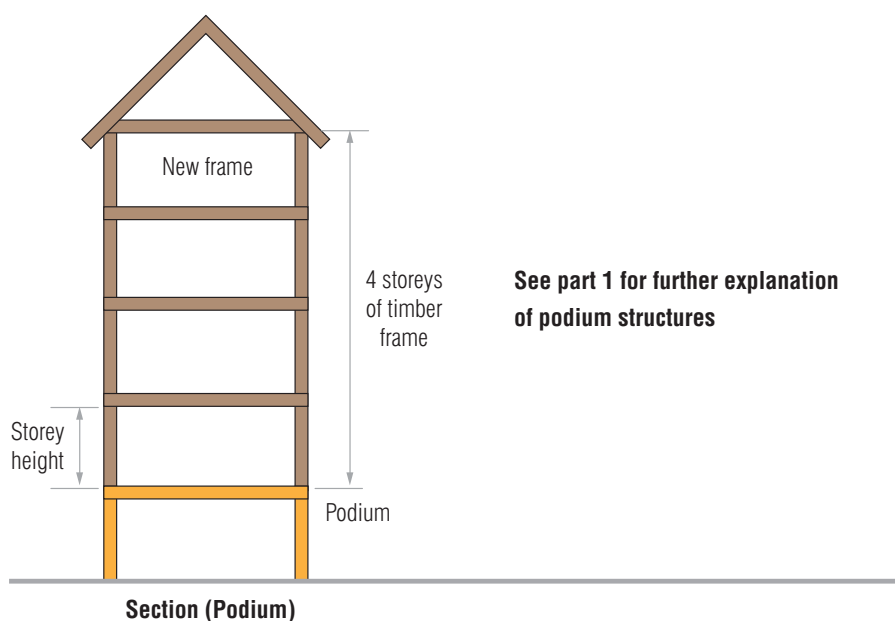


Figure 2.1 Example of storey heights and approach using podiums



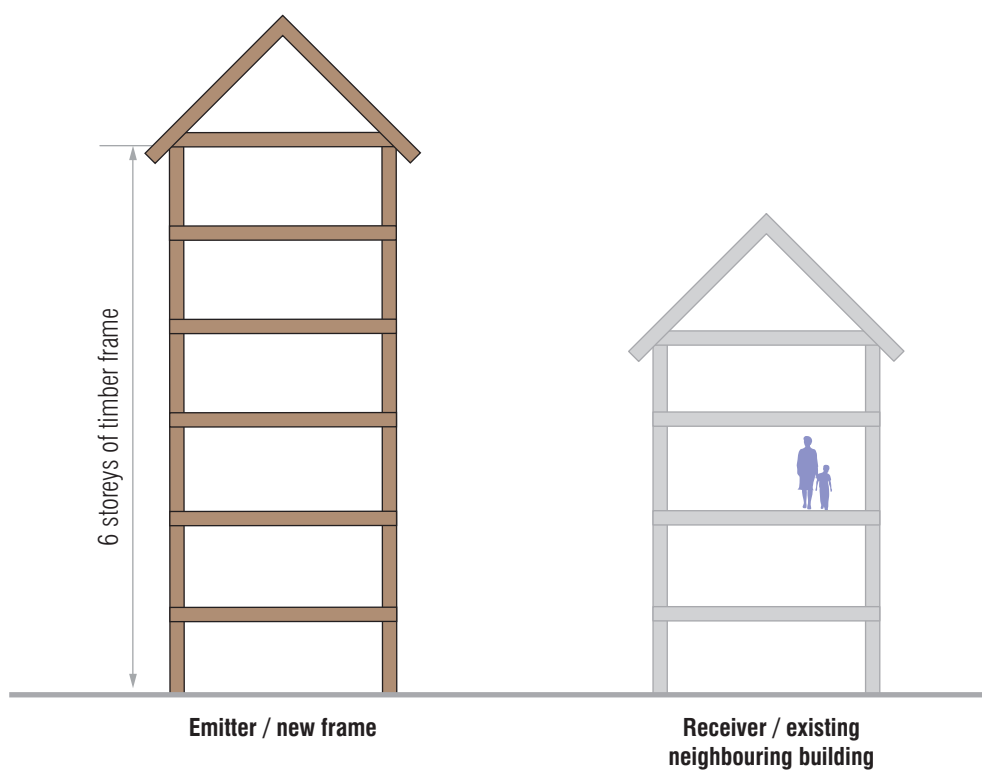
How to use the table for standard timber frame

Step 1: Identify the overall height of emitter

Determine the number of storeys of the emitter building.

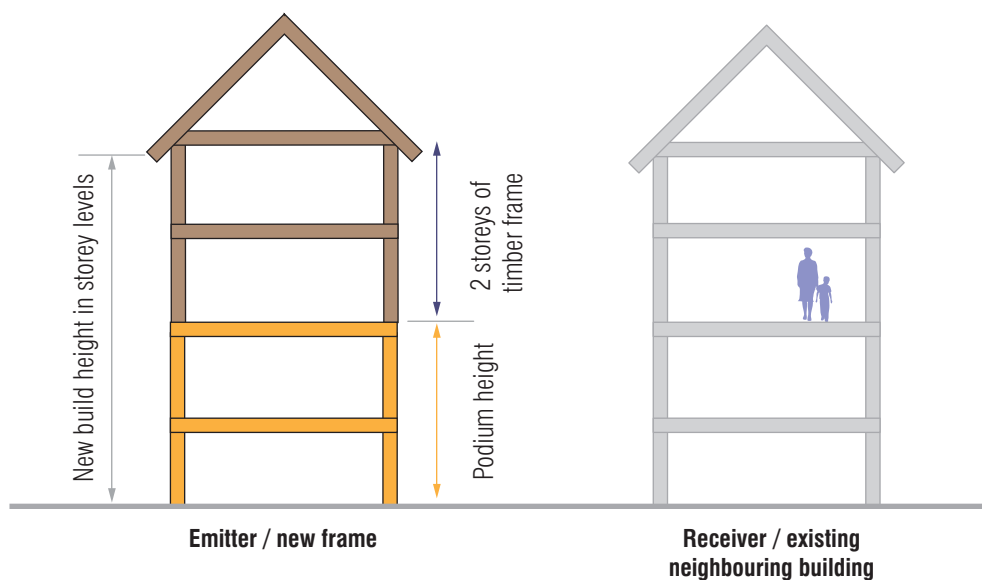
Example Step 1 (a)

Six storey emitter



Example Step 1 (b)

Two storey podium - gives two storey emitter



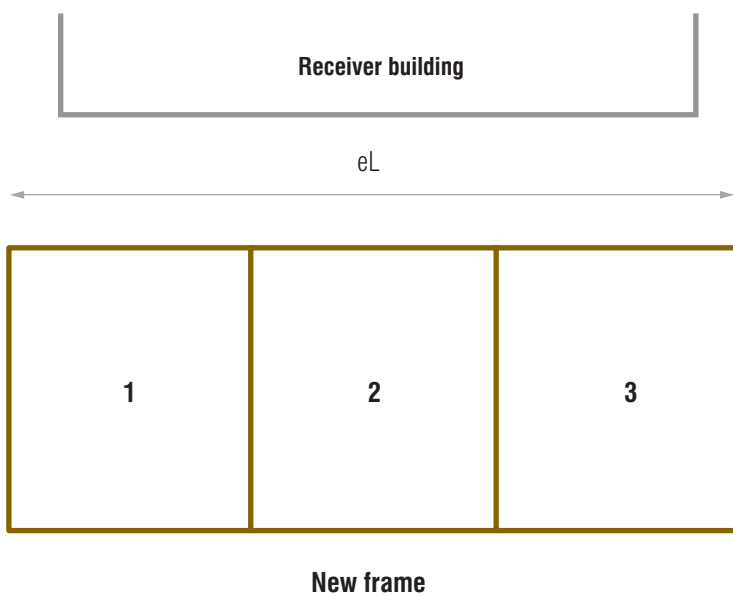


Step 2: Emitter length (eL)

On the face being considered measure the length of the emitter: called emitter length (eL). Note: The length is the face of the emitter opposite the receiver.

Example

The emitter length (eL) on the elevation facing the receiver building



Example

The emitter length (eL) on the elevation facing the receiver building

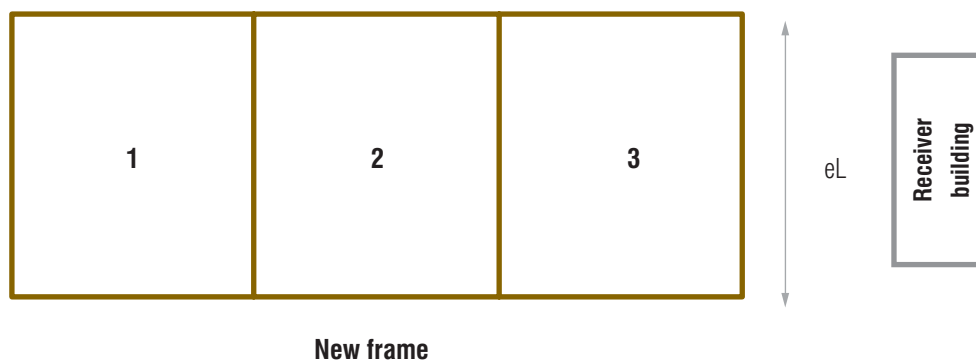


Figure 2.3 Emitter lengths



Step 3: Separating distance (Sr) from table

Using the table, select the separating distance relevant to the emitter length and number of timber frame storeys.

For example, a project with no podium, for a 3 storey timber frame, with length (eL) of 14m the separating distance (Sr) = 16m as read from the Category A table.

Table 1 for Category A - Timber frame separating distance (Sr) in metres

Number of timber frame storeys	Emitter length (eL)						
	≤5m	≤10m	≤15m	≤20m	≤25m	≤40m	>40m
1	5.5	7.25	8.25	8.75	9.5	10.25	10.5
2	7.5	10.5	12.75	14.25	15.5	18	20.25
3	9	13	16	18	20	23.25	28.5
4	10	15	18.5	21.25	23.5	28.5	35.75

Step 4: Determine if the actual distance (Sa) is satisfactory

The separating distance (Sr) derived from the table is checked against the actual distance (Sa) between the emitter and receiver. This can be done diagrammatically by drawing a rectangle (Sr) deep by (eL) long. If the rectangle overlaps the receiver at any point; then fire risk mitigation measures will be required. Guidance on construction process fire risk mitigation measures is provided in this document.

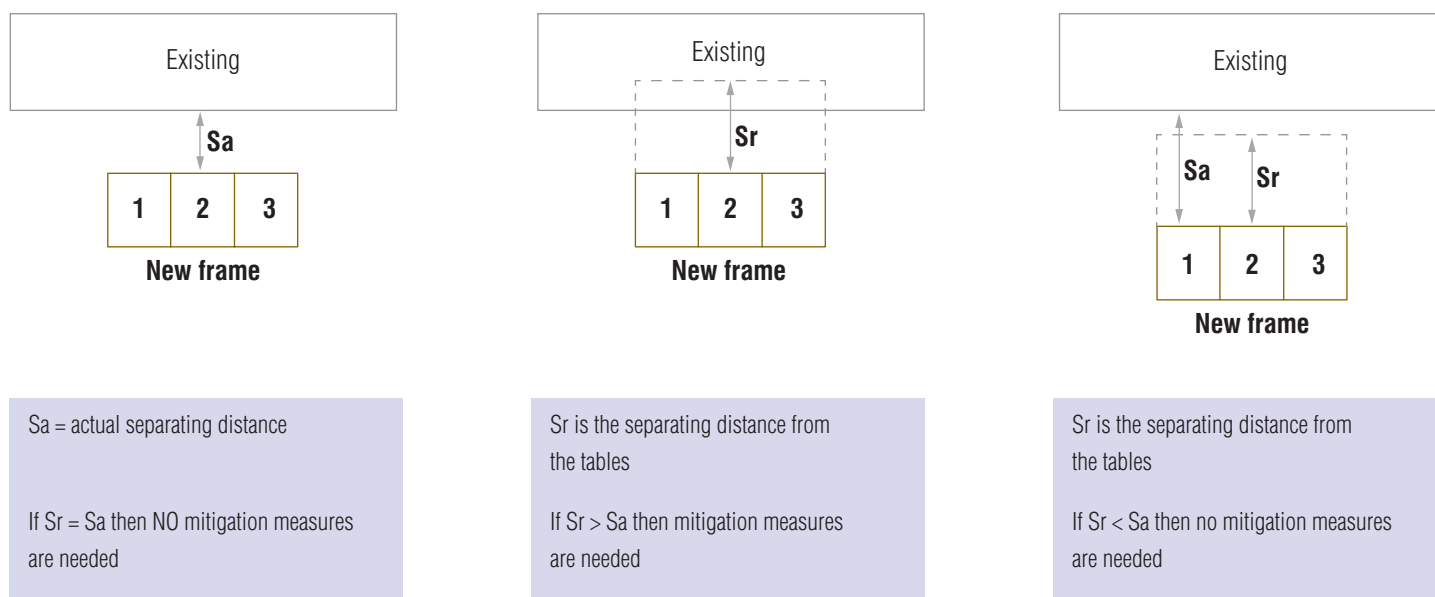


Figure 2.4 Comparing required distances to actual distances between buildings (Plan view)



Example of timber frame separating distance measurements

Project example

A six storey residential building comprises five storeys of timber frame on single storey concrete podium. The building has an elevation length of 45m. The new building's front elevation is 17.5m away from an existing building. What is the separation distance for a Category A frame?

	No. of Timber frame storeys	Actual distance Sa between emitter and receiver	Emitter length eL
Emitter (timber frame element)	5	17.5m	45m

Note the height of the receiver building is not required for the calculations

Table 2 for Category A - Timber frame separating distance (Sr) in metres

Number of timber frame storeys	Emitter length (eL)						
	≤5m	≤10m	≤15m	≤20m	≤25m	≤40m	>40m
1	5.5	7.25	8.25	8.75	9.5	10.25	10.5
2	7.5	10.5	12.75	14.25	15.5	18	20.25
3	9	13	16	18	20	23.25	28.5
4	10	15	18.5	21.25	23.5	28.5	35.75
5	11	16.5	20.5	23.75	26.5	32.5	41.75
6	11.5	18	22.5	26	29	36	47.25
7	12.25	19	24	28	31.5	39.25	52.5

$S_r (= 41.75m) > S_a (=17.50m)$ therefore, a construction process risk mitigation is required for a Category A frame. Consider Category B and C frame options as a priority within a hierarchy risk management approach.



Construction process mitigation measures to reduce the separating distance (so that $S_r < S_a$)

By reducing the emitter length or number of storeys by risk mitigation measures the calculated S_r may be reduced so that $S_r < S_a$. Consider the following:

- a Adopt a more fire resistant timber frame specification (Refer to Part 3).
- b Changing the emitter footprint and / or orientation to avoid risk mitigation requirements.
- c The use of build process to construct the final and permanent building outer cladding - assuming this is building regulation fire compliant for the building, as the timber frame progresses. This has the effect of reducing the frame emitter height used in Table 1 providing the height of the timber frame above the cladding is never exceeded beyond what is calculated as the risk mitigation measure. The designer is to ensure that the cladding is robustly supported so not to collapse prematurely under a fire condition. Consultation with a fire engineer may be required for use of this mitigation measure.
- d Adopt non combustible podium structures to reduce the timber frame height.
- e Engage with a competent fire engineer to assess the site in detail - the site conditions, resistance against arson, accidental damage or weather damage - for both internal and external sources of fire and then review options.

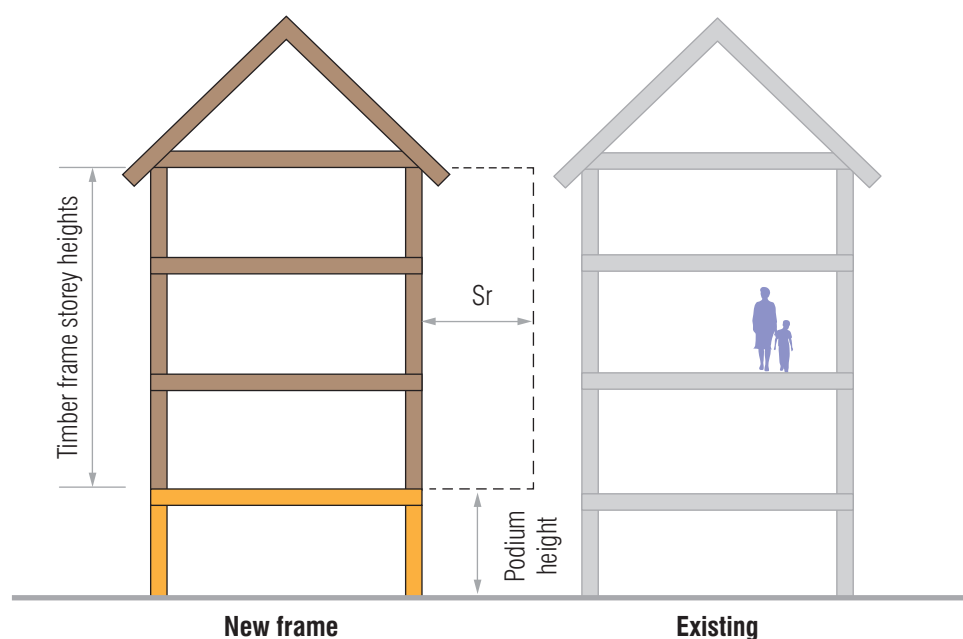


Figure 2.5 How the construction process can be used to reduce the effective storey height

Podium option

The use of a podium structure reduces the effective storey height of the new frame proposed. In this example the emitter height is reduced from 4 to 3 storeys and therefore the separating distance is based on 3 storeys.

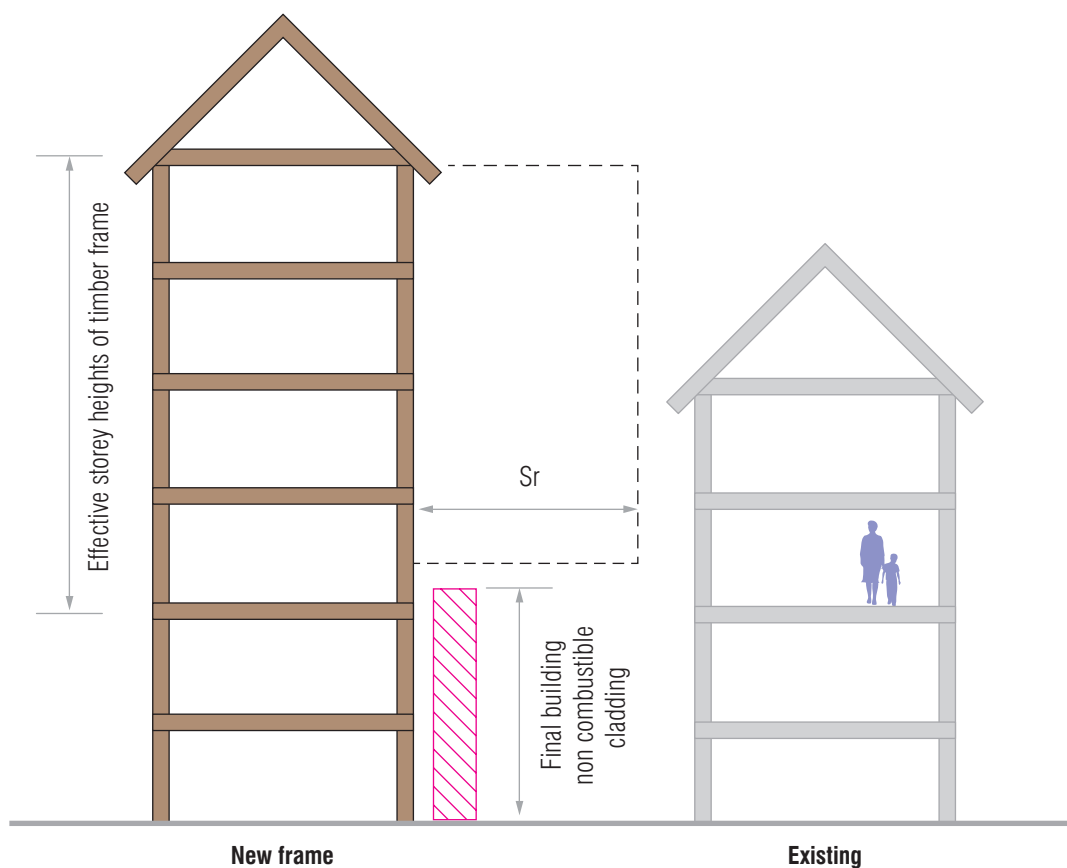


Figure 2.6 Podium and cladding construction options

Final building cladding construction option

Non-combustible cladding (building regulation compliant) attached to the timber frame, built up as the work progresses to reduce the emitter height to ensure S_r is less than S_a . In the example above the 6 storey height new build has been reduced to 4 storey height in terms of determining the separating distance.

The stability of the cladding attached to the Category A timber frame is to be considered, should the timber frame that is supporting the cladding burn away.



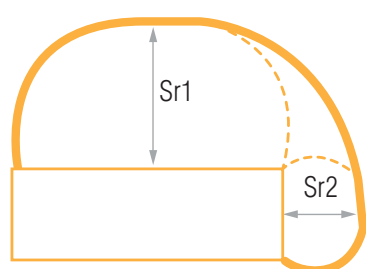
Timber frame build methods to reduce the separating distance (Category B and C)

Consider reduction of the separating distance by using Category B or C type frame specifications. Such measures may include pre insulated walls, non-combustible sheathing, Flame Retardant treatment (FR Build) to timbers and sheathing board, or compartmentation within the building may also be appropriate. Note that doors or service penetrations within a fire compartment must have equal or better resistance to fire spread so as not to create a weak link in the wall. Doors should normally be closed.

Part 3 of this guidance provides advice on different methods of timber frame construction to reduce separating distances.

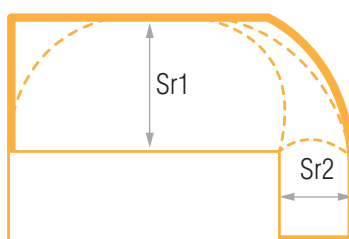
Adopting the separating distance tables for buildings at angles to the new build

The separating distance table on page 19 of this document is based on 'parallel emitters and receivers'. The calculation approach for radiant heat flux is a complex assessment of the relationship between the emitter and receiver. Once the relationship between the emitter and receiver changes to a non-parallel condition the separating distance reduces for most applications. For the purpose of this guidance the separating distance calculation, based on the parallel relationship, is conservative and can be adopted as a guide. A reduced separating distance may result if a competent fire engineer was to assess the project.



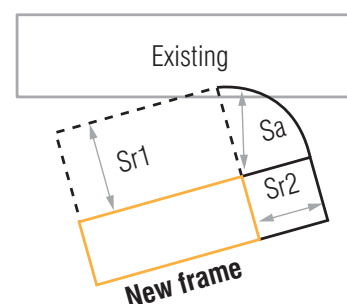
Diagrammatic theoretical profile plan view of the radiant heat flux boundary for a given building.

Boundary based on 12.6 kW/m² at the receiver face.



Assumed profile for the radiant heat flux boundary for a given building.

Boundary based on 12.6 kW/m² at the receiver face.



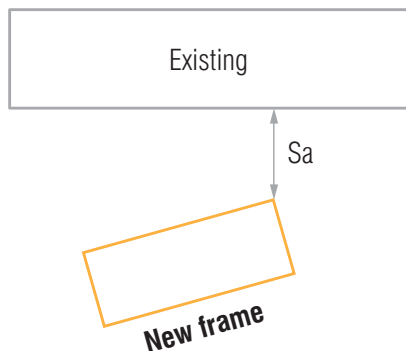
Principle applied at the junction of existing to new build.

Sa is exceeded in the above example.

Figure 2.7 Buildings at angles to the emitter

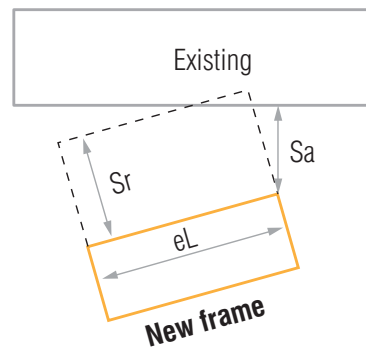


An example of how this applies to the guidance



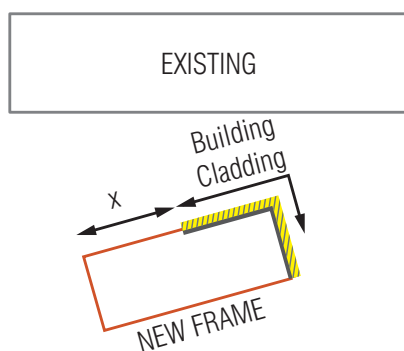
New build at an angle to the existing building.

Figure 2.8a



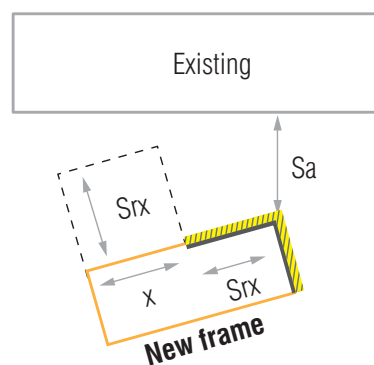
If using the separating tables for a given emitter length (eL) and it is found that the Sr rectangle boundary impinges on the existing building line so that $Sr > Sa$, then mitigation measures are needed.

Figure 2.8b



Mitigation measures to the part of the elevation of the new frame closest to the existing building are required. The existing building can be protected from radiant heat flux by adopting a building regulation compliant cladding strategy to the corner elements. Alternatives for the use of fire shields falls outside of the scope of this guidance. It is pointed out that fire shields are unproven and require assessment by a fire engineer and a structural engineer. They must ensure that the fire growth does not wrap around the fire shield and that the shield itself does not conduct/radiate heat. Structural independent supports will also need to be proven, particularly once subjected to heat from the fire.

Figure 2.8c



With the cladding in place a revised separating distance for the elevation can be calculated.

In this example the table value of Srx (based on the emitter length x) indicates that no further measures are required.

Figure 2.8d



Part 3 - Timber frame build methods to reduce the separating distances

PART 3

Introduction to Part 3

Timber frame build methods that comply with Category B and C to reduce separating distances

Categories of timber frame build methods

Category B and C1 separating distance tables

Principles of reducing separating distances using Category B or C frames

Extreme condition compliance

Compartmentation in Category B or C

Combining Category B and C

Adopting the separating distance tables for buildings at angles to the new build

Acknowledgements



Introduction to Part 3

Part 1 of the Design Guide provides the scope, background and introduction to the separating distance tables. Part 2 of the guidance provides information on the use of the separating distance tables with a specific focus on standard timber frame and construction process mitigation measures. Where assessment shows that the separating distances for standard timber frame cannot be met, the designer can adopt timber frame build methods to reduce the separating distances. This section of the Design Guide outlines alternative timber frame build methods that can be adopted to reduce the separating distances.

There are three categories of timber frame which can be selected to meet the separating distances required. The following table compares the generic performance characteristics of each category used in this guide. Category A timber frame separating distances are dealt with in Part 2 of this guidance.

Standard type of frame Category A	Reduced fire spread timber frame Category B	Fire spread resistant timber frame Category C
Separating distance Standard radiant heat emissions	Separating Distance Guidance Part 3 Reduction in radiant heat emissions	
Standard ignition	Reduction potential for ignition of the frame	
Standard growth of fire through	Slower growth of fire spread through compartment	Limited fire growth from seat of fire

Figure 3.1 Comparison of timber frame categories

NOTE: *In developing the tables Category B is subdivided into three, B1, B2 and B3 with B3 being the best performing, and Category C is subdivided into C1 and C2, with C2 being the best performing category.*

Timber frame build methods that comply with Category B and C to reduce separating distances

Testing of certain timber frame build methods, (i.e. wall and floor panels) has demonstrated that the radiant heat and growth of fire can be reduced.

The STA member Product Paper 4 provides a set of combined assemblies that can be selected by the timber frame supply chain to achieve the relevant timber frame category compliance.

The design phase team can use the tables in this section to select appropriate category B and C as necessary. The Supply chain can adopt the standard solutions given in this guidance or adopt the product paper 4 options that match the design phase team's requirement.



Categories of timber frame build methods

The tables below provides a list of generic timber frame solutions that achieve the relevant category of timber frame required.

Category A frames

Timber frame category	Location					
	External walls	Load bearing walls	Compartment walls / fire compartmentation	Intermediate floor	Roofs below 15 degrees	Roofs above 15 degrees pitch
Category A Timber frame and Structurally Insulated Panels (SIPS)	Standard timber frame and wood based sheathing ^(d) SIPS with wood based board facing ^(h)	Standard timber frame and wood based sheathing ^(d) SIPS with wood based board facing ^(h)	Standard timber frame and where appropriate wood based sheathing ^(d) SIPS with wood based board facing ^(h)	Timber joists and decking ^(e)	Timber joists or timber trusses with or without decking / sarking	Timber joists or timber trusses with or without decking / sarking

Figure 3.2a Category A functional generic standard timber frame build methods - refer to notes for explanations and further information see table 1 for Category A frames^(m)



Category B frames

Timber frame category	Location					
	External walls	Load bearing walls	Compartment walls / fire compartmentation (max 20m centres) ^(f)	Intermediate floor	Roofs below 15 degrees	Roofs above 15 degrees pitch
Category B1 Reduced fire spread frames ⁽ⁱ⁾	B1 FR Build ^(a) frame and FR Build ^(a) sheathing or sheathing of limited combustibility ^(c) or better NOTE: Option for insulation type FI Build 1^(f) Head binders and sole plates OK to non-FR treated	Sheathed walls FR Build ^(a) frame FR Build ^(a) sheathing or sheathing of limited combustibility ^(c) or better or Timber frame not FR treated with non-combustible ^(b) boards on one face of the wall frame ⁽ⁱ⁾ Unsheathed walls FR Build ^(a) framing Head binders and sole plates ok to not FR treated	FR Build ^(a) frame FR Build ^(a) sheathing or sheathing of limited combustibility ^(c) or better, plus party wall cavity insulation or Timber frame not FR treated with non-combustible ^(b) boards on one face of the wall frame either room side or party wall cavity face ⁽ⁱ⁾ Head binders and sole plates ok to not FR treated	FR Build ^(a) joists FR Build ^(a) boards or boards of limited combustibility ^(c) or better Noggins/dwangs/strutting plan area > 10% FR build treatment Rim boards FR treated or covered by mineral wool or FR build board or non combustible board. Trimmers > 10% plan area FR build treatment Steel work not protected	FR Build ^(a) joists/rafters / truss rafters and bracing FR Build ^(a) boards or boards of limited combustibility ^(c) or better Rim boards FR treated or covered by mineral wool or FR build board or non combustible board Trimmers > 10% plan area FR build treatment Steel work not protected	Not FR treated roof members or sarking
Category B2 Reduced fire spread frames ⁽ⁱ⁾	FR Build ^(a) frame and FR Build ^(a) sheathing or sheathing of limited combustibility ^(c) or better plus pre-insulated with type FI Build 2 ^(f) Head binders and sole plates OK to non-FR treated	Timber frame not FR treated with non-combustible ^(b) boards on one face of the wall frame ⁽ⁱ⁾ Unsheathed walls FR Build ^(a) framing Head binders and sole plates ok to not FR treated	Timber frame not FR treated with non-combustible ^(b) boards on one face of the wall frame either room side or party wall cavity face ⁽ⁱ⁾ Head binders and sole plates ok to not FR treated	Noggins/dwangs/strutting plan area > 10% FR build treatment Rim boards FR treated or covered by mineral wool or FR build board or non combustible board. Trimmers > 10% plan area FR build treatment Steel work not protected	Rim boards FR treated or covered by mineral wool or FR build board or non combustible board Trimmers > 10% plan area FR build treatment Steel work not protected	Not FR treated roof members or sarking
Category B3 Reduced fire spread frames ⁽ⁱ⁾	FR Build ^(a) frame and FR Build ^(a) sheathing or sheathing of limited combustibility ^(c) or better plus pre-insulated with type FI Build 3 ^(f) Head binders and sole plates OK to non-FR treated	Timber frame not FR treated with non-combustible ^(b) boards on one face of the wall frame ⁽ⁱ⁾ Unsheathed walls FR Build ^(a) framing Head binders and sole plates ok to not FR treated	Timber frame not FR treated with non-combustible ^(b) boards on one face of the wall frame either room side or party wall cavity face ⁽ⁱ⁾ Head binders and sole plates ok to not FR treated	Noggins/dwangs/strutting plan area > 10% FR build treatment Rim boards FR treated or covered by mineral wool or FR build board or non combustible board. Trimmers > 10% plan area FR build treatment Steel work not protected	Rim boards FR treated or covered by mineral wool or FR build board or non combustible board Trimmers > 10% plan area FR build treatment Steel work not protected	Not FR treated roof members or sarking

Figure 3.2b Categories B functional generic standard timber frame build methods - refer to notes for explanations and further information table 2, 3 and 4 for Category B frames^(m)



Category C frames

Timber frame category	Location					
	External walls	Load bearing walls	Compartment walls / fire compartmentation (max 20m centres) ⁽ⁱ⁾	Intermediate floor	Roofs below 15 degrees	Roofs above 15 degrees pitch
Category C Fire spread resistant frames ⁽ⁱ⁾	Timber frame, not FR treated, with non-combustible ^(b) sheathing on one side, open on the other side - no combustible sheathing on the wall ⁽ⁱ⁾ or FR Build ^(a) timber frame with sheathing of limited combustibility ^(c) or better or FR Build ^(a) frames internally faced with boards of limited combustibility or better and FR Build ^(a) sheathing externally or better - includes pre-insulated type FI Build 1-3 ⁽ⁱ⁾ Head binders and sole plates OK to non-FR treated Exposed noggins plan area > 10% FR build treatment	Sheathed walls FR Build ^(a) frame FR Build ^(a) sheathing or sheathing of limited combustibility ^(c) or better or Timber frame not FR treated with non-combustible ^(b) boards on one face of the wall frame ⁽ⁱ⁾ Unsheathed walls FR Build ^(a) framing Head binders and sole plates OK to non-FR treated Noggins plan area > 10% FR build treatment	FR Build ^(a) frame FR Build ^(a) sheathing or sheathing of limited combustibility ^(c) or better, plus party wall cavity insulation or Timber frame not FR treated with non-combustible ^(b) boards on one face of the wall frame either room side or party wall cavity face ⁽ⁱ⁾ Head binders and sole plates OK to non-FR treated Noggins plan area > 10% FR build treatment	FR Build ^(a) joists FR Build ^(a) boards or boards of limited combustibility ^(c) or better Noggins/dwangs/strutting plan area > 10% FR build treatment Rim boards FR treated or covered by mineral wool or FR build board or non-combustible board Trimmers > 10% plan area FR build treatment Steel work not protected	FR Build ^(a) joists/rafters/truss rafters and bracing FR Build ^(a) boards or boards of limited combustibility ^(c) or better Rim boards FR treated or covered by mineral wool or FR build board or non-combustible board Trimmers > 10% plan area FR build treatment Steel work not protected	Not FR treated roof members or sarking
Category C2 Fire spread resistant frames - no openings ⁽ⁱ⁾	As C1 but no openings and external sheathing to be at least sheathing of limited combustibility ^(c) NOTE: Final design openings can be temporarily closed off head binders and sole plates ok to not FR treated Exposed noggins plan area > 10% FR build treatment					

Figure 3.2c Categories C functional generic standard timber frame build methods - refer to notes for explanations and further information
 See table 5 and 6 for Category C frames^(m)



Notes relating to Figure 3.2 a,b and c on previous page

- a FR Build is a classification of flame retardants (including intumescent coatings) acceptable to the STA based on the Wood Protection Association (WPA) benchmark audit scheme and approvals. EN or BS reaction to fire or fire test data is not acceptable. See supporting Product Paper 1. The STA Product paper 4 provides guidance on FR Build tested joists.
- b Non-combustible boards will be products complying with BS 476 - part 4 or BS EN ISO 1182 euro class A1.
- c Boards of limited combustibility shall be products that comply with BS EN ISO 13823 euro class A2 and BS 476 - part 11.
- d Standard timber frame - typically combustible materials not treated with flame retardants.
- e Standard joists and decking - typically combustible materials not treated with flame retardants.
- f FI Build is a classification of appropriate insulation material acceptable to the STA. i.e. insulation products suitable for off the site installation e.g. rigid polyisocyanurate and phenolic insulation products and mineral wool products that can be protected from the weather. See supporting Product Paper 2.

All insulation material to FI Build classification. The STA website provides the list of products that have been tested for type FI Build 1, type FI Build 2, type FI Build 3.

Product Paper 2 provides information for the insulation companies on the assessment process.
- g Flat roofs are included, as the exposed decking combined with the exposed joists supports or contains fire growth depending on the treatment and ignitability of the materials. Summary of roof consideration below:

For roof pitch less than 15 degrees	Shall be treated as the relevant category floor assembly
Roof pitch equal to 15 degrees and up to 55 degrees	In Category B and C may be standard timber components
Room in the roof and Mansard roofs greater than 55 degrees pitch	To be considered as an additional storey of timber frame

- h Structural Insulated Panels (SIPS) typically have a combustible timber sheathing board to either side of the insulation. It is the combustibility of the sheathing board that places the SIPS into Category A.
- i The use of non-combustible boards to one side of the frame is based on the fact that there is no combustible sheathing exposed to a potential fire on either side of the frame.
- j The STA Product Paper 4 provides the timber supply chain and fire engineers with technical data to support the delivery of Category B and C solutions.
- k Non load bearing walls (unsheathed) are untreated timber regardless of the category of timber frame.
- l For this guidance maximum centres is 20m between compartment walls to break up the frame layout to reduce the emitter lengths.
- m STA Product Paper 5 provides guidance for small frames below 250m² total floor area.



Category B separating distance tables

Category B, reduced fire spread timber frame, where the timber frame structure itself will stop fire spread to varying degrees which reduces the potential fire growth and radiant heat generated. This category is subdivided into three to provide incremental improvements in different materials available to reduce the fire spread from fully a developed fire source. Under extreme circumstances frames in Category B walling may become fully involved in the fire but at a slower rate than Category A. The ability of Category B frames to stop small fires becoming established is not included in the calculated separating distance tables as it assumed a fully developed fire from an external source has initiated the risk. Never the less designers may wish to consider the benefit of the ability of the category B frames stopping a small fire in the first instance.

Table 2 for Category B1 - Timber frame separating distance (Sr) in metres

Number of timber frame	Emitter length (eL) - B1 frame			
	≤5m	≤10m	≤15m	≤20m
1	5	5.5	6.25	6.5
2	6	8.25	10	11
3	7	10.25	12.5	14.25
4	7.5	11.75	14.5	16.75
5	8.25	13	16	18.75
6	8.75	14	18.75	20.25
7	9	14.75	18.75	22

Table 3 for Category B2 - Timber frame separating distance (Sr) in metres

Number of timber frame	Emitter length (eL) - B2 frame			
	≤5m	≤10m	≤15m	≤20m
1	5	5	5.25	5.5
2	5.25	7.25	8.5	9.5
3	6	9	10.75	12.25
4	6.75	10.25	12.75	14.5
5	7	11.25	14	16.25
6	7.25	12	15.25	17.75
7	7.5	12.75	16.25	19.25



Table 4 for Category B3 - Timber frame separating distance (Sr) in metres

Number of timber frame	Emitter length (eL) - B3 frame			
	≤5m	≤10m	≤15m	≤20m
1	5	5	5	5
2	5	6.25	7.25	7.75
3	5	7.75	9.25	10.25
4	5.5	8.75	10.75	12.25
5	5.75	9.5	12	13.75
6	6	10	13	15.25
7	6	11	13.75	16.25

Notes to tables 2,3 and 4

1. The data in these tables applies to all building plan area.
2. The data in these tables is based on a nominal storey height of 3m. The tables assume the worst case of a 1m high parapet wall around the roof and that the roof has a slope of 55 degrees or less. Buildings with a roof pitch greater than 55 degrees and or a parapet higher than 1m shall add an additional storey height in the assessment.
3. Should a podium or higher ground levels be adopted then the actual number of storey levels of timber frame is used in the table.
4. The Category B frame emitter length is set to a maximum 20m. A building may have a length more than this, which for the use of this guidance will require appropriate vertical fire compartmentation to ensure that each emitter length between compartmentation is no greater than 20m. Emitter lengths greater than 20m will require assessment by a competent assessor and falls outside the scope of guidance.
5. The tables have been limited to a minimum separating distance 5m to account for flame impingement and spread by windblown flames. This assumes that the door/window openings will allow flame spread to be the potential source of fire growth to neighbouring buildings and accounts for the effect of winds to carry the flames.



Category C separating distance tables

Category C, resistant to fire spread timber frames, where the structure itself will create a barrier to fire growth and if in the unlikely event a fire is established it will be restricted and not burn through the perimeter walling to the predefined compartmentation. Category C is divided into two with C1 being a fire resistant frame with openings and C2 being without openings or openings temporarily closed with the same product standard as the walls themselves. The ability of Category C frames to significantly stop small to moderate fires becoming established is not included in the calculated separating distances as it assumed a fully developed fire from an external source has initiated the risk.

Table 5 for Category C1 - Timber frame separating distance (Sr) in metres

Number of timber frame	Emitter length (eL) - C1 frame			
	≤5m	≤10m	≤15m	≤20m
1	5	5	5	5
2	5	5	5	5
3	5	5	5.75	6.5
4	5	5.5	7	7.75
5	5	6	7.75	8.75
6	5	6.25	8.25	9.75
7	5	6.5	8.75	10.25

Table 6 for Category C2 - Timber frame separating distance (Sr) in metres

Number of timber frame	Emitter length (eL) - C1 frame			
	≤5m	≤10m	≤15m	≤20m
1 - 7	0	0	0	0

Notes to tables 5 and 6

- The data in these tables applies to all buildings.
- The data in these tables is based on a nominal storey height of 3m. The tables assume the worst case of a 1m high parapet wall around the roof and that the roof has a slope of 55 degrees or less. Buildings with a roof pitch greater than 55 degrees and or a parapet higher than 1m shall add an additional storey height in the assessment.
- Should a podium or higher ground levels be adopted then the actual number of storey levels of timber frame is used in the table.
- The Category C frame emitter length is set to a maximum 20m. A building may have a length more than this, which for the use of this guidance will require appropriate vertical fire compartmentation to ensure that each emitter length between compartmentation is no greater than 20m. Emitter lengths greater than 20m will require assessment by a competent assessor and falls outside the scope of guidance.
- Table 5 values have been limited to a minimum separating distance 5m to account for flame impingement and spread by windblown flames. This assumes that the door/ window openings will allow flame spread to be the potential source of fire growth to neighbouring buildings and accounts for the effect of winds to carry the flames. Closure of openings with a fire resistant board that is non-combustible or of limited combustibility will allow a reduction in the 5m limit and change Category C1 to Category C2.
- Where Category C2 is used the framing needs to extend at least 5m back from the receiver face where it is required.



Principles of reducing separating distances using Category B or C frames

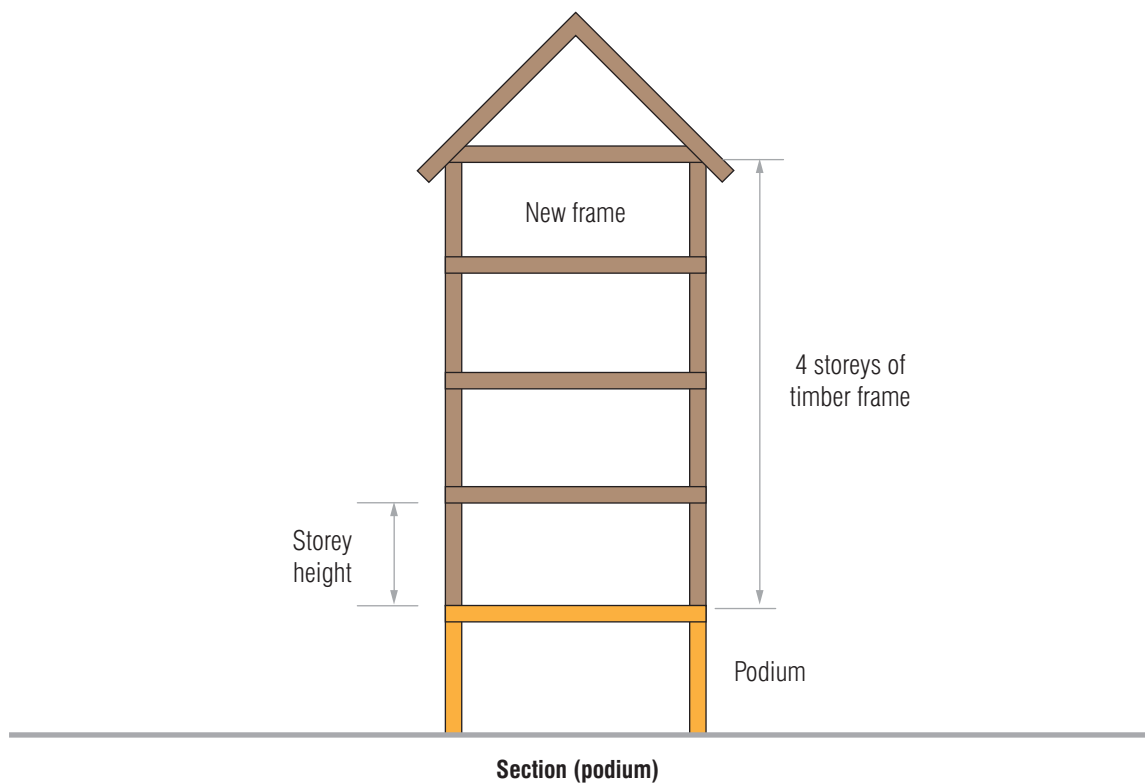
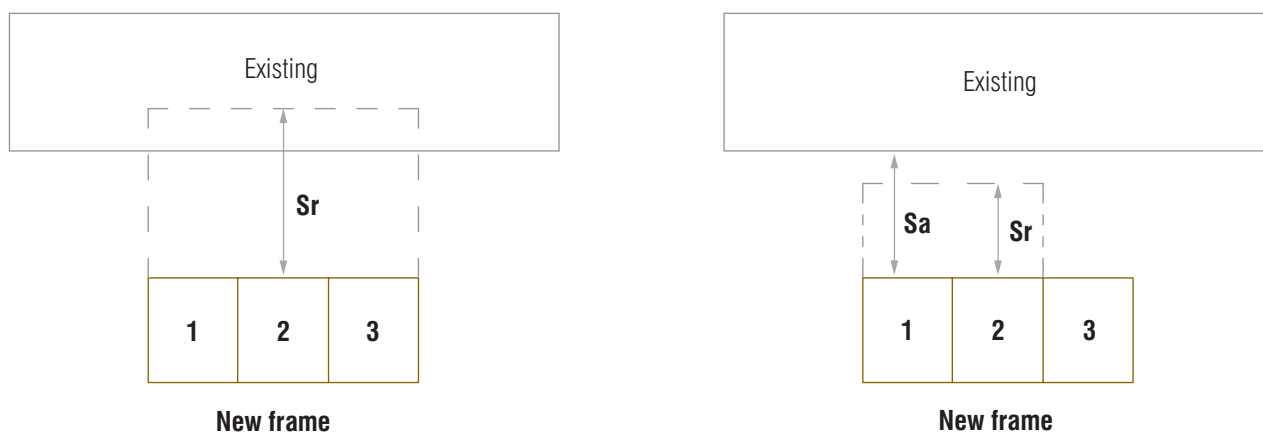


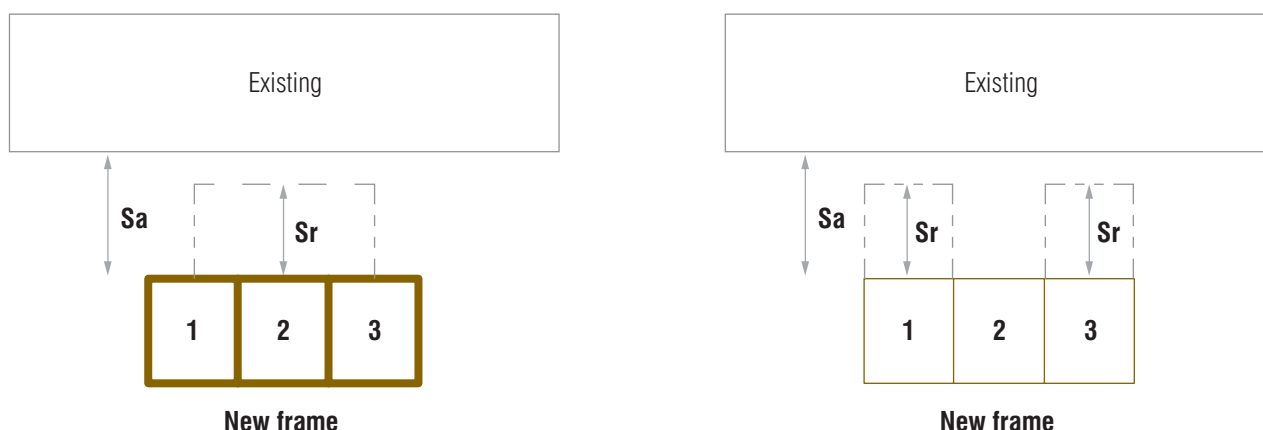
Figure 3.3 Example of storey heights and approach using podiums



Reducing the emitter length and temperature of a fire reduces the separating distance S_r .

Category B or C frame types reduce both the emitter temperature and effective emitter length.

Figure 3.4a Basic explanation of why Category B and C frames reduce the separating distances



From the fire ignition source, the fire will spread horizontally and vertically. For example, a fire starting in unit 2 will attempt to spread to unit 1 and unit 3. The use of Category B forms of timber frame slows down the growth of fire such that it delays the spread between units. By the time the fire has reached unit 1 and 3, the fire in unit 2 will no longer be making a significant contribution to the radiant heat flux. For Category C frames the fire growth is compartmented further and very limited growth can be expected beyond the initial seat of the fire.

Figure 3.4b Basic explanation of why Category B or C frames reduce radiant heat and reduces the separating distances

Extreme condition compliance: Separating distances less than 5m

Where separating distances are less than 5m (for example, on infill sites), then the wall panels within the first compartment of the new build will form a fire compartment to the framing beyond this area. In this instance Category C2 frame types are required. And the C2 is to extend at least 5m back from the receiver face. The remaining building is to be Category C1 for at least the first compartment (minimum 20 metres or the building depth, whichever is the least).

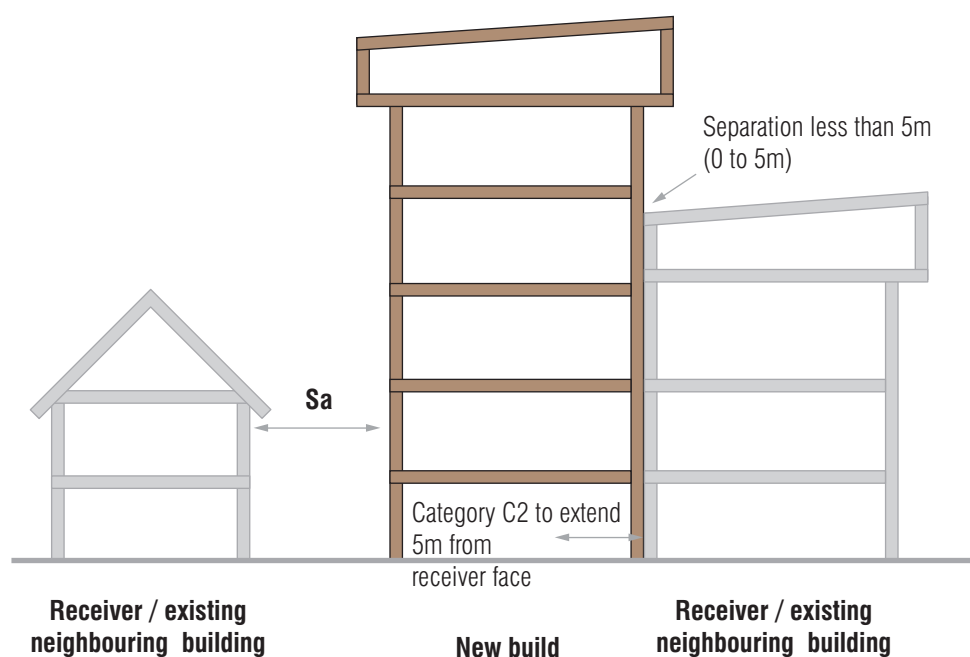


Figure 3.5 Example of extreme condition compliance: where separation distances are closer than possible using Category B or C1 (Elevation view)



Fire compartmentation in Category B or C

The fire compartmentation can provide a reduction in emitter length within a building and can comprise of the following:

1. FR Build sheathing and timber frame party walls with full fill STA fire tested insulation (FI Build) in the party wall cavity.
2. Non-combustible boards fixed to the party wall cavity face.
3. A non-combustible board on both faces to provide a continuous barrier.
4. For compartment walls, the continuity of fire spread resistance approach is to follow across floor levels and up to the top of the roof pitch level, so that there is no breach of fire spread compartmentation.
5. Openings for services and doors for access in any fire compartment wall are to be closed off with non-combustible board material to maintain the fire compartment resistance to fire spread.

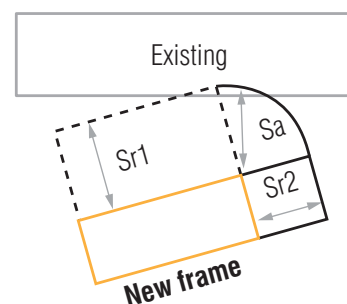
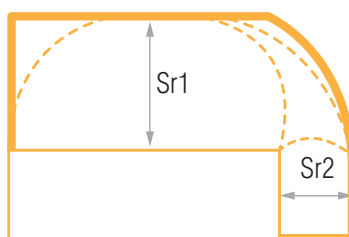
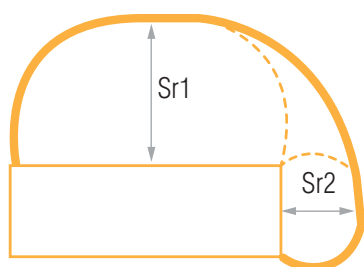
Combining Category B and/or C frames with A in a building

Combining a Category A frame with B or C is outside the scope of this guidance.

A knowledgeable and experienced fire engineer is to be consulted, should the combination of Category A with Category B and C frames in a building be considered. Reference to product paper 5 for alternative strategies with small buildings below 250m².

Adopting the separating distance tables for buildings at angles to the new build

The separating distance table for Category B and C is based on 'parallel emitters and receivers'. The calculation approach for radiant heat flux is a complex assessment of the relationship between the emitter and receiver. Once the relationship between the emitter and receiver changes to a non-parallel condition the separating distance reduces for most applications. For the purpose of this guidance the separating distance calculation, based on the parallel relationship, is conservative and can be adopted as a guide. A reduced separating distance may result if a competent fire engineer was to assess the project.



Diagrammatic theoretical profile plan view of the radiant heat flux boundary for a given building.

Boundary based on 12.6 kW/m² at the receiver face.

Assumed profile for the radiant heat flux boundary for a given building.

Boundary based on 12.6 kW/m² at the receiver face.

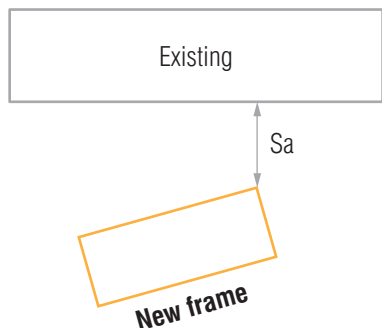
Principle applied at the junction of existing to new build.

Sa is exceeded in the above example.

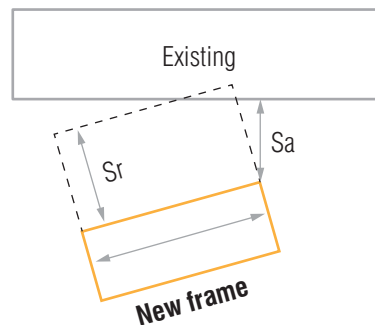
Figure 3.6 Buildings at angles to the emitter



How this applies to the guidance is as follows:



New build at an angle to the existing building.



Using the separating tables for a given emitter length the resultant separating distance S_r boundary impinges on the existing building line so $S_r > S_a$. Therefore mitigation measures needed.



Mitigation measures to the corner of the new build is required. The new build can be divided into distinct parts mixing Category B and Category C in areas where higher risk mitigation is required.



The radiant heat flux from a reduced emitter that adopts Category C frame = $Sr1-C$. This provides sufficient separation from the existing building.

$Sr1-B$ provides sufficient separation and does not impact on the receiver.

Figure 3.7 Examples of the guidance in buildings at angles to the emitter



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2011 Documentation

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