

Design guide to separating distances during construction

Product Paper 5

Guidance for structural timber frame buildings below 250m² in total floor area

Version 2.03 | August 2018 | Authored by Martin Milner

Introduction

Who is this for?

STA member companies to value engineer options for fire risk mitigation on structural timber buildings that have a total internal floor of 250m² or less.

Projects covered

Projects above 40m² for buildings including houses and duplexes and properties up to three floor levels and a total effective or actual length of 20m. The form of construction is taken to cover structural timber walls (Structural timber frame, structural insulated panels, closed panels and pre-insulated panels, all with structural timber joisted floors and timber framed roofs including truss rafter roofs. See appendix for frame types being considered in this guidance.

Background

The STA has a guidance document called 'Design guide to separating distances during construction for timber frame buildings'. This publication is now fourth edition and has removed the application for projects above 600m² floor area.

The STA has worked with the HSE to produce a guide for buildings with reduced fire duration. This work has evolved to conclude that buildings below 250m² can be considered to have a reduced temperature rating for the purposes of determining safe separating distances. The STA also worked with BRE Global to review the engineering assessment behind temperatures of small building fires (<250m²) with a check of open timber frame panel frame and insulated panel options.

How to use this guidance

The user shall be familiar with the STA guidance 'Design guide to separating distances during construction for timber frame buildings' and the user shall determine the combined floor area of their unit building and check if no more than 250m².

If above 250m² the tables in the design guide to separating distances during construction for timber frame buildings shall be used. The Product Page 5 Appendices provide five easy read summary sheets that can be used to apply the rules in this guidance.

1. Rules for calculations

If not above 250m² then continue with this guidance.

- Determine the storey height of the building of the elevation being considered.
- Determine what the wall make up is for the structural timber frame.

Follow the relevant separation distance table for points a) and b).

1.1 Rules to assess the floor area of the unit building

General rules

This guidance for the limit of combined internal floor area of 250m² buildings. The rules for calculating the combined floor area is provided as follows:

- Internal dimensions are adopted from structural stud or sheathing or board as the internal line.
- Semi-detached, terrace and flats are treated as one full building, such that the separation of a party wall is not considered to cause separation in terms of this fire load calculation procedure.
- Building area limit of 250m² is the full area not of each house, room or flat.
- A semi-detached unit is the combined houses - that is both houses are included as a combined area in the 250m² area limit.
- A terrace of three is all three houses combined etc.
- A multi occupancy building is the combined area of all the rooms and corridors making up the building.

Roof space

Check if the roof space is included. Roof space only included if a room is in the roof and the pitch of the roof is greater than 50 degrees on the elevation being considered.

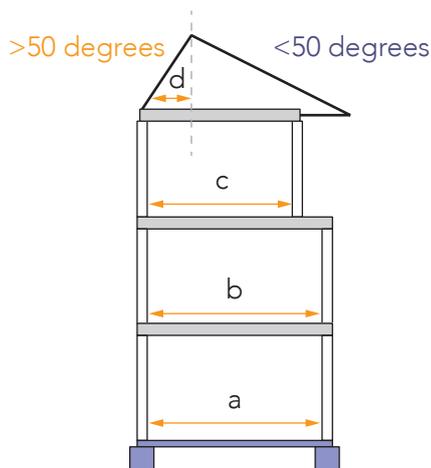


Figure 1: Section of detached building unit

Multi-unit sites

Where there are multiple units (for example a row of houses, semi detached, small terraces) Figure 2 explains how to combine unit areas.

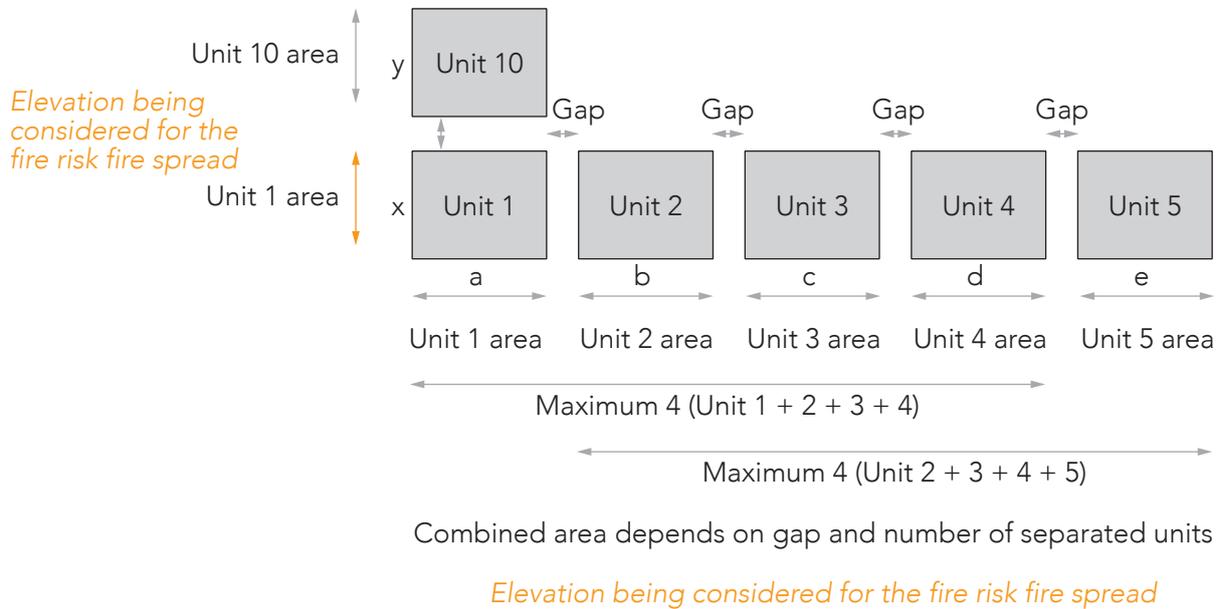


Figure 2: Determining number of separate units in the area calculation

1.2 Reducing multi-unit site number of units to be considered

Where the floor area of a number of units exceed 250m² and there is a requirement to keep the units to below 250m², then fire breaks can be introduced to arrest the flow of fire spread between separated units that in themselves are in themselves below 250m². Fire breaks are to stop horizontal spread of fire in such a way that the peak heat does not occur in both units at the same time. Acceptable fire breaks are:

- Brick cladding to one of the exposed structural timber buildings facing / in line with each other with windows covered in a non-combustible (Euro class A1 or A2) or FR build board product (STA classification see Product Paper 1).
- Sheathing to both exposed structural timber buildings facing / in line with each other to be FR build board product (STA classification see Product Paper 1) and windows covered with same.
- Sheathing to one of the exposed structural timber buildings facing / in line with each other to be a non-combustible (Euro class A1 or A2) and windows covered with same.

The above rules only apply to unit areas of 250m² and less.

1.3 Rules to assess the height of a building

Calculating the storey height of a building.

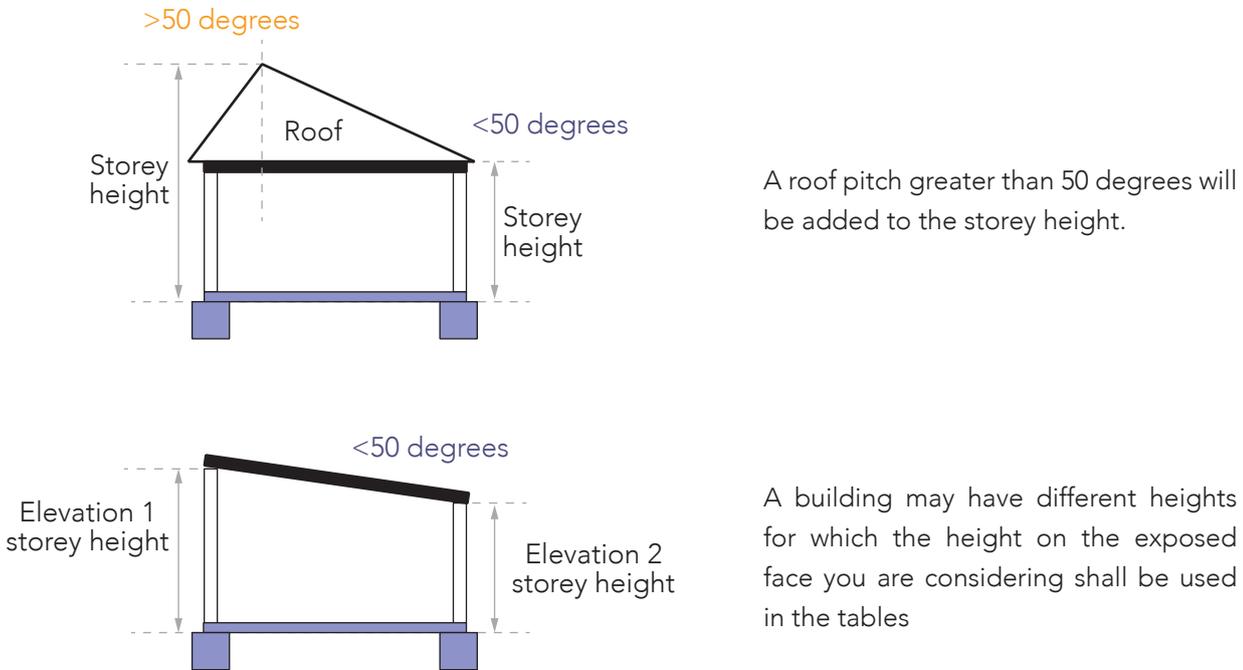


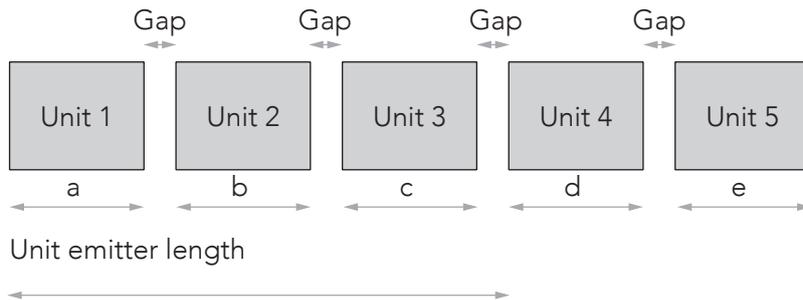
Figure 3: Wall storey height

1.4 Extensions in homes

It should be noted that extensions are not an off the site fire risk but an on the site risk. If the extension is close to a neighbour, then this needs assessment as an off the site fire spread risk. The on the site risk is to consider the effect of a site fire to any persons continuing to live in the property. The risk assessment is to be proportionate to the scale of the extension. It will be expected that any connection to the existing house will be not combustible. All other extensions (e.g. hotels, care homes, schools) are taken as the site boundary in that the existing structure is off the site and taken as a risk.

1.5 Calculating the emitter length for separation distance tables

If a site comprises of multiple units, for example a housing site of detached / semi-detached or small terrace houses, then an assessment of the number of units that can be considered to be burning together under a peak heat is to be undertaken. There is a maximum of 20m length for an emitter to be including in this guidance.



Combined emitter length depends on gap and number of separated units

Figure 4: Combined units for emitter lengths

DISTANCE BETWEEN BUILDINGS	EMITTER LENGTH TO USE IN THE TABLES
Less than 1m	Add up emitter lengths of each unit, for example, two semi-detached unit each with an emitter length of 11m (both houses in the semi) gives $11 + 11 = 22\text{m}$ emitter length $>20\text{m}$ so standard separating guidance documents ref 1 to be adopted.
Between 1m and 2m	Maximum two units taken for emitter length, for example, two semi-detached houses each with length of 9m (both houses in the semi) gives $9 + 9 = 18\text{m}$ emitter length (note floor area kept to single unit, that is, both houses in the semi)
Greater than 2m	Take each building unit in isolation

^{ref 1} STA guidance 'Design guide to separating distances during construction for timber frame buildings

1.6 Reducing emitter lengths on combined units

To reduce the emitter length fire breaks can be installed at gap interfaces between units. See section on reducing multi-unit site number of units to be considered on page 3.

1.7 Separation distance tables for projects 250m² or less

Table A

Buildings 250m² or less total floor area, standard open panel timber frame, Category A frame up to 3m storey height.

Minimum separating distances (Sr) in metres

NO. OF STOREYS	EMITTER LENGTH (EL)											
	4m	5m	6m	7m	8m	9m	10m	11m	12m	14m	18m	20m
1	3.0	3.0	3.0	3.1	3.3	3.4	3.4	3.5	3.5	3.6	3.7	3.8
2	3.4	3.9	4.3	4.7	5.0	5.2	5.5	5.7	5.9	6.2	6.7	6.8
3	4.5	4.5	5.0	5.5	6.0	6.4	6.8	7.1				

Table B

Buildings 250m² or less total floor area, pre-insulated timber frame open panel timber frame with mineral wool insulation and timber sheathed closed panel frames with mineral wool insulation, Category A frame up to 3m storey height.

Minimum separating distances (Sr) in metres

NO. OF STOREYS	EMITTER LENGTH (EL)											
	4m	5m	6m	7m	8m	9m	10m	11m	12m	14m	18m	20m
1	3.0	3.3	3.5	3.8	3.9	4.1	4.2	4.3	4.4	4.5	4.7	4.8
2	4.1	4.6	5.1	5.6	5.9	6.3	6.6	6.8	7.1	7.5	8.2	8.4
3	5.4	5.4	6.1	6.7	7.2	7.7	8.1	8.5				

Table C

Buildings 250m² or less total floor area, pre-insulated timber frame open panel timber frame with rigid foam insulation, Category A frame up to 3m storey height.

Minimum separating distances (Sr) in metres

NO. OF STOREYS	EMITTER LENGTH (EL)											
	4m	5m	6m	7m	8m	9m	10m	11m	12m	14m	18m	20m
1	3.5	3.8	4.2	4.4	4.7	4.8	5.0	5.2	5.3	5.5	5.8	5.9
2	4.8	5.4	6.0	6.5	6.9	7.3	7.7	8.0	8.3	8.8	9.7	10.0
3	6.4	6.4	7.1	7.8	8.4	9.0	9.5	9.9				

Table D

Buildings 250m² or less total floor area, SIPs and timber sheathed closed panel frames with rigid foam insulation up to 3m storey height.

Minimum separating distances (Sr) in metres

NO. OF STOREYS	EMITTER LENGTH (EL)											
	4m	5m	6m	7m	8m	9m	10m	11m	12m	14m	18m	20m
1	4.0	4.4	4.8	5.1	5.4	5.6	5.8	6.0	6.2	6.5	6.9	7.1
2	5.5	6.2	6.9	7.4	7.9	8.4	8.8	9.2	9.5	10.2	11.2	11.7
3	7.4	7.4	8.2	9.0	9.7	10.3	10.9	11.4				

Table E

Buildings 250m² or less total floor area, standard open panel timber frame, Category A frame up to 4m storey height.

Minimum separating distances (Sr) in metres

NO. OF STOREYS	EMITTER LENGTH (EL)											
	4m	5m	6m	7m	8m	9m	10m	11m	12m	14m	18m	20m
1	3	3.2	3.5	3.7	3.9	4.1	4.2	4.3	4.4	4.6	4.8	4.8

Table F

Buildings 250m² or less total floor area, pre-insulated timber frame open panel timber frame with mineral wool insulation and timber sheathed closed panel frames with mineral wool insulation, Category A frame up to 4m storey height.

Minimum separating distances (Sr) in metres

NO. OF STOREYS	EMITTER LENGTH (EL)											
	4m	5m	6m	7m	8m	9m	10m	11m	12m	14m	18m	20m
1	3.4	3.8	4.2	4.5	4.7	4.9	5.1	5.3	5.4	5.7	6.0	6.1

Table G

Buildings 250m² or less total floor area, pre-insulated timber frame open panel timber frame with rigid foam insulation, Category A frame up to 4m storey height.

Minimum separating distances (Sr) in metres

NO. OF STOREYS	EMITTER LENGTH (EL)											
	4m	5m	6m	7m	8m	9m	10m	11m	12m	14m	18m	20m
1	4.0	4.5	4.9	5.2	5.5	5.8	6.0	6.3	6.4	6.8	7.3	7.4

Table H

Buildings 250m² or less total floor area, SIPs and timber sheathed closed panel frames with rigid foam insulation up to 4m storey height.

Minimum separating distances (Sr) in metres

NO. OF STOREYS	EMITTER LENGTH (EL)											
	4m	5m	6m	7m	8m	9m	10m	11m	12m	14m	18m	20m
1	4.6	5.2	5.6	6	6.5	6.7	7	7.3	7.5	7.9	8.6	8.8

2. Escape routes

2.1 Escape routes from neighbouring property

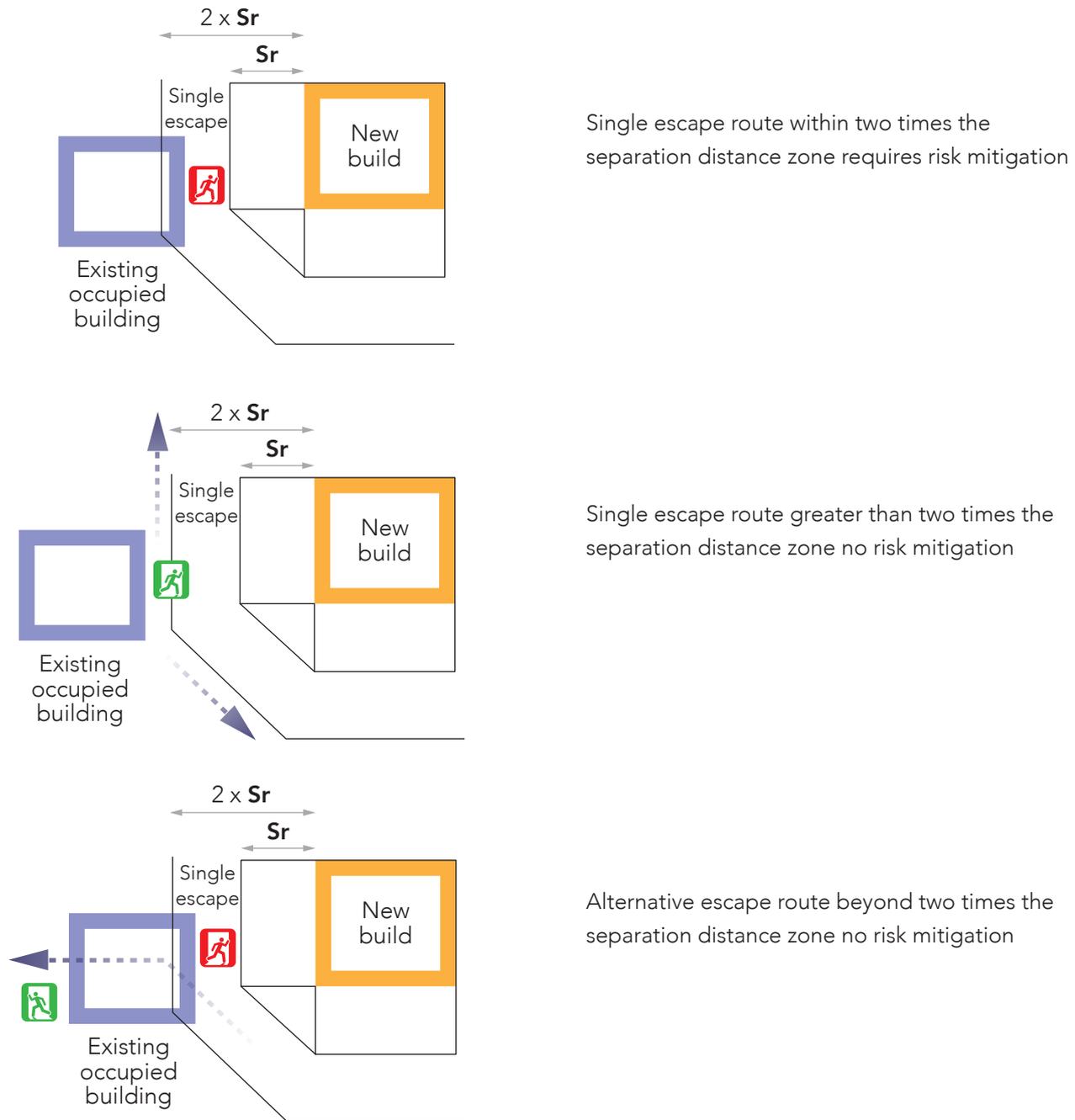
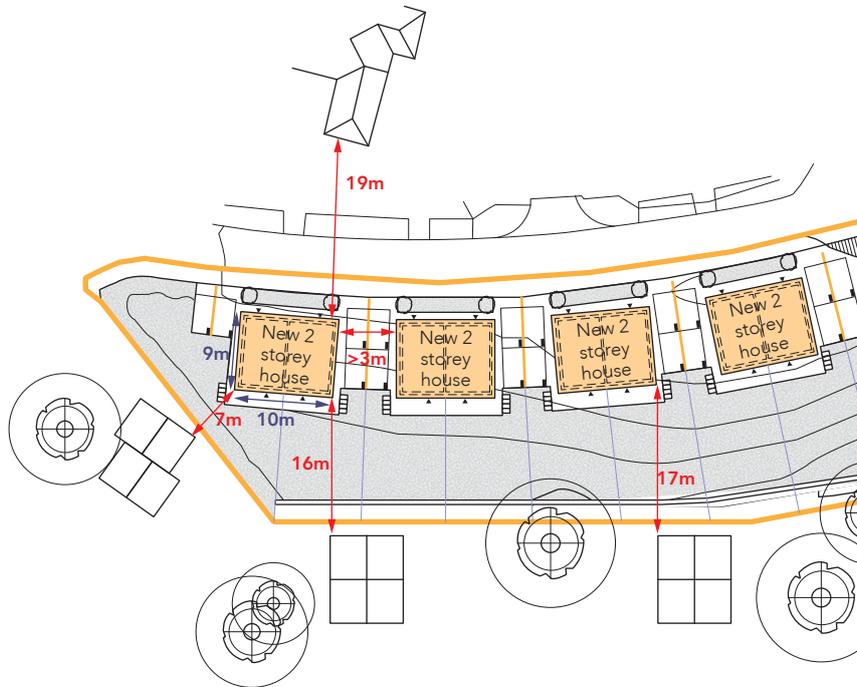


Figure 5: Escape routes review

2.2 Example of application

Site layout consisting of 10 semi-detached houses = 5 units. Semi-detached taken as a building incorporating both units.



Area of building

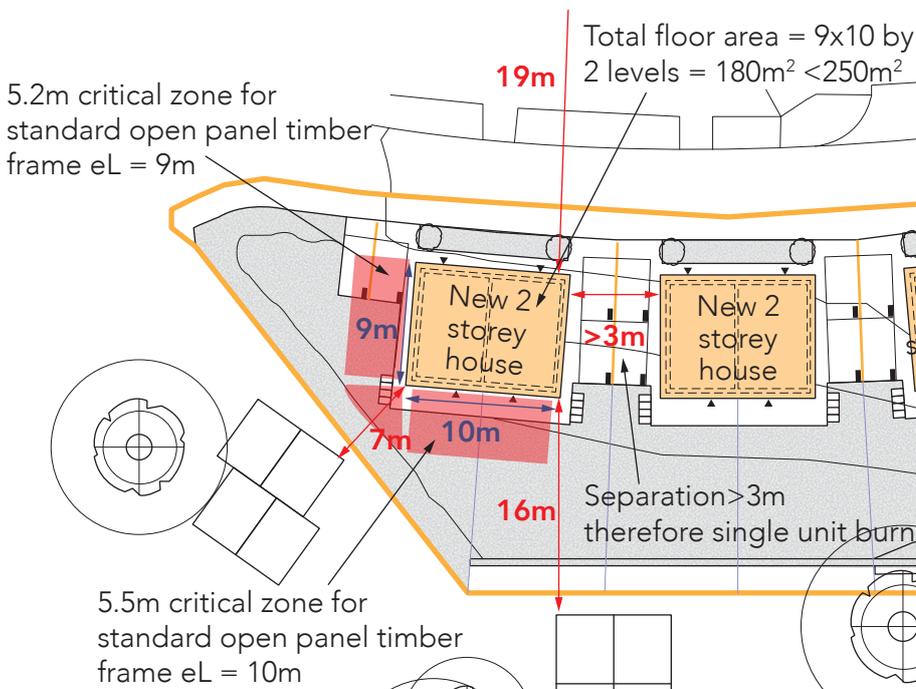
$9\text{m} \times 10\text{m} \times 2$ (storey)

$= 180\text{m}^2$

$< 250\text{m}^2$

Separation between units $> 2\text{m}$
therefore treat as single units

Actual separating distances S_a
to occupied houses noted
on site layout



Check critical locations. The corner of site to be considered - all other locations are sufficiently far away not to require consideration

Critical zone is less than the 7m distance to the neighbour. The unit can be built in standard open panel timber frame

S_r is separation distance required

S_a is actual separation distance

$S_r < S_a = \text{OK}$

Figure 6: Example of application

3. Separating distances

3.1 Separation distances with separate and combined units

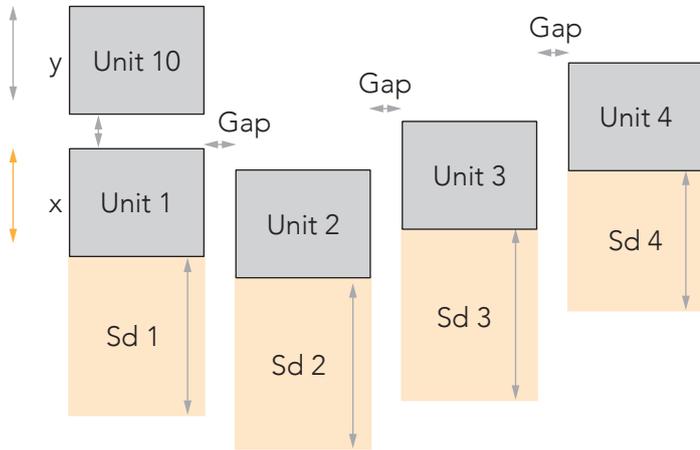


Figure 7: Separate units; where gaps between units >2m

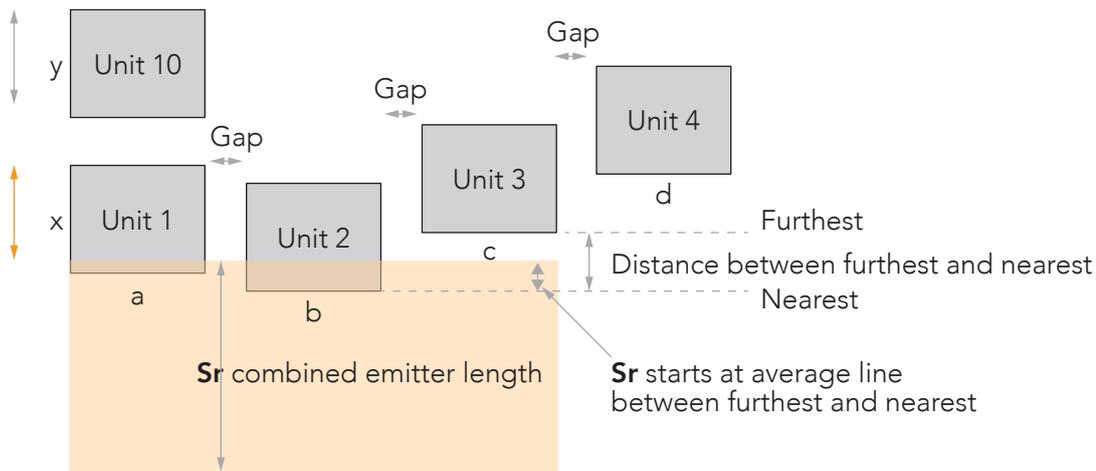


Figure 8: Three combined units; where gaps between units <1m

3.2 Risk mitigation

If the separation distance is not within the safe separation distance noted, then risk mitigation is required.

The STA Fire separation guidance document (ref 1 STA guidance 'Design guide to separating distances during construction for timber frame buildings') can be used to guide on the type of risk mitigation needed and options for Category B and C type frames. In addition to the STA Product Paper 4 for specific Category B and C options.

With any risk mitigation where multi plots are used in the emitter width, due to the plots being less than 2m apart, then in Category B and C type frames the emitter length can be reduced to the plot emitter length only.

3.3 Mixed risk category

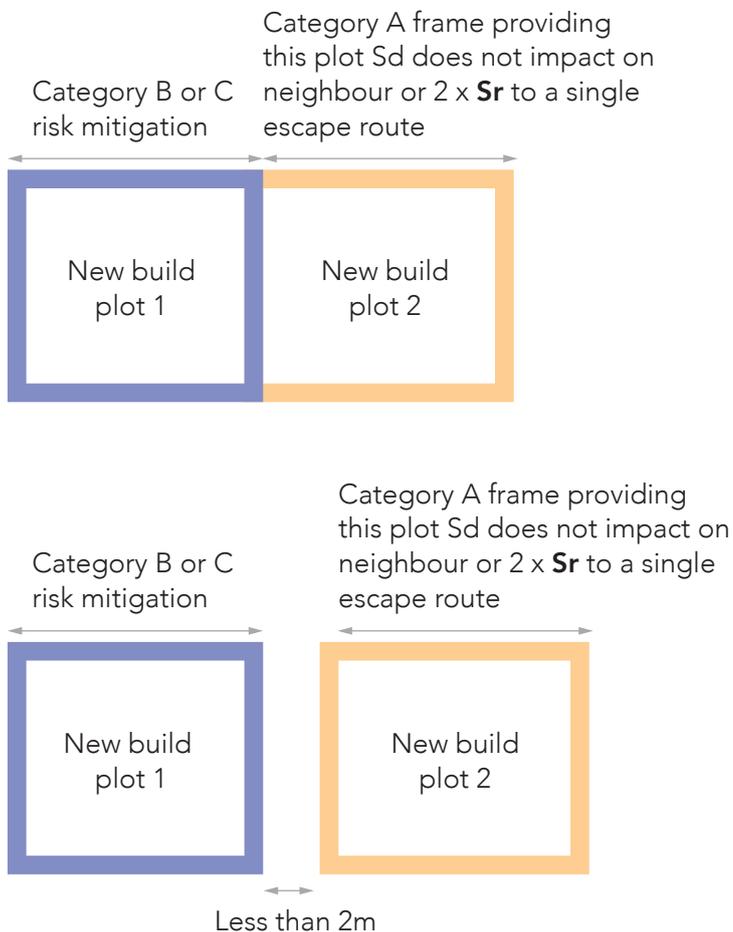
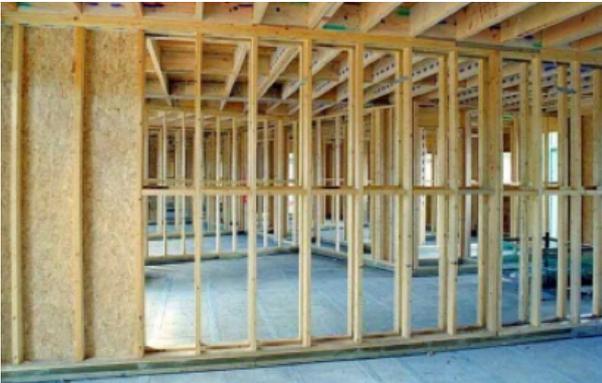
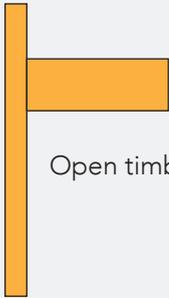
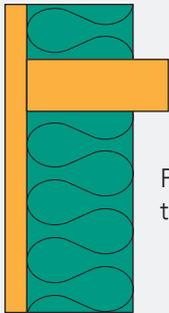
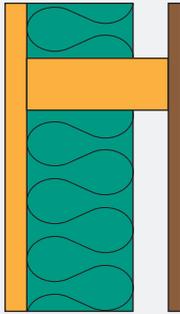
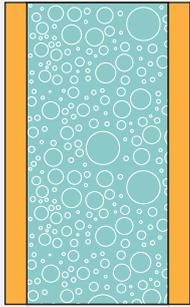


Figure 9: Mixed risk category

4. Structural timber frame types

4.1 Differing structures explained

TYPE	PICTURE	PICTURE
<p>Open timber frame</p> <p>Panel sizes to suit the project typically 2.4m to 5.4m lengths</p>		 <p>Open timber frame</p> <p>Timber based boards over timber stud work</p>
<p>Pre-insulated open timber frame</p> <p>Panel sizes to suit the project typically 2.4m to 5.4m lengths</p>		 <p>Pre insulated timber frame</p> <p>Insulation installed in the factory</p>
<p>Closed panel timber based</p> <p>Panel sizes to suit the project typically 2.4m to 12m lengths</p>		 <p>Closed panel timber frame</p> <p>Internal boarding timber based</p>
<p>Structural Insulated Panels (SIP)</p> <p>Pre-made panels from 1.2m to large whole house lengths up to 12m</p>		 <p>SIP panel timber frame</p> <p>Timber boards enclosing rigid insulation material</p>

5. Technical data

5.1 Technical data behind tables

Critical acceptance criteria for buildings 12.6kW/m² and 2.5kW/m² for escape routes.

In all cases the emissivity from flame is taken as 0.91

TYPE OF FRAME	EMITTER AREA PLUS PLUME HEIGHT	TEMPERATURE °C	MINIMUM DISTANCE
Standard timber frame open panel	Height to eaves + 20% plume height x width of building	600	3m
Pre-insulated open panel with mineral wool insulation types, plus wood sheathed closed wood faced panels with mineral wool insulation		650	3m
Pre-insulated open panel with rigid foam insulation types		750	3m
SIPs and wood sheathed closed panel with rigid foam insulation		750	3m

Document history

Version 1.0 June 2017

Version 1.1 June 2017

Typo corrected

Version 2.0 August 2018

Updates to table at the top of page 5, Sd replaced by Sa, Appendices 1 - 5 added (summary sheet guidance)

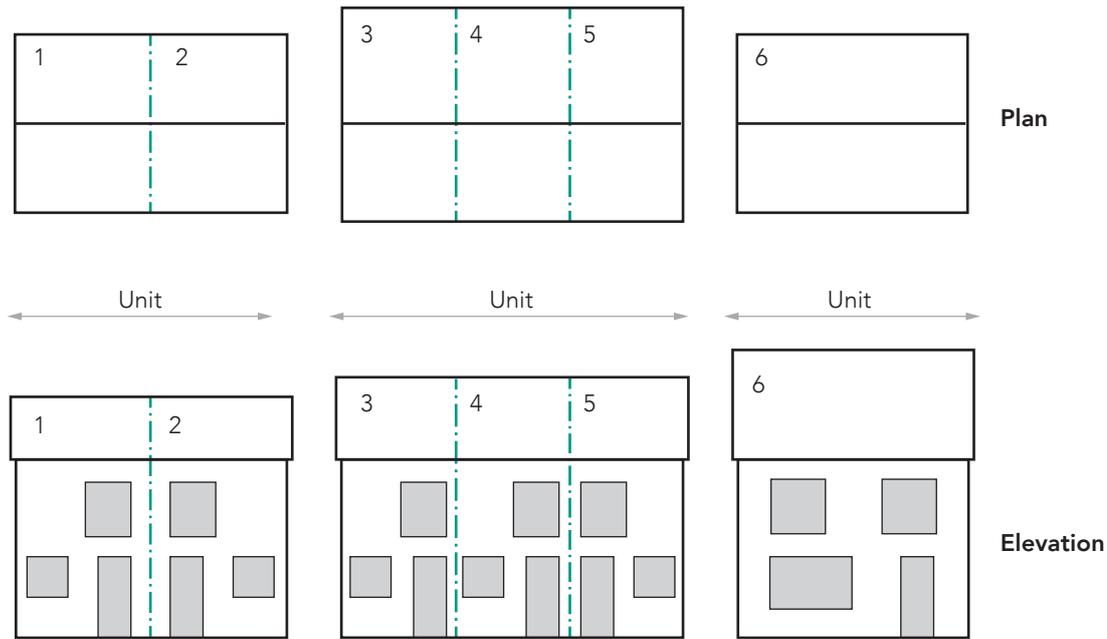
6. Appendices

Appendix 1: Determining overall project size/threshold

To determine if your project falls under the 250m² threshold follow steps A to E

A. What is a unit?

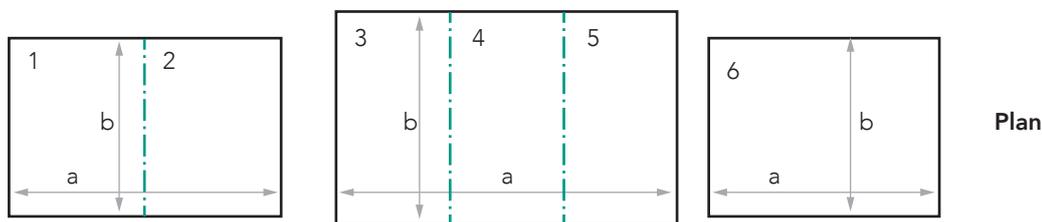
A unit is any new build building block that is continuous walling with no separation; detached house, terrace block, semi-detached block or flats.



Step A

B. How to calculate total floor areas of a unit

Take the internal dimensions of each unit. Total area of each unit to be less than 250m².



Unit - two semi detached houses

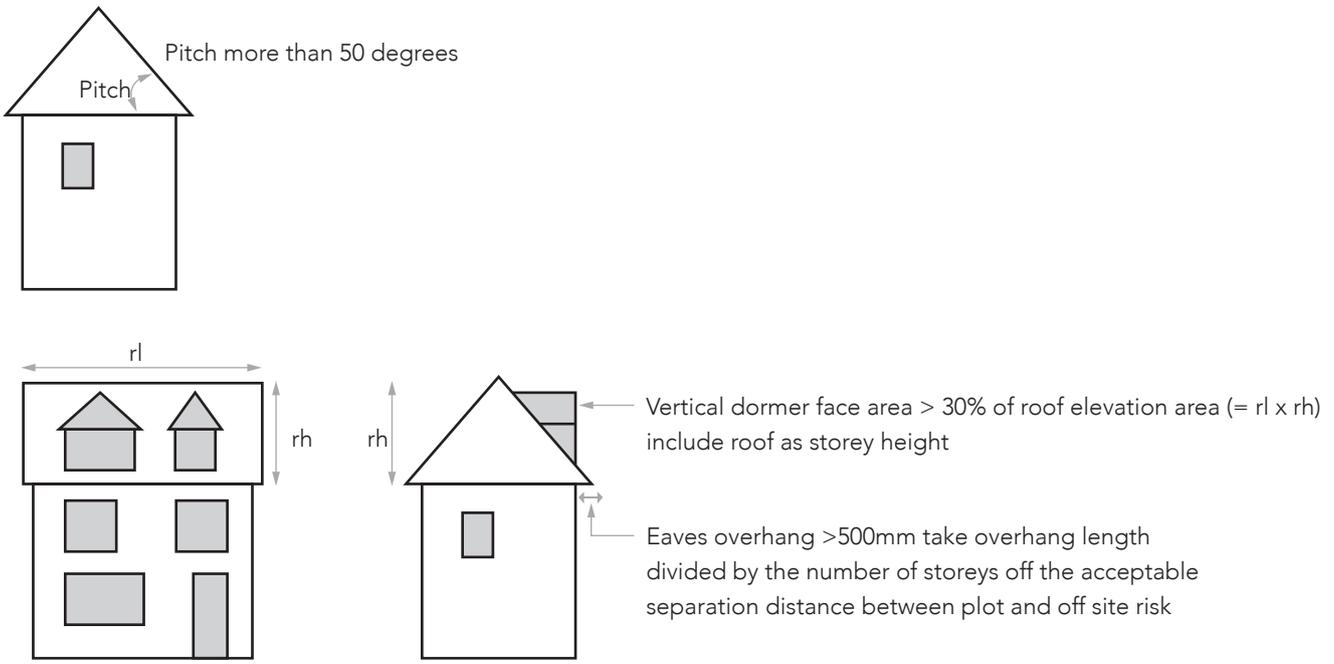
Unit - three terraced houses

Unit - detached house

Step B

C. Roof areas to include in the area calculation

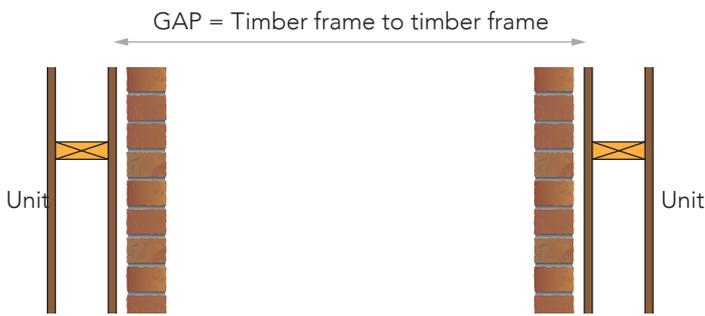
If the roof pitch is greater than 50 degrees then include in the calculation and determine floor area of the storey. If the roof pitch is less than 50 degrees then ignore as a storey. The use of roof space does not influence the outcome e.g. room in the roof or warm attic space.



Step C

D. Considering accumulative total floor area for adjacent units

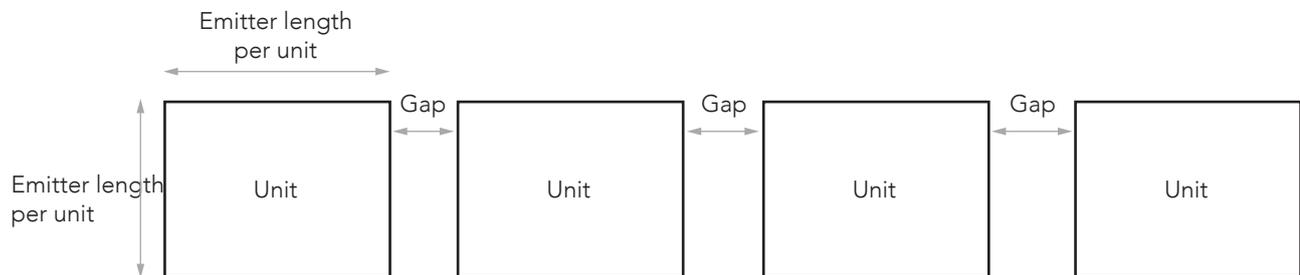
Determine the acceptable accumulative total floor area of units, which is dependent on the gaps between each distinct unit frame.



Step Da

D. Considering accumulative total floor area for adjacent units cont.../

For each unit the following to be considered:



If gap $>2\text{m}$ then assessment based on 1 unit at a time

If gap = $>1\text{m} <2\text{m}$ then assessment based on 2 units at a time

If gap = $<1\text{m}$ then assessment based on up to 4 units at a time

Step Db

E. Refer to STA Fire Safety Guidance

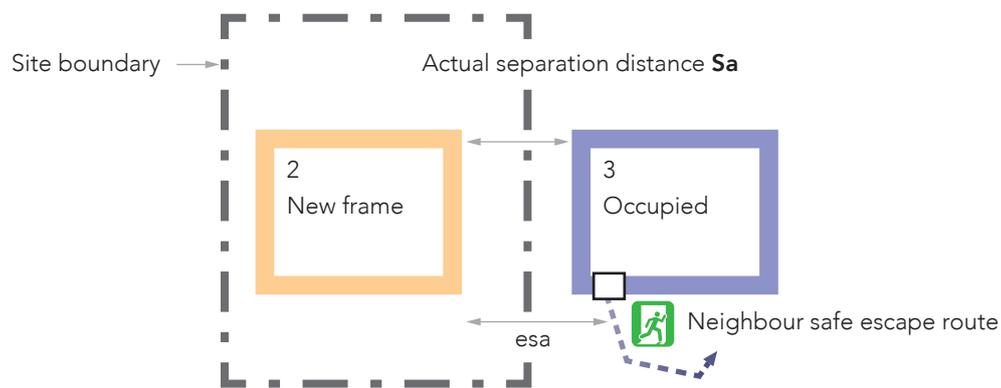
Use the STA fire safety guidance for structural timber frame buildings below 250m^2 in total floor area. See Product Paper 5 for tables and PP5 Appendix 2 for the application of tables.

Appendix 2: How to use the PP5 separation distance tables

Consider the site boundary

The site boundary is the area of land that is controlled by the principal contractor. Outside of the site boundary are lands and neighbouring property that cannot be controlled by the principal contractor.

Determine the separation distance between a new build frame and an occupied neighbour. Use the tables to plot the safe limit zone for fire spread risk - checking neighbouring escape routes as well.



esa = distance from new frame to door of escape route or 1m minimum from a door if opposite the new frame wall being considered

Figure 1 (Plan): Off site boundary and information to determine

For each occupied house opposite the new timber frame building carry out a review as shown in Figures 2 and 3.

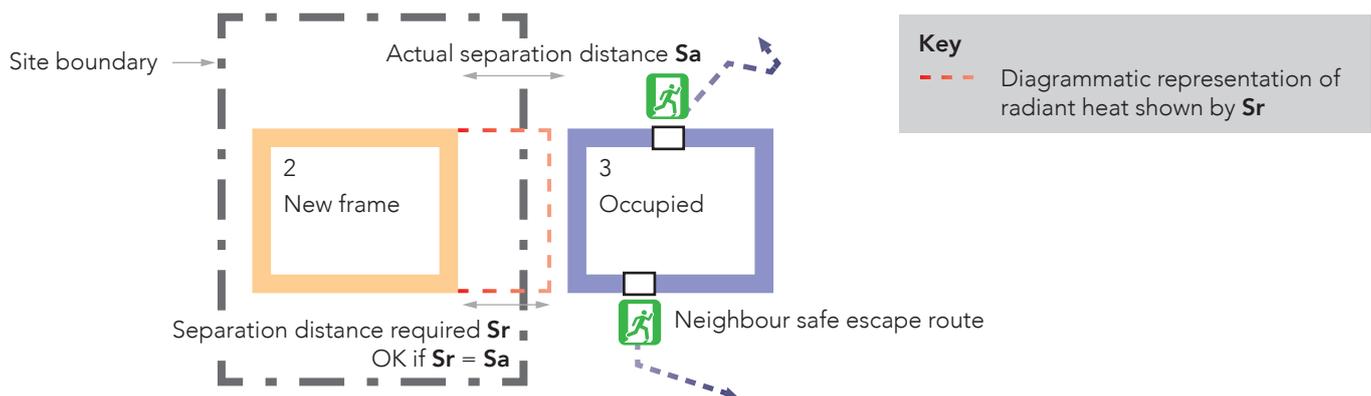


Figure 2 (Plan): No mitigation required as $S_r < S_a$, but escape routes to be checked

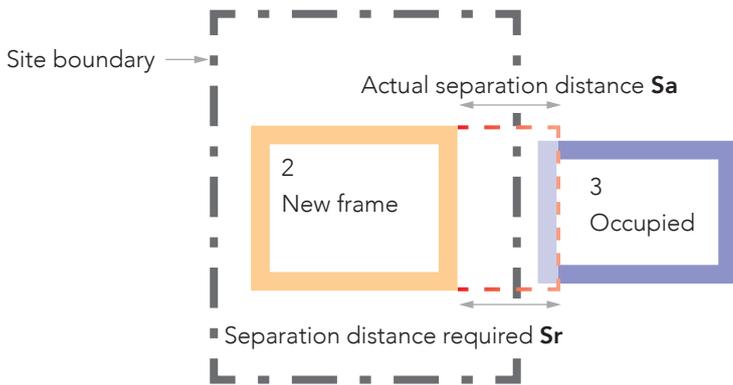


Figure 3 (Plan) Risk mitigation required as $S_r > S_a$

Check escape routes

Note that where the escape route is opposite the new build then the escape distance is 1m from the door to allow persons to escape. If the escape route is channelled to the new house the escape route allowable is to be considered in the assessment.

S_r calculated using PP5 tables.

Figure 4 shows an example where escape routes 1, 2 and 3 are all acceptable.

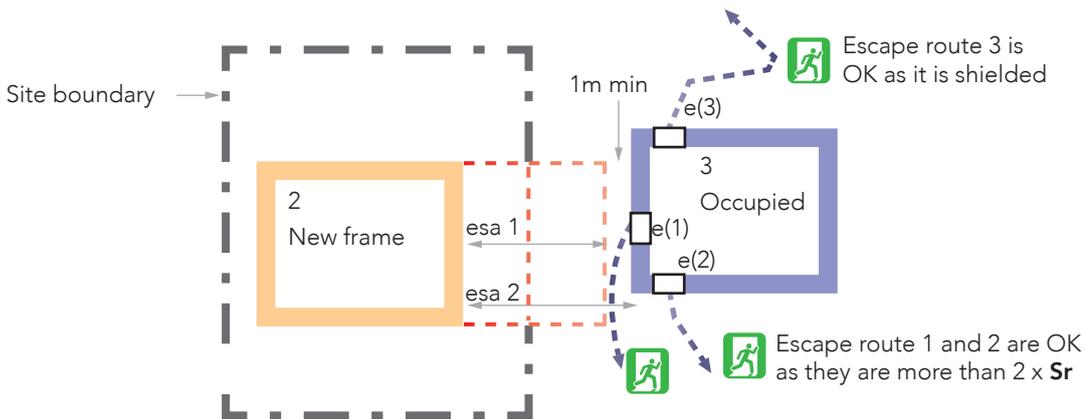


Figure 4 (Plan): Checks on escape routes where they are acceptable

Figure 5 shows that checks on escape routes that are not acceptable (escape route 1 and 2 in the example). Fire risk mitigation required if escape route 3 is not present.

Refer to STA Fire Safety Guidance for fire risk mitigation. Use the STA fire safety guidance for structural timber frame buildings below 250m² in total floor area. See Product Paper 5 for tables and PP5 Appendix 2 for the application of tables.

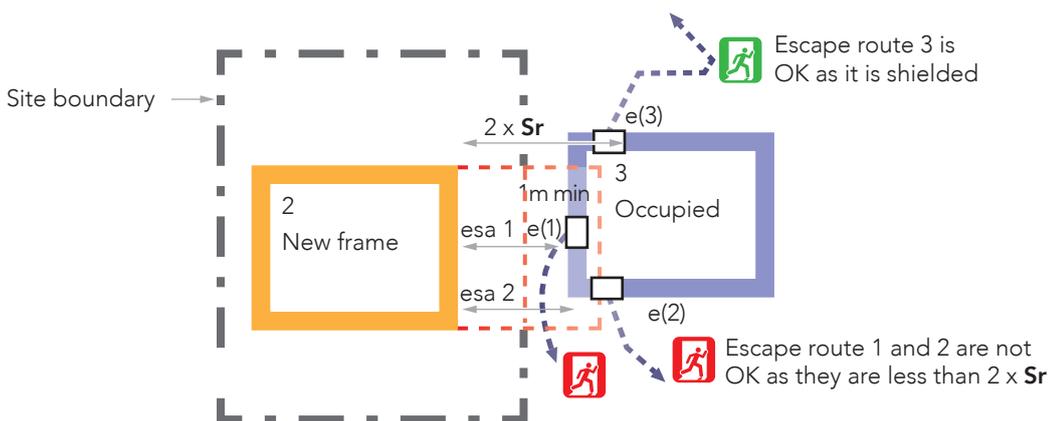


Figure 5 (Plan): Checks on escape routes where they are not acceptable

Appendix 3: Using separation distance tables on sites with multiple units

For multi-unit sites think about the phasing to determine which units are to be considered in any fire spread risk review.

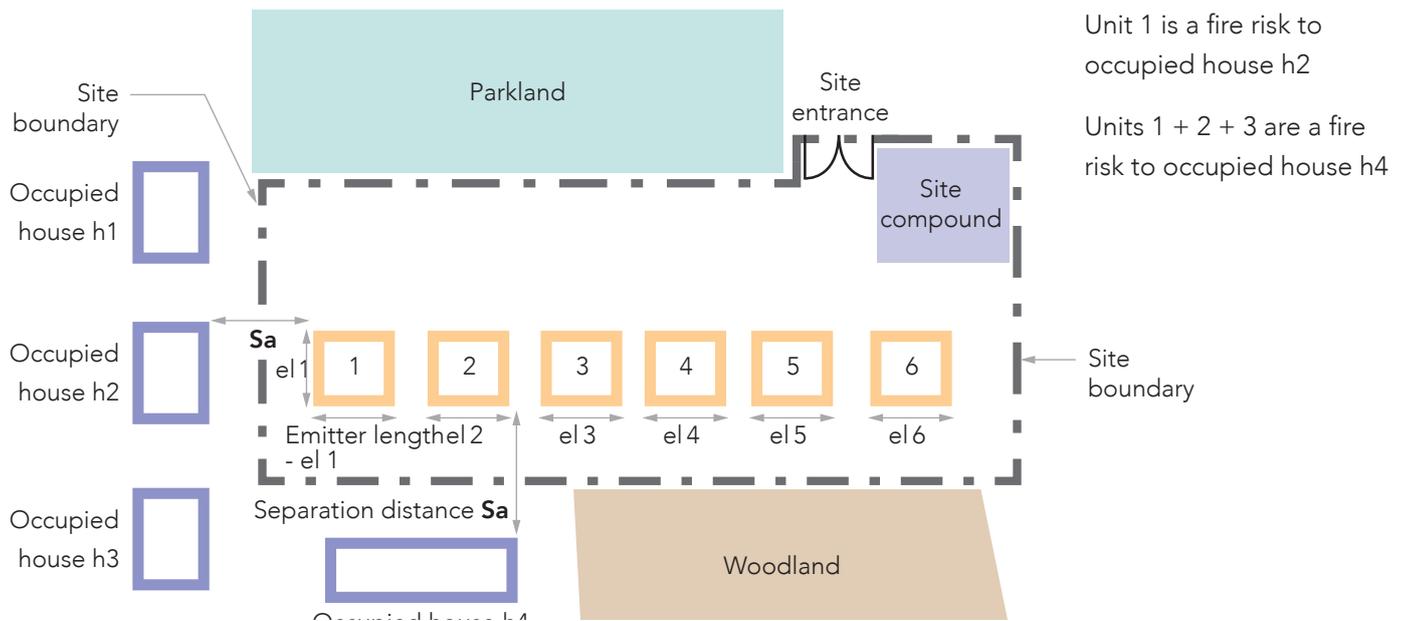


Figure 6: An example of full site with no handover/ phasing

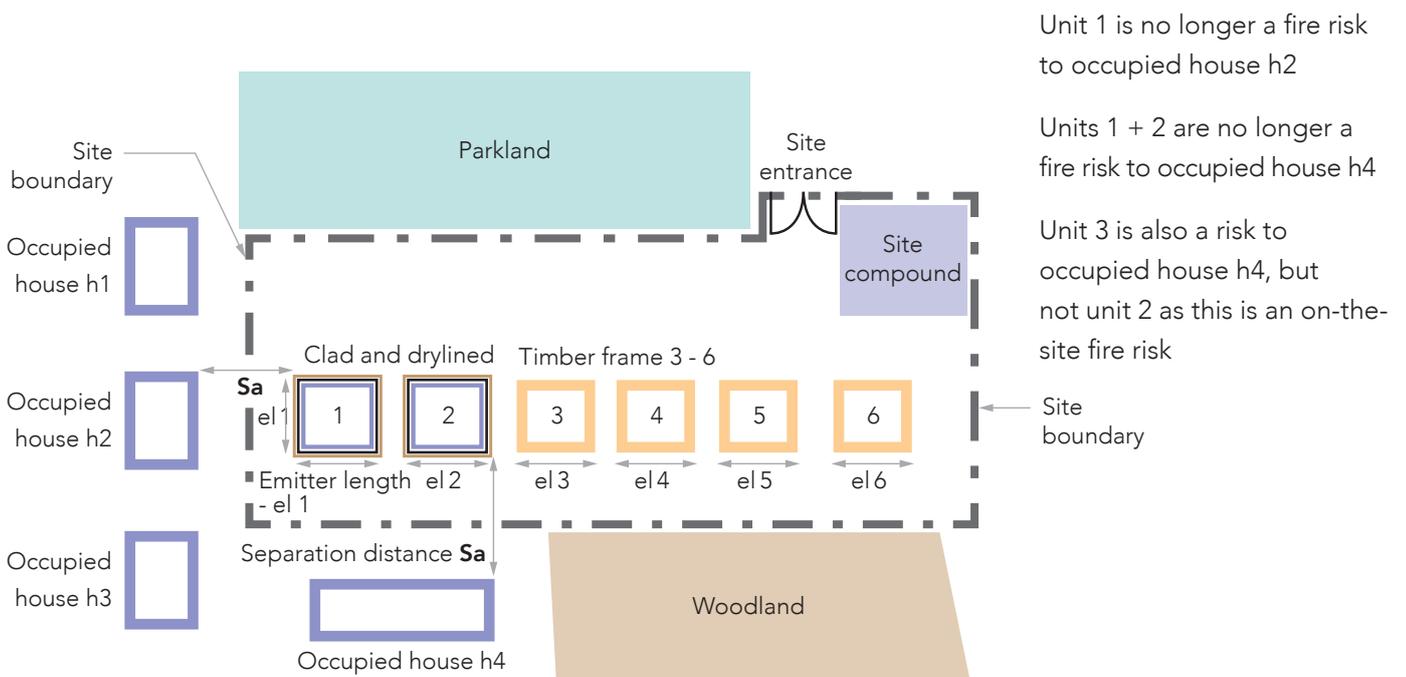


Figure 7: An example of full site but phased build programme - units 1 and 2 progressing in advance of units 3 to 6

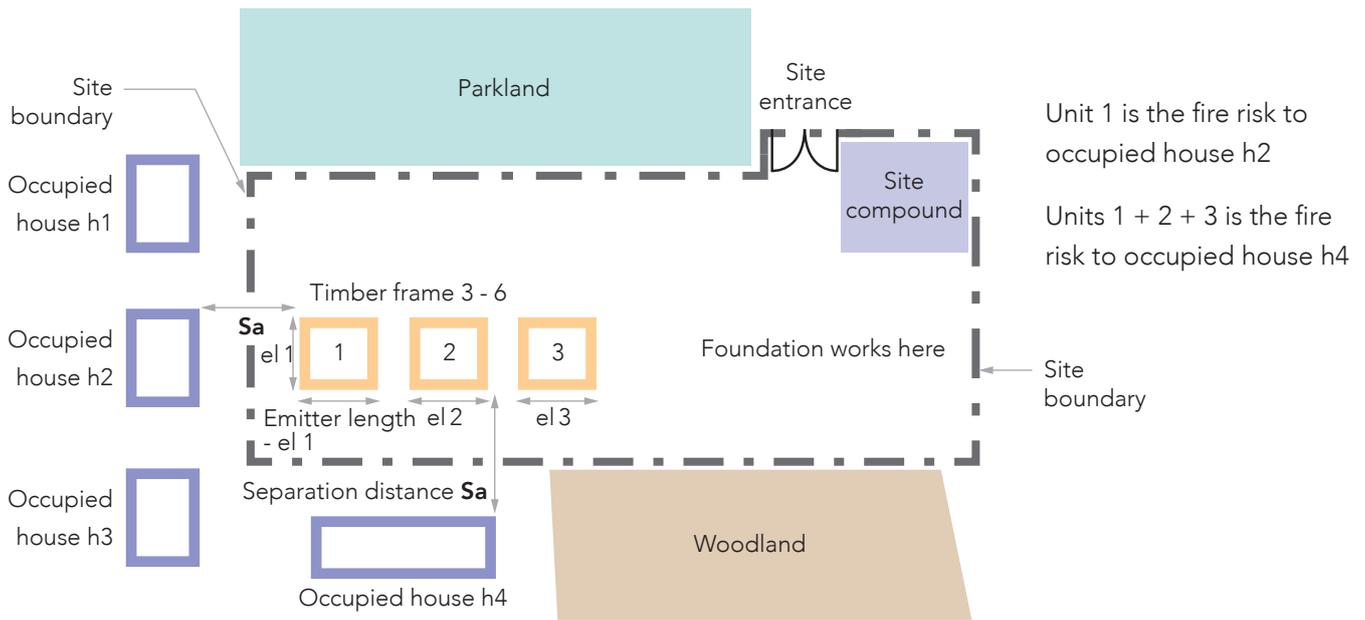


Figure 8: An example of full initial site but phased build programme - units 1 to 3 phase 1 construction in advance of 3 to 6

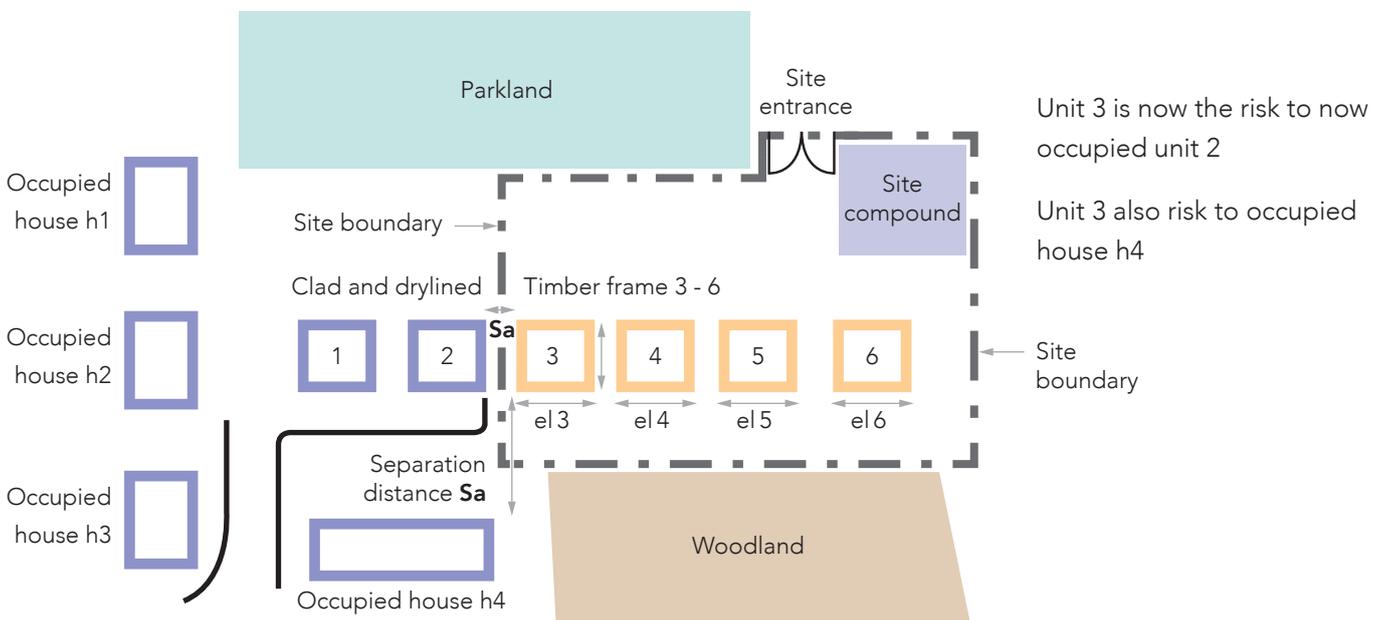


Figure 9: An example of phased build programme - units 1 and 2 handed over, so there is a site boundary change

Appendix 4: Using separation distance tables on sites with phased handover

As a follow on to PP5 Appendix 3, this paper details more complex phasing to determine which units are to be considered in any fire spread risk review.

See PP5 Appendices 1-3 for guidance on assessment process.

See PP5 Appendix 5 for summary guidance.

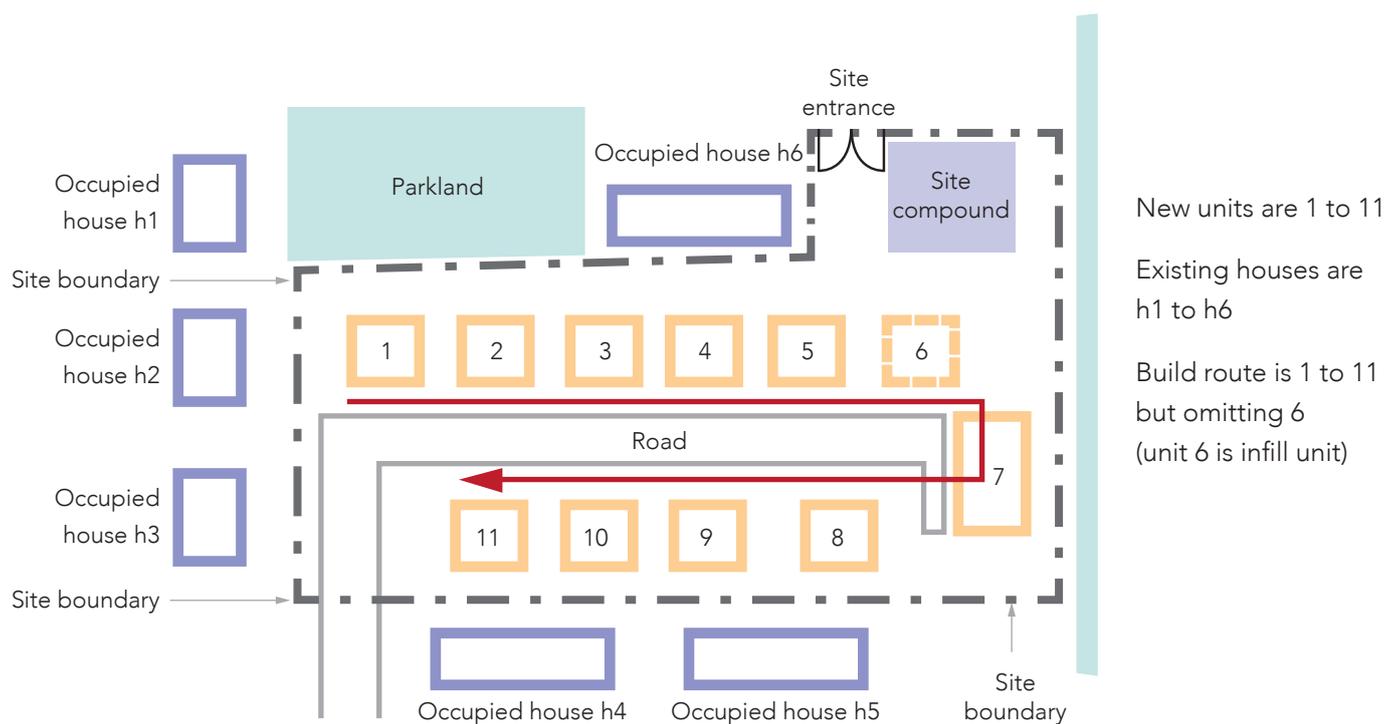


Figure 10: An example of a full site

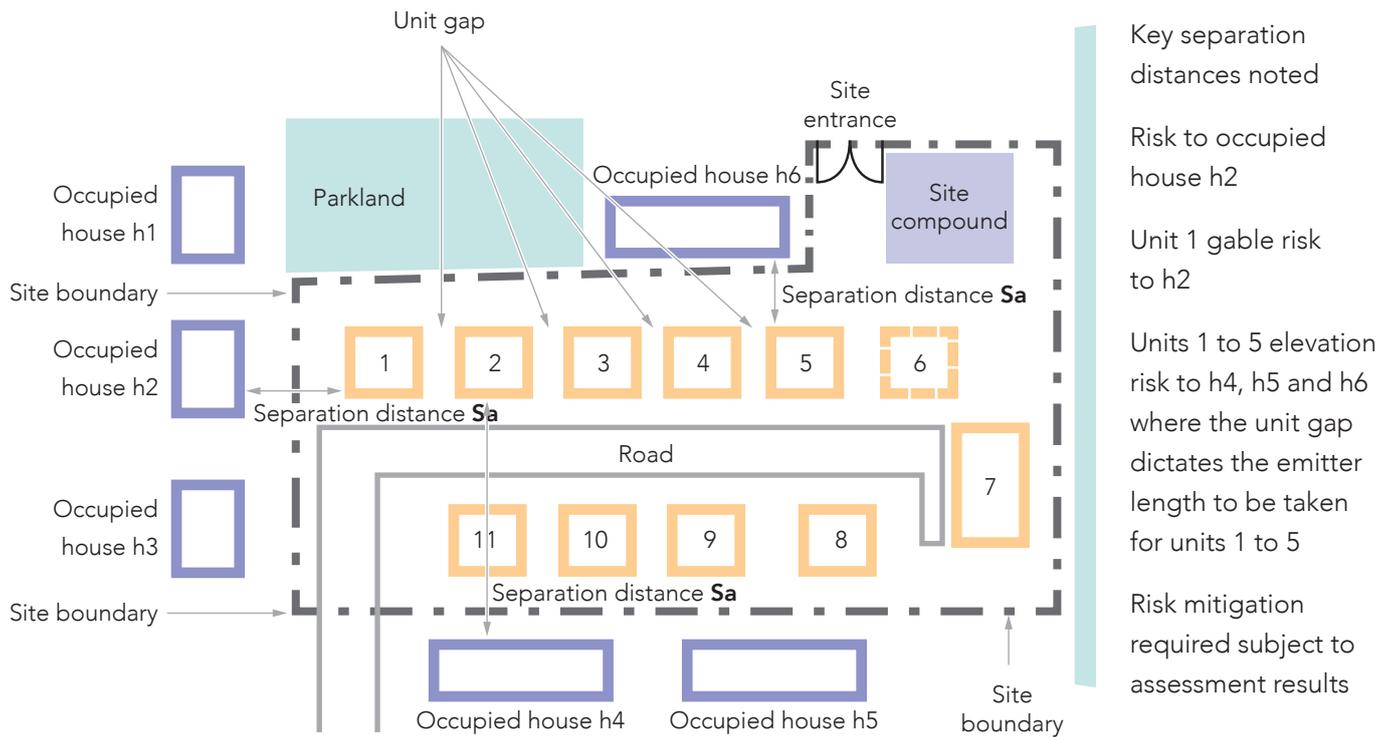


Figure 11: Phase 1 - five timber frame units to be built

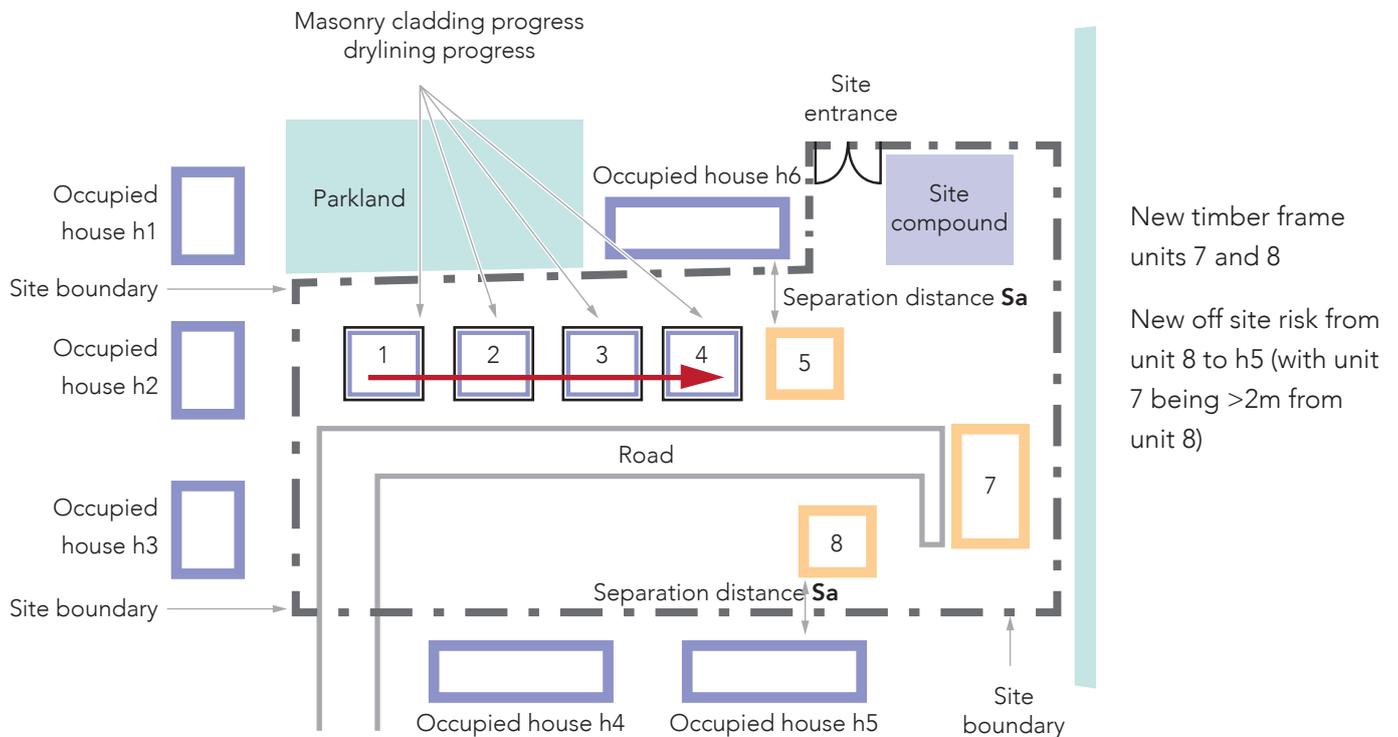
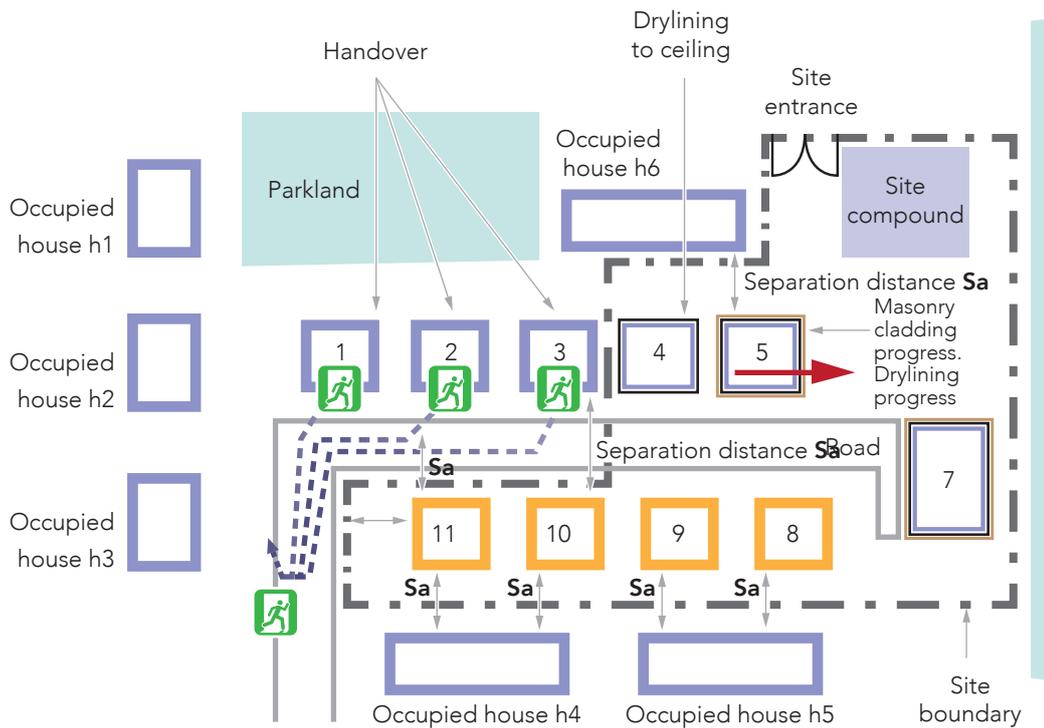


Figure 12: Site progression with masonry cladding and drylining works in units 1 to 4



Site boundary changes as noted

New timber frame units 9 to 11 - noted with off site risk separation distances

Escape routes for plots 1 to 3 are at risk and require checking

Potential risk from unit 4 to handed over plot 3. No risk if the unit has masonry cladding and been drylined. If not, then it requires assessment

Figure 13: Handover of units 1, 2 and 3, which become off the site risks

Appendix 5: Separation distance tables; key notes and advice

See PP5 Appendices 1-4 for guidance on assessment process.

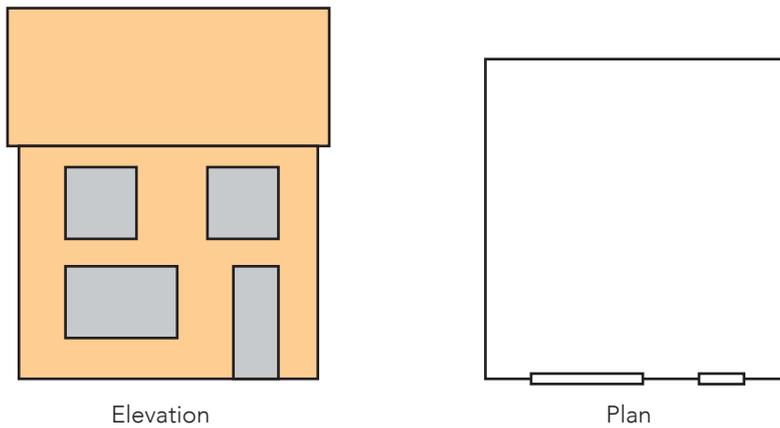


Figure 14: Exposed timber frame offers full face fire conditions and full risk mitigation may be required

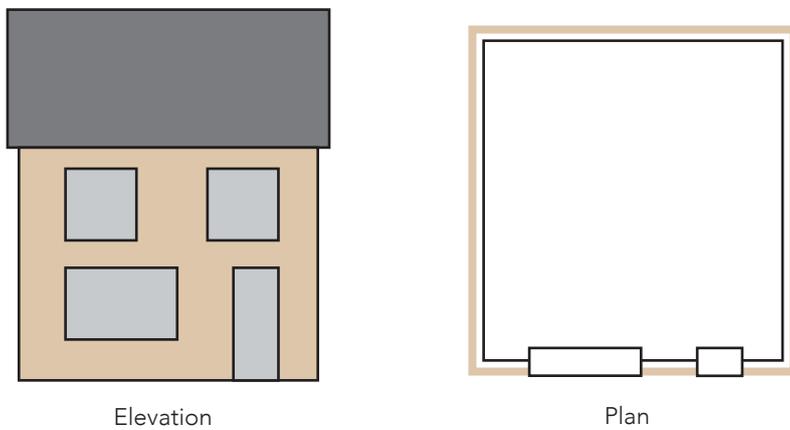


Figure 15: Once masonry clad, then the risk of fire is through the windows and the tables can be reduced by the same ratio of the percentage openings

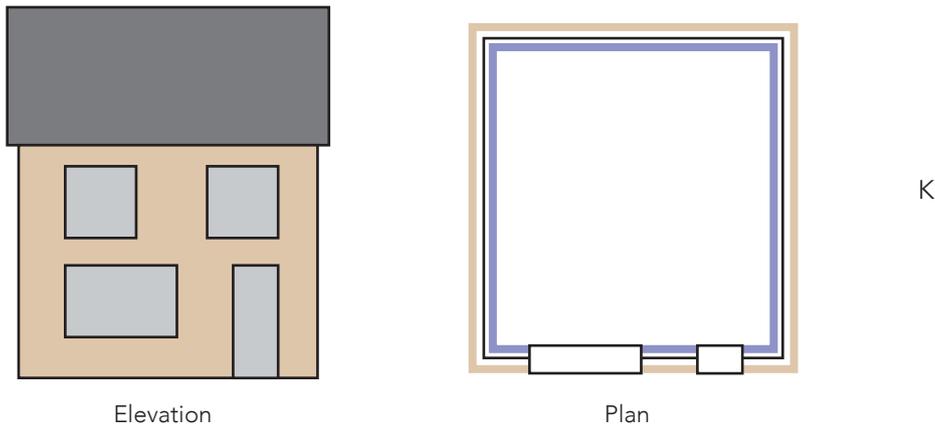


Figure 16: Once the masonry cladding and drylining is complete then full risk mitigation is in place

Separation distance from tables

once masonry clad - table distances

reduced by the % opening value

Separation distance from tables
once masonry clad - table distances
reduced by the % opening value

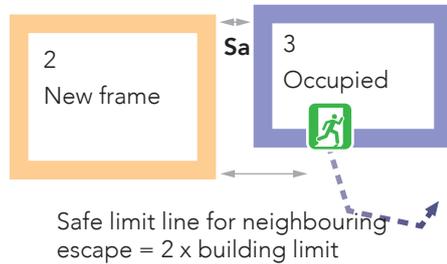


Figure 17: Separation distances for escape and buildings

Further reading

CDM and fire safety, You tube "Structural Timber Association - Designers Guide to fire safety" STA Product Paper 5

STA fire separation guidance parts 1, 2 ,3 and 4 (CLT)

HSE document - HSG 168

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