STA Advice notes

Robustness against fire

STRUCTURAL TIMBER ASSOCIATION
Building solutions in timber

No. 7 - Part 5, September 2014

Part 5 - Design of escape routes during the construction process

Introduction

This advice note provides design information on the subject of escape distances for workmen exiting a building that is under construction. It is part of a series of advice notes on the fire robustness of structural timber buildings. This document is written to be of use to structural timber site contractors, principle contractors, persons responsible for CDM compliance and project planners. This guidance is written to compliment Step 8 of the STA 16 Steps guidance.

The full set of documents under Advice Note 7 is as follows:

Part 1 - Design concepts for the in-service life of the building

Part 2 - Design and installation of fire stopping

Part 3 - Design and installation of cavity barriers

Part 4 - Introduction to fire robustness during construction

Part 5 - Design of escape distances during the construction process

The STA, working in conjunction with the HSE, Fire Protection Association and the Fire Service Bodies has reviewed procedures and this guidance, along with the STA 16 Steps to fire safety, is the output of the review and consultation. This guidance does not consider tower crane escape plans.

Primary documents that should be used on construction sites

- Joint Code of Practice on the Protection from Fire of Construction Sites and Buildings Undergoing Renovation', published by the Construction Confederation and The Fire Protection Association (Eighth Edition - January 2012 - ISBN 978-1-902790-64-0)
- HSG 168 Fire Safety in Construction published by the Health and Safety Executive, ISBN 9780717663453
- STA 16 Steps

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Escape routes and distances

In a fire the effects of smoke and heat can spread quickly. It is important not to overestimate how far people can travel before they are adversely affected by the effects of fire. Appropriate distances and the time taken to reach safety will depend on various factors, including how quickly the fire grows, the structure and layout of the building, the Tables 1 to 3 presented in this advice note provide maximum travel distances to a place of safety. The distances given are from the furthest location of the workman to an exit from the area of danger which is either outside at ground level or to a stairway or compartment protected against fire.

Escape route requirements

The requirements for escape routes are:

1. Providing two possible means of escape in case of fire, so that there is an alternative escape route should one become blocked by fire or smoke.
2. Escape routes are for all site personnel are to be clearly marked, maintained and kept clear at all times.
3. Escape routes will evolve as the building is constructed, which in turn means escape strategy reviews to ensure it is current and appropriate.
4. It is noted that at certain stages of the erecting process, the construction may not be complete enough to provide the appropriate escape route - in which case the scaffold access shall have temporary routes provided.
5. Ladders, appropriately secured, may be acceptable as escape routes for the initial storey lift, but in general ladders are not an accepted escape route method - unless it can be demonstrated that for minor areas it is acceptable.
6. If a protected route is adopted, this should be an escape stairway and route, to the outside of the building.
7. Escape distance is taken from the point of any work to either a protected route or to outside ground level. It is not taken to be the distance between alternative protected routes or access to outside ground levels.
8. There shall be a defined maximum distance to get safely out of the building (to the ground level point), or to a protected route out of the premises.
9. The maximum distance includes the combination of both horizontal and direct vertical distances.

General principles for escape routes during the construction process

1. A fire escape window or maintained opening in the building would provide an escape route out of a building, as long as it is also possible to escape outside the building via scaffolds and stairways nearby.
2. Protected route fire protection can comprise boards that are non-combustible or have durable limited combustibility boards, as noted as in STA Product Paper 4 (STA website download).
3. For internal stairs, fire protection must be provided on all outer face sides to form a protected route and shall include a fire door. For external stairs the fire protection need only be on the building side of the stairway and can either be wrapped around the stairs on three sides as figure 1a or horizontally as noted in figure 1b. Once a stair shaft is used as a protected route it requires fire protection all the way down to ground floor level.
4. Construction escape routes must be maintained at all levels until completion of the buildings in-service fire protection. The use of in-service escape stairs, once constructed, can be used as the escape routes during the construction process.
5. A working fire risk assessment needs to be updated to reflect the loss of the temporary escape routes and the changing nature of the building. i.e escape routes to be assessed and changes to suit circumstances.

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6. Doors to protected shafts must be the same fire resistance as the walls they are incorporated into. This may mean that they do not need to be a regulated 30 minute fire-resistant door, although the 30 minute door set would be a secure method of complying with the requirement.. The shafts under this definition are not firefighting shafts but zones from which the escape distances can be calculated.

7. The position and number of escape stairways is determined on a site specific basis, dependent upon the building size, shape, layout and stair protection.

8. Category B3, C and CLT framing to the building may allow the escape distance to be taken from the place of work to the point of egress from the enclosure or frame, provided no openings occur between the point of egress and the travel route to open space or a protected route; fire doors or Euro Class A1 and A2 boarding can be used to close off openings.

9. Once an internal stair shaft requires fire protecting this is to be continued all the way down to the ground level; for external protected routes see Figure 1 (page 12).

10 During the early stages for the structural building process the frame may be considered to have substantial openings in the roof or external walls, which would allow smoke and heat from any fire to readily disperse. The early stages of the building may have additional escape lengths on a case by case basis to assess the safety of the workforce taking account of the risk of exposure from radiation or direct impingement from a fire in the partially built structure. Any increase of distance relates to ground floor structural build only.

11 Alternative escape routes should, where possible, proceed in substantially opposite directions. The principle is that they are sufficiently apart that any fire should not immediately affect both routes. As such, they should not be less than 45^{o} apart.

12 Dead-end travel distances are significantly restricted. This is so workmen have time to negotiate their way past any fire between them and the exit before it threatens their escape.

13 Structures in an advanced fitting-out stage, e.g. where exposed structural timber has been covered by the in-service fire protection. It is likely that the escape routes will follow in-service design escape routes, however, checks are needed to determine if they are suitable and complete. If not an assessment is needed and additional temporary routes introduced.

14 There is no requirement for specific fire resistance as would be required for the in-service building regulation requirement such as 30 mins or 60 mins. Walls to be considered as a vertical fire barrier in a protected route should be Category B3 to C format; see STA Product Paper 4 for wall with 4 to 5 points in value to comply.

15 Where a fire engineering solution is incorporated as the in-service fire escape plan strategy, for example fire suppression systems and smoke extraction, specific during construction escape design is to be carried out.

Categories of structural timber frames

In terms of robustness against fire spreads during the construction process the STA have frame categories so that the choice of structural timber building system at the design phase can be determined appropriate for the site fire risk assessment.

Category A - Standard timber building system; walls, floors and flat roofs

Category B - Reduced fire spread; walls, floors and flat roofs

Category C - Fire spread resistant; walls, floors and flat roofs

Category CLT - Walls, floors and flat roofs

These Categories of structural timber frame are explained in the STA guidance “Design guide to separating distances during construction”.

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Travel distance rules for escape travel distances

There shall be a target maximum distance for workmen to get safely out of the building, or to a protected route to lead them out of the building. The type of category of structural timber frame will influence the acceptable escape distances. The travel distance rules are presented in four example sets:

Example set 1 - Target escape route distances from within standard timber frame constructions (Category A)

Example set 2 - Target escape route distances from the external areas of standard timber frame constructions (Category A)

Example set 3 - Target escape route distances from within enhanced timber frame constructions (Category B, C and CLT)

Example set 4 - Target escape route distances from the external areas of enhanced timber frame constructions (Category B, C and CLT)

The maximum distances for structural timber buildings that do not follow STA Site Safe strategy (refer to STA 16 Steps) is 25m in HSG 168 (in addition to a one way travel distance limit of 12m referred to as a 'dead end'). For Category A frames this can be extended to 35m (dead end 15m) where enhanced fire safety strategies are put in place such as STA Site Safe strategy and inclusion of fire alarm systems. STA guidance on alarms include strategically placed automatic fire detection or other equally effective measures to give the earliest warning of fire to site personnel. For Category B, C and CLT frames increased travel distances are acceptable as noted in example set 3.

Worked examples of the 35 metre rule using standard timber building system (Category A):

Two storey building

Solution 1 - A 3 metre high unprotected external stair case to the scaffold (ground to first floor level), the maximum permitted distance of travel on the first floor to that stair is 32 metres (35 metres less the 3 metres travel down the unprotected stair).

Solution 2 - Adding a Category C type vertical fire wall to the external scaffold stair (as figure 1a or 1b) would increase the permitted travel distance to the stair from any place of work to a maximum of 35 metres.

Five storey building

A 12 metre high unprotected external scaffold stair from fifth floor level to ground level, the maximum travel distance from any place of work at the fifth floor would be 23 metres (35 metres less the 12 metres travel down the unprotected stair).

Adding fire protection (for example Category C type wall frame/boarding) to the stair exit would increase the permitted travel distance to the stair enclosure to 35m.

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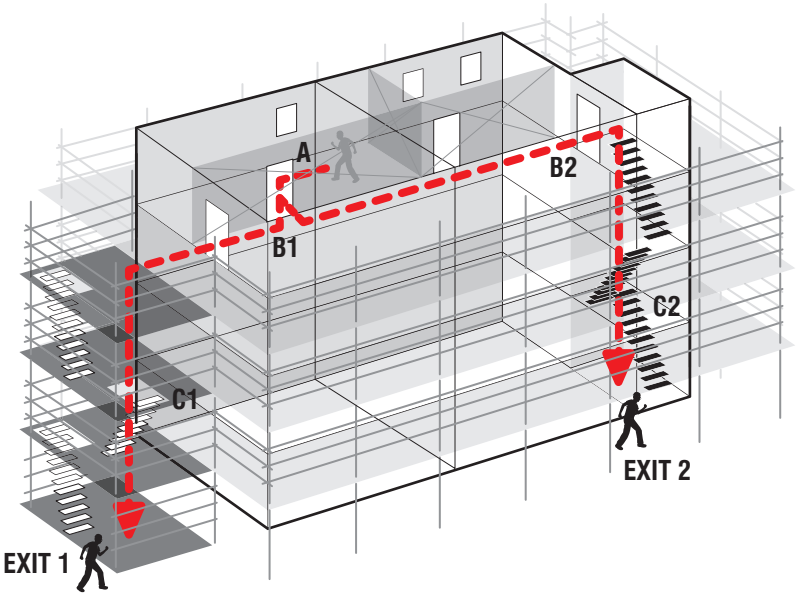
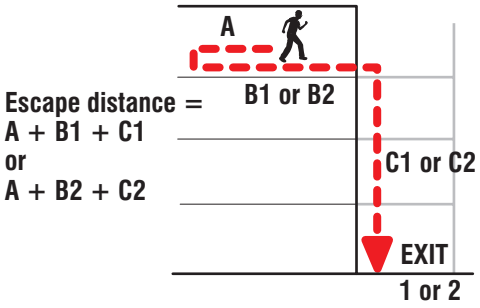
Example set 1
Target escape route distances from within standard timber frame constructions (Category A)

Reference	Situation and description	Diagramatic picture
Internal escape 1	**External scaffold exits and internal stair cores for persons from within the building** Category A standard structural timber frame with combustible ceilings and walls through the building route (dimensions A and B) Exit routes with full 16 Steps and STA membership guidance can be: A+B1+C1 or A+B2+C2 <= 35m Otherwise 25m A < 12m (dead end distance) A dead end is the room in which the worker is in and the distance to the point of alternative routes ***NOTE:*** *Distance C1 and C2 assumes that stair flights occur in the same tower / zone and there is no more than 3m horizontal distance between flights. If this is not the case the distance between flights shall be added to the calculation for travel distances stairs*	  **Escape from unprotected building / scaffold routes**

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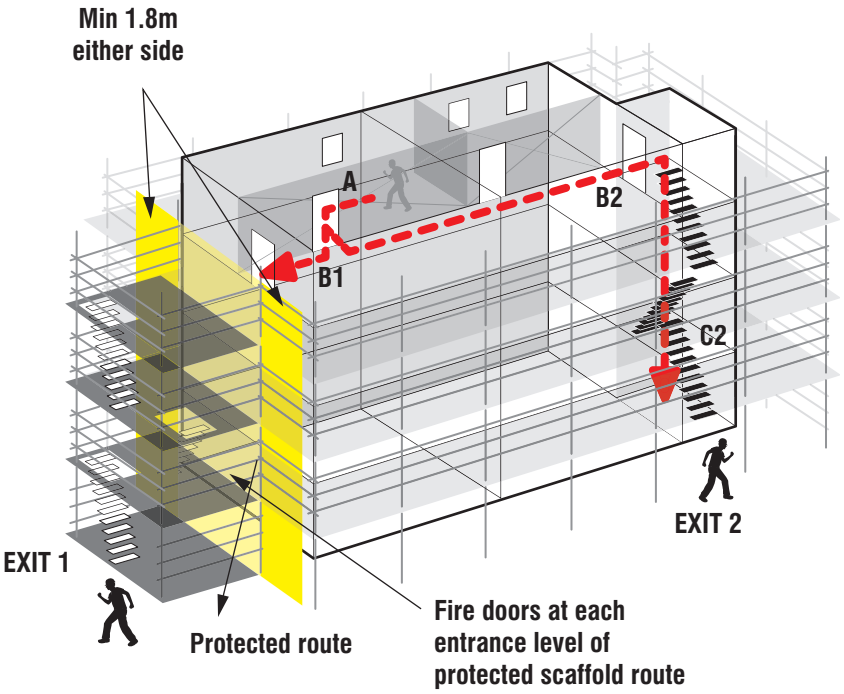
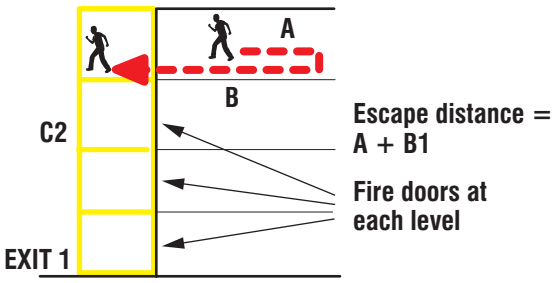
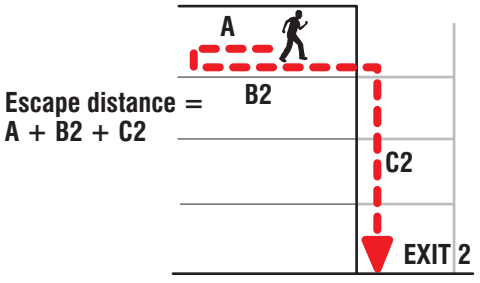
Example set 1 continued.../

Reference	Situation and description	Diagramatic picture
Internal escape 2	**Use of protected external exits** Category A standard structural timber frame with combustible ceilings and walls through the building route (dimensions A and B) Exit routes with full 16 Steps and STA membership guidance can be: A+B1 <= 35m Otherwise 25m A < 15m (dead end distance) A dead end is the room in which the worker is in and the distance to the point of alternative routes	  For each floor level with protected route  For each floor level without a protected route

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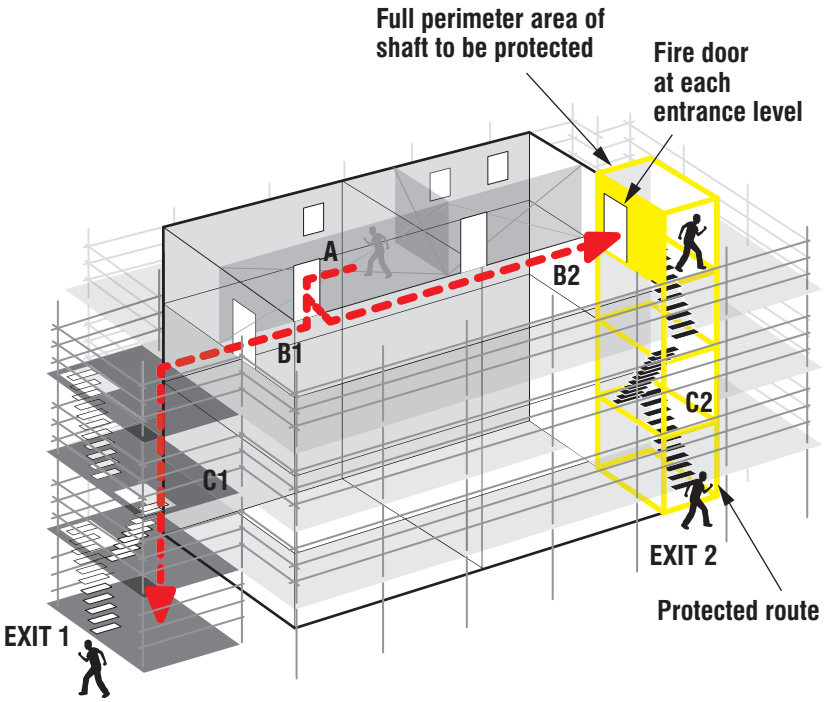
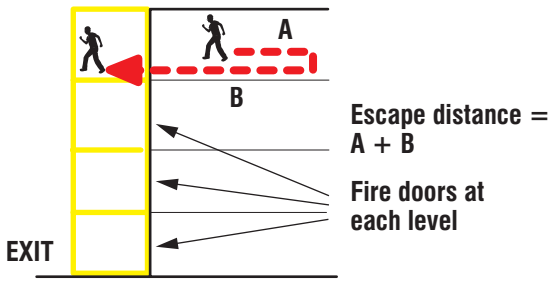
Example set 1 continued.../

Reference	Situation and description	Diagramatic picture
Internal escape 3	**Use of protected internal exits** Category A standard structural timber frame with combustible ceilings and walls through the building route (dimensions A and B) Exit routes with full 16 Steps and STA membership guidance can be: A+B1 <= 35m Otherwise 25m A < 15m (dead end distance) A dead end is the room in which the worker is in and the distance to the point of alternative routes	  **Escape to protected scaffold route**

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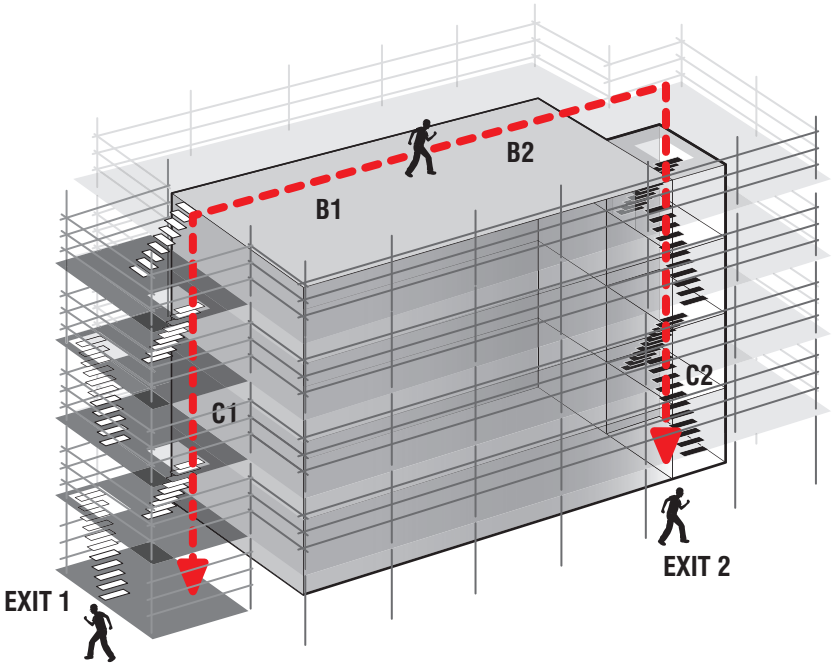
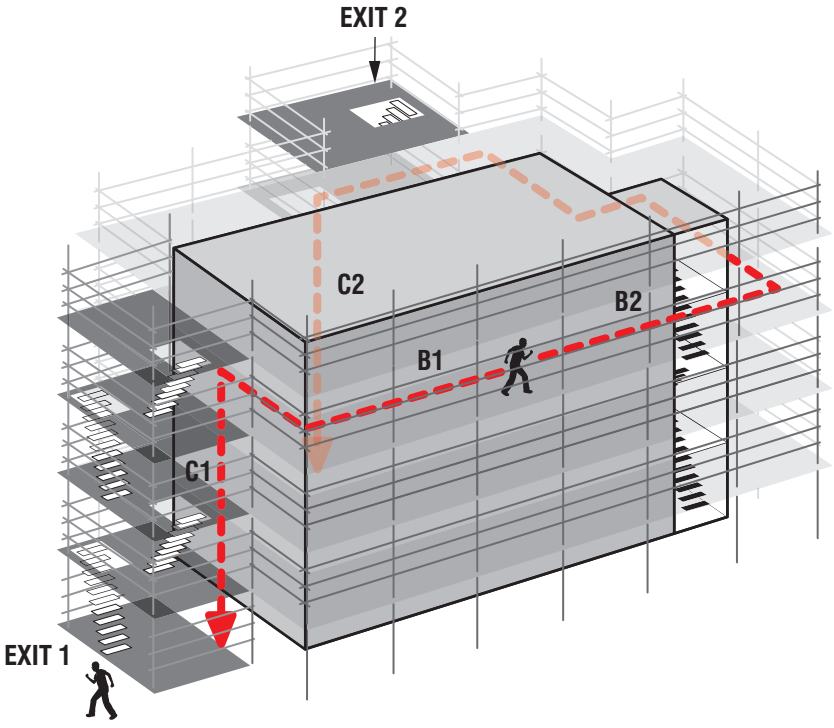
Example set 2
Target escape route distances from the external areas of standard timber frame constructions (Category A)

Reference	Situation and description	Diagramatic picture
External escape 1	**Exit from a roof** Exit routes with full 16 Steps and STA membership guidance can be: B1+C1 or B2+C2 <= 35m Otherwise 25m Use of protected routes can be used as in external escape 2 and 3	
External escape 2	**Exit from the scaffold** Exit routes with full 16 Steps and STA membership guidance can be: B1+C1 or B2+C2 <= 35m Otherwise 25m Dead end distance to be a maximum of 15m Use of protected routes can be used as in external escape 2 and 3 ***NOTE:*** *Distance C1 and C2 assumes that stair flights occur in the same tower / zone and there is no more than 3m horizontal distance between flights. If this is not the case the distance between flights shall be added to the calculation for travel distances stairs*	

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Example set 3
Target escape route distances from within enhanced timber frame constructions (Category B, C and CLT)

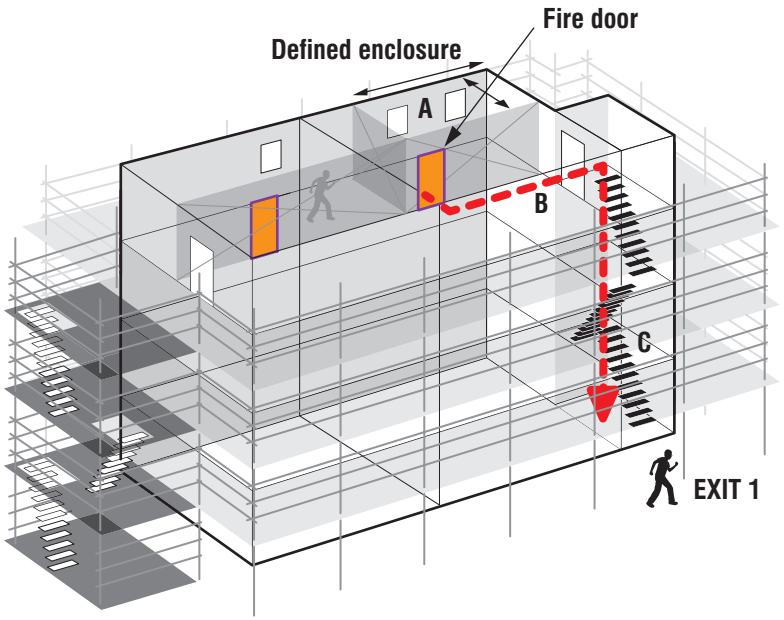
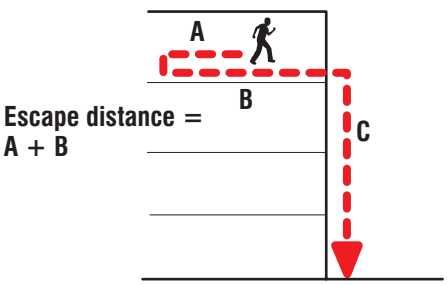
Structural timber building categories:

Category A standard structural timber frame with combustible ceilings and walls through the building route.

Category B reduced fire spread structural timber frame throughout the building route. Note that in Category B flammable and combustible materials are present, but the spread of fire will be slower than in standard timber frame. For small fires the use of FR Build flame retardants will stop the fire from spreading. FR Build is the STA test procedure for flame retardants and products that have passed the testing and are listed on the STA website.

Category C fire resistant structural timber frame with limited areas of combustible walls and floors through the building route. Note that in Category C flammable and combustible materials are present, but of such a type and disposition that any fire will initially be localised.

Category CLT covers structures using cross laminated timber panels and other solid wood panels of a thickness in excess of 60mm. Spread of fire across the surface within the area of the fire is high, but it will be contained in the enclosure or to a limited width on a facade. It is worth noting that a fire on a facade can rapidly spread vertically.

Reference	Situation and description	Diagramatic picture
1	**Category B frames** Exit routes with full 16 Steps and STA membership guidance can be: A+B+C <= 40m A < 17m (dead end distance) A dead end is the room in which the worker is in and the distance to the point of alternative routes ***NOTE:*** *Distance C assumes that stair flights occur in the same tower / zone and there is no more than 3m horizontal distance between flights. If this is not the case the distance between flights shall be added to the calculation for travel distances stairs*	 

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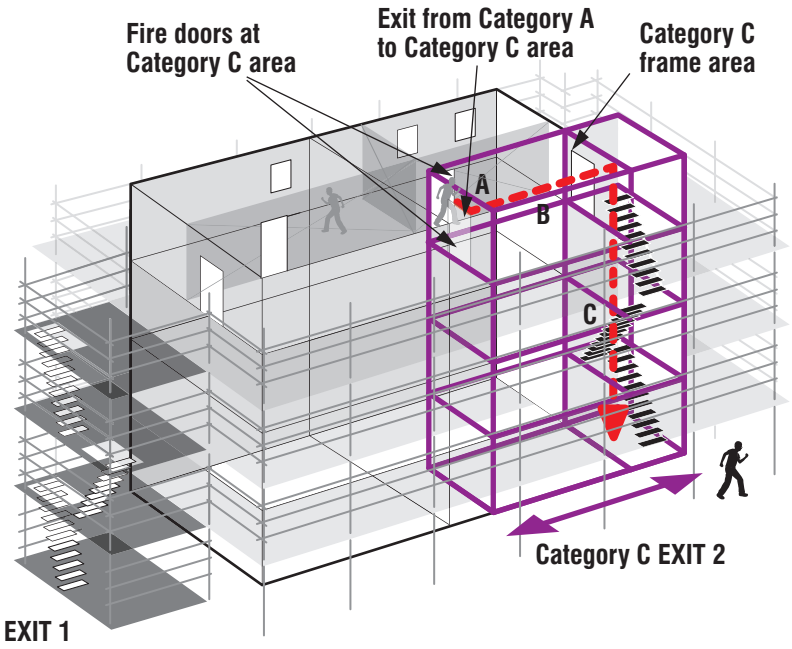
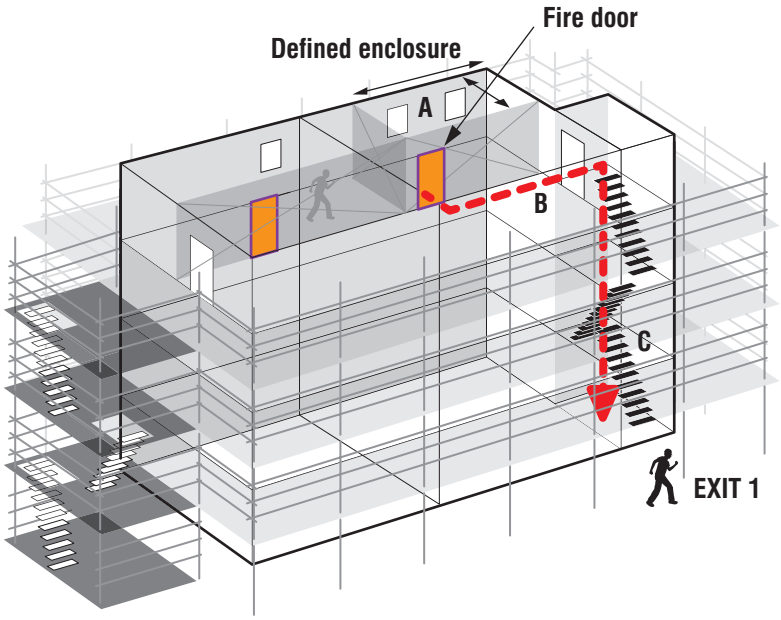
Example set 3 continued.../

Reference	Situation and description	Diagramatic picture
Enhanced internal escape 2	**Category C frames** Exit routes with full 16 Steps and STA membership guidance can be: A+B+C <= 45m or with partial Category C areas for areas B and C routes within the Category C enclosure: A+B+C <= 40m A < 18m (dead end distance) A dead end is the room in which the worker is in and the distance to the point of alternative routes	 **Category A standard timber frame - plus Category C fire resistant enhancement**
Enhanced internal escape 3	**Category CLT** CLT structures can be compartmented by including fire doors at entrances. When this is the case the following is acceptable Exit routes with full 16 Steps and STA membership guidance can be: Internal escape distance to external scaffold routes or internal stairs A+B+C <=35m Internal escape distance to protected shaft A < 15m B < 35m where B takes you to the fire door entrance of the protected shaft as given in example set 1, number 3 Dead end distance in all cases A < 15m A dead end is the room in which the worker is in and the distance to the point of alternative routes ***NOTE:*** *Distance C assumes that stair flights occur in the same scaffold tower / zone and there is no more than 3m horizontal distance between flights. If this is not the case the distance between flights shall be added to the calculation for travel distances stairs*	

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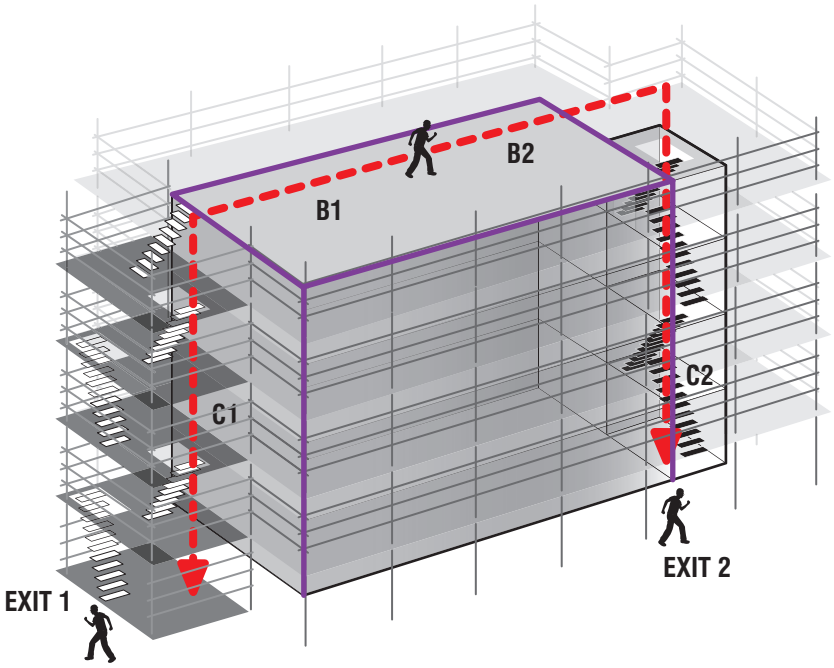
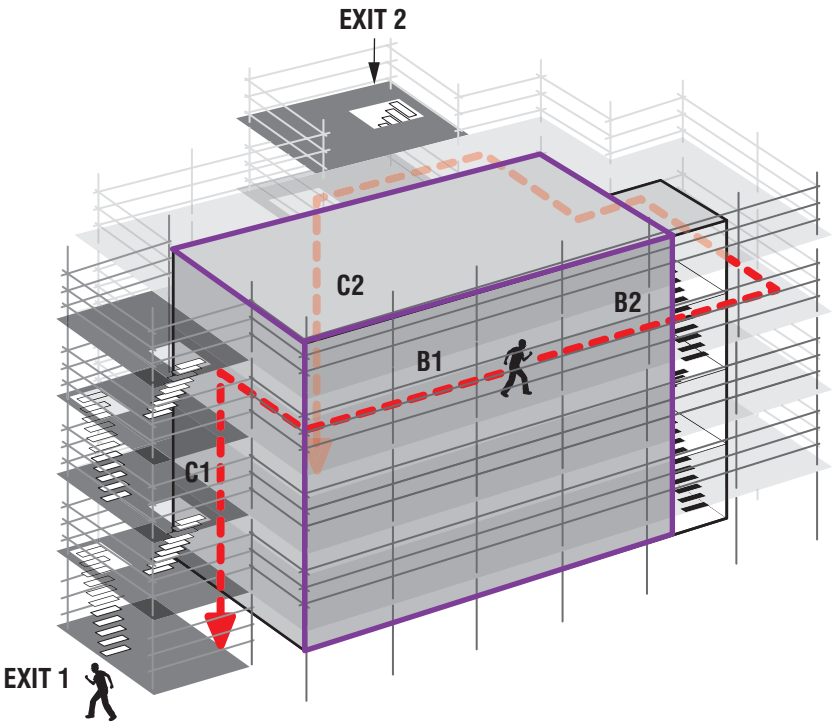
Example set 4
Target escape route distances from the external areas of enhanced timber frame constructions (Category B, C and CLT)

Reference	Situation and description	Diagramatic picture
Enhanced internal escape 4	Exit routes with full 16 Steps and STA membership guidance can be: Category CLT B1+C1 or B2+C2 <= 35m Category B B1+C1 or B2+C2 <= 40m Category B3 or C1 B1+C1 or B2+C2 <= 45m Category C2 B1+C1 or B2+C2 <= 55m ***NOTE:*** *C2 for the full route of the escape means windows and openings are covered.* For CLT with covered windows along the route of escape the distance can be 55m	 **Timber frame B and C and CLT categories**  **Timber frame B and C and CLT categories**

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Protected stair routes (plan drawings)

Figure 1a

Protected external stair route option

NOTE: *Fire door is required in the protected face*

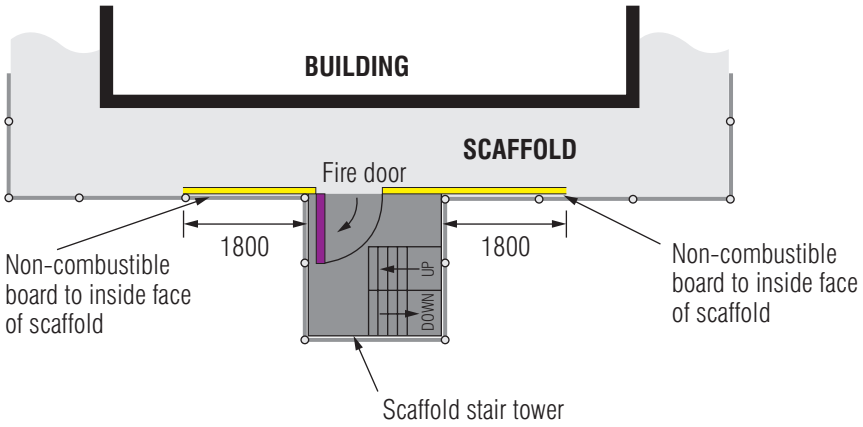
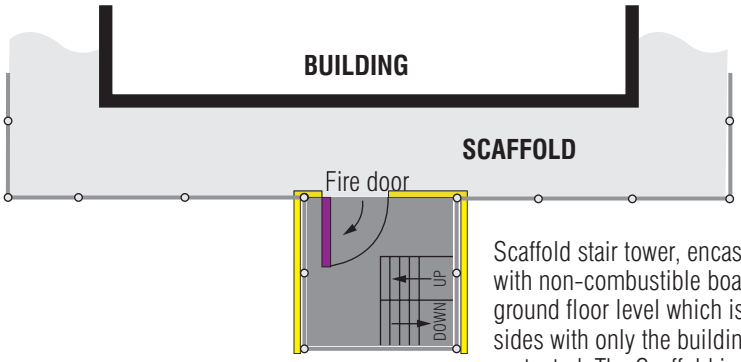


Figure 1b

Protected external stair route option

NOTE: *Fire door is required in the protected face*



Scaffold stair tower, encased on all sides with non-combustible board - except ground floor level which is open on 3 sides with only the building side being protected. The Scaffold is inside the boarding and is protected.

Figure 1c

Protected internal stair route option for the full height of the building

NOTE: *A fire door is required at the entrance of the protected shaft.*

Fire door to have smoke seals

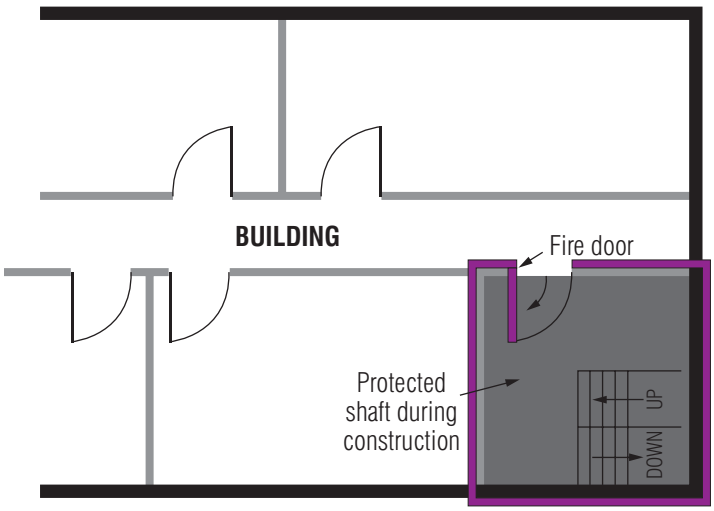


Figure 1 Protected stair route options (external/internal)

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