# Fire assessment report

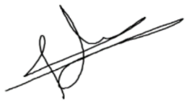
## 78 mm thick Speedpanel wall systems installed in scissor stair configurations

Sponsor: Speedpanel Holdings Pty Ltd and H B Fuller Company Australia Pty Ltd

Report number: FAS220241 Revision: R1.0

Issue date: 26 October 2022 Expiry date: 31 October 2027

# Quality management

| Version | Date | Information about the report | | | |
|---|---|---|---|---|---|
| R1.0 | Issue: 26/10/2022 | Reason for issue | Initial issue | | |
| | | | **Prepared by** | **Reviewed by** | **Authorised by** |
| | Expire: 31/10/2027 | **Name** | Mohammed Mutafi | Mahmoud Akl | Omar Saad |
| | | **Signature** |  |  |  |

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# Executive summary

This report documents the findings of the assessment undertaken to determine the likely fire resistance performance of 78 mm thick Speedpanel wall systems installed for fire compartmentalisation in scissor stair configurations in accordance with AS 1530.4:2014. Horizontally and vertically oriented single and dual-stacked Speedpanel wall systems and Speedpanel boxed and triangular stair risers are also assessed in this report.

The analysis conducted in sections 5 to 9 of this report found that the proposed variations are likely to achieve the fire resistance level (FRL) shown in Table 1, in accordance with AS 1530.4:2014.

**Table 1 Variations and assessment outcome**

| Description | Referenced Figures | Variations | Fire Resistance Level (FRL) |
|---|---|---|---|
| Horizontally stacked Speedpanel wall | Figure 1 to Figure 7 | Maximum horizontal span is 5 m and maximum slab-to-slab height is 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks.<br>Allowable gaps between the stair stringer and the bottom angle are 0-95 mm and the size of the steel angle will vary to accommodate these gaps. | -/120/120 |
| Vertically stacked Speedpanel wall | Figure 8 to Figure 13 | Maximum span is unlimited in the horizontal direction, and the slab-to-slab height is maximum 3 m with 1.15 mm BMT and 1.95 mm BMT side C/J-tracks.<br>Allowable gaps between the stair stringer and the bottom angle are 0-95 mm and the size of the steel angle will vary to accommodate these gaps. | |
| Dual-stacked walls with back-to-back C/J-tracks or central T bracket | Figure 14 to Figure 19 | The spans of the horizontally oriented Speedpanel walls are increased by stacking multiple Speedpanel walls together, connected through back-to-back C/J-tracks or T brackets to increase structural stability.<br>Maximum individual horizontal span is 3 m. The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks. | |
| Dual-stacked wall system with vertical wall segment between two horizontal walls | Figure 20 to Figure 34 | Multiple wall system with a vertically oriented wall section between two horizontally stacked walls. The horizontal and vertical oriented wall sections are connected via back-to-back C/J-tracks. The vertical Speedpanel wall – at mid-width of the dual-stack wall system – is anchored and supported by a concrete mid-landing.<br>Maximum horizontal span of the individual horizontally oriented walls is 3 m. Minimum horizontal width of the vertical wall segment is 500 mm (two panels oriented vertically). The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks. | |
| Single void box riser | Figure 35 to Figure 38 | Constructed from a continuous single or dual-stacked horizontally oriented Speedpanel wall in the longitudinal direction (long ends) with horizontally or vertically oriented transverse wall sections at the edges. Maximum spans of 3 m or 6 m if extended with back-to-back C/J-tracks. | |

| Description | Referenced Figures | Variations | Fire Resistance Level (FRL) |
|---|---|---|---|
| | | The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks.<br>The box risers may include air grilles that are to be installed within an aperture built into a horizontal Speedpanel wall where the aperture must be compliant to EWFA 21622 | |
| Dual void box riser | Figure 39 to Figure 49 | The void is divided centrally into two by a transverse section of Speedpanel wall at mid-span. Constructed from either a continuous single or dual-stacked horizontally oriented Speedpanel wall in the longitudinal direction (long ends) with horizontally oriented wall section at mid-span and either horizontally oriented or vertical transverse wall sections at each end. or vertically orientated transverse wall sections at mid-span and the edges. Maximum horizontal spans are 4.5 m or 6 m if extended to dual-stack system. The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks.<br>The box risers may include air grilles that are to be installed within an aperture built into a horizontal Speedpanel wall where the aperture must be compliant to EWFA 21622 | |
| Riser fixed to side of stairwell | Figure 50 to Figure 54 | Same as single or dual void riser. However, it is to be constructed to the side of the stairwell and not central to it. | |
| Triangular riser | Figure 55 and Figure 56 | Angled connections in a triangular riser construction, proposed as an alternative to the boxed riser.<br>The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks. | **-/120/120** |
| Head track details | Figure 22 to Figure 25, Figure 47 to Figure 48 and Figure 63 to Figure 64 | Steel flashing on the unexposed side replaced with equivalent unequal steel angle of 6 mm plate thickness.<br>Where an additional Speedpanel wall segment connects perpendicular to an existing spine wall separating scissor stairs, the head of the additional Speedpanel wall can be angled to suit the angle of the stair stringer. | |
| Fixings and supports | Figure 15 to Figure 19, Figure 21, Figure 36 to Figure 38, Figure 41 to Figure 46, Figure 54 to Figure 56 | Where the C/J-tracks are exposed with fixings in the void side, they shall be covered over with steel flashings incorporating fire sealants to avoid direct heat exposure and to maintain insulation performance. | |
| Horizontal butt join | Figure 57 and Figure 58 | Installed around consecutive landing slabs not aligned vertically that prevent the same length of panels being used throughout the floor height.<br>The last panel at the slab edge is cut at both ends and butt join the panels at their vertical cuts with minimum 0.4 mm BMT Speedpanel profile cover skin, caulked and installed as per EWFA 21622. | |

| Description | Referenced Figures | Variations | Fire Resistance Level (FRL) |
|---|---|---|---|
| Optional lining with 6 mm fibre cement sheets | Figure 16, Figure 18 and Figure 20 to Figure 34 | The fibre cement sheets will act as a fire resistant barrier on the unexposed side and can substitute for the steel flashing over the panel joints on the unexposed side. | |
| Optional system with a single protected bottom angle on one face of the single or dual stacked Speedpanel wall | Figure 59 | A single protected structural angle on one face of the Speedpanel walls is used to support the single and dual stacked Speedpanel wall systems (horizontally or vertically oriented) instead of two angles on both sides of the wall. This means that there is the stair stringer only run along one side of the wall. | |
| Protected structural steel beam supporting Speedpanel wall | Figure 60 to Figure 62 | Protected structural steel beam installed perpendicular to the dual stacked spine walls as a fixing point between horizontal wall sections instead of a concrete landing. The maximum slab-to-slab heights must be maintained. The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks.<br>If the wall heights extend beyond 3.3 m with C-tracks of 1.15 mm BMT and 4 m with C-tracks of 1.95 mm BMT, the walls must be supported by a structural column. | |
| Speedpanel walls suspended off the side of stair stringers at the top and the base | Figure 65 to Figure 68 | The Speedpanel walls are supported by vertical perimeter C-tracks on either side as well as angled structural steel angles and C-tracks running along the top and the base. The angled C-tracks are fixed to structural steel angles, which are screw fixed to the concrete stairs through FS0885 mechanical power fasteners or equivalent bolts. | |

The variations and outcomes of this assessment are subject to the limitations and requirements described in sections 2, 3 and 11 of this report. The results of this report are valid until 31 October 2027.

# Contents

# 1. Introduction

This report documents the findings of the assessment undertaken to determine the likely fire resistance performance of Speedpanel wall systems installed for fire compartmentalisation in scissor stair configurations and as riser systems in accordance with AS 1530.4:2014[1]. Horizontally and vertically oriented single and dual-stacked Speedpanel wall systems and Speedpanel boxed and triangular stair risers are also assessed in this report.

This assessment was carried out at the request of Speedpanel Holdings Pty Ltd and H B Fuller Company Australia Pty Ltd. The sponsor details are included in Table 2.

**Table 2 Sponsor details**

| Sponsor | Address |
|---|---|
| Speedpanel Holdings Pty Ltd | 421 Dorset Road,<br>Bayswater, 3153<br>VIC<br>Australia. |
| H B Fuller Australia | 16-22 Redgum Drive<br>Dandenong south, 3175<br>Vic<br>Australia |

# 2. Framework for the assessment

## 2.1 Assessment approach

An assessment is an opinion about the likely performance of a component or element of structure if it was subject to a standard fire test.

No specific framework, methodology, standard or guidance documents exists in Australia for doing these assessments. We have therefore followed the 'Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence' prepared by the Passive Fire Protection Forum (PFPF) in the UK in 2019[2].

This guide provides a framework for undertaking assessments in the absence of specific fire test results. Some areas where assessments may be offered are:

- Where a modification is made to a construction which has already been tested
- The interpolation or extrapolation of results of a series of fire resistance tests, or utilisation of a series of fire test results to evaluate a range of variables in a construction design or a product
- Where, for various reasons – eg size or configuration – it is not possible to subject a construction or a product to a fire test.

Assessments will vary from relatively simple judgements on small changes to a product or construction through to detailed and often complex engineering assessments of large or sophisticated constructions.

This assessment uses established empirical methods and our experience of fire testing similar products to extend the scope of application by determining the limits for the design based on the tested constructions and performances obtained. The assessment is an evaluation of the potential fire resistance performance if the elements were to be tested in accordance with AS 1530.4:2014.

[1] Standards Australia (2014) Methods for fire tests on building materials, components and structures Part 4: Fire resistance tests for elements of construction, AS 1530.4:2014.

[2] Passive Fire Protection Forum (PFPF) 2019, Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence, Passive Fire Protection Forum (PFPF), UK.

This assessment has been written using appropriate test evidence generated at accredited laboratories to the relevant test standard. The supporting test evidence has been deemed appropriate to support the manufacturer's stated design.

This assessment report has been prepared to meet the evidence of suitability requirements of the National Construction Code Volumes One and Two – Building Code of Australia (NCC) 2019[3] under A.5.2.(1) (d) and 2016 under Specification A2.3, including amendments.

This assessment has been written in accordance with the general principles outlined in EN 15725:2010[4] for extended application reports on the fire performance of construction products and building elements. It also references test evidence for meeting a performance requirement or deemed to satisfy (DTS) provisions of the NCC under A5.4 for fire resistance levels (FRL), as applicable to the assessed systems.

## 2.2 Declaration

The 'Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence' prepared by the PFPF in the UK requires a declaration from the client. By accepting our fee proposal on 1 September 2020, Speedpanel Holdings Pty Ltd and H B Fuller Company Australia Pty Ltd confirmed that:

- To their knowledge the component or element of structure, which is the subject of this assessment, has not been subjected to a fire test to the standard against which this assessment is being made.
- They agree to withdraw this assessment from circulation if the component or element of structure is the subject of a fire test by a test authority in accordance with the standard against which this assessment is being made and the results are not in agreement with this assessment.
- They are not aware of any information that could adversely affect the conclusions of this assessment and – if they subsequently become aware of any such information – they agree to ask the assessing authority to withdraw the assessment.

# 3. Limitations of this assessment

- The scope of this report is limited to an assessment of the variations to the tested systems described in section 4.3.
- This report details the methods of construction, test conditions and assessed results that are expected if the systems were tested in accordance with AS 1530.4:2014.
- The results of this assessment are applicable to the assessed horizontally or vertically oriented Speedpanel wall systems with fire exposure from either side.
- It is a requirement that the structural steel and concrete members are designed appropriately by a professional structural engineer by considering all the possible design actions. Design of structural steel and concrete members is not a part of the scope of this assessment.
- It is required that the lateral load capacity of the perimeter tracks be verified by an accredited structural engineer for the lateral load capacity under ambient loading conditions.
- It is required that the support construction above and below the wall be capable of providing adequate vertical and lateral support for at least 120 minutes.
- The actual structural strength of the stairs and the surrounding non-Speedpanel walls and their ability to handle the design loads will be validated by a professional structural engineer engaged by others or by the relevant building project construction managers and is not part of this assessment.
- It is expected that the supporting structure, including the perimeter tracks, are of the same or greater fire rating than that of the Speedpanel wall systems.

[3] National Construction Code Volume One – Building Code of Australia 2019 Amendment 1, Australian Building Codes Board, Australia.

[4] European Committee for Standardization, EN 15725:2010: Extended application reports on the fire performance of construction products and building elements, European Committee for Standardization, Brussels, Belgium.

- Handrails are not to be fixed to Speedpanel systems and hence handrail loads are not considered in the structural calculations performed for the purposes of this assessment.
- This assessment is only valid for Speedpanel wall systems with a maximum floor-to-floor height of 4 m with side C-tracks with a minimum thickness of 1.95 mm BMT. If the Speedpanel wall heights are to be increased beyond the recommended maximum floor-to-floor height of 4 m, the supporting structural steel components must be designed accordingly by a professional structural engineer and fire protection of the steel components must be carried out.
- This report is only valid for the assessed systems and must not be used for any other purpose. Any changes with respect to size, construction details, loads, stresses, edge or end conditions – other than those identified in this report – may invalidate the findings of this assessment. If there are changes to the system, a reassessment will need to be done by an Accredited Testing Laboratory (ATL).
- The documentation that forms the basis for this report is listed in Appendix A.
- This report has been prepared based on information provided by others. Warringtonfire has not verified the accuracy and/or completeness of that information and will not be responsible for any errors or omissions that may be incorporated into this report as a result.
- This assessment is based on the proposed systems being constructed under comprehensive quality control practices and following appropriate industry regulations and Australian Standards on quality of materials, design of structures, guidance on workmanship and the expert handling, placing and finishing of the products on site. These variables are beyond the control and consideration of this report.

# 4. Description of the specimen and variations

## 4.1 System description

Speedpanel wall systems are self-supporting non-load bearing walls that may be constructed with either horizontally stacked panels, vertically stacked panels or a combination of both.

Speedpanel walls assessed in this report comprise of 78 mm thick lightweight aerated concrete panels with a 0.4 mm BMT galvanised mild steel cover sheathing and 'tongue and groove' detail on their longitudinal edge. The width of each panel is 250 mm. The unit weight of a Speedpanel can be considered as 435 $kg/m^3$.

All wall systems will consist of perimeter C/J-tracks at the vertical edges and at the top and bottom edges. While C-tracks are commonly used as perimeter tracks in Speedpanel walls, J-tracks can also be used in constructions where a C-track is difficult to be installed or if an elongated flange is required. Single 78 mm thick horizontally and/or vertically oriented walls have been tested as provided in Appendix B, and it is proposed to extend their fire resistance performance to variations of horizontally and vertically oriented single and dual-stacked Speedpanel wall systems and Speedpanel boxed and triangular stair risers as described in 4.3.

## 4.2 Referenced test data

The assessment of the variations to the tested systems and the determination of the likely performance is based on the results of the fire tests documented in the reports summarised in Table 3. Further details of the tested system are described in Appendix B.

**Table 3 Referenced test data**

| Report number | Test sponsor | Test date | Testing authority |
|---|---|---|---|
| BWA 2286900 | Speedpanel (Vic.) Pty Ltd | 18 August 2008 | Bodycote Warringtonfire Aus Pty Ltd |
| EWFA 2736000 | Speedpanel (Vic.) Pty Ltd | 22 June 2012 | Exova Warringtonfire Aus Pty Ltd |
| EWFA 2736001 | Speedpanel (Vic.) Pty Ltd | 26 June 2012 | Exova Warringtonfire Aus Pty Ltd |
| EWFA 2736002 | Speedpanel (Vic.) Pty Ltd | 13 July 2012 | Exova Warringtonfire Aus Pty Ltd |

| Report number | Test sponsor | Test date | Testing authority |
|---|---|---|---|
| EWFA 2848300 | Speedpanel (Vic.) Pty Ltd | 29 May 2013 | Exova Warringtonfire Aus Pty Ltd |
| BWA 2257600 | Speedpanel (Vic.) Pty Ltd | 6 March 2008 | Bodycote Warringtonfire Aus Pty Ltd |
| EWFA 2741700 | Speedpanel (Vic.) Pty Ltd | 20 July 2012 | Exova Warringtonfire Aus Pty Ltd |
| FRT200213 | H B Fuller Australia Pty Ltd | 25 August 2020 | Warringtonfire |

## 4.3 Variations to the tested systems

Identical systems have not been subject to a standard fire test. We have therefore assessed the systems using baseline test information for similar systems. The variations to the tested systems together with the referenced standard fire test reports are described in Table 4.

**Table 4 Variation to tested systems**

| Item | Referenced reports | Description | Variations |
|---|---|---|---|
| Singular horizontally or vertically stacked Speedpanel walls | BWA 2286900<br>EWFA 2736000<br>EWFA 2736001<br>EWFA 2736002<br>EWFA 2848300<br>BWA 2257600<br>EWFA 2741700 | Horizontally stacked Speedpanel wall | Maximum span is 5 m and maximum slab-to-slab height is 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks.<br>Allowable gaps between the stair stringer and the bottom angle are 0-95 mm and the size of the steel angle will vary to accommodate these gaps. |
| | | Vertically stacked Speedpanel wall | Maximum span is unlimited in the horizontal direction and the slab-to-slab height is maximum 3 m with 1.15 mm BMT or 1.95 mm BMT side C/J-tracks.<br>Allowable gaps between the stair stringer and the bottom angle are 0-95 mm and the size of the steel angle will vary to accommodate these gaps. |
| Dual-stacked 78 mm thick Speedpanel walls | | Dual-stacked walls with back-to-back C/J-tracks or central T bracket | The spans of the horizontally oriented Speedpanel walls are to be increased by stacking two Speedpanel walls together, connected through back-to-back C/J-tracks or T brackets to increase structural stability.<br>Maximum individual horizontal span is 3 m. The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks. |
| | | Dual-stacked wall system with vertical wall segment between two horizontal walls | Multiple wall system with vertically oriented wall section between two horizontally stacked walls. The horizontal and vertical oriented wall sections are connected via back-to-back C/J-tracks. The vertical Speedpanel wall – at mid-width of the dual-stack wall system – is anchored and supported by a concrete mid-landing.<br>Maximum horizontal span of the individual horizontally oriented walls is 3 m. The minimum horizontal width of the vertical wall segment is 500 mm (two panels oriented vertically). The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks. |
| Boxed stair pressurisation riser | | Single void box riser | Constructed from a continuous single or dual-stacked horizontally oriented Speedpanel wall in the longitudinal direction (long ends) with horizontally or vertically oriented transverse wall sections at the edges. Maximum spans of 3 m or 6 m if extended with back-to-back C/J-tracks. |

| Item | Referenced reports | Description | Variations |
|---|---|---|---|
| | | | The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks. |
| | | Dual void box riser | The void is divided centrally into two by a transverse section of Speedpanel wall at mid-span. Constructed from either a continuous single or dual-stacked horizontally oriented Speedpanel wall in the longitudinal direction (long ends) with horizontally oriented wall section at mid-span and either horizontally oriented or vertical transverse wall sections at each end. Maximum spans are 4.5 m or 6 m if extended to dual-stack system.<br>The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks. |
| | | Riser fixed to side of stairwell | Same as single or dual void riser. However, it is to be constructed to the side of the stairwell and not central to it. |
| | | Triangular riser | Angled connections in a triangular riser construction, proposed as an alternative to the boxed riser.<br>The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks. |
| Head track detail | | Thermal protection of the head track to be protected with flashing on the unexposed side. | It is proposed that the steel flashing on the unexposed side be replaced with equivalent unequal steel angle of 6 mm plate thickness for box risers.<br>it is also proposed that where an additional Speedpanel wall segment connects perpendicular to an existing spine wall separating scissor stairs, the head of the additional Speedpanel wall can be angled to suit the angle of the stair stringer as the wall passes underneath the stairs. |
| Fixings and supports | | The support C/J-tracks shall not be less than 1.15 mm BMT. The fixings of the panels to the main supports shall be mainly from the stair side and be covered with minimum 0.7 mm BMT galvanised steel flashings. | Where the C/J-tracks are exposed with fixings in the void side, they shall be covered over with steel flashings incorporating fire sealants to avoid direct heat exposure and to maintain insulation performance. |
| Horizontal butt join | | To be installed around consecutive landing slabs not aligned vertically that prevent the same length of panels being used throughout the floor height. | It is proposed to cut the last panel at the slab edge at both ends and butt join the panels at their vertical cuts with 0.4 mm BMT Speedpanel profile cover skin, caulked and installed as per EWFA 21622. |

| Item | Referenced reports | Description | Variations |
|---|---|---|---|
| Optional lining with 6 mm fibre cement sheets | | It is proposed that the Speedpanel wall surfaces be optionally lined with 6 mm fibre cement sheets. | The fibre cement sheets will act as a fire resistant barrier on the unexposed side and can substitute for the steel flashing over the panel joints on the unexposed side. |
| Optional system with a single protected bottom angle on one face of the single or dual stacked Speedpanel wall | | A single protected structural angle on one face of the Speedpanel walls | It is proposed that one steel angle connected to one face of the wall is used to support the single and dual stacked Speedpanel wall systems (horizontally or vertically oriented) instead of two angles on both sides of the wall. |
| Protected structural steel beam supporting Speedpanel wall | | Protected structural steel beam installed perpendicular to the dual stacked spine walls as a fixing point between horizontal wall sections instead of a concrete landing. | The maximum slab-to-slab heights of maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks are to be maintained.<br>If the wall heights extend beyond 3.3 m with C-tracks of 1.15 mm BMT and 4 m with C-tracks of 1.95 mm BMT, the walls are to be supported by a structural column. |
| Speedpanel walls suspended off the side of stair stringers at the top and the base | | The Speedpanel walls are supported by vertical perimeter C-tracks on either side as well as angled structural steel angles and C-tracks running along the top and the base. | It is proposed that single and dual stacked Speedpanel walls extend between and connected to the stair stringers. |

## 4.4 Purpose of the test standard

This assessment is prepared in accordance with AS 1530.4:2014.

AS 1530.4:2014 provides methods for determining the fire resistance of various elements of construction when subjected to standard fire exposure conditions. Section 2 of AS 1530.4:2014 specifies the general requirements for conducting fire resistance tests. Section 3 of AS 1530.4:2014 sets out procedures for determining the fire resistance of masonry, prefabricated and framed walls and is to be read in conjunction with section 2.

## 4.5 Schedule of components

Table 5 outlines the schedule of components for the assessed systems subject to a fire test, as referenced in Appendix B.

**Table 5 Schedule of components of assessed systems**

| Item | Description | |
|---|---|---|
| 1 | Name | Trimming Channel (C-track) or J-track with equal or better sectional bending and compression capacity |
| | Material | Galvanised mild steel |
| | Dimensions | • C-tracks:<br>– 55 mm × 82 mm × 55 mm × 1.15 mm BMT; or<br>– 55 mm × 84 mm × 55 mm × 1.95 mm BMT; and<br>• J-tracks:<br>– 55 mm × 82 mm × 90 mm × 1.15 mm BMT; or<br>– 55 mm × 84 mm × 90 mm × 1.95 mm BMT |
| 2 | Name | Speedpanel |
| | Material | Mild steel section filled with aerated lightweight concrete with nominal density 435 kg/$m^3$. The cover sheathing is minimum 0.4 mm BMT galvanised steel.<br> |
| | Dimensions | 250 mm × 78 mm thickness |
| 3 | Name | Steel angle for stair stringer |
| | Dimensions | • For a wall-to-stair gap of 0-10 mm – the minimum steel angle size is 50 × 50 × 2 mm<br>• For a wall-to-stair gap of 10-20 mm – the minimum steel angle size is 50 × 50 × 4 mm<br>• For a wall-to-stair gap of 20-35 mm – the minimum steel angle size is 75 × 75 × 5 mm<br>• For a wall-to-stair gap of 35-95 mm – the minimum steel angle size is 150 × 50 × 5 mm |
| 4 | Name | Fixings |
| | Material | Flat-top, self-drilling, zinc-coated steel screws, 10g × 30 mm. |
| | Installation | Fixed steel tracks (Item 1) to Speedpanel panels:<br>• vertically installed panels at;<br>– 500 mm centres top, bottom and sides (on one face); and<br>– 2-of in each corner (on one face).<br>• horizontally installed panels at:<br>– 250 mm centres on both sides (on both faces);<br>– 500 mm centres top and bottom (on one face); and<br>– 2-of in each corner (on one face). |

| Item | Description | |
|---|---|---|
| | | • box riser:<br>– 250 mm centres (on one face).<br>– 500 mm centres top and bottom (on one face); and<br>– 2-of in each corner (on one face). |
| 5 | Name | Fuller Firesound Acrylic Sealant |
| | Installation | Filled into the panel to stairs joints for minimum 20 mm deep on the topside of the joint and in the normal Speedpanel installation locations to fill all gaps. |
| 6 | Name | Backing rod |
| | Material | Polyethylene foam backing rod |
| | | • For a maximum joint width of 8 mm – PE rod has a nominal diameter of 10 mm<br>• For a maximum joint width of 12 mm – PE rod has a nominal diameter of 15 mm<br>• For a maximum joint width of 16 mm – PE rod has a nominal diameter of 20 mm<br>• For a maximum joint width of 20 mm – PE rod has a nominal diameter of 25 mm |
| | Installation | Installed into the panel to stairs joints and at least 20 mm back from the topside of joint. |
| 7 | Name | Backfilling material |
| | Material | Rockwool insulation with a density of minimum 140 kg/m$^3$ |
| | Installation | At least 20 mm backed from the topside of joint and filled the rest of the joint |
| 8 | Name | Fixings to concrete landings/stair stringers |
| | Material | Minimum 8 mm diameter FS0885 mechanical power fasteners or equivalent bolt |
| | Installation | Mechanically fixed at top and bottom of side tracks and at least 60 mm embedment into concrete. |
| 9 | Name | Firetherm/TBA Intubatt |
| | Material | 50 mm thick Rockwool with nominal density of 180 kg/m$^3$, coated on both sides with TBA Intumastic to a thickness of 1.0 mm. |
| | Installation | One layer of batt shall be friction fitted into the gap and sitting on the top of the steel angle (item 3). Two large beads of compatible intumastic sealant (previously tested with TBA Intubatt) shall be applied before the installation of the batt along the longitudinal ends and two fillets of Intumastic sealant shall be applied after the installation of the batt. |
| 10 | Name | Steel flashing |
| | Material | 0.55 mm thick |
| | Installation | Capped on topside of the wall to stair joint between Speedpanel barrier and concrete stair and fixed at maximum 500 mm centres by self- drilling, galvanised-coated steel screws, 10g × 30 mm (Item 4). |
| 11 | Name | Head Track Protection |
| | Material | 13 mm × 120 mm strip of fire rated plasterboard |
| | Installation | 2 rows of min. 10g SDS screws at 250mm centres (staggered at 125 mm) |
| 12 | Name | Metal Flashing (Junction Protection) |
| | Material | Minimum 0.7 mm thick galvanised mild steel |
| | Installation | Fixed to at least one face over junctions. |
| 13 | Name | Fibre Cement sheeting |
| | Material | Minimum 6 mm thick Fibre cement sheets |

| Item | Description | |
|---|---|---|
| | Installation | Fixed to both unexposed and exposed sides as per manufacturer's specifications. |
| 14 | Name | Fixing – Series 500 |
| | Material | Minimum 12g SDS |
| | Installation | Fixed through:<br>C/J-Track and any structural steel (Items 1 and 15); and<br>supporting head angles (Items 20 and 21) |
| 15 | Name | Structural Steel |
| | Material | To be engineered by others to support the load of the Speedpanel and any other imposed loads |
| 16 | Name | Fixing – Panel to Panel |
| | Material | Flat top, self-drilling, zinc-coated steel screws, 10g × 16 mm |
| | Installation | Fixed on minimum one face at every joint at<br>• 1000 mm centres; or<br>• 500 mm centres on vertical panels when installed between horizontal stacks |
| 17 | Name | Head Track Flashing |
| | Material | Minimum 0.7 mm × 130 mm Steel flashing |
| | Installation | Fixed using Item 4 in two rows at 250 mm centres (staggered at 125 mm) |
| 18 | Name | Hilti HUS3-P Screw Anchors |
| | Material | 6 × 40/5 |
| | Installation | 500 mm centres into concrete structure |
| 19 | Name | Fixings – Back-to-Back and Box Riser Connections |
| | Material | Min. 10 g × 30 mm SDS |
| | Installation | 250 mm centres staggered from side to side within track |
| 20 | Name | Steel angle at head track |
| | Material | 50 mm × 50 mm × 1.15 mm BMT |
| 21 | Name | Steel angle at head track |
| | Material | 125 mm × 75 mm × 6 mm |
| 22 | | Structural steel protection (consider fitness for purpose)<br>• Blue areas outline scope boundaries of this assessment; and<br>• Green areas outline regions requiring further advice from manufacturer of passive fire protection options listed below |
| | Name | Option 1 – Promatect® 250 |
| | Material | 1 × 15 mm |
| | Installation | Lapped minimum 100 mm onto all exposed faces of the Speedpanel and installed as per the manufacturer's and project engineer's specifications |
| | Name | Option 2 – Vermiculite spray |
| | Material | Cafco® 300 Vermiculite |
| | Installation | Over sprayed minimum 100 mm × 20 mm deep onto all faces of the Speedpanel and installed as per the manufacturer's and project engineer's specifications |
| | Name | Option 3 – Cementitious spray |
| | Material | Cafco Fendolite® MII |

| Item | Description | |
|---|---|---|
| | Installation | Over sprayed minimum 100 mm × 20 mm deep onto all faces of the Speedpanel and installed as per the manufacturer's and project engineer's specifications |
| 23 | Name | Fire rated sealant (for passive fire protection) |
| | Material | Acrylic sealant compatible and tested with Promatect® 250 |
| | Installation | Seal all gaps between the panels (Items 2 and 22) and Promatect® 250 |
| 24 | Name | Fixing – through corner |
| | Material | Min. 12g coarse thread SDS |
| | Installation | Fixed through C-tracks (Item 1) to form corner at:<br>• 500 mm through C-track in vertically installed wall; and<br>• 250 mm centres through C-track in horizontally installed wall |
| 25 | Name | Flashing - corner |
| | Material | 160 mm × 160 mm × 0.7 mm BMT galvanised mild steel |
| | Installation | Fixed along both edges at max. 500 mm centres using Item 4 |

Figure 1 to Figure 7 show the single 78 mm thick horizontally stacked wall.

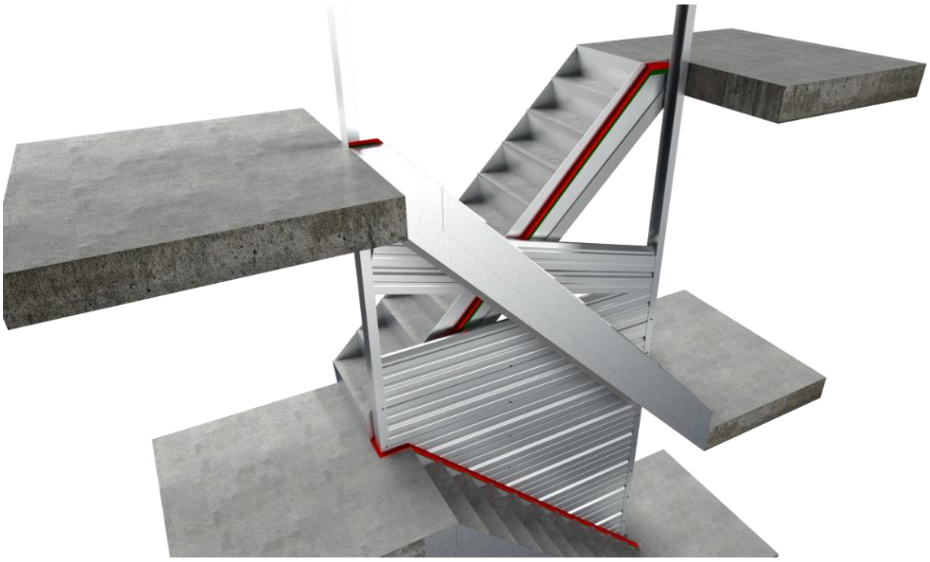

**Figure 1 Single 78 mm thick horizontally stacked wall – Fuller Firesound Acrylic Sealant shown in red**

**Figure 2 Single 78 mm thick horizontally stacked wall – steel angle at bottom of stringer**

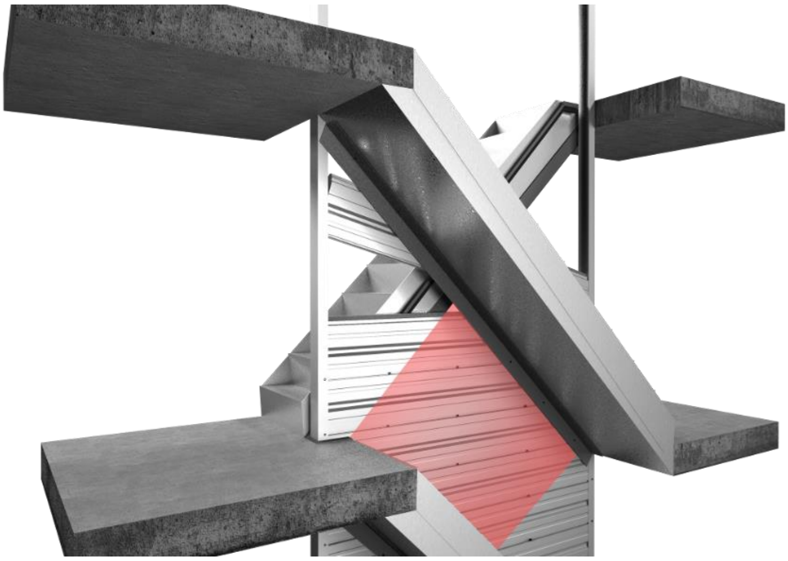

**Figure 3 The section of horizontally oriented wall providing fire separation highlighted**

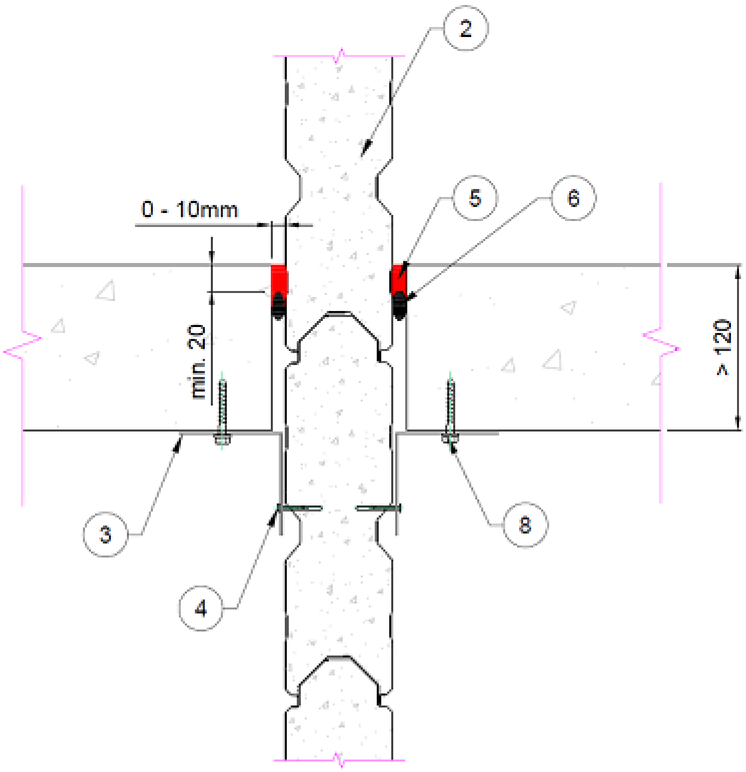


**Figure 4 Wall-to-stair joint (0-10 mm gap)**

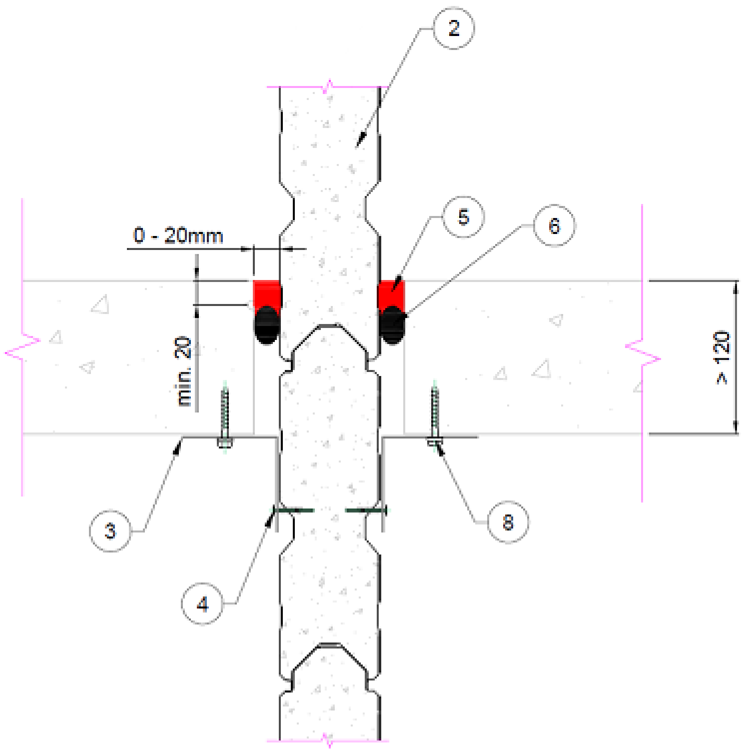


**Figure 5 Wall-to-stair joint (10-20 mm gap)**

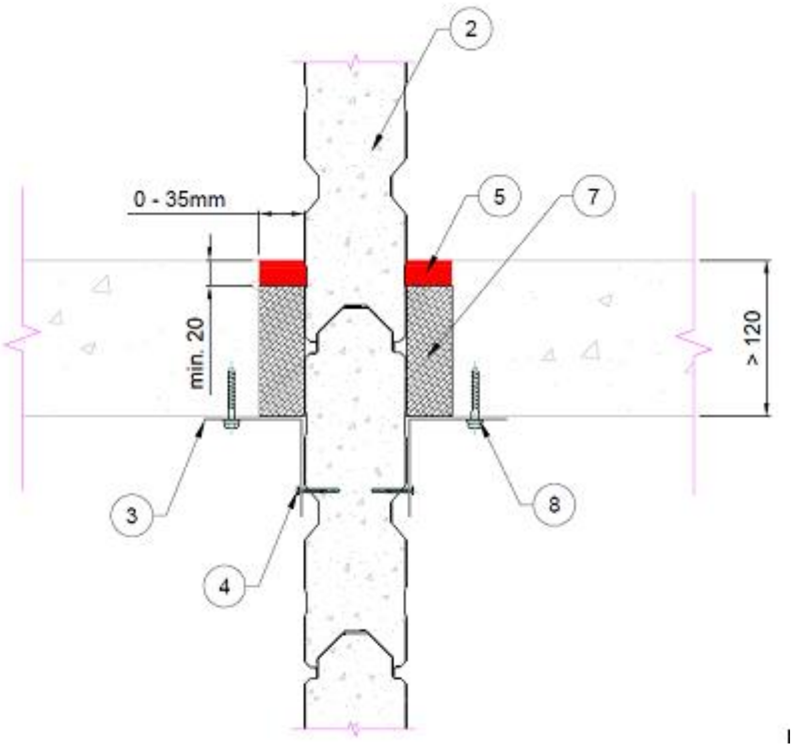


**Figure 6** **Wall-to-stair joint (20-35 mm gap)**

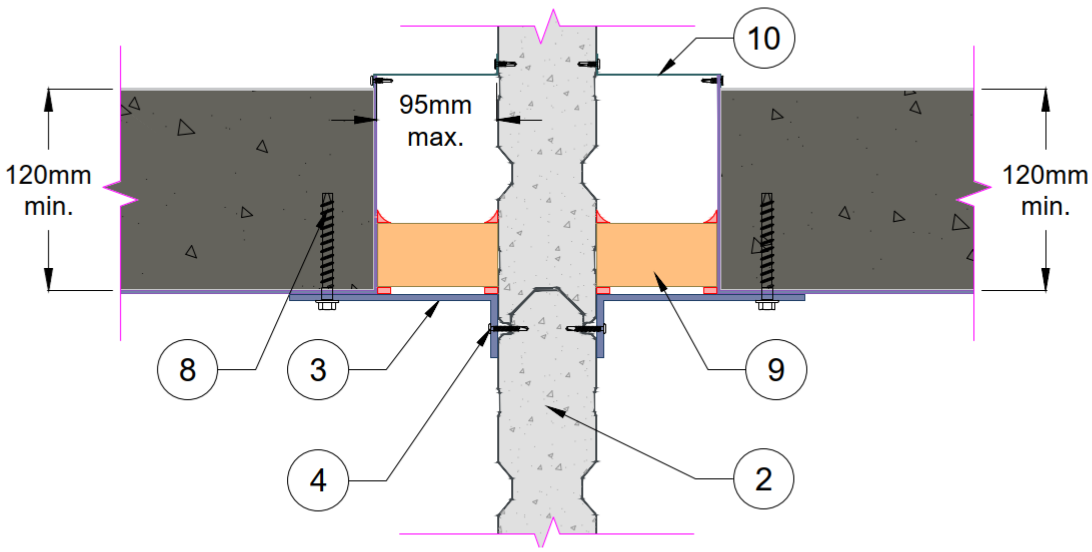


**Figure 7** **Wall-to-stair joint (35-95 mm gap)**

Figure 8 to Figure 13 show the single 78 mm thick vertically stacked wall.

**Figure 8 Single 78 mm thick vertically stacked wall – steel angle at bottom of stringer**

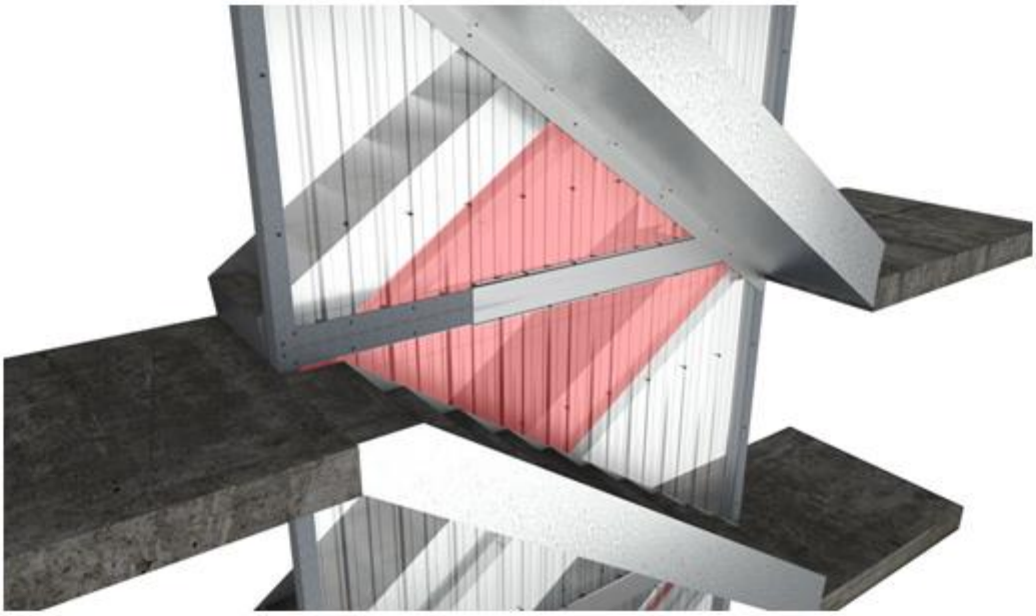

**Figure 9 The section of vertically oriented wall providing fire separation highlighted**

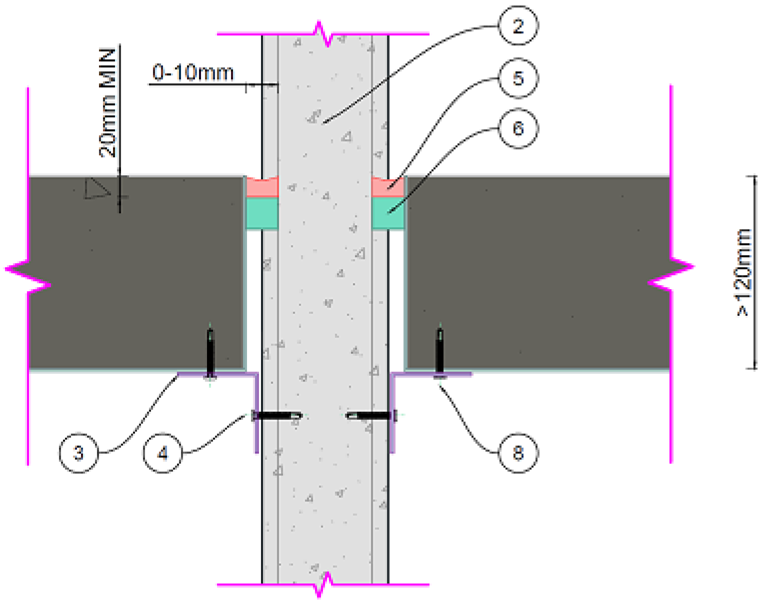


**Figure 10 Wall-to-stair joint (0-10 mm gap)**

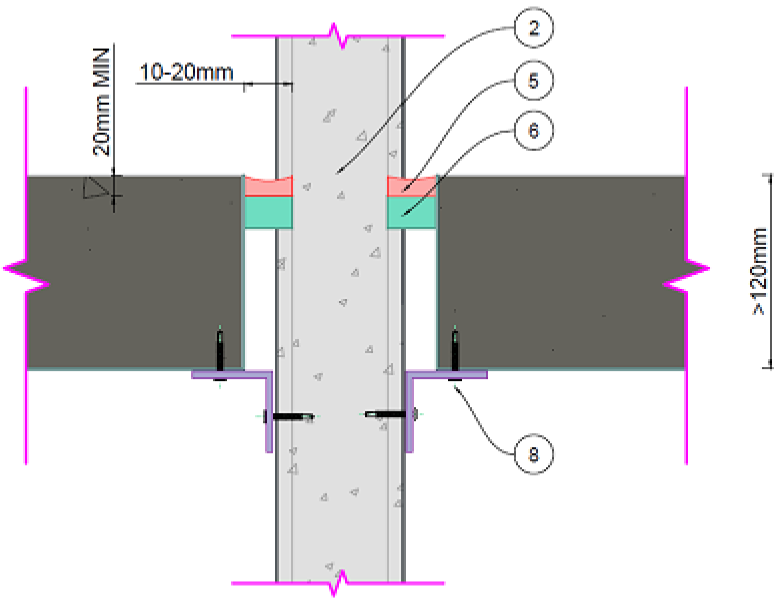


**Figure 11 Wall-to-stair joint (10-20 mm gap)**

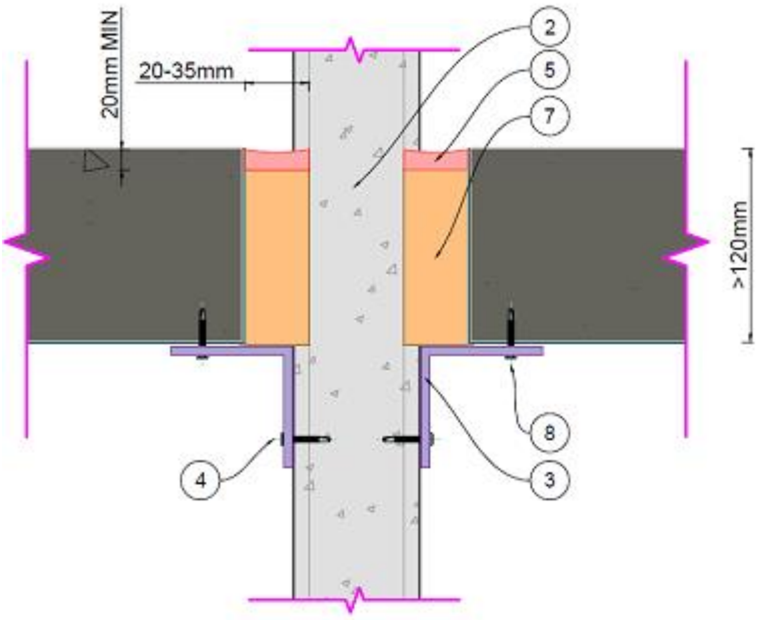


**Figure 12 Wall-to-stair joint (20-35 mm gap)**

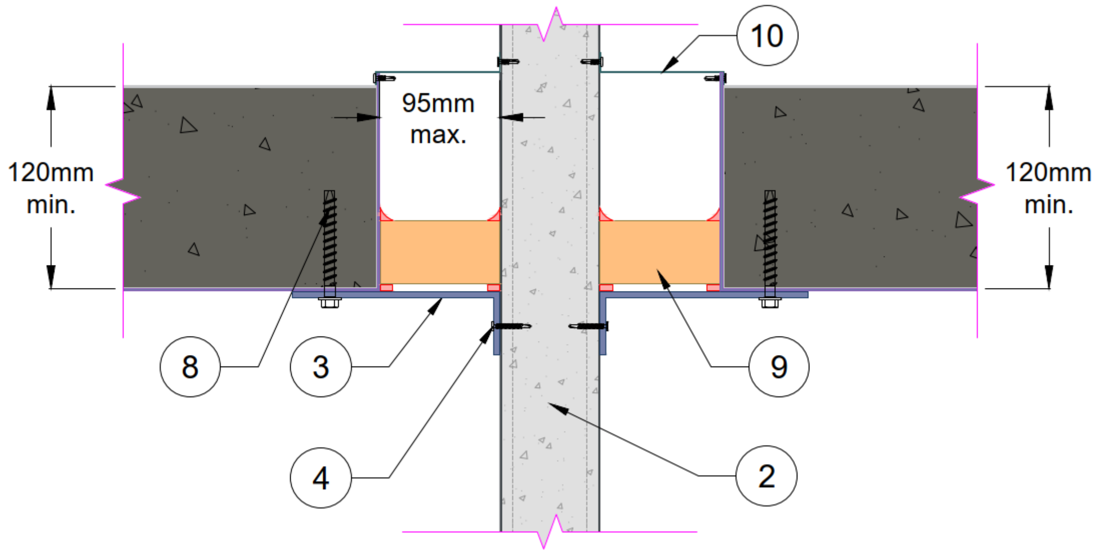


**Figure 13 Wall-to-stair joint (35-95 mm gap)**

Figure 14 to Figure 34 show the proposed multiple stacked 78 mm thick walls.

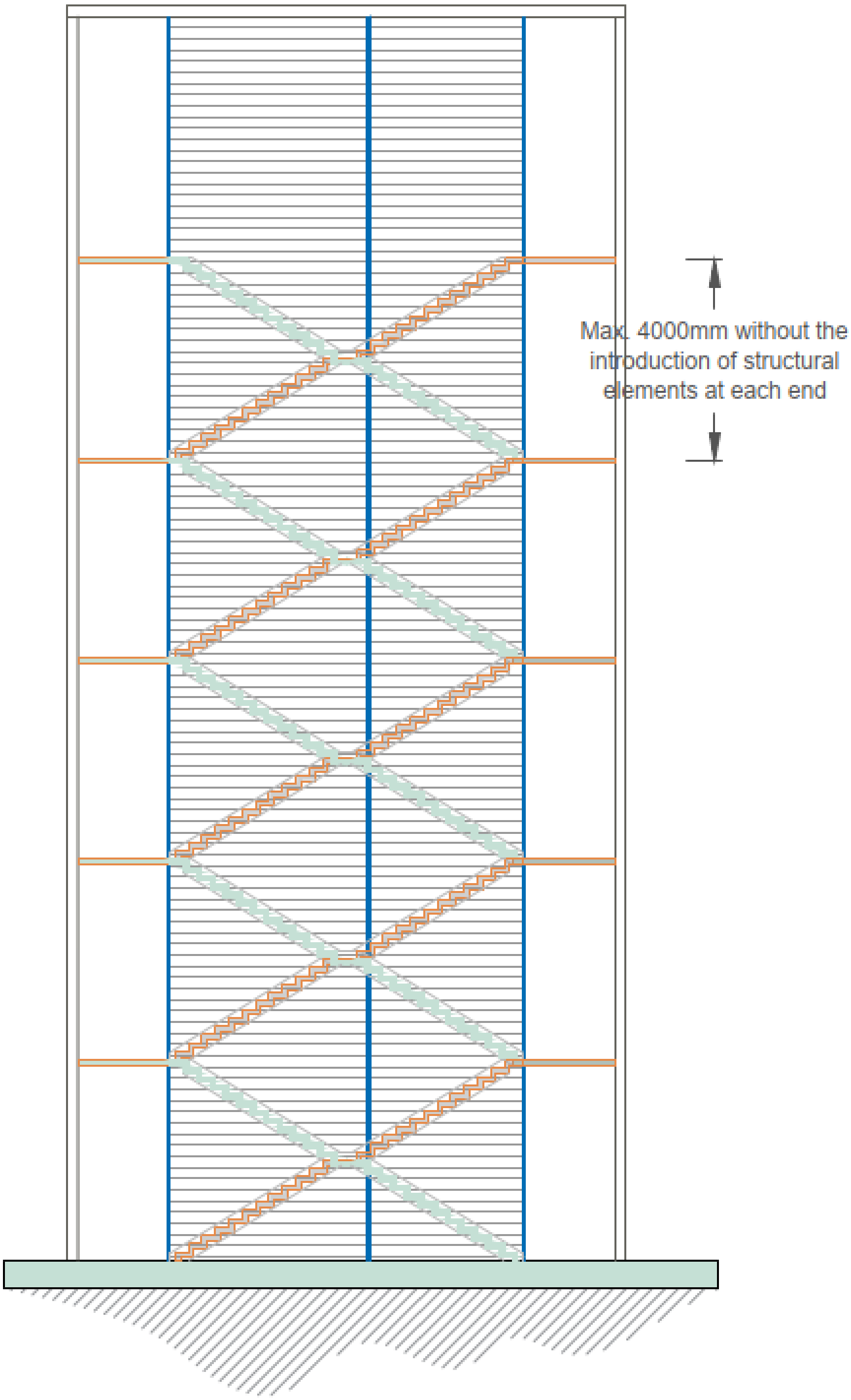


**Figure 14 Dual stack scissor stair – elevation view**

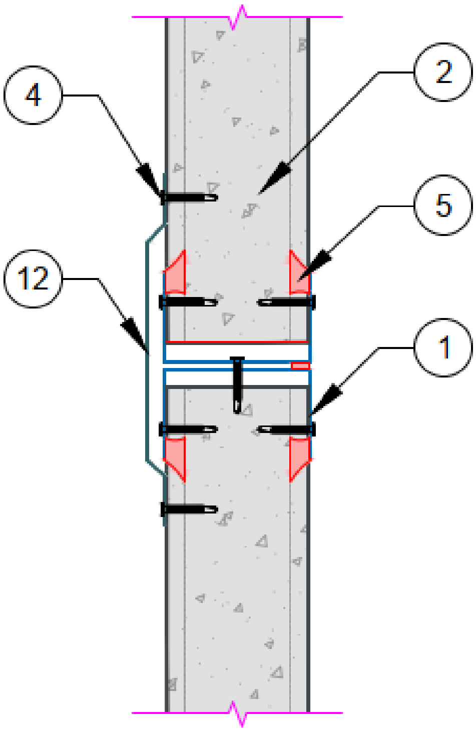


**Figure 15** **Back-to-back C-track connection in dual stack wall with metal flashing on unexposed side**

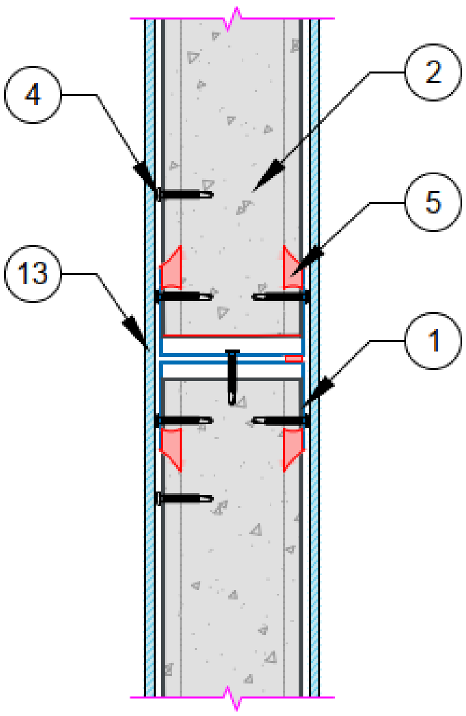


**Figure 16** **Back-to-back C-track connection in dual stack wall with 6 mm fibre cement lining**

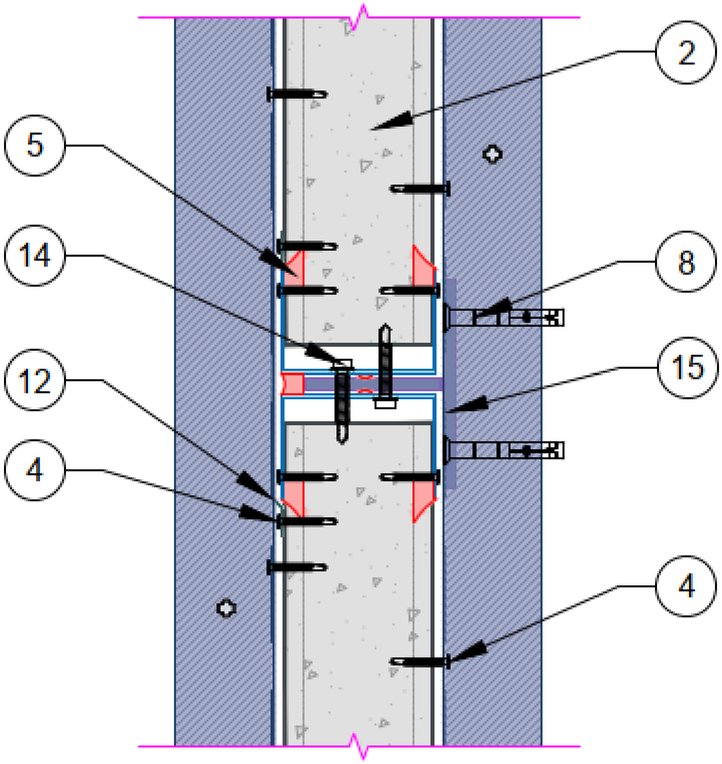


**Figure 17 T-bracket connection in dual stack wall at landing/stair stringer**

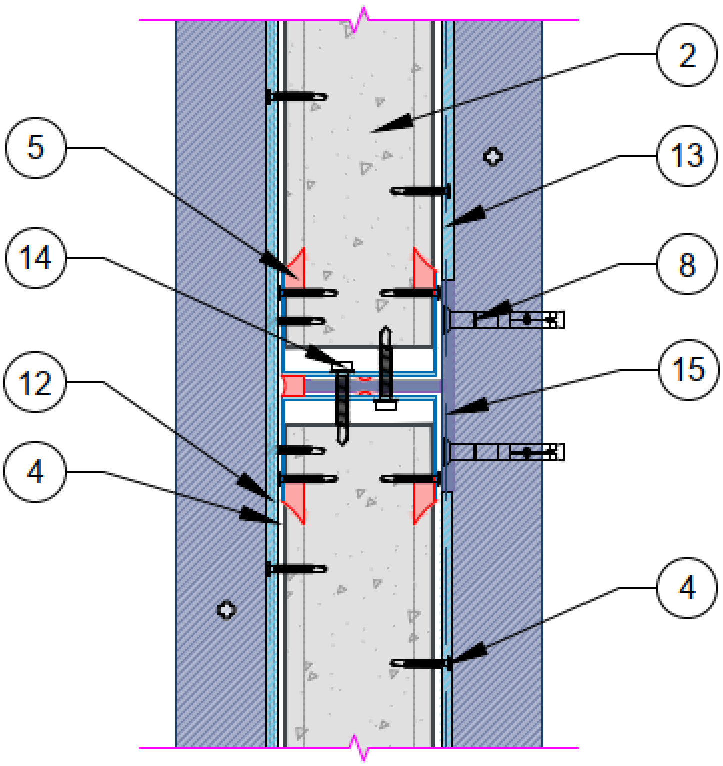


**Figure 18 T-bracket connection in dual-stack wall with 6 mm fibre cement lining**

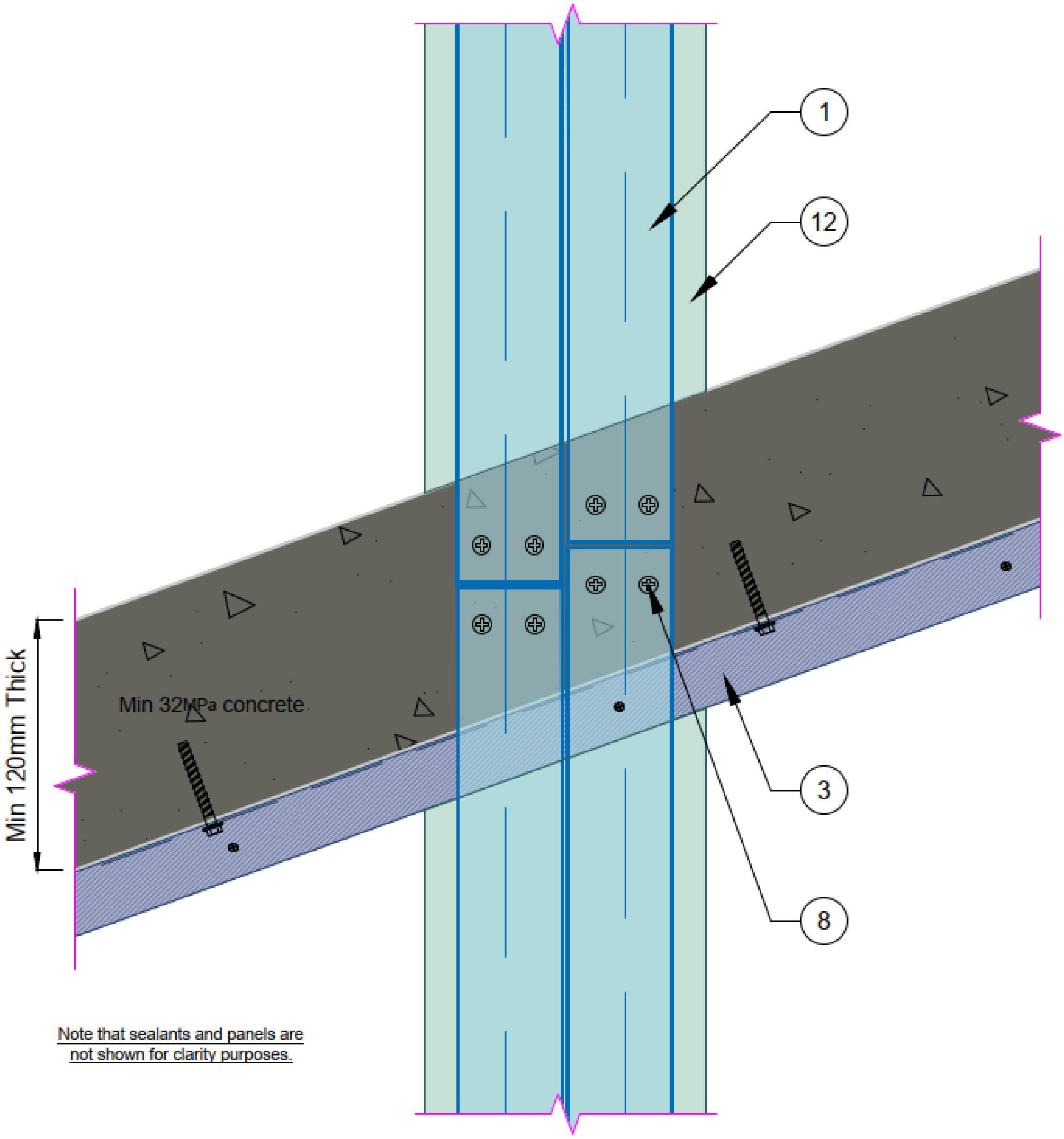


**Figure 19 Elevation of stair stringer connection in dual-stack wall**

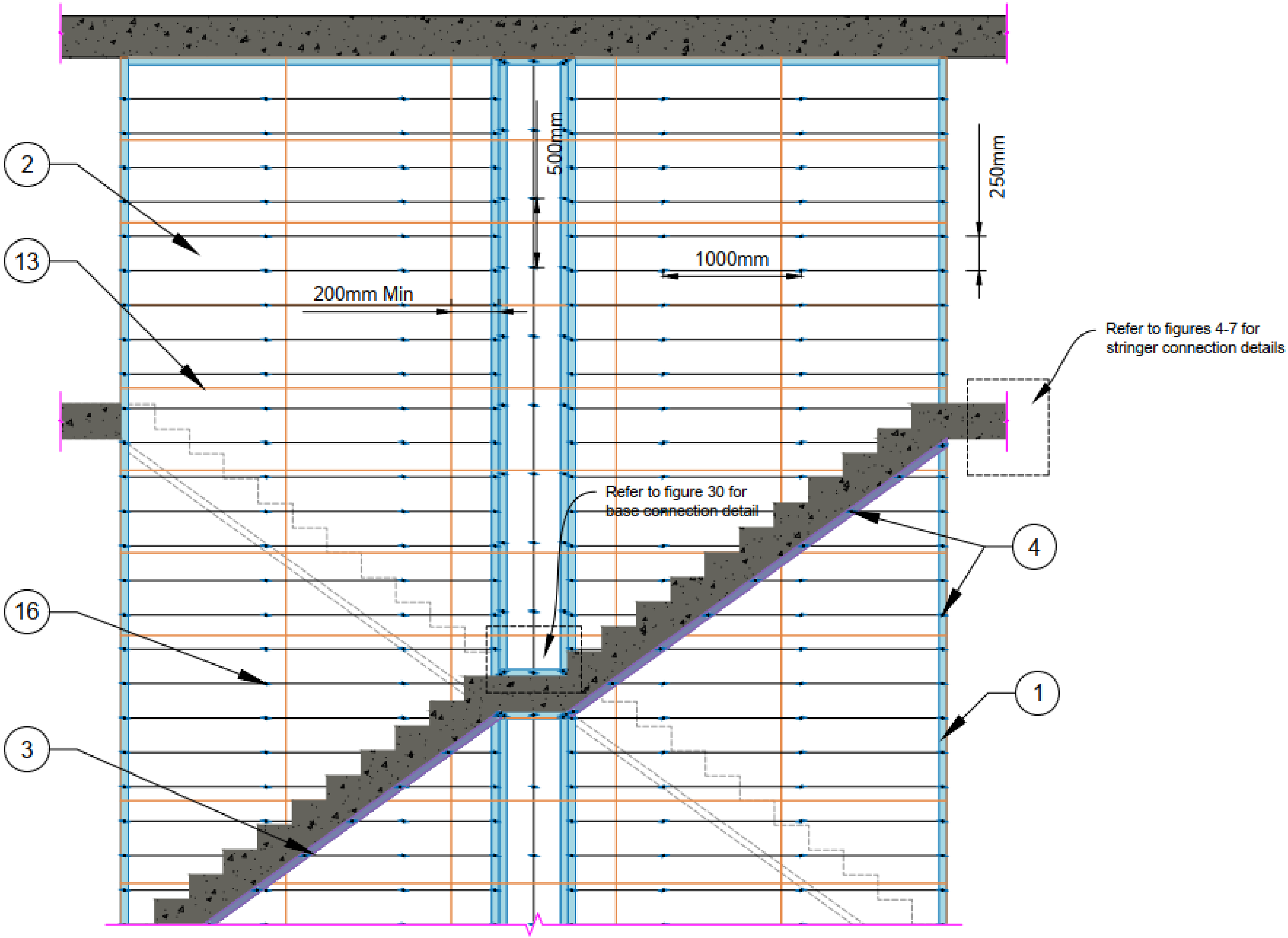


**Figure 20 Dual wall system with vertical wall between horizontal walls – elevation view**

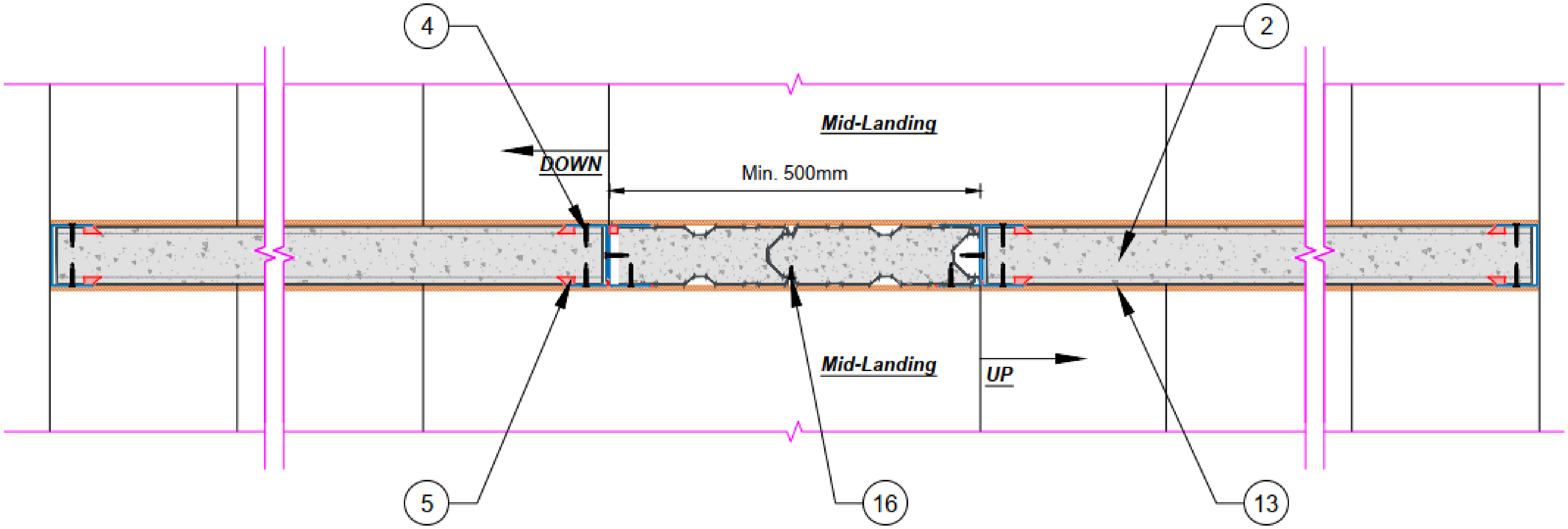


**Figure 21 Dual wall system with vertical wall between horizontal walls – plan view**

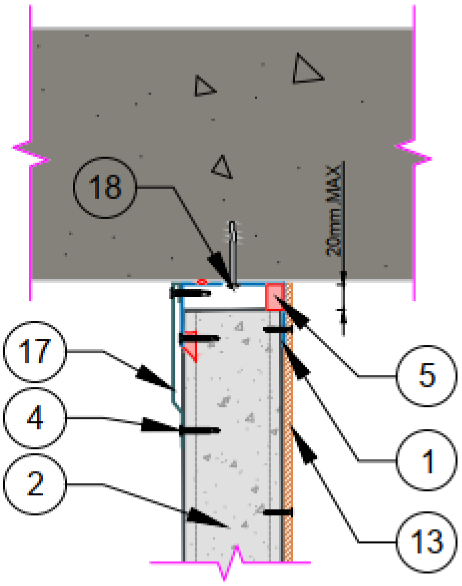


**Figure 22** **Dual wall system with vertical wall between horizontal walls – vertical head detail – option 01**

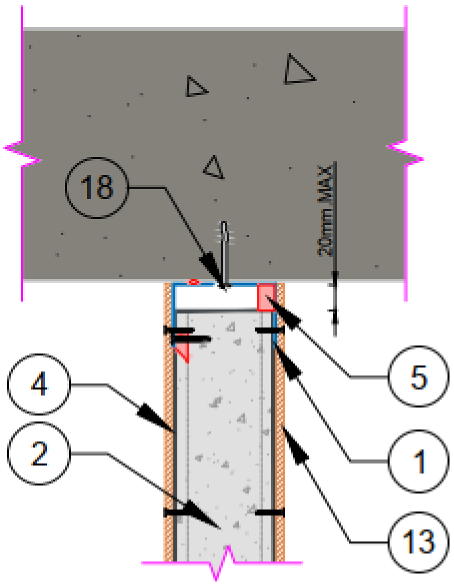


**Figure 23** **Dual wall system with vertical wall between horizontal walls – vertical head detail – option 02**

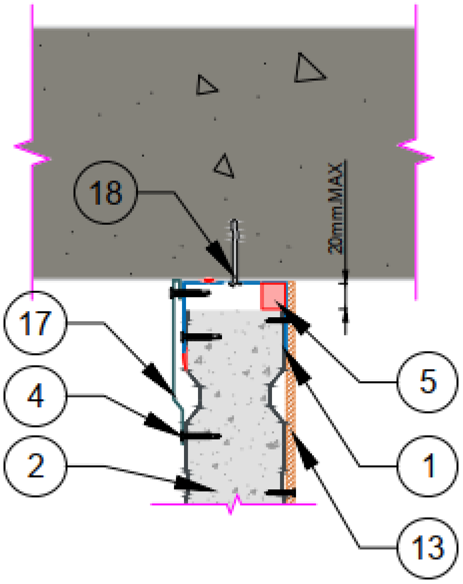


**Figure 24** **Dual wall system with vertical wall between horizontal walls – horizontal head detail – option 01**

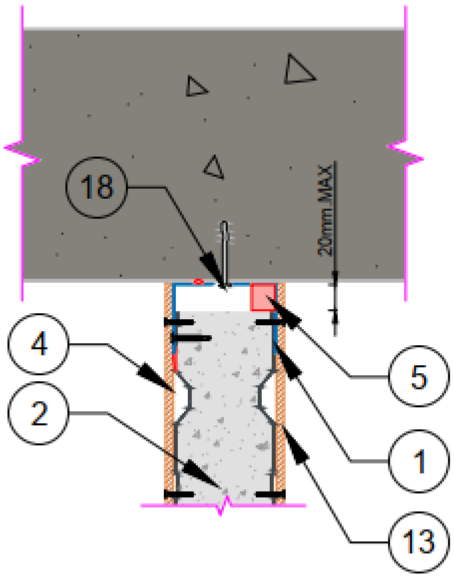


**Figure 25** **Dual wall system with vertical wall between horizontal walls – horizontal head detail – option 02**

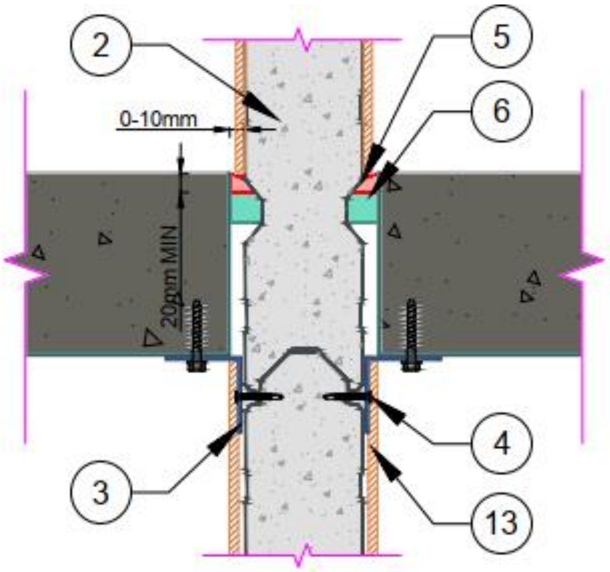


**Figure 26 Dual wall system with vertical wall between horizontal walls –gap width of 0-10 mm between the stair and horizontally oriented wall**

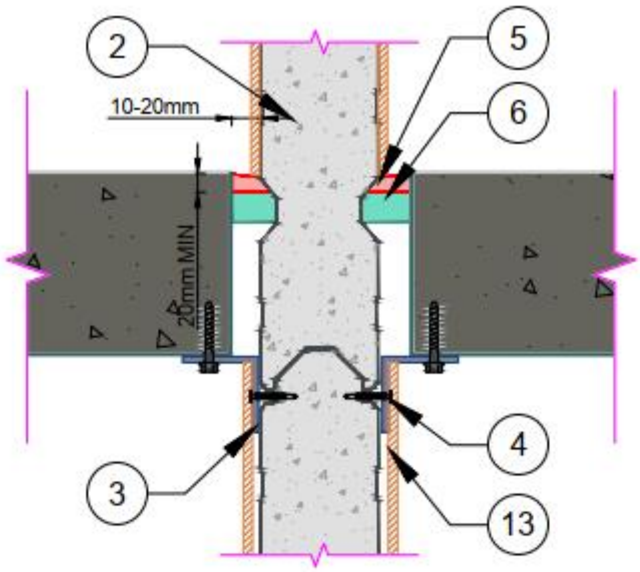


**Figure 27 Dual wall system with vertical wall between horizontal walls – gap width of 10-20 mm between the stair and horizontally oriented wall**

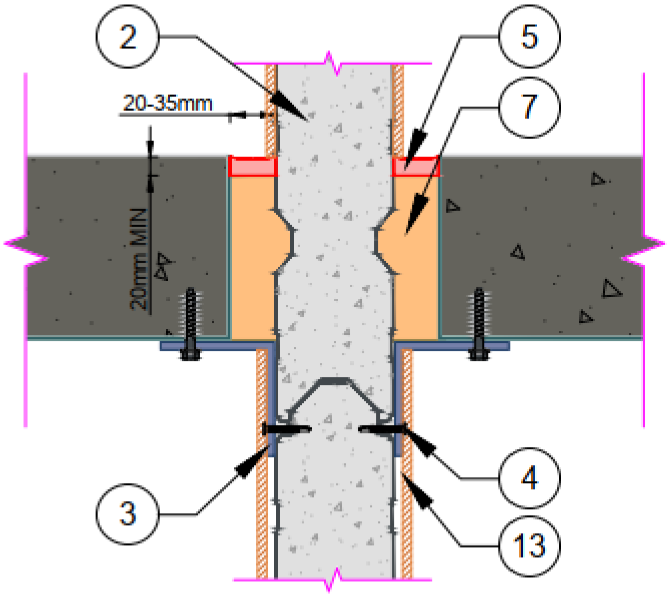


**Figure 28 Dual wall system with vertical wall between horizontal walls – gap width of 20-35 mm between the stair and horizontally oriented wall**

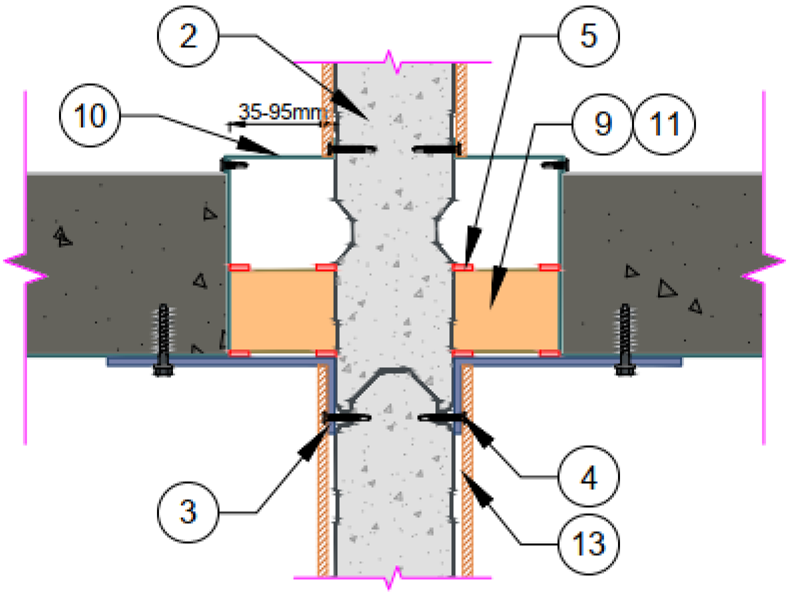


**Figure 29 Dual wall system with vertical wall between horizontal walls – gap width of 35-95 mm between the stair and horizontally oriented wall**

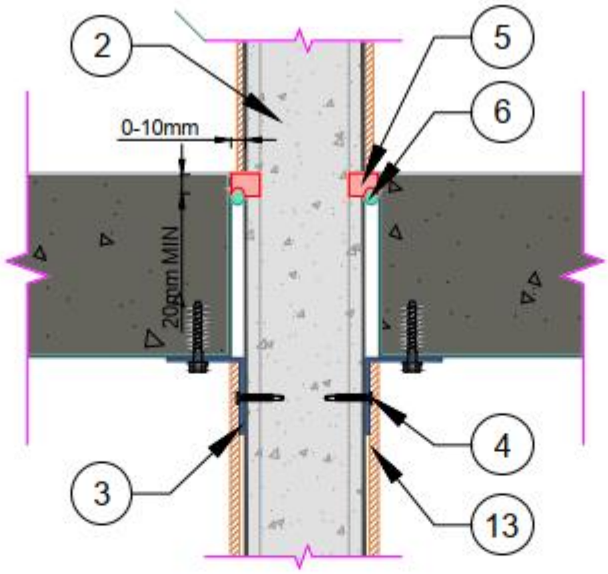


**Figure 30** **Dual wall system with vertical wall between horizontal walls – gap width of 0-10 mm between the stair and vertically oriented wall**

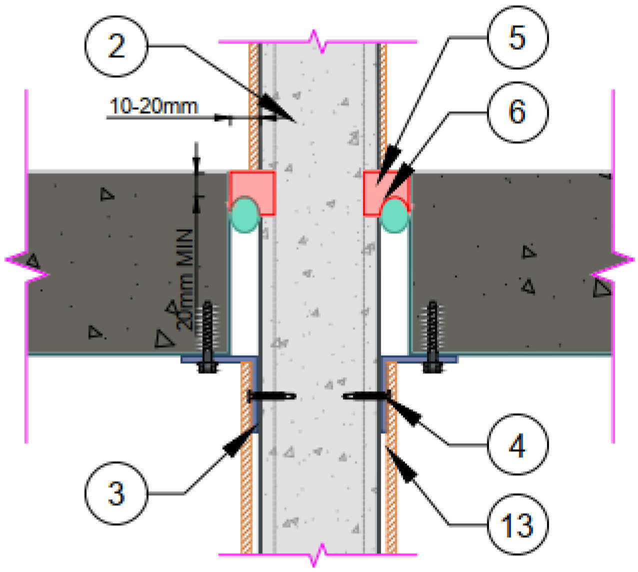


**Figure 31** **Dual wall system with vertical wall between horizontal walls – gap width of 10-20 mm between the stair and vertically oriented wall**

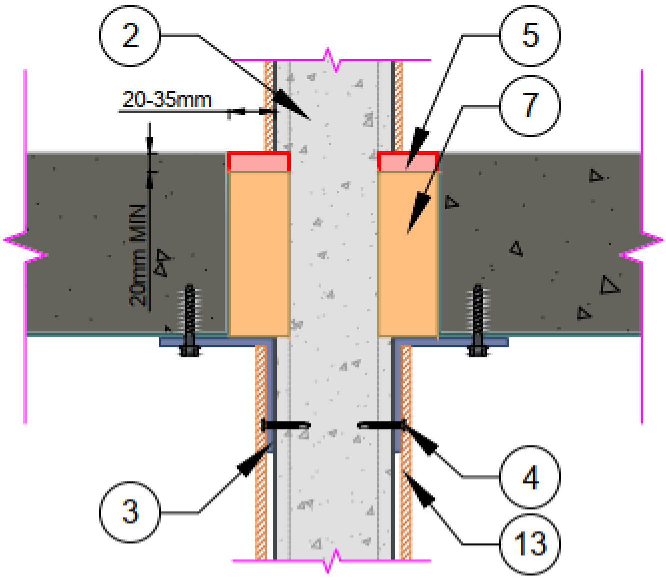


**Figure 32** **Dual wall system with vertical wall between horizontal walls – gap width of 20-35 mm between the stair and vertically oriented wall**

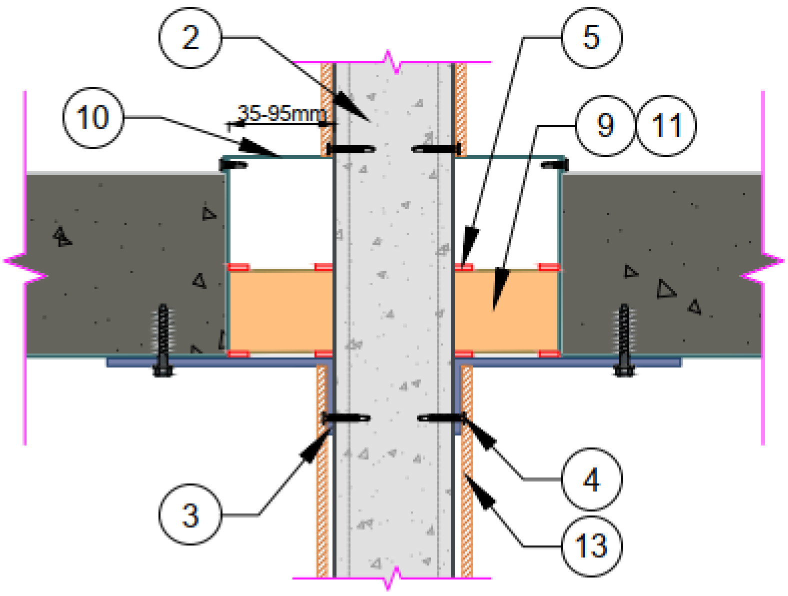


**Figure 33** **Dual wall system with vertical wall between horizontal walls – gap width of 35-95 mm between the stair and vertically oriented wall**

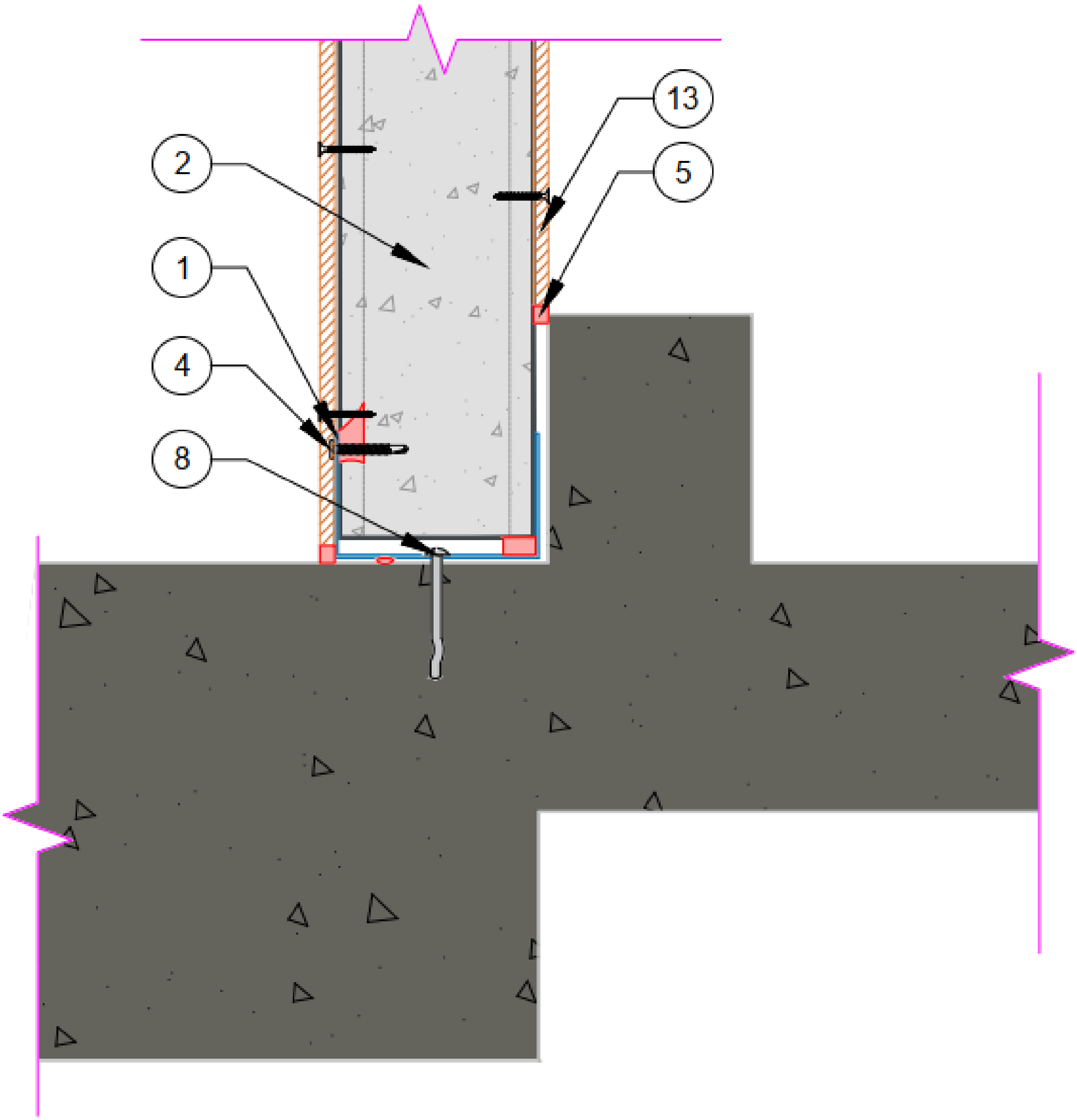


**Figure 34 Dual wall system with vertical wall between horizontal walls – vertical Speedpanel base detail at mid-landings**

Figure 35 to Figure 56 show the proposed riser systems.

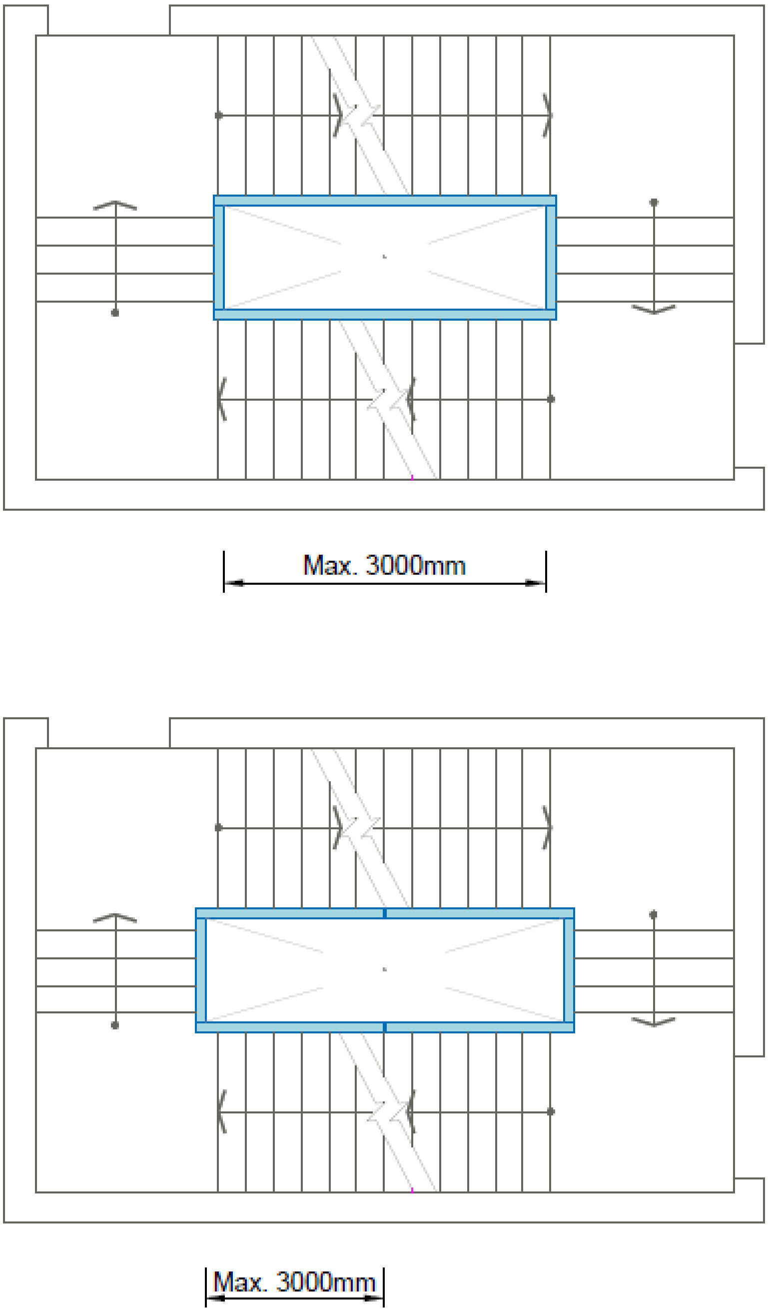


**Figure 35 Single void box riser – plan views**

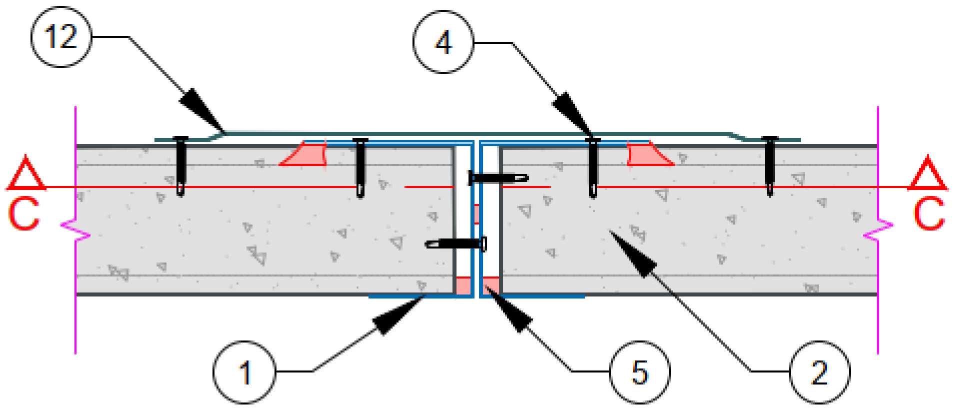


**Figure 36 Single void box riser – mid-wall connection when span is 6 m (metal flashing on unexposed side)**

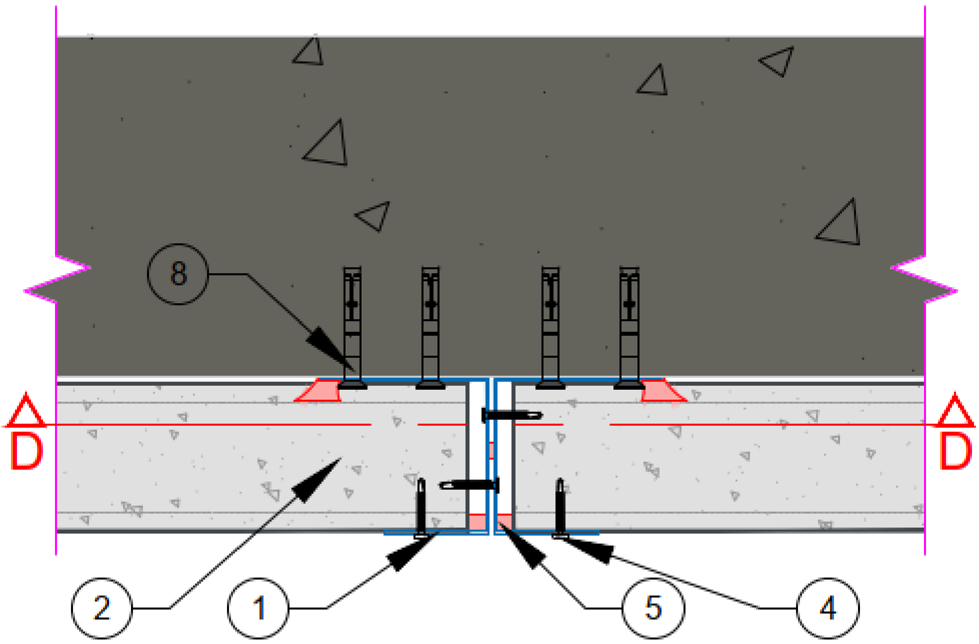


**Figure 37 Single void box riser – mid-wall connection when span is 6 m (connection to stringer)**

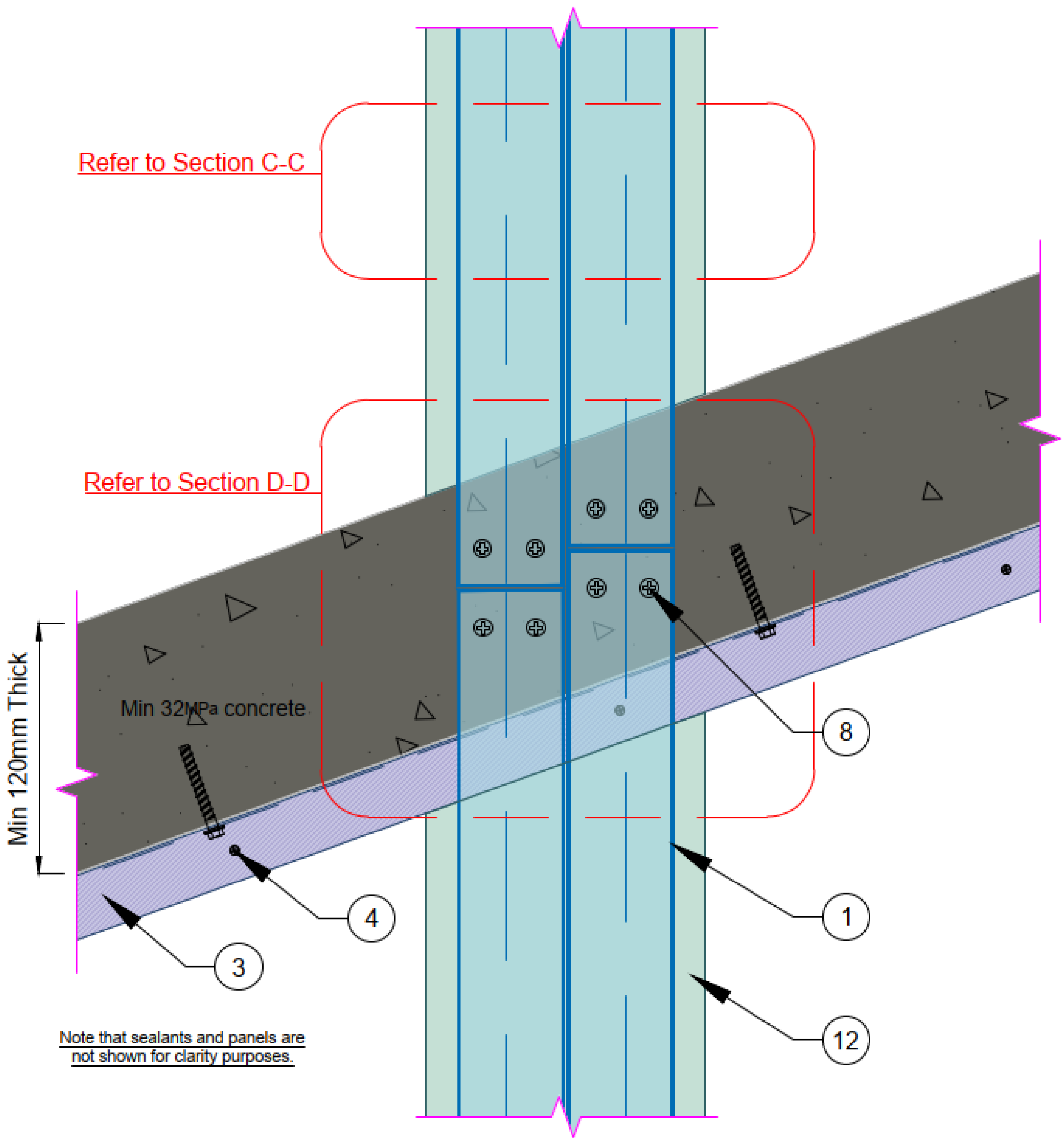


**Figure 38 Single void box riser – mid-wall connection to stair stringer**

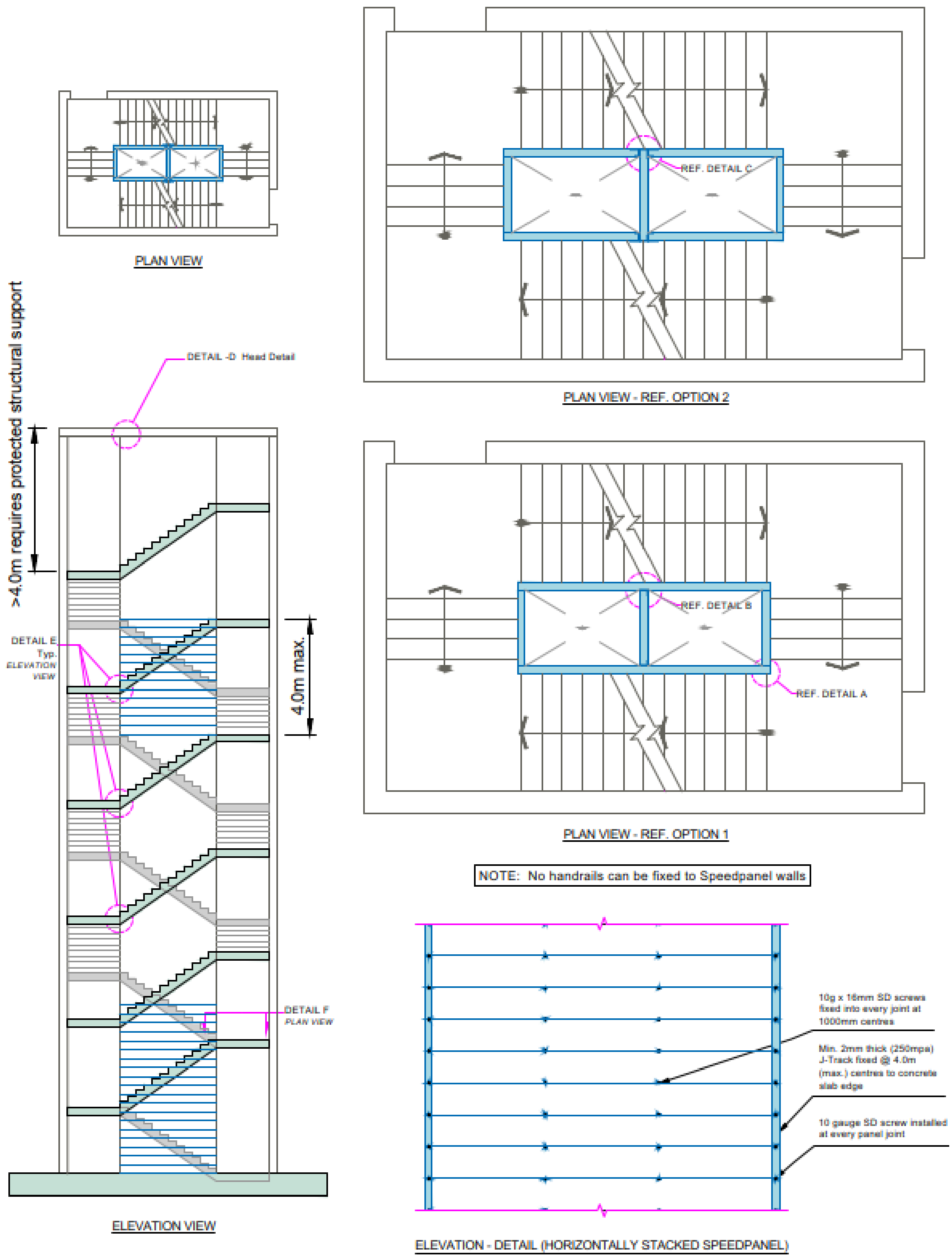


**Figure 39 Dual void box riser – section and elevation views**

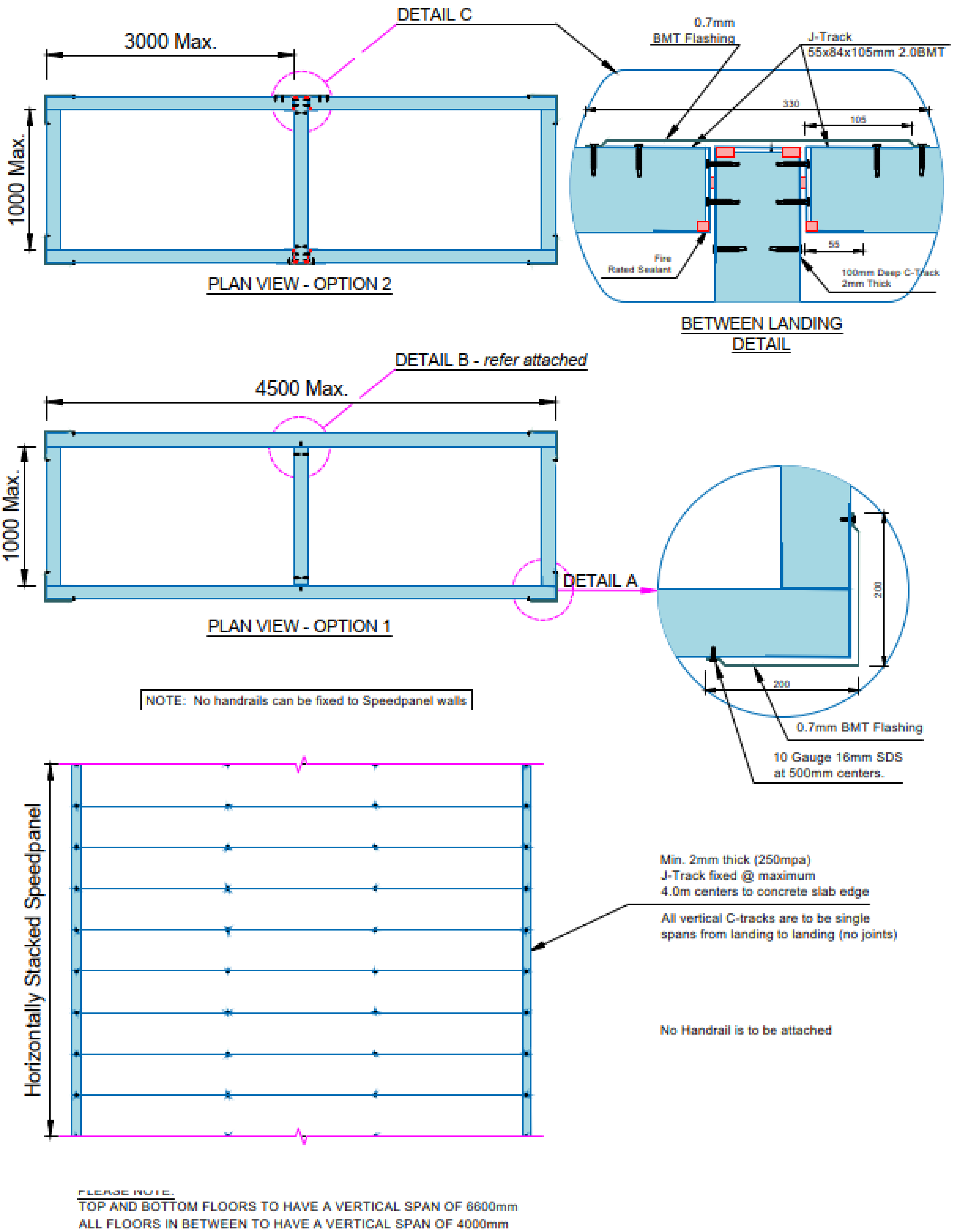


**Figure 40 Dual void box riser – plan and elevation views**

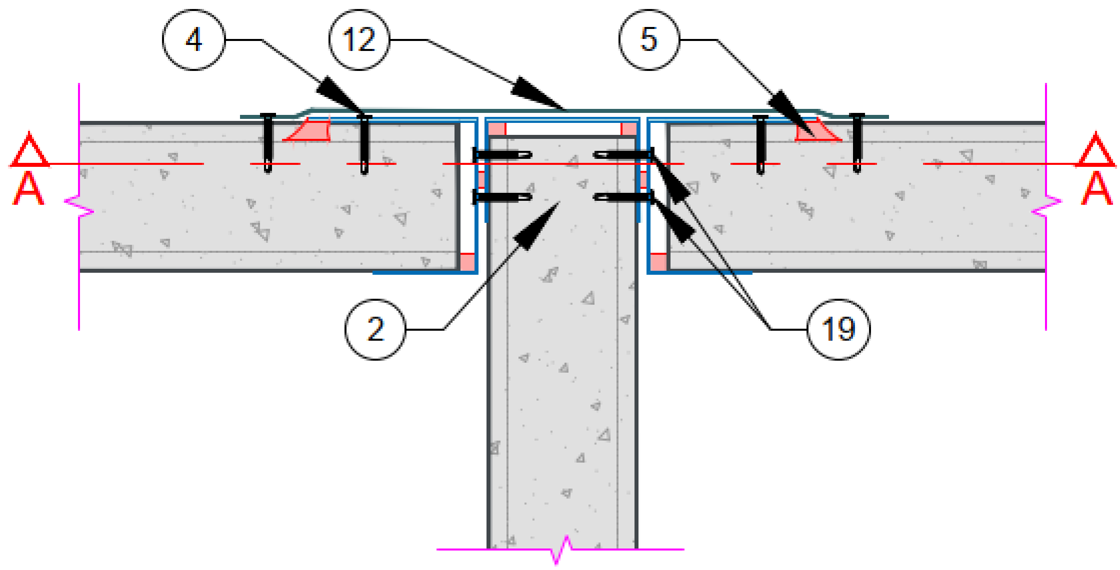


Figure 41 Dual void box riser – mid-wall connection when span is 6 m (metal flashing on unexposed side)

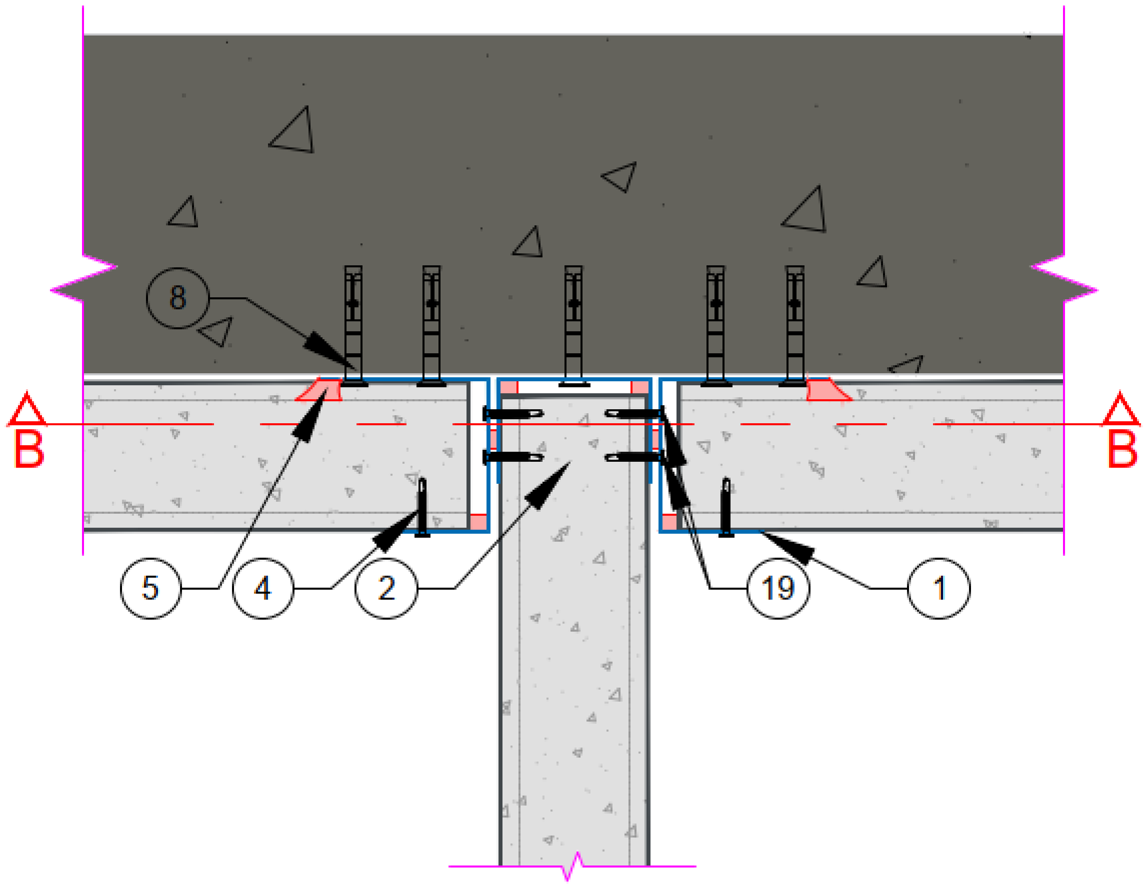


Figure 42 Dual void box riser – mid-wall connection when span is 6 m (connection to stringer)

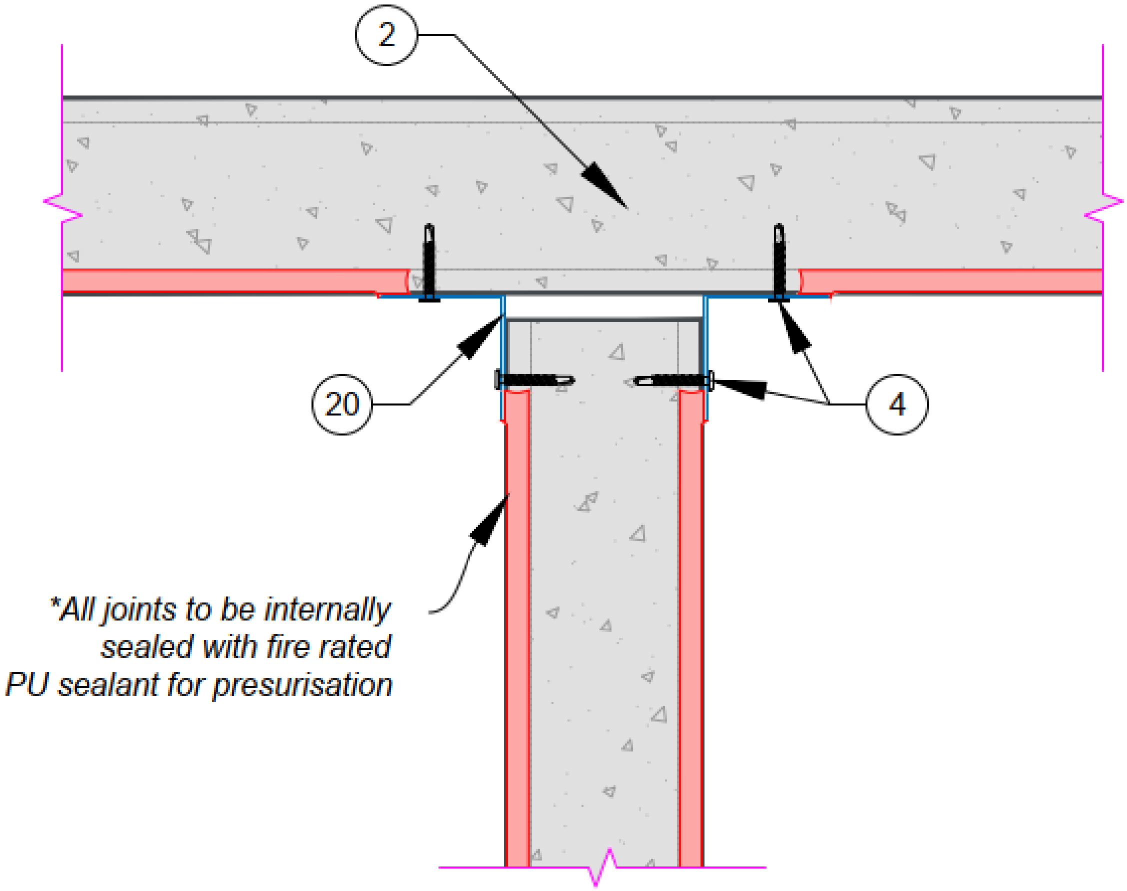


**Figure 43 Dual void box riser – mid-wall connection when span is 4.5 m (infill panel connected to continuous panel via steel angles)**

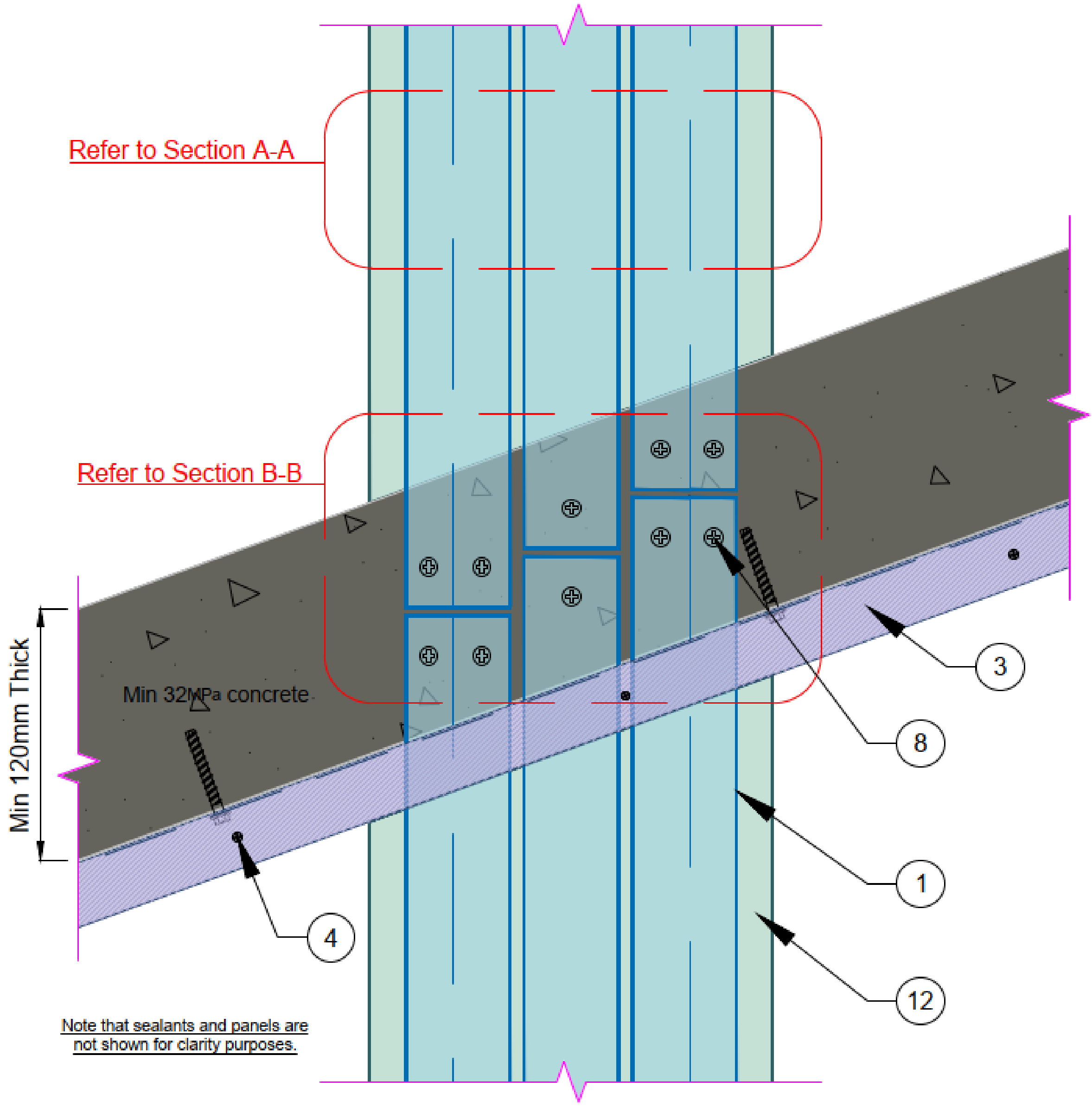


**Figure 44 Dual void box riser – mid-wall connection to stair stringer**

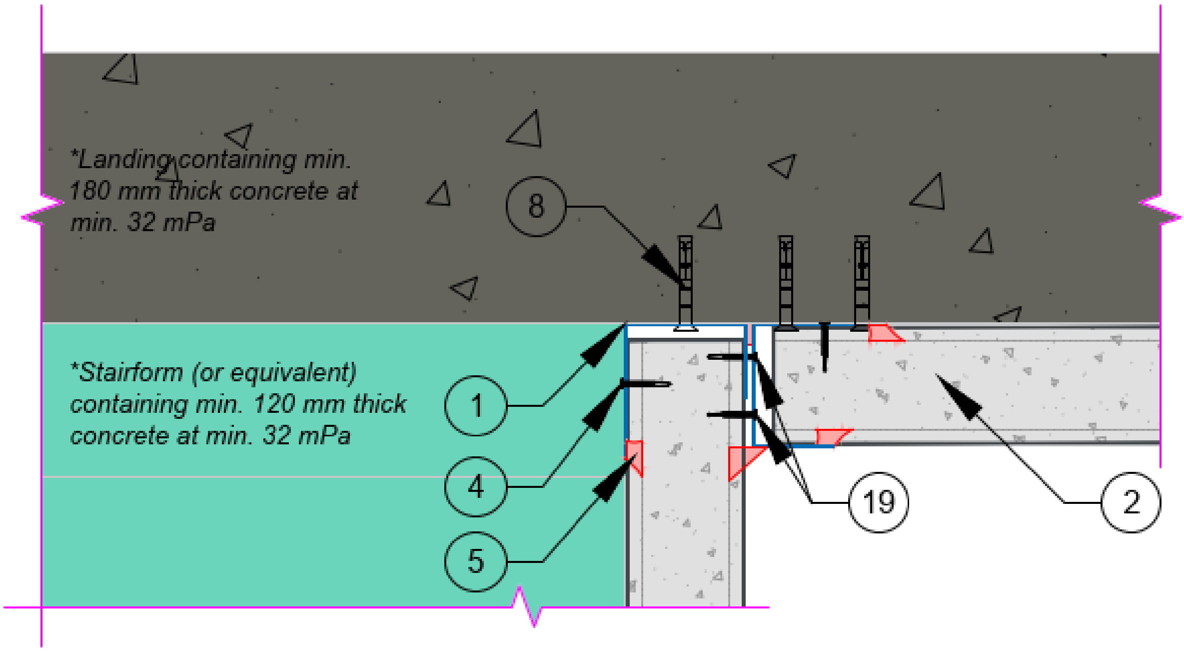


**Figure 45 Box riser – plan view of corner details**

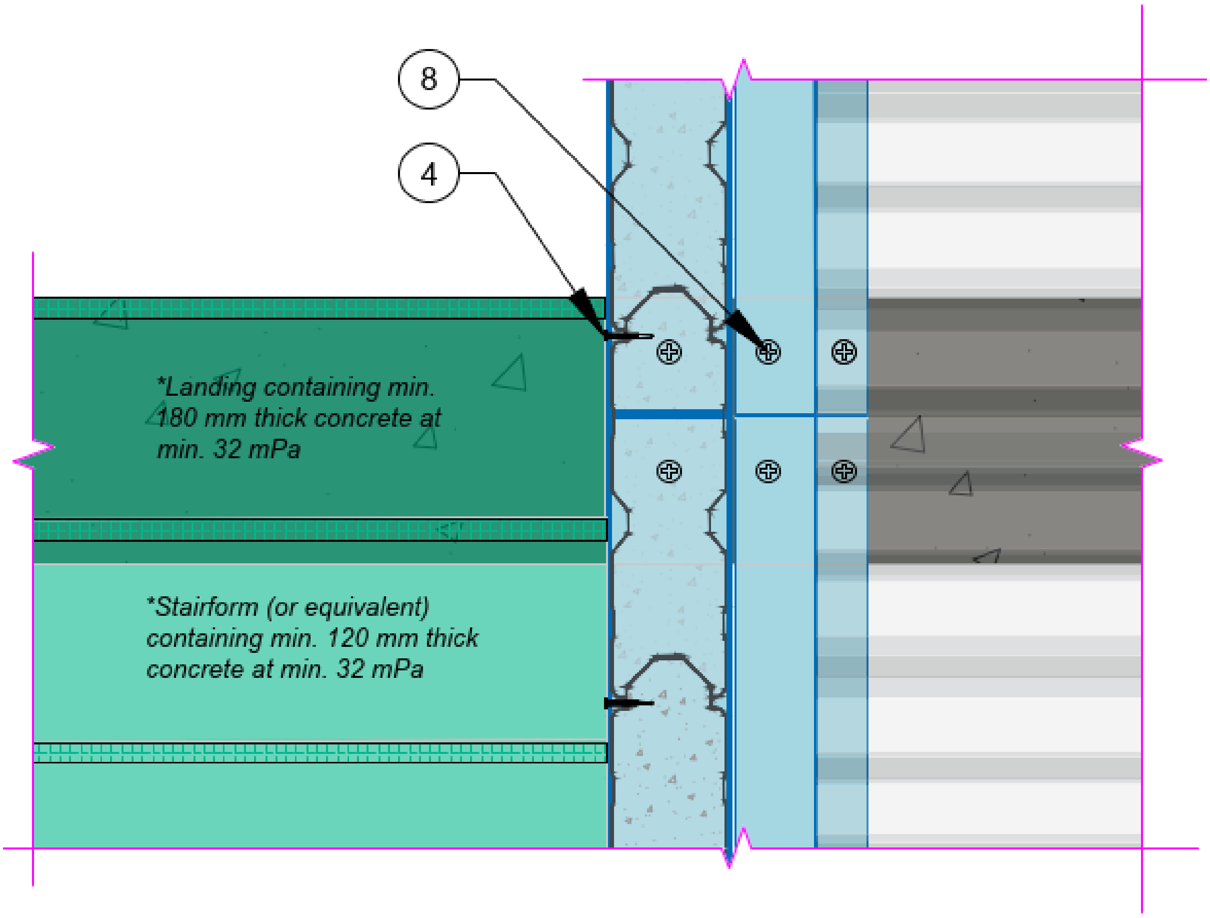


**Figure 46 Box riser – section view of corner details**

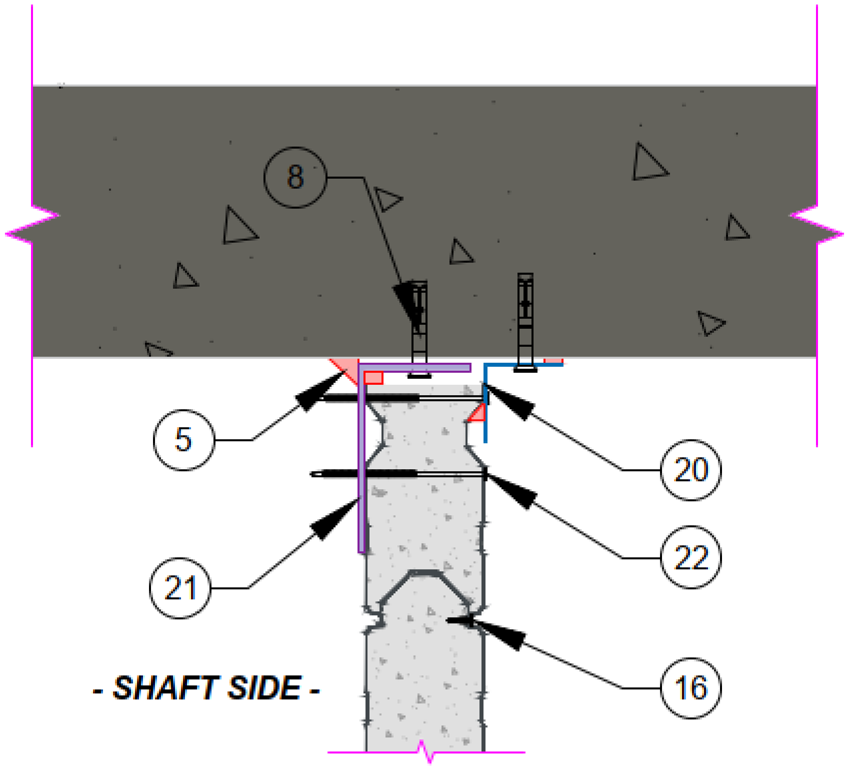


**Figure 47** **Box riser – head support option 01**

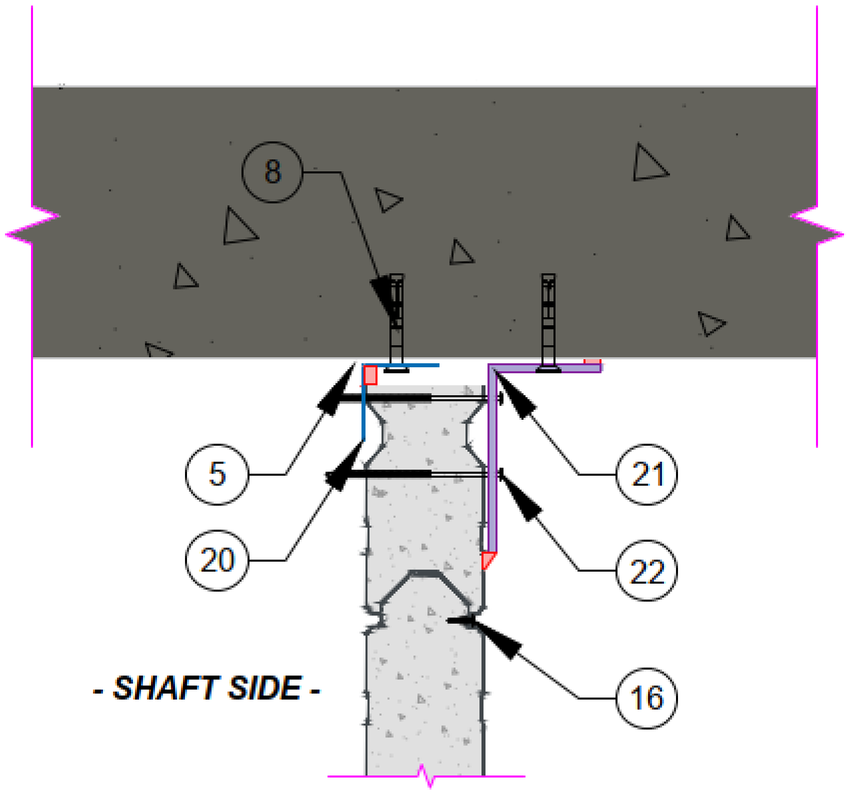


**Figure 48** **Box riser – head support option 02**

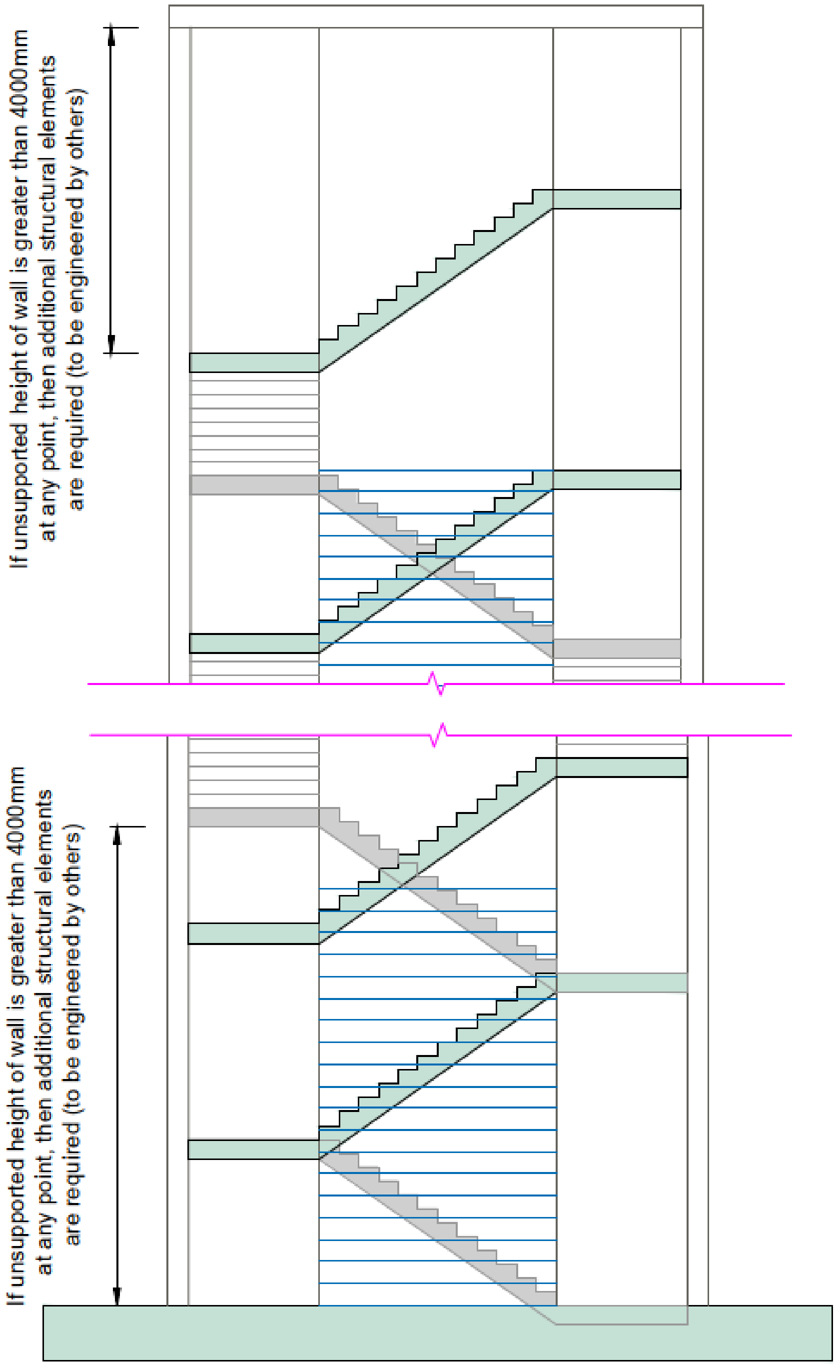


**Figure 49 Box riser – elevation views**

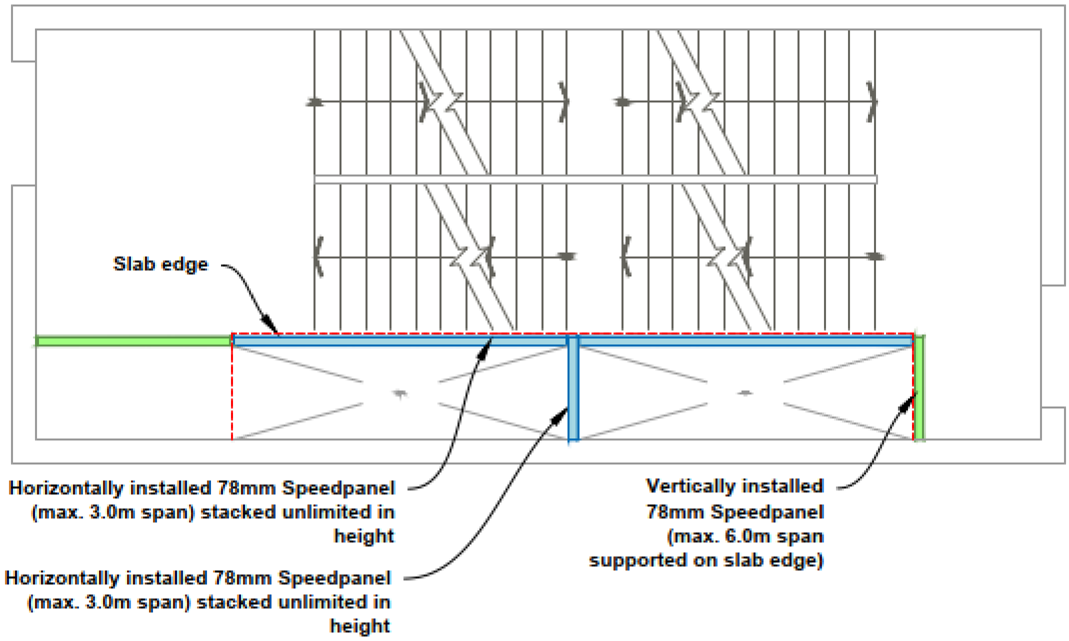


**Figure 50 Riser fixed to side of stair – option 01**

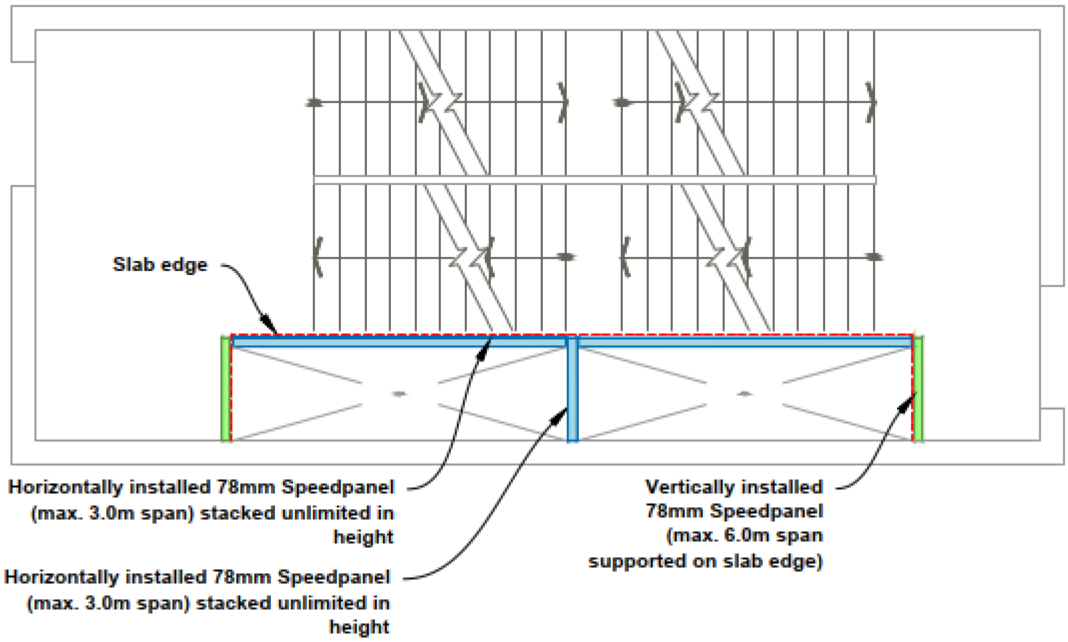


**Figure 51 Riser fixed to side of stair – option 02**

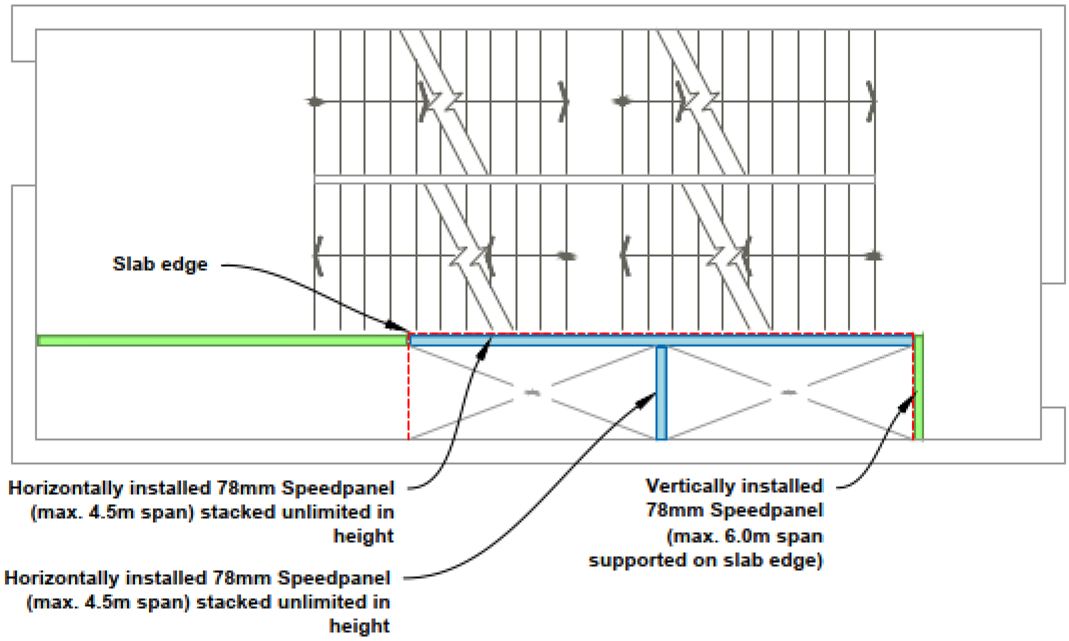


Figure 52 Riser fixed to side of stair – option 03

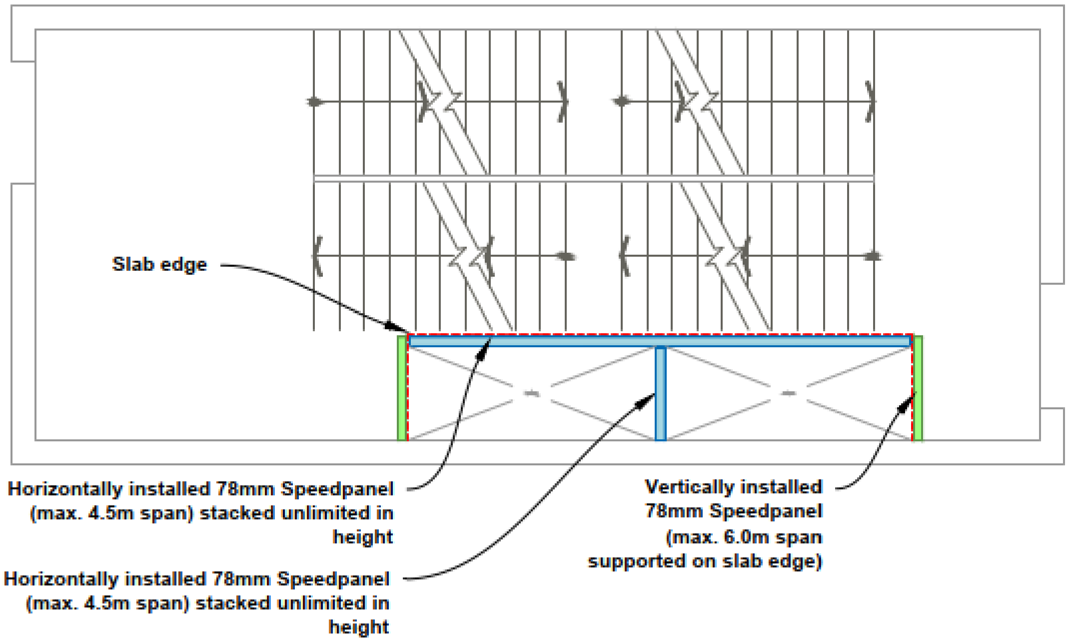


Figure 53 Riser fixed to side of stair – option 04

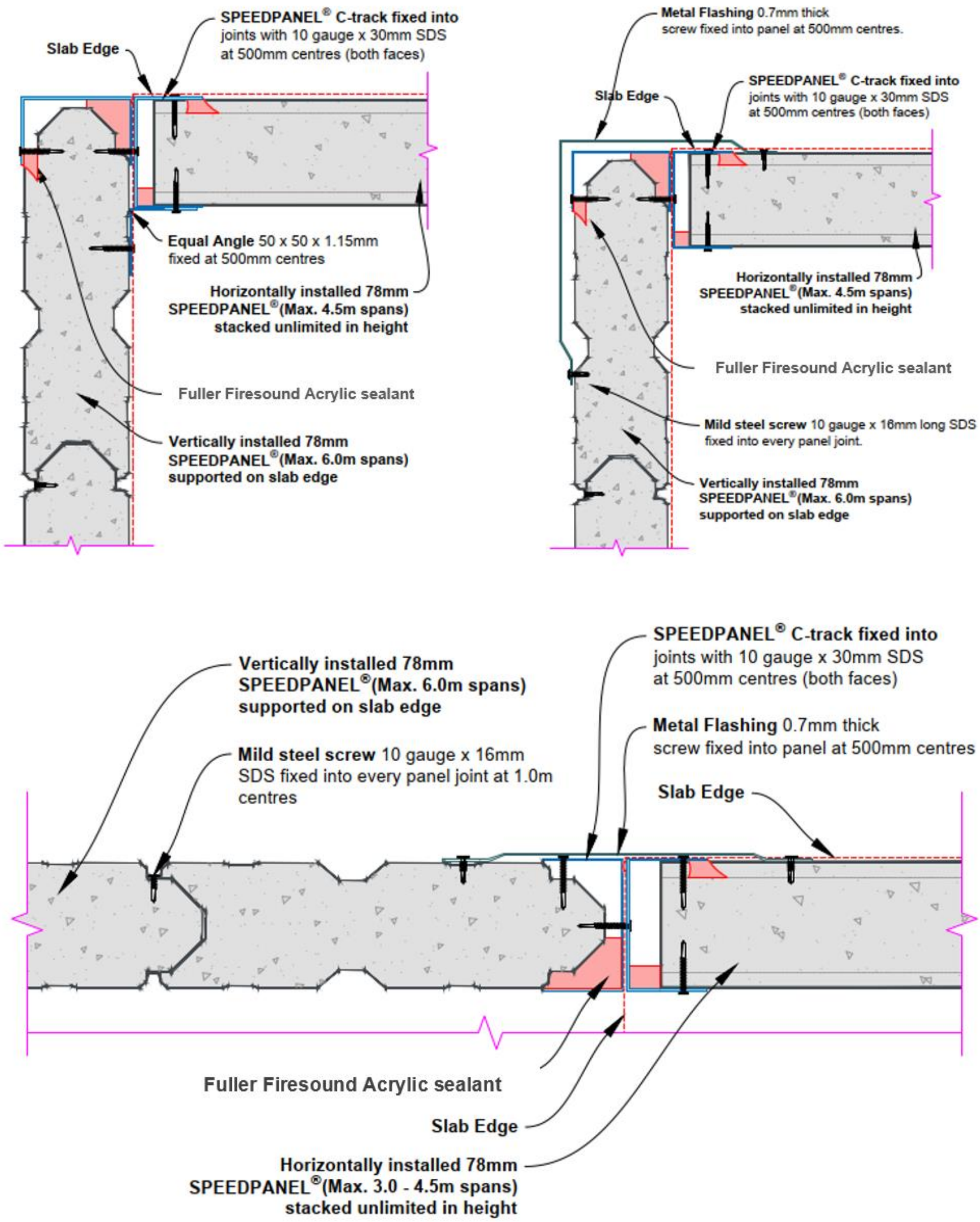


**Figure 54 Riser fixed to side of stair – connection details**

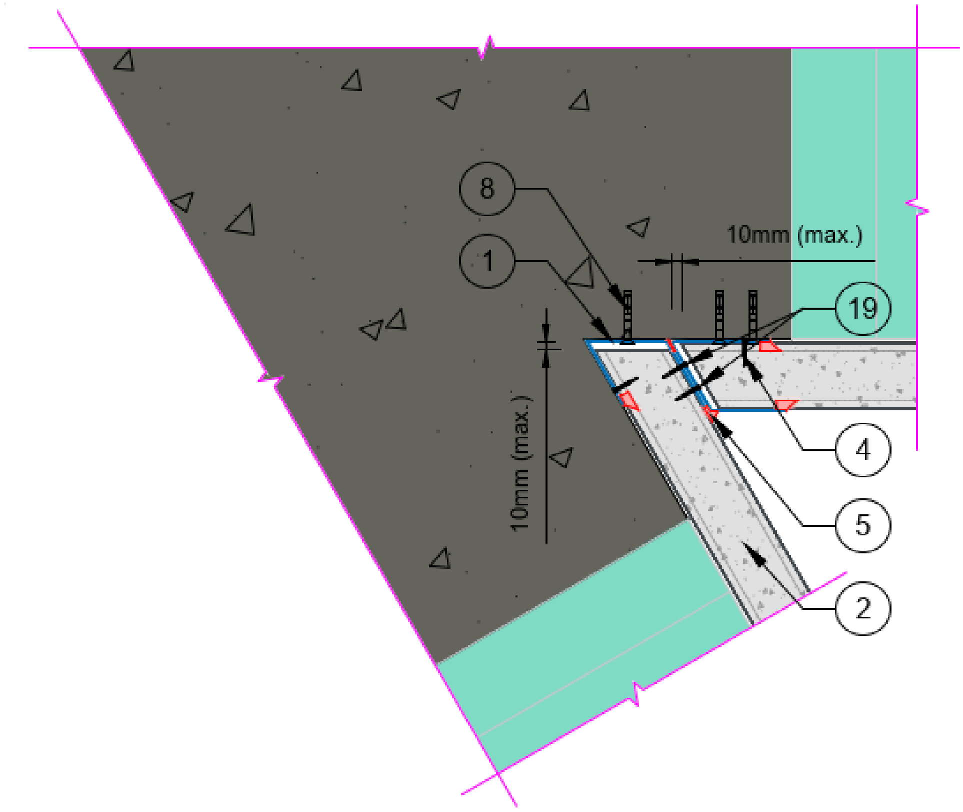


**Figure 55** Triangular riser – plan view

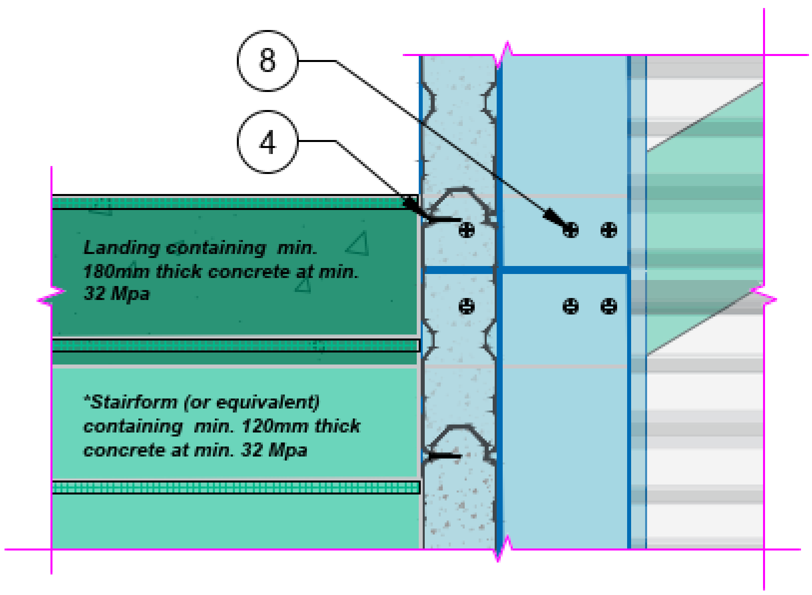


**Figure 56** Triangular riser – connection to stair stringer

Figure 57 and Figure 58 show the proposed horizontal butt joins.

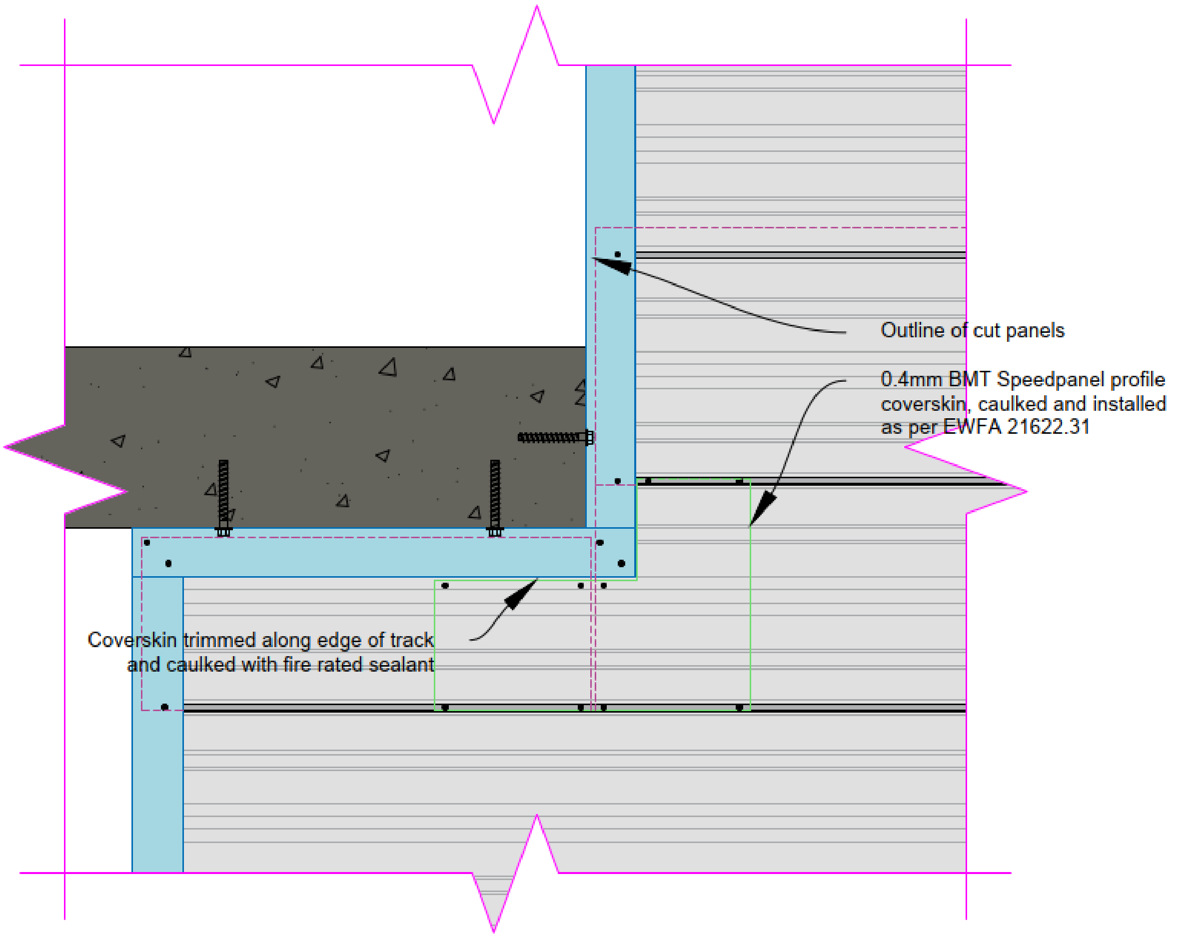


**Figure 57 Horizontal butt join on vertical cuts – option 01**

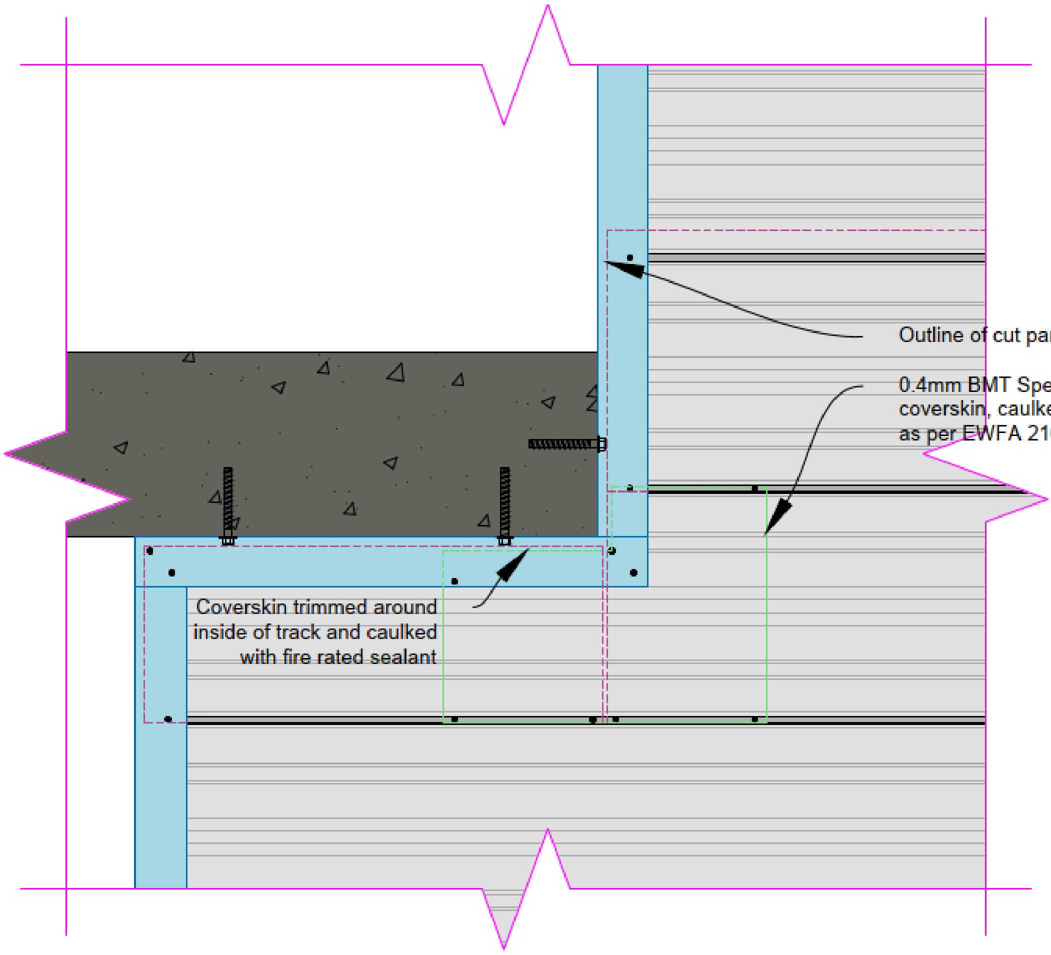


Figure 58 Horizontal butt join on vertical cuts – option 02

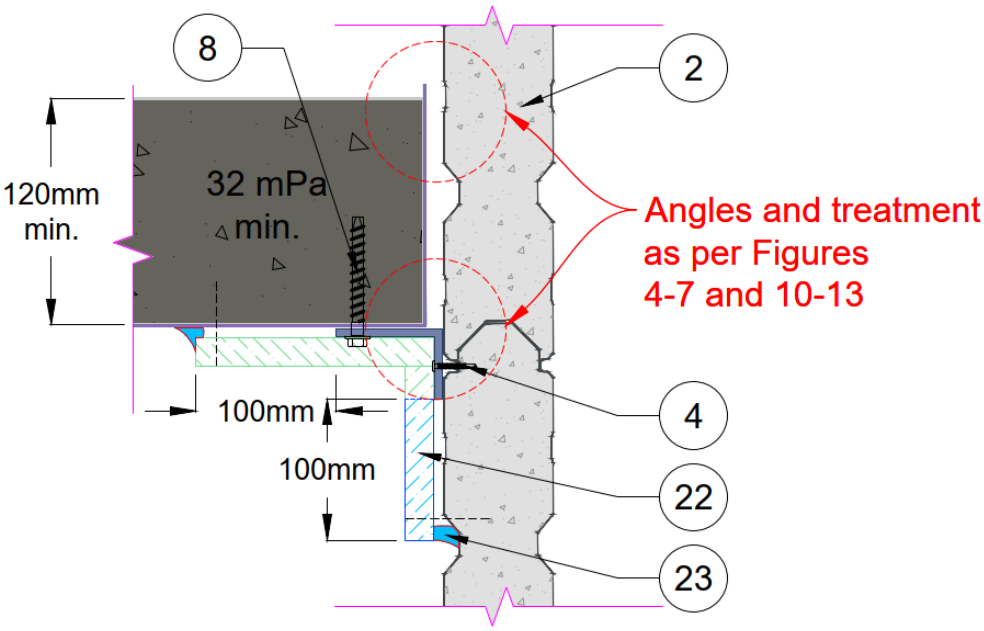


Figure 59 Spine wall to protected angle on one face (section view)

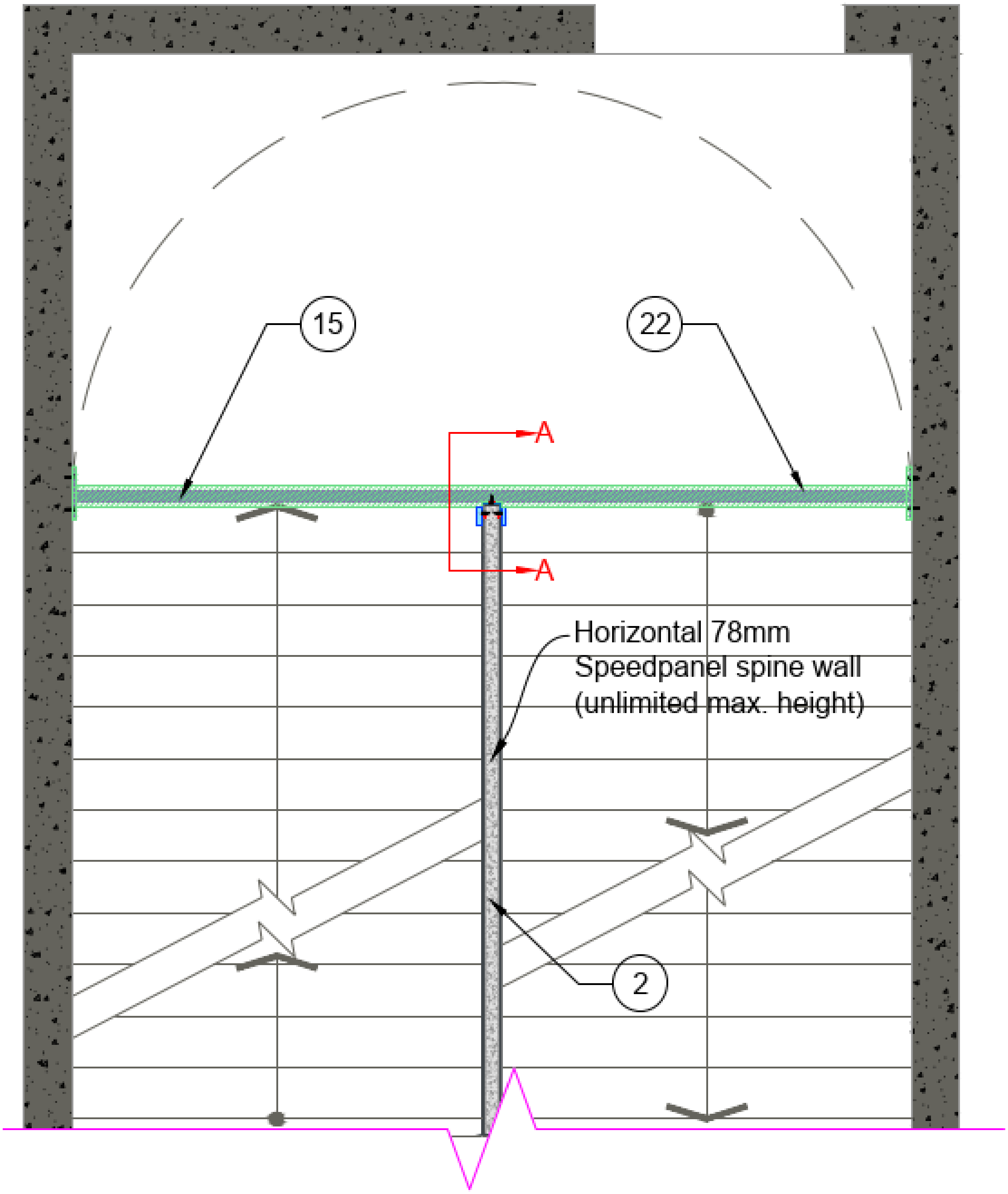


**Figure 60 Protected steel beam perpendicular to spine wall**

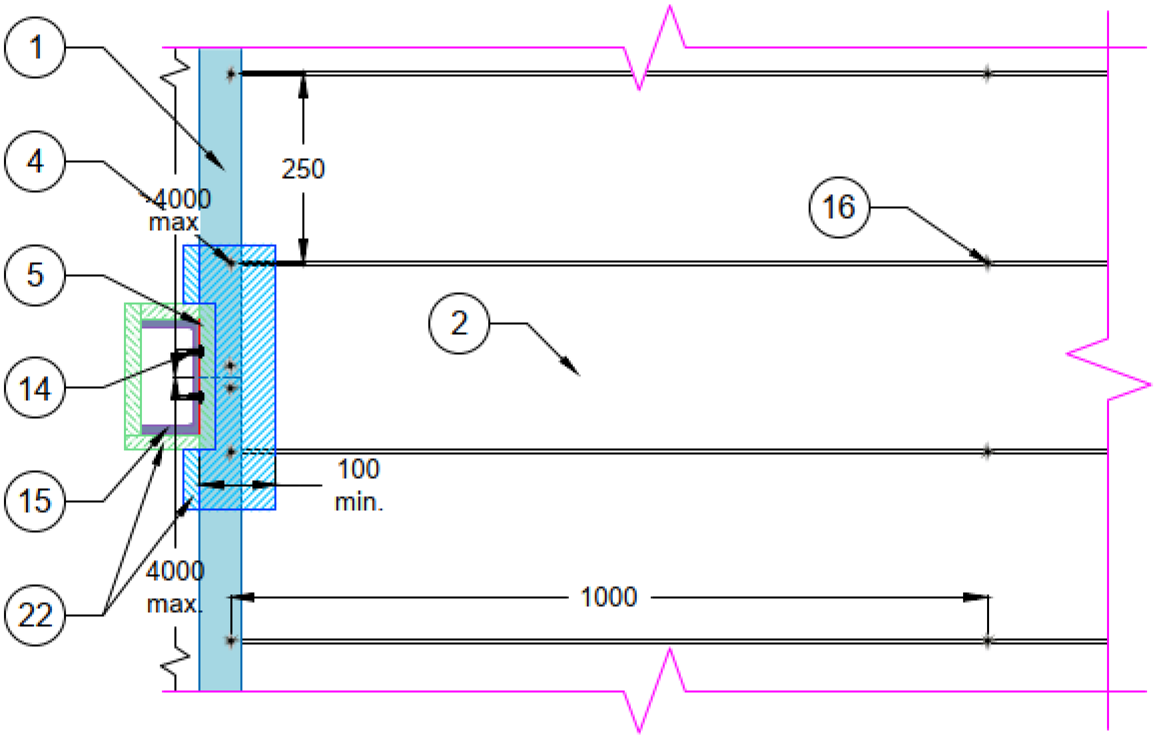


**Figure 61** Protected steel beam perpendicular to spine wall – option 1 (section A-A) view

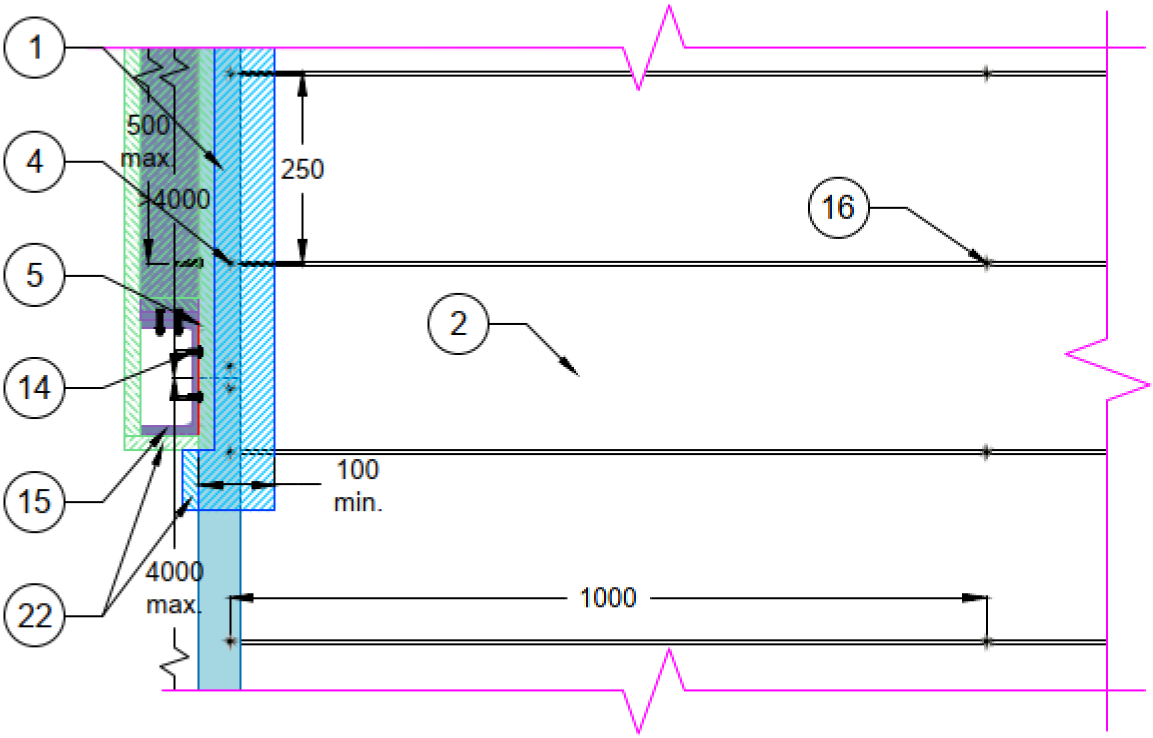


**Figure 62** Protected steel beam and dropper perpendicular to spine wall – option 2 (section A-A) view

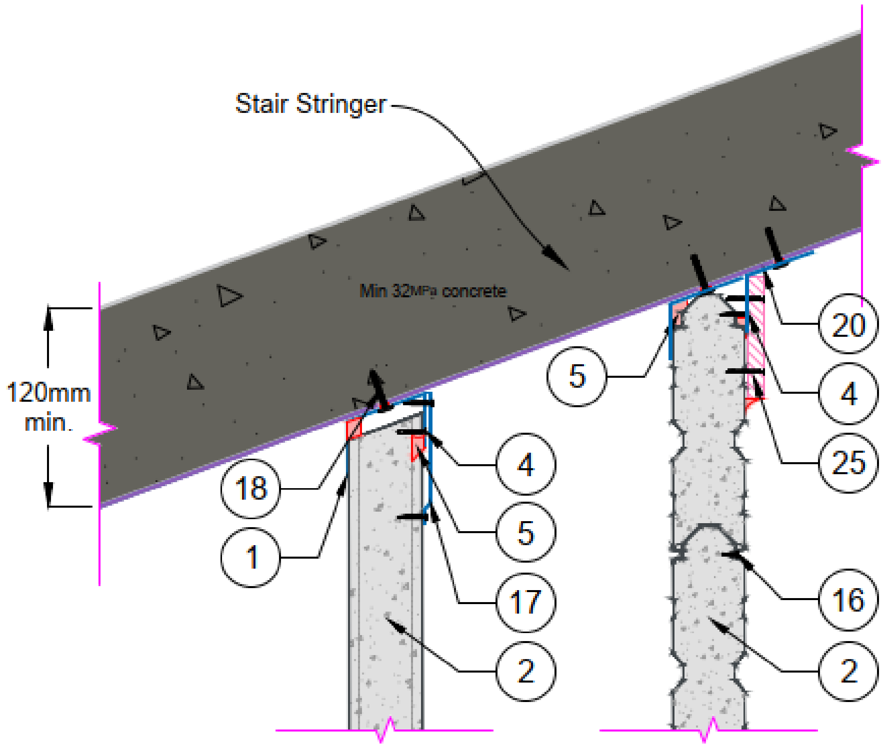


Figure 63 Vertical or horizontal Speedpanel wall under stair stringer (section view)

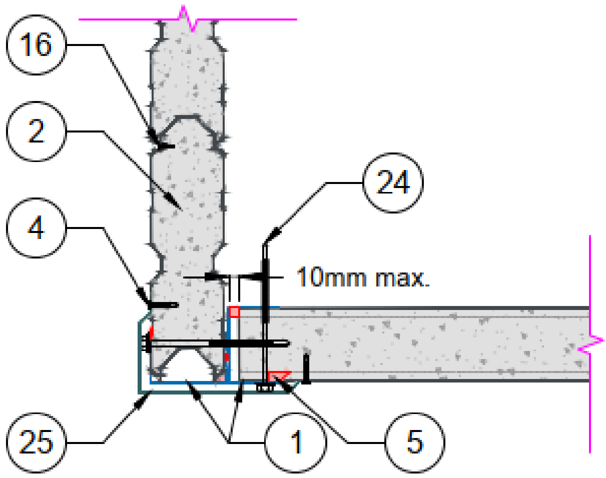


Figure 64 Vertical or horizontal Speedpanel wall under stair stringer (section view)

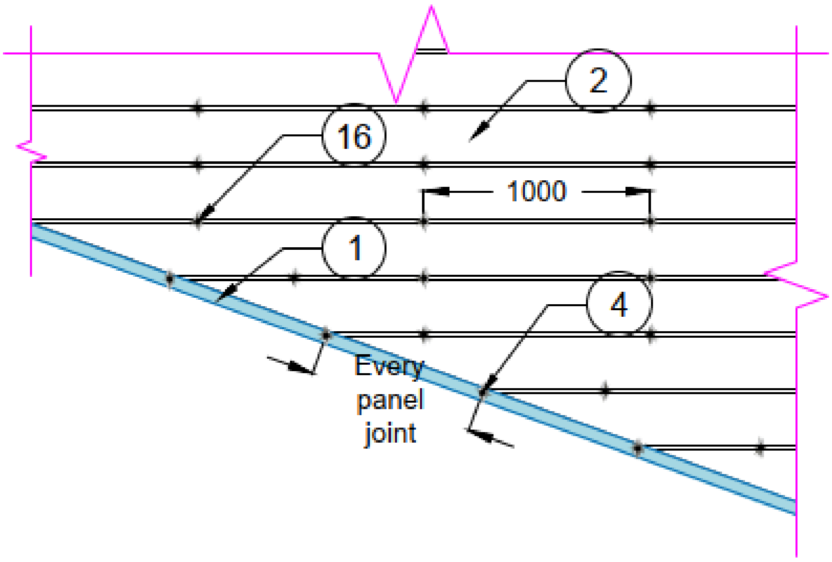


**Figure 65** **Horizontal Speedpanel wall connected to stair stringer (elevation view)**

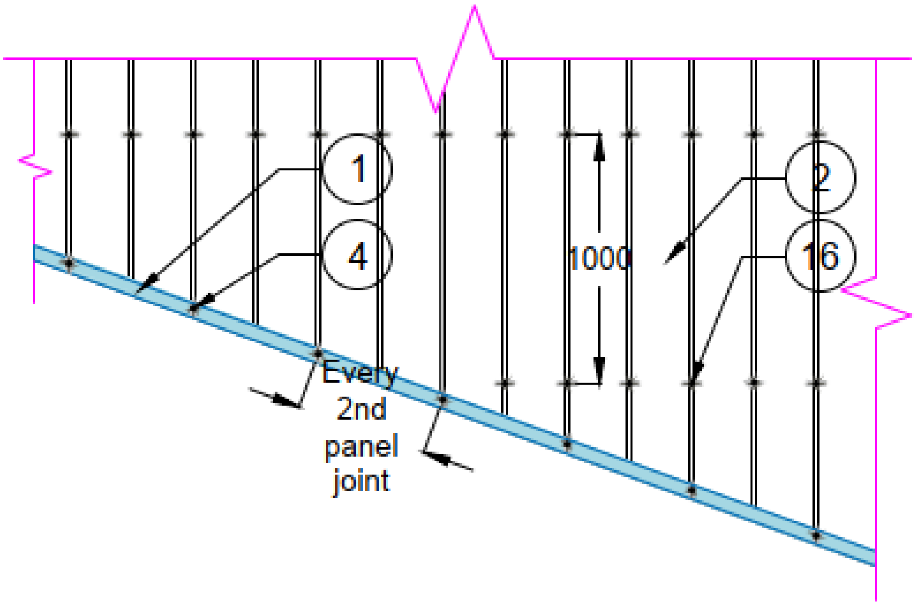


**Figure 66** **Vertical Speedpanel wall connected to stair stringer (elevation view)**

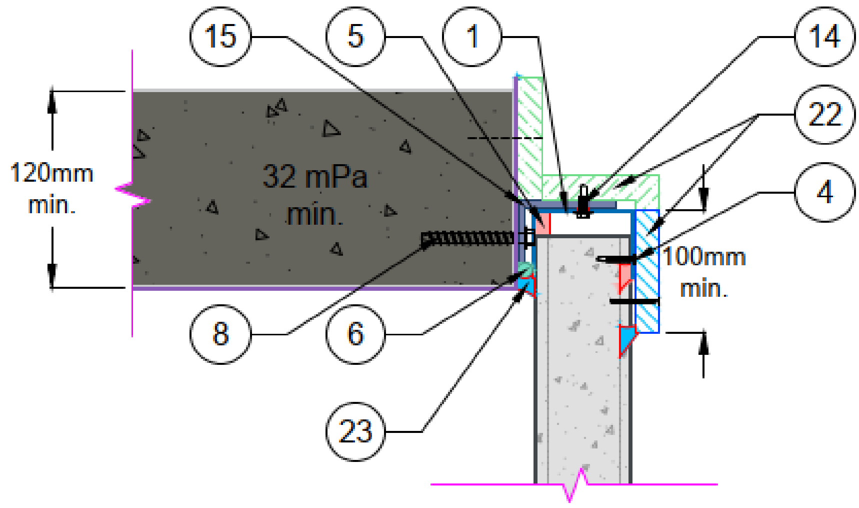


**Figure 67** **Head – vertical or horizontal wall connected to stringer via structural support (section view)**

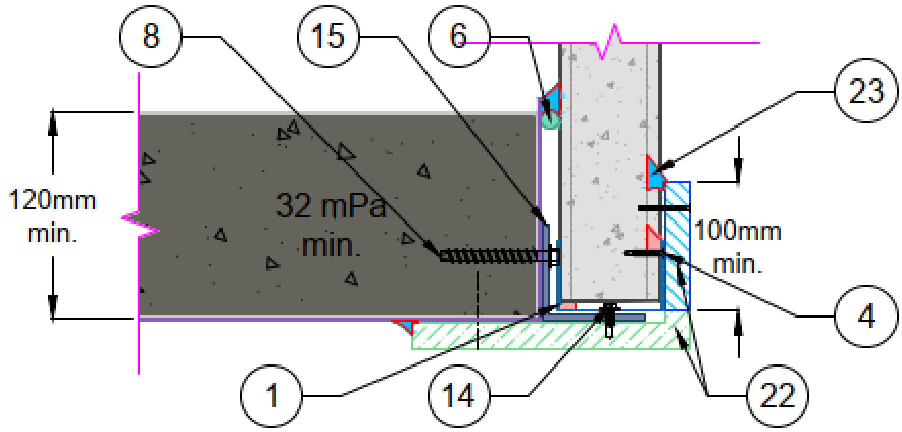


**Figure 68** **Base – vertical or horizontal wall connected to stringer via structural support (section view)**

# 5. Assessment 1 – Relevance of test data to AS 1530.4:2014

## 5.1 Description of variation

The referenced tests and assessment reports – which are detailed in Appendix B – were prepared in accordance with AS 1530.4:2005[5] which differ from AS 1530.4:2014. The effect these differences and the likely fire resistance performance of the tested specimens, if re-tested in accordance with AS 1530.4:2014, is discussed below.

## 5.2 Methodology

The method of assessment used is summarised in Table 6.

**Table 6 Method of assessment**

| Assessment method | |
|---|---|
| Level of complexity | Intermediate assessment |
| Type of assessment | Qualitative |

## 5.3 Relevance of AS 1530.4:2005 test data to AS 1530.4:2014

### 5.3.1 Summary of the referenced test standards

The fire resistance tests BWA 2286900, EWFA 2736000, EWFA 2736001, EWFA 2736002, EWFA 2848300, BWA 2257600 and EWFA 2741700 were conducted in accordance with AS 1530.4:2005, which differs from AS 1530.4:2014. The effect these differences have on the fire resistance performance of the referenced test specimens is discussed below.

### 5.3.2 Furnace temperature regime

The furnace heating regime in fire resistance tests conducted in accordance with AS 1530.4:2014 follows a similar trend to that in AS 1530.4:2005.

The specified specimen heating rate in AS 1530.4:2005 is given by:

$$T_t - T_0 = 345 \log(8t + 1) + 20$$

Where:

$T_t$ = furnace temperature at time t, in degrees Celsius.

$T_0$ = initial furnace temperature, in degrees Celsius.

t = the time into the test, measured in minutes from the ignition of the furnace.

The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4:2014 and AS 1530.4:2005 are not appreciably different.

### 5.3.3 Furnace pressure regime

The furnace pressure conditions for single and multiple penetration sealing systems in AS 1530.4:2005 and AS 1530.4:2014 are not appreciably different.

The parameters outlining the accuracy of control of the furnace pressure in AS 1530.4:2014 and AS 1530.4:2005 are not appreciably different.

### 5.3.4 Performance criteria

AS 1530.4:2014 specifies the following performance criteria for building materials and structures:

[5] Standards Australia (2005), Methods for fire tests on building materials, components and structures Part 4: Fire resistance tests for elements of construction, Standards Australia, AS 1530.4:2005.

- Structural adequacy
- Integrity
- Insulation.

### 5.3.5 Structural adequacy performance criteria

The structural adequacy performance criteria and criteria of failure in AS 1530.4:2014 and AS 1530.4:2005 are not appreciably different with the same limiting values for parameters such as axial contraction and deflection.

### 5.3.6 Integrity performance criteria

To determine integrity failure, AS 1530.4:2014 stipulates that – in addition to the 20 mm thick × 100 mm × 100 mm cotton pads – additional cotton pads must be provided with a reduced 30 mm × 30 mm × 20 mm size with an additional wire frame holder.

Apart from this variation, the failure criteria for integrity in AS 1530.4:2014 and AS 1530.4:2005 are not appreciably different.

### 5.3.7 Insulation performance criteria

The positions of thermocouples and the failure criteria for insulation in AS 1530.4:2014 and AS 1530.4:2005 are not appreciably different.

### 5.3.8 Application of the test and assessment data to AS 1530.4:2014

There is a difference in cotton pad size between the two standards. However, in the referenced tests, the cotton pad test was carried out at all instances when integrity failure was imminent and so the integrity performance is not likely to be affected if measured in terms of the stipulations prescribed in AS 1530.4:2014.

Based on the above discussion – and in absence of any foreseeable integrity and insulation risk – it is concluded that the results relating to the integrity and insulation performance of the tested specimens can be used to assess the integrity and insulation performance in accordance with AS 1530.4:2014.

# 6. Assessment 2 – Single 78 mm thick Speedpanel walls

## 6.1 Horizontally oriented Speedpanel wall

### 6.1.1 Description

The proposed construction is a single wall system comprised of horizontally oriented Speedpanel wall used for fire compartmentalisation between two independent stair stringers in a scissor stair configuration. The main connection points of the horizontal Speedpanel wall are at the angle stair stringer, the side C-tracks and to the concrete landings. The Speedpanel walls are connected to the stair stringers on both sides of the wall via steel angles and are also anchored at concrete landings at each floor level at the base of the C/J tracks fixed to the vertical edges of the wall. The allowable gaps between the stair stringer and the bottom angle are 0-95 mm, and the size of the steel angle will vary to accommodate these gaps as provided in section 4.5.

The proposed configuration is as shown in Figure 1 to Figure 3 and cannot be tested directly in accordance with AS 1530.4:2014. To determine the fire resistance performance of a horizontally oriented Speedpanel wall, it is considered that in practice fire separation occurs in the highlighted section shown in Figure 3 – confined to the area between the angle bracings of the stair stringers. All other sections would be subject to fire conditions on both sides of the wall.

Therefore, it is considered that the highlighted section of Figure 3 will provide the required fire resistance in the horizontal and vertical planes and is the only section of the proposed construction for which an FRL can be attributed. Fire resistance in the horizontal plane will be contributed by the panels in the highlighted section while the fire resistance in the vertical plane will be through the panel-to-stair edge conditions in the perimeter of the highlighted section.

Considering the structural adequacy of the Speedpanel wall components in elevated temperatures and the fire resistance performance of the wall in terms of integrity and insulation, the maximum span of the horizontally oriented 78 mm thick single Speedpanel wall is 5 m and the height is unlimited. The slab-to-slab height (between concrete landings to which the wall is anchored) is maximum 3.3 m with the use of 1.15 mm BMT vertically installed C/J-tracks and a maximum of 4 m with 1.95 mm BMT C/J-tracks. Any additional structures needed to support a Speedpanel wall outside of these assessed spans (eg: steel columns) are required to be engineered by an accredited structural engineer and protected to achieve an FRL 120/120/120 or 120/-/-.

### 6.1.2 Methodology

The approach and method of assessment used for this assessment is summarised in Table 7.

**Table 7 Method of assessment**

| Assessment method | |
|---|---|
| Level of complexity | Complex assessment |
| Type of assessment | Quantitative and qualitative |

### 6.1.3 Structural adequacy of 78 mm thick horizontally oriented Speedpanel wall systems

In the event of a fire in one of the twin scissor stairs, the self-weight of the Speedpanel wall section between two floor levels will be carried by the bottom angle of the unexposed stair stringer and the unexposed side C/J-track. The self-weight of the Speedpanel wall will be transferred via anchor and/or screw connections to the concrete landing slabs and to the unexposed concrete staircase. The maximum self-weight applied on these critical components will be dependent of the maximum span and slab-to-slab height of the walls.

When calculating the structural adequacy of the Speedpanel wall in scissor stair configurations under elevated temperatures resulting from standard fire conditions, the reduction in strength of the steel components needs to be incorporated into the analysis. The reduction factors specified in

BS EN 1993-1-2:2005[7] Table 3.1 are used for this purpose in this assessment report. Reduction factors are determined based on 120 minutes of exposure to a standard fire curve – as prescribed in AS 1530.4:2014 – are considered to be common for all steel elements including the steel angles, side tracks and connection components.

The proposed construction is a Speedpanel wall system similar to the tested wall system in BWA 2286900, but with horizontally oriented Speedpanel panels with an increased horizontal span of 5 m. As Speedpanel walls are non-load bearing systems, it is assumed that only integrity performance will be compromised due to increased wall height. Based on the test evidence, a structural analysis was conducted to demonstrate that the horizontally oriented Speedpanel wall systems with a span of up to 5 m will maintain the same integrity performance as the tested system in BWA 2286900 for at least 120 minutes. The calculation is based on the following assumptions:

- The deflection is based on the deflection measured at 120 minutes in fire test report BWA 2286900.
- The lateral deflections measured at the mid-point of the wall was used directly in determining the bending moment capacity of the proposed construction.
- The radius of curvature of the expected deflection behaviour of the proposed constructions would be similar to that of the tested system. Deflection characteristics of a horizontally oriented panel is assumed to be the same as a vertically oriented panel.

As shown in Table 8, the induced maximum bending moment and the axial load of the proposed maximum 5 m wide (with a maximum of 4 m slab-to-slab height considered here as an example) 78 mm thick horizontally oriented Speedpanel wall is less than the allowable limits obtained from the test in BWA 2286900 for 120 minutes of structural adequacy and integrity performance.

**Table 8 Structural adequacy of 78 mm thick horizontally oriented wall with an increased span**

| Description | | Value |
|---|---|---|
| Tested system | Weight of the panel | 36.5 kg/m$^2$ |
| | Height of the wall | 3 m |
| | Width of the wall | 3 m |
| | Wall thickness | 78 mm |
| | Applied load | 4.3 kN/m |
| | Self-weight at mid height (1.5 m from the base) | 0.54 kN/m |
| | Load at wall mid height in the test | 4.84 kN/m |
| | Deflection before the integrity failure | 177 mm |
| | **Maximum bending moment capacity (calculated)** | **0.856 kNm/m** |
| Proposed system | Measured weight of the panel | 36.5 kg/m$^2$ |
| | Span of the wall | 5 m |
| | Wall thickness | 78 mm |
| | Self-weight of a panel | 1.61 kN/m |
| | Predicted maximum deflection at 120 minutes | 473.7 mm |
| | Determined bending moment capacity at integrity failure | 0.85 kNm/m |
| | **Ratio of safety with respect to bending moment** | **0.99 < 1.0** |

[7] European Committee for Standardization, BS EN 1993-1-2:2005: 2005, Eurocode 3: design of steel structures. General rules-structural fire design, European Committee for Standardization, Brussels, Belgium.

Therefore, a maximum span of 5 m and a floor-to-floor height of 4 m will likely provide the required structural adequacy and integrity performance for 120 minutes similar to the tested specimen. However, the maximum floor-to-floor height is also influenced by the structural capacity – at elevated temperatures – of the stringer bottom angle and side C/J-tracks to which the wall is connected to and these effects are discussed below.

### Structural adequacy of side C-tracks and connections to Speedpanel wall and landings

It is proposed that the Speedpanel walls are fixed to 82 mm wide × 55 mm high × 1.15 mm BMT steel C-tracks or 82 mm wide × 55 mm high × 1.95 mm BMT steel C-tracks on the vertical edges at every second panel join (500 mm centres) on both exposed and unexposed sides with 35 mm long self-tapping screws. This is similar to the tested configuration detailed in test report EWFA 2257600 of a 78 mm thick horizontally oriented vertical Speedpanel wall with the panels fixed to C-tracks on the vertical edges at every second panel join (500 mm centres) on both the exposed and unexposed sides with 35 mm long self-tapping screws.

Since the side tracks are regularly screwed to the Speedpanel walls, they are considered as fully restrained and their section compression capacities are calculated. This compression capacity will determine the maximum self-weight of wall section that can be supported and hence will limit the maximum floor-to-floor height of the wall.

The structural calculations undertaken to determine the ratio of safety with respect to axial compression capacity of the side C-track with 1.15 mm BMT after a fire exposure of 120 minutes is shown in Table 9. It is found that the maximum self-weight that can be supported by the exposed C-track enables a floor-to-floor height of 3.3 m. This is based on the assumption that the vertical loads are also carried by one bottom steel angle between the wall and stringer and the C-track on the opposite edge of the Speedpanel wall, both which will be in ambient conditions and will have a larger bending and compression capacity.

The same methodology can be used to calculate the capacity of C-track with 1.95 mm BMT which enables a floor-to-floor height of 4 m.

**Table 9 Structural calculations for side C-track compression capacity**

| Description | Value |
|---|---|
| Cross-section dimensions of C-section | 55 × 82 × 1.15 mm |
| Cross-sectional area | 218.04 $mm^2$ |
| Yield strength, $f_y$ | 250 $N/mm^2$ |
| Reduction factor for elevated temperatures (120 minutes) | 0.037 |
| Sectional compression capacity | 2.02 kN |
| Dimensions of wall section | 5 m × 3.3 m |
| Self-weight carried by the exposed side C-track | 1.87 kN |
| **Ratio of safety with respect to axial compression** | **0.93 < 1.0** |

FS0885 mechanical power fasteners or equivalent bolt connections are proposed to be used to anchor side C-tracks of the Speedpanel walls to concrete landings. As shown in Table 10 below, the structural capacity of the FS0885 power fasteners can be obtained from the installation manual and should be designed and confirmed by an accredited structural engineer. It is expected that the fasteners will be covered from fire exposure as they are installed between the Speedpanel and the C-tracks and due to their 60 mm embedment in the concrete. The minimum concrete strength of the stringer/landing must be 32 MPa. The example calculation provided in Table 10 is for a wall section with a maximum span of 5 m and a maximum slab-to-slab height of 4 m with 1.95 mm BMT side C-tracks. It is determined that there must be a minimum of 2 power fasteners at each landing connection.

**Table 10 Structural adequacy of FS0885 power fasteners**

| Description | Value |
|---|---|
| Nominal diameter of FS0885 power fasteners | 8 mm |
| Tensile capacity of fastener under limit state design in 32 MPa concrete with an embedment of 60 mm | 7.9 kN |
| Shear capacity of fastener under limit state design in 32 MPa concrete with an embedment of 60 mm | 7.9 kN |
| Reduction factor for hole spacing for tension ($R_s$) | 0.7 |
| Reduction factor for edge spacing for tension ($R_e$) | 0.86 |
| Reduction factor for hole spacing for shear ($R_s$) | 0.7 |
| Reduction factor for edge spacing for shear ($R_e$) | 0.71 |
| Factored tensile capacity | 4.75 kN |
| Factored shear capacity | 3.93 kN |
| Dimensions of wall section | 5 m × 4 m |
| Total design shear load | 6.9 kN |
| Proposed number of bolts for shear at each landing connection | 2 |
| **Ratio of safety with respect to shear** | **0.44 < 1** |

### Structural adequacy of the bottom steel angle and connections to stringer

The Speedpanel walls are connected to stair stringers on both sides of the wall via steel angles with varying section sizes to accommodate gap widths between the stair stringer and Speedpanel wall. It is expected that, in a fire event, one of the steel angles will be compromised and a portion of the loads from the Speedpanel wall section above will be carried by the opposite steel angle on the unexposed side of the wall under ambient conditions. 10g × 30 mm flat-top, self-drilling, zinc-coated steel screws are used to fix the steel angle to the Speedpanel wall at every panel joint.

Table 11 shows the structural calculations undertaken to determine if the bending capacity of the bottom steel angle sections is adequate to support the design load from the Speedpanel wall section above considering a maximum floor-to-floor height of 4 m and a maximum span of 5 m. The example provided is for the minimum steel angle section required for 10 mm stair-to-wall gaps. Table 12 provides the shear capacity of the 10g screws used to connect the steel angle to the Speedpanel walls in accordance with section 5.3 of AS/NZS 4600:2018[8].

**Table 11 Structural adequacy of stair stringer bottom angle**

| Description | Value |
|---|---|
| Cross-section dimensions of steel angle | 50 × 50 × 2 mm |
| Yield strength of steel angle, $f_y$ | 250 N/mm$^2$ |
| Maximum wall span | 5 m |
| Maximum wall height | 4 m |
| Self-weight of wall per unit meter of height | 1.37 kN/m |
| Total design load on angle | 2.27 kN |
| Design bending moment | 1.81 kNm |
| Bending capacity of steel angle | 3.34 kNm |
| **Ratio of safety with respect to bending capacity** | **0.54 < 1.0** |

[8] Standards Australia (2018) Cold-formed steel structures, AS/NZS 4600:2018, Standards Australia.

**Table 12 Shear capacity of the screw connections of the stair stringer bottom angle**

| Description | Value |
|---|---|
| Nominal diameter of 10g screws | 4.8 mm |
| Yield strength of screws, $f_y$ | 240 N/mm$^2$ |
| Yield strength of steel angle, $f_y$ | 250 N/mm$^2$ |
| Maximum wall span | 5 m |
| Maximum wall height | 4 m |
| Self-weight of wall | 1.37 kN/m |
| Total shear load on screws | 2.27 kN |
| Shear load per bolt | 0.14 kN |
| Shear capacity of each screw | 3.24 kN |
| **Ratio of safety with respect to shear capacity** | **0.1 < 1.0** |

### 6.1.4 Horizontal fire separation

The fire resistance performance of the horizontally oriented Speedpanel wall in the horizontal plane is considered in this section.

Test report EWFA 2257600 detailed the fire resistance performance of a 78 mm thick horizontally oriented vertical Speedpanel wall. The panels were fixed to C-tracks on the vertical edges at every second panel join (500 mm centres) on both the exposed and unexposed sides with 35 mm long self-tapping screws. The top and bottom panels were fixed to the top and bottom C-tracks and the first horizontal panel joint from the bottom was fixed at 250 mm centres with 35 mm long self-tapping screws while the second horizontal panel joint from the bottom was fixed at 500 mm centres with 35 mm long self-tapping screws.

The wall maintained integrity for 128 minutes until flaming of cotton pad was observed in the upper half of the wall. Insulation failure was observed at 15 mm below a horizontal join in the upper half of the wall at 117 minutes. However, the galvanised steel sheathing of the tested panels was only 0.2 mm thick. It is expected that, since in the proposed wall construction, the panels will have a cover sheathing of 0.4 mm BMT galvanised steel, the panels will maintain insulation for at least 120 minutes.

The perimeter track failed insulation in accordance with AS 1530.4:2005 at 23 minutes with the individual temperature at a location 300 mm from the bottom of the wall on the west edge C-track exceeding the initial temperature by more than 180K. However, in this location, the sealant was applied on the exposed side only. The perimeter maintained integrity for a period of 242 minutes.

The load-bearing test configuration in EWFA 2736001 incorporated a 78 mm thick vertically oriented Speedpanel wall supported by a horizontally oriented wall system. The specimen was tested with bottom horizontal panel section fixed and top vertical panel section with free vertical edges.

The tested horizontal panels were fixed to side tracks made of 82 mm × 50 mm × 1.15 mm BMT galvanised steel C-tracks on both sides of the wall at both ends of the panel. They were fixed at every second panel joint. The wall system failed integrity at 98 minutes when flaming had become evident at head in the gap between track and panels at head at mid-width.

The wall system failed insulation at 19 minutes 50 seconds when the temperature measured at the head of specimen, at mid-width exceeded the initial temperature of 180K rise. However, thermocouples 014, 015 and 023 placed in the horizontal section of the wall on the panels and at mid-height and the bottom panel on the track did not measure a temperature rise exceeding 180K for 120 minutes.

In the proposed construction, the ends of each panel will be fixed on to side C/J-tracks on both the exposed and unexposed sides at 250 mm centres with 10g × 30 mm screws. This will provide a larger number of screws than the tested systems per wall and so will further contribute to preventing gap openings that could result in integrity failure.

Additionally, the head track can be protected with galvanised steel flashings to improve the fire resistance performance of the overall wall system.

Therefore, it is considered that when the proposed horizontally oriented Speedpanel wall section is exposed to fire from one side, the highlighted fire-resistant wall section will have same number of fixings per panel on the unexposed side in the proposed construction to support the wall section as there were in the construction tested in EWFA 2736001. Therefore, it is considered that the construction tested in EWFA 2736001 has sufficiently demonstrated the ability of the horizontally oriented Speedpanel wall to remain stable for at least 120 minutes if installed as per the proposed configuration.

Furthermore, in the proposed construction, the panels extend past the section relevant to fire separation. Exposure on both sides will tend to reduce deflection and instability of the panels and as they are made from mostly inorganic materials, it is not expected that fire on both side would result in consumption, collapse or the introduction of gaps or potential flaming weakness. It is, therefore, likely that the impact of a section of the panels being exposed to fire on both sides will not introduce any detrimental effects to the shaded area shown in Figure 3 expected to provide fire compartmentalisation to the second staircase.

Additionally, in EWFA 2736001, A fire rated acrylic sealant was applied to the joints between the panels and the C-track and to fill the voids between the contours of the panel. Sealant was not applied at panel-to-panel joints. In EWFA 2257600, Fire rated acrylic sealant was applied on both sides of top of the wall, on both sides of upper half of the wall, on the unexposed side in the mid-lower section and on the exposed side on the lower section of the wall. Therefore, a similar application of sealant between the side tracks, top and bottom tracks and between panels will be required in the proposed construction.

Based on the above discussion, it can be considered that the proposed construction in Figure 3 will maintain integrity and insulation for at least 120 minutes in the horizontal plane in accordance with AS 1530.4:2014.

### 6.1.5 Vertical fire separation

The fire resistance performance of the horizontally oriented Speedpanel wall in the vertical plane is provided at the wall-to-stair stringer joint at the boundaries of the Speedpanel wall section highlighted in Figure 3.

The wall-to-stair stringer joint detail varies based on the width of the joint between the horizontally oriented Speedpanel wall and stairs as shown in Figure 4 to Figure 7.

For a joint width of 0-10 mm, the proposed detail prescribes a steel angle on the under (fire exposed) side and a backing rod and sealant on the upper (non-fire exposed) side. AS 1530.4:2014 clause 10.5.3 stipulates thermocouples are not required on the unexposed side of a seal which is recessed within the separating element when the joint width is less than 12 mm. it is therefore expected the performance is restricted to an evaluation of integrity only.

The proposed concrete stair thickness is minimum 120 mm and so is 30 mm less than the tested 150 mm thick concrete floor slab. Theoretically, reducing the separating element thickness is likely to increase the possibility of the joint sealing system being exposed to the heating source at an earlier time than that in the test.

However, due to the reduction in gap size and additional protection afforded by the proposed steel angle at the fire exposed side, it is expected that the proposed sealing system on the upper (non-fire exposed) side will not be directly exposed to the heating source for at 120 minutes and hence the integrity performance of proposed joint detail would be similar to the tested specimen in FRT200213 for at least 120 minutes in accordance with AS 1530.4:2014.

For joint widths of 10-20 mm, the proposed detail is similar to the tested specimen in FRT200213. The system comprised of a 150 mm thick concrete floor incorporating 30 mm wide control joint protected with 15 mm deep Fuller Firesound Acrylic sealant to the backing rod and finished flush with the face of the separating element. When tested, the control joints A maintained integrity and insulation performance for 240 min and 180 min respectively. The sealant in the control joint expanded and bulged towards the unexposed side and cracks were observed on the surface of the sealant and at the interface of the sealant to the separating element but the system maintained integrity for 240 minutes.

For joint widths of 20-35 mm, the proposed detail prescribes a steel angle on the under (fire exposed) side and 20 mm deep fire rated sealant filled on the upper (non-fire exposed) side. Furthermore, the gap in the joint between the sealant and steel angle is sealed with Rockwool insulation with a density of 140 $kg/m^3$.

The tested control joint B specimen in FRT200213. Is a 30 mm wide control joint protected with 15 mm deep Fuller Firesound Acrylic sealant to the backing rod and finished flush with the face of the separating element. When tested, the control joints B maintained integrity and insulation performance for 240 min and 180 min respectively. The sealant in the control joint expanded and bulged towards the unexposed side and cracks were observed on the surface of the sealant and at the interface of the sealant to the separating element but the system maintained integrity for 240 minutes.

For joint widths of 35-95 mm, the proposed detail prescribes a steel angle on the under (fire exposed) side and 50 mm thick TBA Intubatt friction fitted into the gap to sit on the steel angle. The wall to stair joint is then capped with 0.55 mm thick steel flashing at the topside.

In the load-bearing test EWFA 2736000, the test assembly comprised a 78 mm thick loaded wall system that incorporated various apertures. A 78 mm thick Speedpanel wall system comprising an aperture protected by one layer of 50 mm thick Intubatt was tested. For the purpose of this assessment, only aperture A is relevant. Aperture A was nominally 195 mm high and 1405 mm wide and comprised one layer of 50 mm thick Firetherm Intubatt friction fitted into the aperture. When tested, the friction fitted 50 mm thick Firetherm Intubatt remained in the aperture for at least 120 minutes and the maximum temperature measured on the unexposed side of Firetherm Intubatt piece at 120 minutes was 238°C.

In the proposed joint, the Intubatt is installed in a horizontal position within the gap. In this position, gravitational effects may cause the friction-fitted Intubatt to be unstable within the gap. However, in the proposed joint, the presence of the rigid steel angle will support the Intubatt and maintain it in place for the duration of the fire while preventing the direct exposure of the batt, thus improving the effectiveness of the batt on the exposed side. Furthermore, this means that the Intubatt will not be directly exposed to fire and it is expected that the unexposed side of the Intubatt seal will likely have a much lower unexposed side temperature than that tested in EWFA 2736000. Furthermore, it is expected that the proposed Intubatt seal, which is in the horizontal orientation in the proposed configuration, will be supported by the rigid steel angle and will stay in place for at least 120 minutes. In addition, the presence of the steel flashing at the top side of the wall to stair joint will provide a notional barrier to reduce the rate of heat transfer to the unexposed side. Therefore, it is considered that the proposed seal construction will maintain insulation performance for at least 120 minutes.

For joint widths 35-95 mm, the proposed 50 mm thick TBA Intubatt batt can also optionally be substituted with 50 mm thick Boss Bulkhead batt and caulked with Firemastic 300 intumescent sealant in a similar manner.

Test Chilt/RF01120D detailed a specimen with 1 layer of 50 mm thick Boss Bulkhead Batt friction fitted centrally within a 900 mm by 600 mm aperture in an AAC wall construction. The Boss Bulkhead Batt maintained insulation and integrity performance in excess of 120 minutes.

In the proposed joint, the Boss bulkhead batt will be supported in the horizontal orientation by the rigid steel angle and is likely to stay in place for at least 120 minutes. Additionally, due to the steel angle it would not be directly exposed to fire, and it is expected that the unexposed side of batt seal would have a much lower unexposed side temperature than that tested in Chilt/RF01120D.

Based on the above discussion, it is considered that the proposed horizontally oriented Speedpanel wall will achieve an integrity and insulation performance of 120 minutes in the vertical plane with the proposed wall-to-stair joint details as shown in Figure 4 to Figure 7 in accordance with AS 1530.4:2014.

## 6.2 Vertically oriented Speedpanel wall

### 6.2.1 Description

It is proposed to construct a single vertical wall system comprised of vertically oriented Speedpanel walls used for fire compartmentalisation between two independent stair stringers in a scissor stair application. Similar to the horizontally oriented wall described in the previous section, the main connection points of the Speedpanel walls are to the angles under the stringers, to the side C-tracks and to the concrete landings. The Speedpanel walls are connected to the stair stringers on both sides of the wall via steel angles and are also anchored at concrete landings at each floor level at the base of the C-section / J-section side tracks fixed to the vertical edges of the wall. The allowable gaps between the stair stringer and the bottom angle are 0-10 mm, 10-20 mm, 20-35 mm and 35-95 mm and the size of the steel angle will vary to accommodate these gaps as provided in section 4.5.

It is expected that the vertical panels are supported by a structural beam spanning between opposite landings. This beam must be designed by a professional engineer considering all imposed designed actions to maintain structural adequacy of the Speedpanel walls up to 120 minutes under fire exposure.

Similar to the horizontally oriented wall described in the previous section, the vertically oriented wall shown in Figure 8 cannot be tested directly in accordance with AS 1530.4:2014. It is considered that, in practice, fire separation occurs in the highlighted section shown in Figure 9 – confined to the area between the angle bracings of the stair stringers – and all other sections would be subject to fire conditions on both sides of the wall. This highlighted section is attributed an FRL to denotes its fire resistance performance in terms of integrity and insulation.

The maximum span of the vertically oriented 78 mm thick single Speedpanel wall is unlimited and the slab-to-slab height (between concrete landings to which the wall is anchored) is maximum 3 m with the use of 1.15 mm BMT and 1.95 mm BMT vertically installed C/J-tracks.

Fire resistance in the horizontal plane will be contributed by the panels in the highlighted section while the fire resistance in the vertical plane will be through the panel-to-stair edge joints in the perimeter of the highlighted section.

### 6.2.2 Methodology

The approach and method of assessment used for this assessment is summarised in Table 13.

**Table 13 Method of assessment**

| Assessment method | |
|---|---|
| Level of complexity | Complex assessment |
| Type of assessment | Quantitative and qualitative |

### 6.2.3 Structural adequacy of 78 mm thick vertically oriented Speedpanel wall systems

Considering the structural adequacy of the Speedpanel wall components in elevated temperatures and the fire resistance performance of the wall in terms of integrity and insulation as discussed below, the maximum span of the vertically oriented 78 mm thick single Speedpanel wall is unlimited and the slab-to-slab height (between concrete landings to which the wall is anchored) is maximum 3 m with the use of 1.15 mm BMT and 1.95 mm BMT vertically installed C/J-tracks.

It is expected that the vertical panels are supported by a structural beam spanning between opposite landings. This beam must be designed by a professional engineer considering all imposed designed actions to maintain structural adequacy of the Speedpanel walls up to 120 minutes under fire exposure.

The Speedpanel walls are also connected to stair stringers on both sides of the wall via steel angles with varying section sizes to accommodate gap widths between the stair stringer and Speedpanel wall. It is expected that, in a fire event, one of the steel angles will be compromised and the loads from the Speedpanel wall section above will be carried by the opposite steel angle on the unexposed side of the wall under ambient conditions. 10g × 30 mm flat-top, self-drilling, zinc-coated steel screws are used to fix the steel angle to the Speedpanel wall at every panel joint.

Table 11 shows the structural calculations undertaken for horizontally oriented walls to determine if the bending capacity of the bottom steel angle sections is adequate to support the design load from the Speedpanel wall section above considering a maximum floor-to-floor height of 4 m and a maximum span of 5 m. The example provided is for the minimum steel angle section required for 10 mm stair-to-wall gaps. Table 12 provides the shear capacity of the 10g screws used to connect the steel angle to the Speedpanel walls in accordance with section 5.3 of AS/NZS 4600:2018.

A similar structural calculation as shown in Table 11 and Table 12 was undertaken to determine the structural capability of the bottom steel angle and the screw connections fixing the stair stringer to the Speedpanel wall to carry the design load imposed by the vertically oriented Speedpanel wall considering a maximum floor-to-floor height of 3 m. Similar to the discussion provided above for horizontally oriented walls, in vertically oriented walls, the panels are connected to stair stringers on both sides of the wall via steel angles with varying section sizes to accommodate gap widths between the stair stringer and Speedpanel wall. It is expected that, in a fire event, one of the steel angles will be compromised and the loads from the Speedpanel wall section above will be carried by the opposite steel angle on the unexposed side of the wall under ambient conditions. 10g × 30 mm flat-top, self-drilling, zinc-coated steel screws are used to fix the steel angle to the Speedpanel wall at every panel joint.

It was determined that the steel angle with the least dimensions (suited for 0-10 mm gap) was sufficient to carry the imposed design loads similar to the example shown in Table 11. Similarly, the shear capacity of the screws was also calculated to be sufficient. FS0885 mechanical power fasteners are proposed to be used to anchor side C-tracks of the Speedpanel walls to concrete landings. As shown in Table 10, the structural capacity of the FS0885 power fasteners can be obtained from the installation manual and should be designed and confirmed by an accredited structural engineer. It is expected that the fasteners will be in ambient temperature conditions covered from fire exposure as they are installed between the Speedpanel and the C-tracks and due to their 60 mm embedment in the concrete. A minimum of two fasteners will be required at each connection point to the landing to anchor the vertically oriented Speedpanel wall at its top and bottom to the concrete landings/stringers. The minimum concrete strength of the stringer/landing must be 32 MPa.

### 6.2.4 Horizontal fire separation

The fire resistance performance of the vertically oriented Speedpanel wall in the horizontal plane is considered in this section.

A similar configuration to the proposed vertically oriented Speedpanel wall was tested in BWA 2286900. The test specimen comprised a 2790 mm × 3000 mm × 78 mm thick vertically oriented load-bearing Speedpanel wall restrained at the top and loaded at the bottom. The east and west vertical edges were free from lateral restraint. When tested, the wall system achieved an integrity performance of 120 minutes with sustained flaming for more than 10 seconds occurring at the sealant at the interface of the top C-track and panel just after 120th minute mark. The overall specimen achieved an insulation performance of 64 minutes with the maximum temperature on top C-track exceeding 180 K above the initial temperature. The panels achieved an insulation performance of 80 minutes where the failure location was 15 mm away from a vertical joint.

In test report EWFA 2848300, the test assembly comprised a nominal 3000 mm wide × 3000 mm high × 64 mm thick Speedpanel wall system. The tested configuration incorporated 64 mm thick vertically oriented Speedpanel wall with a 0.75 mm BMT perimeter track. The panels were made from an aerated concrete core encased in a 0.26 mm BMT galvanised steel skin. 10g × 30 mm flat top self-drilling zinc coated steel screws were used to fix the head and bottom tracks to the panels at every second panel join on both exposed and unexposed sides. Head fixings were staggered. Flat top self-drilling, zinc coated steel screws, 10g × 16 mm were used to fix panels to each other at every second panel join at 1500 mm height from the bottom on both exposed and unexposed sides. These fixings were staggered such that one joint had one screw fixing at 1500 mm height. Fire rated sealant Fire resistant joint filler was applied to the joints between the panel and the C-track at head, base and vertical edges on both exposed and unexposed sides and also applied to joints between tracks and surround blockwork along head, base and fixed edges.

The wall panels of this specimen achieved an integrity performance up to 181 minutes and an insulation performance up to 93 minutes. The main failure location, in terms of insulation, was at 15 mm from a vertical joint. However, it can be expected that the insulation performance can be improved when the thickness of the Speedpanel wall is increased from 64 mm to 78 mm and when the thickness of the cover skin is increased from 0.26 mm to 0.4 mm BMT.

Furthermore, the tested assembly in EWFA 2741700 consisted of a nominal 2950 mm wide × 3000 mm high × 78 mm thick non-loadbearing wall system made of vertically oriented 285 mm × 78 mm thick Speedpanel wall, which incorporated two Pyropanel FR Maxi doors, both opening inwards towards the furnace. The panels were made from an aerated concrete core encased in a 0.4 mm BMT galvanised steel skin. The standard 82 mm deep × 50 mm × 1.2 mm BMT head C-track of Speedpanel wall was protected in five different ways as listed in Appendix B. Fire rated sealant was applied in the 20 mm gap between top C-track and wall panels.

With reference to the test results of EWFA 2741700, it was observed that the maximum temperature recorded on the unexposed side at 120 minutes in the configuration where flashing fixed on the fire exposed side of head C-track was 177°C. Similarly, the temperature recorded on the unexposed side at 120 minutes with the flashing on the unexposed side was lower at 145°C. Therefore, flashing on the unexposed side of the wall system, especially in locations vulnerable to gap openings and greater heat conduction, such as the head track, must be installed to improve the integrity and insulation performance of the wall system.

If the highlighted section in Figure 9 is considered in isolation, it is noted that the Speedpanel wall is connected to the stair stringers on each side via steel angles. There is one fixing on each side of the panel due to these fixing details. Due to the angle of the stairs and the proposed width of the system, the panels will span between these fixings to a maximum of 3 m in height in the vertical direction.

Reference is made to test EWFA 2736001 – discussed previously with regards to the fixing details of horizontal wall systems – where the vertically oriented section of the wall was unrestrained at its vertical edges. The side tracks were fixed to the panels at 500 mm centres on the unexposed side.

In the proposed construction, the vertically oriented Speedpanel walls are to be anchored at 3 m height between concrete landings. The ends of each panel will be fixed in a similar manner to the tested system with fixings on one side of the wall only. Hence, the vertically oriented panels will be fixed at alternate panel joints on the exposed or unexposed sides. The proposed fixing details are similar to the horizontally oriented Speedpanel wall discussed above.

Therefore, the proposed 3 m high vertically oriented Speedpanel wall section (highlighted section in Figure 9) will have the same number of fixings per panel on the unexposed side to support the wall section as there were in the construction tested in EWFA 2736001.

In light of the above, it is considered that the construction tested in EWFA 2736001 and BWA 2286900 has sufficiently demonstrated the fixing capacity and the ability of the vertically oriented Speedpanel wall to remain stable for at least 120 minutes if installed as per the proposed configuration.

Even though, in the proposed construction, the panels extend past the section relevant to fire separation, exposure on both sides will tend to reduce deflection and instability of the panels and as they are made from mostly inorganic materials, it is not expected that fire on both side would result in consumption, collapse or the introduction of gaps or potential flaming weakness. It is, therefore, likely that the impact of a section of the panels being exposed to fire on both sides will not introduce any detrimental effects to the shaded area shown in Figure 9 expected to act as a fire barrier.

Additionally, as discussed above, in EWFA 2736001 an intumastic acrylic sealant was applied to the joints between the panels and the C-track and to fill the voids between the contours of the panel. In EWFA 2257600, acrylic sealant was applied on both sides of top of the wall, on both sides of upper half of the wall, on the unexposed side in the mid-lower section and on the exposed side on the lower section of the wall. Therefore, a similar application of sealant between the side tracks, top and bottom tracks and between panels will be required in the proposed construction.

Based on the above it can be considered that the integrity and insulation performance of the proposed construction in Figure 9 will maintain integrity and insulation for at least 120 minutes in the horizontal plane in accordance with AS 1530.4:2014.

### 6.2.5 Vertical fire separation

Similar to the vertical fire separation discussed above for horizontally oriented walls, in vertically oriented Speedpanel walls, the fire resistance performance in the vertical plane is provided at the wall-to-stair stringer joint at the boundaries of the Speedpanel wall section highlighted in Figure 9. The same joint details are provided for the vertically oriented walls which vary based on the width of the joint between the Speedpanel wall and stairs as shown in Figure 10 to Figure 13.

Therefore, similar to that discussed in section 6.1.5, it is considered that the proposed vertically oriented Speedpanel wall will achieve an integrity and insulation performance of 120 minutes in the vertical plane with the proposed wall-to-stair joint details as shown in Figure 10 to Figure 13 in accordance with AS 1530.4:2014.

# 7. Assessment 3 – Dual-stacked 78 mm thick Speedpanel walls

## 7.1 Description

It is proposed that the spans of the Speedpanel wall configurations discussed above are increased by stacking multiple Speedpanel walls together, connected through back-to-back C/J-tracks or T-brackets to increase structural stability. Similar to the single 78 mm thick Speedpanel walls, they are expected to provide fire compartmentalisation to fire isolate individual stair stringers for the full height of the staircase in a scissor stair structure.

As shown in Figure 14 and Figure 20, three configurations of multiple Speedpanel stacked walls are considered.

The first configuration is a dual-stacked wall system, as provided in Figure 14 with two horizontal Speedpanel walls connected via back-to-back C/J-tracks as shown in Figure 15, Figure 16 and Figure 19. The second proposed system, shown in Figure 17 and Figure 18, is similar to the above, however the connection between the horizontally stacked wall sections is through a central steel T-bracket. This connection point is to be protected with a 0.7 mm BMT galvanised steel flashing on the unexposed side to further improve the integrity and insulation performance of the extended wall.

The third configuration is a construction in which the spine Speedpanel wall consists of vertically oriented Speedpanel wall segment in between the horizontally stacked wall systems. The horizontal and vertical wall sections are connected with back-to-back C/J-tracks. The vertical Speedpanel wall segment – at mid-width of the dual-stack wall system – are anchored and supported by a concrete mid-landing. The side C-tracks fixed to the vertical edge of each horizontally stacked walls are fixed onto concrete landings at top and bottom. It is expected that the spine wall will be connected to the stair stringers via bottom steel angles.

As the proposed configurations cannot be directly tested in accordance with AS 1530.4:2014, similar to the fire resistance performance of the single Speedpanel walls assessed previously, it is considered that fire separation occurs in the area between the angle bracings of the stair stringers and that all other sections would be subject to fire conditions on both sides of the wall. This section will provide the required fire resistance in the horizontal and vertical planes and is the only section of the proposed construction for which an FRL can be attributed. Fire resistance in the horizontal plane will be contributed by the panels while the fire resistance in the vertical plane will be through the panel-to-stair edge connection detail. The connection between the back-to-back C-tracks / steel T-bracket will also need to be designed to prevent failure in insulation or integrity in accordance with the performance requirements of AS 1530.4:2014.

Considering the structural adequacy of the Speedpanel wall components in elevated temperatures and the fire resistance performance of the wall in terms of integrity and insulation, the maximum span of each individual wall section in the dual-stacked 78 mm thick Speedpanel wall is 3 m. The slab-to-slab height (between concrete landings to which the wall is anchored) is maximum 3.3 m with the use of 1.15 mm BMT vertically installed side C/J-tracks and a maximum of 4 m with 1.95 mm BMT C/J-tracks.

## 7.2 Methodology

The approach and method of assessment used for this assessment is summarised in Table 14.

**Table 14 Method of assessment**

| Assessment method | |
|---|---|
| Level of complexity | Complex assessment |
| Type of assessment | Quantitative and qualitative |

## 7.3 Dual-stacked walls with back-to-back C/J-tracks or central T-bracket

### 7.3.1 Structural adequacy

Considering the structural adequacy of the Speedpanel wall components in elevated temperatures and the fire resistance performance of the wall in terms of integrity and insulation as discussed below, the maximum span of the dual-stacked 78 mm thick Speedpanel walls is 6 m (with each individual wall spanning a maximum of 3 m in the horizontal direction) and the slab-to-slab height (between concrete landings to which the wall is anchored) is maximum 3.3 m with 1.15 mm BMT and 4 m with 1.95 mm BMT vertically installed C/J-tracks. The thickness of the C-tracks at the mid-span back-to-back connections is to be minimum 1.95 mm.

In the dual-stacked construction, the Speedpanel wall is a build-up of two horizontally oriented continuous height Speedpanel wall panels previously tested and assessed individually as described in section 6.1. The span of the wall is extended from 5 m for single walls to a total of 6 m for dual-stack walls by combining them via 1.95 mm BMT back-to-back C/J-tracks or a central steel T bracket at mid-span. This means that each individual wall section with a horizontal span of 3 m has two C/J-tracks at each vertical edge and the entire wall system will consist of four side C/J-tracks.

In a dual-stacked system, when a fire event occurs at one staircase/landing slab, the C-track that is directly exposed will lose its structural capacity (reduction factor is 0.037 as shown in Table 11) and the vertical C-track on the opposite edge of the Speedpanel wall will be in ambient conditions. In addition to this, it is expected that the temperature of the C-tracks at mid-span will be approximately 600˚C which is approximately half of the temperature expected at 120 minutes under standard fire conditions. The expected reduction factor is 0.5.

Table 15 below shows the structural capacity of the C-tracks at mid-span of the wall considering these lower temperatures when the wall span is 6 m and the maximum slab-to-slab height is 4 m. However, it must be noted that, the slab-to-slab height of the wall (and hence the resultant self-weight) will be limited by the structural compression capacity of the C-track that is fully exposed and this can be determined by following the calculation procedure in Table 11 with amendments to wall span (and hence self-weight). It is based on the assumption that the vertical loads are also carried by one bottom steel angle between the wall and stringer on the unexposed side and the C-tracks at the opposite vertical edge and the back-to-back C-tracks at mid-span.

**Table 15 Structural calculations for mid-C-track compression capacity**

| Description | Value |
|---|---|
| Cross-section dimensions of C-section | 55 × 82 × 1.95 mm |
| Cross-sectional area | 355 mm$^2$ |
| Yield strength, $f_y$ | 250 N/mm$^2$ |
| Reduction factor for elevated temperatures (at mid-span of wall) | 0.5 |
| Sectional compression capacity | 46.2 kN |
| Self-weight carried by the exposed side C-track | 2.27 kN |
| **Ratio of safety with respect to axial compression** | **0.05 < 1.0** |

The nominal bearing capacity of the 10g screws used to connect the back-to-back C-tracks at 250 mm centres as shown in Figure 15 and Figure 16 is calculated in Table 16 below. A similar calculation is done for the connection detailing with T-brackets.

**Table 16 Structural calculations for back-to-back C-track connection details**

| Description | Value |
|---|---|
| Total design load | 6.9 kN |
| Yield strength, $f_y$ | 250 N/mm$^2$ |
| Reduction factor for elevated temperatures (at mid-span of wall) | 0.5 |
| **Tilting and hole bearing (Clause 5.4.2.4 of AS/NZS 4600:2018)** | |

| Description | Value |
|---|---|
| Thickness of connecting parts ($t_1 = t_2$) | 1.95 mm |
| Screw diameter | 4.8 mm |
| Nominal bearing capacity according to clause 5.4.2.4 (a) (i) | 3.13 kN |
| Nominal bearing capacity according to clause 5.4.2.4 (a) (ii) | 3.16 kN |
| Nominal bearing capacity according to clause 5.4.2.4 (a) (iii) | 3.57 kN |
| Spacing of screws | 250 mm |
| Design shear on each screw | 0.52 kN |
| **Ratio of safety with respect to shear capacity** | **0.17 < 1.0** |

In a fire event, the bottom steel angle between the wall and the stair stringer on the unexposed side, will support the wall in a similar manner to that described in section 6.1. As shown in Figure 14, a stair stringer runs across the dual-stacked wall, connected to landing slabs at the wall edges and one landing slab at mid-span. The back-to-back C-track connection of the horizontal walls of the dual-stack system are also anchored in this mid-span landing slab. Therefore, the stair stringer (with its bottom steel angle) can be considered as two stair stringers, each running across one individual horizontal wall, separated at the mid-span landing slab.

The self-weight of each individual horizontal wall will be carried by the steel angle spanning across that wall – between the edge landing and mid-span landing) similar to that described in section 6.1.

Table 11 shows the structural calculations undertaken to determine if the bending capacity of the minimum size of bottom steel angle sections (50 × 50 × 2 mm) is adequate to support the design load from the Speedpanel wall section above considering a single 78 mm thick Speedpanel walls. The same calculations for the steel angle and the connections between the angle and the wall are carried out for each horizontal wall in the dual-stacked system.

Therefore, it is determined that the steel angles and the stringer connecting screws are sufficient to maintain the structural stability of the dual-stack system up to a period of 120 minutes of fire exposure.

As shown in Table 10, the structural capacity of the FS0885 power fasteners can be obtained from the installation manual and should be designed and confirmed by an accredited structural engineer. It is expected that the fasteners will be in ambient temperature conditions covered from fire exposure as they are installed between the Speedpanel and the C-tracks and due to their 60 mm embedment in the concrete. A minimum of two fasteners will be required to anchor the vertically oriented Speedpanel wall at its top and bottom to the concrete landings/stringers. A minimum of eight fasteners will be required to anchor the wall at the concrete mid-landing as shown in Figure 19. The minimum concrete strength of the stringer/landing must be 32 MPa.

### 7.3.2 Horizontal and vertical fire separation

As discussed in section 7.3.1, dual-stacked systems consist of two individual wall sections with two C/J-tracks at each vertical edge and the entire wall system will consist of four side C/J-tracks. Each of these side tracks are anchored to a concrete stair stringer at the top and bottom which means that each individual wall in the dual-stacked system will be fixed and connected to the concrete surround in the same way as the horizontally oriented wall assessed in section 6.1.

Therefore, the horizontal and vertical fire separation of each wall section can be assessed in the same way as discussed in sections 6.1.4 and 6.1.5.

It is expected that the fire separation in the horizontal plane is provided by the panels of the two horizontally oriented wall sections which, individually, are of a similar configuration to the test specimens tested in EWFA 2257600 and EWFA 2736001 which sufficiently demonstrated the ability of the horizontally oriented Speedpanel wall to remain stable for at least 120 minutes if installed as per the proposed configuration.

The fire resistance performance of the horizontally oriented Speedpanel wall in the vertical plane is provided at the wall-to-stair stringer joint at the boundaries where the Speedpanel wall is connected to the stair stringer via steel bottom angles. The wall-to-stair stringer joint detail varies based on the width of the joint between the horizontally oriented Speedpanel wall and stairs as shown in Figure 4 to Figure 7.

Furthermore, back-to-back C/J-track connections or steel T-bracket connections require an additional thermal barrier from fire which must be provided with 0.7 mm BMT galvanised steel flashing fixed onto the unexposed side of the junction. This is similar to the flashing protection provided to the head track in the specimen tested in EWFA 2741700 as discussed in section 6.2.4 and is therefore considered that the proposed detail will maintain integrity and insulation performance for 120 minutes. If fire rating is required from both directions, supporting structural steel must be protected from fire to an equivalent fire rating. Alternatively, the external surfaces of the Speedpanel walls can be lined with 6 mm non-combustible fibre cement sheets for added thermal protection as described in section 9.6. A fire rated sealant must be applied to seal gaps on the exposed sides as shown in Figure 14 to Figure 19.

Based on the above discussion, it can be considered that the integrity and insulation performance of the proposed construction will maintain integrity and insulation for at least 120 minutes in the horizontal and vertical planes in accordance with AS 1530.4:2014.

## 7.4 Dual-stacked wall system with vertical wall section between two horizontal walls

### 7.4.1 Structural adequacy

The calculations undertaken for the determining the structural adequacy of the dual-stacked wall system with a vertical wall segment between two horizontal wall sections will be similar to those described in 7.3.1 as the main components to be checked for structural adequacy are the wall to stringer connections, the side C-tracks and the connections to the concrete landings/stair-stringers, similar to those of the dual-stacked walls described previously.

Maximum horizontal span of the individual horizontally oriented walls is 3 m. The minimum horizontal width of the vertical wall segment is 500 mm (two panels oriented vertically). The slab-to-slab height (between concrete landings to which the wall is anchored) is maximum 3.3 m with the use of 1.15 mm BMT vertically installed side C/J-tracks and a maximum of 4 m with 1.95 mm BMT C/J-tracks.

### 7.4.2 Horizontal and vertical fire separation

The continuous horizontal wall sections on either side of the vertically oriented panels at mid-span, as shown in Figure 20 and Figure 21, must be constructed with similar dimensions and fixing details as a single 78 mm thick horizontally oriented wall system as described in section 6.1 and so will have a similar fire resistance performance in the horizontal and vertical planes. The vertically oriented panel section will perform similar to the 78 mm think single vertically oriented Speedpanel wall as described in section 6.2.

Further thermal protection must be provided at the inter-locking joints between the horizontal and vertical wall sections. Back-to-back C/J-track connections or steel T-bracket connections at these junctions require an additional thermal barrier from fire which must be provided with 0.7 mm BMT galvanised steel flashing fixed onto the unexposed side of the junction. A fire rated sealant must be applied on the exposed side. The head details are given in Figure 22 to Figure 25.

The fire resistance performance in the vertical plane is provided at the wall-to-stair stringer joints which vary based on the width of the joint between the Speedpanel wall and stairs as shown in Figure 26 to Figure 29.

# 8. Assessment 4 – Boxed stair pressurisation riser

## 8.1 Description

The function of a Speedpanel single void or dual void box / triangular riser or dual-stack riser in a stair application is to maintain continuity in compartmentation, with each fire stairwell fire isolated for the full height of the set of stairs. It provides the required FRL for the internal compartmentation within the confines of the surrounding stairwell external shaft walls.

The box risers are proposed to comprise of either single or dual voids. A single void box riser, as shown in Figure 35, is constructed from a continuous single or dual-stacked horizontally oriented Speedpanel wall in the longitudinal direction (long ends) with horizontally or vertically oriented transverse wall sections at the edges. If a continuous horizontal wall section is used for the long edge, the maximum span of the wall is to be 3 m. If dual-stacked horizontal walls are used with back-to-back C/J-tracks at mid-span, the maximum span of the wall is to be up to 6 m with each wall section spanning for 3 m. The width of the box riser in the transverse direction (short ends) is to be maximum 1 m. Each wall section will be supported with vertical steel C-tracks at each end.

As shown in  Figure 39 and Figure 40, in a dual void box riser, the void is divided centrally into two by a transverse section of Speedpanel wall at mid-span. Similar to the single void box riser, the dual-void box riser is constructed from either a continuous single or dual-stacked horizontally oriented Speedpanel wall in the longitudinal direction (long ends) with horizontally or vertically oriented transverse wall sections at mid-span and the edges.

If a continuous horizontal wall section is used for the long edge, the maximum span of the wall is to be 4.5 m with a 1 m wide transverse wall section at mid-span for additional structural support. As shown in Figure 40, in this configuration, the transverse wall section will be fixed onto the continuous horizontal Speedpanel wall via steel angles.

If a dual-stacked horizontal wall is used for the long edge, the maximum span of the wall is to be up to 6 m with each wall section spanning for 3 m with a 1 m wide transverse wall section at mid-span for additional structural support. As shown in Figure 40, in this configuration, the transverse wall section will separate the two horizontal walls and be fixed onto the concrete landing slab or stair stringer via C/J-tracks. The perpendicular walls will also be connected via C-tracks at this junction. The width of the box riser in the transverse direction (short ends) is to be maximum 1 m. Each wall section will be supported with vertical steel C-tracks at each end.

It is also proposed to construct the box riser at the side of the staircase as an alternative to the staircases treading around the riser in the middle of the stairwell.

Furthermore, angled connections in a triangular riser construction, proposed as an alternative to the boxed riser is also assessed.

Extra sealing of Speedpanel joints by adding an extra bead of fire rated sealant at the panel C-track junction at mid-span to seal the inside of the C-track at the wall intersections must be carried out to ensure pressurisation of the box riser. Sealant must also be applied around the wall perimeters on the inside and outside of the C/J-tracks and along each Speedpanel joint.

The box risers may include air grilles that are to be installed within an aperture built into a horizontal or vertical Speedpanel wall where the aperture and wall are compliant to EWFA 21622.

Further considering the structural adequacy of the Speedpanel wall components in elevated temperatures and the fire resistance performance of the wall in terms of integrity and insulation, the slab-to-slab height of the risers (between concrete landings to which the wall is anchored) is maximum 3.3 m with the use of 1.15 mm BMT vertically installed C/J-tracks and a maximum of 4 m with 1.95 mm BMT C/J-tracks.

Due to the nature of the stairwell construction and the direction of exposure of the panel wall changing in directions as it continually rises up the stairs, it is not possible to have the entire wall system tested as one unit in accordance with AS 1530.4:2014. This assessment only addresses the impact of exposure of the non-loadbearing Speedpanel infill wall panels to fire from the outside of the stairwell compartmentation.

## 8.2 Methodology

The approach and method of assessment used for this assessment is summarised in Table 17.

**Table 17 Method of assessment**

| Assessment method | |
|---|---|
| Level of complexity | Complex assessment |
| Type of assessment | Quantitative and qualitative |

## 8.3 Structural adequacy of single and dual void box risers

The structural adequacy of a single void box riser constructed with a continuous 3 m span horizontally oriented Speedpanel wall in the longitudinal direction (long ends) with horizontally or vertically oriented transverse wall sections at the edges, is calculated in a similar procedure as that outline for single Speedpanel walls. However, the primary difference lies in the corner connections between the longitudinal and transverse wall panels.

Similarly, if dual-stacked horizontal walls are used in the single void box riser, with back-to-back C/J-tracks at mid-span and a maximum span of 6 m, the structural adequacy of the system is calculated similar to that of the dual-stacked wall system described in section 7. The main difference, as discussed above, is the corner connections between the longitudinal and transverse wall panels.

The support channels or perimeter C/J-tracks at the corner connections must be secured to the landing slab at every level with six numbers of FS0885 power fasteners and this is confirmed with calculations conducted similar to the procedure outlined in Table 11. Furthermore, the screw connections between the C-tracks of the longitudinal and transverse wall panels at the corner connections can be calculated following the method in Table 16.

In dual void box risers, the long sides are stacked with horizontally oriented Speedpanel segments and can be up to a maximum of 6 m in span with each individual wall spanning a maximum of 3 m in the horizontal direction. The panels require intermediate transverse infill panels as the maximum tested width with no supports is 3 metres. The infill panel wall provides stability to the longitudinal side by limiting the lateral deflection when exposed. This has been assessed provided that the supporting C-tracks are fixed at each floor level onto the landings/stair stringer (which is a permanent structure).

If a continuous horizontal wall section is used for the long edge, the maximum span of the wall is to be 4.5 m and a transverse infill panel will be connected to the longitudinal panel via separate steel angles on both sides of the joint. The screw connections between the Speedpanel and the angles can be calculated in accordance with clause 5.4.2.4 of AS/NZS 4600:2018 as shown for an example in Table 16. When one side of the joint is exposed due to a fire in one of the twin voids, the steel angle on the unexposed side will not be subjected to elevated temperatures and therefore will continue to support the infill panel. This in turn provides continuity in stabilising the infill panel and thus continues to limit the lateral deflection (into the void) for at least for the required 120 minutes duration of exposure.

If a dual-stacked horizontal wall is used for the long edge, the maximum span of the wall is to be up to 6 m with a transverse infill wall section at mid-span for additional structural support. As shown in Figure 40, in this configuration, the transverse wall section will separate the two horizontal walls and be fixed onto the concrete landing slab or stair stringer via C/J-tracks. The perpendicular walls will also be connected via C-tracks at this junction. The connections between the C-tracks at mid-span and corners between the transverse and longitudinal panels are designed for elevated temperatures following the method in Table 16.

For both single and dual void risers, the horizontal panels are held in position at each end by C/J-tracks mounted vertically and fixed onto the stair landing at each level. The panels are in turn fixed onto the vertical C/J-tracks at 250 mm centres. The connection details between the stairs and the walls are as per Figure 41 to Figure 44.

The risers are also connected to the stair stringers via steel bottom angles. The capacities of the C-tracks and the bottom steel angle to support the weight of the box riser are calculated following a similar method as that described in Table 9, Table 11 and Table 12.

It must be ensured that, in construction, the fixing and connection details provided in Figure 35 to Figure 49 are followed.

Considering the structural adequacy of the Speedpanel wall components in elevated temperatures and the fire resistance performance of the wall in terms of integrity and insulation, the slab-to-slab height of the risers (between concrete landings to which the wall is anchored) is maximum 3.3 m with the use of 1.15 mm BMT vertically installed C/J-tracks and a maximum of 4 m with 1.95 mm BMT C/J-tracks.

If the Speedpanel wall heights are to be increased beyond the recommended maximum slab-to-slab height of 4 m, the structural steel forming the load path will need to be designed by an accredited structural engineer and fire protection of the steel components will need to be carried out.

## 8.4 Single Void

### 8.4.1 Horizontal and vertical fire separation

In the case of box risers, the fire separation is between the two stair compartments around the riser and the void within the riser. The entire wall sections are required to have a fire resistance performance for fire originating from within the void area. It is considered that the intent is to fire isolate the stairwell area against any fire from outside of the compartment. The requirement would therefore be that no combustibles are to be allowed inside the stairwell of the scissor stairs.

The first proposed configuration of the box riser with a single void will have a 3 m span horizontally oriented wall in the longitudinal direction as provided in Figure 35 to Figure 38. The 3 m span continuous horizontal wall section used for the long edge must be constructed with similar dimensions and fixing details as and will have a fire resistance performance in the horizontal and vertical planes similar to a single 78 mm thick horizontally oriented wall system described in section 6.1.

The 6 m span single void box riser will have dual-stacked horizontal walls with back-to-back C/J-tracks at mid-span. Each 3 m span individual wall section is supported with vertical steel C-tracks at each end and so will be similar in construction to the dual-stacked spine wall assessed in section 7.3. Both these longitudinal horizontally oriented walls are similar to the normal scissor stair configuration with a dual-stacked Speedpanel spine wall providing a barrier for the fire separation between the two staircases. Back-to-back C/J-track connections or steel T-bracket connections require an additional thermal barrier from fire which must be provided with 0.7 mm BMT galvanised steel flashing fixed onto the unexposed side of the junction. Fire rated sealant must be applied on the exposed side.

The fire resistance performance in the vertical plane is provided at the wall-to-stair stringer joints which vary based on the width of the joint between the horizontally oriented Speedpanel wall and stairs as shown in Figure 4 to Figure 7.

Like the single or dual-stacked horizontal Speedpanel wall, fire exposure is expected from one side only.

## 8.5 Dual Void

### 8.5.1 Horizontal and vertical fire separation

As discussed earlier, the 78 mm thick Speedpanel panel – can be attributed 120 minutes in both insulation and integrity performance. Vulnerability to insulation performance will mainly be at the joints. The main premise is that, in the event of a fire in the void, the transverse infill panel wall at mid-span would be exposed on one side of the twin void. The function of this infill panel is to provide stability to the longitudinal wall.

If a continuous horizontal wall section is used for the long edge (span is 4.5 m), the transverse infill wall section at mid-span will be fixed onto the continuous horizontal Speedpanel wall via steel angles.

Therefore, there will be no vertical panel joints to require additional consideration for insulation performance. The main consideration would be the integrity of the joints between the infill panel and the longitudinal wall. As discussed above, to maintain continuity in the integrity performance when exposed, the fixings are to be via separate steel equal angles on both sides of the joint. When one side of the joint is exposed, the steel angle on the unexposed side will not be subjected to elevated temperatures and therefore will continue to support the infill panel. This in turn provides continuity in stabilising the infill panel and thus continues to limit the lateral deflection (into the void) for at least for the required 120 minutes duration of exposure. Additionally, fire rated sealant must be applied to all gaps including between the steel angles and the Speedpanel.

If a dual-stacked horizontal wall is used for the long edge (span of maximum 6 m) with a maximum 1 m wide infill transverse wall section at mid-span, the transverse wall section will separate the two horizontal walls and be fixed onto the concrete landing slab or stair stringer via C/J-tracks. The perpendicular walls will also be connected via C-tracks at this junction. In this instance, a 0.7 mm BMT steel flashing needs to be provided as a barrier against the early ingress of hot gases through the core of the panels.

Furthermore, all fixings must be adequately protected to maintain an FRL of at least -/120/120 with steel flashings fitted on the unexposed side or optionally, 6 mm fibre cement sheets installed on the wall. The panel fixings, apart from the fixings onto the slab edges of the stair landing, shall be from the side of the stairs together with steel flashings over the fixings. Fire rated sealant must be applied to all gaps. The support channels or C/J-tracks must in turn be secured to the landing slab at every level with a minimum of six numbers of FS0885 power fasteners.

The short ends of the box riser may be fitted with either horizontally or vertically oriented Speedpanel panels. The corner joints between the vertical and horizontal panels are as shown and detailed in Figure 45.

The fire resistance performance in the vertical plane is provided at the wall-to-stair stringer joints which vary based on the width of the joint between the horizontally oriented Speedpanel wall and stairs as shown in Figure 4 to Figure 7.

This assessment only deals with the impact of fire exposure to the Speedpanel walls and is based on the assumption that the loads imposed on the stair landing slabs by the support members for providing stability and rigidity in the Speedpanel walls have been accounted for in the structural design calculations to be performed by others engaged specifically for the construction of the stair system.

The joint and fixings for the proposed box riser construction are as detailed in Figure 39 to Figure 44 and the fixing screws and bolts used in construction shall be not less than those assessed.

The assessment provides confirmation that the Speedpanel risers installed as assessed will perform to the required FRL of -/120/120 providing a 120 minute fire resistant barrier for the fire compartmentation of the stair forming a fire isolated box within the stairwell.

## 8.6 Riser fixed to side of stairwell

### 8.6.1 Structural adequacy

The primary difference between this proposed construction and the dual void box risers discussed above is its location relative to the stair stringers. While the box risers assessed in sections 8.4 and 8.5 were central to the stairwell, alternatively, it is proposed to construct the riser connected to the side of the scissor stairs as depicted in Figure 50 to Figure 54. They are dual void box risers with dual-stacked horizontally oriented walls in the longitudinal directions connected via back-to-back C/J-tracks and a transverse section of wall with a width of 1 m. The short edges of the box risers are 1 m wide horizontally oriented or vertically oriented Speedpanel walls.

The calculations undertaken for determining the structural adequacy of the box riser can be used in this application since the design loads and fire exposure conditions would be similar.

### 8.6.2 Horizontal and vertical fire separation

Since, in the central box riser described in section 8.4, it is assumed that the wall will be exposed to a fire event from one side of the wall only, its application is similar to that of a riser fixed to one side of the stairs only with fire exposure occurring only on one side of the wall. Therefore, the same fire resistance performance in the horizontal and vertical planes as that assessed for central box risers with dual voids (section 8.5.1) can be applied for risers fixed to side of the stairs.

## 8.7 Triangular riser – angled connections

### 8.7.1 Structural adequacy

The structural performance of the triangular riser will be similar to that of the boxed riser provided that the same sealant and connection details are utilised. The structural capacity of the Speedpanel, the connections between the Speedpanel and side tracks, between side tracks, at concrete landings/stair stringers are calculated similarly to the boxed riser and must be constructed as shown in Figure 55 and Figure 56.

The support channels or perimeter C/J-tracks must be secured to the landing slab at every level with six numbers of FS0885 power fasteners.

### 8.7.2 Horizontal and vertical fire separation

The proposed triangular riser with angled horizontally oriented Speedpanel and connections (Figure 55 and Figure 56) can be assessed for horizontal and vertical fire separation in a manner similar to that described for box risers, assuming fire exposure from one side of the wall only. The primary difference would be the fire exposure of the inter-locking joints between the Speedpanel wall sections which are protected to prevent early integrity or insulation failure with steel flashings fire rated sealants applied at all joints between panels and to fill all gaps similar to that of the boxed riser.

# 9. Additional details

## 9.1 Description

The assessment of additional details including proposed head track detail, fixings and support, optional horizontal butt joins and lining of Speedpanel external surfaces with 6 mm fibre cement sheets is discussed below.

## 9.2 Methodology

The approach and method of assessment used for this assessment is summarised in Table 18.

**Table 18 Method of assessment**

| Assessment method | |
|---|---|
| Level of complexity | Complex assessment |
| Type of assessment | Qualitative |

## 9.3 Proposed head track details

The head details in Figure 47 and Figure 48 outlines the provision of a steel angle over the joint gap on the unexposed side of the spine wall or box riser. Test report EWFA 2741700 included head details similar to that in Figure 47 and Figure 48 except that the unexposed side of the panel is fitted with a steel flashing and assessed as being capable of maintaining the required FRL of -/120/120.

It is proposed that the steel flashing on the unexposed side be replaced with equivalent unequal steel angle of 6 mm plate thickness. The angle is much thicker than the 0.7 mm steel flashing and is expected to perform better as it is more rigid. As the treatment of the steel angle installation with sealants is the same as that with the steel flashing, the head details with the steel angle on the unexposed side will similarly provide sufficient cover to maintain 120 minutes in integrity and insulation.

Additionally, it is proposed that where an additional Speedpanel wall segment connects perpendicular to an existing spine wall separating scissor stairs, the head of the additional Speedpanel wall can be angled to suit the angle of the stair stringer as the wall passes underneath the stairs – as shown in Figure 63. This angle is not expected to detrimentally affect the fire resistance performance of the Speedpanel wall as the head detail is not expected to carry the weight of the wall. However, the horizontal fire separation must be ensured.

As discussed above, at the head of the Speedpanel wall, applying Fuller Firesound Acrylic Sealant to a minimum depth of 20 mm and installing steel flashing or a steel angle on the unexposed side – as shown in Figure 63 – is expected to be sufficient cover to maintain 120 minutes in integrity and insulation. The air gap between the head of the Speedpanel wall and the stair stringer must not exceed 20 mm.

The connection between the additional Speedpanel wall and the existing spine wall must be as shown in Figure 64 and the structural adequacy can be calculated as per calculations conducted for single void box risers with perpendicular wall connection – as given in section 8.3.

## 9.4 Fixings and supports

Generally, the support C/J-tracks shall not be less than 1.15 mm BMT or 1.95 mm BMT depending on the required slab-to-slab height. The C-tracks at connecting points such as at the back-to-back connections shall not be less than 2 mm BMT. The fixings of the panels to the main supports shall be mainly from the stair side and be covered with 0.7 mm BMT galvanised steel flashings. Fixing of the supports shall be either to the stair structure (via stair stringer) or landing slabs at each level or between floors. Installers are to be aware of the limitations in height and widths of the panels as detailed in the assessment outcome in section 10.

Where the C/J-tracks are exposed with fixings in the void side, they shall be covered over with steel flashings incorporating fire sealants to avoid direct heat exposure and to maintain insulation performance. Similarly, joints and fixings on the exposed side shall be covered over with steel flashings. Where the panels are lined with fibre cement sheeting and the fixings are covered, the steel flashings may be omitted.

## 9.5 Horizontal butt join

In scissor stair configurations, due to consecutive landing slabs not being aligned vertically, it may be difficult to install horizontally oriented Speedpanel segments of the same length around a slab edge. This is especially not feasible with the last panel under the slab edge. Therefore, it is proposed to cut the last panel at the slab edge at both ends and butt join the panels at their vertical cuts with 0.4 mm BMT Speedpanel profile cover skin, caulked and installed as per EWFA 21622. This is proposed to be done in in two different configurations as shown in Figure 57 and Figure 58 and should be carried out with reference to EWFA 21622. The first proposed alternative is to install the cover skin trimmed along the edge of the perimeter track and caulked with fire rated sealant whereas the second proposed alternative is to install the cover skin around inside of the perimeter track and caulked with fire rated sealant.

## 9.6 Optional lining of Speedpanel external surfaces with 6 mm fibre cement sheets

It is proposed that the Speedpanel wall surfaces be optionally lined with 6 mm fibre cement sheets.

With reference to the test results of EWFA 2741700, it was observed that the maximum temperature recorded on the unexposed side at 120 minutes in a wall specimen where a 13 mm thick × 120 mm deep × 1000 mm long plasterboard capping was installed on the fire exposed side of head C-track was 177°C. Similarly, the temperature recorded on the unexposed side at 120 minutes with the plasterboard on the unexposed side was lower at 154°C. When the plasterboard segment was fixed onto both exposed and unexposed sides, the maximum temperature recorded was 163°C. Therefore, installing a 13 mm thick plasterboard wall on the unexposed side of the head track can prolong the insulation performance of the wall systems.

If 6 mm fibre cement sheets are used as an alternative to the 13 mm plasterboard section, it is recommended that the entire wall is covered with fibre cement sheeting instead of only the head track. This will also cover the steel sheathing of the Speedpanel and limit wall deflections, thus reducing its vulnerability to integrity and structural adequacy failures. In addition, with the fibre cement sheets installed over the entire wall section, it will have a higher thermal mass than a 120 mm deep 13 mm plasterboard section and so will reduce the temperatures reaching the unexposed side.

The fibre cement sheets are non-combustible and will not add to the combustion fuel load of the wall when exposed to fire. The panel will act as a decorative panel and break up into fragments and crumble after more than 6 minutes of exposure. The fibre cement sheet lining on the unexposed side will remain integral for the full duration of 120 minutes of the required FRL as the temperature on the unexposed side is insufficient to cause deterioration or deformation of the fibre cement sheets.

The fibre cement sheets will act as a fire resistant barrier on the unexposed side and can be used as an optional substitute for the steel flashing over the panel joints on the unexposed side or both the unexposed and unexposed sides. The proposed constructions with the fibre cement sheeting are shown in Figure 16, Figure 18 and Figure 20 to Figure 34, installed on both the exposed and unexposed sides.

## 9.7 Speedpanel wall with stair bottom angle on one face only

In sections 6 and 7, it is expected that in the event of a fire in one of the twin scissor stairs, the self-weight of the Speedpanel wall section between two floor levels will be carried by the bottom angle of the unexposed stair stringer and the unexposed side C/J-track. The angle and C/J-track on the exposed side are expected to be fully compromised and not contributing to the load carrying capacity.

The self-weight of the Speedpanel wall will be transferred via anchor and/or screw connections to the concrete landing slabs and to the unexposed concrete staircase.

It is proposed that a single protected structural angle on one face of the Speedpanel walls is used to support the single and dual stacked Speedpanel wall systems (horizontally or vertically oriented) instead of two angles on both sides of the wall. This means that the stairs only run along one side of the wall – see Figure 59.

If the wall system is exposed to fire from the side opposite to where the angle is installed (i.e. the angle is on the unexposed side), it is expected that the angle will be experiencing temperatures less than 200ºC and subjected to the same load as that assessed in sections 6.1.3 above, 7.3.1 aboveand 7.4.1 abovefor single and dual stacked Speedpanel walls. This will be equivalent to one of the two angles from the twin scissor stairs being compromised on the exposed side, leaving the unexposed side angle to carry a portion of the self-weight of the wall section above.

If the wall system is exposed to fire from the same side as the face where the angle is installed (i.e. the angle is on the exposed side), it is expected that the angle will undergo significant reductions in capacity at elevated temperatures. However, it is proposed that the angle is protected with a suitable method of structural steel protection as considered fit for the purpose (based on further advice from manufacturers of passive fire protection options) as given in item 22 of the schedule of components in section 4.5. The steel angle protected with Promatect® 250 boards is shown in Figure 59 and the board protection must extend minimum 100 mm horizontally and vertically beyond the dimensions of the steel angle.

It is expected that the applied steel protection will reduce the temperatures in the steel angle and the screws connecting the angle and the wall. Therefore, the type and thickness of the structural steel protection must be designed by a professional engineer based on the limiting temperatures required for the steel angle and connecting screws to retain sufficient capacity for minimum 120 minutes of fire exposure to carry the applied loads. Further details are given under item 22 of the schedule of components in section 4.5.

All gaps between the Speedpanel wall and the fire protection system must be sealed with fire-rated Fuller Firesound Acrylic sealant – as shown for Promatect 250 boards in Figure 59. Furthermore, the cross-sectional dimensions of the angles must be maintained as given in item 3 of the schedule of components in section 4.5 and the gap between the wall and the stair stringer must be protected as shown in Figure 4 to Figure 7 and Figure 10 to Figure 13.

Based on the above discussion, it is considered that the proposed system with a single steel angle on one face of the single or dual stacked Speedpanel wall systems will achieve an integrity and insulation performance of 120 minutes in accordance with AS 1530.4:2014.

## 9.8 Protected structural steel beam supporting spine wall

It is proposed that a protected structural steel beam is installed perpendicular to the dual stacked spine walls, assessed in section 7, as a point of fixing – as shown in Figure 60.

It is assessed in section 7, that the maximum slab-to-slab height for horizontally oriented dual-stacked Speedpanel walls is 3.3 m with C-tracks of 1.15 BMT and 4 m with C-tracks of 1.95 BMT – without additional structural elements to support the wall.

Therefore, for unsupported walls extending beyond the point of fixing to the steel beam, the maximum slab-to-slab height of 3.3 m for single or dual-stacked Speedpanel walls with C-tracks of 1.15 BMT and 4 m with C-tracks of 1.95 BMT must be maintained. This is shown in Figure 61.

If the proposed steel beam is installed to support heights of Speedpanel walls beyond the assessed 4 m, an additional supporting column along the wall must be constructed as shown in Figure 62.

The structural steel beam and supporting structural column must be designed by a professional engineer in accordance with AS 4100, considering all design actions that may be imposed. The type and thickness of the appropriate structural steel protection to be applied onto the steel beam and column must also be designed by a professional engineer based on the limiting temperatures obtained for minimum 120 minutes of structural adequacy. Further details are given under item 22 of the schedule of components in section 4.5.

The connection between the C-track and the steel beam consists of two minimum 12 g SDS Series 500 screws, one at the top of the wall segment below and one at the base of the wall segment above. Similarly, two screws must be used on the opposite side of the wall at the top and base. As the connection area is also protected with an appropriate method of steel protection, it is not expected that the screws will be subjected to the standard fire temperatures at 120 minutes. Considering this, the shear capacity of the screws is expected to be sufficient. However, it must be noted that the screws and the connection detailing must be revaluated, designed and protected as a part of the design of the structural steel beam by a professional engineer.

## 9.9 Speedpanel walls between stair stringers

It is proposed that horizontally or vertically oriented Speedpanel walls can be installed suspended off the side of stair stringers at the top and the base – instead of being connected to concrete landings via the vertical perimeter C-tracks.

The proposed constructions are shown in Figure 65 to Figure 68. The Speedpanel walls are supported by vertical perimeter C-tracks on either side as well as angled C-tracks running along the top and the base. The angled C-tracks are fixed to structural steel angles, which are screw fixed to the concrete stairs through minimum 8 mm diameter FS0885 mechanical power fasteners or equivalent bolts. The connection detail at the top and the base must be protected with appropriate steel protection methods as shown in Figure 67 to Figure 68.

It is expected that, for horizontal walls, the self-weight of the wall is carried by the perimeter vertical C-tracks, as well as the steel angle running along the stair stringers. The compression loads on the vertical C-tracks will be the same as that assessed in section 6 for single walls and section 7 for dual stacked walls. For vertical walls, the self-weight of the panels will be carried by the steel angle at the base.

The structural steel angle (and associated connection to the stair stringer) must be designed by a professional engineer in accordance with AS 4100, considering all design actions that may be imposed. The type and thickness of the appropriate structural steel protection to be applied onto the steel beam must also be designed by a professional engineer based on the limiting temperatures obtained for minimum 120 minutes of structural adequacy. Further details are given under items 15 and 22 of the schedule of components in section 4.5.

# 10. Conclusion

This assessment demonstrates that the proposed Speedpanel wall systems are likely to achieve the FRL given in Table 19 below if it were tested in accordance with AS 1530.4:2014.

**Table 19 Assessment outcome**

| Description | Referenced Figures | Variations | Fire Resistance Level (FRL) |
|---|---|---|---|
| Horizontally stacked Speedpanel wall | Figure 1 to Figure 7 | Maximum horizontal span is 5 m and maximum slab-to-slab height is 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks.<br>Allowable gaps between the stair stringer and the bottom angle are 0-95 mm and the size of the steel angle will vary to accommodate these gaps. | **-/120/120** |
| Vertically stacked Speedpanel wall | Figure 8 to Figure 13 | Maximum span is unlimited in the horizontal direction, and the slab-to-slab height is maximum 3 m with 1.15 mm BMT and 1.95 mm BMT side C/J-tracks.<br>Allowable gaps between the stair stringer and the bottom angle are 0-95 mm and the size of the steel angle will vary to accommodate these gaps. | |
| Dual-stacked walls with back-to-back C/J-tracks or central T bracket | Figure 14 to Figure 19 | The spans of the horizontally oriented Speedpanel walls are increased by stacking multiple Speedpanel walls together, connected through back-to-back C/J-tracks or T brackets to increase structural stability.<br>Maximum individual horizontal span is 3 m. The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks. | |
| Dual-stacked wall system with vertical wall segment between two horizontal walls | Figure 20 to Figure 34 | Multiple wall system with a vertically oriented wall section between two horizontally stacked walls. The horizontal and vertical oriented wall sections are connected via back-to-back C/J-tracks. The vertical Speedpanel wall – at mid-width of the dual-stack wall system – is anchored and supported by a concrete mid-landing.<br>Maximum horizontal span of the individual horizontally oriented walls is 3 m. Minimum horizontal width of the vertical wall segment is 500 mm (two panels oriented vertically). The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks. | |
| Single void box riser | Figure 35 to Figure 38 | Constructed from a continuous single or dual-stacked horizontally oriented Speedpanel wall in the longitudinal direction (long ends) with horizontally or vertically oriented transverse wall sections at the edges. Maximum spans of 3 m or 6 m if extended with back-to-back C/J-tracks.<br>The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks.<br>The box risers may include air grilles that are to be installed within an aperture built into a horizontal Speedpanel wall where the aperture must be compliant to EWFA 21622 | |

| Description | Referenced Figures | Variations | Fire Resistance Level (FRL) |
|---|---|---|---|
| Dual void box riser | Figure 39 to Figure 49 | The void is divided centrally into two by a transverse section of Speedpanel wall at mid-span. Constructed from either a continuous single or dual-stacked horizontally oriented Speedpanel wall in the longitudinal direction (long ends) with horizontally oriented wall section at mid-span and either horizontally oriented or vertical transverse wall sections at each end. or vertically orientated transverse wall sections at mid-span and the edges. Maximum horizontal spans are 4.5 m or 6 m if extended to dual-stack system. The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks.<br>The box risers may include air grilles that are to be installed within an aperture built into a horizontal Speedpanel wall where the aperture must be compliant to EWFA 21622 | **-/120/120** |
| Riser fixed to side of stairwell | Figure 50 to Figure 54 | Same as single or dual void riser. However, it is to be constructed to the side of the stairwell and not central to it. | |
| Triangular riser | Figure 55 and Figure 56 | Angled connections in a triangular riser construction, proposed as an alternative to the boxed riser.<br>The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks. | |
| Head track details | Figure 22 to Figure 25, Figure 47 to Figure 48 and Figure 63 to Figure 64 | Steel flashing on the unexposed side replaced with equivalent unequal steel angle of 6 mm plate thickness.<br>Where an additional Speedpanel wall segment connects perpendicular to an existing spine wall separating scissor stairs, the head of the additional Speedpanel wall can be angled to suit the angle of the stair stringer. | |
| Fixings and supports | Figure 15 to Figure 19, Figure 21, Figure 36 to Figure 38, Figure 41 to Figure 46, Figure 54 to Figure 56 | Where the C/J-tracks are exposed with fixings in the void side, they shall be covered over with steel flashings incorporating fire sealants to avoid direct heat exposure and to maintain insulation performance. | |
| Horizontal butt join | Figure 57 and Figure 58 | Installed around consecutive landing slabs not aligned vertically that prevent the same length of panels being used throughout the floor height.<br>The last panel at the slab edge is cut at both ends and butt join the panels at their vertical cuts with minimum 0.4 mm BMT Speedpanel profile cover skin, caulked and installed as per EWFA 21622. | |
| Optional lining with 6 mm fibre cement sheets | Figure 16, Figure 18 and Figure 20 to Figure 34 | The fibre cement sheets will act as a fire resistant barrier on the unexposed side and can substitute for the steel flashing over the panel joints on the unexposed side. | |

| Description | Referenced Figures | Variations | Fire Resistance Level (FRL) |
|---|---|---|---|
| Optional system with a single protected bottom angle on one face of the single or dual stacked Speedpanel wall | Figure 59 | A single protected structural angle on one face of the Speedpanel walls is used to support the single and dual stacked Speedpanel wall systems (horizontally or vertically oriented) instead of two angles on both sides of the wall. This means that there is the stair stringer only run along one side of the wall. | |
| Protected structural steel beam supporting Speedpanel wall | Figure 60 to Figure 62 | Protected structural steel beam installed perpendicular to the dual stacked spine walls as a fixing point between horizontal wall sections instead of a concrete landing. The maximum slab-to-slab heights must be maintained. The slab-to-slab height is maximum 3.3 m with 1.15 mm BMT side C/J-tracks and 4 m with 1.95 mm BMT C/J-tracks.<br>If the wall heights extend beyond 3.3 m with C-tracks of 1.15 mm BMT and 4 m with C-tracks of 1.95 mm BMT, the walls must be supported by a structural column. | |
| Speedpanel walls suspended off the side of stair stringers at the top and the base | Figure 65 to Figure 68 | The Speedpanel walls are supported by vertical perimeter C-tracks on either side as well as angled structural steel angles and C-tracks running along the top and the base. The angled C-tracks are fixed to structural steel angles, which are screw fixed to the concrete stairs through FS0885 mechanical power fasteners or equivalent bolts. | |

# 11. Validity

Warringtonfire Australia does not endorse the tested or assessed product in any way. The conclusions of this assessment may be used to directly assess fire hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard under all conditions.

Due to the nature of fire testing and the consequent difficulty in quantifying the uncertainty of measurement, it is not possible to provide a stated degree of accuracy. The inherent variability in test procedures, materials and methods of construction, and installation may lead to variations in performance between elements of similar construction.

This assessment is based on information and experience available at the time of preparation. The published procedures for the conduct of tests and the assessment of test results are subject to constant review and improvement. It is therefore recommended that this report be reviewed on or, before, the stated expiry date.

This assessment represents our opinion about the performance likely to be demonstrated on a test in accordance with AS 1530.4:2014, based on the evidence referred to in this report.

This assessment is provided to the Speedpanel Holdings Pty Ltd and H B Fuller Company Australia Pty Ltd for its own purposes and we cannot express an opinion on whether it will be accepted by building certifiers or any other third parties for any purpose.

# Appendix A Drawings and information

**Table 20 Details of Figures**

| Figure | Dwg no | Date | Provided by |
|---|---|---|---|
| Figure 1 to Figure 13 | - | 19/07/2018 | Speedpanel Holdings Pty Ltd. |
| Figure 14 to Figure 19 | 3150-FA-002 | 10/10/2020 | |
| Figure 20 to Figure 34 | 3148-FA-002 | 10/10/2020 | |
| Figure 35 to Figure 49 | 3147-FA-008 | 26/09/2020 | |
| Figure 50 to Figure 54 | 3149-FA-002 | 26/09/2020 | |
| Figure 55 to Figure 56 | 3183-FA-002 | 26/09/2020 | |
| Figure 57 to Figure 58 | 3187-FA-001 | 20/07/2020 | |
| Figure 59 | 3206-FA-002 | 04/11/2021 | |
| Figure 60 to Figure 68 | 3206-FA-001 | 20/08/2021 | |

# Appendix B Summary of supporting test data

## B.1 Test report – BWA 2286900

**Table 21 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Speedpanel (Vic.) Pty Ltd, 89-91 Canterbury Road, Kilsyth, Vic 3137. |
| Test laboratory | Bodycote Warringtonfire Aus Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. |
| Test date | The fire resistance test was completed on 18 August 2008. |
| Test standards | The test was done in accordance with AS 1530.4:2005. |
| Variation to test standards | None. |
| General description of tested specimen | The test specimen comprised a nominal 2790 mm wide × 3000 mm high × 78 mm thick loadbearing panel wall made of vertically oriented 78 mm thick Speedpanel panels that incorporated a “tongue and groove” detail on their vertical edges. The shell material of the panels was 0.42 mm galvanized mild steel. The wall was restrained at the top and was supported at the base on the loading jacks. The wall had the east and west vertical edges free from lateral restraint, with both edge panels fitted with a ceramic fibre packing end cap. The test assembly was vertical and symmetrical.<br>The perimeter framing comprised 83 mm wide × 58 mm high × 1.2 mm thick steel C-tracks on the top and bottom of the wall system. The end cap on the west side was 50 mm wide × 59 mm high × 0.6 mm thick and the C-track and on the east side was 17 mm wide × 60 mm high × 0.6 mm thick.<br>The panels were fixed to the top and bottom C-tracks at nominal 250 mm centres and fixed to each other along the horizontal centreline on both exposed and unexposed sides with 15 mm long self-tapping screws.<br>Fire rated acrylic sealant was used to seal any gaps in the construction prior to testing.<br>The wall was loaded from the base of the wall at six points, at 500 mm centres. The average load that was applied at each point for the duration of the test was approximately 2.0 kN per load point (4.3 kN/m). The test load was applied to the wall for 15 minutes prior to the commencement of the fire resistance test. |
| Instrumentation | The test report states that the instrumentation was in accordance with AS 1530.4:2005 |

The test specimen achieved the following result in Table 22:

**Table 22 Results summary for this test report**

| Criteria | Performance |
|---|---|
| Structural adequacy | No failure at 144 minutes |
| Integrity | 120 minutes. Ignition of sealant at interface of top C-track and panel initiated failure of specimen by sustained flaming for longer than 10 seconds. |
| Insulation (wall system) | 64 minutes.<br>Maximum temperature on top C-track (T/C B6) exceeded 180 K above the initial temperature. |
| Insulation (panel only) | 80 minutes. Maximum temperature 15 mm from the edge of a vertical joint (T/C B8) exceeded 180K above the initial temperature. |

## B.2 Test report – EWFA 2736000

**Table 23 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Speedpanel (Vic.) Pty Ltd, 89-91 Canterbury Road, Kilsyth, VIC, 3137. |
| Test laboratory | Exova Warringtonfire Aus Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. |
| Test date | The fire resistance test was completed on 22 June 2012. |
| Test standards | The test was done in accordance with AS 1530.4:2005. |
| Variation to test standards | None. |
| General description of tested specimen | The test assembly comprised a nominal 2950 mm wide × 3000 mm high × 78 mm thick loaded wall system that incorporated various apertures. The 78 mm thick Speedpanel were vertically oriented to form a vertical wall system. The panels incorporated a “tongue and groove” detail on their vertical edges. The specimen was tested loaded and with free vertical edges.<br>The panels were stitched together on the unexposed side only at 1500 mm centres.<br>The tested wall system incorporated three apertures and the apertures were filled with 50 mm thick Firetherm Intubatt.<br>For the purpose of the assessment, only aperture A is relevant. At 195 mm high and 1405 mm wide, Aperture A comprised one layer of 50 mm thick Firetherm Intubatt friction fitted into the aperture.<br>A load of 1.975 kN was applied via 6 points nominally 492 mm apart at the bottom edge of the wall. The applied load at each point was 0.329 kN.<br>The test assembly was asymmetric as the screws in the panel joints in the field of the specimen and those connecting the tracks and the panels were not present on the exposed side.<br>The formal test was terminated after 121 minutes. The test was continued to collected additional data on specimen behaviour with increased loading and this part of the test was terminated at 157 minutes after the application of a maximum load of 26.1 kN. |
| Instrumentation | The test report states that the instrumentation was in accordance with AS 1530.4:2005. |

The maximum temperature measured on the unexposed side of 50 mm thick Firetherm Intubatt at 120 minutes was 238°C.

Crushing and distortion of the wall at mid-height was observed at a load of 26.1 kN at 156 minutes.

The 50 mm thick Firetherm Intubatt stayed in place in Aperture A for 156 minutes.

## B.3 Test report – EWFA 2736001

**Table 24 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Speedpanel (Vic.) Pty Ltd, 89-91 Canterbury Road, Kilsyth, VIC, 3137. |
| Test laboratory | Exova Warringtonfire Aus Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. |
| Test date | The fire resistance test was completed on 26 June 2012 |
| Test standards | The test was done in accordance with AS 1530.4:2005. |
| Variation to test standards | None. |
| General description of tested specimen | The tested configuration incorporated 78 mm thick Speedpanel arranged to form a vertically oriented 1920 mm high × 2970 mm wide wall system positioned above a horizontally oriented 1040 mm high × 3000 mm wide wall system.<br>The head detail of the specimen was not typical of regular installation as there was a 15 mm air gap inside the head track at the top of the panels and no mastic on the exposed and unexposed sides at the top of the panels around the head track. The panels incorporated a ‘tongue and groove’ detail on their edges. The specimen was tested with bottom horizontal panel section fixed and top vertical panel section with free vertical edges.<br>The head track was made from 82 mm × 50 mm × 1.15 mm BMT galvanised C-track. At the head of the specimen, the C-track was fixed to the lintel only with galvanised steel spikes, mushroom head at 500 mm centres and at the top of the horizontal panels, C-tracks were fixed to the bottom track of the vertical wall section at 500 mm centres.<br>The side tracks were made from 82 mm × 50 mm × 1.15 mm BMT galvanised C-tracks. Side tracks for top vertical section of wall was not fixed to the support wall and was fixed to the panels with flat top self-drilling, zinc coated steel screws at 500 mm centres on the non-fire side. Side track for bottom horizontal section of wall was fixed to perimeter block work using steel spikes, mushroom head at nominal 400 mm centres. Horizontal panels were fixed to the side track at every second joint, 255 mm and 755 mm from the bottom of the specimen respectively.<br>The bottom track of vertical panels were made from 82 mm × 50 mm × 1.15 mm BMT galvanised C-tracks and fixed to the panel with flat top self-drilling, zinc coated steel screws at 500 mm centres and top track on the horizontal wall section at 500 mm centres.<br>The bottom track of horizontal panels made from 82 mm × 50 mm × 0.55 BMT galvanised C-track fixed to the panel with flat top self-drilling, zinc coated steel screws at 500 mm centres.<br>The test was terminated at 151 minutes. |
| Instrumentation | The test report states that the instrumentation was in accordance with AS 1530.4:2005 |

The wall system failed integrity at 98 minutes when flaming had become evident at head, gap between track and panels at head at mid-width.

The wall system failed insulation at 19 minutes 50 seconds when the temperature measured at the head of specimen, at mid-width exceeded the initial temperature of 180K rise.

The test specimen achieved the following result in Table 25:

**Table 25 Results summary for this test report**

| Item | Criteria | Performance | Location |
|---|---|---|---|
| Wall system | Integrity | Failure at 98 minutes | Flaming at head |
| | Insulation | Failure at 19 minutes | Thermocouple 016 |

## B.4 Test report – EWFA 2736002

**Table 26 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Speedpanel (Vic.) Pty Ltd, 89-91 Canterbury Road, Kilsyth, VIC, 3137. |
| Test laboratory | Exova Warringtonfire Aus Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. |
| Test date | The fire resistance test was completed on 13 July 2012 |
| Test standards | The test was done in accordance with AS 1530.4:2005. |
| Variation to test standards | Average furnace temperature was outside the limits prescribed in AS 1530.4:2005 Clause 2.10.2.2(a) between 21 minutes and 22 minutes 25 seconds. |
| General description of tested specimen | The test specimen consisted of a nominal 3010 mm wide × 2970mm high × 51 mm thick load-bearing wall made of vertically oriented 255 mm wide × 51 mm thick Speedpanel panels that incorporated a “tongue and groove” detail on their vertical edges. The panels were made from 0.2 mm BMT (0.27 mm measured thickness) galvanised mild steel. Steel skin was joined on male and female sides with pop-rivets at nominal 50 mm centres.<br>The test assembly was asymmetric with the West edge fixed and the East edge free from lateral restraint from the formal segment of the test. The fixed edge was then released for the second stage of the test.<br>The perimeter framing consisted of two kinds of head tracks. The west side head track was 885 mm long × 53 mm deep × 50 mm high ×1.01 mm thick (measured) galvanised steel C-track with intumescent strip in channels in web. The east side head track was 2135 mm long × 55 mm deep × 50 mm high × 0.75 mm (measured) galvanised steel C-track with intumescent strips installed in a similar manner to the west side head track. The head track fixed to the lintel with 6.5 mm × 50 mm galvanised steel spikes, mushroom head at 400 mm centres.<br>The perimeter framing also comprised side tracks that were made of 56 mm deep × 55 mm wide × 0.6 mm thick (measured) galvanised steel C-track and bottom track was made of 55 mm deep × 52 mm wide × 1.21 mm thick (measured) galvanised steel C-track.<br>The panels were fixed to the top and bottom C-tracks at nominal 500 mm centres and fixed to each other along the horizontal centreline on both exposed and unexposed side with 16 mm long self-tapping screws.<br>Fire rated sealant was used to seal any gaps in the construction prior to testing.<br>A load of 2.876 kN was applied at three points 1450 mm apart at the base of the wall. The applied load at each hydraulic jack was 0.959 kN and was applied for the duration of the formal part of the test. The load was later increased to 15.15 kN, and post-test observations were collected. |
| Instrumentation | The test report states that the instrumentation was in accordance with AS 1530.4:2005 |

The ambient temperature at the start of the test was 15°C and varied between 15°C and 18°C during the test.

The test was terminated at 94 minutes.

Formal part of the test was terminated at 66 minutes and specimen prepared for load increased section of test and furnace operation continued. Fixed edge screws were removed.

The deflection measured at the centre of wall at 60 minutes was 162 mm. The centre deflection increased to 235 mm when the applied load increased to 15.15 kN.

The concrete lintel spalled heavily during the test affecting the validity of some of the thermocouple readings along the head of the specimen. Thermocouples 031 to 033, 034 to 035, and 047-049 were not affected.

The test specimen achieved the following result in Table 27:

**Table 27 Results summary for this test report**

| Criteria | Performance |
|---|---|
| Structural adequacy | No failure at 66 minutes |
| Integrity | No failure at 66 minutes |
| Insulation (Head Track) | Failed at 23 minutes<br>Maximum temperature on head C-track (T/C 017) exceeded 180K rise above the initial temperature.<br>Maximum temperature on top C-track (T/C B6) exceeded 180 K above the initial temperature. |
| Insulation (Panels only) | Failed at 61 minutes<br>Maximum temperature on top west quarter of panel (T/C 011) exceeded 180K rise above the initial temperature. |

## B.5 Test report – EWFA 2848300

**Table 28 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Speedpanel (Vic.) Pty Ltd, 89-91 Canterbury Road, Kilsyth, VIC, 3137. |
| Test laboratory | Exova Warringtonfire Aus Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. |
| Test date | The fire resistance test was completed on 29 May 2013. |
| Test standards | The test was done in accordance with AS 1530.4:2005. |
| Variation to test standards | None. |
| General description of tested specimen | The test assembly comprised a nominal 3000 mm wide × 3000 mm high × 64 mm thick Speedpanel wall system. The tested configuration incorporated 64 mm thick Speedpanel panels vertically oriented to form a vertical wall system with 0.75 mm BMT perimeter track. The panels incorporate a "tongue and groove" detail on their vertical edges.<br>The side and bottom tracks were made of 67 mm wide × 51 mm deep × 0.8 mm galvanised steel track. Flat top self-drilling, zinc coated steel screws, 10g × 16 mm fixed the side tracks to the panels at 500 mm centres on exposed and unexposed side.<br>Flat top self-drilling, zinc coated steel screws, 10g × 30 mm fixed the head and bottom tracks to the panels at every second panel join on both exposed and unexposed sides. Head fixings were staggered.<br>Flat top self-drilling, zinc coated steel screws, 10g × 16 mm were used to fix panels to each other at every second panel join at 1500 mm height from bottom on both exposed and unexposed sides.<br>These fixings were staggered such that one joint had one screw fixing at 1500 mm height.<br>Acrylic sealant identical to fuller firesound joint filler was applied to the joints between the panel and the C-track at head, base and vertical edges on both exposed and unexposed sides and also applied to joints between tracks and surround blockwork along head, base and fixed edges. |
| Instrumentation | The test report states that the instrumentation was in accordance with AS 1530.4:2005 |

The test was terminated at 181 minutes. The ambient temperature at the start of the test was 18°C and did not vary significantly throughout the duration of the test.

The test specimen achieved the following result in Table 29:

**Table 29 Results summary for the Head and side track performance of this test report**

| Criteria | Result | Location |
|---|---|---|
| Structural Adequacy | Not applicable | Not applicable |
| Integrity | 133 minutes | Sustained flaming at base track |
| Insulation | 14 minutes | The maximum temperature measured at the head track of the specimen in line with join exceeded the maximum temperature rise of 180K. |

## B.6 Test report – BWA 2257600

**Table 30 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Speedpanel (Vic.) Pty Ltd, 89-91 Canterbury Road, Kilsyth, VIC, 3137. |
| Test laboratory | Bodycote Warringtonfire (Aus) Pty. Ltd., 409-411 Hammond Rd, Dandenong, VIC- 3175, Australia. |
| Test date | The fire resistance test was completed on 6 March 2008. |
| Test standards | The test was done in accordance with AS 1530.4:2005. |
| Variation to test standards | None. |
| General description of tested specimen | The test assembly consisted of a nominal 3000 mm wide × 3000 mm high × 78 mm thick non-load bearing panel wall with horizontally oriented Speedpanel panels to form a vertical wall. The panels incorporate a "tongue and groove" detail on their horizontal edges. The panels were supported at their ends on vertical edges. The top and bottom edges are unrestrained. There was nominal 25 mm clearance to the concrete block surround at the top, with a nominal 80 mm clearance to the steel restraint frame at the bottom. The thickness of the galvanised steel sheathing of the panels was 0.22 mm.<br>The panels were fixed by 83 mm wide × 54 mm high × 1.19 mm thick steel C-tracks on the vertical edges at every second panel join (500 mm centres) on both exposed and unexposed sides with 35 mm long self-tapping screws. The wall consisted of a number of different installation details. Top and bottom C-track was not fixed to concrete block surround. Both the top and bottom panels were fixed to the top and bottom C-track at 450 mm centres with 35 mm long self-tapping screws. The first horizontal panel joint from the bottom was fixed at 250 mm centres with 35 mm long self-tapping screws. The second horizontal panel joint from the bottom was fixed at 500mm centres with 35 mm long self-tapping screws. No other fixings were applied to any other joints on either face of the panels. |
| Instrumentation | The test report states that the instrumentation was in accordance with AS 1530.4:2005 |

The ambient temperature at the start of the test was 29°C and varied between 29°C and 30°C during the test. The test was terminated after 242 minutes.

The test specimen achieved the following result in Table 31:

**Table 31 Results summary for this test report**

| Criteria | Performance |
|---|---|
| Results of Panel | |
| Integrity | 128 minutes, flaming of cotton pad in at the first join from the top which had begun to laterally separate near the mid-width of the wall. |
| Insulation on Panel | 117 minutes, temperature measured at 15 mm below a horizontal joint in the upper half of the wall exceeded initial temperature of 180K rise. |
| Results of Perimeter | |
| Integrity | No failure at 242 minutes |
| Insulation | 23 minutes, temperature measured on the east edge at the section where there was only sealant on the unexposed side. |

## B.7 Test report – EWFA 2741700

**Table 32 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Speedpanel (Vic.) Pty Ltd, 89-91 Canterbury Road, Kilsyth, VIC, 3137. |
| Test laboratory | Exova Warringtonfire Aus Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. |
| Test date | The fire resistance test was completed on 20 July 2012. |
| Test standards | The test was done in accordance with AS 1530.4:2005. |
| Variation to test standards | None. |
| General description of tested specimen | The test assembly consisted of a nominal 2950 mm wide × 3000 mm high × 78 mm thick non-loadbearing wall system made of vertically oriented 285 mm × 78 mm thick Speedpanel panels, which incorporated a "tongue and groove" detail on their vertical edges. The specimen was tested unloaded and with free vertical edges. The wall incorporated two Pyropanel FR Maxi doors, both opening inwards towards the furnace. The panels were made from an aerated concrete core encased in a 0.4 mm BMT galvanised steel skin.<br>The test assembly was asymmetric that the head details varied from the East side to the West side. Fire rated sealant was applied in the 20 mm gap between top C-track and wall panels. The five tested head track protecting options are summarised below:<br>• Option 1: Flashing installed on the exposed side only (Temperatures recorded by T/C 121 and 122 on the unexposed side).<br>• Option 2: One layer of 13 mm thick × 120 mm deep CSR Fyrchek plasterboard on the unexposed side only (Temperatures recorded by T/C 123 and 124 on the unexposed side).<br>• Option 3: One layer of 13 mm thick × 120 mm deep CSR Fyrchek plasterboard on each side of the head tracks (Temperatures recorded by T/C 125 and 126 on the unexposed side).<br>• Option 4: Flashing installed on the unexposed side only (Temperature recorded by T/C 127 and 128 on the unexposed side).<br>• Option 5: One layer of 13 mm thick × 120mm deep CSR Fyrchek plasterboard on the exposed side only (Temperatures recorded by T/C 129 and 130 on the unexposed side).<br>The perimeter framing consisted of head and bottom tracks made of 82 mm deep × 50 mm high × 1.2 mm thick galvanised steel C-tracks and side tracks made of 82 mm deep × 50 mm high × 0.5 mm thick galvanised steel C-tracks.<br>The panels were fixed to the top and bottom C-tracks at nominal 400mm centres and fixed to each other at 500mm centres on both exposed and unexposed side with 16 mm long flat top self-drilling, zinc coated steel screws.<br>Fire rated sealantwas used to seal any gaps in the construction prior to testing. Firetherm Intumastic acrylic sealant was used to secure Firetherm Intustrap Intumescent strips into door frame.<br>Details of the doors are not relevant to this assessment report. |
| Instrumentation | The test report states that the instrumentation was in accordance with AS 1530.4:2005 |

The test was terminated at 132 minutes.

The ambient temperature at the start of the test was 17°C and varied between 17°C and 19°C during the test.

The test specimen achieved the following result in Table 33:

**Table 33 Results summary for this test report**

| Head detail | Maximum temperature after 120 minutes (°C) |
|---|---|
| Option 1 | 177 |
| Option 2 | 154 |
| Option 3 | 163 |
| Option 4 | 145 |
| Option 5 | 177 |

## B.8 Test report – FRT200213 R1.0

| Item | Information about test report |
|---|---|
| Report sponsor | H B Fuller Australia Pty Ltd |
| Test laboratory | Warringtonfire Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. |
| Test date | The fire resistance test was completed on 25 August 2020. |
| Test standards | The test was done in accordance with AS 1530.4:2014. |
| Variation to test standards | None. |
| General description of tested specimen | A fire resistance test was conducted to evaluate the ability of linear gap sealing system in a floor construction to determine the fire resistance with respect to the integrity and insulation performance of a floor construction.<br>The test was performed on five control joints. For the purpose of this assessment, only control joints A and B are relevant. In both control joints, the sealant was applied to the depth of the backing rods and finished flush with the face of the separating element on both sides. The control joints were sealed using Fuller Firesound Acrylic sealant.<br>The test was terminated after 240 minutes |
| Instrumentation | The test report states that the instrumentation was in accordance with AS 1530.4:2014 |

The test specimen achieved the following result in

| Control joint | Criteria | Result | Fire resistance level (FRL) |
|---|---|---|---|
| A | Structural Adequacy | Not applicable | **-/240/180** |
| | Integrity | No failure at 241 minutes | |
| | Insulation | Failure at 215 minutes | |
| B | Structural Adequacy | Not applicable | **-/240/180** |
| | Integrity | No failure at 241 minutes | |
| | Insulation | Failure at 213 minutes | |