FAR 3584

Assessment of a Non Load Bearing Continuous Height, Horizontal Orientated Speedpanel Wall Interfaced with a Horizontal Speedpanel Wall

Author: Mark Gannon
Fire Testing Engineer

Reviewer: R. W. Causer
Fire Testing Engineer

Contact:
BRANZ Limited
Moonshine Road
Judgeford
Private Bag 50908
Porirua City
New Zealand
Tel: +64 4 237 1170
Fax: +64 4 237 1171
www.branz.co.nz

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1. CLIENT

Speedpanel (Vic) Pty Ltd
89-91 Canterbury Road
Kilsyth
Victoria
Australia

2. INTRODUCTION

This report gives BRANZ's assessment of the fire resistance of the Speedpanel non-load bearing, pre-cast horizontally aligned wall panels when inserted between two horizontally aligned Speedpanel walls that are up to 4,500 mm wide and a continuous height. The assessment is limited to considering the two 2,400 mm horizontal panels between the 4,500 mm horizontal Speedpanel perimeter panel walls including a continuous wall height as designed in Figure 1. Figure 1 shows the horizontally aligned (up to 4,500 mm span) continuous height panels are fixed at maximum heights of 6,000 mm high (between floor levels) to vertically aligned panels. The methodology and assessment to describe fixing the 4,500 mm span panels to the vertically aligned panels and a single 4,500 mm internal panel is covered by FAR 3580.

The assessment considers that the assessed design criteria (including the panel-to-panel interfacing) as contained BRANZ assessment reports FAR 3580, FAR 3582, FAR 3502 and FAR 3454 for the horizontally aligned panels for spans up to 4,500 mm wide and continuous heights is incorporated into the wall design as highlighted in Figure 1.

Considering the above, this assessment report specifically assesses the insertion of two 2,400 mm internal wide panels.

3. BACKGROUND

3.1 BWA Fire Resistance Test Report 2257600.4

In BWA fire resistance test 2257600.4 the test specimen consisted of a non-loadbearing, Speedwall® panel wall nominally 3,000 mm high by 3,000 mm wide which comprised interlocking panels (tongue and groove), each 285 mm wide x 78 mm thick, of a light weight concrete core with galvanised steel sheathing. Steel C-channels, 54 mm x 83 mm x 54 mm x 1.19 mm thick were fixed to all perimeter edges of the Speedpanel wall.

The perimeter channels were fixed to the specimen concrete frame at the vertical sides but not fixed to the specimen frame top or bottom (i.e. the top and bottom C- track were free edges). The vertical C-channels were fixed to the frame with M8 masonry anchors spaced at 450 mm centres.

The horizontally aligned panels were fixed to the C-Track on the vertical edges at every second panel join at 500 mm centres on the exposed and unexposed face using 35 mm long self tapping screws. 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.

Additional fixings, using 35 mm long self tapping screws, were located on the first and second horizontal panel joint (from the bottom) at 250 mm and 500 mm centres, respectively.

The channels were sealed to the specimen frame and to the panels at the following locations using Premium Flex Fyreseal acrylic sealant (from the bottom up):

Wall Location	**Unexposed Side**	**Exposed Side**
Sides of the Bottom Quarter	No	Yes
Sides of the Second Quarter	Yes	No
Sides of the Top Half	Yes	Yes
Head of the Perimeter Track	Yes	Yes

Nullifire S707-120 Intumescent paint was applied to the exposed and unexposed inside of the C-track located at the east side upper half and extended to the east side half of the head track. No intumescent paint was applied to the west side or lower half of the east side.

A 25 mm clearance gap was provided between the top edge of the panels and the specimen frame, and a 80 mm gap was provided between the specimen frame holder at the bottom. A 10 mm expansion gap was provided at the sides between the panels and side C-track.

The specimen was tested for a duration of 242 minutes in accordance with AS 1530.4-2005 and achieved fire resistance of 128 minutes integrity due to flaming of a cotton pad at a horizontal join in the middle of the upper half of the wall.

After 23 minutes an insulation failure occurred when the temperature recorded on the east side of the bottom quarter channel exceeded the test criterion of 180°C temperature rise (sealant on the exposed side only).

The maximum temperature rise failure around the perimeter C-track of the wall varied from 23 minutes to 114 minutes and depended on the application of intumescent paint and/or acrylic sealant.

The temperature rise of the panel exceeded the test criterion of a temperature rise of 180°C above ambient at 15 mm below a horizontal join in the top half of the wall (approximately the mid point of the top half) after 117 minutes.

Full details of the construction of the wall and the results achieved are given in BWA fire resistance test report 2257600.4, dated 25 June 2008.

3.2 Branz Fire Resistance Test FR 3754

In BRANZ fire resistance test FR 3754 the test Specimen consisted of a non-load bearing, Speedwall® panel wall nominally 3,000 mm high by 3,000 mm wide which comprised interlocking panels (tongue and groove), of a light weight concrete core with galvanised steel sheathing. Steel angles, 64 mm x 55 mm x 1.15 mm thick were fixed

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to the top, base and left hand perimeter edges of the wall with bolts. The angles were sealed to the specimen frame and the panels with Bostik Firecaulk fire rated acrylic sealant. The panels were fixed to the angles and to each other with Hilti DB7 6 mm diameter fasteners. Each panel was fixed to the next at 1,000 mm centres on both sides of the vertical joints.

A 10 mm expansion gap was provided between the top edge of the panels and the specimen frame, and filled with a bead of sealant. A second set of angles was screw fixed to the unexposed face of the panels at the top, base and left hand side with Hilti DB7 fasteners and a bead of sealant was placed between the angles and the panels and specimen frame.

The specimen was tested in accordance with AS 1530.4-1997 and achieved fire resistance of 245 minutes Integrity and 123 minutes Insulation.

Full details of the construction of the wall and the results achieved are given in BRANZ fire resistance test report FR 3754, dated 12 June 2007.

3.3 BRANZ Assessment Report FAR 3502

In BRANZ assessment report FAR 3502 the fire resistance in accordance with AS 1530.4-2005 of two walls as tested in BRANZ fire resistance test FR 3754 and spaced 1,000 mm apart with a horizontally aligned Speedpanel were considered to be at least 120 minutes Integrity and 120 minutes Insulation. The fixing details of the horizontally aligned intermediate Speedpanel is detailed in BRANZ assessment report FAR 3502.

3.4 BRANZ Assessment Report FAR 3454

In BRANZ assessment report FAR 3454 the fire resistance in accordance with AS 1530.4-2005 of a Speedpanel wall in BRANZ fire resistance tests FR 3754 and FR 3569 comprising a 90° fixing to another Speedpanel wall was considered to be at least 120 minutes Integrity and 120 minutes Insulation. The perimeter track detail was required to be the same as that in BWA 2257600 or FR 3569. The fixing details of the Speedpanel 90° angle junction is detailed in BRANZ assessment report FAR 3454.

3.5 BRANZ Assessment Report FAR 3580

In BRANZ assessment report FAR 3580 the fire resistance in accordance with AS 1530.4-2005 of a Speedpanel shaft comprising of horizontal and vertically orientated panels up to 4,500 mm wide and 6,000 mm high, respectively, were considered to provide at least 120 minutes integrity and 120 minutes insulation fire resistance.

The BRANZ assessment report FAR 3580 is based on extensive test and assessment reports including BRANZ structural analysis (FAR 3639) which considers to the potential deflection of the panels over varying wall heights.

3.6 BRANZ Assessment Report FAR 3582

In BRANZ assessment report FAR 3582 the fire resistance in accordance with AS 1530.4-2005 of a Speedpanel shaft comprising of horizontally orientated panels up to 4,500 mm wide were considered to provide at least 120 minutes integrity and 120 minutes insulation fire resistance.

The BRANZ assessment report FAR 3582 is based on extensive test and assessment reports including BRANZ structural analysis (FAR 3639) which considers to the potential deflection of the panels over varying wall heights.

4. DISCUSSION

4.1 Test Standard

The fire resistance tests described in section 3.1 and 3.2 were undertaken in accordance with test standard AS 1530.4-2005. The fire resistance tests described in section 3.3, 3.4 and 3.5 were undertaken in accordance with AS 1530.4-1997. The only significant difference between the two versions of the standard is that the 2005 version includes the cotton pad test for determining integrity failure at gaps which develop in the tested specimen.

In test FR 3569 a gap through the specimen was reported after 105 minutes and hot gases could be seen passing out of the joint which was deemed to be an integrity failure. It is therefore considered that if a cotton pad test was applied at this location the specimen would also achieve the same test result if tested in accordance with AS 1530.4-2005.

In test FR 3754 no gaps through the specimen were reported for the 245 minute duration of the test and hence a cotton pad test was not required. It is therefore considered that the specimen would also achieve the same test result if tested in accordance with AS 1530.4-2005.

4.2 Speedpanel Wall Panels

4.2.1 Insulation

It is considered that the relationship between the thickness of the galvanised steel panel sheath, the location of screw fixings and the curvature of the wall greatly influence the walls performance in terms of Integrity. This is also true for the effect on Insulation of a wall system.

The supporting test evidence reports highlight that the specimens were tested with the minimum number of screw fixings and where the integrity failures occurred in these specimens it mainly occurred due to the panel join opening up which in turn effected the insulation performance of the test specimen.

In the horizontally aligned panel wall tested in fire resistance test BWA 2257600, the thickness of the galvanised steel sheathing of the panels was measured to be 0.22 mm and only every second panel was screw fixed to the vertical track (500 mm centres). No screws were inserted in the “Interlocking” join of the panels except the bottom two panels with screw centres every 250 mm and 500 mm in the first and second panel, respectively.

The wall panel in fire resistance test BWA 2257600 failed the maximum insulation criteria of 180 K rise at a given point located on the second panel down from the head centrally within 15 mm near a panel join after 117 minutes. The panel join above this began to open after 119 minutes.

It is considered that inserting additional screw fixings (as highlighted in Table 1)* at each panel join would maintain the Insulation of the horizontally aligned wall panels for at least 120 minutes by preventing the joints opening up between panels and reducing heat transfer through the join.

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* Table 1 includes the maximum fixing centres at the panel interlock join which is based on section 4.2.2

See Table 2 in section 4.3 for the summary of the minimum perimeter channel/track design criteria to provide 120 minutes Insulation.

Table 1

Maximum Wall Width (mm) **X**	Maximum wall width (mm) NOTE **1** **Y**	Minimum Panel Galv. Steel Sheath Thickness (mm)	Maximum Fixing Centres at the Panel Interlock Join NOTE **2** (mm)
Horizontal Orientated Speedpanel Walls			
2,400	4,500	0.44	For X Direction only - As in fire resistance test BWA 2257600

NOTE 1 Subject to similar design of Figure 1 where the horizontal panels are interfaced with horizontal panels of the same construction and ultimately fixed to the vertical panels not exceeding 6,000 mm high (fixed between floor slabs). See Figure 1 for the location of the X and Y components.

NOTE 2 Located at each interlocking panel junction.

4.2.2 Integrity

4.2.2.1 Horizontally Aligned Panels

The vertical movement of the panels in fire resistance test BWA 2257600 was limited to approximately 10 mm downwards movement for the 242 minute duration of the test indicating that the panels are largely self supporting and did not experience excessive sagging.

The wall failed Integrity after 128 minutes in this test due to the panel join (which had no screw fixings) located between the top panel and second from the top panel opening up and emitting hot gases. The panel joins of the bottom two panels remained closed for the 242 minute duration of the test due to the screw fixings.

Therefore based on the screw fixing centres detailed in fire resistance test report BWA 2257600 (as highlighted in Table 1) it is considered that the Speedpanel wall up to 2,400 mm wide would achieve at least 120 minutes fire resistance performance in terms of Integrity.

4.2.3 Unlimited Height Increase in Speedpanel Horizontal Panel Wall

Where the fire is localised to one location, it is considered that the self-supporting design of each panel (based on the limited vertical movement of the panels in fire resistance test BWA 2257600) with appropriate screw fixings (see table 1) will not compromise the integrity or insulation of the wall for at least 120 minutes where the height of the wall is unlimited. This is subject to the correct perimeter track being used as highlighted in section 4.3.

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4.3 Perimeter Track Design

The supporting test evidence reports and assessment reports such as FP 3904, FR 3754, FAR 3107 and FAR 3525 or EWFA 22551-01 describe the construction of the different perimeter tracks, configuration, size and fixing details etc. that will provide a minimum integrity and insulation performance of at least 120 minutes.

Therefore, the design criteria of the perimeter track for the Speedpanel walls covered by this assessment will provide a fire resistance performance in terms of Integrity and Insulation for Speedpanel walls with horizontally orientated panels up to 2,400 mm wide.

Table 2

Maximum Wall Width (mm) NOTE 1 **X**	Maximum Wall Height between floor levels (mm) NOTE 1 **Y**	Assessment Report Containing the Minimum Perimeter Track Design Details
Horizontal Orientated Speedpanel Walls		
2,400	4,500	For X Direction only - As in fire resistance test BWA 2257600 For Y Direction only - FAR 3107, FAR 3561, FP 3904 and FR 3754

NOTE 1 Subject to similar design of Figure 1 where the horizontal panels are interfaced with horizontal panels of the same construction and ultimately fixed to the vertical panels not exceeding 6,000 mm high (fixed between floor slabs). See Figure 1 for the location of the X and Y components.

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4.4 Panel Junction Detail

Figure 1 highlights the two types of Speedpanel Interface details. The minimum design criteria as described in BRANZ assessment reports FAR 3454, FAR 3502 and FAR 3525 should be incorporated into the interface design. This assessment only covers where the wall is exposed to fire conditions from one side only.

Table 3

Maximum Wall Width (mm) NOTE 1 **X**	Maximum Wall Height between floor levels (mm) NOTE 1 **Y**	Assessment Report Containing the Minimum Panel Junction Design Details
Horizontal Orientated Speedpanel Walls		
2,400	4,500	For X Direction only - FAR 3454 and FAR 3502 For Y Direction only - FAR 3454 and FAR 3502

NOTE 1 Subject to similar design of Figure 1 where the horizontal panels are interfaced with horizontal panels of the same construction. See Figure 1 for the location of the X and Y components.

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5. CONCLUSION

It is considered that the Speedpanel non-load bearing, pre-cast, concrete vertical and horizontal panel wall system as highlighted in Figure 1 would achieve a fire resistance, in accordance with AS 1530.4-1997 and AS 1530.4-2005, of at least 120 minutes Integrity and 120 minutes Insulation with the minimum design criteria contained in section 4 and summarised in Table 4 (see page 10)

6. LIMITATION

This assessment report is subject to the accuracy and completeness of the information supplied.

BRANZ reserves the right to amend or withdraw this report should additional information become available regarding the fire performance of the product assessed herein.

This assessment considers:

1. The wall and/or shaft Speedpanel systems discussed within the report are exposed to fire conditions from one face only.
2. All walls in the systems are non-load bearing.
3. The combined load of the “X” and “Z” walls onto the vertical “Y” walls fixed to the floor slab (as highlighted in Figure 1) should not exceed 180 kg per linear meter. Variations to this limitation will require structural analysis on a project specific basis. See FAR 3583 for additional information
4. Where the perimeter tracks pass through a floor slab, they should be overlapped by at least 350 mm and in all cases should additionally be fixed using a minimum size M8 steel bolt penetrating the floor slab edge, centrally, by at least 50 mm.
5. Subject to the shaft wall lintels and perimeter wall construction being structurally adequate under ambient conditions.

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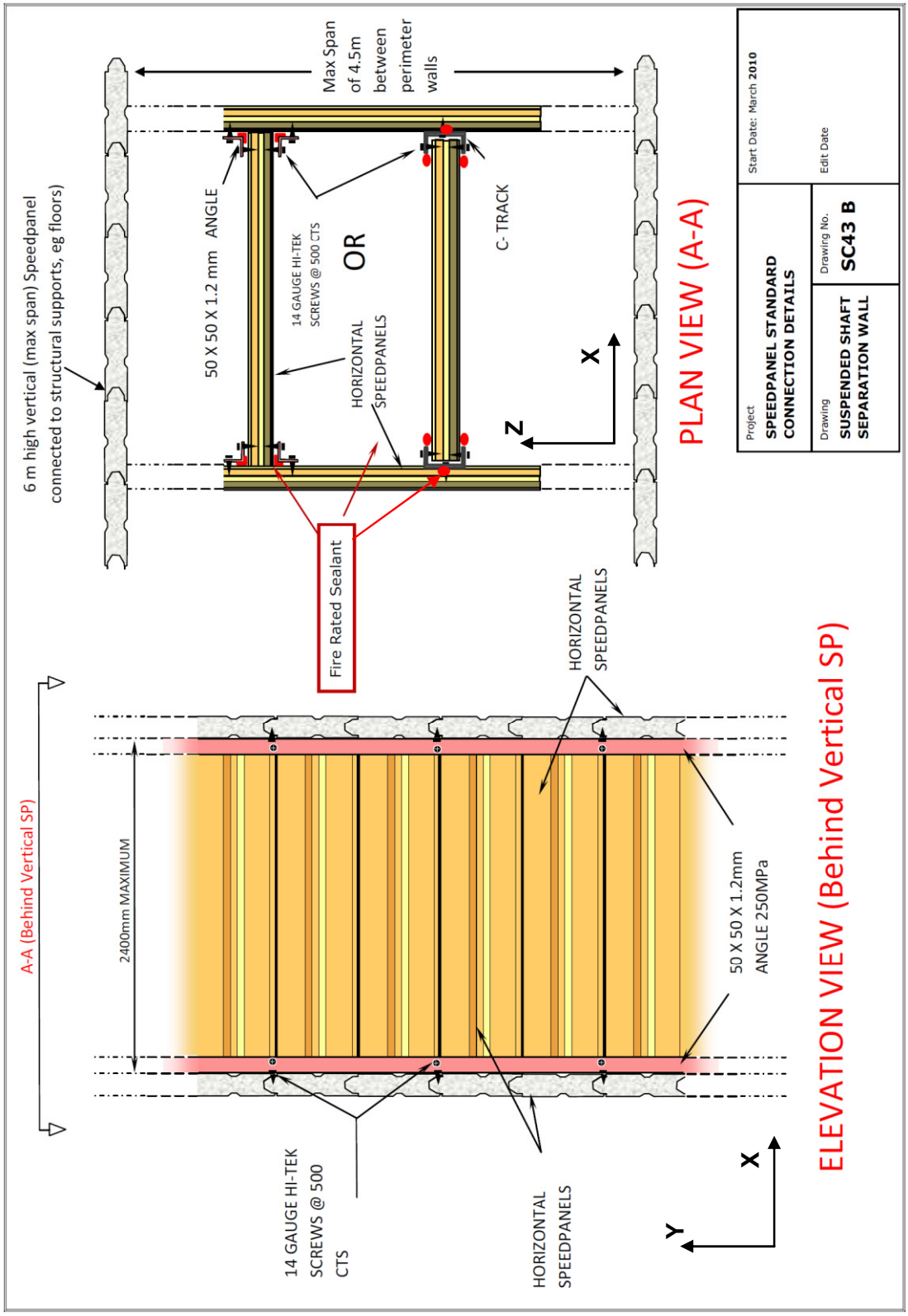
Table 4 –Summary Installation Guide

	Continous height and up to 4,500 mm span side horizontal panel walls between a maximum 6,000 mm height floor slabs (Z-Direction)	Minimum angle thickness and size for vertical panel orientation (Figure 1 page 11)	Minimum bottom C-track thickness and size for vertical panel orientation (Figure 1 page 11)	Minimum C-track thickness and size for horizontal and head track application for walls in the X and Y-Direction (Figure 1 page 11)
Maximum width X direction (Maximum of 2 panels)	2,400 mm	50x50mm Bmt 1.2mm 250 Mpa *	50 X 80mm internal Clearance Bmt 1.2mm 250 Mpa *	90 X 80mm internal Clearance Bmt 1.2mm 250 Mpa * Shielded Ctrack
Horizontal side wall screw fixing distance	1,500 mm (the maximum span of the internal walls in the X direction is 2,400 mm long panelsthe maximum span of the side walls in the Z direction is 4,500 mm long panels)			
Horizontal shaft wall screw fixing distance (for both directions) - Panel to Panel	250 mm centre fixings on the bottom panel **and** 500 mm centre fixings on the second from the bottom panel			
Minimum panel galv. Steel sheath thickness	0.44 mm			
Vertical fixing distance side track (for both directions)	250 mm			
Assessment report containing the minimum perimeter track design	FAR 3580 and For X Direction only - As in fire resistance test BWA 2257600 For Y Direction only - FAR 3107, FAR 3561, FP 3904, FR 3754 and EWFA 22551-01			
Assessment report containing the minimum panel junction design details	FAR 3580 and For X and Y Direction - FAR 3454 and FAR 3502			

* 250 Mpa indicates that the Angle /C-Track is "Grade-250" mild steel

Figure 1 – Horizontal Speedpanel Configuration



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