

Likely fire performance of AFS Logicwall systems

Assessment Report

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Commercial-in-confidence

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Contents

Executive summary.....	4
1 Introduction	5
2 Supporting Data	5
3 Proposal.....	5
4 Analysis.....	5
5 Conclusion.....	7
6 Term of validity	8
Appendix A Supporting Data.....	9
References.....	11

Executive summary

This report provides the assessment of this Division on the likely performance the AFS Logicwall system incorporating;

- increased wall thickness for AFS Logicwall systems AFS162, AFS200(D) and AFS262(D);
- increased length of the wall systems;
- increased steel reinforcement, including two layers of reinforcement for wall systems with a thickness exceeding 200-mm; and
- the likely fire performance of the AFS162 Logicwall system excluding GPO penetrations.

A fire-resistance test has been conducted on the AFS150 Logicwall system. This report is described in Appendix A.

Based on the established fire performance under test and the analysis described in this report, it is the opinion of this Division that an increase in the length and thickness of the AFS Logicwall systems is acceptable under the provisions of AS 1530.4-2005 provided that no individual component is removed or reduced. In addition, the inclusion of additional reinforcement, including two layers of reinforcement for wall systems in excess of 200-mm thickness would not detrimentally affect the fire performance of the proposed wall systems provided that:

- The total load applied to the proposed wall systems does not exceed the maximum load applied to the tested AFS150 wall system, i.e. 200 kN/m; and
- The minimum concrete cover provided over the reinforcement bars of the tested AFS150 Logicwall system is maintained for the alternative AFS162, AFS200(D) and AFS262(D) Logicwall systems.

In addition, it is the assessment of this Division that the AFS162 Logicwall system, identical to the tested AFS150 Logicwall system with an overall wall thickness of 162-mm and without the inclusion of the GPO penetrations and associated PVC conduits would provide a fire-resistance level of 240/240/240 if tested in accordance with the provisions of AS 1530.4-2005 with a maximum applied load of 200 kN/m.

Likely fire performance of AFS Logicwall systems

1 Introduction

This report provides the assessment of this Division on the fire likely performance the AFS Logicwall systems if tested in accordance with AS 1530.4-2005.

2 Supporting Data

A fire-resistance test has been conducted on a load-bearing 150-mm thick AFS150 Logicwall system incorporating service GPO's. This report is described in Appendix A.

3 Proposal

You have proposed the following changes to the tested prototype AFS150 Logicwall system:

- increased wall thickness for AFS Logicwall systems AFS162, AFS200(D) and AFS262(D);
- increased length of the wall systems;
- increased steel reinforcement, including two layers of reinforcement for wall systems with a thickness exceeding 200-mm.

You have also requested us to assess the fire performance of the AFS 162 Logicwall system excluding GPO penetrations.

4 Analysis

The tested AFS150 Logicwall system comprised a permanent formwork system using 6-mm thick fibre cement sheets adhered to a galvanised steel stud frame with steel studs spaced at 110-mm centres to form a 1200-mm wide panel. The formwork panels were joined using steel joiner sections and incorporated vertical and horizontal steel reinforcement bars at 450-mm centres. The panels were completely filled with 32 MPa concrete and carried an evenly distributed total load of 600 kN over the 3000-mm width of the specimen (i.e. 200 kN/m).

Test observations reveal that the exposed layer of fire cement cracked and fell from the exposed face after a period of 25 minutes. After 170 minutes a discoloured area was observed on the unexposed face of the fibre cement sheet above the left GPO. An insulation failure was recorded at 236 minutes due to a thermocouple located above the left GPO exceeding a rise of 180K.

No through cracks or openings were observed in the unexposed face of the element. The structural adequacy and integrity of the specimen was maintained for the 240 minute duration of the test and therefore the specimen achieved a fire-resistance level (FRL) of 240/240/180.

The test standard AS 1530.4-2005, clause 3.8 provides permissible variations for elements of similar construction where one or more of the following changes have been made provided no individual component is removed or reduced:

- (a) Increase in the length of a wall of identical construction if the specimen was tested with one vertical edge unrestrained;
- (b) Increase in the thickness of the wall.

Although the test on the original prototype was conducted in accordance with the requirements of AS 1530.4-1997 it is considered reasonable to apply the permissible variations conditions from the 2005 version of the test standard to the tested prototype wall system.

INCREASE IN WALL LENGTH

The AFS150 prototype was tested with both side edges of the specimen unrestrained. This is considered more onerous than that permitted by condition (a) above as a more excessive amount of deflection of the wall system would be expected during the test due to the unrestrained nature of the element. Therefore an increase in the length of the wall system of greater than the tested 3000-mm length is acceptable.

INCREASE IN WALL SYSTEM THICKNESS

The tested AFS150 Logicwall system comprised an overall thickness of 150-mm; therefore an increase in wall thickness to incorporate Logicwall systems AFS162, AFS200(D) and AFS262(D) with a corresponding overall wall thickness of 162-mm, 200-mm and 262-mm respectively, is acceptable providing that no individual component of the AFS150 wall system is removed or reduced in accordance with condition (b) above.

ADDITIONAL REINFORCEMENT

The tested AFS150 Logicwall system incorporated N12 reinforcing bars located at 450-mm centres both horizontally and vertically centrally within the panel.

The inclusion of additional reinforcement, including two layers of reinforcement for wall systems in excess of 200-mm thickness would not be considered to detrimentally affect the fire performance of the proposed wall systems provided that:

- The total load applied to the proposed wall systems does not exceed the maximum load applied to the tested AFS150 wall system, i.e. 200 kN/m; and
- The minimum concrete cover provided to the reinforcement bars in the AFS150 Logicwall system is maintained for the thicker wall systems.

FIRE PERFORMANCE OF THE PROPOSED AFS 162 LOGICWALL SYSTEM

The inclusion of internal PVC conduits and GPO's on the unexposed face of the AFS150 tested wall system resulted in a maximum temperature insulation failure of the wall system after a period of 236 minutes. This can be directly attributed to the loss of concrete thickness in the area of the GPO due to the inclusion of the PVC conduit and associated electrical junction or wall box.

It is considered that the removal of the GPO penetration and associated wall box and conduit and the subsequent loss of concrete wall thickness in this area, coupled with an increase in the overall wall thickness to 162-mm would provided the required concrete thickness to provide 240 minutes of insulation on the unexposed face of the element.

COMPARISON OF TEST STANDARDS

The fire-resistance test on the AFS150 Logicwall system was conducted in accordance with the requirements of AS 1530.4-1997. On 9 September 2005, AS 1530.4-2005 was published by Standards Australia. This version of the standard introduced changes with regard to the method of assessing the integrity performance of various building elements with the introduction of the cotton pad test in line with various international test standards.

This test involves the use of a cotton pad held over a crack, gap or fissure on the unexposed face of the test specimen for a maximum period of 30 seconds. Ignition of the cotton pad constitutes an integrity failure of the test specimen. Integrity performance in relation to specimen collapse, use of gap gauges and sustained flaming on the unexposed face for periods in excess of 10 seconds remained consistent between the 1997 and 2005 versions of the test standard.

The test photographs indicate that no cracks developed in the unexposed face of the specimen for the 240 minute duration of the test and therefore the application of the cotton pad test would not have been required.

However, test observations reveal that discolouration of the fibre cement on the unexposed face above the GPO's was visible after 170 minutes of testing which may have resulted in application of the cotton pad test in these areas and the subsequent loss of integrity of the wall system due to the GPO penetrations.

Therefore the fire performance of the AFS Logicwall systems AFS162, AFS220(D) and AFS262(D) can be assessed in accordance with the requirements of AS 1530.4-2005 providing these wall systems do not incorporate GPO penetrations.

5 Conclusion

Based on the established fire performance under test and the analysis described in this report, it is the opinion of this Division that an increase in the length and thickness of the AFS Logicwall systems is acceptable under the provisions of AS 1530.4-2005 provided that provided no individual component is removed or reduced.

In addition, the inclusion of additional reinforcement, including two layers of reinforcement for wall systems in excess of 200-mm thickness would not detrimentally affect the fire performance of the proposed wall systems provided that:

- The total load applied to the proposed wall systems does not exceed the maximum load applied to the tested AFS150 wall system, i.e. 200 kN/m; and
- The minimum concrete cover provided over the reinforcement bars of the tested AFS150 Logicwall system is maintained for the alternative AFS162, AFS200(D) and AFS262(D) Logicwall systems.

It is also the assessment of this Division that the AFS162 Logicwall system, identical to the tested AFS150 Logicwall system with an overall wall thickness of 162-mm and without the inclusion of the GPO penetrations and associated PVC conduits would provide a fire-resistance level of 240/240/240 if tested in accordance with the provisions of AS 1530.4-2005 with a maximum applied load of 200 kN/m.

6 Term of validity

This assessment report will lapse on 31 October 2019. Should you wish us to re-examine this report with a view to the possible extension of its term of validity, would you please apply to us three to four months before the date of expiry. This Division reserves the right at any time to amend or withdraw this assessment in the light of new knowledge.

Appendix A Supporting Data

A.1 CSIRO report numbered FSV 1038

On 25 February 2004 this Division conducted a full scale fire-resistance test on a loadbearing, permanent formwork reinforced concrete wall system in accordance with the requirements of AS1530.4-1997.

The specimen comprised a reinforced concrete wall system of dimensions 2980-mm high x 3000-mm wide x 150-mm thick made up of 3 pre-fabricated permanent formwork panels filled with insitu concrete after panel assembly.

The formwork panels were fabricated from two 2980-mm high x 1200-mm wide x 6-mm thick fibre cement sheets bonded to 10 galvanised C-section metal studs of dimensions 136-mm x 35-mm x 0.6-mm using "AV Syntec" general purpose building glue. The studs were spaced at 100-mm centres and fixed together in a rigid frame. The studs incorporated 90-mm diameter round holes spaced at 150-mm centres for a provision of horizontal reinforcing bars.

The wall panels were fixed to a galvanised steel C-section floor track with provision for reinforcing starter bars from a completed floor slab. Succeeding panels were fitted together in a tongue and groove arrangement, and fixed with 9-18 x 20-mm countersunk rib head screws at 500-mm centres. The wall was reinforced with N12 reinforcing bars at 450-mm centres, horizontally and vertically.

Electrical services were installed in the cavity of the wall, and included two general purpose outlets (GPO's) and associated PVC conduits at 1200-mm centres with the conduits running vertically to the top of the specimen. The GPO's were located nominally 1000-mm above the base of the specimen.

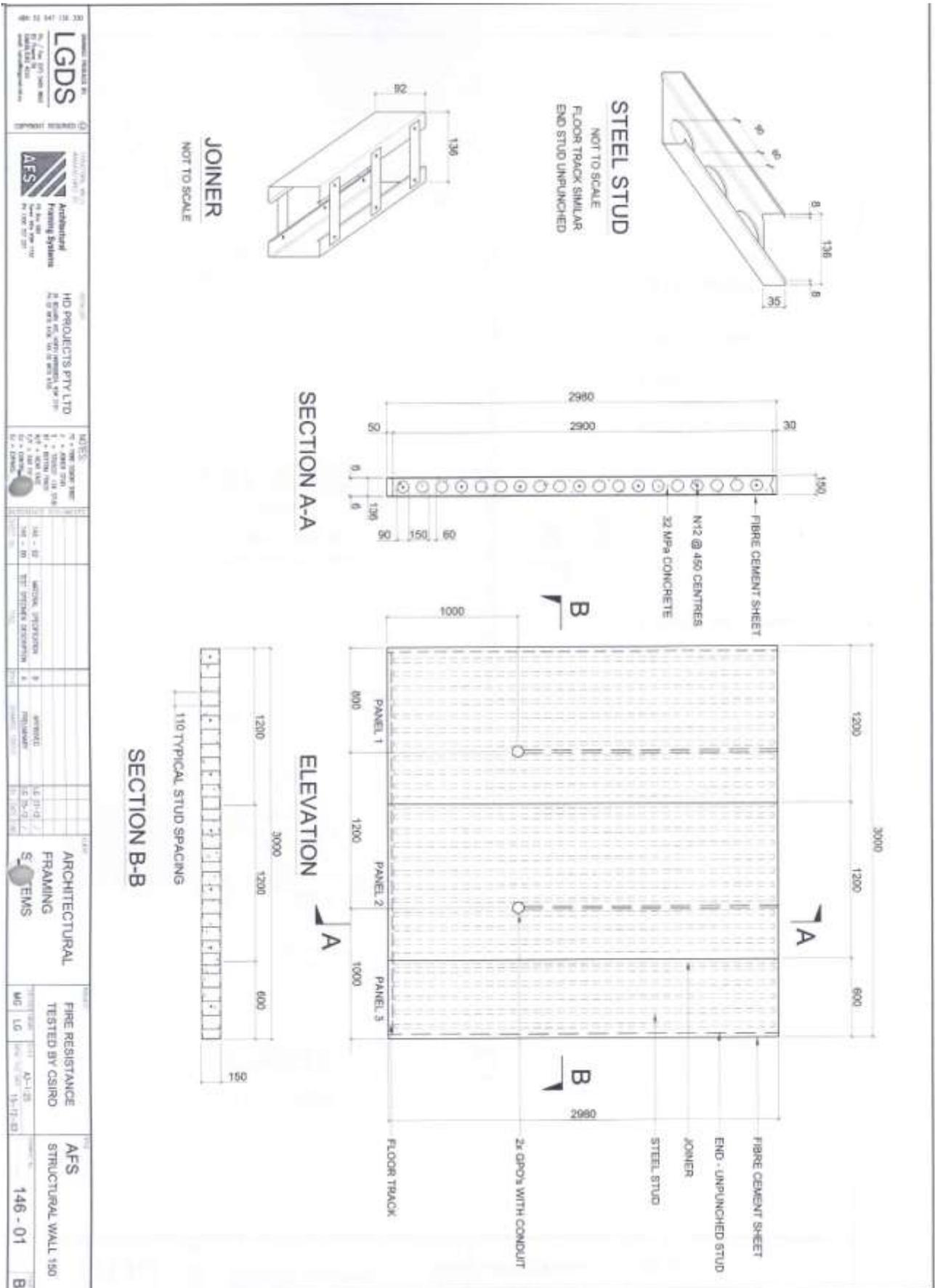
The panels were appropriately braced and 32 MPa concrete 32-10-120 was pumped in through the top openings in 1500-mm layers and trowelled-off when the formwork was completely filled.

The wall system was left to cure for a period of 28 days prior to testing.

Prior to the commencement of the test the specimen was subjected to an evenly distributed total load of 600 kN, this load was maintained for the 240 minute duration of the test.

Test observations reveal that the exposed fibre cement sheets cracked and had fallen from the specimen after a period of 25 minutes. After 170 minutes a discoloured area was visible on the fibre cement sheet above the left GPO. An insulation failure was recorded at 236 minutes due to a thermocouple located above the left GPO exceeding a rise of 180K. No through cracks or openings developed in the unexposed face of the element. The structural adequacy and integrity of the specimen was maintained for the 240 minute duration of the test and therefore the specimen achieved a fire-resistance level (FRL) of 240/240/180.

A.2 AFS150 Logicwall system drawing



LGDS <small>LOGICWALL SYSTEMS PTY LTD</small> <small>10/110 WILSON ST, WILSON ST, WILSON ST, WILSON ST</small> <small>WILSON ST, WILSON ST, WILSON ST, WILSON ST</small>		AFS <small>Architectural Framing Systems</small> <small>10/110 WILSON ST, WILSON ST, WILSON ST, WILSON ST</small> <small>WILSON ST, WILSON ST, WILSON ST, WILSON ST</small>		HD PROJECTS PTY LTD <small>10/110 WILSON ST, WILSON ST, WILSON ST, WILSON ST</small> <small>WILSON ST, WILSON ST, WILSON ST, WILSON ST</small>		NOTES: 1. ALL DIMENSIONS IN MILLIMETRES 2. ALL DIMENSIONS TO FACE UNLESS STATED OTHERWISE 3. ALL DIMENSIONS TO FACE UNLESS STATED OTHERWISE 4. ALL DIMENSIONS TO FACE UNLESS STATED OTHERWISE 5. ALL DIMENSIONS TO FACE UNLESS STATED OTHERWISE	
ARCHITECTURAL FRAMING AFS 146 - 01		FIRE RESISTANCE TESTED BY CSIRO A2-1-20 146 - 01		AFS STRUCTURAL WALL 150 146 - 01		B	

References

The following informative documents are referred to in this Report:

- | | |
|----------------|---|
| AS 1530.4-1997 | Methods for fire tests on building materials, components and structures Part 4: Fire-resistance tests of elements of building construction. |
| AS 1530.4-2005 | Methods for fire tests on building materials, components and structures Part 4: Fire-resistance tests of elements of building construction. |
| CSIRO FSV 1038 | Full-scale fire-resistance test in accordance to AS1530.4-1997 on a load-bearing vertical separating element. |

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