DISCLAIMER

The information contained in this document is intended for the use of suitably qualified and experienced architects and engineers and other building professionals. This information is not intended to replace design calculations or analysis normally associated with the design and specification of buildings and their components. Dincel Construction System Pty Ltd accepts no liability for any circumstances arising from the failure of a specifier or user of any part of Dincel Construction System to obtain appropriate professional advice about its use and installation or from failure to adhere to the requirements of appropriate Standards and Codes of Practice, and relevant Building Codes.

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Amendment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>May 2010</td>
<td>Added Non-Combustibility Assessment by CSIRO</td>
</tr>
<tr>
<td>B</td>
<td>June 2010</td>
<td>Added Hydro Carbon Fire</td>
</tr>
</tbody>
</table>
SUMMARY

The fire performance of DINCEL®-WALL has been assessed by:

1. Fire Resistance Levels


The letter of assessment by CSIRO FCO-2674 (Reference No: 4) states that polymer web links of Dincel-Form when concrete filled will not burn or melt away to create holes when subjected to fire conditions.

2. Fire Hazard Properties

Attachments and Liners to the walls must comply with BCA – Specification C.1.10a (Reference No: 3) for Flammability and Smoke issues. As shown in the attached CSIRO certificate, Dincel is a GROUP 1 material (i.e. no limitations for its use in any place without any protection). Dincel’s smoke criteria is 2.5 times better than what is allowed by the BCA.

The abovementioned certificates clearly states that Dincel-Polymer has no limitations of its use for flammability and smoke generation.

3. Non-Combustibility

The BCA requires the use of non-combustible materials to limit the fire load, smoke and fire spread.

The letter of assessment by CSIRO FCO-2800 (Reference No: 8) states that the Dincel-Polymer is the equivalent of the deemed to non-combustible materials in Clause C1.12 of the BCA-2010.

4. Bushfire Prone Areas

The letter of assessment by CSIRO FCO-2755 (Reference No: 7) states that when Dincel Forms are filled with concrete it will comply with AS3959 – 2009 and allowed to be used in all bushfire conditions, including Bushfire Attack Level of BAL-FZ (i.e. the worst bushfire level).

5. Hydro Carbon Fire

Existing and new building structures are built to satisfy the Building Code of Australia and the AS3600 Concrete Structures Code may not be suitable in resisting a hydro carbon fire depending on the type of concrete used and its moisture content. For more information (Download – Dincel Solution for Hydro Carbon Fire)

Readers may refer to the following for further information.

DINCEL®-WALL AND FIRE PERFORMANCE

DINCEL®-WALL is a permanent polymer formwork for concrete filling.
Dincel-Polymer forms DO NOT provide fire rating but the CONCRETE DOES.

The concrete infill of **DINCEL®-WALL** provides the appropriate provisions. The requirement is, BCA-A 2.3 – Fire Resistance of Building Elements, Clause 2.d (ii) – Fire Resistance Level (FRL) of load bearing concrete wall to be determined in accordance with Australian Standard AS3600 for concrete structures as certified by (Reference No: 5).

AS3600, Clause 5 states: where concrete wall has a thickness in excess of 170mm the FRL level of the concrete wall is a minimum of 240/240/240 minutes.

**DINCEL®-WALL** has a thickness in excess of 170mm. (Refer to AS3600, Clause 5.7.2 (b) or refer to report by Professor Mark Bradford of the University of New South Wales which defines the wall thickness of **DINCEL®-WALL** for fire purposes as 189mm (Reference No: 5).

**DINCEL®-WALL** already complies with the Deemed-To-Satisfy condition of the Building Code of Australia (Reference 5).

The CSIRO Certificate (Reference No: 6) has been organised to validate that Reference No: 4 which is Dincel-Form’s web-link will not burn or melt away to create holes so that the fire resistance level of **DINCEL®-WALL** is not affected. The test result by CSIRO (Reference No: 6 – Appendix A) has revealed that the presence of high slump plays important roles in the fire resistance level (FRL). As a result, the following FRL levels are to be adopted.

- **Concrete Slump > 110mm**: FRL is 240/240/230 minutes
- **Concrete Slump < 110mm**: FRL is 240/240/240 minutes

The Dincel-Polymer formwork holds the wet concrete until it sets. If for some reason Dincel-Polymer is required to be removed or even burns during a fire event, the remaining core component is ordinary concrete which provides the required Fire Resistance Level for structural adequacy/integrity/insulation. Therefore, the presence of Dincel-Polymer remaining at the face of the concrete wall can be considered as nothing more than a lining or wall cladding material.

**The Non-Combustibility of DINCEL®-WALL**

**DINCEL®-WALL** consists of concrete infill and permanent polymer formwork. The non-combustibility of concrete has never been questioned. The question that must be answered is: – If Dincel-Polymer is used without any protection (i.e. sprinklers and/or non-combustible materials such as plasterboard, fibre cement sheets, etc.), does the BCA prohibit or limit the use of **DINCEL®-WALL** as a building product? In other words, in accordance with Reference 1, BCA is looking for the non-combustibility conditions if the presence of Dincel-Polymer increases fire load, smoke and fire spread. The answer to this question is ‘NO’ in accordance with the CSIRO report FCO-2800 in this document (Reference No: 8).

In addition to CSIRO’s confirmation for the non-combustibility issue of **DINCEL®-WALL**, DCS offers the following further explanation for the benefit of the reader:
The behaviour of the building element in question under fire conditions is normally controlled by the use of non-combustible materials.

The many materials listed in the BCA as deemed to be “non-combustible” fail when tested in accordance with non-combustibility test, AS1530.1 (Reference 1).

Reference No: 1 states that the BCA appears to use non-combustible construction in several roles.

(i) The non-combustibility used to limit the potential fire load. The non-combustibility of Dincel-Polymer is not used to provide an appropriate fire resistance level. The concrete infill of DINCHEL®-WALL provides the fire resistance level of a minimum four (4) hours as shown above.

Reference No: 2 classifies the “Degree of Combustibility” as shown in the following table:
A SUGGESTED CLASSIFICATION SCHEME FOR "DEGREES OF COMBUSTIBILITY"
USING HEAT RELEASE DATA FROM THE CONE CALORIMETER\(^{(a)}\)
(RICHARDSON AND BROOKS 1991)

<table>
<thead>
<tr>
<th>Category</th>
<th>Peak heat release heat (kW/m(^2))</th>
<th>Total heat release (MJ/m(^2))</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10 or less</td>
<td>5 or less</td>
<td>Mineral fibre insulation board</td>
</tr>
<tr>
<td>2</td>
<td>100 or less</td>
<td>25 or less</td>
<td>(Paper-faced) gypsum plaster</td>
</tr>
<tr>
<td>3</td>
<td>150 or less</td>
<td>50 or less</td>
<td>FR Plywood</td>
</tr>
<tr>
<td>4</td>
<td>300 or less</td>
<td>100 or less</td>
<td>White pine planks; red oak flooring</td>
</tr>
<tr>
<td>5</td>
<td>300 or less</td>
<td>100 or less</td>
<td>Expanded polystyrene(^{(b)})</td>
</tr>
</tbody>
</table>

\(^{(a)}\) Test duration 15 min; irradiance 50 kW/m\(^2\)
\(^{(b)}\) Presence/absence of fire retardants not stated

BCA – 2007, Part C1 – Fire Resistance and Stability. Clause C 1.12 – Non-Combustible Materials provides the list of materials that can be used as non-combustible. The gypsum plaster of the above table is classified as a non-combustible material.

RIGID POLYMER FACED CONCRETE (DINCEL) TESTING BY CSIRO

<table>
<thead>
<tr>
<th>Test Method</th>
<th>Irradiance(^{(a)}) (kW/m(^2))</th>
<th>Peak HRR(^{(a)}) (kW/m(^2))</th>
<th>Total Heat Release(^{(a)}) (MJ/m(^2))</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS/NZS 3837:1998</td>
<td>50</td>
<td>15.5</td>
<td>4.41</td>
</tr>
<tr>
<td>ISO 5660 Part 1 and Part 2</td>
<td>50</td>
<td>32</td>
<td>3.87</td>
</tr>
</tbody>
</table>

The comparison between Dincel testing results by CSIRO and the above table from Reference No: 2 qualifies Dincel polymer to be considered as non-combustible. The Dincel-Polymer heat release test results are much better than the gypsum plaster which is well known as a non-combustible material.

(ii) **The non-combustibility is used to provide a temporary barrier against smoke spread.**

The materials that do not ignite at a surface temperature of approximately 300°c are suitable for use as smoke barriers (Reference 1) in accordance with AS1530.5 which is identical to ISO 5657, Fire Tests – Reaction to Fire Ignitability of Building Products.

The well known rigid PVC behaviour is:

- Flash ignition temperature - 390°c (temperature resulting from the presence of flame) greater than 300°c.
- Self ignition temperature - 450°c (temperature when no flame is present) greater than 300°c.

The tests conducted by CSIRO have also measured a smoke criteria of 90.5m\(^2\)/kg which is significantly less than the smoke threshold allowed by BCA which is 250m\(^2\)/kg (specification C 1.10a – 3 c (ii)).
(iii) **Non-combustibility is used to prevent flame spread over surfaces.** The BCA – Specification A 2.4 – C 1.10a – Fire Hazard Properties – Walls and Ceilings controls flame spread and fire growth in the early stages of the fire, the purpose is the same as control of lining materials. Dincel-Polymer forms consisting of concrete filling have been tested by CSIRO and classified as a Group 1 material. This means that **DINCEL®-WALL** without any cover or protection has no limitation for its use for the purpose of flame spread.

**CONCLUSION**

The above references confirm the following use of **DINCEL®-WALL** without any additional protection:

- **DINCEL®-WALL** provides 240/240/240 min FRL (Reference Nos: 4, 5 and 6) for the 200mm wall and 90/90/90 min FRL for the 110mm wall.
- The smoke test readings of Dincel-Polymer by CSIRO is 2.5 times better than the allowable smoke limit specified by BCA (Specification 1.10 a – 3 c (ii)). (Reference 3).
- Dincel-Polymer does not contribute to spread of fire since it is classified as a Group 1 material by CSIRO in accordance with BCA (Specification C 1.10a – 3 c). (Reference 3).
- Dincel-polymer is the equivalent of the deemed to non-combustible materials of the BCA, Clause C1.12 (Reference 8).

**References**

1. Non-Combustibility in the Building Code of Australia (BCA) Implications FOR A NEW GLOBAL STANDARD
   Jane Blackmore – Fire Science and Technology Laboratory (FSTL), CSIRO, Australia.


3. CSIRO Certificate (HF07ANK4245 and No: 439) and Report Number FNK 0065. The Certificate for the report is attached to this assessment. If required the full report can be provided.


5. Certificate and Report by the University of New South Wales Consulting Services. [Download – Structural Engineering Design Certification](#)


7. CSIRO Letter of Assessment FCO-2755 for Bushfire Prone Areas.

8. CSIRO Letter of Assessment FCO-2800 for Non-Combustibility.
REFERENCE NO: 3

Certificate of Assessment
No. 439

HF07ANK4245

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This is to certify that the specimen described below was tested by the CSIRO Division of
Manufacturing and Infrastructure Technology in accordance with Australian/ New Zealand Standard
3837, Method of test for heat and smoke release rates for materials and products using an oxygen
consumption calorimeter, 1998, at 50 kWm², on behalf of:

Dincel Construction System Pty Ltd
Level 3, 7K Parkes Street
PARRAMATTA NSW
AUSTRALIA

A full description of the test specimen and the complete test results are detailed in the Division’s
sponsored investigation report numbered PNK 0065.

SAMPLE
IDENTIFICATION: Dincel - Formwork

DESCRIPTION OF SAMPLE: The sponsor described the tested specimen as an extruded rigid PVC profile
filled with normal density concrete. The specimen contained smoke
suppressant additives.
Nominal thickness of PVC: 1.5 mm
Nominal total thickness: 50 mm
Nominal density of PVC: 1.45 g/cm³
Nominal density of concrete: 2400 kg/m³

SAMPLE
CLASSIFICATION: Group Number: Group 1
(In accordance with Specification A2.4 of the Building Code of Australia.)
Average specific extinction area: 90.5 m²/kg
(Refer to Specification C1.10a section 3(c) of the Building Code of Australia.)

Testing Officer: Russell Collins Date of Test: 20 November 2003

Issued on the 5th day of February 2007 without alterations or additions. This issue supersedes issue

Garry E Collins
Manager, Fire Testing and Assessments

CSIRO Manufacturing & Infrastructure Technology
14 Julius Avenue, Riverside Corporate Park, North Ryde NSW 2113 AUSTRALIA
Telephone: 61 2 9490 5444 Facsimile: 61 2 9490 5555

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REFERENCE NO: 3

BCA SPECIFICATION C1.10a

BUILDING CODE OF AUSTRALIA (B.C.A) FIRE REQUIREMENTS SPECIFICATION C1.10a FIRE HAZARD PROPERTIES OF WALL LININGS

<table>
<thead>
<tr>
<th>BCA Building Class</th>
<th>Fire isolated exits</th>
<th>Public corridors</th>
<th>Specific areas</th>
<th>Other areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 2 &amp; 3</td>
<td>Wall</td>
<td>Wall</td>
<td>Wall</td>
<td>Wall</td>
</tr>
<tr>
<td>Excluding accommodation for the aged, disabled and children</td>
<td>1</td>
<td>1, 2</td>
<td>1, 2, 3</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Sprinklered</td>
<td>1</td>
<td>1, 2, 3</td>
<td>1, 2, 3</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Class 3 &amp; 9a</td>
<td>Accommodation for the aged, disabled and children, Health-care buildings</td>
<td>1</td>
<td>1, 2</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Sprinklered</td>
<td>1</td>
<td>1, 2</td>
<td>1, 2, 3</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Class 5, 6, 7, 8 &amp; 9b Schools</td>
<td>1</td>
<td>1, 2</td>
<td>1, 2, 3</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Sprinklered</td>
<td>1</td>
<td>1, 2, 3</td>
<td>1, 2, 3</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Class 9b – Theatres, halls etc.</td>
<td>1</td>
<td>1</td>
<td>1, 2</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Unsprinklered</td>
<td>1</td>
<td>1, 2</td>
<td>1, 2, 3</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Sprinklered</td>
<td>1</td>
<td>1, 2, 3</td>
<td>1, 2, 3</td>
<td>1, 2, 3</td>
</tr>
</tbody>
</table>

Notes:
1. "Sprinklered" refers to a building fitted with a sprinkler system complying with Specification E1.5.
2. "Specific areas" refers to:
   (a) for Class 2 and 3 buildings, a sole-occupancy unit.
   (b) for Class 5, open-plan offices with a minimum floor dimension/floor to ceiling height ratio > 5.
   (c) for Class 6, shops with a minimum floor dimension/floor to ceiling height ratio > 5.
   (d) for Class 9a health care buildings, patient care areas.
   (e) for Class 9b theatres and hall etc., an auditorium.
   (f) for Class 9b schools, a classroom.

CSIRO fire testing results in accordance with AS 3837 confirms that DINCEL® consists of Group 1 material and its Specific Extinction Area (SEA) is less than 250m²/kg to comply with the requirements of the Building Code of Australia specification C1.10a Fire Hazard Properties for walls. (Refer attached certificate by CSIRO)
Our ref: FCO-2674/-

Dincel Construction Systems Pty Limited
Level 3, 7K Parkes Street
PARRAMATTA NSW 2150

Attention: Mr Burak Dincel

DINCEL CONSTRUCTIONS CONCRETE WALL SYSTEM
Assessment Number FCO-2674
Your e-mail of 25 July

INTRODUCTION

We have examined the information referenced by you on the likely fire performance of the Dincel-Form concrete filled wall system. The information included

- CSIRO test report numbered FSV 1346 on a full-scale fire-resistance test on a loadbearing wall system in accordance with AS 1534.4:2005 conducted on 26 February 2009; and


We have retained this documentation.

You have requested the Division to examine the performance of your PVC formwork when incorporated in a fire tested wall system.

ANALYSIS

On 26 February 2009, this Division conducted a full-scale fire-resistance test on a wall system comprising a reinforced concrete wall system: 3000-mm high x 3000-mm wide x 200-mm thick made up of nine pre-fabricated Dincel-permanent polymer formwork panels filled with in-situ concrete after assembly.

The formwork panels measured 333-mm in width x 2-mm in thickness, each module connected to the other via a patented snap engagement mechanism at each joint. The prefabricated panels incorporated 25-mm high x 65-mm base triangular service voids, as well as 115-mm diameter holes spaced at 150-mm centres located in the webbing of the panel.

The panels were put up vertically and appropriately braced before 20 Mpa concrete mix (slump estimated by the client to be in excess of 150-mm) was pumped in through the top in one continuous pour without the use of concrete vibrators, and trowelled off when completely filled. There was no reinforcement bars used in the test wall.

A total load of 800 kN was applied to the specimen for the duration of the test.

THIS ASSESSMENT SUPERSEDES ASSESSMENT NUMBERED FCO-2674 DATED 30 JULY 2008
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Queensland Centre for Advanced Technologies +61 7 3227 4444 • Tintenbar +61 2 6900 7819 • Yarralumla +61 2 6281 9002
Australian Science. Australia's Future www.csiro.au
The integrity of the wall system was maintained for the full 240 minute duration of the test.

OPINION/CONCLUSION

Based on the observed performance under test conditions of the full-scale fire-resistance test it is the opinion of this Division that the temperature would be such that the polymer web links of Dincel-Form when concrete filled will not burn or melt away to create holes when subjected to fire conditions. Thus the presence of web links will not affect the smoke and FRL capacity of Dincel-Wall if tested in accordance with AS 1530.4-2005.

TERM OF VALIDITY

This assessment report will lapse on 31 May 2014. Should you wish us to re-examine this assessment 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 report in the light of new knowledge.

Yours faithfully

Garry Collins
Manager, Fire Testing and Assessment

4 May 2009
REFERENCE NO: 6

Certificate of Test

No. 2129

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This is to certify that the element of construction described below was tested by the CSIRO Division of
Materials Science and Engineering in accordance with Australian Standard 1530, Methods for fire tests
on building materials, components and structures, Part 4-2005 on behalf of:

Dincl Construction System Pty Ltd
Level 3, 7K Parkes Street
PARRAMATTA NSW

A full description of the test specimen and the complete test results are detailed in the Division's
sponsored investigation report numbered FSV 1346.

Product Name: Permanent polymer form, load-bearing, reinforced concrete wall system.

Description: The specimen comprised a reinforced concrete wall system
3600-mm high x 2000-mm wide x 200-mm thick made up of nine pre-fabricated
Dincl-permanent polymer formwork panels filled with in-situ concrete after assembly.

The formwork panels measured 333-mm in width x 2-mm in thickness, each module
connected to the other via a patented snap engagement mechanism at each joint. As
shown in drawing numbered DCS-TP1 Issue A, dated 30 January 2009, by Dincl
Construction Systems, the prefabricated panels incorporated 25-mm high x 65-mm
base triangular service voids, as well as 115-mm diameter holes spaced at 150-mm
centres located in the webbing of the panel.

The panels were put up vertically and appropriately braced before 20 Mpa concrete
mix (slump estimated by the client to be in excess of 150-mm) was pumped in through
the top in one continuous pour without the use of concrete vibrators, and truelled off
when completely filled.

There was no reinforcement bars used in the test wall.
The wall was left to cure for approximately six months.

The element of construction described above satisfied the following criteria for
fire-resistance for the period stated.

Structural Adequacy - no failure at 241 minutes
Integrity - no failure at 241 minutes
Insulation - 230 minutes

For the purpose of Building Regulations in Australia, a fire-resistance level (FRL) of 240/240/180 was
achieved. The FRL is applicable for exposure to fire from either direction.

This certificate is provided for general information only and does not comply with the regulatory
requirements for evidence of compliance.

Testing Officer: Chris Wojtak Date of Test: 26 February 2009.
Issued on the 13th day of March 2009 without alterations or additions.

Gary E Collins
Manager, Fire Testing and Assessments

CSIRO Materials Science and Engineering
14 Julius Avenue, Riverside Corporate Park, North Ryde NSW 2113 AUSTRALIA
Telephone: 61 2 9490 5444 Facsimile: 61 2 9490 5555

This document is issued in accordance with NATA's accreditation requirements

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Facsimile: (612) 9689 2028
A.B.N. 78 083 639 614

Level 3, 7K Parkes Street
Parramatta NSW 2150
AUSTRALIA

Email: construction@dincel.com.au
Website: www.dincelsolutions.com
APPENDIX 5

Test Performance and Spalling

As noted in the description of the specimen the panels were filled with a nominal 20 Mpa concrete mix with a slump estimated by the client to be in excess of 150-mm. The concrete was pumped in through the top in one continuous pour without the use of concrete vibrators, and trowelled off when completely filled.

The use of concrete with such a high slump and water content resulted in there being a considerable quantity of free water trapped within the wall, particularly in the bottom half. During the conduct of the test the rapid rise in temperature results in this free water being turned into superheated steam and produces spalling of the concrete. This can clearly be seen in Photograph 12, in the main body of the report, where significant spalling was demonstrated approximately 500-mm from the bottom of the specimen.

If the excess water is reduced during the construction phase of the wall then this would significantly reduce the spalling and enhance the performance of the wall system. It is therefore the opinion of this Division that if the slump of the concrete used in the construction of the wall system was less than or equal to 110-mm, during pouring, then the wall system detailed in this report would be capable of achieving fire-resistance levels of 240/240/240 if tested in accordance with AS 1530.4-2005.
REFERENCE NO: 7

Our ref: FCO-2725/3751

Dincel Construction Systems Pty Limited
Level 3, 7K Parkes Street
PARRAMATTA NSW 2150

Attention: Mr Burak Dincel

DINCEL CONSTRUCTIONS CONCRETE WALL SYSTEM IN BUSHFIRE PRONE AREAS
Assessment Number FCO-2725
Your e-mail of 23 April

INTRODUCTION

We have examined the information referenced by you on the likely fire performance of the Dincel-Form concrete filled wall system. The information included:

- CSIRO test report numbered FSV 1346 on a full-scale fire-resistance test on a loadbearing wall system in accordance with AS 1534.4-2005 conducted on 26 February 2009;
- AS 3959: Construction of buildings in bushfire-prone areas - 2009;
- AS 1530: Methods for tests on building materials, components and structures: Part 8.2: Tests on elements of construction for buildings exposed to simulated bushfire attack - Large flaming sources

We have retained this documentation.

You have requested the Division to examine the performance of your tested wall system in order to determine the likely Bushfire Attack Level (BAL) of the wall system.

ANALYSIS

On 26 February 2009, this Division conducted a full-scale fire-resistance test on a wall system comprising a reinforced concrete wall system 3000-mm high x 3000-mm wide x 200-mm thick made up of nine pre-fabricated Dincel-permanent polymer formwork panels filled with in-situ concrete after assembly.

The formwork panels measured 333-mm in width x 2-mm in thickness, each module connected to the other via a patented snap engagement mechanism at each joint. The

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Queensland Centre for Advanced Technologies +01 73327 4444 • Tumbulgum +01 2 6201 7819 • Yarralumla +01 2 6281 8102
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prefabricated panels incorporated 25-mm high x 65-mm base triangular service voids, as well as 115-mm diameter holes spaced at 150-mm centres located in the webbing of the panel.

The panels were put up vertically and appropriately braced before 20 Mpa concrete mix (slump estimated by the client to be in excess of 150-mm) was pumped in through the top in one continuous pour without the use of concrete vibrators, and trowelled off when completely filled. There was no reinforcement bars used in the test wall.

A total load of 800 kN was applied to the specimen for the duration of the test.

The system, as tested achieved fire-resistance levels of 240/240/180.

AS 3959 describes the requirements for buildings constructed in bushfire-prone areas in Australia. In that document it defines a series of Bushfire Attack Levels (BAL) ranging from Low through 12.5, 19, 28, 40 to FZ(Fire Zone) in ascending severity of attack. Levels up to BAL-40 are covered in AS 1530.8.1 and BAL-FZ is covered in AS 1530.8.2.

AS 1530.8.2 specifies that the test shall be performed in accordance with the requirements of AS 1530.4, except that the test duration is 90 min comprising a 30 min heating phase and a subsequent 60 minutes period during which the performance of the element is monitored.

The specimen shall be exposed to the standard heating regime specified in AS 1530.4. Control of the furnace shall be in accordance with the requirements of AS 1530.4. Within 2 min of termination of heating, the specimen shall be removed from the furnace to enable observation of the fire-exposed face.

With respect to AS 1530.8.2 test criteria, the test specimen reported in FSV 1346 was subjected to the heating conditions of AS 1530.4 for the 30 minutes and was continued to be subjected to the heating conditions of AS 1530.4 for the subsequent 60 minute observation period.

The performance criteria of AS 1530.8.2 are specified in Clause 13.8 and states:

When exposed to the design bushfire conditions, the building exterior shall not permit the following:

(a) Formation of an opening from the fire-exposed face to the non-fire-exposed face of the element through which a 3 mm diameter probe can penetrate for the duration of the 90 min test period.

(b) Sustained flaming for more than 10 s on the non-fire side for the duration of the 90 min test period.

(c) Flaming on the fire-exposed side more than 30 min after termination of the heating phase, that is, flaming on the fire exposed face during the last 30 min of the monitoring phase.

(d) Radiant heat flux 365 mm from the non-fire side of the specimen in excess of 15 kW/m² from glazed and uninsulated areas during the 30 min exposure and for a subsequent 60 min test period.

(e) Mean and maximum temperature rises greater than 140 K and 180 K on the non-fire side during the 30 min heating regime and for a subsequent 60 min period, except for glazed/uninsulated areas for which the radiant heat flux limits are applicable.

(f) Radiant heat flux 250 mm from the fire-exposed face of the specimen, greater than 3 kW/m² more than 30 min after completion of the heating phase, that is, flaming on the fire exposed face during the last 30 min of the monitoring phase.
REFERENCE NO: 7

FCO-2725

(g) Mean and maximum temperatures of the internal faces of construction including cavities, exceed 250°C and 300°C, 30 min or more after completion of the heating phase.

Evaluating the performance of the wall reported in FSV 1346 against these criteria shows:

(a) No holes of any size where formed in the wall during the first 90 minutes of the test period;
(b) No sustained flaming on the unexposed face for the first 90 minutes of the test period;
(c) No evaluated but after 30 minutes the exposed face consisted on plain concrete that is non-combustible;
(d) The temperature recorded on the unexposed face at 90 minutes was approximately 67°C from which the received radiation at 365 mm would be approximately 0.7 kW/m²;
(e) The maximum temperature rise and average temperature rise were approximately 65K and 22K, respectively, at 90 minutes;
(f) See (c) above; and
(g) The wall was solid and did not incorporate internal faces.

As can be seen the tested wall would not have failed any of the performance criterion.

OPINION/CONCLUSION

Based on the performance recorded during the conduct of the full-scale fire-resistance test it is the opinion of this Division that the wall system reported in FSV 1346 would achieve a Bushfire Attack Level of BAL-FZ if tested in accordance with AS 1530.8.2-2007.

TERM OF VALIDITY

This assessment report will lapse on 31 May 2014. Should you wish us to re-examine this assessment 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 report in the light of new knowledge.

Yours faithfully

Garry Collins
Manager, Fire Testing and Assessment

4 May 2009
Our ref: FCO-2800

Dincel Construction Systems Pty Limited
Level 3, 7K Parkes Street
PARRAMATTA NSW 2150

Attention: Mr Burak Dincel

PROPERTIES OF DINCEL CONSTRUCTIONS CONCRETE WALL SYSTEM AS RELATED TO THE NON-COMBUSTIBILITY REQUIREMENTS OF THE BCA
Assessment Number FCO-2800

INTRODUCTION

We have examined the information referenced by you on the likely fire performance of the Dincel-Form concrete filled wall system. The information included

- CSIRO test report numbered FSV 1346 on a full-scale fire-resistance test on a loadbearing wall system in accordance with AS 1530.4-2005 conducted on 26 February 2009;
- AS/NZS 3837-1998, Method of test for heat and smoke rates for materials and products using an oxygen consumption calorimeter;
- ISO 5660, Part 1 and Part 2

We have retained this documentation.

You have requested the Division to examine the performance of your tested wall system in order to determine the likely performance in comparison to non-combustible wall linings.

ANALYSIS

Clause C1.12 ‘Non-combustible materials’ of the Building Code of Australia states:

‘The following materials, though combustible or containing combustible fibres may be used wherever a non-combustible material is required

(a) Plasterboard.
(b) Perforated gypsum plath with a normal paper finish.
(c) Fibrous-plaster sheets.
(d) Fibre-reinforced cement sheathing.

This assessment supersedes assessment numbered FCO-2800 dated 23 April, 2010

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(e) Pre-finished metal sheeting having a combustible surface finish not exceeding 1 mm thickness and where the Spread-of-Flame Index of the product is not greater than 0.

(f) Bonded laminated materials where –
(i) each laminate is non-combustible; and
(ii) each adhesive layer does not exceed 1 mm in thickness; and
(iii) the total thickness of adhesive layers does not exceed 2 mm; and
(iv) the Spread-of-Flame Index and Smoke-Developed Index of the laminated material as a whole does not exceed 0 and 3 respectively.

The Dincel concrete wall system does not strictly comply with these requirements but has been tested under the requirements of BCA Specification C1.10a and achieved a Group 1 classification as a wall lining. This classification permits it to be used in the construction of walls, both internal and external, for all classes and types of buildings and including fire isolated exits.

Additionally the results of the AS/NZS 3837 testing showed that the rigid polymer faced Dincel concrete panel had a peak heat release rate of 15.5 kW/m² and a total heat release of 4.41 MJ/m². The ISO 5660 Part 1 testing resulted in a peak heat release rate of 32 kW/m² and a total heat release of 3.87MJ/m². This compares with plasterboard that typically achieves values of 50-70 kW/m² for peak heat release rate and 2.6-3 MJ/m² for the total heat release.

OPINION/CONCLUSION

The principal reason for the BCA to stipulate non-combustibility for wall systems is to control the spread of fire along the wall as well as to reduce the contribution of the wall in the initial growth of the fire.

Based on the performance demonstrated during the conduct of the specified fire tests it is the opinion of this Division that the wall Dincel concrete wall system as reported in FSV 1346 would be capable of achieving a performance related to flame spread comparable to that achieved by some of the deemed to non-combustible products in Clause C1.12 within the Building Code of Australia 2010.

TERM OF VALIDITY

This assessment report will lapse on 30 April 2015. Should you wish us to re-examine this assessment 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 report in the light of new knowledge.

Yours faithfully

Garry Collins  
Manager, Fire Testing and Assessment  
11 May 2010

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ASSESSMENT NUMBERED: FCO-2800 DATED 23 APRIL 2010