



PROPOSAL FOR CHANGE  
NATIONAL CONSTRUCTION CODE SERIES

SUBJECT Bonded Laminates Clause

Document tendered by <i>Mr. David Shorbridge MLC</i>
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BCA Volume One:	C1.9(e)(vii)
BCA Volume Two:	N/A
Guide to Volume One:	N/A
PCA Volume Three:	N/A

Proposer's name: **Melissa Herrmann**  
Proposer's Organisation: **Fairview Architectural**  
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**The Proposal**

1. What is the proposal?
  1. It is recommended that C1.9(e)(vii) be retained in NCC 2022
  2. It is recommended that C1.9(e)(vii) be amended as below in NCC 2022

(vii) Bonded laminated materials where—

- A. Each lamina, including any core, is non-combustible; and
- B. Each adhesive layer does not exceed ~~1mm~~ 0.5mm in film thickness and the total thickness of the adhesive layers does not exceed ~~2mm~~ 1mm; and
- C. The Spread-of-Flame Index and the Smoke-Developed Index of the bonded laminated material as a whole do not exceed 0 and 3 respectively;

**The Current Problem**

2. What problem is the proposal designed to solve?

The ABCB has done an excellent job in responding to the issue of combustible cladding, with the implementation of NCC 2019. The inclusion of CV3 (AS5113) and the clarification of the application of C1.9(e)(vii) to combustible cores have gone a long way in providing safer, simpler and more transparent routes to compliance for cladding materials.

In spite of this, there is currently a lack of public trust in the bonded laminates clause. This is partly due to the perception that the clause may still be 'unresolved' due to it remaining unchanged after its proposed removal in 2019, and partly because of the safety considerations around the amount of adhesive currently permissible in the clause.

There are many proven, safe products that utilise the C1.9e(vii) concession, including aluminium cladding panels, foil-faced insulation and mineral wool insulated sandwich panel, which will be badly affected by clause removal. This would present a new series of approval, compliance and



management headaches for a construction sector already struggling with the fundamentals of construction safety.

The use of bonded laminate materials has significant advantages over solid panels including machinability, strength, formability, light weight, aesthetic appearances, rigidity and so on. To prevent the use of these panels also compromises building safety, with increased fire debris total mass and debris element weight a key factor.

State legislation is increasingly focused on building products being as safe as practicable and fit-for-purpose. While a performance based route to compliance will remain available for high-performance panels, it is the reality that PI insurance is continuing to restrict the ability of engineers to complete performance solutions, and building insurance is preventing cladding being used that is not Deemed to Satisfy (DtS). It is important that a DtS pathway is available for professionals to fulfill their legal obligations.

However, unless the clause is strengthened, commercially driven scaremongering about the clause will continue to persist regarding the safety of the current allowable 2 mm adhesive limit, regardless of whether a product contained well below the allowable amount or not, and whether or not evidence of fire spread exists.

### 3. What evidence exists to show there is a problem?

#### **BOLCAR**

The Queensland Building and Other Legislation (Cladding) Amendment Regulation 2018 defines combustible cladding as cladding that -

- (a) is made of a material of a kind that is not mentioned in the BCA, clause C1.9(e)(i),(ii), (iii), (iv) or (v); or
- (b) Is deemed to be combustible under AS1530.1 - 1994 (Methods for fire tests on building materials, components and structures, Part 1: Combustibility test for material), section 3.4(a), (b) or (c).

Bonded laminates are treated as "combustible" in Queensland if they are already installed on a building. The presumption is that historically, ACPs / BLM found on older buildings were likely to have a flammable core and needed extra scrutiny to determine whether they were fit for purpose. A problem arises when a proven and safe product is not considered as a replacement for rectification works on unsafe cladding because it falls under clause C1.9(e)(vi) or (vii).

Queensland's legislation has caused much confusion as the assumptions have been that rectification works are held to a different standard than new builds. The knock-on effect has been that practitioners have shunned bonded laminates altogether, believing that they must not be suitable for new builds either.

Queensland's scrutiny on existing ACPs have led to misinformation being spread that bonded laminates are "banned" in the state. This scaremongering has added to the concern around the clause changing in the future and many national builders are approaching bonded laminates with apprehension, although these are some of the highest performing facade products available. Many are issuing nationwide mandates to restrict the use of bonded laminates to reflect the position held in Queensland for rectification of "affected buildings".

Issuing restrictions on the application of the performance based NCC, is effectively a vote of no confidence in the building code, which could detrimentally impact innovation and progress within the industry.



### AS5113 test results on DtS products

With the lack of trust in the bonded laminates clause, the industry is using other DtS products. While all of these products have their place, it is concerning to see building professionals accepting lower performance products in order to protect themselves from litigation due to perceived future code changes.

Evidence of safety concerns are clear in comparing debris from AS 5113 test results:

AS 5113 Cladding	3mm Aluminium	Fibre Cement	Concrete	BLM (4mm aluminium core ACP)	BLM (ACP with solid NC core)
<b>Debris</b>	Test 1: 43.5kg Test 2: 44kg	Panels exploding under heat	83kg	15kg	7kg
<b>Maximum individual size</b>	Test 2: 23kg	Not identified	Not identified	<2kg	Not identified

3mm aluminium and concrete result in large quantities of debris when tested in AS5113, and fire cement panels have exploded, spreading debris a good distance from the test wall. On the other hand, both bonded laminate tests demonstrate very low debris mass. In a building fire scenario, this indicates occupant egressing and firefighters will be safer with bonded laminates, as there is less falling debris.

See Appendix 1 for full publicly available details of test configurations and results, including temperatures.

### Concerns regarding solid aluminium

Solid aluminium is generally the preferred material when rectifying buildings with at-risk cladding. Due to its paint coating, it would be combustible if tested as a whole to AS 1530.1, and relies on clause C1.9e(v) for DtS compliance. Fairview is a supplier of 3mm solid aluminium cladding.

Fairview observed industry wide concern regarding the performance of solid aluminium, and we are reviewing this further internally. These concerns include:

1. Thermal performance
2. Thermal movement
3. Weatherproofing
4. Oil canning & other aesthetics
5. Coating quality

### Thermal Performance

The thermal conductivity of solid aluminium compared to a bonded laminate is shown in the below table. Solid aluminium has 80x the thermal conductivity, or an 80x faster rate of heat transfer into a building.

Material	Solid Aluminium	Ultracore G2
Thermal conductivity (W/mK)	205	2.54

This means that buildings with combustible cladding are being rectified using cladding with far inferior thermal performance characteristics, affecting the energy ratings for those buildings.



### Thermal Movement

The increased thermal conductivity of solid aluminium also means these panels are subject to higher bulk temperatures and therefore increased thermal movement. Without care in installation and system detailing, which are not well developed in the industry, this can result in a higher chance of structural panel failure.

### Weatherproofing

Feedback from panel installers, even during winter in Sydney, is that panels on north facades get too hot to touch. This often means that sealant application temperatures are exceeded, requiring sealing early morning or during the night; otherwise sealants can fail. A poor sealant job increases the chance of a weatherproofing failure, but this might not occur during the building's normal warranty period.

### Oil-canning

Another consequence of the reduced rigidity of solid aluminium and increased temperatures is panels visually deforming or oil canning. This can occur in a wavy pattern or panels 'pillowing'. It occurs on both 3mm and 4mm aluminium. While this can be somewhat addressed through the aluminium grade (3000 series is superior to 5000 series) and fixing system it cannot be entirely prevented.

Industry practice is to use metal 'stiffeners' attached to the back of solid aluminium panels by adhesive tape to minimise oil canning. But adhesive tape is combustible and not provided for under the DtS provisions for Type A & B construction.

### Coating quality

There are very few coaters globally who can coil coat 3mm aluminium to an acceptable level of quality due to the line size required, and aluminium tensions that need to be managed. Vitradual is one of these that can. There is however a 'goldrush' of new 3mm aluminium suppliers in Australia who want to sell material for rectification. These do not have a track record of use, and generally are coated using inferior processes. To date Fairview has supplied panel to reclad projects to replace defective 3mm aluminium cladding (from other suppliers).

### **Lack of insurance for performance solutions**

With insurers taking a highly conservative approach to PI insurance and applying a wide variety of "cladding exclusions" to policies, many building practitioners are, in turn, taking an overly risk-adverse approach to material selection. Many fire engineers and building surveyors see a deemed-to-satisfy route to compliance as less risky compared to a performance-based approach, which may be interpreted as subjective.

The problem here is that if a claim were to arise, the question of compliance is generally assessed at the date of the claim, not the date of the relevant conduct. If there is any concern around a clause changing, like the ongoing concerns around the bonded laminate clause, building practitioners will avoid all bonded laminates in fear of them becoming non-compliant in the future. This leads to potentially inferior or arguably less-safe products being installed.



## The Objective

### 4. How will the proposal solve the problem?

The proposal will solve the problem of the lack building code trust and safety by:

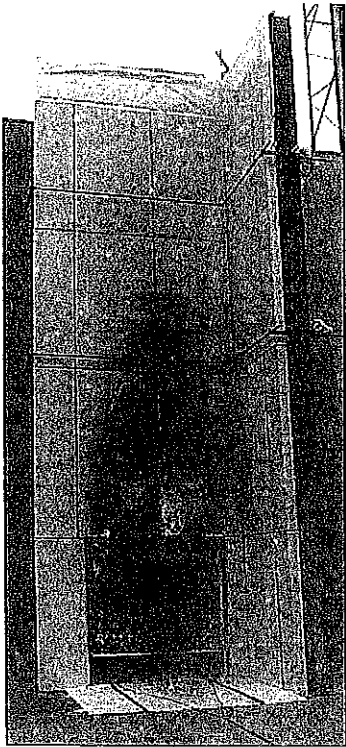
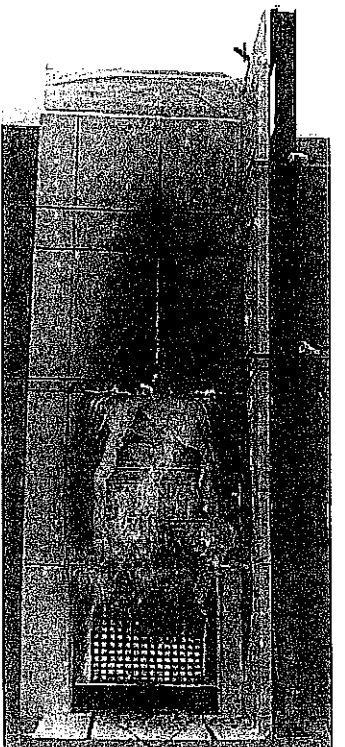
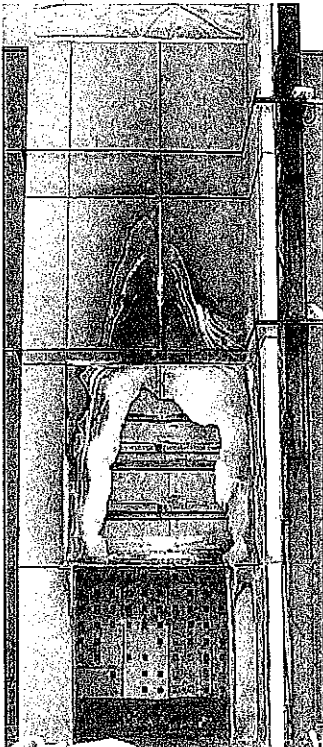
- A. Enabling best fire performance for wall cladding
- B. Enabling best general performance for wall cladding
- C. Remove doubt as to 'loopholes' for dangerous products

### A. Enabling best fire performance for wall cladding

#### Large Scale Testing

It is clear from the array of AS 5113 test results presented in Appendix 1 that bonded laminated materials generally outperform other DtS cladding types, in both flame spread and debris.

The below images are from the Vitracore G2 AS 5113 test demonstrating no spread of flame. The melted aluminium and burnt paint show a very clear heat map of the temperatures generated by the timber crib.

13 Minutes	23 Minutes	Completion
		
<p>Sealant has fallen from panel joints and is visible flaming on the ground and top of the opening.</p>	<p>Further sealant flaming at panel joint. No vertical flame spread via the panels.</p>	<p>Vitracore G2 demonstrated no flame spread. Clear 'heat map' on the façade from the crib fire.</p>



Vitracore G2 has also been tested in the tallest fire test in the world, at 19m, as a 'Fire break'. As shown in the below images, a oversized test rig was clad with the bottom half being PE cored ACP, and the top half Vitracore G2. At the very top is a red strip of PE core ACP. The aim of the test was to ascertain the flame spread height from PE core, and what height fire break was required to prevent propagation up a building.

The results are clear. Through the intensity of the fire from the PE cored panels (which exceeded that of the timber crib) the lower Vitracore G2 cladding was consumed but did not propagate flame, providing a successful fire break.



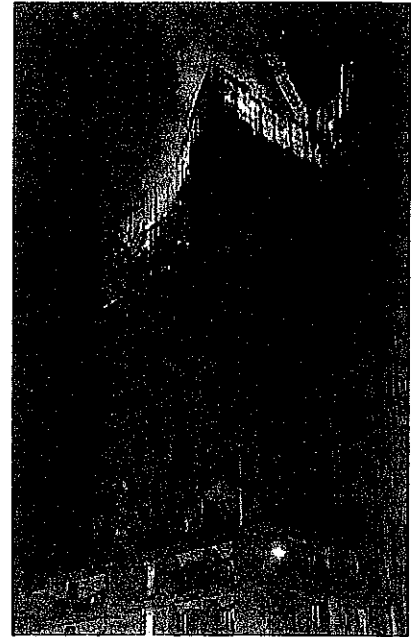


However, regardless of test results (which are often accused of not representing real-life scenarios), it is actual building fires that provide the true performance test on cladding.

#### Papermill Apartments – September 2017

This fire occurred at an apartment building under construction in Liverpool NSW on 7 September 2017. The fire burnt through the top four floors, during which the bonded laminate cladding (Vitracore G2) came under direct flame attack. Vitracore G2 did not combust, or in any way further conduct the fire. The FRNSW post fire report identified concrete spalling and shattered windows, demonstrating the intensity of the fire.

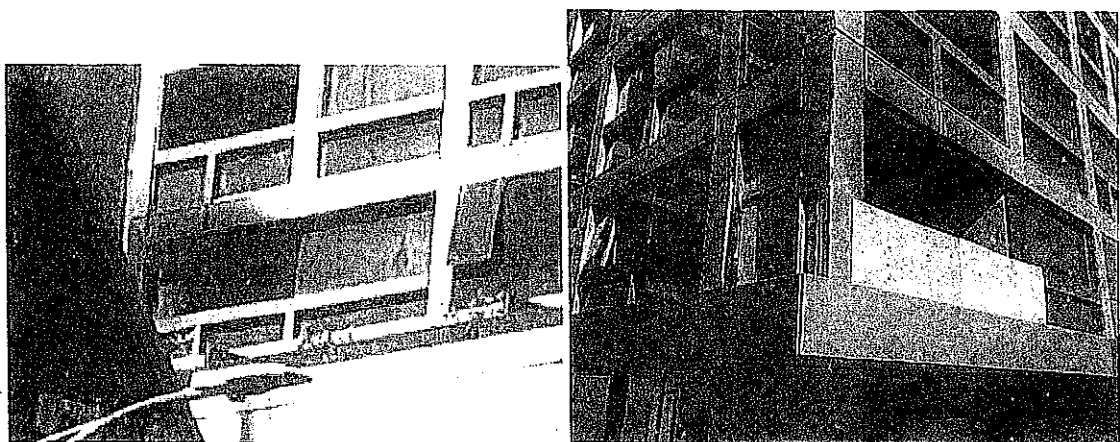
Image right of the building fire. The 'checkerboard' light and dark gray panels visible on both elevations are Vitracore G2.



#### Fifth Apartments – December 2019

This fire occurred on the 8<sup>th</sup> level of a 44 story apartment building. The Vitracore G2 facade did not ignite, flame or conduct fire even under 20-minutes of fire attack. After discarded cigarette butts ignited a fuel source of stored domestic items on the balcony (including paper and food packaging) an aircon unit and fridge also caught fire. However, the balcony's cladding - Vitracore G2 - only showed soot and smoke marks after 20+ minutes of fire. The MFB report into the incident confirmed that the Vitracore G2 layered aluminium cladding was located next to the likely fire locus. And while the immediate cladding melted, it did not conduct or spread the fire around the building's 8th floor. In effect, the Vitracore G2 cladding acted as a de-facto fire break, stopping the fire engulfing the clad façade.

The silver Vitracore G2 cladding surrounding the balcony is clear in the below images.





Common concerns raised as to the fire safety of bonded laminates include delamination, the hollow core allowing a 'chimney effect' for faster fire spread and fire gaining access to the panel core through penetrations. The testing and fire scenarios demonstrate that:

1. Vitracore G2 did not delaminate nor did large pieces fall to the ground:
2. There was no flame spread via the panel core.
3. Penetrations are not an issue. Even when the panels melted right through (creating a 'penetration') fire did not travel up the panel core.

The testing and fire scenarios outlined provide clear evidence that the clause C1.9e(vii) currently permits high performing cladding products to be used as external cladding on high rise buildings, highlighting confidence needs to be built into the clause to allow building practitioners to best achieve their required safety outcomes.

#### **B. Enabling best general performance for wall cladding**

As highlighted in section 3, the use of products such as solid aluminium creates risks around thermal performance, thermal movement, weatherproofing, oil canning and paint quality.

The use of bonded laminates offers significant benefits over all these areas.

As building professionals are required to use DtS products due to their insurance requirements, and legally have to provide products which are as safe as practicable and fit-for-purpose, maintaining and tightening the bonded laminates clause C1.9e(vii) is critical for their role to be appropriately fulfilled.

#### **C. Remove doubt as to 'loopholes' for dangerous products**

Notwithstanding the proof points on the performance of BLM's, clause C1.9e(vii) is often criticised as a 'loophole'. The bonded laminates clause can be considered to exhibit some weaknesses around adhesive thickness, which should be addressed in a revision of the clause.

There is a view shared in the market that allowing up to 2mm of adhesive may create a panel that theoretically could spread flame. Fairview have not seen any evidence to prove or disprove this but in help of relieving this concern Fairview is recommending the allowed adhesive be reduced.

The reason for the selection of 0.5mm/layer, 1mm total is based on the manufacturing requirements of insulated sandwich panels. Mineral wool cored sandwich panels with steel skins are an extremely high performing and inert material, achieving up to 4 hours fire resistance. Being steel and mineral wool they will not melt and cause debris in a typical façade fire. The proposed reduced adhesive thicknesses are chosen to allow insulated sandwich panel to comply as DtS, and are not likely to contribute to external flame spread. Many existing products comply with this proposed adhesive thickness.

In the consultation, concern was raised as to the ability of manufacturers to precisely control the amount of adhesive to the reduced quantities, and how this is measured. For this reason the word 'film' has been inserted to make clear the measurement requirements, and additionally control the adhesive application to maintain a high level of consistency.





5. What alternatives to the proposal (regulatory and non-regulatory) have been considered and why are they not recommended?

Testing to AS 3837 has been considered as an extension to the AS 1530.3 whole panel testing. This is a performance test with a more onerous testing procedure. It is equivalent to ISO 5660, which the New Zealand building code uses as an alternative measure for non-combustibility. It is proposed the same performance requirement be used, being total heat released is less than 25MJ/m<sup>2</sup>. This has the benefit of being a test currently available in Australia with NATA approval.

Alternatively, panel performance could be measured by heat-of-combustion of the product as a whole does not exceeding 3MJ/m<sup>2</sup> to EN ISO 1716 (less than the EN 13501 A2 criteria), however this requires individual component testing and calculation to a whole panel. Preference is for testing to AS 3837 (ISO 5660) as this is readily available in Australia by NATA approved laboratories.

However, in both cases the proposal lacked experimental evidence, and the consultation recommendation received was to review this at a later date.

### **The Impacts**

6. Who will be affected by the proposal?

The stakeholders who will be affected by the proposal are first and foremost, the building owners and clients, government, building practitioners and suppliers of bonded laminate products.

7. In what way and to what extent will they be affected by the proposal?

The effect on stakeholders can only be a positive one. Keeping the clause provides a very transparent and unambiguous pathway for compliance for evidenced, safe cladding, and allows for product options with better performance at more cost-effective prices.

Strengthening the clause will increase confidence around bonded laminate products, recognising that the added requirements and reduced adhesive content demonstrates that industry concerns around safety and performance have been resolved.



## Consultation

8. Who has been consulted and what are their views?

Dr Jonathan Barnett, Managing Director

### **Basic Expert**

### **National Chair of the Society of Fire Safety**

Email dated 31/08/2020

Basic Expert is in support of your proposal

Damien Jenkins, Senior Quality & Compliance

### **Multiplex Australasia**

Email dated 27/08/2020

We at Multiplex agree with Fairview position maintain in NCC 2022 the Deem to Satisfy (DTS) clause relating to Bond Laminated Materials Clause C1.9 (e) (vi) with some minor changes.

Multiplex Construction has used Bond Laminated Material in the past and would certainly wish use to this type of material in the Future. We see significant advantages in using Bond Laminated Material over solid panels in that Bond Laminated Materials are machinability, formability, light weight and are aesthetic appearances is better than solid panels material which is likely to have an oil canning appearance finish.

Fairview's proposed changes will help strengthen Deem to Satisfy Clause C1.9 (e) (vi) to show a material has undergone a higher level performance checks to achieve compliance to Clause C1.9 (e) (vi) while satisfy the Performance requirements listed in CP1 to CP9 to address Fire and Spread of Fire.

- The reduction of each adhesive layer and a total thickness adhesive, is a positive move to address Heat of Combustion from adhesive. We do not opposed changes proposed by Fairview to Clause C1.9 (e) (vii) B.

It is also important to maintain the Bonded Laminate Clause C1.9 (e) (vi) for materials undergoing a Performance Solution pathway to compliance because a material needs to demonstrate it is at least equivalent to the Deem to Satisfy Provision or better than a DTS. Without Bonded Laminate Clause C1.9 (e) (vi) how can an any material assessed under a Performance Solution by be deem equivalent to a material meet the is at Deem to Satisfy Provision and also meeting Performance requirements listed in CP1 to CP9 for Fire and Spread of Fire without undergoing expensive testing.



Kjetil Pedersen, Vic manager – fire safety consulting

**Warringtonfire**

**Victorian Chair of the Society of Fire Safety**

Email dated 31/08/2020

What about honeycomb core laminates etc? Can the manufacturers actually control the adhesive layers to that precision? Intent of change (reduced glue) is positive, but is it practical and achievable?

Fairview note: Core laminates have been addressed in the NCC 2016 Amendment 1, making it clear the core of a bonded laminate is required to be non-combustible. The concern as to precision has been taken on board, and addressed through including the word 'film' as described in section 4.

Blair Stratton, Associate Director

**RED Fire Engineers**

**Chartered Professional Engineer**

Email dated 28/08/2020

Yes, we think the reduction in adhesive allowance is reasonable and seems fair given your point about bonded insulated systems. Should the phrase 'film' thickness or 'bead thickness' be used to avoid further doubts about how the thickness is measured?

Fairview note: This feedback has been taken on board through including the word 'film' to make the thickness measurement clear.

Letter to Fairview (advice #1) 19 Aug 2020

**Lander & Rogers**

Fairview requested legal advice about the possibility of a ban for a bonded laminate product such as Vitracore G2. The advice reviews Vitracore G2 for compliance and safety. Please find the document link in **Appendix 2**

Lander & Rogers considers the likelihood of a more expansive ban being implemented (applicable to Vitracore G2 in NSW and/or Victoria), to be low.



## APPENDIX 1 – Full AS 5113 result comparisons



AS 5113 Result  
Comparisons.pdf

## APPENDIX 2 – Lander & Rogers legal advice



Letter to Fairview  
(advice #1)19Aug20.p