THE BUILDING BUSINESS LTD

Assessment of the performance of bbi Wood Products OSB panels as an alternative solution

Kevin Brunton

Technical Director

Version 1.0, February 2026

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info@thebuildingbusiness.co.nz
www.thebuildingbusiness.co.nz
PO Box 54 245 The Marina Auckland 2144

Produced under an ISO 9001 certified system.

Introduction

This evaluation considers the performance metrics, manufacturing standards and data for Tolko T-Strand Pro OSB panels supplied by bbi Wood Products for use as structural flooring, roof substrates and rigid wall barriers.

There is no New Zealand or Australian standard for oriented strand board (OSB), and with the exception of the generalised methods in B2/VM1 for establishing durability, the Verification Methods do not provide a compliance pathway for OSB for the relevant Building Code clauses, and the use of OSB is also not covered by Acceptable Solutions or the Building Product Specifications.

Therefore compliance with Building Code Clauses B1 and Clause E2 must be established as an alternative solution.

Background

bbi Wood Products supplies Tolko T-Strand Pro OSB panels for use as structural flooring, roof substrates and rigid wall barriers. The OSB panels are oriented strand board (OSB) engineered structural wood panels. The panels are manufactured from Canadian Aspen wood fibre strands, adhesive and wax and are certified by the Engineered Wood Association (APA) and comply with APA PS2-18 Performance Standard for Wood Structural Panels. The panels are treated with zinc-borate in accordance with AS/NZS 1604.1:2021.

OSB is outside the scope of the Acceptable Solutions. NZS 3604:2011 referenced by B1/AS1 references wood-based components for use in buildings including flooring, (paragraphs 2.3.6 and 2.3.7), however it is limited to particleboard manufactured to AS/NZS 1860. There is no New Zealand or Australian standard for OSB.

While E2/AS1 provides solutions for rigid wall underlays, it is a requirement for Extra High wind zones only and is limited to 7 mm thick plywood and 6 mm thick fibre cement. Therefore, the use of OSB as a rigid wall underlay is also outside the scope of E2/AS1.

Therefore compliance of bbi Wood Products' OSB panels with the Building Code needs to be demonstrated as an alternative solution for Building Code clauses B1, B2 and E2.

Methodology

This evaluation is based on comparing metrics derived from Acceptable Solutions, Verification Methods, New Zealand and Australian standards with the international certification and testing

already carried out for the OSB panels. The evaluation has been carried out in this way because the product has already been subject to overseas testing and certification, and additional New Zealand based testing or assessment is unlikely to add value to demonstrating that the product is fit for purpose, particularly as there is no Australian or New Zealand standard for OSB.

Evaluation

Tolko T-Strand Pro OSB panels certifications and testing

The Tolko T-Strand Pro OSB panels are manufactured in accordance with the Industry Voluntary Product Standard PS 2-18 Performance Standard for Wood-Based Structural-Use Panels and meet the design properties specified in APA Panel Design Specification D510-2020.

The Tolko T-Strand Pro OSB panels are also classified as OSB/3 (load bearing in dry or humid conditions) under EN 300. OSB is widely used as a sheathing panel overseas and OSB3 manufactured in accordance with EN 300:2006 and EN 13986:2004, the current international ISO standard for OSB (ISO 16894:2009) links together international standards and therefore provides a link to consider typical OSB3 performance criteria.

The Tolko T-Strand Pro OSB is generally manufactured in accordance with EN 300:2006 and tested in accordance with EN 310, EN 317, EN 319 and EN 321 as referenced in EN 300:2006. For flatwise bending, the North American test used as specified in APA Panel Design Specification D510-2020 is a variation to what is required by EN 310, as the APA section 14 test requires a larger cross section, however this test is found to be conservative compared to the requirements of EN 310.

Use as structural flooring

Section 2.3.6 of NZS 3604:2011 states that processed wood-based components and flooring are to be manufactured to AS/NZS 1860. AS/NZS 1860.1:2017 covers particleboard flooring manufactured to provide durability and stiffness as required for flooring as well as other structural applications. Particleboard used as flooring in accordance with NZS 3604:2011 falls within this scope, using Class 2 classification set out in AS/NZS 1860. AS/NZS 1860.1:2017 specifies testing in accordance with AS/NZS 4266.1:2017 for the mechanical properties of the particleboard.

The Tolko T-Strand Pro OSB is manufactured in accordance with EN 300:2006 and tested in accordance with EN 310, EN 317 and EN 319 as referenced in EN 300:2006.

The tested values for the OSB panels are compared with AS/NZS 1860.1:2017 values for particleboard flooring in Table 1.

Table 1: Tested values for the OSB panels compared with AS/NZS 1860.1:2017 values for particleboard flooring

Mechanical property	AS/NZS 1860.1:2017 Class 2 requirements for particleboard flooring	EN 300 values for Tolko T-Strand Pro OSB 10 to 18 mm thick panels
Modulus of rupture (MOR)	17 MPa	20 MPa EN 310 tested value as referenced in EN 300
Modulus of elasticity (MOE)	2650 MPa Tested to AS/NZS 4266.1:2017 (lower limit)	3500 MPa EN 310 tested value as referenced in EN 300
Internal bond strength	0.50 MPa Tested to AS/NZS 4266.1:2017 (lower limit)	0.32 MPa EN 319 tested value as referenced in EN 300
24 hour thickness swell	14 % Tested to AS/NZS 4266.1:2017 (upper limit)	15 % EN 317 tested values as referenced in EN 300
Thickness stability	25 % Tested to AS/NZS 4266.1:2017 (upper limit)	Not tested
Glue bond quality	2.9 MPa Tested to AS/NZS 4266.1:2017	Not tested
Surface water absorption	210 g/m^2 Tested to AS/NZS 4266.1:2017	Not tested

Comparability of test methods

Modulus of rupture and elasticity

The EN 310 test method for modulus of elasticity and rupture is determined by applying a load to the centre of a test piece supported at two points. The values are calculated by using the slope of the linear region of the load-deflection curve. The AS/NZS 4266.1:2017 test method specified by AS/NZS 1860.1:2017 is comparable with the EN 310 method as it is also based on centre point (or four point loading) on test specimens with the values calculated using the load-deflection curve.

Internal bond strength and glue bond quality

The test methods for internal bond strength are comparable because the tests measure axial tensile loading perpendicular to the panel using glued loading blocks with perpendicular tensile force applied and calculate the stress in the same way. AS/NZS 4266.1:2017 was developed from earlier AS/NZS tests and harmonises with EN test methods. The internal bond strength of the panels can be considered with glue bond quality.

Thickness swell and thickness stability

EN 317 as referenced in EN 300 and AS/NZS 4266.1 have comparable test methods for thickness swell that measure swelling after short-term water immersion, with the percentage increase in thickness recorded, although there are minor differences between the test methods and apparatus.

EN 300 does not require a thickness stability test like AS/NZS 4266.1 that tests cyclic-humidity or long-term dimensional stability. However, the Tolko T-Strand Pro OSB is manufactured in accordance with the APA Industry Voluntary Product Standard PS 2-18 Performance Standard for Wood-Based Structural-Use and the APA PS-2 has requirements for bond durability to be assessed using accelerated aging (soak-dry cycles followed by mechanical strength tests) and dimensional change to be measured after exposure to controlled humidity cycles. Although these tests are not directly comparable with the AS/NZS 4266.1 thickness stability test, they can be used as a proxy to assessing the performance of the panel.

Surface water absorption

EN 300 does not require testing for surface water absorption.

Comparison of tested results

Modulus of rupture and elasticity

The comparison of mechanical properties shows the Tolko T-Strand Pro OSB has significantly higher bending and shear properties compared to particleboard, and this is typical of OSB because of the cross-oriented layers created by the long strands of wood.

Internal bond strength and glue bond quality

Particleboard is manufactured by creating a continuous internal glue network as it is formed from broken down wood particles, mixed with wax and resin and made into panels by applying temperature and pressure. The particles create a larger surface area for the glue, meaning glue is distributed evenly throughout the entire panel. The internal bond strength of particleboard is its key mechanical property as the glue bond must be high to keep the particles together.

In comparison, OSB is manufactured using a completely different process, formed from cross-orientated, layers of wooden strands, bonded using structural waterproof adhesives with high temperature, high pressure curing. OSB doesn't need to have a high internal bond strength to achieve its structural properties. Therefore, while the Tolko T-Strand Pro OSB have a lower bond strength that particleboard, this performance metric is not material to the structural performance of the OSB panels.

Thickness swell and thickness stability

The Tolko T-Strand Pro OSB has comparable thickness swell properties compared to particleboard.

The Engineered Wood Association (APA) describes wood structural panels including plywood and OSB as smart vapour barriers as they change characteristics and have low permeability when the relative humidity is low and increased permeability as the relative humidity increases. According to the APA the use of wood structural panels helps aid vapour diffusion through exterior walls, mitigating moisture build up in concealed spaces.

Internationally recognised certifications are provided, which show it complies with:

- PS 2-18 Performance Standard for Wood-Based Structural-Use Panels, and
- EN 300 OSB3, i.e. it is satisfactory for use in environmental conditions covered by classes 1 and 2 for wood-based products in BS EN 335:2013. Class 2 includes conditions where not persistent wetting can occur.

Although there is no test result to compare directly with the AS/NZS 4266.1 thickness stability test, the Tolko T-Strand Pro OSB has demonstrated durability, including structural performance,

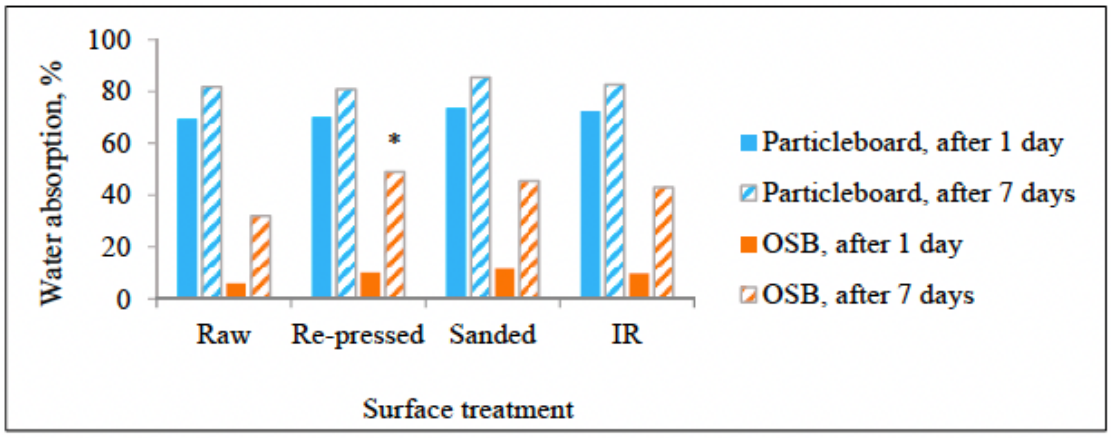
under cyclic exposure testing and these attributes have also been assessed under the APA PS-2 certification.

On this basis, it is concluded the Tolko T-Strand Pro OSB has comparable thickness swell and stability properties compared to particleboard.

Surface water absorption

EN 300 does not require OSB to be tested for surface water absorption. However, in general, the moisture resistance properties of OSB have been found to be comparable or better than particleboard. Tests on particleboard and OSB panels after 1 and 7 days of immersion in water shows the water absorption of OSB is significantly less than that of particleboard, as shown in the below graph (Copak et al, 2021).

As shown in the below graph the absorption of water in OSB is significantly lower than particle board based on immersion testing.



Conclusion

The comparison of the tested values of the Tolko T-Strand Pro OSB and typical OSB3 panels compared to particleboard shows the OSB panels will have equivalent or better performance than particleboard manufactured in accordance with AS/NZS 1860.1:2017. In addition, the Tolko T-Strand Pro OSB panels when used as a flooring substrate will be protected from moisture. This is included as a limitation of use.

Use as a rigid underlay

Acceptable Solution E2/AS1 requires external walls to have a rigid underlay in Extra High wind zones and includes a comment that the primary function of air barriers and air seals is to moderate airflows at junctions and inside the wall cavity.

BRANZ states ‘The rigid underlay ensures that the depth of the cavity is maintained and remains functional in high wind, and helps protect the internal linings from excessive air pressure changes.’ [BRANZ, 01/02/2012].

BRANZ Study Report 299 (2013) Rigid Sheathing and Airtightness in New Zealand also confirms that the use of rigid sheathing in extra high wind zones reduces the risk of screw pull out in internal linings by lowering the pressure resisted by the internal linings.

E2/AS1 specifies that rigid wall underlays must comply with Table C.2.1.1 and shall be minimum 7 mm H3 plywood, or 6 mm fibre cement sheet, be installed with sheet edges fixed over solid framing and be over-fixed with a flexible wall underlay that complies with Table C.2.1.1.

There are a number of proprietary products, on the market, that are rigid underlays and air barriers and have been assessed as meeting the specifications of Table 23, E2/AS1. It should be noted that in order to meet the E2/AS1 specifications, each of these proprietary systems incorporates a form of waterproofing.

The use of Tolko T-Strand Pro OSB as a rigid underlay must be assessed as an alternative solution, as E2/AS1 is limited to the use of fibre cement and plywood.

Research on the mechanical properties of wood-based composite materials shows the lower limits of the static bending properties of plywood, which covers strength and flexibility, are comparable with the upper limits of OSB [Cai, Z., & Robert, R.J., 2010].

The physical performance of the OSB panels has been assessed using BRANZ Technical Paper P21 (2010) A wall bracing test and evaluation procedure. The bracing ratings of the 9.5 mm thick OSB panels for 1200 mm x 2400 mm sheets with ECKO hold down corner brackets were determined to be 177 bracing units per metre for wind and 166 bracing units per metre for earthquake.

By research, typical tested values of 7 mm thick, 1200 mm x 2400 mm plywood sheets with GIB Handibrac® hold-downs were found to be approximately 25 % less than the OSB panels. The tested values for the OSB panels also exceed the maximum NZS 3604:2011 bracing values of 120 bracing units per metre for wind and 135 bracing units per metre for earthquake for a NZS 3604 construction with a concrete or timber floor.

This demonstrates the OSB panels will perform as well as plywood as a rigid underlay in terms of resistance to excessive air pressure due to the mechanical properties of the OSB panels. The OSB panels will perform in the same way as an E2/AS1 rigid underlay to ensure the depth of the cavity is maintained and remains functional in high wind, and to protect the internal linings from excessive air pressure changes.

As per the installation requirements for the OSB panels, the panels will be over-fixed with a flexible wall underlay that complies with Table C.2.1.1.

Durability

The Tolko T-Strand Pro OSB is treated in accordance with section 8 of AS/NZS 1604.1:2021 particle treated (strands) with zinc borate treatment equivalent to 0.15 % boron and 0.30 % zinc in accordance with Table 8.3 of AS/NZS 1604.1:2021 [APA, 29/01/2026]. AS/NZS 1604.1:2021 is an MBIE approved solution for 15 years durability as per the Building product Specification. Zinc borate treatment is listed in Table 8.3 and Appendix D as an approved treatment.

B2/AS1 and the Building Product Specification do not include processed wood-based components like OSB or particleboard within its scope for 50-year durability and OSB is outside the scope of the other Acceptable Solutions and there is no New Zealand or Australian standard for OSB. Therefore, compliance with Clause B2 can be demonstrated by way of comparison and in service performance.

Zinc borate treatment is an approved preservative for wood-based composites under the American Wood Protection Association (AWPA) and is suitable for use on processed wood products like OSB and particleboard because the timber strands are treated prior to manufacture of the boards or panels so the treatment provides protection throughout the panel. Information compiled about the efficacy of zinc-borate treatment based on CSIRO laboratory testing shows efficacy against C. acinaciformisat 1.01% w/w and M. darwiniensisat 2.06% w/w, retention of the treatment, and durability in lyctine tests as well as in service performance data.

Zinc borate has low solubility and a high dehydration onset temperature, which allows it to remain stable in OSB during pressing and only slowly release boric acid when moisture is present. This slow, controlled hydrolysis provides long-term fungal and insect protection [Bonigut et al, 2014]. Zinc-borate treated OSB (0–2% ZB) was studied over 78 months in outdoor exposure and all samples met or exceeded the outdoor decay-resistance requirements of JIS K171 in a Japanese field study [Hirano, Yamazaki, 2024].

Conclusion

Therefore, this comparison of the material properties and characteristics of the Tolko T-Strand Pro OSB shows

- the OSB panels will have equivalent or better performance where used in place of AS/NZS 1860 particleboard flooring as set out in section 2.3.6 of AS/NZS 1860

- the OSB panels will perform as well as plywood as a rigid underlay in terms of resistance to excessive air pressure due to the mechanical properties of the OSB panels.

Therefore the OSB panels will comply with the Building Code as an alternative solution for Building Code clauses B1, B2 and E2 as a structural flooring or rigid underlay provided the panels are used within the scope and limitation of the pass™ and in accordance with bbi's design and installation requirements.

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