



BRANZ Appraised

Appraisal No.481 [2005]

BRANZ Appraisals

**Technical Assessments of products
for building and construction**

**BRANZ
APPRAISAL
No. 481 (2005)**

**TRIBOARD
CONSTRUCTION
SYSTEM**

Juken New Zealand Ltd
P O Box 153
Kaitaia

Tel: 09 408 0300
Fax: 09 408 2979



BRANZ Limited
Private Bag 50 908
Porirua City
New Zealand
Tel: +64 4 237 1170
Fax: +64 4 237 1171
www.branz.co.nz



Product

1.1 The Triboard Construction System is a structural wall and ceiling panel system for use in the construction of Triboard Panel houses. All other aspects of the design and construction of Triboard Panel houses, such as foundations, floors, roofs, joinery, cladding, services and interior finishing, are conventional.

1.2 Triboard wall panels are 36 mm thick, and Triboard ceiling panels are 18 mm thick. Triboard panels are manufactured to consist of a strandboard core flanked by two outer layers of fibreboard.

1.3 Wall and ceiling panels are factory cut to shape and size, including window and door openings, by Triboard Re-manufacturers. All panel surfaces and exposed edges are pre-painted by the Re-manufacturer prior to delivery to site.

1.4 Onsite the wall panels are connected by specified structural connectors to a ground floor platform of either concrete-slab-on-ground or suspended timber framed floor. The exterior wall panels are strengthened externally by vertical timber battens, and the lintels can be strengthened either with a double thickness of Triboard or flitch plates.

1.5 For two-storey houses the upper floor construction is of standard timber framing and the upper floor wall panels connected to the floor.

1.6 Ceiling panels are installed over the wall panels and roof trusses are fixed over the ceiling panels. Conventional ceiling systems may also be used. The building is then completed using conventional construction.



Scope

2.1 The Triboard Construction System has been appraised for use in single unit (detached) housing which meets the scope of Clause 1.1.2 of NZS 3604 with the following limitations:

- buildings must be single or two-storey; and
- in NZS 3604 building wind zones up to and including very high; and
- in NZS 3604 earthquake zones A, B, and C; and
- the ground floor construction platform must comprise one of: a concrete slab-on-ground; or a suspended timber framed floor constructed in accordance with NZS 3604; and,
- the first (upper) floor is a suspended timber floor constructed in accordance with NZS 3604; and
- the first floor live load does not exceed 1.5 kPa; and
- roof construction comprises trusses and roof framing in accordance with NZS 3604; and
- roof pitches must not exceed 35°, nor be less than 10°; and
- Triboard ceiling panel diaphragms not exceeding 8 m in length.

2.2 This Certificate does not cover the general or wet area finishing to walls.

2.3 The use of Triboard wall and ceiling panels in the following situations has not been assessed and is outside the scope of this Certificate:

- sauna rooms and the like where they may be exposed to sustained high humidity (greater than 95% RH) or liquid water.
- where temperatures are in excess of 35°C over large areas for prolonged periods (e.g. ceiling heating installations) or in excess of 50°C in localised areas (e.g. the area adjacent to a fuel burning appliance - see Paragraph 11.1).
- in skillion roofs.

Building Regulations

New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, the Triboard Construction System comprising Triboard wall and ceiling panels and connections if designed, used, installed and maintained in accordance with the statements and conditions of this Certificate, will meet the following provisions of the NZBC:

Clause B1 STRUCTURE: Performance B1.3.1, B1.3.2 and B1.3.4. The Triboard Construction System will meet the requirements for loads arising from self-weight, imposed gravity loads arising from use, earthquake, snow and wind [i.e. B1.3.3 (a), (b), (f), (g) and (h)]. See Paragraphs 8.1 - 8.8.

Clause B2 DURABILITY: Performance B2.3.1 (a) not less than 50 years. The Triboard Construction System will meet this requirement. See Paragraph 9.1.

Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. The Triboard Construction System will meet this requirement and will not present a health hazard to people. See Paragraphs 15.1 - 15.2.

3.2 This Certificate appraises an Alternative Solution in terms of New Zealand Building Code compliance.

Technical Specification

Triboard Panels

4.1 The Triboard panels used with the Triboard Construction System are supplied by Juken New Zealand Limited. They are a three-layered wood panel product with a medium density fibreboard surface, 2 to 3 mm thick, on both sides of a non-oriented strandboard core. Triboard wall panels are manufactured to be 4.0 m x 2.45 m x 36 mm thick with a nominal density of 600 kg/m³. Triboard ceiling panels are manufactured to be 4.0 m x 2.45 m x 18 mm with a nominal density of 635 kg/m³.

Triboard Panel Re-manufacturers

4.2 Triboard panels are only supplied to accredited Triboard Re-manufacturers, who are members of ACTRANZ. Refer to the Technical Literature for a list of these companies. Re-manufacturers cut the Triboard wall and ceiling panels to size, including all door and window openings, and paint all surfaces of the sheets to provide limited protection during construction.

4.3 Other components used with the Triboard Construction System and supplied by either the Re-manufacturer or the building contractor include:

Batten Timber

4.4 Timber wall battens are MSG 8, H3.1 treated, kiln dried ex 50 x 50 mm or 75 x 50 mm radiata pine (dry dressed 45 x 45 mm or 70 x 45 mm) with a moisture content of 18% or less.

Fasteners

4.5 A range of standard nails and screws are used with the Triboard Construction System. For details refer to the Technical Literature.

Connectors

4.6 A range of commercially available products are used for connecting the Triboard wall and ceiling panels to each other and the rest of the structure. For details refer to the Technical Literature.

Thermal Insulation

4.7 Systems for achieving the required wall insulation values are given in the Technical Literature.

Other Components

4.8 The remaining materials and components required to construct a house are supplied by the building contractor in accordance with the requirements of NZS 3604.

Handling and Storage

5.1 Triboard wall and ceiling panels are trucked to the site and normally lifted into position. To minimise storage and handling on-site and to maximise construction efficiency, panel transport from the Re-manufacturer's factory should be carefully timed to coincide with the approximate time of erection. Panels must be handled carefully at all times to avoid physical damage and kept dry under cover until ready for construction.

5.2 For long term storage, Triboard panels must be kept dry under cover and be stacked horizontally on fillets in between sheets at 1200 mm maximum spacing to allow air circulation. Triboard panels must be protected from direct sunlight whilst in storage.

5.3 The pre-painted surfaces of the panels provide adequate protection against occasional rain wetting during construction. To minimise exposure, however, roof and wall claddings should be installed as soon as possible. Panels must not be exposed to the weather for more than two weeks.

5.4 When prolonged exposure to the weather is anticipated during building construction, waterproof covers such as tarpaulins must be provided to keep the panels dry.

Technical Literature

6.1 Refer to the Appraisals listing on the BRANZ website for details of the current Technical Literature. The Technical Literature must be read in conjunction with this Certificate. All aspects of design, use, installation and maintenance contained in the Technical Literature and within the scope of this Certificate must be followed.

Design Information

General

7.1 Buildings are constructed using the information in the Technical Literature and NZS 3604. The Triboard Construction System has been designed in accordance with NZS 4203 to comply with the appropriate design loadings for domestic buildings built within the scope of NZS 3604.

7.2 The ground floor construction platform is designed and constructed in accordance with NZS 3604 and to the requirements of the Technical Literature.

7.3 External Triboard wall panel and wall batten requirements for various applications are selected directly from tables in the Technical Literature.

7.4 The Triboard wall battens provide a framing cavity for the inclusion of thermal insulation designed in accordance with the Technical Literature.

7.5 The Triboard wall battens provide supporting framing, including around joinery openings, equivalent to conventional timber wall framing. From this point on the remainder of the wall construction is conventional. A wall wrap and cladding system (either direct-fixed or drained cavity) complying with New Zealand Building Code Acceptable Solution E2/AS1 is installed over the battens. Window and door joinery is conventionally fixed, also in accordance with NZBC Acceptable Solution E2/AS1.

7.6 Triboard ceiling panels provide an effective ceiling diaphragm. The ceiling is nail-fixed to the top of Triboard wall

panels, and screw-fixed via brackets to floor joists or to truss chords.

7.7 Triboard wall panels are finished internally, either directly with a paint system or wall paper, or they may be battened out for internal linings, e.g. where impervious linings are required in wet areas or to accommodate services.

7.8 Roof trusses must be subject to a specific design. Purlins and other roof framing must be in accordance with Section 10 of NZS 3604. Roof cladding must be in accordance with NZBC Acceptable Solution E2/AS1.

Structure

Wall Loads

8.1 The structural design of the system is based on the action of a configuration of connected Triboard wall and ceiling panels with perimeter Triboard wall panels being stiffened by face-fixed timber wall battens.

8.2 Walls comprising Triboard wall panels and wall battens have been designed as an integral unit. The stiffness and strength of the walls and lintels are adequate to resist gravity, wind and earthquake loads to the same level as conventional timber framing with similar deflections.

Live Loads

8.3 The maximum first floor live load is 1.5 kPa. All other live loads are those prescribed by NZS 4203 for NZS 3604 applications.

Wall Bracing Resistance

8.4 The Technical Literature provides bracing resistance values for a number of Triboard wall panel configurations in order to satisfy the requirements for earthquake and wind bracing which are determined from the tables in Section 5 of NZS 3604.

8.5 The in-plane rigidity of a Triboard wall panel is high, and the wind and earthquake bracing resistance it provides is limited by the connections. Sliding is prevented by connections at the floor and ceiling. Overturning is prevented by connections to abutting walls, and for external walls, by connections to the floor. Connection to other wall panels and the ceiling is by nailing or screwing. Connections to the floor are by galvanised steel angles, nails, screws, and cast-in floor framing anchors. Adhesive used at panel joints is ignored in terms of structural resistance.

Wind Loads

8.6 Housing built with Triboard wall and ceiling panels, in accordance with the provisions of the Technical Literature and this Certificate, is suitable for use in all NZS 3604 building wind zones up to and including very high. This is provided all other aspects are rated for the appropriate Building Wind Zone.

Impact

8.7 Triboard wall panels are robust and have a high resistance to soft body impacts, and most hard body impacts associated with normal use situations.

Service Penetrations

8.8 Penetration details for piping and electrical cabling are provided in the Technical Literature. All other penetrations are outside the scope of this Appraisal and Juken New Zealand Ltd must be consulted for advice.

Durability

9.1 The durability opinion is dependent on the Triboard wall and ceiling panels and the connections remaining dry in service. It is also dependent on the Triboard wall and ceiling panels not being exposed to sustained high humidity, liquid water, or high temperatures (see Paragraph 2.3).

Maintenance

10.1 The exterior cladding system, including joints, openings and perimeter junctions, must be maintained to ensure adequate protection is continually provided against water ingress. The internal linings, floor coverings and finishing (including joints, openings and the perimeters) must be maintained to provide protection from internal moisture. Regular inspections (at least annually) of the external cladding system and the internal linings and finishes must be made, and any damage or deterioration repaired or restored. The Technical Literature contains details of how Triboard wall and ceiling panels must be maintained.

Outbreak of Fire

11.1 Triboard wall and ceiling panels contain combustible components which must be protected from heat sources such as chimneys, solid fuel heaters and flues. Clearances from such heat sources specified in NZBC Acceptable Solution C/AS1 Part 9 may not be sufficient for some appliances to ensure that 50°C is not exceeded.

Spread of Fire

12.1 NZBC Acceptable Solution C/AS1 Part 6 requires that foamed plastics, such as EPS, which forms part of a wall must be protected from ignition by a flame barrier. Triboard wall panels, when joined with screw-fixed back-blocking or metal strips in accordance with details in the Technical Literature, will satisfy the NZBC Acceptable Solution C/AS1 Part 6 requirements for a flame barrier. EPS used for insulation must also meet the flame propagation criteria of AS1366 as required by NZBC Acceptable Solution C/AS1 Part 6, Paragraph 6.20.12(c) and Table 6.3.

12.2 There are no other external fire spread requirements for single unit detached housing up to two-storeys (Fire Purpose Group SH) built more than 1 m from the relevant boundary. Where less than 1 m from the relevant boundary, the fire requirements are given in NZBC Acceptable Solution C/AS1 Part 7.

External Moisture

13.1 Buildings must be designed such that aspects relating to external moisture comply with NZBC Clause E2. This is achieved by the building envelope being designed and constructed in accordance with NZBC Acceptable Solution E2/AS1.

Internal Moisture

14.1 Ventilation must meet the performance requirements of NZBC Clause G4.3.1, and thermal insulation must be provided in accordance with Clause 1.1.1 (a) of NZBC Acceptable Solution E3/AS1.

14.2 Some permanent ventilation, not reliant on window openings, must be provided in wet areas, such as bathrooms and laundries. Vented windows, wall or ceiling mounted extract fans, or similar fittings are recommended in all building wet areas. Extract fans for moisture laden air must be vented externally.

14.3 The incorporation of vented windows and other forms of permanent ventilation are recommended in all rooms to ensure adequate air circulation and to prevent the build-up of moisture levels.

14.4 In wet areas (where sanitary fixtures are installed), and in rooms where the walls are likely to be splashed, the surface of Triboard wall panels must be finished with an impervious lining which is easily cleaned. All joints must be impervious to water, and protection of the walls must be provided by extending

impervious floor membranes up the wall in accordance with the coved detail of NZBC Acceptable Solution E3/AS1 Figure 1.

Hazardous Building Materials

15.1 Although Triboard wall and ceiling panels are manufactured using melamine fortified urea formaldehyde adhesive, vapour emissions are minimal because the panels are encapsulated by a paint coating.

15.2 The degree of health hazard caused by vapour release will depend on the total amount of vapour released from all sources in the building including flooring and furniture, the ventilation rate and the degree of encapsulation provided by surface finishes, such as coatings and carpets. The permanent ventilation required and recommended to control moisture levels (see Internal Moisture) will also minimise any accumulation of formaldehyde gas.

Energy Efficiency

16.1 The Technical Literature provides options for meeting H1.3.1 and H1.3.2 and the wall thermal insulation requirements of Clause 1.1.1(a) of NZBC Acceptable Solution E3/AS1. These are based on several different wall insulation options, and conventional floor and roof space insulation. Compliance is achieved by meeting the minimum wall, floor and roof thermal insulation resistance (R) values for the schedule method of NZS 4218.

Installation Information

Installation Skill Requirements

17.1 Houses built using the Triboard Construction System are built by building contractors who have been approved by ACTRANZ. For ACTRANZ member contact details, see the Technical Literature.

Inspection

17.2 For inspection reference must be made to the Technical Literature, especially for confirmation of fixing types and spacings.

General

17.3 Triboard wall and ceiling panels must be constructed in accordance with the non-specific design information contained within the Technical Literature. The following is a summary of important aspects.

17.4 Triboard wall and ceiling panels must be inspected for water damage before, during and after installation and damaged panels repaired or replaced.

17.5 Particular care must be taken that the foundations and building platform are level and square and that perimeter dimensions are accurate. This is important as Triboard panels are accurately factory cut to size.

17.6 All timber framing including battens must have a moisture content of not more than 18% at the time of enclosure.

17.7 To minimise the use of temporary braces, the erection sequence for Triboard wall panels is best planned so that, during construction, the panels at right angles support each other. Checks for final location should be made before fixing Triboard wall panels into position.

17.8 Battens must be screw or nail-fixed in place in accordance with the details in the Technical Literature. Sometimes battens are fitted at the re-manufacturer's factory.

17.9 External walls must be connected to concrete floors by means of a galvanised steel angle, and by galvanised steel anchors fixed to the battens with galvanised nails. Anchors and fixings must be Grade 316 stainless steel in the sea spray zone, which is within 500 m of the coast or within 100 m of a harbour or estuary (refer to NZS 3604). The steel angle is screw-fixed to the Triboard wall panel and fixed to concrete floors using concrete nails. Battens are fixed to concrete floors using proprietary bottom plate anchors that are cast into the slab. With timber floor framing, Triboard wall panels and wall battens are nail-fixed to floor framing.

17.10 Internal Triboard wall panels are fixed to timber floors by skew nailing from both sides and to concrete floors via the galvanised steel angle using screws and concrete nails as for external Triboard wall panels.

17.11 All exposed pre-cut Triboard wall and ceiling panel edges are protected by a factory paint coating. It is important that any site cut, or site exposed, edges are similarly protected using the sealing paint supplied with the Triboard wall and ceiling panels.

17.12 Integral and separate Triboard lintel options are detailed in the Technical Literature. Lintels are strengthened either by the installation of an additional Triboard lintel panel section, or by installing mild steel plates between Triboard lintel panels to make flitch beams. Details are shown in the Technical Literature.

17.13 Triboard ceiling panels are temporarily supported on purpose built ceiling support frames. They are then nail-fixed to the top of walls and fixed together by a continuous screw-fixed galvanised steel strap or board cleat running parallel with and centred on the joint. Where the joint is parallel to a framing member and more than 150 mm away from it, the ceiling joint is supported by blocking between the framing members and by using a ceiling cleat near the joint.

17.14 After the ceiling has been installed, the roof trusses or the first floor framing are placed in position and fixed to the Triboard ceiling panels. The ceiling support frames are then removed.

17.15 First floor joists, roof trusses and Triboard ceiling panels must be supported by Triboard wall panels. Floor joists must be blocked at all wall supports. Blocking must be the same size as the joists. Blocking and joists at supports must be skew-nailed to the walls or lintels below.

17.16 Roof trusses must be restrained against wind uplift by using one of the hardware fixing options shown in the Technical Literature. Connections must be grade 316 stainless within the sea spray zone.

17.17 Roof and wall cladding should be installed as soon as practicable. Where Triboard wall and ceiling panels are exposed for longer than 14 days, waterproof covers such as tarpaulins must be provided to keep them dry.

Services

18.1 Electrical switch box holes are hole sawn or routed into Triboard wall panels after walls have been installed, and ducts are drilled to them from the appropriate panel edge. Wiring may be fed through the ducts, or fixed to the outside surface of external Triboard wall panels. PVC sheathed electrical cables must not come into contact with the EPS insulation. Where electrical cabling is located in recesses cut into the face of Triboard wall panels, vertical routing is recommended. Horizontal or diagonal recesses, particularly through the middle third height of the Triboard wall panels, should be avoided as this weakens the walls.

18.2 Plumbing and pipework is run through the foundation platform, where possible up behind or in fitted joinery, or through ducts mounted on the Triboard wall panel face.

Panel Finishing

20.1 Where a fine surface finish is required, surface sanding of the Triboard panels is recommended.

20.2 All dust should be removed from the surface of Triboard panels prior to applying a paint or paper finish.

Health and Safety

21.1 Suitable protective masks must be worn to prevent inhalation of dust resulting from cutting or working with the Triboard panels.

Basis of Appraisal

The following is a summary of the technical investigations carried out.

Tests

22.1 Tests have been carried out by Juken New Zealand Ltd at their Kaitaia Mill and at Gangnail New Zealand Ltd to establish characteristic strengths and stiffnesses of the wall and ceiling panels, the panel to panel connections, the batten to wall panel connection and the wall panel to floor connections. This work has been reviewed by BRANZ and found to be satisfactory.

22.2 Cyclic humidity tests were carried out by BRANZ to establish the durability of Triboard wall and ceiling panels.

Calculations

23.1 Calculations to justify the structural adequacy of the Triboard Construction System have been examined by BRANZ and found to be satisfactory.

Other Investigations

24.1 The satisfactory performance of Triboard wall and ceiling panels in New Zealand since 1987 has been recognised by BRANZ. BRANZ have inspected a number of Triboard panel houses up to 15 years old.

24.2 Site visits at various stages of construction, to assess installation methods and to examine completed installations, have been made by BRANZ.

24.3 Results of a formaldehyde monitoring investigation carried out by Paragon Health and Safety Ltd have been obtained. The results show that the air concentration of formaldehyde in a number of finished (closed up) houses is acceptable, being within the generally accepted indoor Air Quality Guidelines of 0.05 – 0.10 ppm.

24.4 The Technical Literature has been examined by BRANZ and found to be satisfactory.

Quality

25.1 The manufacture of Triboard wall and ceiling panels by Juken New Zealand Ltd has been examined by BRANZ, and details regarding the quality and composition of the materials used were obtained by BRANZ and found to be satisfactory.

25.2 The quality control systems of Juken New Zealand Ltd have been assessed and registered as meeting the requirements of ISO 9001:2000 by SGS International Certification Services Pty Ltd, Certificate number NZ03/052C, dated 11 February 2005.

25.3 The quality of the Triboard panels supplied by Juken New Zealand Ltd is their responsibility.

25.4 A re-manufacturer's factory operation for pre-cut house panels has been assessed by BRANZ.

25.5 Quality on-site is the responsibility of the building contractor.

25.6 The building contractor is responsible for the quality of installation of Triboard wall and ceiling panels.

25.7 Building owners are responsible for the maintenance of Triboard wall and ceiling panels and their connections in accordance with the instructions of Juken New Zealand Ltd.

Sources of Information

- AS 1366.3-1992 Rigid cellular plastic sheets for thermal insulation – Rigid cellular polystyrene - Moulded.
- AS/NZS 4266.15:1995, Reconstituted wood-based panels – methods of test – Method 15: Determination of formaldehyde (perforator method).
- NZS 3602:2003 Timber and wood based products for use in buildings.
- NZS 3604:1999 Timber framed buildings.
- NZS 4203:1992 General structural design and design loadings for buildings.
- NZS 4218:1996 Energy efficiency – housing and small building envelope.
- Approved Document for New Zealand Building Code External Moisture Clause E2, Building Industry Authority, 1992.
- New Zealand Building Code, Handbook and Approved Documents, Building Industry Authority, 1992.
- The Building Regulations 1992, up to and including April 2003 Amendment.
- World Health Organisation (WHO) Working Group on the Evaluation of Carcinogenic Risks to Humans, Wood Dust and Formaldehyde, 1995.

NZBC Acceptable Solution E2/AS1

References to NZBC Acceptable Solution E2/AS1 in this Certificate are to NZBC Acceptable Solution E2/AS1 Third Edition June 2004.



BRANZ

In the opinion of BRANZ, Triboard Construction System is fit for purpose and will comply with the Building Code to the extent specified in this Certificate provided it is used, designed, installed and maintained as set out in this Certificate.

The Appraisal Certificate is issued only to the Certificate Holder, Juken New Zealand Ltd, and is valid until further notice, subject to the Conditions of Certification.

Conditions of Certification

1. This Certificate:
 - a) relates only to the product as described herein;
 - b) must be read, considered and used in full together with the technical literature;
 - c) does not address any Legislation, Regulations, Codes or Standards, not specifically named herein;
 - d) is copyright of BRANZ.
2. The Certificate Holder:
 - a) continues to have the product reviewed by BRANZ;
 - b) shall notify BRANZ of any changes in product specification or quality assurance measures prior to the product being marketed;
 - c) abides by the BRANZ Appraisals Services Terms and Conditions.
3. The product and the manufacture are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ.
4. BRANZ makes no representation as to:
 - a) the nature of individual examples of, batches of, or individual installations of the product, including methods and workmanship;
 - b) the presence or absence of any patent or similar rights subsisting in the product or any other product;
 - c) any guarantee or warranty offered by the Certificate Holder.
5. Any reference in this Certificate to any other publication shall be read as a reference to the version of the publication specified in this Certificate.

For BRANZ

P Robertson
Chief Executive

Date of issue: 29 June 2005