



## BRANZ Appraised

Appraisal No.545[2007]

BRANZ Appraisals

Technical Assessments of products  
for building and construction

## BRANZ APPRAISAL No. 545 (2007)

Amended 16 April 2010

## LUMBERWORX I-BEAMS

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## Product

1.1 LumberworX I-Beams are fabricated from laminated veneer lumber (LVL) Radiata pine flanges and a plywood web. They are used as structural members such as floor joists, beams and rafters.



## Scope

- 2.1 LumberworX I-Beams have been appraised for use as floor framing (joists and blocking) and rafters in non-specific design situations – as an alternative to solid timber joist sections specified in NZS 3604, and in specific design floor and rafter applications.
- 2.2 LumberworX I-Beams come as both untreated and treated to hazard class H3.1, and may be used where these treatment levels are required by NZS 3602.
- 2.3 LumberworX I-Beam floor joists and rafters must be designed, installed, used and maintained in accordance with the LumberworX I-Beams Technical Literature.

## Building Regulations

### New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, LumberworX I-Beams if designed, installed, used and maintained in accordance with the statements and conditions of this Appraisal, will meet the following provisions of the NZBC:

**Clause B1 STRUCTURE:** Performance B1.3.1, B1.3.2 and B1.3.4. LumberworX I-Beams meet the requirements for loads arising from self-weight, imposed gravity loads arising from use, earthquake, snow, wind and creep and shrinkage [i.e. B1.3.3 (a), (b), (f), (g), (h) and (q)]. See Paragraphs 9.1 - 9.20.

**Clause B2 DURABILITY:** Performance B2.3.1 (a), not less than 50 years. The LumberworX I-Beams meet this requirement. See Paragraphs 10.1 and 10.2.

**Clause F2 HAZARDOUS BUILDING MATERIALS:** Performance F2.3.1. LumberworX I-Beams meet this requirement and will not present a health hazard to people. See Paragraphs 12.1 - 12.2.

## Technical Specification

### General

4.1 LumberworX I-Beams are composite structural members constructed of laminated veneer lumber (LVL) Radiata pine flanges pressed and adhered onto a plywood web. They are available in four depths, and are supplied in lengths from 3.0 to 9.6 m long in 600 mm increments. See Table 1 for details.

**Table 1: LumberworX I-Beam Properties**

LumberworX I-Beam <sup>(1)</sup>	Depth (mm) <sup>(2)</sup>	Flange width (mm) <sup>(3)</sup>
LIB 200.65	200	63
LIB 240.65	240	63
LIB 300.65	300	63
LIB 360.65	360	63
LIB 200.90	200	88
LIB 240.90	240	88
LIB 300.90	300	88
LIB 360.90	360	88

Tolerances:

<sup>(1)</sup> Crook of <1 mm per 1000 mm length

<sup>(2)</sup> -0 mm, 2.0 mm

<sup>(3)</sup> -1.0 mm, +1.0 mm

4.2 Both untreated and H3.1 treated LumberworX I-Beams are available. H3.1 treated LumberworX I-Beams are treated after fabrication.

4.3 Flange feed stock is laminated veneer lumber (LVL), which is manufactured from Radiata pine. Flanges are grooved on one wide face to accommodate the web. The LVL is manufactured to the requirements of AS/NZS 4357.0.

4.4 Webs are cut from 9 mm thick plywood manufactured from Radiata pine to AS/NZS 2269. The outer plies of the web have the grain running perpendicular to the flanges and the web sections are joined into long lengths using a resorcinol adhesive. Webs are tapered at the flange ends and press-fitted and adhered into the LVL flanges using a resorcinol adhesive.

4.5 Each LumberworX I-Beam is ink stamped with the product name, size, and date of manufacture.

### Packaging, Handling and Storage

5.1 LumberworX I-Beams leave the factory in packets of 25 beams wide, or less. The packets are wrapped in plastic and strapped to bearers with metal straps.

5.2 LumberworX I-Beams should be protected from the weather but in any event must not be exposed to the weather for more than six weeks. This period includes any time the LumberworX I-Beams are unprotected during transportation, storage and building construction.

5.3 LumberworX I-Beams must be transported, carried and stored with the web in a vertical position. Care must be taken during handling and storage to avoid damage to the beams. For long-term storage, LumberworX I-Beams must be kept dry in well-ventilated conditions, off the ground on evenly spaced timber bearers (or dunnage). For short-term exterior storage (up to one month), LumberworX I-Beams may be left in their plastic wrapping.

## Technical Literature

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

## Design Information

### General

7.1 This Appraisal covers the use of LumberworX I-Beams as floor joists and rafters in enclosed environments above ground and when loading is applied in the direction parallel to the web and perpendicular to the flanges. They are designed for floor systems carrying distributed loads and light concentrated loads applied to the top flange and as rafters. The lower flanges of the LumberworX I-Beams are able to support small loads such as those associated with normal domestic services and ceilings.

7.2 The use of LumberworX I-Beams is by specific or non-specific design in accordance with the requirements of the LumberworX I-Beam Technical Literature. See Section 6.1.

7.3 Typical floor framing details are given in the Technical Literature including blocking options, details for the support of load bearing walls and details of cantilevered floor joists for balconies and cantilevers which support load bearing walls. A number of connection options mainly based on joist hangers are given.

7.4 Where floor sheeting is adhesive and nail-fixed to LumberworX I-Beams and is intended to be part of a diaphragm, the diaphragm must be subject to specific design as the ductility of the system will be different from that assumed for diaphragms constructed in accordance with NZS 3604.

7.5 LumberworX I-Beam rafters can be used for flat and skillion type roofs. Typical rafter layout details are given in the Technical Literature including blocking details.

7.6 LumberworX I-Beams will arrive on site with a typical flange moisture content range of 12 to 18%. They will not shrink in the same manner as wet solid timber; therefore care is needed to avoid problems of differential movement when using different materials.

7.7 For moisture control, the buildings must meet the performance requirements of NZBC Clauses E1, E2 and E3. In dry interior environments, untreated LumberworX I-Beams may be used. Untreated LumberworX I-Beams must not be exposed to in-service conditions that would result in the moisture content of the flanges exceeding 18% (from either internally or externally generated moisture). In all installations LumberworX I-Beams must be protected from direct wetting and high humidity which may lead to excessive moisture content. Direct wetting is likely to occur in buildings with large openings such as garages or warehouses. High humidity will occur in spa rooms and saunas. Untreated LumberworX I-Beams are not intended for use in subfloor situations or exposed to ground atmosphere. In these areas H3.1 treated LumberworX I-Beams must be used. Where treated LumberworX I-Beams extend beyond the wall of the structure, e.g. in cantilevered balconies or roofs, suitable claddings and/or linings and associated fittings must be used to enclose LumberworX I-Beams.

7.8 Other means to control moisture, e.g. ventilation, insulation, vapour barriers etc, must also be considered at the design stage and specified where required or where deemed appropriate, for the application. These moisture control measures have not been assessed and are outside the scope of this Appraisal.

7.9 All claddings, linings and associated fittings used to enclose LumberworX I-Beams must be fit for purpose and must meet the relevant requirements of the NZBC. Such claddings and/or linings have not been assessed and are outside the scope of this Appraisal.

7.10 LumberworX I-Beams must not be exposed to continuous high local temperatures, such as from heat flues or chimneys. Suitable spacing and/or protection should be used where these items are in close proximity to LumberworX I-Beams. These methods have not been assessed and are outside the scope of this Appraisal.

7.11 In rafter applications LumberworX I-Beam flanges must be separated from the roof cladding by purlins or tile battens. BRANZ recommends the use of ridge and eave vents where LumberworX I-Beam rafters are installed.

## Services

8.1 The LumberworX I-Beam Technical Literature provides rules for the size and location of circular and rectangular penetrations in LumberworX I-Beam webs to accommodate services such as electrical wiring and plumbing. These penetrations, while reducing the shear capacity, will still meet beam shear requirements where the LumberworX I-Beams are used as a direct substitute for solid sections in NZS 3604 or as per the tables in the Technical Literature (see Paragraph 6.1). Penetrations beyond these rules have not been assessed and are outside the scope of this Appraisal.

## Structure

9.1 LumberworX I-Beams may be incorporated into buildings through either non-specific design under NZS 3604 or through specific engineering design. When non-specific design is used, all aspects of NZS 3604 with regards to blocking and lateral support must be followed.

### Non specific design:

9.2 **Floors:** LumberworX I-Beams may be used as a direct substitute for the same depth solid Radiata pine timber joist sections specified in NZS 3604, for uniformly distributed floor loads up to 3 kPa (see Table 2). The LumberworX I-Beam support fixings and supporting structure shall be in accordance with NZS 3604.

**Table 2: NZS 3604 Table 7.1 (a) and (b) and Table 14.8 VSG 10 and MSG 10 Substitution**

**(This Table does not cover cantilevered floor joists, which must be subject to specific design.)**

NZS 3604 Joist Size (mm)	LumberworX I-Beam Suitable Substitution
190 x 45	LIB 200.65 & LIB 200.90
240 x 45	LIB 240.65 & LIB 240.90
290 x 45	LIB 300.65* & LIB 300.90

\* This beam size will match the NZS 3604 requirements when standard timber flooring is used (up to 40 kg/m<sup>2</sup>), but may not meet this requirement for heavier overlay materials such as a mortar bed with a tile or slate floor. Refer to the Technical Literature for more detail.

9.3 Where walls are supported by LumberworX I-Beams at supports, LumberworX I-Beam squash blocks may be required, but no web stiffeners are required. Refer to the Technical Literature.

9.4 Where posts and trimmer studs are supported over LumberworX I-Beams at supports, both LumberworX I-Beam squash blocks and web stiffeners may be required. The necessary details are given in the Technical Literature.

9.5 Lateral support of LumberworX I-Beams to meet Clause 7.1.2.3 of NZS 3604 is not required.

9.6 LumberworX I-Beams are able to support concentrated loads applied to the top or bottom flange. This situation must be assessed as part of a specific design using the design information in the LumberworX I-Beam Technical Literature.

9.7 **Roofs:** LumberworX I-Beams may be used as a direct substitute for the same depth solid Radiata pine timber rafter sections specified in NZS 3604, Table 10.2 for VSG 10 and MSG 10 providing that the spans given in Table 4 of the Technical Literature are greater than those given in Table 10.2 of NZS 3604. If the spans in Table 4 of the Technical Literature are less than those given in Table 10.2 of NZS 3604 then specific engineering design is required. Table 4 in the Technical Literature gives LumberworX I-Beam spans for light and heavy roofs for each of the Building Wind Zones of NZS 3604 and for 0.5 kPa and 1.0 kPa snow loads. The Tables allow for maintenance loads but not pedestrian traffic.

9.8 The rafter spans given in the table in the Technical Literature require a ceiling or rigid soffit to be direct fixed to the underside of the rafters, or to battens that are direct fixed to the underside of the rafters.

9.9 LumberworX I-Beam rafters must be seated with a pitching plate (wedge) on wall plate supports. To prevent roll-over, rafter ends must be torsionally restrained at supports. The Technical Literature shows a blocking detail to achieve this. Stiffeners are also required as supports and at the fascia. Details for these items are also given in the Technical Literature.

9.10 Ridge beams, hip and valley rafters and their connections shall be subject to a specific design. The Technical Literature contains guidance on proprietary joist hangers which may be used to connect LumberworX I-Beam rafters to these members.

### Specific design:

9.11 The structural performance of LumberworX I-Beams relies on adequate lateral support of the compression flanges. LumberworX I-Beam floor joists have this provided by the floor sheet material and LumberworX I-Beam rafters have this provided by blocking for wind uplift and purlins or tile battens for gravity loads.

9.12 The specific design of LumberworX I-Beams shall be carried out by a suitably qualified structural design engineer in accordance with AS/NZS 1170, NZS 3603 and the design information given in the LumberworX I-Beam Technical Literature. The design information includes bending moment and shear capacities, deflection as a function of flexural and shear rigidities (where creep is allowed for by using a factor  $k_2 = 2.0$ ), characteristic bearing capacities and capacities and details for web stiffening. The design must take account of the beams themselves and the connections and the supporting structure, which are outside the scope of this Appraisal.

9.13 When using NZS 3603 as part of a specific design process, no allowance should be made for load sharing, as LumberworX I-Beams are less variable than solid timber sections, i.e.  $k_4 = k_5 = k_6 = 1.0$ .

9.14 LumberworX I-Beam ends must be torsionally restrained by means of end blocking or continuous solid section boundary joists. The LumberworX I-Beam Technical Literature has the details for non-specific design. For specific design cases, guidance is given but the requirements must be determined as part of the specific design.

9.15 LumberworX I-Beams used as rafters must have their flanges checked for lateral stability. Stability to the top flange may be provided by purlins and to the bottom flange by blocking or strap bracing. The Technical Literature has the details.

9.16 Concentrated loads, including in-span wall loads and all loads at supports shall be subject to a specific design using the information in the LumberworX I-Beam Technical Literature.

9.17 The LumberworX I-Beam Technical Literature provides guidance for connections for LumberworX I-Beam floor joists. A suitably qualified structural design engineer shall verify that the specified connections will meet the design requirements for the LumberworX I-Beams and that the supporting structure has adequate stiffness and strength. When supported by other beam systems, the vibratory response and deflection of the total system must be considered.

9.18 LumberworX I-Beams used as long-span floor joists may give rise to vibrations due to impact or dynamic loading, such as movement of people, plant, machinery and appliances. This may be accentuated where limited or no in-floor blocking is provided within the span, or limited or no in-span partitioning exists. Whether the dynamic response of floors is acceptable or not is related to personal perception. LumberworX I-Beam floor joists used as a direct substitute for the solid joist sections in NZS 3604 have a fundamental frequency greater than 8 Hertz and a maximum deflection of 2 mm under a concentrated 1.0 kN load at mid-span. The span tables in the Technical Literature are also based on these criteria. LumberworX I-Beams that have been subject to a specific design using the beam properties given in the Technical Literature should also at least meet these requirements.

9.19 Flooring associated with plant and machinery, and specialist floors which fulfil some function over and above the Building Code's performance requirements have not been assessed and are not covered by this Appraisal. These floors should be designed to deflection and vibration criteria agreed by the designer and other interested parties.

#### **Load Bearing Cantilevers**

9.20 Load bearing cantilevers must be designed according to the instructions and span tables given in the Technical Literature.

#### **Durability**

10.1 LumberworX I-Beams, if designed, installed and maintained in accordance with the requirements of the Technical Literature and this Appraisal, will have a durable life of at least 50 years

10.2 The long-term durability of LumberworX I-Beams used in buildings which are infested with borer cannot be assured. If infestation is found, all affected timber must be removed and the remaining timber treated with an appropriate chemical. For these applications H3.1 treated LumberworX I-Beams must be used.

#### **Maintenance**

11.1 If LumberworX I-Beams are installed as directed by this Appraisal then no maintenance will be required, other than that required by the cladding, lining or paint coating manufacturers, or should borer infestation occur.

#### **Hazardous Building Materials**

12.1 Formaldehyde gas will be emitted into the building from the phenol-resorcinol-formaldehyde resins used in the manufacture of the LumberworX I-Beams. The level of this emission will be small compared with the level of formaldehyde emission from other materials. The potentially hazardous nature of formaldehyde is recognised. However, if an adequate level of ventilation is provided in accordance with NZBC Acceptable Solution E3/AS1, Paragraph 1.2, or in accordance with the relevant requirements of NZBC Acceptable Solution G4/AS1, the provisions of F2.3.1 will be met.

12.2 The level of formaldehyde emission will decrease with time, and in the long-term will result in negligible formaldehyde emissions from the LumberworX I-Beams.

## **Installation Information**

### **General**

13.1 LumberworX I-Beams must be installed in accordance with the statements and conditions of this Appraisal and the LumberworX I-Beam Technical Literature.

13.2 Hardware associated with joist support connections, such as joist hangers, must be installed in accordance with the hardware manufacturers' instructions.

13.3 LumberworX I-Beams are lighter than solid timber equivalents and are therefore more easily handled. The joists are easily cut to length using conventional wood working tools and the flanges are wide and easily nailable for the fixing of flooring and ceiling materials.

13.4 LumberworX I-Beams should be protected from wetting during construction. In any event they must not be exposed to the weather for more than six weeks. Once the building has been closed-in, LumberworX I-Beams must be allowed to dry to a maximum moisture content of 18% prior to fixing ceiling linings, or to the moisture content specified by the lining material manufacturer, whichever is less.

13.5 As LumberworX I-Beams have no camber they may be installed either way up.

13.6 Temporary bracing should be provided to keep the LumberworX I-Beams in a straight and plumb position and to avoid instability during installation.

13.7 Any web stiffeners, blocking and packing must be installed in accordance with the details in the LumberworX I-Beam Technical Literature.

13.8 LumberworX I-Beams must only be cut and have holes made in the webs, in accordance with the LumberworX I-Beam Technical Literature. Associated trades people must be made aware of this requirement.

13.9 Do not use LumberworX I-Beams if the flanges or web have been damaged.

## **Basis of Appraisal**

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

### **Tests**

14.1 Structural testing was carried out by BRANZ Limited, in accordance with the American Society for Testing and Materials Standard (ASTM) D5055-02. The following tests were carried out on beams of all depths:

- Long span bending tests to determine stiffness and ultimate strength.
- Short span bending tests to determine shear capacity.
- Long span bending tests to determine shear stiffness and capacity with a variety of holes cut in the web.
- Bearing and crushing tests to determine concentrated load capacity.

14.2 The following adhoc testing was also carried out by BRANZ Limited:

- Tension tests to determine load required to pull the flange vertically from the web.
- Vibration testing.

## Other Investigations

15.1 The LumberworX I-Beam Technical Literature has been reviewed by BRANZ and found to be satisfactory.

15.2 Existing data relating to the durability of timber and adhesives in the specified environments was examined and found to be satisfactory.

## Quality

16.1 The manufacture of LumberworX I-Beams has been examined by BRANZ and found to be satisfactory.

16.2 Quality assurance procedures in place for the manufacture of LumberworX I-Beams, including process and quality control documentation and verification testing, have been assessed by BRANZ and found to be satisfactory.

16.3 Details of the quality and composition of materials used were obtained and found to be satisfactory.

16.4 Lumberworx Ltd are responsible for the quality of the LumberworX I-Beams supplied.

16.5 Designers are responsible for the design of the building and incorporating the LumberworX I-Beams in accordance with the Technical Literature.

16.5 Quality on the site is the responsibility of the installer.

## Sources of Information

- AS/NZS 1170 Structural design actions.
- AS/NZS 2269:2004 Plywood - Structural.
- AS/NZS 4357.0:2005 Structural laminated veneer lumber - Specifications.
- ASTM D5055:2002 Standard specification for establishing and monitoring structural capacities of prefabricated wood I joists.
- NZS 3602:2003 Timber and wood-based products for use in building.
- NZS 3603:1993 Timber structures standard.
- NZS 3604:1999 Timber framed buildings.
- New Zealand Building Code Handbook and Approved Documents, Building Industry Authority, 1992.
- The Building Regulations 1992, up to and including October 2004 amendment.

### Amendment No. 1, dated 17 March 2008.

The Appraisal has had Paragraph 9.5 amended.

### Amendment No. 2, dated 24 April 2009.

This Appraisal has been amended to update the reference from NZS 4203 to AS/NZS 1170.

### Amendment No. 3, dated 16 April 2010.

This Appraisal has been amended as flange sizes have changed.



# BRANZ

In the opinion of BRANZ, LumberworX I-Beams are fit for purpose and will comply with the Building Code to the extent specified in this Certificate provided they are used, designed, installed and maintained as set out in this Certificate.

The Appraisal Certificate is issued only to the Certificate Holder, Lumberworx 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: 22 March 2007