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Legacy report on the 2000 International Building Code®, the 2000 International Residential Code®, the 2002 Accumulative Supplement to the International Codes™, the BOCA® National Building Code/1999, the 1999 Standard Building Code®, and the 1997 Uniform Building Code™

DIVISION: 06—WOOD AND PLASTICS
Section: 06500—Structural Plastics

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1.0 SUBJECT

XTENDEX and E-Deck Composite Decking & Guardrail Systems

2.0 PROPERTY FOR WHICH EVALUATION IS SOUGHT

- 2.1 Structural Performance
2.2 Durability
2.3 Surface Burning Characteristics

3.0 DESCRIPTION

3.1 General

The material composition for the decking and guardrail system is approximately 40% of virgin HDPE (High Density Polyethylene) and 60% of natural cellulose-based fiber (rice husks). Additional additives such as coupling agents, colorings and UV stabilizers are added to improve the physical properties (structural strength and impact resistance) and provide different stable colors. The "XTENDEX™" products are manufactured by a continuous extrusion process in accordance with the manufacturer's Quality Control manual, producing engineered hollow profiles comparable to conventional sawn lumber-sized profiles.

"XTENDEX™" and "E-Deck" composite Decking and Guardrail systems are manufactured by Carney Timber Company at their plant located in Barrie, Ontario.

3.2 Decking Boards

The 5/4 Decking System is a board with 4 hollow cavities and grooved beveled edges. The groove allows for the use of "XTENDEX™" or "E-Deck" Hold Down Clips and provides for invisible fasteners. The 5/4 boards are 1-1/4 inches thick and 5-3/8 wide. The deck is finished by using an "XTENDEX™" or "E-Deck" Edge Trim to cover the cavity openings and

grooves around the edge of the deck. The 5/4 board can also be used for a stair tread with stringers spaced not more than 12 inches on center.

The 2x6 Decking System is a board with 4 hollow cavities and rectangular shape. The 2x6 boards are 1-1/2 inches thick and 5-1/2" wide. The deck is finished by using "XTENDEX™" or "E-Deck" End Caps and/or 1x6 (1x8) fascia profiles to cover the cavity openings around the edge of the deck. The "XTENDEX™" or "E-Deck" Edge Trim can be used for the same purpose. The 2x6 board can also be used for a stair tread with stringers spaced not more than 16 inches on center.

3.3 Guardrail Components

The "XTENDEX™" guardrail system is made up of several parts and can be constructed in two different systems, Type 1, and 2. Type 1 has a 2x6 top rail and 2x4 bottom rail attached to steel reinforced 5x5 post in front with 2x2 pickets (both ends cut at a 45° angle and capped) attached to the top and bottom rail, spaced at no more than 4 inches apart. Flat or peaked post caps are used to cover the top of each 5x5 post. Type 2 has 2x6 board flat over the 5x5 post+2x4 notched into the 5x5 post top rail and 2x4 mounted on rail brackets bottom rail with 2x2 pickets (both ends cut at 45° angle and capped or straight without caps) attached to the top & bottom rail, spaced at no more than 4 inches apart.

"XTENDEX™" and "E-Deck" 5x5 Post: The post has nine hollow cavities in three different dimensions. The actual size is 4-9/16 x 4-9/16 inches. The post is covered with either a peaked or flat "XTENDEX™" or "E-Deck" 5x5 Cap or a 2x6 top plate. In both guardrail systems Type 1 & Type 2 the 5x5 post is reinforced with a steel tube.

"XTENDEX™" and "E-Deck" 2x2 Picket: The pickets are nominal 2x2 hollow sections or actual size of 1-5/8 inches by 1-5/8 inches. The ends of each picket can be covered with a 45° cap.

"XTENDEX™" and "E-Deck" 2x4 Board: The 2x4 boards are hollow members with two cavities with actual dimensions of 3-1/2 inches by 1-1/2 inches. These boards are used as both top (Type 2) and bottom rails (Type 1 & 2).

"XTENDEX™" and "E-Deck" 2x6 Board: The 2x6 boards are hollow members with four cavities with actual dimensions of 5-1/2 inches by 1-1/2 inches. These boards are the same as the deck board and are used as top plates/rail in both Type 1 & Type 2 systems.

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“XTENDEX™” and “E-Deck” 1x6 Board: The 1x6 boards are hollow members with four cavities with actual dimensions of 5-1/2 inches by 3/4 inches. These boards are used as fascia boards and are mounted over the deck band.

“XTENDEX™” and “E-Deck” 1x8 Board: The 1x8 boards are hollow members with five cavities with actual dimensions of 7-1/2 inches by 3/4 inches. These boards are used as fascia boards and are mounted over the deck band.

“XTENDEX™” and “E-Deck” 1-1/2"x1-1/2"x0.065" (16 ga) Galvanized Reinforcing: The 1-1/2x1-1/2x16Ga - 30" long galvanized reinforcing is a steel tube made from 45-ksi steel (ASTM A500) and is used in the 5x5 post.

“XTENDEX™” and “E-Deck” 1"x1"x0.065" (16 gauge) Galvanized Reinforcing: The 1x1x16Ga - reinforcing is a steel tube made from 45-ksi steel (ASTM A500) and is used in the 2X6 top rail in Type 1.

3.4 Durability

“XTENDEX™” and “E-Deck” Decking and Guardrail Systems have been tested in accordance with ASTM D1413-76 and ASTM D3345-74 for termite and fungus. “XTENDEX™” has also been tested in accordance with ASTM G155-00 for accelerated aging (2000 hrs.) and exposure to UV.

3.5 Surface Burning Characteristics

“XTENDEX™” and “E-Deck” Decking and Guardrail Systems were tested for surface burning characteristics under ASTM E 84 and demonstrated a flame spread index (FSI) of 104 and a smoke development index (SDI) of 1597.

3.6 Coefficient of Friction

“XTENDEX™” and “E-Deck” Decking Systems were tested in accordance with ASTM D2394. See Table 3, at the end of the report, for static coefficient of friction values. The appropriateness of the determined static coefficient of friction, with respect to the requirement for slip-resistance in the applicable code, is subject to the specific approval of the code official.

4.0 INSTALLATION

4.1 General

“XTENDEX™” and “E-Deck” Decking System and “XTENDEX™” and “E-Deck” Guardrail System shall be installed over a conventional pressure treated wood substructure, which is not in the scope of this evaluation.

Installation shall comply with the manufacturer's published instructions and this report. The manufacturer's published installation instructions shall be made available to the code official upon request, and shall be available on the job site during construction.

4.2 Deck Board

Xtendex™ and “E-Deck” Deck boards shall be installed at span no greater than listed in Table 1 below. Xtendex™ and “E-Deck” 5/4 Deck Boards are attached to the framing using Xtendex™ or “E-Deck” hold down clips and #6x1-1/2" wood screws. Xtendex™ and “E-Deck” 2x6 boards are attached to the framing using #8x2-1/2" wood screws.

TABLE 1^{1,2,3,4,5,6}
XTENDEX™ DECKING SPAN CHART

MEMBER SIZE (inches)	MAXIMUM UNIFORM LIVE LOAD (130°F)	MAXIMUM UNIFORM LIVE LOAD (130°F)
	60 psf	100 psf
	Maximum Member Span Between Supports	Maximum Member Span Between Supports
5/4 Decking Board	16 inches	16 inches
2x6 Decking Board	24 inches	16 inches

Notes:

- The spans and decking sizes indicated in this table are recommendations by the manufacturer that are to be used in lieu of application-specific calculations.
- Values indicated in this table are recommended maximum center-to-center joist spacing for XTENDEX™ or “E-Deck” Decking. Values are based on a fully loaded two (2) span continuous condition engaging three (3) joists. Decking shall be securely fastened to each joist.
- The maximum span of 12 inches for 5/4 boards and 16" for 2 x 6 boards between stringers is allowed in case decking boards are used as a stair tread.
- Recommended span is based on a maximum deflection of L/360.
- All decking members shall be installed flatwise.
- SI units conversion: 1 psf = 49 Pa, 1 inch = 25.4 mm, 1 ft. = 0.3m.
- The allowable values are based on use at a maximum air temperature of 130 degrees F.

4.3 Guardrail Assemblies

Type 1 Guardrail

Top Rail Design:

Xtendex or E-Deck 2x6 top rail, edgewise, continuous beside the post, reinforced with one metal tube (1"x1"x16 gauge). Top rail fastened to post using six #10x3-1/2" deck screws.

In-Fill:

Xtendex or E-Deck 2x2 balusters, 5-1/2 inches on-center, fastened to 2x4 top and bottom rail with two #8x2-1/2" wood screws.

Bottom Rail:

Xtendex or E-Deck 2x4 rail, edgewise, continuous beside posts, reinforced with one metal tube (1x1x16 gauge). Bottom rail fastened to posts using four #10x3-1/2" deck screws.

Posts:

Xtendex or E-Deck 5x5 post, 5'-4" on-center, reinforced with one 1-1/2"x1-1/2"x30" 16 gauge metal tube, fastened to frame with two 5/16 inch by 8 inch carriage bolts.

Type 2 Guardrail

Top Rail Design:

Xtendex or E-Deck 2x6 top rail, flatwise, continuous over posts, fastened to 2x4 rail with #8x2-1/2" at 12 inches on center maximum deck screws. Xtendex 2x4 top rail, vertical, notched into post and fastened with two #8x2-1/2 inch deck screws into each post.

In-Fill:

Xtendex or E-Deck 2x2 balusters, 5-1/2 inches on-center, fastened to 2x4 top and bottom rail with two #8x2-1/2" wood screws.

Bottom Rail:

Xtendex or E-Deck 2x4 rail, edgewise, fastened to posts using Xtendex or E-Deck bracket with two #10x3-1/2" deck screws.

Posts:

Xtendex or E-Deck 5x5 post, 5'-4" on-center, reinforced with one 1-1/2"x1-1/2"x30" 16 gauge metal tube, fastened to frame with two 5/16 inch by 8 inch carriage bolts.

TABLE 2^{1,2,3,4,5}
XTENDEX™ GUARDRAIL CHART

MAXIMUM SECTION SPAN AND HEIGHT BETWEEN SUPPORTS	MAXIMUM LIVE LOAD (130°F)
5' - 4" wide by 42" high	200 psf In-field
	200 lbs Concentrated Mid-point Top Rail
	50 plf Horizontally and 100 plf Vertically

Notes:

- The spans indicated in this table are recommendations by the manufacturer that are to be used in lieu of application-specific calculations.
- Values indicated in this table are recommended maximum span for XTENDEX™ or E-Deck Railing System Type 1 & Type 2. Values are based on a fully loaded guardrail mounted to XTENDEX™ or E-Deck 5x5 post reinforced with a 1-1/2 inch by 1-1/2 inch 16 gauge, galvanized steel tube 30 inches long. Each 2x2 baluster is attached to the top and bottom rail using 2 #8x2-1/2 inch deck screws on both ends of each baluster. Installation of the post, top and bottom rail and pickets for both Type 1 & Type 2 Guardrail systems are shown in XTENDEX™ or E-Deck Installation Guide.
- Recommended span is based on a maximum deflection recovery of 75% or higher.
- SI units conversion: 1 psf = 49 Pa, 1 inch = 25.4 mm, 1 ft. = 0.3m.
- The allowable values are based on use at a maximum air temperature of 130 degrees F.

4.4 Uplift

Xtendex™ and E-Deck Deck boards have been tested for wind uplift and has the following uplift rating when installed using fasteners as indicated in Section 4.2 of this report. Xtendex™ and E-Deck 5/4 Deck Boards have an uplift capacity of 80 psf and the Xtendex™ and E-Deck 2x6 Deck Boards have an uplift capacity of 200 psf.

5.0 IDENTIFICATION

XTENDEX™ and E-Deck Composite Decking & Guardrail System shall be permanently identified with the manufacturer's name and address, the product name,

manufacturing location, the name or logo of the third party inspection agency (ITS NA Ltd.), and this ICC-ES Legacy report number.

6.0 EVIDENCE SUBMITTED

- Quality control manual, prepared in conjunction with Intertek Testing Services and signed by representatives of Intertek Testing Services and Composite Building Products International, Inc., dated August, 2002.
- XTENDEX™ Installation Guide dated March 2003, and drawings.
- Test report on XTENDEX™ Decking Board and Guardrail Components prepared by Cambridge Materials Testing Limited, Report No. 316650-02-Final, dated February 27, 2003, signed by Jill Cook and Chris Clegg, in accordance with the following test standards,
 - ASTM D-256-00 Izod Pendulum Impact Resistance of Notched Specimens of Plastic.
 - ASTM D-790-02 Flexural Properties of Unreinforced and reinforced Plastic and Electrical insulation Material.
 - ASTM D-792-00 Specific Gravity (Relative Density) and Density of Plastic by Displacement.
 - ASTM D-1413-99 Wood Preservatives by Laboratory Soil-Block Cultures.
 - ASTM D-2017-81(1994) Accelerated Laboratory Test of Natural Decay Resistance of Woods
 - ASTM D-2394-83 (1999) Simulated Service Testing of Wood and Wood Base Finish Flooring.
 - ASTM D-3345 (1999) Laboratory Evaluation of Wood and Other Cellulosic Materials for Resistance to Termites.
 - ASTM D-6109-97 Flexural Properties of Unreinforced and Reinforced Plastic Lumber.
 - ASTM D-6111-97 Bulk Density and Specific Gravity of Plastic Lumber and Shapes by Displacement.
 - ASTM D-6117-97 Mechanical Fasteners in Plastic Lumber
 - ASTM D-6341-98 Determination of the Linear Coefficient of Thermal Expansion of Plastic Lumber and Plastic Lumber Shapes.
 - ASTM E-84-01 Surface Burning Characteristics for Building Materials
 - ASTM G-155-00 Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials
 - Section 1714.3.1 Pre-Construction Load Test, 2000 International Building Code.
- Test report on mechanical fasteners prepared by Cambridge Materials Testing Limited, Laboratory No. 293183-01 Revised, dated December 6, 2001, signed by Frank Mangiardi and Derek Wild, in accordance with the following test standards,
 - ASTM D-6117 Mechanical Fasteners in Plastic Lumber and Shapes
 - ASTM D-953 Bearing Strength of Plastic
 - ASTM D-6435 Shear Properties of Plastic Lumber and Shapes
- Test report on XTENDEX™ Guardrail Components - Flexural Properties prepared by Cambridge Materials Testing Limited, Report No. 328840-03, dated April 2, 2003, signed by Jill Cook and Chris Clegg.
- Letter prepared by Cambridge Materials Testing Limited and ULC, discussing flame spread testing;

- Cambridge Material Testing letter dated April 1, 2003, signed by Joe DeRose
 - ULC letter dated March 27, 2003; signed by Stanis Yu, and G. Abbas. Nanji, P.E.
- 6.7 Structural analysis of decking and rail profiles, dated December 3, 2002, by Peter Simko, P.E.
- 6.8 Structural analysis of temperature adjustments for stair treads, dated June 22, 2003, by Peter Simko, P.E.
- 6.9 Structural analysis of uplift on both 5/4 and 2x6 boards, dated June 12, 2003, by Peter Simko, P.E.
- 6.10 Structural analysis of 2x6 boards, dated July 8, 2003, by Peter Simko, P.E.
- 6.11 Test report on XTENDEX™ Decking Board - Coefficient of Friction prepared by Cambridge Materials Testing Limited, Report No. 336092-03, dated July 22, 2003, signed by Frank Mangiardi and Chris Clegg.
- 6.12 Test report on XTENDEX™ Decking Board - Coefficient of Friction prepared by Cambridge Materials Testing Limited, Report No. 339534-03, dated August 27, 2003, signed by Frank Mangiardi and Chris Clegg.

7.0 CONDITIONS OF USE

The ICC-ES Subcommittee for the National Evaluation Service finds that XTENDEX™ and E-Deck Composite Decking & Guardrail System as described in this report complies with or is a suitable alternate to that specified in the 2000 *International Building Code*® with 2002 *Accumulative Supplement to the International Codes*™, BOCA® *National Building Code/1999*, the 1999 *Standard Building Code*®, the 1997 *Uniform Building Code*™, and the 2000 *International Residential Code*® with 2002 *Accumulative Supplement to the International Codes*™ subject to the following conditions:

- 7.1 XTENDEX™ and E-Deck Composite Decking & Guardrail System shall not be used as a component of trusses or structural diaphragms, and shall not be used in interior framing applications for decking, flooring, joists, rafters, studs, beams, columns, or posts.
- 7.2 The design and installation of XTENDEX™ and E-Deck Composite Decking & Guardrail System shall be in accordance with the manufacturer's published installation instructions and this report.
- 7.3 Use of XTENDEX™ and E-Deck Composite Decking & Guardrail System for structural applications other than those described in Tables 1 and 2 of this report is beyond the scope of this report.

Any allowable designs used in the structural calculations are outside the scope of this evaluation report.

- 7.4 The maximum spans of XTENDEX™ and E-Deck decking and railing shall comply with **Table 1 & 2** of this report.

The design values listed in **Table 1 & 2** of this report are for loads of a normal load duration and are applicable to either dry or wet conditions of use. The design values are applicable in uses up to a temperature not exceeding 130° F (54.4° C).

Adjustment factors in NDS-97 and applicable Codes shall not adjust the Values in **Table 1 & 2**, unless

increasing the load duration. The allowable values are applicable in uses up to a temperature of 130° F (54.4° C).

- 7.5 Each piece of XTENDEX™ and E-Deck shall bear a brand, stamp, or label with the information identified in Section 5.0 of this report.
- 7.6 Allowable capacity of fasteners installed in XTENDEX™ and E-Deck shall comply with Section 3.2.2 of this report.
- 7.7 XTENDEX™ and E-Deck shall be limited to use with building types where the use of combustible material is permitted. XTENDEX™ and E-Deck shall not be used as a component of heavy timber construction.
- 7.8 XTENDEX™ and E-Deck decking shall be gapped to permit adequate drainage in accordance with the manufacturer's instructions. XTENDEX™ and E-Deck shall not be attached to any solid surface or water-tight flooring systems, such as sheathing, waterproof membranes, concrete, roof decks or patios.
- 7.9 XTENDEX™ and E-Deck shall be fastened directly to floor joists having adequate strength and stiffness.
- 7.10 If the use and installation of XTENDEX™ and E-Deck Composite Decking & Guardrail System conflicts with this evaluation, this evaluation is null and void.
- 7.11 Design calculations and details for specific applications, which address the ability of the supporting construction to resist all imposed loads required by the applicable code, shall be furnished to the code official verifying compliance with this report and the applicable code. The individual preparing such documents shall possess the necessary credentials regarding competency and qualifications as required by the applicable code and the professional registration laws of the state where the construction is under taken.
- 7.12 This report is subject to periodic re-examination. For information on the current status of this report, consult the ICC-ES website.

TABLE 3
XTENDEX™ AND E-DECK DECKING
STATIC COEFFICIENT OF FRICTION

SOLE & ORIENTATION	DECK MATERIAL	STATIC COEFFICIENT OF FRICTION DRY	STATIC COEFFICIENT OF FRICTION WET
Sole Leather Longitudinal	Fine Grain	0.0359	0.405
	Wood Grain	0.300	0.376
	Wood	0.723	0.891
Sole Leather Transverse	Fine Grain	0.396	0.552
	Wood Grain	0.379	0.499
	Wood	0.721	0.859
Sole Rubber Longitudinal	Fine Grain	0.604	0.580
	Wood Grain	0.346	0.411
	Wood	0.884	0.842
Sole Rubber Transverse	Fine Grain	0.813	0.701
	Wood Grain	0.568	0.582
	Wood	0.944	0.902