Listing and Technical Evaluation Report™

A Duly Authenticated Report from an Approved Agency

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Bedford® Industries PolyScape® Engineered Plastic Lumber

Trade Secret Report Holder:

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CSI Designations:

DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

Section: 06 05 23 - Wood, Plastic, and Composite Fastenings

Section: 06 10 00 - Rough Carpentry

Section: 06 15 00 - Wood Decking

Section: 06 17 00 - Shop-Fabricated Structural Wood

1 Innovative Product Evaluated[1]

1.1 PolyScape® Engineered Plastic Lumber

2 Product Description and Materials

2.1 The innovative product evaluated in this report is shown in **Figure 1**, and available colors are presented in **Figure 2**.

Figure 1. PolyScape® Engineered Plastic Lumber - Ultra Grade

Figure 2. PolyScape® Engineered Plastic Lumber - Ultra Grade Available Colors

2.2 PolyScape® Engineered Plastic Lumber - Ultra Grade is a structural-grade plastic lumber product for use as main framing members (e.g., joists, stringers, beams, and columns) and secondary framing members (e.g., planks, posts, and bracing) in outdoor structures such as decks, boardwalks, docks, and platforms.

2.2.1 PolyScape® Engineered Plastic Lumber - Ultra Grade is comprised of fiberglass-reinforced polyolefin with less than twenty-five percent (25%) inorganic filler.

2.2.1.1 ≥ 15% of overall total weight is fiberglass.

2.2.2 PolyScape® Engineered Plastic Lumber is manufactured in various profiles and lengths. See **Table 1** for available sizes, in addition to the edge profiles.

Table 1. PolyScape® Engineered Plastic Lumber Product Information[2]

Product	Nominal Size	Actual Size	Available Maximum Length (ft)	Available Edge Profiles[1]
PolyScape® Engineered Plastic Lumber – Ultra Grade	2" x 4"	1.5" x 3.4375"	16	Square Corner, Round Corner
	2" x 6"	1.5" x 5.4375"	16	Square Corner, Round Corner
	2" x 8"	1.5" x 7.4375"	16	Square Corner, Round Corner
	2" x 10"	1.5" x 9.25"	16	Square Corner, Round Corner
	2" x 12"	1.5" x 11.25"	16	Square Corner, Round Corner
	3" x 4"	2.4375" x 3.4375"	16	Round Corner
	3" x 10"	2.4375" x 9.25"	16	Round Corner
	4" x 4"	3.4375" x 3.4375"	16	Round Corner
	4" x 6"	3.4375" x 5.4375"	16	Round Corner
	5" x 5"	4.4375" x 4.4375"	16	Round Corner
	6" x 6"	5.4375" x 5.4375"	16	Round Corner

SI: 1 in = 25.4 mm

1. See Figure 3 for an illustration of the different edge profiles.
2. Nominal Sizes.

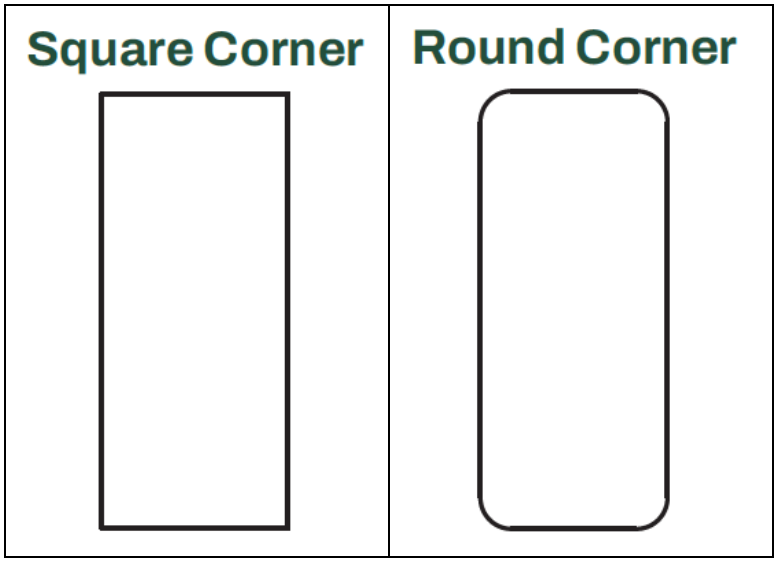


Figure 3. PolyScape® Engineered Plastic Lumber – Ultra Grade Edge Profiles

2.3 As needed, review material properties for design in **Section 6** and the regulatory evaluation in **Section 8**.

3 Definitions[2]

3.1 New Materials[3] are defined as building materials, equipment, appliances, systems, or methods of construction, not provided for by prescriptive and/or legislatively adopted regulations, known as alternative materials.[4] The design strength and permissible stresses shall be established by tests[5] and/or engineering analysis.[6]

3.2 Duly authenticated reports[7] and research reports[8] are test reports and related engineering evaluations that are written by an approved agency[9] and/or an approved source.[10]

3.2.1 This report utilizes intellectual property and/or trade secrets to create public domain material properties for commercial end-use.

3.2.1.1 This report protects confidential Intellectual Property and trade secrets under the regulation, 18.US.Code.90, also known as Defend Trade Secrets Act of 2016 (DTSA).[11]

3.3 An approved agency is *"approved"* when it is ANAB ISO/IEC 17065 accredited. DrJ Engineering, LLC (DrJ) is accredited and listed in the ANAB directory.

3.4 An approved source is *"approved"* when a professional engineer (i.e., Registered Design Professional, hereinafter RDP) is properly licensed to transact engineering commerce. The regulatory authority governing approved sources is the state legislature via its professional engineering regulations.[12]

3.5 Testing and/or inspections conducted for this duly authenticated report were performed by an ISO/IEC 17025 accredited testing laboratory, an ISO/IEC 17020 accredited inspection body, and/or a licensed RDP.

3.5.1 The Center for Building Innovation (CBI) is ANAB[13] ISO/IEC 17025 and ISO/IEC 17020 accredited.

3.6 The regulatory authority shall enforce[14] the specific provisions of each legislatively adopted regulation. If there is a non-conformance, the specific regulatory section and language of the non-conformance shall be provided in writing[15] stating the nonconformance and the path to its cure.

3.7 The regulatory authority shall accept duly authenticated reports from an approved agency and/or an approved source with respect to the quality and manner of use of new materials or assemblies as provided for in regulations regarding the use of alternative materials, designs, or methods of construction.[16]

3.8 ANAB is an International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA) signatory. Therefore, recognition of certificates and validation statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA with the appropriate scope shall be approved.[17] Thus, all ANAB ISO/IEC 17065 duly authenticated reports are approval equivalent,[18] and can be used in any country that is an MLA signatory found at this link: https://iaf.nu/en/recognised-abs/

3.9 Approval equity is a fundamental commercial and legal principle.[19]

4 Applicable Local, State, and Federal Approvals; Standards; Regulations[20]

4.1 *Local, State, and Federal*

4.1.1 Approved in all local jurisdictions pursuant to ISO/IEC 17065 duly authenticated report use, which includes, but is not limited to, the following featured local jurisdictions: Austin, Baltimore, Broward County, Chicago, Clark County, Dade County, Dallas, Detroit, Denver, DuPage County, Fort Worth, Houston, Kansas City, King County, Knoxville, Las Vegas, Los Angeles City, Los Angeles County, Miami, Nashville, New York City, Omaha, Philadelphia, Phoenix, Portland, San Antonio, San Diego, San Jose, San Francisco, Seattle, Sioux Falls, South Holland, St. Louis County, Texas Department of Insurance, and Wichita.[21]

4.1.2 Approved in all state jurisdictions pursuant to ISO/IEC 17065 duly authenticated report use, which includes, but is not limited to, the following featured states: California, Florida, New Jersey, Oregon, New York, Texas, Washington, and Wisconsin.[22]

4.1.3 Approved by the Code of Federal Regulations Manufactured Home Construction: Pursuant to Title 24, Subtitle B, Chapter XX, Part 3282.14[23] and Part 3280[24] pursuant to the use of ISO/IEC 17065 duly authenticated reports.

4.1.4 Approved means complying with the requirements of local, state, or federal legislation.

4.2 *Regulations*

4.2.1 *IBC – 18, 21, 24: International Building Code®*

4.2.2 *IRC – 18, 21, 24: International Residential Code®*

4.3 *Standards*

4.3.1 *ASTM C1028: Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method*

4.3.2 *ASTM D256: Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics*

4.3.3 *ASTM D570: Standard Test Method for Water Absorption of Plastics*

4.3.4 *ASTM D2344: Standard Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates*

4.3.5 *ASTM D2394: Standard Test Methods for Simulated Service Testing of Wood and Wood-Based Finish Flooring*

4.3.6 *ASTM D2915: Standard Practice for Sampling and Data-Analysis for Structural Wood and Wood-Based Products*

4.3.7 *ASTM D5764: Standard Test Method for Evaluating Dowel-Bearing Strength of Wood and Wood-Based Products*

4.3.8 *ASTM D6108: Standard Test Method for Compressive Properties of Plastic Lumber and Shapes*

4.3.9 *ASTM D6109: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber and Related Products*

4.3.10 *ASTM D6117: Standard Test Methods for Mechanical Fasteners in Plastic Lumber and Shapes*

4.3.11 *ASTM D6341: Standard Test Method for Determination of the Linear Coefficient of Thermal Expansion of Plastic Lumber and Plastic Lumber Shapes Between –30 and 140°F (–34.4 and 60°C)*

4.3.12 *ASTM D7032: Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite and Plastic Lumber Deck Boards, Stair Treads, Guards, and Handrails*

4.3.13 *ASTM D7568: Standard Specification for Polyethylene-Based Structural-Grade Plastic Lumber for Outdoor Applications*

4.3.14 *ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials*

5 Listed[25]

5.1 Equipment, materials, products, or services included in a List published by a nationally recognized testing laboratory (e.g., CBI), an approved agency (e.g., CBI and DrJ), and/or an approved source (e.g., DrJ), or other organization(s) concerned with product evaluation (e.g., DrJ), that maintains periodic inspection (e.g., CBI) of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

6 Tabulated Properties Generated from Nationally Recognized Standards

6.1 *Structural Applications*

6.1.1 PolyScape® Engineered Plastic Lumber - Ultra Grade was evaluated for structural capacities for gravity loads when used as deck posts, joists, beams, and headers.

6.1.1.1 Decks shall be supported on footings designed in accordance with IRC Section R507.3.

6.1.1.2 Bottom of posts shall be restrained to prevent lateral displacement as specified in IRC Section R407.3, and shall be designed in accordance with IRC Section R507.4.1.

6.1.2 *Joist Spans:*

6.1.2.1 Maximum allowable joist spans are provided in **Table 2** through **Table 5**.

6.1.2.1.1 **Table 2** provides the maximum allowable joist spans based on a Total Load (TL) of 50-psf:

6.1.2.1.1.1 10-psf Dead Load (DL) and 40-psf Live Load (LL)

6.1.2.1.2 **Table 3** provides the maximum allowable joist spans based on a TL of 70-psf:

6.1.2.1.2.1 10-psf DL and 60-psf LL

6.1.2.1.3 **Table 4** provides the maximum allowable joist spans based on a TL of 90-psf:

6.1.2.1.3.1 10-psf DL and 80-psf LL

6.1.2.1.4 **Table 5** provides the maximum allowable joist spans based on a TL of 110-psf:

6.1.2.1.4.1 10-psf DL and 100-psf LL

6.1.2.2 The procedure for using **Table 2** through **Table 5** is as follows:

6.1.2.2.1 Determine the desired deck length.

6.1.2.2.2 Find a combination of joist span and cantilever length to achieve the desired length taking into account of the expected load on the deck.

6.1.2.2.3 The length of the joist span in **Table 2** through **Table 5** is defined in IRC Figure R507.6.

6.1.2.2.4 The cantilever length is defined, in **Section 6.1.2.4**, as the distance from the exterior side of the post or beam to the end of the rim joist.

Table 2. Joist Spans Using PolyScape® Engineered Plastic Lumber - Ultra Grade at Various Deflection Limits – 50-psf TL[4]

PolyScape® Engineered Plastic Lumber Profile	Joist Spacing (in. o.c.)	Deflection Limits					
		L/360[1]		L/240[2]		L/180[2]	
		Joist Span	Maximum Cantiliver[3]	Joist Span	Maximum Cantiliver[3]	Joist Span	Maximum Cantiliver[3]
2 x 6	12	6' 2"	0' 6"	6' 2"	0' 8"	6' 10"	0' 10"
	16	5' 7"	0' 6"	5' 7"	0' 9"	6' 2"	0' 11"
	24	4' 11"	0' 7"	4' 11"	0' 10"	5' 5"	1' 0"
2 x 8	12	8' 6"	0' 11"	8' 6"	1' 4"	9' 4"	1' 7"
	16	7' 8"	1' 0"	7' 8"	1' 5"	8' 6"	1' 8"
	24	6' 9"	1' 1"	6' 9"	1' 6"	7' 5"	1' 10"
2 x 10	12	10' 7"	1' 4"	10' 7"	2' 0"	11' 8"	2' 0"
	16	9' 7"	1' 6"	9' 7"	2' 0"	10' 7"	2' 0"
	24	8' 5"	1' 8"	8' 5"	2' 0"	9' 3"	2' 0"
2 x 12	12	12' 10"	2' 0"	12' 10"	2' 0"	14' 2"	2' 0"
	16	11' 8"	2' 0"	11' 8"	2' 0"	12' 10"	2' 0"
	24	10' 2"	2' 0"	10' 2"	2' 0"	11' 3"	2' 0"

SI: 1 ft = 0.305 m, 1 in = 25.4 mm

1. Joist spans based on a deck design live load of 40-psf.
2. Joist spans based on a deck design live load of 40-psf, and a dead load of 10-psf.
3. Maximum cantilever based on twice the joist span deflection limit and a 220 lb point load applied to the end.
4. Joist spans are based on a factor of 1.0 for temperature, hygrothermal cycling, and UV. A creep factor of 2.0 applied to the dead load component.

Table 3. Joist Spans Using PolyScape® Engineered Plastic Lumber - Ultra Grade at Various Deflection Limits – 70-psf TL[4]

PolyScape® Engineered Plastic Lumber Profile	Joist Spacing (in. o.c.)	Deflection Limits					
		L/360[1]		L/240[2]		L/180[2]	
		Joist Span	Maximum Cantiliver[3]	Joist Span	Maximum Cantiliver[3]	Joist Span	Maximum Cantiliver[3]
2 x 6	12	5' 5"	0' 6"	5' 7"	0' 9"	6' 2"	0' 11"
	16	4' 11"	0' 7"	5' 1"	0' 10"	5' 7"	1' 0"
	24	4' 3"	0' 8"	4' 5"	0' 11"	4' 11"	1' 1"
2 x 8	12	7' 5"	1' 0"	7' 8"	1' 5"	8' 6"	1' 8"
	16	6' 9"	1' 1"	7' 0"	1' 6"	7' 8"	1' 10"
	24	5' 10"	1' 2"	6' 1"	1' 6"	6' 9"	1' 8"
2 x 10	12	9' 3"	1' 6"	9' 7"	2' 0"	10' 7"	2' 0"
	16	8' 5"	1' 8"	8' 9"	2' 0"	9' 7"	2' 0"
	24	7' 4"	1' 10"	7' 7"	1' 10"	8' 5"	2' 0"
2 x 12	12	11' 3"	2' 0"	11' 8"	2' 0"	12' 10"	2' 0"
	16	10' 2"	2' 0"	10' 7"	2' 0"	11' 8"	2' 0"
	24	8' 11"	2' 0"	9' 3"	2' 0"	10' 2"	2' 0"

SI: 1 ft = 0.305 m, 1 in = 25.4 mm

1. Joist spans based on a deck design live load of 60-psf.
2. Joist spans based on a deck design live load of 60-psf, and a dead load of 10-psf.
3. Maximum cantilever based on twice the joist span deflection limit and a 220 lb point load applied to the end.
4. Joist spans are based on a factor of 1.0 for temperature, hygrothermal cycling, and UV. A creep factor of 2.0 applied to the dead load component.

Table 4. Joist Spans Using PolyScape® Engineered Plastic Lumber - Ultra Grade at Various Deflection Limits – 90-psf TL[4]

PolyScape® Engineered Plastic Lumber Profile	Joist Spacing (in. o.c.)	Deflection Limits					
		L/360[1]		L/240[2]		L/180[2]	
		Joist Span	Maximum Cantiliver[3]	Joist Span	Maximum Cantiliver[3]	Joist Span	Maximum Cantiliver[3]
2 x 6	12	4' 11"	0' 7"	5' 2"	0' 10"	5' 9"	1' 0"
	16	4' 5"	0' 7"	4' 9"	0' 10"	5' 2"	1' 0"
	24	3' 11"	0' 8"	4' 1"	0' 11"	4' 7"	1' 1"
2 x 8	12	6' 9"	1' 1"	7' 2"	1' 6"	7' 10"	1' 9"
	16	6' 1"	1' 2"	6' 6"	1' 7"	7' 2"	1' 9"
	24	5' 4"	1' 3"	5' 8"	1' 5"	6' 3"	1' 6"
2 x 10	12	8' 5"	1' 8"	8' 11"	2' 0"	9' 10"	2' 0"
	16	7' 7"	1' 9"	8' 1"	2' 0"	8' 11"	2' 0"
	24	6' 8"	1' 8"	7' 1"	1' 9"	7' 9"	1' 11"
2 x 12	12	10' 2"	2' 0"	10' 10"	2' 0"	11' 11"	2' 0"
	16	9' 3"	2' 0"	9' 10"	2' 0"	10' 10"	2' 0"
	24	8' 1"	2' 0"	8' 7"	2' 0"	9' 5"	2' 0"

SI: 1 ft = 0.305 m, 1 in = 25.4 mm

1. Joist spans based on a deck design live load of 80-psf.
2. Joist spans based on a deck design live load of 80-psf, and a dead load of 10-psf.
3. Maximum cantilever based on twice the joist span deflection limit and a 220 lb point load applied to the end.
4. Joist spans are based on a factor of 1.0 for temperature, hygrothermal cycling, and UV. A creep factor of 2.0 applied to the dead load component.

Table 5. Joist Spans Using PolyScape® Engineered Plastic Lumber - Ultra Grade at Various Deflection Limits – 110-psf TL[4]

PolyScape® Engineered Plastic Lumber Profile	Joist Spacing (in. o.c.)	Deflection Limits					
		L/360[1]		L/240[2]		L/180[2]	
		Joist Span	Maximum Cantiliver[3]	Joist Span	Maximum Cantiliver[3]	Joist Span	Maximum Cantiliver[3]
2 x 6	12	4' 7"	0' 7"	4' 11"	0' 10"	5' 5"	1' 0"
	16	4' 1"	0' 8"	4' 5"	0' 11"	4' 11"	1' 1"
	24	3' 7"	0' 9"	3' 11"	0' 11"	4' 3"	1' 0"
2 x 8	12	6' 3"	1' 2"	6' 9"	1' 6"	7' 5"	1' 10"
	16	5' 8"	1' 3"	6' 1"	1' 6"	6' 9"	1' 8"
	24	4' 11"	1' 2"	5' 4"	1' 4"	5' 10"	1' 5"
2 x 10	12	7' 9"	1' 9"	8' 5"	2' 0"	9' 3"	2' 0"
	16	7' 1"	1' 9"	7' 7"	1' 10"	8' 5"	2' 0"
	24	6' 2"	1' 6"	6' 8"	1' 8"	7' 4"	1' 10"
2 x 12	12	9' 5"	2' 0"	10' 2"	2' 0"	11' 3"	2' 0"
	16	8' 7"	2' 0"	9' 3"	2' 0"	10' 2"	2' 0"
	24	7' 6"	1' 10"	8' 1"	2' 0"	8' 11"	2' 0"

SI: 1 ft = 0.305 m, 1 in = 25.4 mm

1. Joist spans based on a deck design live load of 100-psf.
2. Joist spans based on a deck design live load of 100-psf, and a dead load of 10-psf.
3. Maximum cantilever based on twice the joist span deflection limit and a 220 lb point load applied to the end.
4. Joist spans are based on a factor of 1.0 for temperature, hygrothermal cycling, and UV. A creep factor of 2.0 applied to the dead load component.

6.1.2.3 In general, the maximum joist cantilever is 2' 0", twice the deflection limit used for the main span at the cantilever, or twenty-five percent (25%) of the length of the joist span, in accordance with IRC Section R507.6, whichever length is less.

6.1.2.4 The length of the cantilever is measured from the exterior side of the post or beam to the end of the rim joist.

6.1.3 *Beam Spans – Single Span Beams:*

6.1.3.1 The maximum post spacing recommended for support of deck beams with two supports are shown in **Figure 4** and **Table 6**.

6.1.3.1.1 The post spacing provided in **Table 6** shall be used in place of the tables specified in IRC Section R507.5.

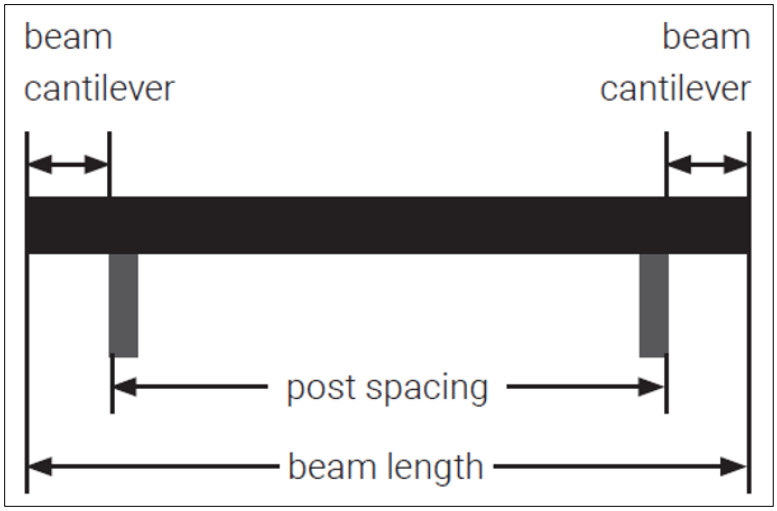


Figure 4. Post Spacing for Support of Beams at Two Locations

Table 6. Maximum Post Spacing (Beam Span) and Cantilever Lengths for Support of Beams at Two Locations[1,2] – 40-psf LL

Profile	Number of Plies	PolyScape® Engineered Plastic Lumber Beam Parameters									
		Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever
		Length of PolyScape® Engineered Plastic Lumber Ultra Joist (ft)[3]									
		4		5		6		7		8	
2 x 6	1	3' 11"	0' 11"	3' 9"	0' 11"	3' 7"	0' 10"	3' 6"	0' 10"	3' 5"	0' 10"
	2	4' 11"	1' 2"	4' 8"	1' 2"	4' 7"	1' 1"	4' 5"	1' 1"	4' 3"	1' 0"
	3	5' 7"	1' 4"	5' 5"	1' 4"	5' 2"	1' 3"	5' 0"	1' 3"	4' 11"	1' 2"
2 x 8	1	5' 4"	1' 4"	5' 1"	1' 3"	4' 11"	1' 2"	4' 9"	1' 2"	4' 8"	1' 2"
	2	6' 9"	1' 8"	6' 6"	1' 7"	6' 3"	1' 6"	6' 0"	1' 6"	5' 10"	1' 5"
	3	7' 8"	1' 11"	7' 5"	1' 10"	7' 2"	1' 9"	6' 11"	1' 8"	6' 9"	1' 8"
2 x 10	1	6' 8"	1' 8"	6' 5"	1' 7"	6' 2"	1' 6"	6' 0"	1' 6"	5' 10"	1' 5"
	2	8' 5"	2' 0"	8' 1"	2' 0"	7' 9"	1' 11"	7' 6"	1' 10"	7' 4"	1' 10"
	3	9' 7"	2' 0"	9' 3"	2' 0"	8' 11"	2' 0"	8' 7"	2' 0"	8' 5"	2' 0"
2 x 12	1	8' 1"	2' 0"	7' 9"	1' 11"	7' 6"	1' 10"	7' 3"	1' 9"	7' 1"	1' 9"
	2	10' 2"	2' 0"	9' 10"	2' 0"	9' 5"	2' 0"	9' 2"	2' 0"	8' 11"	2' 0"
	3	11' 8"	2' 0"	11' 3"	2' 0"	10' 10"	2' 0"	10' 6"	2' 0"	10' 2"	2' 0"
3 x 10	1	7' 10"	1' 11"	7' 6"	1' 10"	7' 3"	1' 9"	7' 0"	1' 9"	6' 10"	1' 8"
	2	9' 10"	2' 0"	9' 6"	2' 0"	9' 2"	2' 0"	8' 10"	2' 0"	8' 7"	2' 0"
6 x 6	1	5' 6"	1' 4"	5' 3"	1' 3"	5' 1"	1' 3"	4' 11"	1' 2"	4' 9"	1' 2"

Table 6. Maximum Post Spacing (Beam Span) and Cantilever Lengths for Support of Beams at Two Locations[1,2] – 40-psf LL

Profile	Number of Plies	PolyScape® Engineered Plastic Lumber Beam Parameters									
		Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever
		Length of PolyScape® Engineered Plastic Lumber Ultra Joist (ft)[3]									
		9		10		11		12		13	
2 x 6	1	3' 4"	0' 10"	3' 3"	0' 9"	3' 2"	0' 9"	3' 1"	0' 9"	3' 0"	0' 9"
	2	4' 2"	1' 0"	4' 1"	1' 0"	4' 0"	1' 0"	3' 11"	0' 11"	3' 10"	0' 11"
	3	4' 9"	1' 2"	4' 8"	1' 2"	4' 7"	1' 1"	4' 5"	1' 1"	4' 4"	1' 1"
2 x 8	1	4' 6"	1' 1"	4' 5"	1' 1"	4' 4"	1' 1"	4' 3"	1' 0"	4' 2"	1' 0"
	2	5' 9"	1' 5"	5' 7"	1' 4"	5' 5"	1' 4"	5' 4"	1' 4"	5' 3"	1' 3"
	3	6' 7"	1' 7"	6' 5"	1' 7"	6' 3"	1' 6"	6' 1"	1' 6"	6' 0"	1' 6"
2 x 10	1	5' 8"	1' 5"	5' 6"	1' 4"	5' 5"	1' 4"	5' 3"	1' 3"	5' 2"	1' 3"
	2	7' 1"	1' 9"	6' 11"	1' 8"	6' 9"	1' 8"	6' 8"	1' 8"	6' 6"	1' 7"
	3	8' 2"	2' 0"	7' 11"	1' 11"	7' 9"	1' 11"	7' 7"	1' 10"	7' 5"	1' 10"
2 x 12	1	6' 10"	1' 8"	6' 8"	1' 8"	6' 7"	1' 7"	6' 5"	1' 7"	6' 3"	1' 6"
	2	8' 8"	2' 0"	8' 5"	2' 0"	8' 3"	2' 0"	8' 1"	2' 0"	7' 11"	1' 11"
	3	9' 11"	2' 0"	9' 8"	2' 0"	9' 5"	2' 0"	9' 3"	2' 0"	9' 1"	2' 0"
3 x 10	1	6' 8"	1' 8"	6' 6"	1' 7"	6' 4"	1' 7"	6' 2"	1' 6"	6' 1"	1' 6"
	2	8' 4"	2' 0"	8' 2"	2' 0"	8' 0"	2' 0"	7' 10"	1' 11"	7' 8"	1' 11"
6 x 6	1	4' 8"	1' 2"	4' 7"	1' 1"	4' 5"	1' 1"	4' 4"	1' 1"	4' 3"	1' 0"
		14		15		16					
2 x 6	1	2' 11"	0' 8"	2' 11"	0' 8"	2' 10"	0' 8"				
	2	3' 9"	0' 11"	3' 8"	0' 11"	3' 7"	0' 10"				
	3	4' 3"	1' 0"	4' 2"	1' 0"	4' 1"	1' 0"				
2 x 8	1	4' 1"	1' 0"	4' 0"	1' 0"	3' 11"	0' 11"				
	2	5' 1"	1' 3"	5' 0"	1' 3"	4' 11"	1' 2"				
	3	5' 10"	1' 5"	5' 9"	1' 5"	5' 8"	1' 5"				
2 x 10	1	5' 1"	1' 3"	5' 0"	1' 3"	4' 11"	1' 2"				
	2	6' 5"	1' 7"	6' 3"	1' 6"	6' 2"	1' 6"				
	3	7' 4"	1' 10"	7' 2"	1' 9"	7' 1"	1' 9"				
2 x 12	1	6' 2"	1' 6"	6' 1"	1' 6"	5' 11"	1' 5"				
	2	7' 9"	1' 11"	7' 8"	1' 11"	7' 6"	1' 10"				
	3	8' 11"	2' 0"	8' 9"	2' 0"	8' 7"	2' 0"				

Table 6. Maximum Post Spacing (Beam Span) and Cantilever Lengths for Support of Beams at Two Locations[1,2] – 40-psf LL

Profile	Number of Plies	PolyScape® Engineered Plastic Lumber Beam Parameters									
		Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever
		Length of PolyScape® Engineered Plastic Lumber Ultra Joist (ft)[3]									
		14 continued		15 continued		16 continued					
3 x 10	1	5' 11"	1' 5"	5' 10"	1' 5"	5' 9"	1' 5"				
	2	7' 6"	1' 10"	7' 4"	1' 10"	7' 3"	1' 9"				
6 x 6	1	4' 2"	1' 0"	4' 1"	1' 0"	4' 0"	1' 0"				

SI: 1 ft = 0.305 m, 1 in = 25.4 mm

1. Post spacing (beam span) is based on a deck design live load of 40-psf, a deflection limit of L/360, and a factor of 1.0 for temperature, hygrothermal cycling, and UV exposure.
2. Bedford lumber decks use proprietary materials and conditions not prescribed in IRC Section R507.1.
3. Length of Bedford lumber Joist refers to the joist span (deck joist back span) as shown in IRC Figure R507.6. This value is not the same as tributary span.

6.1.3.2 In general, the maximum beam cantilever is 2' 0", twice the deflection limit used for the main span at the cantilever, or twenty-five percent (25%) of the length of the post spacing, in accordance with IRC Section R507.5, whichever length is less.

6.1.3.3 The length of the cantilever is measured from the exterior side of the post to the end of the beam length.

6.1.3.3.1 For more information, see the manufacturer installation guide or contact Bedford® Industries, Inc. technical support.

6.1.4 *Beam Spans – Multi-Span Beams:*

6.1.4.1 The maximum post spacing recommended for support of deck beams with three supports are outlined in **Figure 5** and **Table 7**.

6.1.4.1.1 The post spacing provided in **Table 7** shall be used in place of the tables specified in IRC Section R507.5.

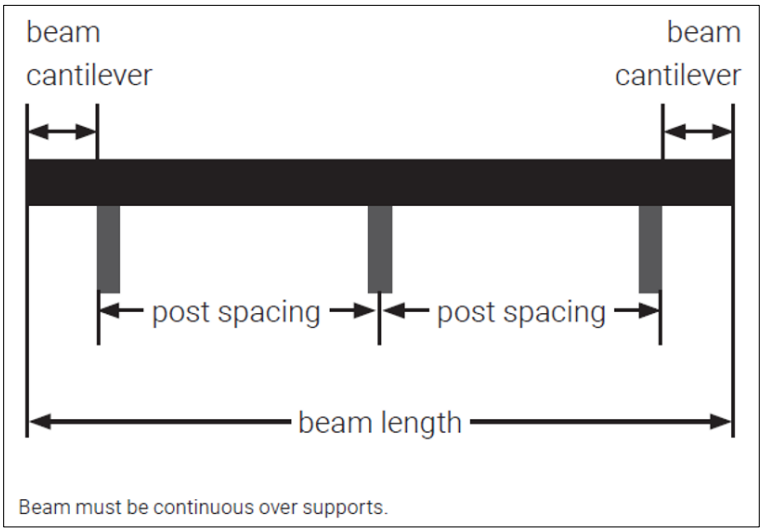


Figure 5. Post Spacing for Support of Beams at Three or More Locations

Table 7. Maximum Post Spacing (Beam Span) and Cantilever Lengths for Support of Beams at Three or More Locations[1,2] – 40-psf LL and 10-psf DL

Profile	Number of Plies	PolyScape® Engineered Plastic Lumber Beam Parameters									
		Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever
		Length of PolyScape® Engineered Plastic Lumber Ultra Joist (ft)[3]									
		4		5		6		7		8	
2 x 6	1	3' 10"	0' 11"	3' 8"	0' 11"	3' 7"	0' 10"	3' 5"	0' 10"	3' 4"	0' 10"
	2	4' 10"	1' 2"	4' 8"	1' 2"	4' 6"	1' 1"	4' 4"	1' 1"	4' 3"	1' 0"
	3	5' 7"	1' 4"	5' 4"	1' 4"	5' 2"	1' 3"	5' 0"	1' 3"	4' 10"	1' 2"
2 x 8	1	5' 3"	1' 3"	5' 1"	1' 3"	4' 11"	1' 2"	4' 9"	1' 2"	4' 7"	1' 1"
	2	6' 8"	1' 8"	6' 5"	1' 7"	6' 2"	1' 6"	6' 0"	1' 6"	5' 10"	1' 5"
	3	7' 8"	1' 11"	7' 4"	1' 10"	7' 1"	1' 9"	6' 10"	1' 8"	6' 8"	1' 8"
2 x 10	1	6' 7"	1' 7"	6' 4"	1' 7"	6' 1"	1' 6"	5' 11"	1' 5"	5' 9"	1' 5"
	2	8' 4"	2' 0"	8' 0"	2' 0"	7' 8"	1' 11"	7' 6"	1' 10"	7' 3"	1' 9"
	3	9' 6"	2' 0"	9' 2"	2' 0"	8' 10"	2' 0"	8' 7"	2' 0"	8' 4"	2' 0"
2 x 12	1	8' 0"	2' 0"	7' 8"	1' 11"	7' 5"	1' 10"	7' 2"	1' 9"	7' 0"	1' 9"
	2	10' 1"	2' 0"	9' 9"	2' 0"	9' 5"	2' 0"	9' 1"	2' 0"	8' 10"	2' 0"
	3	11' 7"	2' 0"	11' 1"	2' 0"	10' 9"	2' 0"	10' 5"	2' 0"	10' 1"	2' 0"
3 x 10	1	7' 9"	1' 11"	7' 5"	1' 10"	7' 2"	1' 9"	6' 11"	1' 8"	6' 9"	1' 8"
	2	9' 9"	2' 0"	9' 5"	2' 0"	9' 1"	2' 0"	8' 9"	2' 0"	8' 6"	2' 0"
6 x 6	1	5' 5"	1' 4"	5' 3"	1' 3"	5' 1"	1' 3"	4' 11"	1' 2"	4' 9"	1' 2"
		9		10		11		12		13	
2 x 6	1	3' 3"	0' 9"	3' 2"	0' 9"	3' 1"	0' 9"	3' 1"	0' 9"	3' 0"	0' 9"
	2	4' 1"	1' 0"	4' 0"	1' 0"	3' 11"	0' 11"	3' 10"	0' 11"	3' 9"	0' 11"
	3	4' 9"	1' 2"	4' 7"	1' 1"	4' 6"	1' 1"	4' 5"	1' 1"	4' 4"	1' 1"
2 x 8	1	4' 6"	1' 1"	4' 5"	1' 1"	4' 3"	1' 0"	4' 2"	1' 0"	4' 1"	1' 0"
	2	5' 8"	1' 5"	5' 6"	1' 4"	5' 5"	1' 4"	5' 3"	1' 3"	5' 2"	1' 3"
	3	6' 6"	1' 7"	6' 4"	1' 7"	6' 2"	1' 6"	6' 1"	1' 6"	5' 11"	1' 5"
2 x 10	1	5' 7"	1' 4"	5' 5"	1' 4"	5' 4"	1' 4"	5' 3"	1' 3"	5' 1"	1' 3"
	2	7' 1"	1' 9"	6' 11"	1' 8"	6' 9"	1' 8"	6' 7"	1' 7"	6' 5"	1' 7"
	3	8' 1"	2' 0"	7' 11"	1' 11"	7' 8"	1' 11"	7' 7"	1' 10"	7' 5"	1' 10"
2 x 12	1	6' 10"	1' 8"	6' 8"	1' 8"	6' 6"	1' 7"	6' 4"	1' 7"	6' 3"	1' 6"
	2	8' 7"	2' 0"	8' 5"	2' 0"	8' 2"	2' 0"	8' 0"	2' 0"	7' 10"	1' 11"
	3	9' 10"	2' 0"	9' 7"	2' 0"	9' 5"	2' 0"	9' 2"	2' 0"	9' 0"	2' 0"

Table 7. Maximum Post Spacing (Beam Span) and Cantilever Lengths for Support of Beams at Three or More Locations[1,2] – 40-psf LL and 10-psf DL

Profile	Number of Plies	PolyScape® Engineered Plastic Lumber Beam Parameters									
		Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever	Beam Span	Maximum Cantilever
		Length of PolyScape® Engineered Plastic Lumber Ultra Joist (ft)[3]									
		9 continued		10 continued		11 continued		12 continued		13 continued	
3 x 10	1	6' 7"	1' 7"	6' 5"	1' 7"	6' 3"	1' 6"	6' 2"	1' 6"	6' 0"	1' 6"
	2	8' 4"	2' 0"	8' 1"	2' 0"	7' 11"	1' 11"	7' 9"	1' 11"	7' 7"	1' 10"
6 x 6	1	4' 7"	1' 1"	4' 6"	1' 1"	4' 5"	1' 1"	4' 4"	1' 1"	4' 3"	1' 0"
		14		15		16					
2 x 6	1	2' 11"	0' 8"	2' 10"	0' 8"	2' 10"	0' 8"				
	2	3' 8"	0' 11"	3' 8"	0' 11"	3' 7"	0' 10"				
	3	4' 3"	1' 0"	4' 2"	1' 0"	4' 1"	1' 0"				
2 x 8	1	4' 0"	1' 0"	3' 11"	0' 11"	3' 11"	0' 11"				
	2	5' 1"	1' 3"	5' 0"	1' 3"	4' 11"	1' 2"				
	3	5' 10"	1' 5"	5' 9"	1' 5"	5' 7"	1' 4"				
2 x 10	1	5' 0"	1' 3"	4' 11"	1' 2"	4' 10"	1' 2"				
	2	6' 4"	1' 7"	6' 3"	1' 6"	6' 1"	1' 6"				
	3	7' 3"	1' 9"	7' 1"	1' 9"	7' 0"	1' 9"				
2 x 12	1	6' 1"	1' 6"	6' 0"	1' 6"	5' 11"	1' 5"				
	2	7' 8"	1' 11"	7' 7"	1' 10"	7' 5"	1' 10"				
	3	8' 10"	2' 0"	8' 8"	2' 0"	8' 6"	2' 0"				
3 x 10	1	5' 11"	1' 5"	5' 9"	1' 5"	5' 8"	1' 5"				
	2	7' 5"	1' 10"	7' 4"	1' 10"	7' 2"	1' 9"				
6 x 6	1	4' 2"	1' 0"	4' 1"	1' 0"	4' 0"	1' 0"				

SI: 1 ft = 0.305 m, 1 in = 25.4 mm

1. Post spacing (beam span) is based on a deck design live load of 40-psf on the outer spans, a uniformly distributed dead load of 10-psf, and a factor of 1.0 for temperature, hygrothermal cycling, and UV exposure. A creep factor of 2.0 applied to the dead load component.
2. Bedford lumber decks use proprietary materials and conditions not prescribed in IRC Section R507.1.
3. Length of Bedford Lumber Joist refers to the joist span (deck joist back span) as shown in IRC Figure R507.6. This value is not the same as tributary span.

6.1.4.2 In general, the maximum beam cantilever is 2' 0", twice the deflection limit used for the main span at the cantilever, or twenty-five percent (25%) of the length of the post spacing, in accordance with IRC Section R507.5, whichever length is less.

6.1.4.3 The length of the cantilever is measured from the exterior side of the exterior post to the end of the beam length.

6.1.4.4 For more information, see the manufacturer installation guide or contact Bedford® Industries, Inc. technical support.

6.1.5 *Columns/Posts:*

6.1.5.1 The maximum bearing capacity of built-up PolyScape® Engineered Plastic Lumber posts that are used to support PolyScape® Engineered Plastic Lumber - Ultra Grade beams are provided in **Table 8**.

6.1.5.1.1 All posts shall be diagonally braced to prevent side-sway and/or buckling as required per local building codes.

6.1.5.1.2 For more information regarding post and bracing installations, see the manufacturer installation guide or contact Bedford® Industries, Inc. technical support.

Table 8. Maximum Bearing Capacity (lb) of Solid Columns and Built-up Posts[1]

Unbraced Column Length (in)	PolyScape® Engineered Plastic Lumber – Ultra Grade Profiles					
	1-Ply 4 x 4	1-Ply 4 x 6	1-Ply 5 x 5	1-Ply 6 x 6	2-Ply 2 x 6[2,3]	3-Ply 2 x 6[2,3]
12	15,950[4]	25,200[4]	26,550[4]	41,350[4]	26,900[4]	40,350[4]
24	15,950[4]	25,200[4]	26,550[4]	41,350[4]	18,850	40,350[4]
36	11,500	18,200	26,550[4]	41,350[4]	8,350	28,300
48	6,450	10,200	15,200	37,400	4,700	15,900
60	4,100	6,550	9,700	23,950	3,000	10,150
72	2,850	4,550	6,750	16,600	2,050	7,050
84	2,100	3,300	4,950	12,200	1,500	5,150
96	1,600	2,550	3,800	9,350	1,150	3,950
108	1,250	2,000	3,000	7,350	900	3,100
120	1,000	1,600	2,400	5,950	750	2,500
132	850	1,350	2,000	4,950	600	2,100
144	700	1,100	1,650	4,150	500	1,750
156	600	950	1,400	3,500	400	1,500
168	500	800	1,200	3,050	350	1,250

SI: 1 lb = 4.45 N, 1 in = 25.4 mm, 1 ft = 0.305 m

1. The allowable loads provided assume buckling occurs about the weak axis (minor axis).
2. See Figure 6 for column illustrations.
3. See Section 9.3.3 for ply-to-ply connections for Column/Post applications.
4. Controlled by crushing.

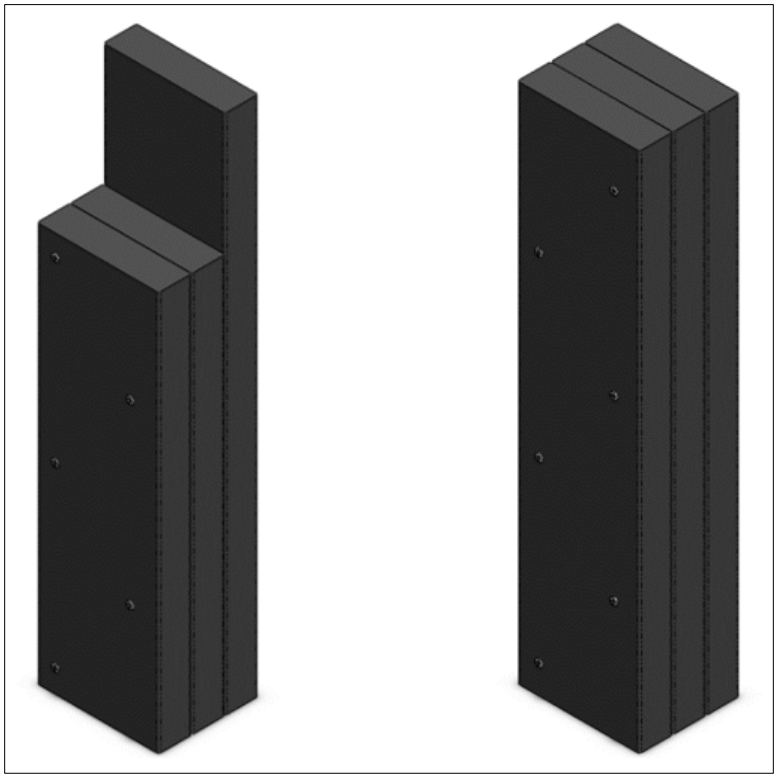


Figure 6. Built-Up 3-Ply PolyScape® Engineered Plastic Lumber Columns Supporting 2-Ply Beams (Left) and 3-Ply Beams (Right)

6.2 *Fastener Connection Performance*

6.2.1 Head-pull through and withdrawal resistance of fasteners when installed in PolyScape® Engineered Plastic Lumber were evaluated and the allowable connection design values for the specified fasteners are presented in **Table 9**.

6.2.1.1 For fasteners not listed in **Table 9**, the empirical formulas in AWC NDS, and the applicable listed equivalent Specific Gravities (SG) in **Table 11**, can be used to determine reference design values for head-pull-through and withdrawal resistance.

Table 9. Reference Head-Pull-Through and Withdrawal Design Values

Fastener	Allowable Head Pull-Through (lb)	Reference Withdrawal Design Value (lb/in)
0.148" x 3" Smooth Shank Nail	425	60
#10 x 1¼" Hillman PowerPro® One™ Screws	-	235
SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 lb/in = 0.175 N/mm		

6.2.2 Lateral resistance of fasteners when installed in PolyScape® Engineered Plastic Lumber were evaluated and the allowable connection design values for the specified fasteners are presented in **Table 10**.

6.2.2.1 For fasteners not listed in **Table 10**, the empirical formulas in AWC NDS and the applicable listed equivalent SG in **Table 11** can be used to determine reference design values for lateral resistance.

6.2.2.1.1 For proprietary fasteners, published bending yield strength from the manufacturer evaluation report is permitted to be used in place of the specified bending yield strengths listed in AWC NDS.

Table 10. Reference Lateral Design Values

Fastener	Side Member Thickness (in)	Main Member Penetration (in)	Allowable Lateral Shear Load (lb)	
			$Z_{\parallel}$	$Z_{\perp}$
#9 x 3" GripFast® Deck Screws	1.5	1.5	390	420
SI: 1 in = 25.4 mm, 1 lb = 4.45 N				

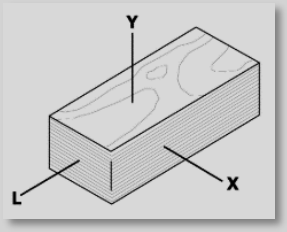
6.2.3 *Equivalent Specific Gravity for Use in Accordance with the NDS:*

6.2.3.1 Dowel bearing strength for nails and bolts, and withdrawal loads for nails and screws installed in PolyScape® Engineered Plastic Lumber are permitted to be determined in accordance with the NDS using the equivalent specific gravity listed in **Table 11**.

Table 11. Equivalent Specific Gravities (SG) for Design of Mechanical Connections per NDS[2,3]

Product	Fastener	Fastener Axis Orientation[1]	Load Direction	Equivalent SG for Design Purposes
PolyScape® Engineered Plastic Lumber - Ultra	Screws	Y Axis	Withdrawal[4]	0.50
	Nails	Y Axis		0.47
	Nails	Y Axis	L Axis	0.48
	Bolts	Y Axis	L Axis	0.37

1. Orientation nomenclature for PolyScape® Engineered Plastic Lumber:



2. Adjustment of the fastener values for duration of load in accordance with the NDS is not applicable.
3. Determination of lateral resistance and withdrawal design values are as provided in the NDS for sawn lumber having equivalent specific gravities as shown.
4. Equivalent specific gravity values for withdrawal may be used to determine reference pull-through values in accordance with NDS.

6.3 *Creep Recovery*

6.3.1 PolyScape® Engineered Plastic Lumber products were evaluated for creep-recovery in accordance with ASTM D7032, Section 5.4 and met the requirements therein.

6.4 *Reference Design Values*

6.4.1 Section properties for various PolyScape® Engineered Plastic Lumber member sizes are specified in **Table 12**.

6.4.2 Reference unadjusted Allowable Stress Design (ASD) values for various PolyScape® Engineered Plastic Lumber member sizes are provided in **Table 13**.

Table 12. PolyScape® Engineered Plastic Lumber Section Properties

Profile	Edgewise				Flatwise			
	Width, b_y (in)	Depth, d_y (in)	Section Modulus, S_y (in^3)	Area Moment of Inertia, I_y (in^4)	Width, b_x (in)	Depth, d_x (in)	Section Modulus, S_x (in^3)	Area Moment of Inertia, I_x (in^4)
2 x 4	1.50	3.44	2.95	5.08	3.44	1.50	1.29	0.97
2 x 6	1.50	5.44	7.39	20.10	5.44	1.50	2.04	1.53
2 x 8	1.50	7.44	13.83	51.43	7.44	1.50	2.79	2.09
2 x 10	1.50	9.25	21.39	98.93	9.25	1.50	3.47	2.60
2 x 12	1.50	11.25	31.64	177.98	11.25	1.50	4.22	3.16
3 x 4	2.44	3.44	4.80	8.25	3.44	2.44	3.40	4.15
3 x 10	2.44	9.25	34.76	160.76	9.25	2.44	9.16	11.16
4 x 4	3.44	3.44	6.77	11.64	3.44	3.44	6.77	11.64
4 x 6	3.44	5.44	16.94	46.05	5.44	3.44	10.71	18.41
5 x 5	4.44	4.44	14.56	32.31	4.44	4.44	14.56	32.31
6 x 6	5.44	5.44	26.79	72.85	5.44	5.44	26.79	72.85
SI: 1 in = 25.4 mm, 1 in^3 = 16.39 cm^3, 1 in^4 = 416.23 cm^4								

Table 13. PolyScape® Engineered Plastic Lumber Design Values (ASD)[1,2]

Profile	Edgewise					Flatwise					Compression[3]	
	F_{by} (psi)	$(F_bS)_y$ (lb-in)	E_y (psi)	$(EI)_y$ (lb-in^2)	$F_{v,y}$ (psi)	F_{bx} (psi)	$(F_bS)_x$ (lb-in)	E_x (psi)	$(EI)_x$ (lb-in^2)	$F_{v,x}$ (psi)	$F_{c,//}$ (psi)	$F_{c,\perp}$ (psi)
2 x 4	2,000	5,900	325,000	$1.70 \cdot 10^6$	240	1,850	2,400	300,000	$2.90 \cdot 10^5$	250	1,650	750
2 x 6	1,650	12,200	325,000	$6.50 \cdot 10^6$	240	1,850	3,750	300,000	$4.60 \cdot 10^5$	250	1,650	750
2 x 8	1,650	22,800	325,000	$1.67 \cdot 10^7$	210	2,200	6,150	300,000	$6.30 \cdot 10^5$	250	1,650	850
2 x 10	1,500	32,100	325,000	$3.22 \cdot 10^7$	210	2,250	7,800	300,000	$7.80 \cdot 10^5$	250	1,650	850
2 x 12	1,500	47,450	325,000	$5.78 \cdot 10^7$	190	2,800	11,800	300,000	$9.50 \cdot 10^5$	250	2,150	1,150
3 x 4	1,750	8,400	325,000	$2.70 \cdot 10^6$	190	1,650	5,600	300,000	$1.20 \cdot 10^6$	250	1,650	750
3 x 10	1,400	48,650	325,000	$5.22 \cdot 10^7$	190	2,250	20,600	300,000	$3.30 \cdot 10^6$	250	1,650	750
4 x 4	2,000	5,900	325,000	$3.20 \cdot 10^6$	190	1,750	11,850	275,000	$3.20 \cdot 10^6$	190	1,350	400
4 x 6	1,650	12,200	325,000	$1.27 \cdot 10^7$	190	1,850	19,800	275,000	$5.10 \cdot 10^7$	250	1,350	400
5 x 5	1,650	22,800	325,000	$8.10 \cdot 10^6$	190	1,550	22,550	250,000	$8.10 \cdot 10^6$	190	1,350	400
6 x 6	1,500	32,100	325,000	$1.82 \cdot 10^7$	190	1,550	41,550	250,000	$1.82 \cdot 10^7$	190	1,400	400

SI: 1-psi = 6.89 kPa, 1 lb-in = 113 N-mm, 1 lb-in^2 = 2,870 N-mm^2

1. Listed reference unadjusted Allowable Stress Design (ASD) values shall be multiplied by all applicable adjustment factors listed in **Table** 14.
2. Values do not account for long-term loading.
3. $F_{c,//}$ refers to compression loading parallel to direction of extrusion. $F_{c,\perp}$ refers to compression perpendicular to direction of extrusion.

6.4.3 *Environmental Adjustments:*

6.4.3.1 Reference ASD values in **Table 13** shall be multiplied by all applicable adjustment factors to account for end-use environmental conditions and weathering for engineered designs.

6.4.3.1.1 Design value adjustments are tabulated in **Table 14**.

Table 14. Adjustment Factors for PolyScape® Engineered Plastic Lumber

Adjustment Type		F_b	E	F_v	$F_{c,//}$	$F_{c,\perp}$
Temperature, C_T	T ≤ 70°F	1.00	1.00	1.00	1.00	1.00
	70°F ≤ T ≤ 100°F	0.78	0.80	0.78	0.77	0.77
	100°F ≤ T ≤ 125°F	0.59	0.62	0.59	0.56	0.56
Freeze-Thaw[1]		1.00	1.00	1.00	1.00	1.00

1. Freeze-thaw (hygrothermal cycling) of PolyScape® Engineered Plastic Lumber evaluated in accordance with ASTM D7568, Section 6.13. Results met the criteria therein.

6.4.4 Applications of the PolyScape® Engineered Plastic Lumber that require professional engineering are those conditions where the application is outside of the prescriptive applications provided in **Table 2** through **Table 8**.

6.4.4.1 A deck design that requires higher applied loads, longer spans, multiple joist spans, a cantilever, a concentrated load, multiple applied loads, and so forth, will require an engineered design.

6.4.5 The engineered design drawing development process includes, but is not be limited to, the following guidelines:

6.4.5.1 To size PolyScape® Engineered Plastic Lumber structural members, use the allowable stress design values found in **Table 13**.

6.4.5.2 Using the allowable stress design properties and standard engineering equations, analyze the resistance needed, for the pertinent member size designated in **Table 13**.

6.4.5.2.1 These design properties are based upon test data and used actual design dimensions as shown in **Table 12**.

6.4.5.3 Apply the applicable adjustment factors listed in **Table 14**.

6.4.6 For time dependent deformations (creep), the total deflection, DT, shall be calculated as follows:

Equation 1.

$$D_T = (K_{CR} \times D_{LT}) + D_{ST}$$

where:

K_{CR} = 2.0, time dependent deformation (creep) factor

D_{LT} = immediate deflection due to long-term component of design load (in)

D_{ST} = deflection due to short-term or normal component of design load (in)

6.4.6.1 Create an engineered design drawing for the application which includes, but is not limited to, span, depth, applied loads, support conditions, anchorage, reaction limits, component connections, deflection limits, moisture conditions, serviceability conditions, durability conditions, end connection details, boundary condition application details, and so forth.

6.4.6.2 Each PolyScape® Engineered Plastic Lumber engineered design and associated engineered design drawing shall provide sufficient detailing for the specific floor, wall, or roof installation.

6.4.6.3 Each PolyScape® Engineered Plastic Lumber structural member design is defined as an engineered design pursuant to the building code and professional engineering law, which requires the design to be performed by an RDP, where all loading and boundary conditions are provided by the owner or the Registered Design Professional in Responsible Charge of the project.

6.4.6.3.1 Where assistance is needed regarding PolyScape® Engineered Plastic Lumber specialty engineered designs, please contact Bedford® Industries, Inc. technical support.

6.4.6.4 To establish a complete load path, all connections shall be designed separately to transfer load from PolyScape® Engineered Plastic Lumber to other structural members and then onto the foundation. Please refer to the manufacturer details and installation instructions, or contact Bedford® Industries, Inc. technical support.

6.5 *Physical Properties*

6.5.1 Physical characteristics and dimensional stability of PolyScape® Engineered Plastic Lumber were assessed to determine its behavior under typical environmental fluctuations.

6.5.1.1 Performance regarding moisture effects, thermal expansion, and slip resistance are furnished in **Table 15**.

Table 15. Physical Characteristics

Property		Reference Standard	Results
Water Absorption	%	ASTM D570	0.019
Moisture Effects	-		No change in appearance, no observed warping
Thermal Expansion, α	(in/in)/°F	ASTM D6341	1.904×10^{-5}
Coefficient of Friction, μ	Static Dry	ASTM D2394	0.583
	Dynamic Dry		0.504
	Static Wet	ASTM C1028	0.344
	Dynamic Wet		0.300
Impact Resistance	(lb-ft)/in	ASTM D256	1.25
SI: 1 (in/in)/°F = 1.8 (m/m)/°C, 1 (lb-ft)/in = 53.38 (N-m)/m			

6.6 *Fire Performance*

6.6.1 *Surface Burning Characteristics:*

6.6.1.1 PolyScape® Engineered Plastic Lumber was evaluated for surface burning characteristics (flame spread) in accordance with IBC Section 2612.3 and IRC Section R507.2.2.2.

6.6.1.2 The surface burning characteristics of PolyScape® Engineered Plastic Lumber are given in **Table 16**.

Table 16. Surface Burning Characteristics[1]

Product	Flame Spread Index	Smoke Developed Index
PolyScape® Engineered Plastic Lumber - Ultra Grade	80	800
1. Tested in accordance with ASTM E84.		

6.7 Alternative techniques shall be permitted in accordance with accepted engineering practice and experience. These provisions for the use of alternative materials, designs, and methods of construction are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed herein. This includes, but is not limited to, the following areas of engineering: mechanics of materials, structures, building science, and fire science.

7 Certified Performance[26]

7.1 All construction methods shall conform to accepted engineering practices to ensure durable, livable, and safe construction and shall demonstrate acceptable workmanship reflecting journeyman quality of work of the various trades.[27]

7.2 The strength and rigidity of the component parts and/or the integrated structure shall be determined by engineering analysis or by suitable load tests to simulate the actual loads and conditions of application that occur.[28]

8 Regulatory Evaluation and Accepted Engineering Practice

8.1 PolyScape® Engineered Plastic Lumber complies with the following legislatively adopted regulations and/or accepted engineering practice for the following reasons:

8.1.1 PolyScape® Engineered Plastic Lumber was tested and/or evaluated for:

8.1.1.1 Structural capacities for gravity loads when used as deck posts and joists.

8.1.1.2 Fastener connection performance in accordance with ASTM D6117.

8.1.1.3 Surface burning characteristics testing was conducted in accordance with ASTM E84 as specified in IBC Section 2612.3 and IRC Section R507.2.2.2.

8.2 Any building code, regulation and/or accepted engineering evaluations (e.g., research reports, duly authenticated reports, etc.) that are conducted for this Listing were performed by DrJ, which is an ISO/IEC 17065 accredited certification body and a professional engineering company operated by RDP or approved sources. DrJ is qualified[29] to practice product and regulatory compliance services within its scope of accreditation and engineering expertise,[30] respectively.

8.3 Engineering evaluations are conducted with DrJ's ANAB accredited ICS code scope of expertise, which is also its areas of professional engineering competence.

9 Installation

9.1 Installation shall comply with the approved construction documents, the manufacturer installation instructions, this report, and the applicable building code.

9.2 In the event of a conflict between the manufacturer installation instructions and this report, contact the manufacturer for counsel on the proper installation method.

9.3 *Installation Procedure*

9.3.1 *Joist Applications:*

9.3.1.1 PolyScape® Engineered Plastic Lumber joists shall be installed in the orientation, sizes, and maximum spans shown in **Table 2** through **Table 5**.

9.3.1.2 Joist spacing and layout shall be as shown on approved construction plans. If spacing is not specified, an engineered design shall be drafted by an RDP.

9.3.1.3 Joists shall be laterally restrained with blocking at specified intervals per construction plans as required to prevent rotation and to maintain alignment.

9.3.1.4 Joist hangers shall be rated for the joist size and design loads, and shall be fastened using the fasteners specified by the hanger manufacturer (including quantity and type).

9.3.2 *Beam Applications:*

9.3.2.1 PolyScape® Engineered Plastic Lumber beams, either solid or built-up (multi-ply) beams, shall be installed in the sizes, configurations, and maximum spans shown in **Table 6** or **Table 7**.

9.3.2.2 Built-up beams shall be assembled in accordance with **Figure 7**.

9.3.2.2.1 Fastener spacing shall be in accordance with the nailed built-up columns as detailed in NDS Section 15.3.3 using #10 x 3" wood screws staggered along each edge and on both sides.

9.3.2.2.2 A 2-ply beam shall be fastened to each notched 3-ply PolyScape® Engineered Plastic Lumber post with two rows of #10 x 3" screws. Minimum edge distance shall be $1^1/_2$".

9.3.2.2.2.1 2 x 6 beams require two (2) screws per row at each notched post.

9.3.2.2.2.2 2 x 8 beams require three (3) screws per row at each notched post.

9.3.2.2.2.3 2 x 10 beams require four (4) screws per row at each notched post.

9.3.2.2.3 A 3-ply beam shall be secured to the 3-ply PolyScape® Engineered Plastic Lumber post with a code-compliant post cap connector with a minimum uplift capacity of 2,000 lb.

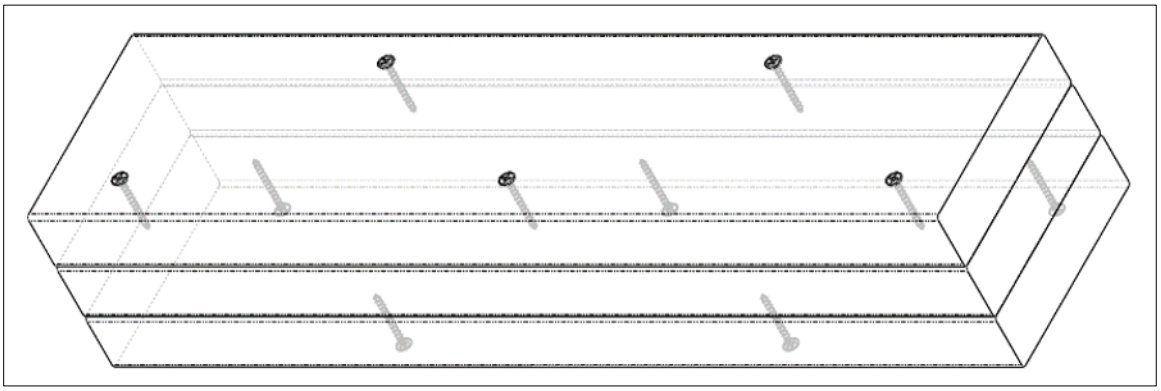


Figure 7. PolyScape® Engineered Plastic Lumber Multi-Ply Beam Assembly

9.3.2.3 Beams shall be continuously supported at designated bearing points. Concentrated reactions shall be transferred through approved hardware (e.g., post caps, saddles, hangers, or bearing plates).

9.3.2.4 Knee bracing at posts shall be provided as required by the governing code to prevent sway.

9.3.3 *Column/Post Applications:*

9.3.3.1 PolyScape® Engineered Plastic Lumber posts, either solid or built-up (multi-ply) posts, shall be installed plumb and supported to provide concentric load transfer consistent with the axial/bearing capacities shown in **Table 8**.

9.3.3.2 Notched 3-ply 2 x 6 built-up posts for 2-ply beams shall be assembled in accordance with **Figure 8**.

9.3.3.2.1 Fastener spacing shall be in accordance with the nailed built-up columns as detailed in NDS Section 15.3.3 using #10 x 4" wood screws staggered along each edge and on both sides.

9.3.3.2.2 3-ply 2 x 6 built-up posts for 3-ply beams shall have all three plies flush as shown in **Figure 6**.

9.3.3.2.2.1 Fastener spacing shall be the same as the notched 3-ply built-up posts.

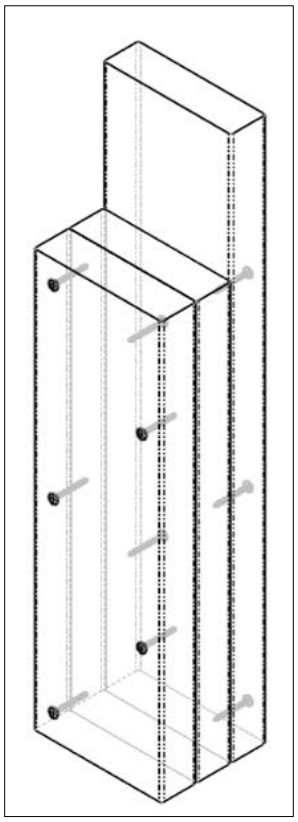


Figure 8. PolyScape® Engineered Plastic Lumber Multi-Ply Beam Assembly

9.3.3.3 Post bases and caps shall be designed and installed to resist design uplift and lateral loads.

10 Substantiating Data

10.1 Testing has been performed under the supervision of a professional engineer and/or under the requirements of ISO/IEC 17025 as follows:

10.1.1 Flexural testing in accordance with ASTM D6109

10.1.2 Shear testing in accordance with ASTM D2344

10.1.3 Compression testing in accordance with ASTM D6108

10.1.4 Head-pull through, withdrawal resistance, and lateral resistance testing in accordance with ASTM D6117

10.1.5 Dowel bearing testing in accordance with ASTM D5764

10.1.6 Creep Recovery testing in accordance with ASTM D7032

10.1.7 Joist spans, beam spans, and solid/built-up post capacities in calculations by DrJ Engineering, LLC

10.1.8 Moisture effects testing in accordance with ASTM D570

10.1.9 Linear thermal expansion testing in accordance with ASTM D6341

10.1.10 Coefficient of friction testing in accordance with ASTM C1028 and ASTM D2394

10.1.11 Impact resistance testing per ASTM D256

10.1.12 Surface burning characteristics in accordance with ASTM E84

10.2 Information contained herein may include the result of testing and/or data analysis by sources that are approved agencies, approved sources, and/or an RDP. Accuracy of external test data and resulting analysis is relied upon.

10.3 Where applicable, testing and/or engineering analysis are based upon provisions that have been codified into law through state or local adoption of regulations and standards. The developers of these regulations and standards are responsible for the reliability of published content. DrJ's engineering practice may use a regulation-adopted provision as the control. A regulation-endorsed control versus a simulation of the conditions of application to occur establishes a new material as being equivalent to the regulatory provision in terms of quality, strength, effectiveness, fire resistance, durability, and safety.

10.4 The accuracy of the provisions provided herein may be reliant upon the published properties of raw materials, which are defined by the grade mark, grade stamp, mill certificate, or duly authenticated reports from approved agencies and/or approved sources provided by the supplier. These are presumed to be minimum properties and relied upon to be accurate. The reliability of DrJ's engineering practice, as contained in this duly authenticated report, may be dependent upon published design properties by others.

10.5 *Testing and Engineering Analysis*

10.5.1 The strength, rigidity, and/or general performance of component parts and/or the integrated structure are determined by suitable tests that simulate the actual conditions of application that occur and/or by accepted engineering practice and experience.[31]

10.6 Where additional condition of use and/or regulatory compliance information is required, please search for PolyScape® Engineered Plastic Lumber on the DrJ Certification website.

11 Findings

11.1 As outlined in **Section 6**, PolyScape® Engineered Plastic Lumber has performance characteristics that were tested and/or meet applicable regulations. In addition, they are suitable for use pursuant to its specified purpose.

11.2 When used and installed in accordance with this duly authenticated report and the manufacturer installation instructions, PolyScape® Engineered Plastic Lumber shall be approved for the following applications:

11.2.1 Joists as shown in **Table 2** through **Table 5**.

11.2.2 Beams as shown in **Table 6** and **Table 7**.

11.2.3 Posts as shown in **Table 8**.

11.2.4 Fastener connection performance as prescribed in **Table 9** and **Table 10**, or calculated using AWC NDS and **Table 11**.

11.2.5 Engineered designs using section properties listed in **Table 12**, reference ASD values listed in **Table 13**, adjustments listed in **Table 14**, and applicable physical properties in **Table 15**.

11.3 Unless exempt by state statute, when PolyScape® Engineered Plastic Lumber is to be used as a structural and/or building envelope component in the design of a specific building, the design shall be performed by an RDP.

11.4 Any application specific issues not addressed herein can be engineered by an RDP. Assistance with engineering is available from Bedford® Industries, Inc.

11.5 IBC Section 104.2.3[32] (IRC Section R104.2.2[33] and IFC Section 104.2.3[34] are similar) in pertinent part state:

> 104.2.3 Alternative Materials, Design and Methods of Construction and Equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative is not specifically prohibited by this code and has been approved.

11.6 **Approved:**[35] Building regulations require that the building official shall accept duly authenticated reports.[36]

11.6.1 An approved agency is *"approved"* when it is ANAB ISO/IEC 17065 accredited.

11.6.2 An approved source is *"approved"* when an RDP is properly licensed to transact engineering commerce.

11.6.3 Federal law, Title 18 US Code Section 242, requires that, where the alternative product, material, service, design, assembly, and/or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved. Denial without written reason deprives a protected right to free and fair competition in the marketplace.

11.7 DrJ is a licensed engineering company, employs licensed RDPs and is an ANAB Accredited Product Certification Body – Accreditation #1131.

11.8 Through the IAF Multilateral Arrangement (MLA), this duly authenticated report can be used to obtain product approval in any jurisdiction or country because all ANAB ISO/IEC 17065 duly authenticated reports are equivalent.[37]

12 Conditions of Use

12.1 As defined in **Section 6**, where material and/or engineering mechanics properties are created for load resisting design purposes, the resistance to the applied load shall not exceed the ability of the defined properties to resist those loads using the principles of accepted engineering practice.

12.2 For PolyScape® Engineered Plastic Lumber used as joists or beams, the design values in this report apply to full cross-sections as shown in **Table 12**. For members modified by notching, cutting, or drilling, additional engineering considerations are required.

12.3 When required by adopted legislation and enforced by the building official, also known as the Authority Having Jurisdiction (AHJ) in which the project is to be constructed:

12.3.1 Any calculations incorporated into the construction documents shall conform to accepted engineering practice and, when prepared by an approved source, shall be approved when signed and sealed.

12.3.2 This report and the installation instructions shall be submitted at the time of permit application.

12.3.3 At a minimum, this innovative product shall be installed per **Section 9**.

12.3.4 The review of this report by the AHJ shall comply with IBC Section 104.2.3.2 and IBC Section 105.3.1.

12.3.5 This innovative product has an internal quality control program and a third party quality assurance program in accordance with IBC Section 104.7.2, IBC Section 110.4, IBC Section 1703, IRC Section R104.7.2, and IRC Section R109.2.

12.3.6 The application of this innovative product in the context of this report is dependent upon the accuracy of the construction documents, implementation of installation instructions, inspection as required by IBC Section 110.3, IRC Section R109.2, and any other regulatory requirements that may apply.

12.4 The approval of this report by the AHJ shall comply with IBC Section 1707.1, where legislation states in part, *"the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 104.2.3"*, all of IBC Section 104, and IBC Section 105.3.

12.5 Design loads shall be determined in accordance with the regulations adopted by the jurisdiction in which the project is to be constructed and/or by the building designer (i.e., owner or RDP).

12.6 The actual design, suitability, and use of this report for any particular building, is the responsibility of the owner or the authorized agent of the owner.

13 Identification

13.1 PolyScape® Engineered Plastic Lumber, as listed in **Section 1.1**, is identified by a label on the board or packaging material bearing the manufacturer name, product name, this report number, and other information to confirm code compliance.

13.2 Additional technical information can be found at www.polyscape.com.

14 Review Schedule

14.1 This report is subject to periodic review and revision. For the latest version, visit www.drjcertification.org.

14.2 For information on the status of this report, please contact DrJ Certification.

Notes

1 For more information, visit drjcertification.org or call us at 608-310-6748.

2 Capitalized terms and responsibilities are defined pursuant to the applicable building code, applicable reference standards, the latest edition of TPI 1, the NDS, AISI S202, US professional engineering law, Canadian building code, Canada professional engineering law, Qualtim External Appendix A: Definitions/Commentary, Qualtim External Appendix B: Project/Deliverables, Qualtim External Appendix C: Intellectual Property and Trade Secrets, definitions created within Design Drawings and/or definitions within Reference Sheets. Beyond this, terms not defined shall have ordinarily accepted meanings as the context implies. Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

3 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1702

4 Alternative Materials, Design and Methods of Construction and Equipment: The provisions of any regulation code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by a regulation. Please review https://www.justice.gov/atr/mission and https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#104.2.3

5 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1706.2:~:text=the%20design%20strengths%20and%20permissible%20stresses%20shall%20be%20established%20by%20tests

6 The design strengths and permissible stresses of any structural material shall conform to the specifications and methods of design of accepted engineering practice. https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1706.1:~:text=Conformance%20to%20Standards-,The%20design%20strengths%20and%20permissible%20stresses,-of%20any%20structural

7 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1707.1:~:text=the%20building%20official%20shall%20make%2C%20or%20cause%20to%20be%20made%2C%20the%20necessary%20tests%20and%20investigations%3B%20or%20the%20building%20official%20shall%20accept%20duly%20authenticated%20reports%20from%20approved%20agencies%20in%20respect%20to%20the%20quality%20and%20manner%20of%20use%20of%20new%20materials%20or%20assemblies%20as%20provided%20for%20in%20Section%20104.2.3.

8 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1703.4.2

9 https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#approved_agency

10 https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#approved_source

11 https://www.law.cornell.edu/uscode/text/18/1832 (b) Any organization that commits any offense described in subsection (a) shall be fined not more than the greater of $5,000,000 or 3 times the value of the stolen trade secret to the organization, including expenses for research and design and other costs of reproducing the trade secret that the organization has thereby avoided. The federal government and each state have a public records act. To follow DTSA and comply state public records and trade secret legislation requires approval through ANAB ISO/IEC 17065 accredited certification bodies or approved sources. For more information, please review this website: Intellectual Property and Trade Secrets.

12 https://www.nspe.org/resources/issues-and-advocacy/professional-policies-and-position-statements/regulation-professional AND https://apassociation.org/list-of-engineering-boards-in-each-state-archive/

13 https://www.cbitest.com/accreditation/

14 https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#104.1:~:text=directed%20to%20enforce%20the%20provisions%20of%20this%20code

15 https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#104.2.3 AND https://up.codes/viewer/mississippi/ibc-2024/chapter/1/scope-and-administration#105.3.1

16 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1707.1

17 https://iaf.nu/en/about-iaf-mla/#:~:text=Once%20an%20accreditation%20body%20is%20a%20signatory%20of%20the%20IAF%20MLA%2C%20it%20is%20required%20to%20recognise%20certificates%20and%20validation%20and%20verification%20statements%20issued%20by%20conformity%20assessment%20bodies%20accredited%20by%20all%20other%20signatories%20of%20the%20IAF%20MLA%2C%20with%20the%20appropriate%20scope

18 True for all ANAB accredited product evaluation agencies and all International Trade Agreements.

19 https://www.justice.gov/crt/deprivation-rights-under-color-law AND https://www.justice.gov/atr/mission

20 Unless otherwise noted, the links referenced herein use un-amended versions of the 2024 International Code Council (ICC) 2024 International Code Council (ICC) model codes as foundation references. Mississippi versions of the IBC 2024 and the IRC 2024 are un-amended. This material, product, design, service and/or method of construction also complies with the 2000-2012 versions of the referenced codes and the standards referenced therein. As pertinent to this technical and code compliance evaluation, CBI and/or DrJ staff have reviewed any state or local regulatory amendments to assure this report is in compliance.

21 See Adoptions by Publisher for the latest adoption of a non-amended or amended model code by the local jurisdiction. https://up.codes/codes/general

22 See Adoptions by Publisher for the latest adoption of a non-amended or amended model code by state. https://up.codes/codes/general

23 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3282/subpart-A/section-3282.14

24 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280

25 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#p-3280.2(Listed%20or%20certified); https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#listed AND https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#labeled

26 https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1703.4

27 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#:~:text=All%20construction%20methods%20shall%20be%20in%20conformance%20with%20accepted%20engineering%20practices%20to%20insure%20durable%2C%20livable%2C%20and%20safe%20housing%20and%20shall%20demonstrate%20acceptable%20workmanship%20reflecting%20journeyman%20quality%20of%20work%20of%20the%20various%20trades

28 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#:~:text=The%20strength%20and%20rigidity%20of%20the%20component%20parts%20and/or%20the%20integrated%20structure%20shall%20be%20determined%20by%20engineering%20analysis%20or%20by%20suitable%20load%20tests%20to%20simulate%20the%20actual%20loads%20and%20conditions%20of%20application%20that%20occur

[29] Qualification is performed by a legislatively defined Accreditation Body. ANSI National Accreditation Board (ANAB) is the largest independent accreditation body in North America and provides services in more than 75 countries. DrJ is an ANAB accredited product certification body.

[30] https://anabpd.ansi.org/Accreditation/product-certification/AllDirectoryDetails?prgID=1&orgID=2125&statusID=4#:~:text=Bill%20Payment%20Date-,Accredited%20Scopes,-13%20ENVIRONMENT.%20HEALTH

[31] See Code of Federal Regulations (CFR) Title 24 Subtitle B Chapter XX Part 3280 for definition: https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280

[32] 2021 IBC Section 104.11

[33] 2021 IRC Section R104.11

[34] 2018: https://up.codes/viewer/wyoming/ifc-2018/chapter/1/scope-and-administration#104.9 AND 2021: https://up.codes/viewer/wyoming/ibc-2021/chapter/1/scope-and-administration#104.11

[35] Approved is an adjective that modifies the noun after it. For example, Approved Agency means that the Agency is accepted officially as being suitable in a particular situation. This example conforms to IBC/IRC/IFC Section 201.4 (https://up.codes/viewer/mississippi/ibc-2024/chapter/2/definitions#201.4) where the building code authorizes sentences to have an ordinarily accepted meaning such as the context implies.

[36] https://up.codes/viewer/mississippi/ibc-2024/chapter/17/special-inspections-and-tests#1707.1

[37] Multilateral approval is true for all ANAB accredited product evaluation agencies and all International Trade Agreements.