



CERTIFICATION



Approved. Sealed. Code Compliant.

Technical Evaluation Report

TER 1312-01

Boral Stone Adhered Masonry Veneer
Applications over Continuous Insulation

Boral Stone Group

Product:

**Boral Stone Adhered Masonry
Veneer**

Issue Date:

February 5, 2014

Revision Date:

March 19, 2020

Subject to Renewal:

April 1, 2021



COMPANY
INFORMATION:

Boral Stone Group
2256 Centennial Rd
Toledo, OH 43617-1870
425-903-5937
rgaragliano@boral.com
boralamerica.com

ADDITIONAL
LISTEES:

Eldorado Stone 1200 Industry St Everett, WA 98203 760-736-3232 eldoradostone.com	ProStone 350 Tower Rd American Canyon, CA 94503 590 Ecology Ln Chester SC 29706 prostoneveneer.com	Dutch Quality Stone PO Box 308 Mount Eaton, OH 44659 877-359-7866 dutchqualitystone.com	Cultured Stone 350 Tower Rd American Canyon, CA 94503 culturedstone.com	StoneCraft Industries 8300 County Road 189 Holmesville, OH 44633 888-580-6448 stonecraft.com
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DIVISION: 04 00 00 - MASONRY
SECTION: 04 70 00 - Manufactured Masonry
SECTION: 04 73 00 - Manufactured Stone Masonry

1 PRODUCT EVALUATED^{1,2}
1.1 Boral Stone Adhered Masonry Veneer

¹ Building codes require data from valid research reports be obtained from approved sources. Agencies who are accredited through ISO/IEC 17065 have met the code requirements for approval by the building official. DrJ is an ISO/IEC 17065 ANSI-Accredited Product Certification Body – Accreditation #1131.

Through ANSI accreditation and the IAF MLA, DrJ certification can be used to obtain product approval in any jurisdiction or country that has IAF MLA Members & Signatories to meet the Purpose of the MLA – “certified once, accepted everywhere.”

Building official approval of a licensed registered design professional (RDP) is performed by verifying the RDP and/or their business entity complies with all professional engineering laws of the relevant jurisdiction. Therefore, the work of licensed RDPs is accepted by building officials, except when plan (i.e. peer) review finds an error with respect to a specific section of the code. Where this TER is not approved, the building official responds in writing stating the reasons for disapproval.

For more information on any of these topics or our mission, product evaluation policies, product approval process, and engineering law, visit drjcertification.org or call us at 608-310-6748.

² The adhered masonry veneer products manufactured by the listees noted above are part of this evaluation and are used interchangeably for the Boral Stone name throughout this document subject to the conditions herein.

2 APPLICABLE CODES AND STANDARDS^{3,4}

2.1 Codes

- 2.1.1 *IBC—12, 15, 18: International Building Code®*
- 2.1.2 *IRC—12, 15, 18: International Residential Code®*

2.2 Standards and Referenced Documents

- 2.2.1 *AISI S100: North American Specification for the Design of Cold-formed Steel Structural Members*
- 2.2.2 *ANSI/AWC NDS: National Design Specification (NDS) for Wood Construction*
- 2.2.3 *ANSI/AWC SDPWS: Special Design Provisions for Wind and Seismic*
- 2.2.4 *ANSI/AWC WFCM: Wood Frame Construction Manual for One- and Two-Family Dwellings*
- 2.2.5 *ASCE/SEI 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures*
- 2.2.6 *ASTM C1063: Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster*
- 2.2.7 *ASTM C1289: Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board*
- 2.2.8 *ASTM C150: Standard Specification for Portland Cement*
- 2.2.9 *ASTM C578: Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation*
- 2.2.10 *ASTM C90: Standard Specification for Loadbearing Concrete Masonry Units*
- 2.2.11 *ASTM D5206: Standard Test Method for Windload Resistance of Rigid Plastic Siding*
- 2.2.12 *ASTM E330: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference*
- 2.2.13 *ASTM F1667: Standard Specification for Driven Fasteners: Nails, Spikes, and Staples*

3 PERFORMANCE EVALUATION

3.1 The Boral Stone products were evaluated to determine:

- 3.1.1 The ability of various fasteners to support the gravity and transverse loads induced by the products when installed over wood or steel light-frame construction with the addition of continuous insulation installed between the framing and the Boral Stone products.
- 3.1.2 The ability of various fasteners to support the gravity and transverse loads induced by the products when installed over concrete and masonry construction with the addition of continuous insulation installed between the framing and the Boral Stone products.

3.2 Use in applications requiring a fire-resistance rating are outside the scope of this evaluation.

3.3 Any code compliance issues not specifically addressed in this section are outside the scope of this TER.

3.4 Any engineering evaluation conducted for this TER was performed on the dates provided in this TER and within Dr.J's professional scope of work.

4 PRODUCT DESCRIPTION AND MATERIALS

4.1 Boral Stone products are manufactured, precast, concrete veneer products made from Portland cement, aggregate, water, admixtures, and coloring used as adhered, non-bearing exterior veneer or as an interior finish.

4.2 Boral Stone products have the following characteristics:

- 4.2.1 Color and texture similar to various stone or brick surfaces. Examples are shown in Figure 1.

³ Unless otherwise noted, all references in this TER are from the 2018 version of the codes and the standards referenced therein (e.g., *ASCE 7, NDS, ASTM*). This material, design, or method of construction also complies with the 2000-2015 versions of the referenced codes and the standards referenced therein.

⁴ All terms defined in the applicable building codes are italicized.

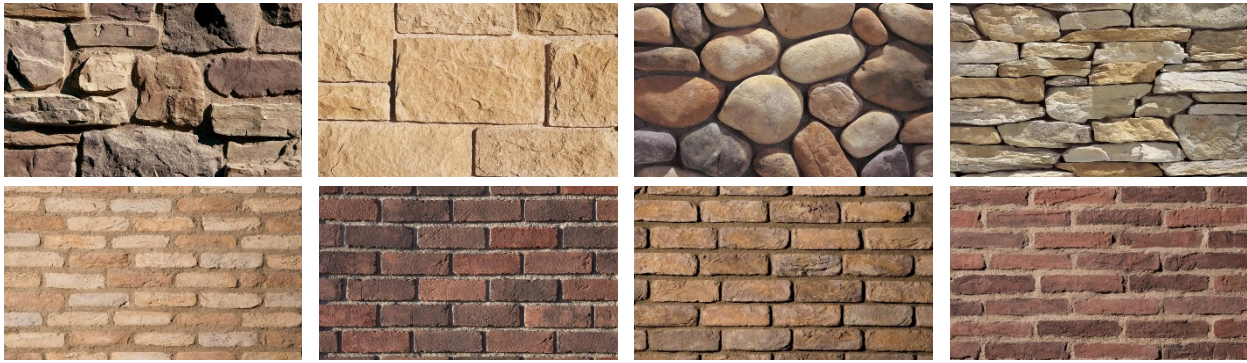


FIGURE 1. EXAMPLES OF BORAL STONE PRODUCT FINISHES

- 4.2.2 Patterns have a maximum per unit area of 720 square inches (0.464 m²).
- 4.2.3 Patterns have a maximum per unit dimension of 36" (914 mm).
- 4.2.4 Patterns have a maximum average thickness of 1.65" (42 mm).
- 4.2.5 Patterns have a nominal oven dry density less than 105 lb/ft³ (1362 kg/m³) and a maximum saturated weight not to exceed 15 lb/ft² (73.2 kg/m²).
- 4.2.6 The total cladding system weight, including the mortar setting bed, lath and scratch coat, is a maximum of 25 lbs per square foot (122 kg/m²) when fully saturated.
- 4.2.7 Product profiles and information is available in the appendices:
 - 4.2.7.1 Appendix A: Eldorado Stone
 - 4.2.7.2 Appendix B: ProStone
 - 4.2.7.3 Appendix C: Dutch Quality Stone
 - 4.2.7.4 Appendix D: Cultured Stone
 - 4.2.7.5 Appendix E: Stonecraft

5 APPLICATIONS

- 5.1 Boral Stone products are used as an exterior wall covering in accordance with the applicable sections of IBC Chapter 14 and Chapter 25 and IRC Section R703 and are installed over wood- or steel-framed walls and wood structural panels (WSP) capable of supporting the imposed loads in accordance with IBC Section 1609 and IRC Section R301.2.1, including all required transverse wind loads.
- 5.2 Boral Stone products are used as an exterior wall covering installed over wood- or steel-framed walls; (1) where the WSP is over sheathed with continuous insulation, or (2) onto masonry or concrete walls that are sheathed with continuous insulation. The maximum foam thickness for various framing and fastener types are as shown in Table 1, Table 2, and Table 3.

TABLE 1. FASTENER REQUIREMENTS TO SUPPORT CLADDING WEIGHT FOR BORAL STONE PRODUCTS INSTALLATION OVER CONTINUOUS INSULATION – WOOD

Fastener Penetration Into	Fastener Type	Substrate	Min. Fastener Length (in)	Max. Dist from Face of Framing to Underside of Fastener Head (in) (GAP)	Maximum Vertical Spacing (in) of Fasteners along Each Stud						
					Maximum Cladding Weight (psf)						
					5	10	15	18	22	25	
Wood	8d nail (0.131 in. dia.)	Lath/Mortar	See footnote 4	≤ 1.125	7	7	7	7	7	7	
			2.5	1.625	7	7	7	7	6	5	
	12d nail (0.148 in. dia.)		3.25	≤ 1.625	7	7	7	7	7	7	
			See footnote 4	≤ 3.625	7	7	7	7	7	7	
	TRUFAST® SIP TP		6	4.125	7	7	7	7	7	6	
			6.5	4.625	7	7	7	7	7	6	
			See footnote 4	≤ 3.625	7	7	7	7	7	7	
	TRUFAST® SIP LD		See footnote 4	≤ 3.125	7	7	7	7	7	7	
	HeadLOK®		See footnote 4	≤ 3.125	7	7	7	7	7	7	
	TRUFAST® SIP TP		Permabase or Durarock	2.5	≤ 0.875	8	8	8	8	8	8
				3	1.125	8	8	8	8	8	7
				3.5	1.625	8	8	8	8	7	6
				4	2.125	8	8	8	7	6	5
				4.5	2.625	8	8	7	6	5	4
		5		3.125	8	8	7	5	4	4	
		5.5		3.625	8	8	6	5	4	-	
		6		4.125	8	8	5	4	-	-	
		6.5		4.625	8	7	5	4	-	-	
		TRUFAST® SIP LD		See footnote 4	≤ 0.875	8	8	8	8	8	8
				4	1.125	8	8	8	8	8	7
				4.5	1.625	8	8	8	8	7	6
				5	2.125	8	8	8	7	6	5
				5.5	2.625	8	8	8	6	5	4
	6		3.125	8	8	7	5	4	4		
	6.5		3.625	8	8	6	5	4	-		
	HeadLOK®	See footnote 4	≤ 2.125	8	8	8	8	8	8		
		6	2.625	8	8	8	8	8	7		
		6.5	3.125	8	8	8	8	7	6		

 SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m²

- Lath shall be minimum 2.5-lb. metal lath having a minimum 0.020" thickness and shall be attached in accordance with Section 6.8. Tensile strength of the lath steel shall be minimum 43,900 psi.
- Maximum stud spacing is 16" o.c. Expanded metal lath shall be attached with fasteners, vertically, along each stud a maximum of 7" o.c.

3. Wood studs shall have a minimum specific gravity of 0.42.
4. Screws shall be corrosion-resistant, self-drilling, self-tapping and have a wafer or pancake head or a washer with a diameter sufficient to prevent the head from pulling through the openings in the lath and shall be in accordance with *ASTM C954* or *ASTM C1002*. Screws shall penetrate the studs a minimum of 1¼" in addition to the tapered point.
5. For thicker continuous insulation applications, design is required in accordance with accepted engineering practice.
6. The total distance from the face of the stud, to the underside of the fastener head shall not be more than that listed above. This includes any additional sheathing materials such as OSB, Gypsum, DensGlass®, plywood, lath, rain screen, or airspace incorporated in the design of the wall assembly. Where OSB or plywood is separately attached directly to the stud, the distance from framing to the underside of fastener head may be calculated from the face of the OSB or plywood.
7. Not all fasteners are commonly available in the lengths specified. Proprietary fasteners of equal strength and size are permitted.
8. This table provides some options evaluated by DrJ for the attachment of Boral Stone products over foam plastic insulating sheathing. Other methods, such as Cascadia clips or Knight Wall Systems, may be considered, but have not been evaluated by DrJ.
9. HeadLOK® screws are proprietary fasteners manufactured by OMG®, Inc. (DBA FastenMaster®). For HeadLOK® fastener code compliance issues, see the manufacturer's product literature and code compliance reports.
10. TRUFAST® fasteners are proprietary fasteners manufactured by TRUFAST®, LLC. For TRUFAST® fastener code compliance issues, see the manufacturer's product literature and code compliance reports.
11. Framing is defined as wood studs.
12. Continuous insulation shall be foam plastic sheathing with a minimum compressive strength of 15 psi in accordance with *ASTM C578* or *ASTM C1289*.
13. Values were calculated considering only gravity (lateral) loads. Where transverse load resistance is required, withdrawal resistance of the fastener shall be additionally considered.

TABLE 2. FASTENER REQUIREMENTS TO SUPPORT CLADDING WEIGHT FOR BORAL STONE PRODUCTS INSTALLATION OVER CONTINUOUS INSULATION – STEEL

Fastener Penetration Into	Fastener Type	Substrate	Min. Fastener Length (in)	Max Dist from Face of Framing to Underside of Fastener Head (in) (GAP)	Maximum Vertical Spacing (in) of Fasteners along Each Stud					
					Maximum Cladding Weight (psf)					
					5	10	15	18	22	25
Steel Framing (33 mil, 20 ga, 33 ksi)	#6 screw	Lath/Mortar	1	0.625	7	7	7	7	7	6
			1	0.875	7	7	7	7	6	6
			1.5	1.125	7	7	7	7	6	6
			2	1.625	7	7	7	6	4	4
			2.5	2.125	7	7	6	4	4	-
			3	2.625	7	4	-	-	-	-
			3.5	3.125	4	-	-	-	-	-
	#8 screw		1	0.625	7	7	7	7	7	7
			1	0.875	7	7	7	7	7	6
			1.5	1.125	7	7	7	7	7	6
			2	1.625	7	7	7	7	6	4
			2.5	2.125	7	7	7	6	4	4
			3	2.625	7	7	6	4	4	-
			3.5	3.125	7	6	4	-	-	-
	#10 screw		See footnote 3	≤ 1.125	7	7	7	7	7	7
			2	1.625	7	7	7	7	6	6
			2.5	2.125	7	7	7	7	6	4
			3	2.625	7	7	7	6	4	4
			3.5	3.125	7	7	6	4	4	-
			4	3.625	7	6	4	-	-	-
			4.5	4.125	7	4	-	-	-	-
	#12 screw		See footnote 3	≤ 1.125	7	7	7	7	7	7
			2	1.625	7	7	7	7	7	6
			2.5	2.125	7	7	7	7	6	6
			3	2.625	7	7	7	7	6	4
			3.5	3.125	7	7	7	6	4	4
			4	3.625	7	7	6	4	4	-
			4.5	4.125	7	6	4	-	-	-

Fastener Penetration Into	Fastener Type	Substrate	Min. Fastener Length (in)	Max Dist from Face of Framing to Underside of Fastener Head (in) (GAP)	Maximum Vertical Spacing (in) of Fasteners along Each Stud					
					Maximum Cladding Weight (psf)					
					5	10	15	18	22	25
	#14 screw		5	4.625	7	4	-	-	-	-
			See footnote 3	≤ 1.625	7	7	7	7	7	7
			2.5	2.125	7	7	7	7	7	6
			3	2.625	7	7	7	7	6	6
			3.5	3.125	7	7	7	7	6	4
Steel Framing (33 mil, 20 ga, 33 ksi)	#14 screw	Lath/Mortar	4	3.625	7	7	7	6	4	4
			4.5	4.125	7	7	6	4	4	-
			5	4.625	7	6	4	4	-	-
	TRUFAST® SIP LD		3	≤ 0.875	7	7	7	7	7	7
			3	1.125	7	7	7	7	7	6
			3	1.625	7	7	7	7	6	4
			3	2.125	7	7	6	6	4	4
			3	2.625	7	7	4	4	4	-
			3.5	3.125	7	6	4	-	-	-
			4	3.625	6	-	-	-	-	-
Steel Framing (43 mil, 18 ga, 33 ksi)	#6 screw	See footnote 3	≤ 1.125	7	7	7	7	7	7	
		2	1.625	7	7	7	7	7	6	
		2.5	2.125	7	7	7	6	6	4	
		3	2.625	7	7	4	4	4	-	
		3.5	3.125	7	4	-	-	-	-	
	#8 screw	See footnote 3	≤ 1.625	7	7	7	7	7	7	
		2.5	2.125	7	7	7	7	7	6	
		3	2.625	7	7	7	6	6	4	
		3.5	3.125	7	7	6	4	4	-	
		4	3.625	7	4	-	-	-	-	
	#10 screw	See footnote 3	≤ 2.125	7	7	7	7	7	7	
		3	2.625	7	7	7	7	7	6	
		3.5	3.125	7	7	7	6	6	4	
		4	3.625	7	7	6	4	4	-	
		4.5	4.125	7	4	-	-	-	-	

Fastener Penetration Into	Fastener Type	Substrate	Min. Fastener Length (in)	Max Dist from Face of Framing to Underside of Fastener Head (in) (GAP)	Maximum Vertical Spacing (in) of Fasteners along Each Stud							
					Maximum Cladding Weight (psf)							
					5	10	15	18	22	25		
	#12 screw		See footnote 3	≤ 2.625	7	7	7	7	7	7		
			3.5	3.125	7	7	7	7	7	6		
			4	3.625	7	7	7	6	6	4		
			4.5	4.125	7	7	6	4	4	4		
			5	4.625	7	6	4	-	-	-		
	#14 screw		See footnote 3	≤ 3.125	7	7	7	7	7	7	7	
			4	3.625	7	7	7	7	7	6		
			4.5	4.125	7	7	7	7	6	4		
			5	4.625	7	7	6	6	4	4		
	TRUFAST® SIP LD		3	≤ 1.625	7	7	7	7	7	7	7	
			3	2.125	7	7	7	7	7	6		
			3	2.625	7	7	7	6	6	4		
			3.5	3.125	7	7	6	4	4	-		
			4	3.625	7	4	-	-	-	-		
	Steel Framing (54 mil, 16 ga., 50 ksi)		#6 screw	Lath/Mortar	See footnote 3	≤ 1.625	7	7	7	7	7	7
					2.5	2.125	7	7	7	7	7	6
					3	2.625	7	7	7	6	4	4
					3.5	3.125	7	4	-	-	-	-
#8 screw		See footnote 3	≤ 2.125		7	7	7	7	7	7		
		3	2.625		7	7	7	7	7	6		
		3.5	3.125		7	7	7	6	6	4		
		4	3.625		7	6	4	4	-	-		
#10 screw		See footnote 3	≤ 2.625		7	7	7	7	7	7		
		3.5	3.125		7	7	7	7	7	6		
		4	3.625		7	7	7	6	6	4		
		4.5	4.125		7	7	4	4	-	-		
#12 screw		See footnote 3	≤ 3.625		7	7	7	7	7	7		
		4.5	4.125		7	7	7	7	6	4		
		5	4.625		7	7	6	4	4	-		
#14 screw		See footnote 3	≤ 4.125		7	7	7	7	7	7		

Fastener Penetration Into	Fastener Type	Substrate	Min. Fastener Length (in)	Max Dist from Face of Framing to Underside of Fastener Head (in) (GAP)	Maximum Vertical Spacing (in) of Fasteners along Each Stud					
					Maximum Cladding Weight (psf)					
					5	10	15	18	22	25
	TRUFAST® SIP LD		5	4.625	7	7	7	7	6	6
			3	≤ 2.125	7	7	7	7	7	7
			3	2.625	7	7	7	7	7	6
			3.5	3.125	7	7	7	6	4	4
			4	3.625	7	6	4	-	-	-

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m²

- Lath shall be minimum 2.5-lb. metal lath having a minimum 0.020" thickness and shall be attached in accordance with Section 6.8. Tensile strength of the lath steel shall be minimum 43,900 psi.
- Maximum stud spacing is 16" o.c. Expanded metal lath shall be attached with fasteners, vertically, along each stud a maximum of 7" o.c.
- Screws shall be corrosion-resistant, self-drilling, self-tapping and penetrate a minimum of 3/8" and have a wafer or pancake head or a washer with a diameter sufficient to prevent the head from pulling through the openings in the lath and shall be in accordance with *ASTM C954* or *ASTM C1002*.
- For thicker continuous insulation applications, design is required in accordance with accepted engineering practice.
- The total distance from the face of the stud, to the underside of the fastener head shall not be more than that listed above. This includes any additional sheathing materials such as OSB, plywood, Gypsum, DensGlass®, lath, rain screen, or airspace incorporated in the design of the wall assembly.
- Not all fasteners are commonly available in the lengths specified. Proprietary fasteners of equal strength and size are permitted.
- This table provides some options evaluated by DrJ for the attachment of Boral Stone products over foam plastic insulating sheathing. Other methods, such as Cascadia clips or Knight Wall Systems, may be considered, but have not been evaluated by DrJ.
- Framing is defined as steel studs.
- Continuous insulation shall be foam plastic sheathing with a minimum compressive strength of 15 psi in accordance with *ASTM C578* or *ASTM C1289*.
- Values were calculated considering only gravity (lateral) loads. Where transverse load resistance is required, withdrawal resistance of the fastener shall be additionally considered.

TABLE 3. FASTENER REQUIREMENTS TO SUPPORT CLADDING WEIGHT FOR BORAL STONE PRODUCTS INSTALLATION OVER CONTINUOUS INSULATION – MASONRY & CONCRETE

Lath Fastener Through Continuous Insulation Into:	Lath Fastener Type	Max. Veneer Weight (includes lath, scratch coat, and mortar setting bed) (psf)	Maximum Distance from Face of Framing ¹⁰ to Underside of Fastener Head (in)	Lath Fastener – Minimum Size (dia. x length)
Concrete (minimum 2,500 psi)	TRUFAST® TRUGRIP, TRUFAST® SIP LD, or Tapcon® Hex Screw	15	1.375	TRUFAST® SIP LD or TRUFAST® TRUGRIP 3" or Tapcon® Hex Screw 3/16" x 3.25"
			1.875	TRUFAST® SIP LD or TRUFAST® TRUGRIP 3.5" or Tapcon® Hex Screw 1/4" x 3.75"
			2.375	TRUFAST® SIP LD or TRUFAST® TRUGRIP 4" or Tapcon® Hex Screw 1/4" x 4"
			3.375	TRUFAST® TRUGRIP 4.5" or Tapcon® Hex Screw 1/4" x 5"
		18	1.375	TRUFAST® SIP LD or TRUFAST® TRUGRIP 3" or Tapcon® Hex Screw 3/16" x 3.25"
			1.875	TRUFAST® SIP LD or TRUFAST® TRUGRIP 3.5" or Tapcon® Hex Screw 1/4" x 3.75"
			2.375	TRUFAST® SIP LD or TRUFAST® TRUGRIP 4" or Tapcon® Hex Screw 1/4" x 4"
			3.375	Tapcon® Hex Screw 1/4" x 5"
		22	1.375	TRUFAST® SIP LD or TRUFAST® TRUGRIP 3" or Tapcon® Hex Screw 1/4" x 3.25"
			1.875	TRUFAST® TRUGRIP 3.5" or Tapcon® Hex Screw 1/4" x 3.75"
			2.375	TRUFAST® TRUGRIP 4" or Tapcon® Hex Screw 1/4" x 4"
			3.375	Tapcon® Hex Screw 1/4" x 5"
		25	1.375	TRUFAST® TRUGRIP 3" or Tapcon® Hex Screw 1/4" x 3.25"
			1.875	TRUFAST® TRUGRIP 3.5" or Tapcon® Hex Screw 1/4" x 3.75"
			2.375	Tapcon® Hex Screw 1/4" x 4"
			3.375	Tapcon® Hex Screw 5/16" x 5"
Masonry (medium/normal Hollow CMU per ASTM C90)	TRUFAST® SIP LD, or Tapcon® Hex Screw	15	1.375	TRUFAST® SIP LD 3" or Tapcon® Hex Screw 3/16" x 2.75"
			1.875	TRUFAST® SIP LD 3.5" or Tapcon® Hex Screw 3/16" x 3.25"
			2.375	Tapcon® Hex Screw 1/4" x 3.75"
			3.375	Tapcon® Hex Screw 1/4" x 5"

		18	1.375	TRUFAST® SIP LD 2.5" or Tapcon® Hex Screw 3/16" x 2.75"
			1.875	Tapcon® Hex Screw 3/16" x 3.25"
			2.375	Tapcon® Hex Screw 1/4" x 3.75"
			3.375	Tapcon® Hex Screw 1/4" x 5"
		22	1.375	Tapcon® Hex Screw 1/4" x 2.75"
			1.875	Tapcon® Hex Screw 1/4" x 3.25"
			2.375	Tapcon® Hex Screw 1/4" x 3.75"
			3.375	Tapcon® Hex Screw 5/16" x 5"
		25	1.375	Tapcon® Hex Screw 1/4" x 2.75"
			1.875	Tapcon® Hex Screw 1/4" x 3.25"
			2.375	Tapcon® Hex Screw 1/4" x 3.75"

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m²

1. Lath shall be minimum 2.5-lb. metal lath having a minimum 0.020" thickness and shall be attached in accordance with Section 6.8. Tensile strength of the lath steel shall be minimum 43,900 psi.
2. Maximum fastener spacing in masonry and concrete is 16" o.c. horizontally and 7" o.c. vertically.
3. Masonry Construction – Tapcon® fasteners shall penetrate a minimum of 1". TRUFAST® SIP HD and TRUGRIP fasteners shall penetrate a minimum of 1½".
4. Concrete Construction – Tapcon® fasteners shall penetrate a minimum of 1½". TRUFAST® SIP HD and TRUGRIP fasteners shall penetrate a minimum of 1½".
5. For thicker continuous insulation applications, design is required in accordance with accepted engineering practice.
6. The total distance from concrete or masonry to the underside of the fastener head shall not be more than that listed above. This includes any additional sheathing materials such as OSB, plywood, Gypsum, DensGlass®, rain screen, or airspace incorporated in the design of the wall assembly.
7. Not all fasteners are commonly available in the lengths specified. Proprietary fasteners of equal strength and size are permitted.
8. This table provides some options evaluated by DrJ for the attachment of Boral Stone products over foam plastic insulating sheathing. Other methods, such as Cascadia clips or Knight Wall Systems, may be considered, but have not been evaluated by DrJ.
9. Tapcon® fasteners are proprietary fasteners manufactured by ITW Buildex. For Tapcon® fastener code compliance issues, see the manufacturer's product literature and code compliance reports.
10. TRUFAST® fasteners are proprietary fasteners manufactured by TRUFAST®, LLC. For TRUFAST® fastener code compliance issues, see the manufacturer's product literature and code compliance reports.
11. Continuous insulation shall be foam plastic sheathing with a minimum compressive strength of 15 psi in accordance with *ASTM C578* or *ASTM C1289*.

5.3 Boral Stone products are used as an exterior wall covering installed over furring. The furring is placed over the continuous insulation and fastened to the wood or steel studs or concrete or masonry substrate. The maximum foam thickness for various fastener sizes and types is listed in Table 4.

TABLE 4. MAXIMUM FOAM THICKNESS FOR FASTENER TYPE AND SIZE

Furring Material	Framing Member	Min Fastener Penetration into Wall Framing	Cladding Weight (psf)	Max Distance from the Face of Framing ¹⁹ to the Underside of the Furring Material (in)	Fastener Type & Minimum Size (dia. x length)
Minimum 1x3 Wood Furring	Minimum 2x Wood Stud	1 1/2"	15	1	0.148" x 3.25" Nail or HeadLOK® 4.5" or TRUFAST® SIP (LD or TP) 4"
				1.5	HeadLOK® 4.5" or TRUFAST® SIP (LD or TP) 4.5"
				2	HeadLOK® 5" or TRUFAST® SIP (LD or TP) 5"
				3	HeadLOK® 6" or TRUFAST® SIP (LD or TP) 7"
			18	1	0.148" x 3.25" Nail or HeadLOK® 4.5" or TRUFAST® SIP (LD or TP) 4"
				1.5	HeadLOK® 4.5" or TRUFAST® SIP (LD or TP) 4.5"
				2	HeadLOK® 5" or TRUFAST® SIP (LD or TP) 5"
				3	HeadLOK® 6" or TRUFAST® SIP (LD or TP) 7"
			22	1	0.148" x 3.25" Nail or HeadLOK® 4.5" or TRUFAST® SIP (LD or TP) 4"
				1.5	HeadLOK® 4.5" or TRUFAST® SIP (LD or TP) 4.5"
				2	HeadLOK® 5" or TRUFAST® SIP (LD or TP) 6"
				3	HeadLOK® 6" or TRUFAST® SIP (LD or TP) 7"
			25	1	0.148" x 3.25" Nail or HeadLOK® 4.5" or TRUFAST® SIP (LD or TP) 4"
				1.5	HeadLOK® 4.5" or TRUFAST® SIP (LD or TP) 5.5"
				2	HeadLOK® 5" or TRUFAST® SIP (LD or TP) 6"
				3	NONE
Steel Hat Channel (minimum 33 mil, 33 ksi)	Steel Stud (33 mil or thicker, 33 ksi)	Steel Thickness + 3 Threads	15	1	#4 (0.112" x 1.5") or TRUFAST® SIP LD 1.5"
				1.5	#6 (0.138" x 2") or TRUFAST® SIP LD 2"
				2	#6 (0.138" x 2.5") or TRUFAST® SIP LD 2.5"
				3	#10 (0.186" x 3.5") or TRUFAST® SIP LD 3.5"
			18	1	#4 (0.112" x 1.5") or TRUFAST® SIP LD 1.5"
				1.5	#6 (0.138" x 2") or TRUFAST® SIP LD 2"
				2	#8 (0.164" x 2.5") or TRUFAST® SIP LD 2.5"
				3	#12 (0.216" x 3.5") or TRUFAST® SIP LD 3.5"
			22	1	#6 (0.138" x 1.5") or TRUFAST® SIP LD 1.5"
				1.5	#8 (0.164" x 2") or TRUFAST® SIP LD 2"
				2	#10 (0.186" x 2.5") or TRUFAST® SIP LD 2.5"

Furring Material	Framing Member	Min Fastener Penetration into Wall Framing	Cladding Weight (psf)	Max Distance from the Face of Framing ¹⁹ to the Underside of the Furring Material (in)	Fastener Type & Minimum Size (dia. x length)			
				3	#14 (0.242" x 3.5") or TRUFAST® SIP LD 3.5"			
			25	1	#8 (0.164" x 1.5") or TRUFAST® SIP LD 1.5"			
				1.5	#10 (0.186" x 2") or TRUFAST® SIP LD 2"			
				2	#12 (0.216" x 3.5") or TRUFAST® SIP LD 2.5"			
				3	#16 (0.268" x 3.5") or TRUFAST® SIP LD 3.5"			
Steel Hat Channel (minimum 33 mil, 33 ksi)	Steel Stud (43 mil or thicker, 33 ksi) Steel Stud	Steel Thickness + 3 Threads	15	1	#4 (0.112" x 1.5") or TRUFAST® SIP LD 1.5"			
				1.5	#6 (0.138" x 2") or TRUFAST® SIP LD 2"			
				2	#6 (0.138" x 2.5") or TRUFAST® SIP LD 2.5"			
				3	#8 (0.164" x 3.5") or TRUFAST® SIP LD 3.5"			
			18	1	#4 (0.112" x 1.5") or TRUFAST® SIP LD 1.5"			
Steel Hat Channel (minimum 33 mil, 33 ksi)	Steel Stud (43 mil or thicker, 33 ksi)	Steel Thickness + 3 Threads	18	1.5	#6 (0.138" x 2") or TRUFAST® SIP LD 2"			
				2	#6 (0.138" x 2.5") or TRUFAST® SIP LD 2.5"			
				3	#10 (0.186" x 3.5") or TRUFAST® SIP LD 3.5"			
			22	1	#6 (0.138" x 1.5") or TRUFAST® SIP LD 1.5"			
				1.5	#6 (0.138" x 2") or TRUFAST® SIP LD 2"			
				2	#8 (0.164" x 2.5") or TRUFAST® SIP LD 2.5"			
			25	3	#10 (0.186" x 3.5") or TRUFAST® SIP LD 3.5"			
				1	#6 (0.138" x 1.5") or TRUFAST® SIP LD 1.5"			
				1.5	#8 (0.164" x 2") or TRUFAST® SIP LD 2"			
				2	#8 (0.164" x 2.5") or TRUFAST® SIP LD 2.5"			
							3	#12 (0.216" x 3.5") or TRUFAST® SIP LD 3.5"
			Steel Hat Channel (minimum 33 mil, 33 ksi)	Masonry (medium/normal hollow CMU per ASTM C90)	1"	15	1	3/16" x 2.25" Tapcon® Hex Screw or TRUFAST® SIP LD 2.5"
1.5	3/16" x 2.75" Tapcon® Hex Screw or TRUFAST® SIP LD 3"							
2	3/16" x 3.25" Tapcon® Hex Screw or TRUFAST® SIP LD 3.5"							
18	3	1/4" x 5" Tapcon® Hex Screw or TRUFAST® SIP LD 4"						
	1	3/16" x 2.25" Tapcon® Hex Screw or TRUFAST® SIP LD 2.5"						
	1.5	3/16" x 2.75" Tapcon® Hex Screw or TRUFAST® SIP LD 3"						
							2	1/4" x 3.25" Tapcon® Hex Screw or TRUFAST® SIP LD 3.5"

Furring Material	Framing Member	Min Fastener Penetration into Wall Framing	Cladding Weight (psf)	Max Distance from the Face of Framing ¹⁹ to the Underside of the Furring Material (in)	Fastener Type & Minimum Size (dia. x length)
			22	3	1/4" x 5" Tapcon® Hex Screw
				1	3/16" x 2.25" Tapcon® Hex Screw or TRUFAST® SIP LD 2.5"
				1.5	1/4" x 2.75" Tapcon® Hex Screw or TRUFAST® SIP LD 3"
				2	1/4" x 3.25" Tapcon® Hex Screw or TRUFAST® SIP LD 3.5"
				3	1/4" x 5" Tapcon® Hex Screw
			25	1	1/4" x 2.25" Tapcon® Hex Screw or TRUFAST® SIP LD 2.5"
				1.5	1/4" x 2.75" Tapcon® Hex Screw or TRUFAST® SIP LD 3"
				2	1/4" x 3.25" Tapcon® Hex Screw or TRUFAST® SIP LD 3.5"
				3	5/16" x 5" Tapcon® Hex Screw
			Steel Hat Channel (minimum 33 mil, 33 ksi)	Concrete (minimum 2,500 psi)	1.5"
1.5	3/16" x 3.25" Tapcon® Hex Screw or TRUFAST® SIP LD or TRUFAST® TRUGRIP 3.5"				
2	3/16" x 3.75" Tapcon® Hex Screw or TRUFAST® SIP LD or TRUFAST® TRUGRIP 4"				
3	3/16" x 5" Tapcon® Hex Screw or TRUFAST® SIP LD or TRUFAST® TRUGRIP 5"				
25	1	3/16" x 2.75" Tapcon® Hex Screw or TRUFAST® SIP LD or TRUFAST® TRUGRIP 3"			
	1.5	3/16" x 3.25" Tapcon® Hex Screw or TRUFAST® SIP LD or TRUFAST® TRUGRIP 3.5"			
	2	3/16" x 3.75" Tapcon® Hex Screw or TRUFAST® SIP LD or TRUFAST® TRUGRIP 4"			
Steel Hat Channel (minimum 33 mil, 33 ksi)	Concrete (minimum 2,500 psi)	1.5"	25	3	1/4" x 5" Tapcon® Hex Screw or TRUFAST® SIP LD or TRUFAST® TRUGRIP 5"

 SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m²

- Lath shall be minimum 2.5-lb. metal lath having a minimum 0.020" thickness and shall be attached in accordance with Section 6.8. Tensile strength of the lath steel shall be minimum 43,900 psi.
- Where furring is installed vertically, it shall be installed directly over wall studs spaced a maximum of 16" o.c. Furring shall be attached to the studs at a maximum of 7" o.c. along the length of the stud. Where furring is attached vertically to concrete or masonry walls, it shall be spaced a maximum of 16" o.c. and fastened a maximum of 7" o.c. vertically. Where furring is attached horizontally to concrete or masonry, it shall be spaced a maximum of 7" o.c. and shall be fastened to the concrete or masonry with fasteners spaced a maximum of 16" o.c.

Furring Material	Framing Member	Min Fastener Penetration into Wall Framing	Cladding Weight (psf)	Max Distance from the Face of Framing ¹⁹ to the Underside of the Furring Material (in)	Fastener Type & Minimum Size (dia. x length)
<p>3. Where furring is installed horizontally, it shall be installed at a maximum 7" o.c. along the length of the stud and attached to each wall stud. Maximum stud spacing is 16" o.c.</p> <p>4. Wood furring shall be a minimum 3/4"-thick. Wood furring and wood studs shall have a minimum specific gravity of 0.42.</p> <p>5. Nails supporting the furring strips shall penetrate the studs a minimum of 1 1/2". Steel hat channel furring shall be a minimum 33 mil (33 ksi) thick steel with a 7/8" depth.</p> <p>6. Wood Construction – Nails shall penetrate wood framing a minimum of 1 1/2" and have a head size or a washer with a diameter sufficient to prevent the head from pulling through the openings in the lath. Screws shall penetrate the studs a minimum of 1 1/4".</p> <p>7. Steel Framing – Screws shall be corrosion-resistant, self-drilling, self-tapping and penetrate a minimum of 3/8" and have a wafer or pancake head or a washer with a diameter sufficient to prevent the head from pulling through the openings in the lath.</p> <p>8. Masonry Construction – Fasteners shall penetrate a minimum of 1".</p> <p>9. Concrete Construction – Tapcon® fasteners shall penetrate a minimum of 1 1/2". TRUFAST® TRUGRIP fasteners shall penetrate a minimum of 1".</p> <p>10. Corrosion-resistant, self-drilling, self-tapping screw fasteners for connection of siding to steel framing shall comply with the requirements of <i>AISI S200</i>. Other approved fasteners of equivalent or greater diameter and bending strength shall be permitted.</p> <p>11. Nail fasteners shall be common or box nails and shall comply with <i>ASTM F1667</i>, except nail length shall be permitted to exceed <i>ASTM F1667</i> standard lengths. Minimum bending yield strength for nails with a diameter up to 0.148", 0.162", and 0.225" shall be 90,000 psi, 90,000 psi, and 80,000 psi respectively.</p> <p>12. A minimum 2x wood furring shall be used where the required wall covering fastener penetration into wood material exceeds 3/4" (19.1 mm) and is not more than 1 1/2" (38.1 mm), unless approved deformed shank siding nails or siding screws are used to provide equivalent withdrawal strength, allowing the wall covering connection to be placed into 1x wood furring.</p> <p>13. Continuous insulation shall be foam plastic sheathing with a minimum compressive strength of 15 psi in accordance with <i>ASTM C578</i> or <i>ASTM C1289</i>.</p> <p>14. The total distance from the face of the stud, concrete or masonry to the underside of the furring shall not be more than the maximum thickness listed above. This includes any additional sheathing materials such as OSB, plywood, Gypsum, Densglass®, rain screen, or airspace incorporated in the design of the wall assembly. Cladding shall be attached to the furring in accordance with the manufacturer's installation instructions. Not all fasteners are commonly available in the lengths specified. Proprietary fasteners of equal strength and size are permitted.</p> <p>15. This table provides some options evaluated by DrJ for the attachment of Boral Stone products over foam plastic insulating sheathing. Other methods, such as Cascadia clips or Knight Wall Systems, may be considered, but have not been evaluated by DrJ.</p> <p>16. Materials in the assembly, other than the veneer, lath, and mortar setting bed and furring are assumed to be separately attached and are not included in the fastener size calculations. Furring weight shall be included as part of the listed cladding weight.</p> <p>17. HeadLOK® Screws are proprietary fasteners manufactured by OMG®, Inc. (DBA FastenMaster®). For HeadLOK® fastener code compliance issues, see the manufacturer's product literature and code compliance reports.</p> <p>18. Tapcon® fasteners are proprietary fasteners manufactured by ITW Buildex. For Tapcon® fastener code compliance issues, see the manufacturer's product literature and code compliance reports.</p> <p>19. TRUFAST® fasteners are proprietary fasteners manufactured by TRUFAST®, LLC. For TRUFAST® fastener code compliance issues, see the manufacturer's product literature and code compliance reports.</p> <p>20. Framing is defined as wood studs, steel studs, concrete, or masonry substrates.</p>					

5.4 Transverse Wind Loads

- 5.4.1 Boral Stone products shall not be installed in areas where the design wind pressure exceeds the capacity of the cladding and its attachment to resist the load in accordance with Table 5.
- 5.4.2 Table 5 provides the maximum design wind pressure allowed for the installation of this product. The maximum wind speed that corresponds with this wind pressure is provided to aid the user in determining where the product can be used. See the applicable building code for the maximum design wind speed allowed for the location of the building. The wind speed listed in Table 5 shall exceed the required design wind speed from the applicable code.

TABLE 5. MAXIMUM ALLOWABLE WIND PRESSURE AND WIND SPEEDS FOR BORAL STONE PRODUCT LATH FASTENERS

Exposure Category	Maximum Allowable Wind Pressure (psf)	Maximum Wind Speed ¹ , V_{ult}/V_{asd} (mph)
B	70	≤ 190/145
C		≤ 165/130
D		≤ 150/115

SI: 1 psf = 0.0479 kN/m², 1 mph = 1.61 km/h

- The first wind speed listed is V_{ult} , per ASCE 7-10 and 7-16, and is the maximum allowed wind speed for the Exposure Category shown with a maximum Mean Roof Height (MRH) of 30'. The second wind speed capacity shown for each exposure category is the ASCE 7-10 and 7-16 ultimate wind speed converted to V_{asd} for allowable stress design and rounded to the nearest 5 mph.
- Design wind pressure is per ASCE 7-10 and 7-16 for components and cladding, Method 1 for the condition shown.
- Maximum allowable wind speeds are based on the average ultimate loads tested for each condition divided by an allowable stress design reduction factor of 1.6, in accordance with SDPWS Section 3.2.1.
- Pressure Equalization factor in accordance with ASTM D5206, Procedure B equals 1.0.
- Wind pressure resistance is based on the lowest published withdraw capacity for the fasteners shown. Fasteners of equal or greater withdrawal resistance and equal or greater head size are permitted.

- 5.4.3 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.
- 5.4.4 For additional information or use in other applications, consult the manufacturer's installation instructions:
- 5.4.4.1 Eldorado Stone: www.eldoradostone.com/resources
 - 5.4.4.2 Prostone: prostoneveneer.com/resources
 - 5.4.4.3 Dutch Quality Stone: dutchqualitystone.com/installation.php
 - 5.4.4.4 Cultured Stone: www.culturedstone.com/resources
 - 5.4.4.5 Stonecraft: stonecraft.com/installation.php

6 INSTALLATION

- 6.1 Boral Stone products shall be installed in accordance with the manufacturer's published installation instructions (Section 5.4.3), the Masonry Veneer Manufacturer Association's Installation Guide, and this TER. In the event of a conflict between the manufacturer's installation instructions, the Masonry Veneer Manufacturer Association's Installation Guide and this TER, the more restrictive shall govern.
- 6.2 Installation is subject to the conditions of use set forth in Section 9.
- 6.3 Veneer must be applied to a wall framing system in which the studs are spaced a maximum of 16" o.c. (406 mm).
- 6.4 Boral Stone products may be installed over continuous insulation on wood- or steel-framed walls, with or without WSP sheathing, and attached in accordance with Table 1 or Table 2 and Table 4.
- 6.4.1 Where WSP sheathing is used, it shall be installed in accordance with the applicable building code or other standards as permitted by the building code (such as SDPWS or WFCM) and shall comply with one of the following minimum requirements:
- 6.4.1.1 Minimum 7/16" Structural 1, Exposure 1 OSB complying with PS 2
 - 6.4.1.2 Minimum 1/2" Structural 1 rated, exterior grade plywood complying with PS 1
- 6.5 Boral Stone products may be installed over continuous insulation on masonry or concrete walls and attached in accordance with Table 3 and Table 4.

- 6.6 Boral Stone products must be installed over two (2) layers of a water-resistant barrier (WRB) in accordance with IBC Section 1403.2⁵ and Section 2510.6 and IRC Section R703.2. The base layer WRB may be a liquid-applied, a sheet material, or a rigid continuous insulation with taped joints where the continuous insulation is approved for use as a WRB.
- 6.6.1 Exception: Where installed over concrete or masonry substrate, the WRB may not be required.
- 6.7 Weep screeds and code compliant flashing must be installed at the bottom of walls; the top of windows, doors and other fenestrations; and at all horizontal terminations of the veneer.
- 6.7.1 The weep screed must comply with and be installed in accordance with IBC Section 1404.10.1.2.1⁶ and Section 2512.1.2 or IRC Section R703.7.2.1.⁷
- 6.7.2 Exception: Where installed over concrete or masonry substrate, the weep screed is not required.
- 6.8 Veneer must be installed over 2.5 lb/yd² (1.4 kg/m²) galvanized diamond mesh metal lath, 3.4 lb/yd² (1.8 kg/m²) 3/8"-thick (9.5 mm) galvanized expanded metal lath, 18 gage [0.051"-thick (1.30 mm)] galvanized woven wire mesh, or other code-approved lath of equal or better performance.
- 6.9 Lath shall be:
- 6.9.1 Installed per the manufacturer's installation instructions or *ASTM C1063*.
- 6.9.2 Installed over the two (2) WRB layers, unless the following conditions are met:
- 6.9.2.1 Lath is paper-backed, in which case only one (1) additional layer of WRB is required, except as noted in Section 6.7.
- 6.9.2.2 If the foam sheathing has been qualified by the manufacturer to perform as a layer of WRB, then only one (1) additional layer of WRB is required.
- 6.9.2.3 If a rain screen is used, only one (1) additional layer of WRB is required, in accordance with IBC Section 2510.6.
- 6.9.3 Fastened through continuous insulation to each stud at 7" o.c. (152 mm) vertically along the stud or as shown in Table 2 and Table 4.
- 6.9.4 Attached to wood, steel, or concrete substrates with fasteners in accordance with Table 1, Table 2, and Table 3.
- 6.9.5 When the lath is installed over furring, the furring shall be fastened to the wood, steel, or concrete substrate in accordance with Table 4.
- 6.10 Boral Stone products shall be adhered to the supporting walls with a 1/2"-thick to 3/4"-thick (12.7 to 19.1 mm) mortar setting bed.
- 6.10.1 The mortar shall comply with IBC Section 2103.2⁸ or IRC Table R606.2.8⁹ for the application.
- 6.10.2 Other mortars of equal or greater performance shall be permitted, when installed in accordance with the manufacturer's installation instructions.
- 6.11 All other installation and flashing details germane to the project shall be in accordance with the applicable building code and the manufacturer's installation instructions.

⁵ 2015 IBC Section 1404.2

⁶ 2015 IBC Section 1405.10.1.2.1, 2012 IBC Section 1405.10.1.2

⁷ 2012 IRC Section R703.6.2.1

⁸ 2012 IBC Section 2103.9

⁹ 2015 IRC Section R606.2.7, 2012 IRC Section R607.1

7 TEST ENGINEERING SUBSTANTIATING DATA

- 7.1 Test report for wind load resistance by Architectural Testing
- 7.2 Foam Sheathing Committee Tech Matters, *Guide to Attaching Exterior Wall Coverings through Foam Sheathing to Wood or Steel Framing*.
- 7.3 New York State Energy Research and Development Authority, *Fastening Systems for Continuous Insulation*.
- 7.4 American Wood Council Technical Report TR-12, *General Dowel Equations for Calculating Lateral Connection Values*.
- 7.5 Masonry Veneer Manufacturers Association Installation Guide
- 7.6 Some information contained herein is the result of testing and/or data analysis by other sources which conform to IBC Section 1703 and relevant professional engineering law. DrJ relies on accurate data from these sources to perform engineering analysis. DrJ has reviewed and found the data provided by other professional sources to be credible.
- 7.7 Where appropriate, DrJ's analysis is based on design values that have been codified into law through codes and standards (e.g., *IBC*, *IRC*, *NDS®*, and *SDPWS*). This includes review of code provisions and any related test data that aids in comparative analysis or provides support for equivalency to an intended end-use application. Where the accuracy of design values provided herein is reliant upon the published properties of commodity materials (e.g., lumber, steel, and concrete), DrJ relies upon the grade mark, stamp, and/or design values provided by raw material suppliers to be accurate and conforming to the mechanical properties defined in the relevant material standard.

8 FINDINGS

- 8.1 Fasteners used in accordance with Table 1, Table 2, Table 3, and Table 4 are adequate for the support of Boral Stone products in applications where there is a layer of continuous insulation installed between the products and the underlying substrate (e.g., light-frame wood- or steel-framed walls or concrete or masonry walls).
- 8.2 Fasteners used in accordance with Table 1, Table 2, Table 3, and Table 4 are adequate to resist the transverse wind loads as shown in Table 5.
- 8.3 IBC Section 104.11 (IRC Section R104.11 and IFC Section 104.9 are similar) states:

104.11 **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 has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code...Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons the alternative was not *approved*.
- 8.4 This product has been evaluated in the context of the codes listed in Section 2 and is compliant with all known state and local building codes. Where there are known variations in state or local codes applicable to this evaluation, they are listed here.
 - 8.4.1 No known variations

9 CONDITIONS OF USE

- 9.1 Installation shall be on exterior walls consisting of wood framing, steel framing, masonry, or concrete capable of supporting the imposed loads, including transverse wind loads.
- 9.2 Where the seismic provisions of IRC Section R301.2.2 apply, the wall assembly shall not exceed the weight limits of Section R301.2.2.1, unless an engineered design is provided in accordance with Section R301.1.3.
- 9.3 Walls shall be braced to resist shear (racking) load by other means and in accordance with the applicable code.
- 9.4 Exterior wall framing shall be limited to a maximum out-of-plane deflection of H/360 (H equals the height of the wall).
- 9.5 Where required by the building official, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed, this TER and the installation instructions shall be submitted at the time of permit application.
- 9.6 Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval.
- 9.7 Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed and/or by the Building Designer (e.g., owner or registered design professional).
- 9.8 At a minimum, this product shall be installed per Section 6 of this TER.
- 9.9 This product is manufactured under a third-party quality control program in accordance with IBC Section 104.4 and 110.4 and IRC Section R104.4 and R109.2.
- 9.10 The actual design, suitability, and use of this TER, for any particular building, is the responsibility of the owner or the owner's authorized agent. Therefore, the TER shall be reviewed for code compliance by the building official for acceptance.
- 9.11 The use of this TER is dependent on the manufacturer's in-plant QC, the ISO/IEC 17020 third-party quality assurance program and procedures, proper installation per the manufacturer's instructions, the building official's inspection, and any other code requirements that may apply to demonstrate and verify compliance with the applicable building code.

10 IDENTIFICATION

- 10.1 Boral Stone products described in this TER are identified by a label on the packaging material bearing the manufacturer's name, product name, manufacturing plant location, product code, and other information to confirm code compliance.
- 10.2 Additional technical information can be found at boralamerica.com/stone.

11 REVIEW SCHEDULE

- 11.1 This TER is subject to periodic review and revision. For the most recent version of this TER, visit drjcertification.org.
- 11.2 For information on the current status of this TER, contact DrJ Certification.

APPENDIX A: ELDORADO STONE

Profile Name	Weight of Total Façade Includes Lath, Scratch, Bond Mortar & Stone, Saturated (psf)	Weight of Total Façade Includes 1/2" Cement Board, Bond Mortar & Stone, Saturated (psf)
Ashlar	20.4	17.1
Bluff Stone	19.3	16.1
Brick, Adobe	21.1	17.8
Brick, Arabian	18.5	15.3
Brick, Modena	17.0	13.7
Brick, Roma	19.6	16.3
Brick, Tundra	16.8	13.6
Brick, Via	18.4	15.1
Broken Top	22.4	19.2
Castlestone, English	20.0	16.7
Cliffstone	20.7	17.4
Coarsed Stone	21.3	18.0
Coastal Reef	20.6	17.3
Cobblestone	22.8	19.6
Country Rubble	21.0	17.7
Country Rubble, Oversized	24.9	21.7
Cut Coarsed Stone	22.2	19.0
Cypress Ridge	19.6	16.3
European Ledge Cut	22.2	18.9
Field Ledge	19.2	15.9
Top Rock	20.4	17.1
Hillstone	22.0	18.8
Latitude30	21.6	18.3
Ledgecut33	22.3	19.0
Limestone	21.2	18.0
Longitude24	21.6	18.3
Mountain Ledge Panel	22.0	18.8
Mountain Ledge	22.1	18.9
Ridgetop 18	21.6	18.3
River Rock, Northwest	21.7	18.5
River Rock, Creek Cobble	16.7	13.5
River Rock, Streamstone	22.5	19.3

Profile Name	Weight of Total Façade Includes Lath, Scratch, Bond Mortar & Stone, Saturated (psf)	Weight of Total Façade Includes 1/2" Cement Board, Bond Mortar & Stone, Saturated (psf)
River Rock, White Water	20.2	16.9
Rough Cut	22.2	18.9
Rustic Ledge	20.1	16.9
Shadow Rock	23.3	20.1
Sierra Cut24	27.3	24
Stack Stone	19.4	16.1
Vantage30	21.6	18.3
Vintage Ranch	20.5	17.2
Weathered Edge	22.0	18.8
Zen24	21.6	18.3

SI: 1 psf = 0.0479 kN/m²

1. This table is provided by the manufacturer to aid in selecting fasteners. DrJ Engineering has not independently verified the values in these tables.

APPENDIX B: PROSTONE

Profile Name	Weight of Total Façade Includes Lath, Scratch, Bond Mortar & Stone, Saturated (psf)	Weight of Total Façade Includes ½" Cement Board, Bond Mortar & Stone, Saturated (psf)
Tuscan Cobble	15	12
Carolina Collection Field Rubble	18	15
Carolina Collection Ledgestone	19	16
Carolina Collection Rough Ledge	19	16
Fieldstone	15	12
Aged Limestone	16	13
Ledgestone	16	13
River Rock	16	13
Easy Fit Savannah Ledgestone	22	19

 Sl: 1 psf = 0.0479 kN/m²

1. This table is provided by the manufacturer to aid in selecting fasteners. DrJ Engineering has not independently verified the values in these tables.

APPENDIX C: DUTCH QUALITY STONE

Profile Name	Weight of Total Façade Includes Lath, Scratch, Bond Mortar & Stone, Saturated (psf)	Weight of Total Façade Includes ½" Cement Board, Bond Mortar & Stone, Saturated (psf)
CastleStone	20.0	16.8
Drystack	20.5	17.3
FieldStone	19.6	16.3
Ledgestone	20.1	16.8
Limestone	20.7	17.5
Michigan Split Granite	22.0	18.8
River Rock	20.5	17.3
Stack Ledge	21.3	18.1
Tuscan Ridge	21.4	18.1
Tuscany Veneer	20.2	16.9
Weather Ledge	20.5	17.3

 Sl: 1 psf = 0.0479 kN/m²

1. This table is provided by the manufacturer to aid in selecting fasteners. DrJ Engineering has not independently verified the values in these tables.

APPENDIX D: CULTURED STONE

Product Style	Stone Saturated Weight (psf)	Saturated Density Stone and Scratch and Lath and Bonding Mortar (psf)	Saturated Density Stone and Cement Board and Bonding Mortar (psf)
Ancient Villa LedgeStone	11.4	21.4	18.1
Cast-Fit 12x24	12.0	22.0	18.7
Cast-Fit 8x16	13.8	23.8	20.5
Cobblefield	13.9	23.9	20.6
Coral Stone	10.1	20.1	16.8
Country LedgeStone	12.6	22.6	19.3
Cultured Brick Veneer-Handmade Brick	10.2	20.2	16.9
Cultured Brick Veneer-Used Brick	11.2	21.2	17.9
Del Mare LedgeStone	12.3	22.3	19.0
Dressed Fieldstone	14.3	24.3	21.0
Drystack LedgeStone	14.7	24.7	21.4
European Castle Stone	10.0	20.0	16.7
Hewn Stone 308	14.2	24.2	20.9
Hewn Stone 314	14.7	24.7	21.4
Hewn Stone 514	14.5	24.5	21.2
Hewn Stone 522	13.9	23.9	20.6
Hewn Stone 822	13.0	23.0	19.7
Limestone	13.6	23.6	20.3
Old Country Fieldstone	13.5	23.5	20.2
Pro-Fit Alpine LedgeStone	13.3	23.3	20.0
Pro-Fit LedgeStone	10.3	20.3	17.0
Pro-Fit Modera LedgeStone	12.0	22.0	18.7
Pro-Fit Terrain LedgeStone	12.2	22.2	18.9
River Rock	13.4	23.4	20.1
Rock Face	12.5	22.5	19.2
Southern LedgeStone	12.6	22.6	19.3
Split Face	13.3	23.3	20.0
Stream Stone	9.6	19.6	16.3

 St: 1 psf = 0.0479 kN/m²

1. This table is provided by the manufacturer to aid in selecting fasteners. DrJ Engineering has not independently verified the values in these tables.

APPENDIX E: STONECRAFT

Profile ID	Weight of Total Façade Includes Lath, Scratch, Bond Mortar & Stone, Saturated (psf)	Weight of Total Façade Includes 1/2" Cement Board, Bond Mortar & Stone, Saturated (psf)
Cobble	24.4	21.2
Dutchcraft	24.5	21.3
Farmledge	21.6	18.4
Fieldstone	20.7	17.5
Heritage	24.2	20.9
Laurel Cavern	22.3	19.0
Ledgestone	23.7	20.5
Monarch	20.9	17.7
River Rock	23.2	19.9
Top Rock	21.6	18.4

SI: 1 psf = 0.0479 kN/m²

1. This table is provided by the manufacturer to aid in selecting fasteners. DrJ Engineering has not independently verified the values in these tables.