SECTION 044200 - EXTERIOR STONE CLADDING

Revise this Section by deleting and inserting text to meet Project-specific requirements.

1. GENERAL
	* + 1. RELATED DOCUMENTS
				1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			2. SUMMARY
				1. Section Includes:

Stone panels set with individual anchors.

First subparagraph below applies to vertical trusses spanning floor to floor and to spandrel trusses spanning column to column.

Stone panels mechanically anchored on steel trusses.

First subparagraph below applies to vertical steel members spanning floor to floor.

Stone panels mechanically anchored on steel strongback frames.

First subparagraph below applies to spandrel panel frames or frames spanning floor to floor for low-rise uses.

Stone panels mechanically anchored on steel stud frames.

Stone panels mechanically anchored (field installed) on a metal-grid system.

Stone panels set in architectural precast concrete.

Stone panels glazed into aluminum curtain-wall framing system.

Retain option(s) in first subparagraph below to describe units required; insert other descriptive terms to suit Project.

Stone trim units, including [**bands] [copings] [sills] [jambs] [and] [soffits**].

Stone units with carving or inscriptions.

* + - 1. DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

* + - * 1. Definitions contained in ASTM C119 apply to this Section.
				2. IBC: Uniform Code.

Design Consultant to review code references and verify that the referenced sections/tables are current. Note that code references shall be based on the current version of the Uniform Code.

Delete "Stone Cladding Assembly" Paragraph below if Section only includes stone panels set in architectural precast concrete, stone panels glazed into curtain walls, or stone trim.

* + - * 1. Stone Cladding Assembly: An exterior wall covering system consisting of stone panels[ **and trim**] together with anchors, [**backup structure,] [secondary weather barrier (sheathing),] [mortar,] [adhesives,]** fasteners, and sealants used to secure the stone to the building structure and to produce a weather-resistant covering.

Backup structure includes [**steel trusses] [steel strongback frames] [steel stud frames] [metal-grid system] [and] [miscellaneous steel framing required to secure stone to the building structure**].

* + - 1. PREINSTALLATION MEETINGS

Retain "Preinstallation Conference" Paragraph below if Work of this Section is extensive or complex enough to justify a conference.

* + - * 1. Preinstallation Conference: Conduct conference at Project site.

If needed, insert list of conference participants.

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each[ **variety of stone**,] stone accessory, and manufactured product.
				5. Sustainable Design Submittals:
				6. Shop Drawings: Show fabrication and installation details for stone cladding assembly, including dimensions and profiles of stone units.

Show locations and details of joints both within stone cladding assembly and between stone cladding assembly and other construction.

Include details of [**mortar joints] [sealant joints] [and] [mortar joints pointed with sealant**].

Show locations and details of anchors[ **and backup structure**].

Show direction of veining, grain, or other directional pattern.

Include large-scale shaded elevations and details of decorative surfaces and inscriptions.

* + - * 1. Samples for Initial Selection: For joint materials involving color selection.

Generally retain "Stone Samples for Verification" Paragraph below, especially for more variable varieties where Samples may serve to define acceptable range of colors, patterns, and so forth.

* + - * 1. Stone Samples for Verification: Sets for each variety, color, and finish of stone required; not less than 12 inches square.

Section 013300 "Submittal Procedures" requires that Samples for verification "show the full range of color and texture variations expected"; however, this requirement may be inadequate for stone varieties that exhibit wide variations in color and veining.

Sets shall consist of at least [**two] [three] [four] [five**] Samples, exhibiting extremes of the full range of color and other visual characteristics expected and will establish the standard by which stone will be judged.

* + - * 1. Colored Pointing Mortar Samples for Verification: For each color required. Make Samples using same sand and mortar ingredients to be used on Project.
				2. Sealant Samples for Verification: For each type and color of joint sealant required.

Retain "Delegated-Design Submittal" Paragraph below if design services have been delegated to Contractor.

* + - * 1. Delegated-Design Submittal: For stone cladding assembly.

Coordinate "Qualification Data" Paragraph below with qualification requirements in "Quality Assurance" Article.

* + - * 1. Qualification Data: For [**Installer] [fabricator] [professional Director’s Representative] [and] [testing agency**].

Retain "Welding certificates" Paragraph below if retaining "Welding Qualifications" Paragraph in "Quality Assurance" Article.

* + - * 1. Welding certificates.

Retain "Material Test Reports" Paragraph below for material test reports that are Contractor's responsibility.

* + - * 1. Material Test Reports:

Stone Test Reports: For[ **each**] stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, other than abrasion resistance, according to referenced ASTM standards. Base reports on testing done within previous [**five] [three**] years.

For metal components, by a qualified testing agency, indicating chemical and physical properties of metal.

Sealant Compatibility and Adhesion Test Report: From sealant manufacturer complying with requirements in Section 079200 "Joint Sealants" and indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.

Retain "Preconstruction test reports" Paragraph below if specifying preconstruction testing in "Preconstruction Testing" Article as Contractor's responsibility.

* + - * 1. Preconstruction test reports.
				2. Source quality-control reports.
				3. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.
			1. MAINTENANCE MATERIAL SUBMITTALS
				1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Coordinate requirements for extra materials with storage space.

Stone Units: Furnish <**Insert number**> finished stone panels <**Insert required dimensions**> for each finish and variety of stone specified.

* + - 1. QUALITY ASSURANCE
				1. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate stone cladding assemblies similar to that required for this Project and whose products have a record of successful in-service performance.
				2. Installer Qualifications: A firm or individual experienced in installing stone cladding assemblies similar in material, design, and extent to that indicated for this Project, whose work has a record of successful in-service performance.

Retain "Testing Agency Qualifications" Paragraph below if Contractor selects testing agency or if Contractor is required to provide services of a qualified testing agency.

* + - * 1. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

Retain "Welding Qualifications" Paragraph below if welding is required. If retaining, also retain "Welding certificates" Paragraph in "Informational Submittals" Article

* + - * 1. Welding Qualifications: Qualify procedures and personnel according to [AWS D1.1, "Structural Welding Code - Steel] [AWS D1.2, "Structural Welding Code - Aluminum] [AWS D1.3, "Structural Welding Code - Sheet Steel] [and] [AWS D1.6, "Structural Welding Code - Stainless Steel]."
				2. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Director’s Representative specifically approves such deviations in writing.

Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

* + - 1. PRECONSTRUCTION TESTING

Retain this article for preconstruction testing. Project-specific preconstruction testing of assemblies can be expensive but may be the best means of proving that performance requirements are met.

* + - * 1. Preconstruction Stone Testing Service: [**Director’s Representative will engage**] [**Engage**] a qualified testing agency to perform preconstruction testing.

Consider deleting first subparagraph below. If a specific stone variety is named in the Specifications, requiring it to also comply with test requirements may be unreasonable. Selecting stone varieties that can pass test requirements by a suitable margin may eliminate the need for retesting.

Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

First subparagraph below requires test specimens that are "representative of" materials to be used, not that they be taken from same blocks. Testing of specimens from same blocks used is in "Source Quality Control" Article.

Furnish test specimens that are representative of materials proposed for incorporation into the Work.

Physical Property Tests: For[ each] stone variety proposed for use on Project, tested for compliance with physical property requirements, other than abrasion resistance, according to referenced ASTM standards.

Usually retain "Flexural Strength Tests" Subparagraph below to determine adequacy of stone thickness for spans.

Flexural Strength Tests: For[ **each combination of**] stone variety, thickness, orientation of cut, and finish, proposed for use on Project, tested according to ASTM C880, in both wet and dry conditions.

Usually retain "Anchorage Tests" Subparagraph below to verify capacity of stone and anchor combinations.

Anchorage Tests: For[ **each combination of**] stone variety, orientation of cut, finish, and anchor type proposed for use on Project, tested according to ASTM C1354.

Usually delete "Anchoring System Mockup Test" Subparagraph below; it tests stone anchoring systems. Adjust maximum test load, if needed, on advice of structural Director’s Representative, stone consultant, testing agency, and so forth. Note that mockup for test below is installed at testing agency's facilities rather than at Project site.

Anchoring System Mockup Test: For stone anchoring system, tested according to ASTM C1201, Procedure B, with a maximum test load equal to 3 times the design load. Build laboratory mockup at testing agency facility; use personnel, materials, and methods of construction that will be used at Project site. Mockup shall consist of one panel <**Insert dimensions**> in size.

Retain "Preconstruction Sealant Compatibility and Adhesion Testing" Paragraph below if sealants are specified in this Section.

* + - * 1. Preconstruction Sealant Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for compatibility and adhesion testing according to sealant manufacturer's standard testing methods and Section 079200 "Joint Sealants," Samples of materials that will contact or affect joint sealants.

Retain applicable requirements in Section 079200 "Joint Sealants."

* + - * 1. Preconstruction Field Testing of Sealants: Before installing joint sealants, field test their adhesion to joint substrates according to Section 079200 "Joint Sealants."
			1. DELIVERY, STORAGE, AND HANDLING
				1. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, and other causes.

Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.

Store stone on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to stone. Ventilate under covers to prevent condensation.

* + - * 1. Mark stone units, on surface that will be concealed after installation, with designations used on Shop Drawings to identify individual stone units. Orient markings on vertical panels so that they are right side up when units are installed.
				2. Deliver sealants to Project site in original unopened containers labeled with manufacturer's name, product name and designation, color, expiration period, pot life, curing time, and mixing instructions for multicomponent materials.
				3. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
				4. Store aggregates in locations where grading and other required characteristics can be maintained and where contamination can be avoided.
			1. FIELD CONDITIONS
				1. Protect stone cladding during erection by doing the following:

Cover tops of stone cladding installation with nonstaining, waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress. Extend cover a minimum of 24 inches down both sides and hold securely in place.

Prevent staining of stone from mortar, grout, sealants, and other sources. Immediately remove such materials without damaging stone.

Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.

Protect sills, ledges, and projections from mortar and sealant droppings.

* + - * 1. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Remove and replace stone cladding damaged by frost or freezing conditions. Comply with cold-weather construction and protection requirements for masonry contained in TMS 602/ACI 530.1/ASCE 6.
				2. Hot-Weather Requirements: Comply with hot-weather construction and protection requirements for masonry contained in TMS 602/ACI 530.1/ASCE 6.
				3. Environmental Limitations for Sealants: Do not install sealants when ambient and substrate temperatures are outside limits permitted by sealant manufacturer or below 40 deg F or when joint substrates are wet.
			1. COORDINATION
				1. Coordinate installation of inserts that are to be embedded in concrete or masonry, flashing reglets, and similar items to be used by stone cladding Installer for anchoring, supporting, and flashing of stone cladding assembly. Furnish setting drawings, templates, and directions for installing such items and deliver to Project site in time for installation.
				2. Time delivery and installation of stone cladding to avoid extended on-site storage and to coordinate with work adjacent to stone cladding.
1. PRODUCTS

Manufacturers and products listed in SpecAgent and Masterworks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

* + - 1. MANUFACTURERS

Delete third option in "Source Limitations for Stone" Paragraph below if stone for other Sections is specified in a stone schedule in this Section or if not using other stone Sections.

* + - * 1. Source Limitations for Stone: Obtain[ **each variety of**] stone[, **regardless of finish**,] from single quarry[, **whether specified in this Section or in another Section of the Specifications**,] with resources to provide materials of consistent quality in appearance and physical properties.

For stone types that include same list of varieties and sources, provide same variety from same source for each.

Examination of blocks is usually only done for large installations and involves traveling to the quarry or to the shop where blocks are sawed into slabs, which is frequently not the fabrication shop.

Make quarried blocks available for examination by Director’s Representative.

* + - * 1. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.
				2. Source Limitations for Other Materials: Obtain each type of stone accessory[, **sealant**,] and other material from single manufacturer for each product.

Retain "Stone Fabricators" Paragraph below if a list of preapproved firms is used as a quality-control procedure. Retain first or second option if additional firms will not be considered; retain third option if they will. If retaining third option, include procedure for approving other firms in the Instructions to Bidders.

* + - 1. PERFORMANCE REQUIREMENTS

If deleting this article, give a copy of it to Project's structural Director’s Representative as an example of design requirements for stone cladding assemblies.

Retain "Delegated Design" Paragraph below if Contractor is required to assume responsibility for design.

* + - * 1. Delegated Design: Engage a qualified professional Director’s Representative, licensed and registered to practice in the jurisdiction of the Project, to design stone cladding assembly.
				2. General: Design stone anchors and anchoring systems according to ASTM C1242.

Subparagraph below is IBC requirement for slab-type veneer.

Stone anchors shall withstand not less than two times the weight of the stone cladding in both compression and tension.

* + - * 1. Structural Performance: Stone cladding assembly shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

Wind Loads: As indicated.

Equipment Loads: Allow for loads due to window cleaning and maintenance equipment.

Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Verify requirements of authorities having jurisdiction.

* + - * 1. Seismic Performance: Stone cladding assembly shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

Component Importance Factor is 1.0 unless the structure is in Seismic Use Group III and stone cladding assembly is necessary for continued operation of facility or failure of assembly could impair continued operation of facility, in which case the Component Importance Factor is 1.5.

Component Importance Factor: [**1.5] [1.0**].

* + - * 1. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

Differential values in "Temperature Change" Subparagraph below are suitable for dark-colored stone in most of the United States. Revise to suit local conditions.

Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

* + - * 1. Horizontal Building Movement (Interstory Drift): Allow for maximum horizontal building movement equal to quotient resulting from dividing floor-to-floor height at any floor by 400.

Retain "Shrinkage and Creep" Paragraph below for concrete frame buildings only; consult Project's structural Director’s Representative for value to insert.

* + - * 1. Shrinkage and Creep: Allow for progressive vertical shortening of building frame equal to <**Insert value**> in 10 feet.
				2. Safety Factors for Stone: Design stone cladding assembly to withstand loads indicated without exceeding stone's allowable working stress determined by dividing stone's average ultimate strength, as established by testing, by the following safety factors:

Safety factors in subparagraphs below are examples based on industry-recognized recommendations. Adjust to suit capabilities of stone selected. See the Evaluations for discussion of safety factors.

Safety Factor for Granite: 3.

Safety Factor for Oolitic Limestone: 8.

Safety Factor for Dolomitic Limestone: 6.

Safety Factor for Marble: 5.

Safety Factor for Quartz-Based Stone: 6.

Safety Factor for Serpentine: 6.

Safety Factor for Slate: 5.

Safety Factor for Travertine: 8.

"Safety Factor for Concentrated Stresses" Subparagraph below is based on MIA's recommendations. Other industry-recognized recommendations suggest that safety factors above are sufficient and that requirements below are unnecessary.

Safety Factor for Concentrated Stresses: 4 for granite and 10 for stone varieties other than granite.

* + - * 1. Design stone anchors[ **and backup structure**] to withstand loads indicated without exceeding allowable working stresses established by the following:

Retain only requirements in subparagraphs below for metals specified in Part 2.

For Structural Steel: AISC 360.

For Cold-Formed Steel: AISI's "North American Specification and Commentary for the Design of Cold-Formed Steel Structural Members."

For Cold-Formed Stainless Steel: ASCE/SEI 8, "Specification for the Design of Cold-Formed Stainless Steel Structural Members."

For Aluminum: AA ADM-1, "The Aluminum Design Manual."

"For Cast-in-Place and Postinstalled Fasteners in Concrete" and "For Postinstalled Fasteners in Masonry" subparagraphs below are examples only. Verify safety factors to suit conditions and types of fasteners indicated. Overhead, vibratory, and other critical loads generally require higher safety factors.

For Cast-in-Place and Postinstalled Fasteners in Concrete: One-fourth of tested capacity when installed in concrete with compressive strength indicated.

For Postinstalled Fasteners in Masonry: One-sixth of tested capacity when installed in masonry units indicated.

Revise criteria in first paragraph below if applicable after determining deflection that stone can withstand.

* + - * 1. Limit deflection in each prefabricated assembly caused by indicated loads and thermal movements, acting singly or in combination with one another, to not more than [**1/720] <Insert ratio**> of assembly's clear span or the following, whichever is smaller:

1/16 inch, measured in plane of wall.

1/4 inch, measured perpendicular to wall.

* + - * 1. Provisions for Fabrication and Erection Tolerances: Allow for fabrication and erection tolerances of building's structural system. [**Concrete fabrication and erection tolerances are specified in Section 033000 "Cast-in-Place Concrete."] [Structural-steel fabrication and erection tolerances are specified in Section 051200 "Structural Steel Framing.**"]
				2. Provision for Deflection of Building Structure:

Deflection Due to Weight of Stone Cladding Assembly: Allow for 1/4-inch vertical deflection in 20-foot span of structural members supporting stone cladding assembly.

Revise "Deflection Due to Weight of Stone Cladding Assembly" Subparagraph above and "Live Load Deflection" Subparagraph below to suit Project conditions. Note that stone cladding must be designed to withstand combination of deflection above and below. Delete above if Contractor is responsible for designing stone-supporting framing system that, in turn, is supported only on building columns. Delete below if stone framing system neither includes nor is connected to floor or roof spandrel beams or slab edge.

Live Load Deflection: Allow for 1/4-inch vertical deflection, in 20-foot span of structural members supporting stone cladding assembly, due to live loads imposed on building's structural frame after stone installation.

* + - * 1. Corrosion and Staining Control: Prevent galvanic and other forms of corrosion as well as staining by isolating metals and other materials from direct contact with incompatible materials. Materials shall not stain exposed surfaces of stone and joint materials.

Retain one or more of first eight articles below to describe stone types used. If only one type from an article is required, the generic name can be retained and used on Drawings instead of a stone-type designation. Otherwise, copy and re-edit article for each type required, inserting a different stone-type drawing designation each time.

* + - 1. GRANITE <**Insert drawing designation**>
				1. Material Standard: Comply with ASTM C615.

"Description" Paragraph below is an example of a generic description that can be retained and revised for a nonproprietary specification. For a more explicit specification, retain "Varieties and Sources" Paragraph below and name specific products.

* + - * 1. Description: Uniform, [**fine] [medium**]-grained, [**white] [pink] [gray] [black**] stone[ **without veining**].
				2. Varieties and Sources: Subject to compliance with requirements, [**provide the following] [provide one of the following] [available stone varieties that may be incorporated into the Work include, but are not limited to, the following**]:

<**Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers**>.

Retain "Cut" Paragraph below if variety has veining and is cut parallel (fleuri cut) as well as perpendicular (vein cut) to the plane of the veining.

* + - * 1. Cut: [**Vein] [Fleuri**].

Retain "Orientation of Veining" Subparagraph below if retaining vein cut.

Orientation of Veining: [**Horizontal] [Vertical] [As indicated**].

Retain first paragraph below only if available and applicable.

* + - * 1. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
				2. Finish: [**Polished] [Honed] [Thermal] [As indicated] [Match Director’s Representative's sample**].

Retain first paragraph below for added quality control if required.

* + - * 1. Match Director’s Representative's samples for color, finish, and other stone characteristics relating to aesthetic effects.

Verify availability of thickness retained with stone suppliers. Minimum thickness depends on application, size of stone panels, spans, variety of stone, and finish; consult producers of stone varieties selected. 30 mm and 1-1/4, 1-5/8, and 2 inches are typical thicknesses used for exterior panels. 3/4-inch granite is generally only used for facing precast concrete or for small panels, such as for planter walls. For locations where other thicknesses are required, such as sills, copings, and so forth, indicate thickness on Drawings.

* + - * 1. Thickness: Not less than [**3/4 inch**] **[30 mm**] [**1-1/4 inches**] [**1-5/8 inches**] [**2 inches**] unless otherwise indicated.
			1. LIMESTONE <**Insert drawing designation**>
				1. Material Standard: Comply with ASTM C568.

Retain one of four options in "Classification" Subparagraph below. First generally applies to very porous limestone that should only be used on building exteriors in mild climates; second, to oolitic limestone; third and fourth, to dolomitic limestone.

Classification: [**I Low-Density] [II Medium-Density] [II Medium-Density except as follows: absorption, 5 percent by weight maximum; density, 150 lb/cu. ft. minimum; compressive strength, 8000 psi minimum; and modulus of rupture 800 psi minimum] [III High-Density**].

If retaining "Description" Paragraph below, retain one of three options. Coordinate with option retained in "Classification" Subparagraph. Description can serve as a salient characteristic if varieties other than those named are allowed and can be deleted if only specific named varieties are allowed.

* + - * 1. Description: [**Dolomitic] [Oolitic] [Shell]** limestone.
				2. Varieties and Sources: Subject to compliance with requirements, [**provide the following] [provide one of the following] [available stone varieties that may be incorporated into the Work include, but are not limited to, the following**]:

<**Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers**>.

Retain "Varieties and Sources" Paragraph below if Indiana limestone is required. If retaining below, retain "II Medium-Density" option in "Classification" Subparagraph and "Oolitic" option in "Description" Paragraph. Revise paragraph below if stone from a particular quarry is required.

* + - * 1. Varieties and Sources: Indiana limestone quarried in Lawrence, Monroe, or Owen Counties, Indiana.

Select and Standard grades are hard to get in large sizes; gray is more plentiful than buff. Verify availability with producers.

Indiana Limestone Grade and Color: [**Select, buff] [Select, gray] [Standard, buff] [Standard, gray] [Rustic, buff] [Rustic, gray] [Variegated**], according to grade and color classification established by ILI.

Retain "Cut" Paragraph below if variety has veining and is cut parallel (fleuri cut) as well as perpendicular (vein cut) to the plane of the veining. Delete if variety retained, such as Indiana limestone, has no veining.

* + - * 1. Cut: [**Vein] [Fleuri**].

Retain "Orientation of Veining" Subparagraph below if retaining vein cut.

Orientation of Veining: [**Horizontal] [Vertical] [As indicated**].

Retain first paragraph below only if available and applicable. Matched blocks are not possible with Indiana limestone.

* + - * 1. Cut stone from one block or contiguous, matched blocks in which natural markings occur.

Retain last option in "Finish" Paragraph below for Indiana limestone.

* + - * 1. Finish: [**Smooth finish] [Sand rubbed] [Machine tooled, four bats per 1 inch] [Machine tooled, six bats per 1 inch] [Machine tooled, eight bats per 1 inch] [As indicated] [Match Director’s Representative's sample][, matching standard ILI finish**].

Retain first paragraph below for added quality control if required.

* + - * 1. Match Director’s Representative's samples for color, finish, and other stone characteristics relating to aesthetic effects.

Verify availability of thickness retained with stone suppliers. Minimum thickness depends on application, size of stone panels, spans, variety of stone, and finish; consult producers of stone varieties selected. Dolomitic limestone is generally available in 1-1/4, 2-1/2, and 3 inches. Oolitic limestone is generally available in 2, 2-1/2, 3, and 4 inches. For locations where other thicknesses are required, such as sills, copings, and so forth, indicate thickness on Drawings.

* + - * 1. Thickness: Not less than [**1-1/4 inches**] [**2 inches**] [**2-1/2 inches**] [**3 inches**] [**4 inches**] unless otherwise indicated.
			1. MARBLE <**Insert drawing designation**>

Retain one of first two options in "Material Standard" Paragraph below; also retain third option for stone used on building exteriors, except possibly in mild climates.

* + - * 1. Material Standard: Comply with ASTM C503, [**Classification I Calcite] [Classification II Dolomite][, Group A**].

"Description" Paragraph below is an example of a generic description that can be retained and revised for a nonproprietary specification. Description is for a crystalline calcite marble; revise to describe other marble varieties if required. For a more explicit specification, retain "Varieties and Sources" Paragraph and name specific products.

* + - * 1. Description: Uniform, fine- to medium-grained, [**white] <Insert color**> stone with only slight veining.
				2. Varieties and Sources: Subject to compliance with requirements, [**provide the following] [provide one of the following] [available stone varieties that may be incorporated into the Work include, but are not limited to, the following]:**

<**Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers**>.

Retain "Cut" Paragraph below if variety has veining and is available either cut parallel (fleuri cut) or perpendicular (vein cut) to the plane of the veining.

* + - * 1. Cut: [**Vein] [Fleuri**].

Retain "Orientation of Veining" Subparagraph below if retaining vein cut.

Orientation of Veining: [**Horizontal] [Vertical] [As indicated**].

Retain first paragraph below only if available and applicable.

* + - * 1. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
				2. Finish: [**Polished] [Honed] [As indicated] [Match Director’s Representative's sample**].

Retain first paragraph below for added quality control if required.

* + - * 1. Match Director’s Representative's samples for color, finish, and other stone characteristics relating to aesthetic effects.

Verify availability of thickness retained with stone suppliers. Minimum thickness depends on application, size of stone panels, spans, variety of stone, and finish; consult producers of stone varieties selected. 1 inch is the minimum thickness allowed by the IBC for marble slabs as a weather covering of exterior walls and is preferred for facing precast concrete. 30 mm and 1-1/4, 1-5/8, and 2 inches are typical exterior-panel thicknesses. For locations where other thicknesses are required, such as sills, copings, and so forth, indicate thickness on Drawings.

* + - * 1. Thickness: Not less than [**1 inch] [30 mm] [1-1/4 inches] [1-5/8 inches] [2 inches**] unless otherwise indicated.
			1. QUARTZ-BASED STONE <**Insert drawing designation**>

Retain one of first three options in "Material Standard" Paragraph below; for bluestone, retain third and fourth options.

* + - * 1. Material Standard: Comply with ASTM C616, [**Classification I Sandstone] [Classification II Quartzitic Sandstone] [Classification III Quartzite][ except for minimum free silica content**].
				2. Varieties and Sources: Subject to compliance with requirements, [**provide the following] [provide one of the following] [available stone varieties that may be incorporated into the Work include, but are not limited to, the followin**g]:

<**Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers>.**

* + - * 1. Finish: [**Sand rubbed] [Natural cleft] [Thermal] [As indicated] [Match Director’s Representative's sample**].

Retain first paragraph below for added quality control if required.

* + - * 1. Match Director’s Representative's samples for color, finish, and other stone characteristics relating to aesthetic effects.

Verify availability of thickness retained with stone suppliers. Minimum thickness depends on application, size of stone panels, spans, variety of stone, and finish; consult producers of stone varieties selected. For locations where other thicknesses are required, such as sills, copings, and so forth, indicate thickness on Drawings.

* + - * 1. Thickness: Not less than [**2 inches**] [**2-1/2 inches**] [**3 inches**] [**4 inches**] unless otherwise indicated.
			1. SERPENTINE <**Insert drawing designation**>

Retain second option in "Material Standard" Paragraph below only for interior applications when all of Project's stone is specified in this Section.

* + - * 1. Material Standard: Comply with ASTM C1526, [**Classification I Exterior] [Classification II Interior**].
				2. Varieties and Sources: Subject to compliance with requirements, [**provide the following] [provide one of the following] [available stone varieties that may be incorporated into the Work include, but are not limited to, the following**]:

<**Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers**>.

Retain first paragraph below only if available and applicable.

* + - * 1. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
				2. Finish: [**Polished] [Honed] [As indicated] [Match Director’s Representative's sample**].

Retain first paragraph below for added quality control if required.

* + - * 1. Match Director’s Representative's samples for color, finish, and other stone characteristics relating to aesthetic effects.

Verify availability of thickness retained with stone suppliers. Minimum thickness depends on application, size of stone panels, spans, variety of stone, and finish; consult producers of stone varieties selected. 1-inch serpentine is generally only used for facing precast concrete or for small panels, such as for planter walls. Typically use panels 30 mm, 1-1/4 inches, or thicker for exterior panels. For locations where other thicknesses are required, such as sills, copings, and so forth, indicate thickness on Drawings.

* + - * 1. Thickness: Not less than [**1 inch**] [**30 mm**] [**1-1/4 inches**] [**1-5/8 inches**] [**2 inches**] unless otherwise indicated.
			1. SLATE <**Insert drawing designation**>

Retain second option in "Material Standard" Paragraph below only for interior applications when all of Project's stone is specified in this Section.

* + - * 1. Material Standard: Comply with ASTM C629, [**Classification I Exterior] [Classification II Interior**].

"Description" Paragraph below is an example of a generic description that can be retained and revised for a nonproprietary specification. For a more explicit specification, retain "Varieties and Sources" Paragraph below and name specific products.

* + - * 1. Description: [**Black] [Blue-black] [Gray] [Blue-gray] [Green] [Purple] [Mottled purple and green] [Red**] slate with a fine, even grain[ and unfading color,] from clear, sound stock.
				2. Varieties and Sources: Subject to compliance with requirements, [**provide the following] [provide one of the following] [available stone varieties that may be incorporated into the Work include, but are not limited to, the following**]:

<**Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers**>.

* + - * 1. Finish: [**Honed] [Sand rubbed] [Natural cleft] [As indicated] [Match Director’s Representative's sample**].

Retain first paragraph below for added quality control if required.

* + - * 1. Match Director’s Representative's samples for color, finish, and other stone characteristics relating to aesthetic effects.

Verify availability of thickness retained with stone suppliers. Minimum thickness depends on application, size of stone panels, spans, variety of stone, and finish; consult producers of stone varieties selected. For locations where other thicknesses are required, such as sills, copings, and so forth, indicate thickness on Drawings.

* + - * 1. Thickness: Not less than [**1 inch] [1-1/4 inches] [1-1/2 inches**] unless otherwise indicated.
			1. TRAVERTINE <**Insert drawing designation**>

Retain second option in "Material Standard" Paragraph below only for interior applications when all of Project's stone is specified in this Section.

* + - * 1. Material Standard: Comply with ASTM C1527, [**Classification I Exterior] [Classification II Interior**].
				2. Varieties and Sources: Subject to compliance with requirements, [**provide the following] [provide one of the following] [available stone varieties that may be incorporated into the Work include, but are not limited to, the following**]:

<**Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers**>.

Usually retain "Vein" option in "Cut" Paragraph below. Fleuri-cut travertine is often called "cross-cut travertine." See the Evaluations.

* + - * 1. Cut: [**Vein] [Fleuri**].

Retain "Orientation of Veining" Subparagraph below if retaining vein cut.

Orientation of Veining: [**Horizontal] [Vertical] [As indicated**].

Retain first paragraph below only if available and applicable.

* + - * 1. Cut stone from one block or contiguous, matched blocks in which natural markings occur.

Retain "Filling" Paragraph below if filling is required.

* + - * 1. Filling: Fill pores on faces of stone with cementitious filler of color [**selected by Director’s Representative] [matching Director’s Representative's sample**].
				2. Finish: [**Polished] [Honed] [As indicated] [Match Director’s Representative's sample**].

Retain first paragraph below for added quality control if required.

* + - * 1. Match Director’s Representative's samples for color, finish, and other stone characteristics relating to aesthetic effects.

Verify availability of thickness retained with stone suppliers. Minimum thickness depends on application, size of stone panels, spans, variety of stone, and finish; consult producers of stone varieties selected. 1-inch travertine is generally only used for facing precast concrete or for small panels, such as planter walls. 30 mm and 1-1/4, 1-5/8, and 2 inches are typical exterior-panel thicknesses. For locations where other thicknesses are required, such as sills, copings, and so forth, indicate thickness on Drawings.

* + - * 1. Thickness: Not less than [**1 inch] [30 mm] [1-1/4 inches] [1-5/8 inches] [2 inches]** unless otherwise indicated.
			1. OTHER STONE <**Insert drawing designation**>

Usually replace "Other Stone" in title of this article with common name or varietal name of stone as used on Drawings.

* + - * 1. Material Standards:

Maximum Absorption per ASTM C97: <**Insert value**>.

Minimum Compressive Strength per ASTM C170: <**Insert value>.**

Minimum Flexural Strength per ASTM C880: <**Insert value**>.

* + - * 1. Varieties and Sources: Subject to compliance with requirements, [**provide the following] [provide one of the following] [available stone varieties that may be incorporated into the Work include, but are not limited to, the following**]:

<**Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers**>.

* + - * 1. Finish: [**Polished] [Honed] [Sand rubbed] [Natural cleft] [As indicated] [Match Director’s Representative's sample**].

Retain first paragraph below for added quality control if required.

* + - * 1. Match Director’s Representative's samples for color, finish, and other stone characteristics relating to aesthetic effects.

Verify availability of thickness retained with stone suppliers. Minimum thickness depends on application, size of stone panels, spans, variety of stone, and finish; consult producers of stone varieties selected. For locations where other thicknesses are required, such as sills, copings, and so forth, indicate thickness on Drawings.

* + - * 1. Thickness: Not less than [**2 inches**] [**2-1/2 inches**] [**3 inches**] [**4 inches**] unless otherwise indicated.
			1. FRAMING FOR BACKUP STRUCTURE

Revise minimum thicknesses to suit Project based on advice of structural Director’s Representative. Insert other materials as required.

* + - * 1. [**Steel Trusses] [Strongback Frames] [and] [Miscellaneous Steel Framing**]: For framing members in contact with stone, fabricate from same material and finish specified for anchors. For framing members not in contact with stone, comply with requirements indicated below:

If backup structure is detailed on Drawings, retain forms of steel required in three subparagraphs below. If Contractor designs backup structure, retain all three.

Steel Plates, Shapes, and Bars: ASTM A36 or ASTM A992, minimum thickness of 3/16 inch.

Steel Tubing: ASTM A500 or ASTM A513, minimum thickness of 3/16 inch.

Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-4, made from [**galvanized steel complying with ASTM A653, structural steel, Grade 33, with G90 coating, and not less than 0.108-inch nominal thickness] [steel sheet complying with ASTM A1008, structural steel, Grade 33, not less than 0.105-inch nominal thickness, hot-dip galvanized after fabrication to comply with ASTM A123**].

* + - * 1. Steel Stud Frames: Galvanized-steel wall framing complying with Section 054000 "Cold-Formed Metal Framing."

Secondary Weather Barrier (Sheathing): Galvanized-steel sheet complying with ASTM A653, commercial steel, coating designation G90.

Before specifying grid systems, consult manufacturers of systems under consideration to determine suitability and availability for Project's stone installation.

* + - * 1. Manufacturer's standard integrated system that combines metal struts, fittings, fasteners, and stone anchors and is engineered expressly for mechanically installing stone cladding.

Revise "Struts" Subparagraph below if other finishes or materials are required or acceptable. Struts are also available in stainless steel or in steel sheet with factory-applied paint in lieu of hot-dip galvanized coating.

Struts: Cold-formed metal channels with continuous slot complying with MFMA-4, of size and shape required for application indicated, made from [**galvanized steel complying with ASTM A653, with G90 coating, and not less than 0.108-inch nominal thickness] [steel sheet complying with ASTM A1008, not less than 0.105-inch nominal thickness, hot-dip galvanized after fabrication to comply with ASTM A123**].

Fittings and Fasteners: System manufacturer's standard components of design, size, and material required to securely attach struts to building structure, by method indicated or selected, and stone anchors to struts, as well as to prevent galvanic corrosion. Fabricate components in contact with stone from same material specified for anchors.

Stone Anchors: Shapes and sizes standard with system manufacturer, complying with "Anchors and Fasteners" Article.

* + - 1. ANCHORS AND FASTENERS

The term "anchor" refers only to the metal device inserted into a slot or hole in stone. Retain anchor materials in first three paragraphs below, usually Type 304 stainless steel. Retain Type 316 for increased corrosion resistance in a coastal environment.

* + - * 1. Fabricate anchors[, **including shelf angles**,] from stainless steel, ASTM A240 or ASTM A666, [**Type 304] [Type 316**]; temper as required to support loads imposed without exceeding allowable design stresses. Fabricate dowels and pins for anchors from stainless steel, ASTM A276, [**Type 304] [Type 31**6].

Hot-dip galvanized steel is considered acceptable for shelf angles supporting limestone.

* + - * 1. Fabricate shelf angles for limestone from hot-dip galvanized steel, ASTM A36 for materials and ASTM A123 for galvanizing.

Retain first paragraph below with caution and only after verifying that aluminum is not corroded by contact with stone selected.

* + - * 1. Fabricate anchors, including shelf angles, from extruded aluminum, ASTM B221, alloy and temper as required to support loads imposed without exceeding allowable design stresses, but not less than strength and durability properties of Alloy 6063-T6.
				2. Cast-in-Place Concrete Inserts: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel, with capability to sustain, without failure, a load equal to 4 times the loads imposed as determined by testing per ASTM E488, conducted by a qualified independent testing agency. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.
				3. Postinstalled Anchor Bolts for Concrete and Masonry: [**Chemical anchors] [torque-controlled expansion anchors] [or] [undercut anchors**] made from stainless-steel components complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 for bolts and nuts; ASTM A240, ASTM A276, or ASTM A666, Type 304 or 316, for anchors, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E488, conducted by a qualified independent testing agency.
				4. Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers.

Use Alloy Group 1 (A1) fasteners with aluminum and Type 304 stainless steel, and use Alloy Group 2 (A4) fasteners with Type 316 stainless steel.

For [**stainless steel] [and] [aluminum**], use annealed stainless-steel bolts, nuts, and washers; for bolts, ASTM F593; and for nuts, ASTM F594, Alloy [**Group 1] [Group 2**].

Retain subparagraph below if needed for galvanized anchors or for backup structure.

For [**galvanized-steel shelf angles] [and] [backup structure**], use carbon-steel bolts, nuts, and washers; for bolts, ASTM A307, Grade A; for nuts, ASTM A563, Grade A; and for washers, ASTM F436; all hot-dip or mechanically zinc coated.

* + - * 1. Weld Plates for Installation in Concrete: Comply with Section 055000 "Metal Fabrications."
			1. MORTAR MATERIALS

Retain "Portland Cement" and "Hydrated Lime" paragraphs below for portland cement-lime mix or for job-mixed, portland cement-lime mortar.

* + - * 1. Portland Cement: ASTM C150, Type I or Type II, except Type III may be used for cold-weather construction, natural color or white as required to produce mortar color indicated.

Retain "Low-Alkali Cement" Subparagraph below to limit staining if using limestone.

Low-Alkali Cement: Portland cement for use with limestone shall contain no more than 0.60 percent total alkali when tested according to ASTM C114.

* + - * 1. Hydrated Lime: ASTM C207.

Retain "Mortar Pigments" Paragraph below for colored portland cement-lime mix or for pigments added at Project site.

* + - * 1. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979. Pigments shall have a record of satisfactory performance in mortar.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Davis Colors.

Lanxess Corporation.

Solomon Colors, Inc.

Approved equivalent.

* + - * 1. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime.

Mix in "Colored Portland Cement-Lime Mix" Paragraph below allows better control of color than does job-mixed, portland cement-lime mortar with pigment added.

* + - * 1. Colored Portland Cement-Lime Mix: Packaged blend of portland cement, hydrated lime, and mortar pigments. Mix shall produce color indicated or, if not indicated, as selected from manufacturer's standard colors. Pigments shall not exceed 10 percent of portland cement by weight.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Holcim (US) Inc.

Lafarge North America Inc.

Lehigh Hanson; HeidelbergCement Group.

Approved equivalent.

* + - * 1. Aggregate: ASTM C144; except for joints narrower than 1/4 inch and pointing mortar, 100 percent shall pass No. 16 sieve.

White Aggregates: Natural white sand or ground white stone.

Colored Aggregates: Natural-colored sand or ground marble, granite, or other durable stone; of color necessary to produce required mortar color.

* + - * 1. Water: Potable.
			1. STONE ACCESSORIES

Retain "Setting Shims" Paragraph below for stone supported on split-tab anchors or shelf angles.

* + - * 1. Setting Shims: Strips of [**resilient plastic] [or] [vulcanized neoprene, Type A Shore durometer hardness of 50 to 70]**, nonstaining to stone, of thickness needed to prevent point loading of stone on anchors and of depths to suit anchors without intruding into required depths of pointing materials.

Retain "Setting Buttons" Paragraph below for stone set with mortar, where stone is supported on concrete, masonry, or stone course below.

* + - * 1. Setting Buttons: Resilient plastic buttons, nonstaining to stone, sized to suit joint thicknesses and bed depths of stone units without intruding into required depths of pointing materials.

Zinc-tin, alloy-coated stainless steel is preferred by some if soldered seams are required.

* + - * 1. Concealed Sheet Metal Flashing: Fabricated from[ **zinc-tin, alloy-coated**] stainless steel in thicknesses indicated, but not less than 0.0156 inch thick, and complying with Section 076200 "Sheet Metal Flashing and Trim."
				2. Cementitious Dampproofing[ **for Limestone**]: Cementitious formulation recommended by ILI and nonstaining to stone; compatible with joint sealants and noncorrosive to anchors and attachments.

Retain one or more of "Weep and Vent Tubes," "Cellular Plastic Weep Hole/Vents," and "Mesh Weep/Vent" paragraphs below for weeping setting space, and one or both of first two for venting.

* + - * 1. Weep and Vent Tubes: [**Medium-density polyethylene tubing, 1/4-inch OD] [Rectangular, cellular, polypropylene or clear butyrate extrusion, 3/8 by 1-1/2 inches**], of length required to extend from exterior face of stone to cavity behind.
				2. Cellular Plastic Weep Hole/Vents: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, of length required to extend from exterior face of stone to cavity behind, in color selected from manufacturer's standard.
				3. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, of length required to extend from exterior face of stone to cavity behind, in color selected from manufacturer's standard.
				4. Wicking Material: Absorbent rope, made from [**cotton] [or] [UV-resistant synthetic fiber**], 1/4 to 3/8 inch in diameter, of length required to produce 2-inch exposure on exterior and 18 inches in cavity between wythes.

Delete "Sealants for Joints in Stone Cladding" Paragraph below if no joint sealants are used or if filling or pointing joints is specified in Section 079200 "Joint Sealants."

* + - * 1. Sealants for Joints in Stone Cladding: Manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Section 079200 "Joint Sealants" and do not stain stone:

Coordinate type of joint sealants retained in subparagraphs below with applicable subparagraphs in Part 2 articles in Section 079200 "Joint Sealants" in which various sealant types are specified. If more than one sealant type is required, indicate locations of each on Drawings or in a schedule. Verify compatibility of each sealant specified with stone specified. Verify that sealant does not stain stone. Some silicone sealants may stain stone, especially light-colored porous stone.

Joint Sealant: Silicone, nonstaining, [**S, NS, 100/50, NT] [S, NS, 50, NT] [S, NS, 100/50, T, NT] [M, NS, 50, NT**].

Joint Sealant: Urethane, [**S, NS, 25, NT] [S, NS, 100/50, T, NT] [M, NS, 50, NT] [M, NS, 50, T, NT] [M, NS, 25, T, NT**].

Joint Sealant: <**Insert joint sealant**>.

Joint-Sealant Colors: [**As indicated by manufacturer's designations] [Match Director’s Representative's sample] [As selected by Director’s Representative from manufacturer's full range of colors] [Match color of stone**].

If retaining "Preformed Joint Seals" Paragraph below, coordinate type of joint seals retained in paragraph with applicable Paragraphs in Part 2 articles in Section 079100 "Preformed Joint Seals."

* + - * 1. Preformed Joint Seals: Preformed [**silicone] [foam**] joint seals that comply with applicable requirements in Section 079100 "Preformed Joint Seals" and do not stain stone.

Retain "Sealant for Filling Kerfs" Paragraph below with either option if stone is not set with mortar, even if sealants for filling or pointing joints are specified in Section 079200 "Joint Sealants." A rigid sealant, such as high-modulus or traffic type (Use T), is generally recommended to provide even load transfer from stone to anchor. However, using the same sealant used for joints eliminates compatibility problems, and the confined space in the kerf tends to make the sealant more rigid. If retaining first option in paragraph below, delete following subparagraphs and list of products. See the Evaluations in Section 079200 "Joint Sealants" for more information.

* + - * 1. Sealant for Filling Kerfs: [**Same sealant used for joints in stone cladding.] [Manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Section 079200 "Joint Sealants" and that do not stain stone:**]

Verify suitability of sealant in first subparagraph below before retaining. Silicone sealants often stain porous, light-colored stone.

Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Adfast.

GE Construction Sealants; Momentive Performance Materials Inc.

The Dow Chemical Company.

Tremco Incorporated.

Approved equivalent.

Urethane, M, NS, 25, T, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

BASF Corporation.

Bostik, Inc.

Sika Corporation.

Approved equivalent.

* + - 1. FABRICATION OF STONE
				1. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.

Retain applicable references in subparagraphs below. No references for quartz-based stone and slate currently exist.

For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."

For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."

For marble, serpentine, and travertine, comply with recommendations in MIA's "Dimension Stone - Design Manual VII."

Options in first paragraph below are examples only. Retain one example or insert clearance to suit Project. Usually delete paragraph for stone set in grid systems and for prefabricated panel systems.

* + - * 1. Control depth of stone and back check to maintain minimum clearance of [**1 inch] [1-1/2 inches**] between backs of stone units and surfaces or projections of structural members, fireproofing (if any), backup walls, and other work behind stone.
				2. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.
				3. Cut and drill sinkages and holes in stone for anchors, fasteners, supports, and lifting devices as indicated or needed to set stone securely in place.
				4. Finish exposed faces and edges of stone[, **except sawed reveals**,] to comply with requirements indicated for finish and to match approved samples[ **and mockups**].

Usually delete first paragraph below and detail corners on Drawings. Quirk-mitered corners are often used for marble. Delete for stone varieties not mitered.

* + - * 1. Quirk-miter corners unless otherwise indicated; provide for cramp anchorage in top and bottom bed joints of corner pieces.

Options in first paragraph below are examples only. Revise to suit Project.

* + - * 1. Cut stone to produce uniform joints [**3/8 inch] [1/2 inch**] wide and in locations indicated.
				2. Contiguous Work: Provide chases, reveals, reglets, openings, and similar features as required to accommodate contiguous work.
				3. Fabricate molded work, including washes and drips, to produce stone shapes with a uniform profile throughout entire unit length, with precisely formed arris slightly eased to prevent snipping, and with matching profile at joints between units.

Retain subparagraph below for polished or honed granite and marble moldings.

Produce moldings and molded edges with machines that use abrasive shaping wheels made to reverse contour of molding shape.

Depending on nature and extent of carving involved, developing an allowance for this work and specifying providers may be necessary.

* + - * 1. Carve and cut [**inscriptions] [and] [decorative surfaces**]. Use skilled stone carvers experienced in the successful performance of work similar to that indicated.

Abrasive etching is less expensive than carving; however, it also does not have as much depth of relief.

* + - * 1. Abrasively etch [**inscriptions] [and] [decorative surfaces**].

Laser etching produces almost no relief but can be used to reproduce photographic images on polished stone.

* + - * 1. Laser etch [**inscriptions] [and] [decorative surfaces**].
				2. Clean backs of stone to remove rust stains, iron particles, and stone dust.
				3. Inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.

Grade and mark stone for overall uniform appearance when assembled in place. Natural variations in appearance are acceptable if installed stone units match range of colors and other appearance characteristics represented in approved samples and mockups.

* + - 1. FABRICATION OF BACKUP STRUCTURE
				1. Fabrication of [**Steel Trusses] [Strongback Frames] [and] [Miscellaneous Steel Framing**]: Fabricate in shop to comply with AISC 303.

Weld shop connections to comply with applicable provisions of AWS D1.1.

Fabricate joints to exclude water or to permit its escape to building exterior, at locations where water could accumulate because of condensation or other causes.

Retain subparagraph below for hot-dip galvanized finish; delete for shop-primed or -painted finish.

Hot-dip galvanize backup structure after fabrication to comply with ASTM A123.

* + - * 1. Fabrication of Steel Stud Frames: Fabricate and assemble by welding to comply with requirements in Section 054000 "Cold-Formed Metal Framing."

Weld secondary weather barrier (sheathing) to outside face of steel stud frames. Use continuous welds at all four edges of sheets to provide continuous weather seal.

Clean welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

* + - 1. SHOP-PAINTED STEEL FINISHES

Retain this article for shop-painted steel framing for backup structure.

* + - * 1. General: Paint uncoated steel backup structure before delivering to Project site to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel."

Revise "Surface Preparation" Paragraph below if change in coating system requires change in method of surface preparation.

* + - * 1. Surface Preparation: After fabricating steel items, prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

Retain one of two paragraphs below. First provides only minimum protection for steel framing; usually retain second paragraph for better protection against rust staining of stone panels. A high-performance paint system on framing costs little compared with stone.

* + - * 1. Apply one coat of fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#76.[ After primer has dried, apply one coat of exterior alkyd enamel complying with MPI#96 of a different color than primer.]
				2. Apply two-coat, high-performance coating system consisting of epoxy zinc-rich primer, complying with MPI#20 and topcoat of high-build epoxy coating, complying with MPI#108.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Cloverdale Paint.

PPG Paints.

Sherwin-Williams Company (The).

Approved equivalent.

* + - 1. MORTAR MIXES
				1. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortar of uniform quality and with optimum performance characteristics.

Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated. Do not use calcium chloride.

Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer unless otherwise indicated. Discard mortar when it has reached initial set.

Retain one mortar type in "Portland Cement-Lime Setting Mortar" Paragraph below or retain third option and mortar types in following subparagraphs applicable to stone groups selected. Verify selection of type for application indicated. Verify that mortar has lower compressive strength than stone.

* + - * 1. Portland Cement-Lime Setting Mortar: Comply with ASTM C270, Proportion Specification, [**Type S.] [Type N.] [for types of mortar indicated below**:]

Set granite with Type S mortar.

Set limestone with Type N mortar.

Set marble with Type S mortar.

Set quartz-based stone with [**Type S] [Type N**] mortar.

Set serpentine with Type S mortar.

Set slate with Type S mortar.

Set travertine with Type N mortar.

Backparge travertine with Type O mortar.

Retain one mortar type in "Pointing Mortar" Paragraph below or retain fourth option if more than one mortar type is required.

* + - * 1. Pointing Mortar: Comply with ASTM C270, Proportion Specification, [**Type S] [Type N] [Type O**] [**for types of mortar indicated**]. Provide pointing mortar mixed to match Director’s Representative's sample and complying with the following:

Retain "Pigmented Pointing Mortar," "Packaged Portland Cement-Lime Mix Mortar," or "Colored-Aggregate Pointing Mortar" Subparagraph below. Ratio in first applies only to pigment types included in "Mortar Materials" Article. Other pigments, if inserted, may require different limitations.

Pigmented Pointing Mortar: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1:10, by weight.

Packaged Portland Cement-Lime Mix Mortar: Use portland cement-lime mix of selected color.

Colored-Aggregate Pointing Mortar: Produce color required by combining colored aggregates with portland cement of selected color.

If more than one mortar type is required, retain mortar types in subparagraphs below applicable to stone groups selected. Do not point with mortar stronger than setting mortar; Type S is stronger than Type N, which is stronger than Type O. See the Evaluations.

Point granite with [**Type S] [Type N**] mortar.

Point limestone with [**Type N] [Type O**] mortar.

Point marble with [**Type N] [Type O**] mortar.

Point quartz-based stone with [**Type N] [Type O**] mortar.

Point serpentine with [**Type N] [Type O**] mortar.

Point slate with Type N mortar.

Point travertine with [**Type N] [Type O**] mortar.

* + - 1. SOURCE QUALITY CONTROL
				1. Testing Agency: [**Director’s Representative will engage] [Engage**] a qualified testing agency to perform source quality-control testing.

Consider deleting first subparagraph below. If specific stone varieties are named in the Specifications and testing is retained, verify that stone varieties can meet test requirements. Retaining stone varieties that can pass test requirements by a suitable margin can eliminate the need for retesting.

Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

Furnish test specimens [**randomly selected] [selected by testing agency**] from same blocks as actual materials proposed for incorporation into the Work.

Options in "Flexural Strength Tests" Subparagraph below are examples only. One set of tests per 10,000 sq. ft. is appropriate for stone varieties that give consistent test results; increase testing frequency if using stone varieties that give varying results. If using several varieties of stone, copying and revising subparagraph below for each may be necessary.

Flexural Strength Tests: ASTM C880, performed on specimens of same thickness, orientation of cut, and finish as installed stone. One set of test specimens is required to be tested for every [**10,000 sq. ft.] [5000 sq. ft.] [3000 sq. ft.],** but not fewer than two sets for each stone variety.

Insert other tests to suit Project.

1. EXECUTION
	* + 1. EXAMINATION
				1. Examine surfaces to receive stone cladding and conditions under which stone cladding will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone cladding.
				2. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of stone cladding.
				3. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. INSTALLATION OF BACKUP STRUCTURE
				1. Installing [**Steel Trusses] [Strongback Frames] [and] [Miscellaneous Steel Framing**]: Comply with AISC 303 and install to accommodate construction tolerances specified.

Maintain erection of backup structure within tolerances in AISC 303.

For prefabricated units to which stone has been installed before erection, maintain tolerances of stone faces and edges as specified in "Installation Tolerances" Article.

Retain first subparagraph below for control of fastening methods for structural-steel framing if needed.

Install by [**welding to steel weld-plates anchored in concrete] [bolting to inserts cast into concrete] [or] [bolting to structural-steel frame**].

Clean welds, bolted connections, and abraded areas immediately after erection.

Retain one of two subparagraphs below to match finish specified for backup structure.

Repair galvanizing to comply with ASTM A780.

Apply paint to exposed areas using same material as used for shop painting.

Retain one of three options in "Installing Steel Stud Frames" Paragraph below for control of fastening methods for steel stud frames, or delete all three and rely on Section 054000 "Cold-Formed Metal Framing" to specify fastening methods.

* + - * 1. Installing Steel Stud Frames: Install [by welding to steel weld-plates anchored in concrete] [by welding to structural-steel frame] [by bolting to structural-steel frame] to comply with requirements in Section 054000 "Cold-Formed Metal Framing."

Install steel stud frames level, plumb, and true to line with no variation in plane or alignment exceeding 1/16 inch and no variation in position exceeding 1/8 inch.

For prefabricated frames to which stone has been installed before erection, maintain tolerances of stone faces and edges as specified in "Installation Tolerances" Article.

Clean welds, bolted connections, and abraded areas immediately after erection. Repair galvanizing to comply with ASTM A780.

* + - * 1. Installing Metal-Grid Systems: Comply with manufacturer's written instructions to provide integrated system that combines metal struts, fittings, fasteners, and stone anchors.

Fasten struts by bolting to [inse**rts in concrete] [or] [steel angle clips bolted to steel framing**].

Fasten stone supports and anchors by bolting to struts.

Shim and adjust struts and stone supports and anchors to provide grid that is level, plumb, and true to line with no variation in plane or alignment exceeding 1/16 inch and no variation in position exceeding 1/8 inch.

* + - 1. INSTALLATION OF STONE CLADDING, GENERAL

Retain or revise paragraphs in this article if applicable to Project; delete if not.

* + - * 1. Before setting stone, clean surfaces that are dirty or stained by removing soil, stains, and foreign materials. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.
				2. Coat limestone with dampproofing to extent indicated below:

Stone at Grade: Beds, joints, and back surfaces to at least 12 inches above finish-grade elevations.

Stone Extending Below Grade: Beds, joints, back surfaces, and face surfaces below grade.

Allow dampproofing to cure before setting dampproofed stone. Do not damage or remove dampproofing while handling and setting stone.

Delete first paragraph below if travertine is not used or if not needed.

* + - * 1. Parge back of travertine panels with mortar not less than 3/8 inch thick.
				2. Execute stone cladding installation by skilled mechanics and employ skilled stone fitters at Project site to do necessary field cutting as stone is set.

Use power saws with diamond blades to cut stone. Produce lines cut straight and true, with edges eased slightly to prevent snipping.

* + - * 1. Contiguous Work: Provide reveals, reglets, and openings as required to accommodate contiguous work.
				2. Set stone to comply with requirements indicated. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure stone cladding in place. Shim and adjust anchors, supports, and accessories to set stone accurately in locations indicated, with uniform joints of widths indicated, and with edges and faces aligned according to established relationships and indicated tolerances.
				3. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.

Retain first subparagraph below if sealing joints are not specified in this Section.

Sealing expansion and other joints is specified in Section 079200 "Joint Sealants."

Retain subparagraph below if using mortar-set stone.

Keep expansion joints free of mortar and other rigid materials.

* + - * 1. Install concealed flashing at continuous shelf angles, lintels, ledges, and similar obstructions to downward flow of water, to divert water to building exterior. Extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.

Cavities in paragraph below are recommended; however, authorities having jurisdiction may require space to be grouted solid.

* + - * 1. Keep cavities open where unfilled space is indicated between back of stone units and backup wall; do not fill cavities with mortar or grout.

Place weep holes in joints where moisture may accumulate, including at base of cavity walls and above shelf angles and flashing. Locate weep holes at intervals not exceeding 24 inches. Use [**weep and vent tubes] [plastic weep hole/vents] [or] [wicking material**].

Place vents in cavity walls at tops of cavities, below shelf angles and flashing, and at intervals not exceeding 20 feet vertically. Locate vents in joints at intervals not exceeding 60 inches horizontally. Use [**weep and vent tubes] [or] [plastic weep hole/vents**].

* + - 1. INSTALLATION OF MECHANICALLY ANCHORED STONE CLADDING

Retain this article for stone set on framing system or on individual mechanical anchors.

* + - * 1. Set stone cladding with mechanical anchors without mortar unless otherwise indicated.
				2. Attach anchors securely to stone and to backup surfaces. Comply with recommendations in ASTM C1242.
				3. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with sealant indicated for filling kerfs.
				4. Set stone supported on clips or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths and to prevent point loading of stone on anchors. Hold shims back from face of stone a distance at least equal to width of joint.
			1. INSTALLATION OF STONE CLADDING WITH MORTAR

Retain this article for mortar-set stone with mortar- or sealant-pointed joints.

* + - * 1. Set stone cladding with mortar and mechanical anchors [**where indicated] [unless otherwise indicated**].
				2. Set stone in full bed of mortar with head joints filled unless otherwise indicated.

Use setting buttons of adequate size, in sufficient quantity, and of thickness required to maintain uniform joint width and to prevent mortar from extruding. Hold buttons back from face of stone a distance at least equal to width of joint, but not less than depth of pointing materials.

Do not set heavy units or projecting courses until mortar in courses below has hardened enough to resist being squeezed out of joint.

Support and brace projecting stones until wall above is in place and mortar has set.

Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with mortar.

Delete first paragraph below if using cavity. Cavity is recommended; however, authorities having jurisdiction may require space to be grouted. The IBC requires 1-inch grout between backing and stone veneer, but not for slab-type veneer.

* + - * 1. Fill space between back of stone units and backup wall solidly with mortar or grout.
				2. Embed ends of sills in mortar; leave remainder of joint open until final pointing.

Retain first four paragraphs below for joints pointed with mortar.

* + - * 1. Rake out joints for pointing with mortar to depths of not less than 1/2 inch. Rake joints to uniform depths with square bottoms and clean sides.
				2. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply first layer of pointing mortar in layers not more than 3/8 inch until a uniform depth is formed.
				3. Point stone joints by placing pointing mortar in layers not more than 3/8 inch. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.
				4. Tool joints with a round jointer having a diameter 1/8 inch larger than width of joint, when pointing mortar is thumbprint hard.

Retain first paragraph below for sealant-pointed joints.

* + - * 1. Rake out mortar from sealant-pointed joints to depths required for sealant and sealant backing, but not less than 1/2 inch. Rake joints to uniform depths with square bottoms and clean sides.

Retain paragraph below with mortar- or sealant-pointed joints.

* + - * 1. Set the following stone cladding with unfilled head joints for installing joint sealants:

Items in subparagraphs below are examples of stone that is partially or totally horizontal. Revise list to suit Project.

Cornices.

Copings.

Sills.

Belt and other projecting courses.

* + - 1. INSTALLATION OF JOINT-SEALANTS

Retain this article for sealant-pointed joints and for sealant joints if sealing joints are specified in this Section.

* + - * 1. Prepare joints and apply sealants of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."
			1. INSTALLATION TOLERANCES

Tolerances in six paragraphs below are more stringent than those published by the Brick Industry Association for unit masonry and are generally appropriate for smooth-finished stone. Some of the tolerances may be stricter than needed for work that is only seen at a great distance, such as on upper floors of high-rise construction. Revise tolerances to suit Project.

* + - * 1. Variation from Plumb: For vertical lines and surfaces of walls, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners, corners and jambs within 20 feet of an entrance, expansion joints, and other conspicuous lines, do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 3/8 inch in 40 feet or more.
				2. Variation from Level: For lintels, sills, water tables, parapets, horizontal bands, horizontal grooves, and other conspicuous lines, do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 3/8 inch maximum.
				3. Variation of Linear Building Line: For positions shown in plan and related portions of walls and partitions, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
				4. Variation in Cross-Sectional Dimensions: For thickness of walls from dimensions indicated, do not exceed plus or minus 1/4 inch.
				5. Variation in Joint Width: Do not vary from average joint width more than plus or minus 1/8 inch or a quarter of nominal joint width, whichever is less. For joints within 60 inches of each other, do not vary more than 1/8 inch or a quarter of nominal joint width, whichever is less from one to the other.

Revise or delete "Variation in Plane between Adjacent Stone Units (Lipping)" Paragraph below for natural-cleft, thermal, and similar finishes.

* + - * 1. Variation in Plane between Adjacent Stone Units (Lipping): Do not exceed 1/16-inch difference between planes of adjacent units.
			1. ADJUSTING AND CLEANING
				1. Remove and replace broken, chipped, stained, or otherwise damaged stone, defective joints, and stone cladding that does not match approved samples[ **and mockups**]. Damaged stone may be repaired if Director’s Representative approves methods and results.
				2. Replace damaged or defective work in a manner that results in stone cladding's matching approved samples[ **and mockups**], complying with other requirements, and showing no evidence of replacement.
				3. In-Progress Cleaning: Clean stone cladding as work progresses.[ **Remove mortar fins and smears before tooling joints**.] Remove excess sealant and smears as sealant is installed.

Revise "Final Cleaning" Paragraph below if pressure water-cleaning methods are acceptable. Usually delay cleaning as long as possible so construction-related soiling is also removed; minimum for curing mortar and sealants is six days.

* + - * 1. Final Cleaning: Clean stone cladding no fewer than six days after completion of pointing and sealing, using clean water and stiff-bristle fiber brushes. Do not use wire brushes, acid-type cleaning agents, cleaning agents containing caustic compounds or abrasives, or other materials or methods that could damage stone.

END OF SECTION 044200