

PROJECT NO:
DATE:

PROJECT NAME
PROJECT LOCATION

Indiana Limestone Company:

July 29, 2016

Corporate Offices: 123 South College Avenue, Bloomington, Indiana 47404

Phone: (800) 457-4026 **Office:** (812) 275-3341 **Fax:** (812) 287-7522

Website: www.indianalimestonecompany.com

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Regional Manager: [_____]

Product Guide Specification:

Specifier Note: This product guide specification is written according to the Construction Specifications Institute (CSI) current versions of MasterFormat, SectionFormat and PageFormat and as described in various Practice Guides.

Use this guide specification as the basis for developing a project specification.

Layout of Header/Footer is based on PageFormat, edit as necessary in compliance with project requirements.

Section must be carefully reviewed and edited by Architect/Design Professional to meet requirements of project and local building code.

Coordinate this section with Drawings and other specification sections; coordinate these numbers and titles with sections included for specific project.

Brackets [____], and/or, <____> and “or” are used to indicate when a selection is required.

Windows 2010 - Upon completion of section editing, you may turn-off “Specifier Notes” as follows; click on “File” then on “Options” then “Display” and remove check-mark for “Hidden text” in two locations.

SECTION 04 4308 – LIMESTONE MASONRY

Specifier Note: This section covers the Indiana Limestone Company line of limestone products used in stone masonry application. Consult with Indiana Limestone Company and the Indiana Limestone Handbook for technical assistance in editing this section.

PART 1- GENERAL

1.01 SECTION INCLUDES

- A. Modular limestone units and accessories.
- B. Modular limestone full bed veneer units and accessories.
- C. Thin limestone adhered veneer units and accessories.

Specifier Note: Edit the following list of related requirements for the project, and coordinate for consistent use of section numbers and titles. List any other sections with work directly related to work of this section.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 – Cast-in-Place Concrete: **[Inserts] [Weld plates]** in concrete.
- B. Section 04 2000 – Unit Masonry: **[Inserts] [Stone trim]** in unit masonry.
- C. Section 05 1200 – Structural Steel Framing: Steel structural framing members.

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- D. Section 05 5000 – Metal Fabrications: Steel framing and support fabrications.
- E. Section 07 2500 – Weather Barriers: Weather resistant barrier.
- F. Section 07 6200 – Sheet Metal Flashing and Trim: Flashing materials.
- G. Section 07 9200 – Joint Sealants.
- H. Section 08 4313 – Aluminum-Framed Storefronts.
- I. Section 08 4413 – Glazed Aluminum Curtain Walls.

1.03 DEFINITIONS

- A. ACI – American Concrete Institute (www.concrete.org).
- B. AISC – American Institute of Steel Construction (www.aisc.org).
- C. ASTM – American Society for Testing and Materials (www.astm.org).
- D. AWS – American Welding Society (www.aws.org).
- E. ILIA – Indiana Limestone Institute of America (www.iliai.com).
- F. IMI – International Masonry Institute (imiweb.org).

Specifier Note: Edit the following list of reference standards to only those being used for project.

1.04 REFERENCE STANDARDS

- A. ASTM A36/A36M – Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- C. ASTM A153/A153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016.
- D. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength; 2014.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015e1.
- F. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2009 (Reapproved 2015).
- G. ASTM C97/C97 - Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone; 2015.
- H. ASTM C99/C99M - Standard Test Method for Modulus of Rupture of Dimension Stone; 2015.
- I. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar; 2011.
- J. ASTM C150/C150M – Standard Specification for Portland Cement; 2016.
- K. ASTM C170/C170M - Standard Test Method for Compressive Strength of Dimension Stone; 2016.
- L. ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

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- M. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- N. ASTM C305 - Standard Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency; 2014.
- O. ASTM C321 - Standard Test Method for Bond Strength of Chemical-Resistant Mortars; 2000 (Reapproved 2012).
- P. ASTM C568/C568M – Standard Specification for Limestone Dimension Stone; 2015.
- Q. ASTM C847 – Standard Specification for Metal Lath; 2014a.
- R. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2016a.
- S. ASTM C1242 – Standard Guide for Selection, Design, and Installation of Dimension Stone Attachment Systems; 2015a.
- T. ASTM C1780 - Standard Practice for Installation Methods for Adhered Manufactured Stone Masonry Veneer; 2016.
- U. ASTM D570 – Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).
- V. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.
- W. ASTM D695 – Standard Test Method for Compressive Properties of Rigid Plastics; 2015.
- X. ASTM D2240 – Standard Test Method for Rubber Property-Durometer Hardness; 2015.
- Y. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.
- Z. AWS D1.1/D1.1M – Structural Welding Code – Steel; 2015.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate limestone masonry assemblies with rain drainage, flashing, sills and trim, and other adjoining work.

Specifier Note: Review Preinstallation meeting information and confirm that this Work is extensive enough to justify this meeting and for project specific meeting requirements.

- B. Preinstallation Meeting:
 - 1. Attendees:
 - a. Owner.
 - b. Architect.
 - c. Limestone masonry manufacturer's representative.
 - d. Installer's whose work interfaces with or affects limestone masonry including installers of **[doors]**, **[windows]**, **[storefront]**, **[curtain wall]**, and **[_____]**.
 - 2. Review and finalize construction schedule.
 - 3. Verify availability of materials, installer's personnel, equipment, and facilities needed to maintain schedule.
 - 4. Review means and methods related to installation, including manufacturer's written instructions.
 - 5. Examine support conditions for compliance with requirements, including alignment and attachment to structural members.

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6. Review flashings, special masonry details, wall penetrations, openings, and condition of other construction that affects this Work.
7. Review temporary protection requirements for during and after installation of this Work.

Specifier Note: Edit the following list of submittal requirements and provide only those required for project, and verify section number and title for project submittal procedure requirements.

1.06 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer’s product data sheets including certified laboratory test reports for limestone, accessories, and other products required.
- C. Shop Drawings: Submit fabrication and installation layouts of limestone masonry units; including exterior elevations, details of edge conditions, joints, profiles, corners, sills, anchorage and attachment system, trim, flashings, closures, accessories, and special details.
 1. Include in shop drawings details as developed by cladding engineer in accordance with specified requirements.
 2. Include large scale details of decorative surfaces and inscriptions.
 3. Include mechanical anchoring and framing of preassembled units showing epoxy joint construction.
- D. Samples: Submit **[two]** or **[three]** samples for each type of limestone masonry required, **[at least 12 inch (305 mm) high by 12 inch (305 mm) wide by 1 inch (25.4 mm) thick]** or **[in sizes representative of materials specified]**.
 1. Sets of samples to represent range of variations in color and finish as expected in completed work.
 2. Submit samples of joint sealants for each type and color required.
- E. Samples, Preassembled Units: Submit two samples of stone units bonded together with epoxy adhesive, at least 6 inch (152 mm) long by 3 inch (76 mm) wide by 3/4 inch (19 mm) thick bonded together on large face at right angles.
- F. Delegated Design Submittals: Submit the following data on limestone that has been signed and stamped by Professional Engineer registered in state the project is located who certifies preparing or supervising the preparation of design data in compliance with specified performance requirements and recognized engineering principles and practices.
 1. Engineering calculations.
 2. Connection details.
- G. Test and Evaluation Reports: Submit on each type of limestone masonry system provided for project based on evaluation of comprehensive tests performed by qualified testing agency.
- H. Qualification Statements: Submit evidence of qualifications as indicated.

1.07 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Company specializing in manufacturing products specified in this section with at least **[twenty]** **[_____]** years of documented experience, and member of Indiana Limestone Institute of America, Inc. (ILIA).
- B. Fabricator Qualifications: Company specializing in custom fabrication of limestone masonry products as specified in this section with at least **[ten]** **[_____]** years of documented experience, **[and recommended by manufacturer]**.

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- C. Installer Qualifications: Company specializing in performing work of this section with at least **[ten]** **[_____]** years of documented experience **[and recommended by manufacturer]**.
- D. Testing Agency Qualifications: Contractor to engage independent testing laboratories to perform preconstruction testing.
 - 1. Test limestone for compliance with specified performance requirements.
 - 2. Conduct tests using specimens randomly selected from proposed materials designated for use in this work.
- E. Welder Qualifications: Company with welding operators qualified for processes required for this work in accordance with AWS standard qualification procedures.

Specifier Note: Review Mock-Up information and coordinate that it is in compliance with project requirements.

- F. Mock-Ups: Provide mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects of each type, color and texture of limestone masonry units, and to establish quality standards for fabrication and installation.

Specifier Note: Edit following sub-paragraph for large scale mock-up, indicate portion of building to represent mock-up on Drawings, or indicate mock-up as separate element on Drawings in compliance with project requirements.

- 1. Build mock-up of limestone masonry assembly on site, **[as shown on drawings]**, including but not limited to adhesives, mortars, and grouts.
 - a. Size and location of mock-up as designated by Architect.
 - b. Do not proceed with this Work until Architect approves materials and workmanship.
 - c. Rework mock-up as required to produce acceptable limestone masonry assembly.
 - d. **[Remove mock-up when directed by Architect.]**
 - e. **[Acceptable mock-up may be incorporated into the work.]**

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials and products in strict compliance with manufacturer's instructions, recommendations, and industry standards.
- B. Store and handle stone and related materials to prevent deterioration and damage.
 - 1. Do not use pinch or wrecking bars on stonework.
 - 2. Lift limestone using wide-belt type slings where possible; do not use wire ropes, or ropes containing tar or other substances that may cause staining.
 - 3. Store limestone on non-staining wood skids or pallets, and cover with non-staining, waterproof membrane.
 - 4. Place and stack skids and limestone to distribute weight evenly and to prevent breakage or cracking of limestone.
 - 5. Store cementitious materials above ground or floor, under cover, and in dry location.

1.09 SITE CONDITIONS

Specifier Note: Include the following for projects with mortar used in setting, and when freezing weather is possible.

- A. Cold Weather Protection: Comply with IMI - Cold Weather Masonry Construction and Protection Recommendations (www.imiweb.org/cold-weather-masonry-construction).
- B. Protect limestone masonry work during construction as follows:
 - 1. Cover top of walls with non-staining waterproof sheeting at end of work each day.

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2. Cover partially completed stonework while work is not in progress.
3. Extend cover at least 24 inches (610 mm) down both sides and hold securely in place.
4. Prevent staining of stone from mortar, grout, sealants, and other materials; immediately remove such materials from stone without damaging stonework.
5. Protect base of walls from rain-splashed mud and mortar splatter using approved coverings spread on ground and applied over wall surface.
6. Protect sills, ledges and projections from droppings of mortar and sealants.

PART 2- PRODUCTS

2.01 MANUFACTURER

- A. Indiana Limestone Company:
1. Address: 123 South College Avenue, Bloomington, Indiana 47404.
 2. Phone: (800) 457-4026
 3. Office: (812) 275-3341
 4. Fax: (812) 287-7522
 5. Website: www.indianalimestonecompany.com.
 6. Contact for Regional Managers: www.indianalimestonecompany.com/contact-us.
 7. Regional Manager: [_____].
- B. Provide limestone for entire project from the following quarry:
1. **[Empire Quarry - 301 Main Street, Oolitic, Indiana 47451.]**
 2. **[Victor Oolitic Quarry - 7850 South Victor Pike, Bloomington, Indiana 47403.]**

2.02 LIMESTONE MATERIALS

- A. Limestone: Complies with ASTM C568/C568M, Type II (Medium Density) Classification.
1. Variety: Indiana Limestone.
 2. Absorption by Weight: 7.5 maximum percentage; ASTM C97/C97M.
 3. Density: 135 lbs/cu ft (2160 kg/cu m), minimum; ASTM C97/C97M.
 4. Compressive Strength: 4000 psi (28 MPa), minimum; ASTM C170/C170M.
 5. Modulus of Rupture: 700 psi (3.4 MPa), minimum; ASTM C99/C99M.

Specifier Note: Edit the following list of limestone material characteristics including color, grade, and finish in compliance with project requirements. Refer to the Indiana Limestone Handbook, latest edition, for additional information.

- B. Color: **[Buff] [Silver buff] [Gray] [Full color blend] [As indicated under PRODUCT TYPES article] or [As indicated on drawings].**

*Specifier Note: Indicate the applicable **Grade Classifications** of limestone masonry selected for the project, and indicate location(s) on the drawings.*

Standard - Fine to moderately large-grained limestone permitting an average amount of typical limestone characteristics.

Rustic - Fine to very coarse-grained limestone permitting an above-average amount of typical limestone characteristics.

- C. Grade Classifications: Provide limestone of the following grade(s) at locations as indicated on the drawings in compliance with samples and shop drawings approved by the Architect.
1. **[Standard] and/or [Rustic].**

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*Specifier Note: Indicate the applicable **Finishes** of limestone masonry selected for the project, and indicate location(s) on the drawings.*

Smooth - Least textural of standard limestone finishes having the least surface interruption to eye or to touch.

Coarse and Textured Finishes:

Plucked - Machine finish created by rough planning limestone surface breaking or plucking out small particles.

Machine Tooled - Consists of cutting parallel, concave grooves in limestone, typically four, six, or eight grooves per inch ranging from 1/32 to 1/16 inch deep.

Bushhammer - Finish that is pneumatically applied, either by hand or machine, with texture range from light to fairly coarse; maximum relief is a fraction of an inch.

Split Face - A rough, uneven, concave-convex finish produced by splitting action of large guillotine type knife.

Rock Face - Dressed by machine or by hand producing a bold, convex projection along face of limestone; provides bolder, more massive appearance than split faced.

Chat Sawed - Flat, with coarse pebbled surface resulting from use of coarse sand abrasive during gang sawing operation, and may have directional score or saw marks; for best economy confine use to coarser grades of limestone. Contact Indiana Limestone Institute of America for local suppliers of this unique finish; "www.iliai.com/pages/Contact_Us".

Shot Sawed - Flat, with coarse uneven finish ranging from a pebbled surface to one that is ripped with irregular, roughly parallel grooves resulting from use of steel shot and coarse sand abrasive during gang sawing process, and may have directional grooves; for best economy confine use to coarser grades of limestone. Contact Indiana Limestone Institute of America for local suppliers of this unique finish; "www.iliai.com/pages/Contact_Us".

Custom Textures – Describe below as necessary.

- D. Limestone Finishes: Provide limestone of the following finish at locations as indicated on the drawings in compliance with samples and shop drawings approved by the Architect.
1. Smooth.
 2. Coarse and Textured Finishes:
 - a. Plucked.
 - b. Machine Tooled.
 - c. Bushhammer.
 - d. Split Face.
 - e. Rock Face.
 - f. Chat Sawed.
 - g. Shot Sawed.
 3. Custom Textures: [_____].

2.03 PRODUCT TYPES

Specifier Note: Select from following limestone product types available from Indiana Limestone Company (ILC). "Type" is provided to coordinate with designation used on the drawings. These types of limestone are being listed for use in stand-alone limestone masonry, full bed veneer limestone masonry, and adhered veneer limestone masonry types of installation applications.

This "Product Types" article may be omitted for projects that include custom or dimensional stone work only.

Refer to "Product Guide" available on ILC website at; www.indianalimestonecompany.com, for additional information.

- A. Type (___) - Vanderbilt Classic Smooth:
1. Smooth face with sawn top, bottom, back and each end.

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2. Color: **[Full color blend]** and/or **[Gray]**.
 3. Height: **[3-5/8 inch (92 mm)] [7-5/8 inch (194 mm)] [11-5/8 inch (295 mm)]** and/or **[15-5/8 inch (397 mm)]**.
 4. Thickness: 3-5/8 inch (92 mm).
 5. Length: **[23-5/8 inch (600 mm)]** and/or **[35-5/8 inch (905 mm)]**.
- B. Type () - Vanderbilt Classic Split Face:
1. Split face with sawn top, bottom, back and each end.
 2. Color: Full color blend.
 3. Height: **[3-5/8 inch (92 mm)] [7-5/8 inch (194 mm)]** and/or **[11-5/8 inch (295 mm)]**.
 4. Thickness: 3-5/8 inch (92 mm).
 5. Length: 23-5/8 inch (600 mm).
- C. Type () - Rockford Estate Blend Full Bed Veneer:
1. Lightly tumbled, with split front, back and each end, and sawn top and bottom.
 2. Color: Full color blend.
 3. Height: Range of 2 inch (51 mm) to 12 inch (305 mm).
 4. Thickness: Range of 3 inch (76 mm) to 5 inch (127 mm).
 5. Length: Range of 6 inch (152 mm) to 18 inch (457 mm).
- D. Type () - Berkshire Full Bed Veneer:
1. Split face with split or sawn back.
 2. Color: **[Full color blend] [Buff]** and/or **[Gray]**.
 3. Height, with 7-3/4 Inch (197 mm) Maximum: 15 percent at 2-1/4 inch (57 mm) high, 40 percent at 5 inch (127 mm) high, and 45 percent at 7-3/4 inch (197 mm) high coursing heights.
 4. Height, with 10-1/2 Inch (267 mm) Maximum: 10 percent at 2-1/4 inch (57 mm) high, 35 percent at 5 inch (127 mm) high, 40 percent at 7-3/4 inch (197 mm) high, and 15 percent at 10-1/2 inch (267 mm) high coursing heights.
 5. Thickness: Range of 3 inch (76 mm) to 4 inch (102 mm), varies with finish.
 6. Length: Random lengths of 24 inch (607 mm) to 40 inch (1016 mm) and jointed on site at lengths conforming to pattern approved by Architect.
- E. Type () - Rockford Estate Blend Thin Veneer:
1. Lightly tumbled, with split front, back and each end, and sawn top and bottom.
 2. Color: Full color blend.
 3. Height: Range of 2 inch (51 mm) to 12 inch (305 mm).
 4. Thickness: 1-1/4 inch (31.8 mm), nominal.
 5. Length, Flats: Range of 8 inch (203 mm) to 18 inch (457 mm).
 6. Length, Corners: Range of 4 inch (102 mm) to 12 inch (305 mm).
- F. Type () - Berkshire Thin Veneer:
1. Split face with sawn back.
 2. Color: **[Full color blend] and/or [Buff]**.
 3. Height, with 7-3/4 Inch (197 mm) Maximum: 15 percent at 2-1/4 inch (57 mm) high, 40 percent at 5 inch (127 mm) high, and 45 percent at 7-3/4 inch (197 mm) high coursing heights.
 4. Height, with 10-1/2 Inch (267 mm) Maximum: 10 percent at 2-1/4 inch (57 mm) high, 35 percent at 5 inch (127 mm) high, 40 percent at 7-3/4 inch (197 mm) high, and 15 percent at 10-1/2 inch (267 mm) high coursing heights.
 5. Thickness: 1-1/4 inch (31.8 mm), nominal (3/4 inch (19 mm) to 1-1/2 inch (38 mm)].
 6. Length, Flats: Random lengths of 8 inch (203 mm) to 40 inch (1016 mm) and jointed on site at lengths conforming to pattern approved by Architect.
 7. Length, Corners: Random lengths of 4 inch (102 mm) to 12 inch (305 mm).

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Specifier Note: Edit the following Performance Requirements in compliance with project requirements.

2.04 PERFORMANCE REQUIREMENTS

- A. Physical Properties: Provide limestone with physical properties that meet or exceed values listed in ILIA Indiana Limestone Handbook, latest edition.
- B. Safety Factors: Provide safety factors for design loads and stresses of limestone masonry assembly that meet or exceed values indicated in ILIA Technote on Safety Factors.
- C. Limestone Connections and Attachments: Design steel supports, shapes, plates, bolts, and attachments to support design loads with safety factors and allowable stresses in accordance with ASTM C1242 and AISC Steel Construction Manual, latest edition, and the following.
 - 1. Do not stress steel supports carrying gravity loads more than 50 percent of yield stress in bending.
 - 2. Welds: Comply with AWS D1.1/D1.1M.
 - 3. Concrete Embedded Items: Comply with ACI or manufacturers recommendations, with safety factor not less than 4 to 1 based on concrete failure.
- D. Design Loads: Design cladding and cladding attachments in compliance with following design loads with safety factors as specified.
 - 1. Wind Loads, Dead and Live Loads [, and Seismic Loads]: Comply with local building code requirements and authorities having jurisdiction.
- E. Corrosion and Stain Control: Prevent galvanic and other types of corrosion or staining by isolating metals and other materials from direct contact with incompatible materials, or by applying suitable coatings; staining of stone and joint surfaces is not permitted.

2.05 MORTAR

- A. Setting Mortar, Full Bed Veneer: ASTM C270, Proportion Specifications, Type N, non-staining, and in proportions as recommended by manufacturer.
- B. Setting Mortar, Adhered Thin Veneer: ASTM C270, Proportion Specifications, Type S, non-staining, and in proportions as recommended by manufacturer.
- C. Joint Width: Provide 3/8 inch (9.5 mm) minimum width, 1/2 inch (12.7 mm) maximum width concave mortar joints, unless otherwise noted.
- D. Portland Cement: ASTM C150/C150M, Type I.
 - 1. Provide gray or white cement as necessary for selected mortar color.
 - 2. For cold weather applications, use ASTM C150/C150M, Type III (high early strength).
- E. Hydrated Lime: ASTM C207, Type S (special hydrated lime for masonry purposes).
- F. Aggregate: ASTM C144; for mortar joints narrower than 1/4 inch (6.4 mm) provide with 100 percent passing No. 8 Sieve and 95 percent passing No. 16 Sieve.
- G. Water: Clean, non-alkaline, and potable.
- H. Mixing: Combine and thoroughly mix cementitious materials, aggregates, and water in a mechanical batch mixer; comply with ASTM C305 for mixing time and water content, unless noted otherwise.
- I. Do not add mixtures such as coloring pigments, air-entraining agents, accelerators, retarders, water repellents, anti-freeze compounds, or calcium chloride, unless noted otherwise.

2.06 STONE ANCHORS AND ATTACHMENTS

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- A. Provide anchors and attachments of required type and size to support stonework and fabricated from following materials for conditions indicated:
 - 1. Anchors and Expansion Bolts Embedded in Stone: Stainless steel, Types 304 or 316.
 - 2. Adjustable Inserts Embedded in Concrete: Galvanized malleable iron.
 - 3. Anchor Bolts, Nuts and Washers Not in Direct Contact with Stone: Comply with ASTM A307, Grade A materials; galvanized in accordance with ASTM A153/A153M, Class C.
 - 4. Steel Plates, Shapes and Bars Not in Direct Contact with Stone: Comply with ASTM A36/A36M for materials; galvanized in accordance with ASTM A123/A123M.
 - 5. Expansion Bolts Not in Direct Contact with Stone: Zinc plated or cadmium plated bolts with stainless steel expansion clips.
 - 6. High Strength Threaded Bolts: Comply with ASTM F3125/F3125M
 - 7. Steel Angles Supporting Stone: Comply with ASTM A36/A36M for materials; galvanized in accordance with ASTM A123/A123M.
 - a. Upon approval from Architect; protect supports with one shop coating of zinc-rich or other rust-inhibiting paint, and one field coat of similar compatible paint.
- B. Dovetail Slots: Provide dovetail slots with filler strips, and slot sized to receive anchors; with at least 22 gage, 0.0336 inch (0.85 mm) thick galvanized steel sheet, ASTM A653/A653M, G90 Coating Designation.

Specifier Note: Metal lath may be used for limestone masonry thin veneer applications, edit the following in compliance with project requirements.

2.07 LATH

- A. Metal Lath: Galvanized, expanded diamond metal lath, 3.4 lbs/sg yd (1.8 kg/sq m), minimum, in compliance with ASTM C847.
- B. Non-Metallic Lath: Comply with standards of ASTM C1780, and acceptable to authorities having jurisdiction.
- C. Provide self-furring lath, or lath attached with self-furring fasteners that allows at least 1/4 inch (6.4 mm) of mortar behind front of lath.

2.08 PREASSEMBLED UNITS

- A. Adhesive Properties: Provide two-component epoxy consisting of epoxy resin and hardener that meets the following minimum requirements after seven-day cure at 75 degrees F (24 degrees C).
 - 1. Tensile Bond Strength: Comply with ASTM C321 for cohesive failure in stone.
 - 2. Tensile Elongation: ASTM D638, maximum 2.5 percent tensile elongation.
 - 3. Tensile Strength: ASTM D638, minimum 3500 psi tensile strength.
 - 4. Compressive Strength: ASTM D695, minimum 6000 psi compressive strength.
 - 5. Shore D Hardness: ASTM D2240, at least 75.
 - 6. Water Absorption: ASTM D570, maximum of 0.05 percent after 24 hours.
- B. Adhesive Joint: 1/8 inch (3.2 mm) thick, maximum.
- C. Shop Assembly Requirements:
 - 1. Use dry stone, free from grease, oil, dirt, loose particles, and efflorescence.
 - 2. Use clean compressed air to blow stone dust from pores of stone, and use heat for removal of moisture from stone prior to applying epoxy, with no moisture creeping into bonding areas upon removal of heat source.
 - 3. Assembly units when stone temperature and surrounding air is within temperature range of 50 degrees F (10 degrees C) and 95 degrees F (35 degrees C).
 - a. Assembly of units with ambient temperature below 50 degrees F (10 degrees C) is permitted

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only when stone units and adhesive are heated to above 50 degrees F (10 degrees C), and after units are joined continue to apply heat adjacent to joint area providing adhesive curing temperature above 50 degrees F (10 degrees C).

- b. Install clips, frames, expansion bolts, and other mechanical connections in accordance with approved shop drawings.
4. Mix adhesive in “parts by weight” or “parts by volume” in accordance with manufacturer’s written instructions and in compliance with “pot life” recommendations of adhesive.
5. Use suitable clamps or bracing to join stone units together and use shims as necessary to maintain proper alignment until adhesive is fully cured.
6. Do not move assembled stone units until adhesive is sufficiently cured to ensure there is no joint damage.
 - a. Remove excessive adhesive from joint areas after adhesive has taken on its initial hardening with a putty knife on a textured stone finish.
 - b. Remove completely hardened excessive adhesive on smooth stone finish with power sanders.

2.09 FABRICATION

- A. Fabricate limestone masonry in sizes and shapes as necessary and in compliance with requirements indicated on approved shop drawings.
- B. Comply with written recommendations of the ILIA - Indiana Limestone Handbook, latest edition.
- C. Cut and drill depressed areas and holes in stones for anchors, fasteners, supports, and lifting devices as indicated or as necessary to set stonework securely in place; shape beds to fit supports.
- D. Cut stones to fabricate pieces of thickness, size, and shape as indicated or required for this Work within fabrication tolerances recommended by ILIA - Indiana Limestone Handbook, latest edition.
- E. Tolerances: Provide connections that allow for fabrication, erection, and structural deflection tolerances; refer to Sections 03 3000 and 05 1200 for additional requirements.
- F. Fabricate stone to thicknesses required in compliance with performance requirements, but not less than as shown on drawings; use tables in ILIA - Indiana Limestone Handbook, latest edition, as a guide for size requirements.
- G. Control depth of stone and check to maintain suitable clearance between backside of stone and surfaces and projections of structural members, **[fireproofing,]** backup walls, and other substrate related work.
- H. Fabricate bed and vertical joints straight and at 90 degree angle to stone face, unless noted otherwise, of uniform width and at locations indicated.
 1. Joint Width: **[1/4 inch (6.4 mm)] [As indicated on drawings] or [_____].**
- I. Fabricate quirk-miter corners, unless noted otherwise, and provide for U-bar cramp anchors in top and bottom bed joints of corner pieces.
- J. Fabricate chases, reveals, reglets, openings, and other similar features as required to accommodate unbroken sequence of contiguous stone work.
- K. Fabricate profiled stone work, including washes and drips, to produce stone shapes with uniform profile throughout their entire length and with precisely formed arises slightly eased to prevent snipping, and matched at joints between units.
- L. Fabricate carved and cut decorative surfaces and inscriptions to conform with drawings or models approved by Architect, and employ skilled stone carvers experienced in successful performance of work similar to that being specified.

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- M. Finish exposed faces and edges of stones in compliance with indicated requirements for finish under each type and application of stone required and to match approved samples **[and mock-ups]**.

2.10 ACCESSORIES

- A. Sealants: Refer to Section 07 9200.
- B. Setting Shims: Sized to suit stone joint thicknesses and bed depths without intruding into depths required for joint sealants.
 - 1. Materials: Lead, stainless steel, or plastic shims; non-staining to limestone.
- C. Concealed Flashing: Fabricate from **[stainless steel]** or **[materials as indicated in Section 07 6200]**, with minimum thickness of 0.015 inch (0.38 mm).
- D. Weeps: Provide medium density polyethylene plastic tubing weeps, 1/4 inch (6.4 mm) outside diameter and length as required to extend from interior cavity out to exterior face of limestone.
- E. Weather Resistant Barrier (WRB): Provide WRB in compliance with local building code and the authorities having jurisdiction within wall assembly to control condensation and other moisture in wall.
 - 1. Refer to Section 07 2500 for additional requirements.
- F. Drainage Mats: Provide drainage mats in compliance with local building code and the authorities having jurisdiction within wall assembly to allow moisture to flow downward and out weeps system providing a rapid drying capacity.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive limestone masonry and conditions under which limestone masonry will be installed, with Installer present, for compliance with specified requirements.
- B. Submit written report, validated by Installer, listing any conditions that are not in compliance with specified requirements.
- C. Do not proceed with installation until surfaces and conditions comply with specified requirements for limestone masonry or other related work that affects this Work.

3.02 PREPARATION

- A. Advise installers of related work about specific requirements for proper placement and installation of inserts, flashing reglets, and other necessary items to be used for anchoring, supporting, and flashing of this Work.
 - 1. Provide installers of related work with drawings or templates showing proper locations of these items.
 - 2. Installer of weld-plates and other embedded materials used for connection of limestone masonry to provide drawings to installer of limestone masonry work indicating accurate locations of these materials.
- B. Prior to setting, clean limestone surfaces that have become dirty or stained by removing soil, stains, and other foreign materials.
 - 1. Thoroughly clean limestone by scrubbing stones with fiber brushes followed by thorough drenching with clean clear water, and using only mild cleaning compounds that do not contain any acids, caustic or abrasive materials.

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Specifier Note: Select from the following list of limestone installation types in compliance with project requirements.

3.03 INSTALLATION

A. Setting Limestone:

1. Execute limestone masonry work with skilled mechanics, and use skilled stone fitters on site to complete necessary field cutting as stones are set in place.
 - a. Use power saws to cut stones.
 - b. For stones with exposed edges, provide edges that are cut straight and true.
 - c. Use of mallet and chisel is permitted provided craftsmen are skilled in their use.
2. Aligned and Adjacent Limestone Masonry Work: Provide chases, reveals, reglets, openings and other spaces as indicated on drawings to accommodate adjacent work, and close up openings in stonework after other work is in place with stonework that matches stonework already set.
3. Setting of Stones:
 - a. Comply with requirements indicated on drawings and approved shop drawings.
 - b. Install anchors, supports, fasteners and other attachments indicated or as necessary to properly secure stonework in place.
 - c. Properly shim and adjust anchors, supports and accessories to set stones accurately in locations indicated with uniform joints with widths as indicated, and with edges and faces in alignment in accordance with established relationships and tolerances.
4. Dampproofing for Stain Prevention: Where indicated on drawings, apply coatings of **[cementitious waterproof stone backing]** or **[bituminous dampproofing]** to the back, beds, and joints of stones used at grade, and also dampproof adjacent **[concrete]** or **[concrete masonry unit (CMU)]** haunches, ledges, and support angles.
 - a. Dampproof unexposed surfaces of stone to at least 12 inches (305 mm) above grade.
 - b. Dampproof joints only to within 1 inch (25.4 mm) of finished surfaces when using bituminous or asphaltic solutions.
 - c. Dampproof stones extending below grade as indicated above, and in addition provide dampproofing to grade level on face surfaces that are covered with grade material.
 - d. Allow cementitious coatings to fully cure prior to setting stones in place.
 - e. Exercise due care when handling dampproofed stone to avoid chipping or off-setting of stones.
5. Joints: Provide expansion joints, control joints, and pressure relieving joints of widths and at locations indicated on drawings or as required.
 - a. Use of mortar or shims in expansion joints is not permitted.
 - b. Joint Sealants: Refer to Section 07 9200 for additional requirements.

B. Setting Limestone with Sealant Joints:

1. Support limestone masonry work on gravity supports, and insert anchors for support of lateral loads of type and quantity as indicated on approved shop drawings in compliance with requirements.
2. Securely attach anchors to limestone and backup substrate surfaces.
3. Attach framing for limestone masonry support system to structural frame of building at connection locations indicated by welded or bolted field connections in compliance with the following requirements:
 - a. Install high strength threaded fasteners or anchor bolts in compliance with AISC recommendations.
 - b. Provide joints that allows water to drain to exterior face of building, and provide weeps at locations where water may accumulate due to condensation or for other reasons.
 - c. Galvanized Surfaces: Comply with ASTM A780/A780M for cleaning field welds, bolted connections and abraded areas, and for applying galvanizing repair paint to surfaces of assembled framing.

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- d. Shop Painted Surfaces: Clean field welds, bolted connections, and abraded areas immediately after erection, and apply paint to exposed areas using same materials as used for shop painting.
 4. Fill anchor holes with non-staining mortar or sealant, and where dowels occur at pressure-relieving joints, provide compressive material above and below dowels.
 5. Limestone Supported on Clips or Continuous Angles: Set limestone on non-corrosive and non-staining shim material with sufficient area to support load; mortar may be used in lieu of shims provided that setting pads are provided to maintain joint sizes needed if weight of stone squeezes out mortar.
 - a. Locate setting buttons of adequate size, in sufficient quantity, and of uniform thickness as indicated joint width, to prevent mortar from squeezing out and to maintain uniform joint widths.
 - 1) Place setting buttons back from face of stone to provide space for backer rod and sealant.
 - b. Provide joint free of mortar or shims between bottom of relieving angles and top surface of stones below angles to avoid transfer of loads.
 6. Install concealed flashing at continuous shelf angles, lintels, ledges and similar obstructions to maintain downward water flow and to divert such water to exterior side.
 7. Maintain open cavities between back of stone veneer and backup substrate wall; do not fill cavities with mortar or grout.
 8. Install weepholes/vents in joints where moisture may accumulate including base of cavity walls, above shelf angles and flashing.
 - a. Locate weepholes/vents at intervals of not more than 2 feet (0.61 m).
 - b. Locate vents at intervals of not more than 5 feet (1.5 m) horizontally and 20 feet (6.1 m) vertically.
 9. At locations that mortar is used in setting stones on anchors, or other locations, rake out mortar from joints to depth necessary for placement of backer rod and sealant.
 10. Embed ends of lugged sills on shims or mortar, and leave balance of joint open until final sealing.
 11. For installation of joint sealants, set the stonework with open vertical joints, do not use shims or spacers in these vertical joints.
 12. Install sealants and joint systems in compliance with ILIA - Indiana Limestone Handbook, latest edition, and refer to Section 07 9200 for additional requirements.
 13. Movement Joints: Provide 3/8 inch (9.5 mm) minimum width, 1/2 inch (12.7 mm) maximum width concave movement joints, unless otherwise noted, and located as indicated on drawings.
- C. Thin Veneer Lath Installation: Comply with Indiana Limestone, Thin Veneer Installation Guide; latest edition.
1. Install metal lath with cup profile facing up to prevent mortar from sagging and to support physical bond, and comply with ASTM C1063.
 2. Lap metal lath at least 1 inch (25.4 mm) on each side and ends, with staggered ends of adjoining sheets of lath.
 3. Install metal lath tight against supporting substrate to prevent spring back effect.
 4. Wrap metal lath tightly around corners, at least 12 inches (305 mm), and fasten to framing member.
 5. Install fasteners as follows:
 - a. Wood Studs: Penetrate at least 1-1/4 inch (31.8 mm).
 - b. Metal Studs: Penetrate at least 3/8 inch (9.5 mm).
 - c. Provide with at least 7/16 inch (11 mm) diameter non-corrosive washer to prevent lath pull out.
 - d. Space fasteners at maximum of 7 inch (178 mm) on center vertically and 16 inch (406 mm) on center horizontally.

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6. Adhered Limestone Veneer Exceeding 25 PSF: When exterior continuous insulation is greater than 1-1/2 inch (38 mm) thick, provide non-corrosive Z-furring channels to support adhered limestone masonry veneer that exceeds 25 psf, install Z-furring perpendicular to wall framing.

Specifier Note: The tolerances indicated in the following article are masonry industry setting tolerances and are provided for the specifier's convenience. As a production industry, the Indiana Limestone industry cannot and does not control them.

3.04 TOLERANCES

- A. Variations from Plumb:
 1. For lines and surfaces of columns, walls or other vertical surfaces, do not exceed:
 - a. 1/4 inch in 10 feet (6.4 mm in 3 m).
 - b. 3/8 inch (9.5 mm) in story height, 20 feet (6 m) maximum.
 - c. 1/2 inch in 40 feet (12.7 mm in 12.2 m) or more.
 2. For external corners, expansion joints and other conspicuous lines, do not exceed:
 - a. 1/4 inch (6.4 mm) in any story, 20 feet (6 m) maximum.
 - b. 1/2 inch in 40 feet (12.7 mm in 12.2 m) or more.
- B. Variations from Level:
 1. For exposed lintels, sills, parapets, horizontal grooves or other horizontal surfaces, do not exceed:
 - a. 1/2 inch (12.7 mm) in any bay, 20 feet (6 m) maximum.
 - b. 3/4 inch in 40 feet (19 mm in 12.2 m) or more.
- C. Variations of Linear Building Lines:
 1. For positions shown in plan on drawings and related portion of columns, walls and partitions, do not exceed:
 - a. 1/2 inch (12.7 mm) in any bay, 20 feet (6 m) maximum.
 - b. 3/4 inch in 40 feet (19 mm in 12.2 m) or more.
- D. Variations in Cross-Sectional Dimensions:
 1. For columns and thickness of walls from dimensions indicated, do not exceed:
 - a. Plus 1/2 inch (12.7 mm), or minus 1/4 inch (6.4 mm).

3.05 ADJUSTING

- A. Repair of damaged stone is permitted as some chipping of the stone is expected; repair of small chips is not required if it does not detract from the overall appearance of the work, or impair effectiveness of mortar and sealant installation.
- B. Criteria for acceptance of chips and repairs will be based on industry standards and practices, unless other criteria is mutually agreed upon, in writing, by limestone masonry supplier and the Architect.
- C. Remove and replace stonework with the following description:
 1. Stones are so damaged that repair is not possible, either structurally or aesthetically.
 2. Joints are defective.
 3. Stones and joints are not in compliance with established standards based on samples and field-constructed mock-ups as approved by the Architect.
 4. Stonework is not in compliance with other specified requirements.
- D. Replace defective stonework with materials in compliance with established standards and specified requirements and showing no evidence of replacement.

3.06 CLEANING

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- A. Clean limestone masonry using clean water and stiff fiber bristle brushes. Do not use wire brushes, acidic type cleaning agents, or other materials or methods that could damage stone.
- B. Mechanical or pressure cleaning methods may be used if approved in writing by the Architect.

3.07 PROTECTION

- A. Protect limestone masonry when adjacent brick is being acid-washed.
- B. Provide protection and maintain conditions, in a manner acceptable to fabricator and installer that ensures limestone masonry will be without damage or deterioration the Date of Substantial Completion.

END OF SECTION