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## SECTION 32 1440.11 – LIMESTONE PAVING

### PART 1- GENERAL

#### 1.01 SECTION INCLUDES

- A. Limestone pavers.
- B. Mortar bed.

#### 1.02 RELATED REQUIREMENTS

- A. Section 23 8300 – Radiant Heating Units: Snow melting system.
- B. Section 31 2200 – Grading: Preparation of subsoil for pavers.
- C. Section 31 2323 – Fill: Compacted fill for pavers.
- D. Section 32 1313 – Concrete Paving: Subbase for pavers.

#### 1.03 DEFINITIONS

- A. ASTM – American Society for Testing and Materials ([www.astm.org](http://www.astm.org)).
- B. ILIA – Indiana Limestone Institute of America ([www.iliai.com](http://www.iliai.com)).
- C. IMI – International Masonry Institute ([imiweb.org](http://imiweb.org)).

#### 1.04 REFERENCE STANDARDS

- A. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2016b.
- B. ASTM C97/C97 - Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone; 2015.
- C. ASTM C99/C99M - Standard Test Method for Modulus of Rupture of Dimension Stone; 2015.
- D. ASTM C150/C150M – Standard Specification for Portland Cement; 2016e1.
- E. ASTM C170/C170M - Standard Test Method for Compressive Strength of Dimension Stone; 2016.
- F. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- G. ASTM C568/C568M – Standard Specification for Limestone Dimension Stone; 2015.
- H. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.
- I. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).
- J. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013)e1.
- K. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2004a (Reapproved 2013).

#### 1.05 SUBMITTALS

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- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer’s product data sheets including paver units, dimensions, special shapes, and setting materials.
- C. Shop Drawings: Submit installation layouts of paving units; including dimensions of paved areas, site elevations, and affected adjacent construction.
- D. Samples: Submit **[two]** or **[\_\_\_\_\_]** samples of each type of limestone paver size, illustrating style, color range and surface texture of units specified.
- E. Manufacturer’s Installation Instructions: Indicate substrate requirements **[\_\_\_\_\_]**, and installation methods.
- F. Qualification Statements: Submit evidence of qualifications as indicated.
- G. Maintenance Materials: Provide the following for Owner’s use in maintenance of project.
  - 1. See Section 01 6000 – Product Requirements, for additional requirements.
  - 2. Extra Pavers: Provide **[ten]** or **[\_\_\_\_\_]** of each type and size.

#### 1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of this section with at least **[ten]** **[\_\_\_\_\_]** years of documented experience **[and recommended by manufacturer]**.
- B. 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 paving units, and to establish quality standards for fabrication and installation.
  - 1. Build mock-up of limestone paving assembly on site, **[as shown on drawings]**, including but not limited to setting beds, **or [\_\_\_\_\_]**, joints, and edging.
    - 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 paver assembly.
    - d. **[Remove mock-up when directed by Architect.]**
    - e. **[Acceptable mock-up may be incorporated into the work.]**

#### 1.07 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 limestone paving work.
  - 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 paving 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 paving.
  - 5. Store cementitious materials above ground or floor, under cover, and in dry location.
  - 6. Exercise care when handling stone pavers to avoid chipping or off-setting of stones.

#### 1.08 SITE CONDITIONS

- A. Cold Weather Protection: Comply with IMI - Cold Weather Masonry Construction and Protection Recommendations ([www.imiweb.org/cold-weather-masonry-construction](http://www.imiweb.org/cold-weather-masonry-construction)).

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- B. Protect limestone paving work during construction as follows:
  - 1. At end of working day and during rainy weather, cover partially completed paving work with waterproof coverings securely anchored in place.
  - 2. Prevent staining of stone from mortar, grout, sealants, and other materials; immediately remove such materials from stone without damaging stonework.

## 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](http://www.indianalimestonecompany.com).
  - 6. Contact for Regional Managers: [www.indianalimestonecompany.com/contact-us](http://www.indianalimestonecompany.com/contact-us).
  - 7. Regional Manager: [\_\_\_\_\_].
- B. Provide limestone for entire project from the following Indiana Limestone Company Quarries and Mills:
  - 1. Supplied from either the Empire Quarry and Mill or Victor Oolitic Quarry and Mill.
    - a. Empire Quarry - 301 Main Street, Oolitic, Indiana 47451.
    - b. 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.
- B. Color: **[Gray]** **[Full color blend]** **[As indicated under PRODUCT TYPES article]** or **[As indicated on drawings]**.
- C. 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.

### 2.03 PRODUCT TYPES

- A. Type (\_\_\_) - Classic Garden Steppers:
  - 1. Split front, back and ends, and sawn top and bottom.
  - 2. Color: **[Full color blend]** and/or **[Gray]**.
  - 3. Width: **[36 inch (914 mm)] [48 inch (1220 mm)]** and/or **[60 inch (1524 mm)]**.
  - 4. Thickness: 6 inch (152 mm).
  - 5. Depth: 16 inch (406 mm).
- B. Type (\_\_\_) – Limestone Pavers:
  - 1. Sawn on each side and bottom, with top having a 60 grit finish
  - 2. Color: **[Full color blend]** and/or **[Gray]**.
  - 3. Width: **[11-5/8 inch (295 mm)] [17-5/8 inch (448 mm)]** and/or **[23-5/8 inch (600 mm)]**.
  - 4. Thickness: **[1-1/2 inch (38 mm)]** and/or **[2 inch (51 mm)]**.

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5. Depth: [11-5/8 inch (295 mm)] [17-5/8 inch (448 mm)] [23-5/8 inch (600 mm)] [29-5/8 inch (752 mm)] and/or [35-5/8 inch (905 mm)].

C. Type (\_\_\_) – Limestone Pattern Pavers:

1. **Chesapeake** Pattern: Paver pattern of 90 total sq ft and consisting of nine 12 by 24 inch, nine 24 by 24 inch, and six 24 by 36 inch paving units, each at 1-1/2 inch thick, and installed in specific pattern.
  - a. Color: Full color blend.
2. **Modesto** Pattern: Paver pattern of 30 total sq ft and consisting of three 12 by 24 inch, three 24 by 24 inch, and two 24 by 36 inch paving units, each at 1-1/2 inch thick, and installed in specific pattern.
  - a. Color: Full color blend.
3. **High-Point** Pattern: Paver pattern of 30 total sq ft and consisting of three 12 by 24 inch, three 24 by 24 inch, and two 24 by 36 inch paving units, each at 1-1/2 inch thick, and installed in specific pattern.
  - a. Color: Full color blend.

#### 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.

#### 2.05 MATERIALS

- A. Setting Bed: ASTM C270, Proportion Specifications, Type N – White Masonry Cement, non-staining, and in proportions as recommended by manufacturer.
  1. Setting Bed Depth: 1 to 1-1/2 inches (25.4 to 38 mm)
- B. Joint Grout: ASTM C270, Proportion Specifications, Type N – White Masonry Cement:
  1. Compressive Strength (28 day): 750 psi (5.2 MPa).
  2. Mix with white sand to match coloring as necessary.
- C. Water: Clean, non-alkaline, and potable.

#### 2.06 FABRICATION

- A. Fabricate limestone paving 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 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.
- D. Fabrication Tolerances for Stone Pavers: Within 1/8 inch (3.2 mm) [\_\_\_\_\_] of [actual] or [nominal] dimensions.
- E. 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: [3/8 inch (9.5 mm)] [As indicated on drawings] or [\_\_\_\_\_].

#### 2.07 ACCESSORIES

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- A. Expansion Joint Sealant: ASTM C920, self-leveling or nonsag polyurethane or silyl-terminated polyether/polyurethane (STPE/STPU) sealant explicitly approved by manufacturer for traffic exposure without being recessed below the top of substrate surface.
  - 1. Color: Concrete gray; or [\_\_\_\_\_].
- B. Expansion Joint Backer Rod: ASTM C1330, closed-cell polyethylene, 25 to 33 percent larger in diameter than joint width.
- C. Mortar Bed Joint Filler: Preformed compressible strip complying with ASTM D1751 or D1752, or closed-cell non-absorbent compressible polyethylene or polymer foam in sheet form; thickness as required to form joint of indicated width; intended to remain in joint to allow moderate movement.
- D. Dampproofing: Provide cementitious based dampproofing to back and each unexposed side of the pavers to protect against moisture and staining.

### **PART 3- EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine surfaces to receive limestone pavers and conditions under which limestone paving will be installed, with Installer present, for compliance with specified requirements.
- B. 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 this Work.

#### **3.03 INSTALLATION – SETTING BED**

- A. Coordinate placement of snow melting system. Refer to Section 23 8300 for requirements.
- B. Locate control and expansion joints directly above joints in structural base and where indicated on drawings; use joint filler to form full depth joint before laying mortar bed.
  - 1. Control Joints: 1/2 inch (13 mm) or [\_\_\_ inch (\_\_\_ mm)] wide.
  - 2. Expansion Joints: 1/2 inch (13 mm) or [\_\_\_ inch (\_\_\_ mm)] wide.
- C. Set paver units in full mortar bed of minimum 1 inch (25 mm) or [\_\_\_ inch (\_\_\_ mm)] thickness, to support pavers over full bearing surface.
- D. Place paver units in [**Chesapeake**] [**Modesto**] [**Highpoint**] [**Herringbone**] [**Ashlar**] [**Square Running Bond**] [**Rectangular Running Bond**] [**Small Limestone**] [**Large Limestone**] or [\_\_\_\_\_] pattern, from straight reference edge.
- E. Place half units, special shaped units, and curbs at edges and interruptions, and machine saw partial units.
- F. Maintain uniform joint width of 3/8 inch (9 mm) or [\_\_\_ inch (\_\_\_ mm)] between pavers, and at abutting vertical surfaces and protrusions, and to accommodate grout, rake out joints 1/4 to 3/8 inch (6 to 9 mm) deep.
- G. Keep control and expansion joints free of grout, for sealant installation.
- H. Fill joints with grout; pack and work into voids; neatly tool surface to [**concave**] [**flush**] or [\_\_\_\_\_] joint, and wet cure.

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- I. Seal control and expansion joints with sealant, in accordance with sealant manufacturer's instructions; use joint filler, backer rod, and or bond breaker tape to achieve width-to-depth ratio recommended by sealant manufacturer.
- J. 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.
  1. Dampproof unexposed surfaces of stone at least 12 inches (305 mm) above grade.
  2. Dampproof joints to within 1 inch (25.4 mm) of finished surfaces when using bituminous or asphaltic solutions.
  3. 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.
  4. Allow cementitious coatings to fully cure prior to setting stones in place.
  5. Exercise due care when handling dampproofed stone to avoid chipping or off-setting of stones.

### 3.04 ADJUSTING

- A. Repair of damaged pavers 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 stone pavers 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. Stone paving is not in compliance with other specified requirements.
- D. Replace defective stone paving with materials in compliance with established standards and specified requirements and showing no evidence of replacement.

### 3.05 CLEANING

- A. Clean limestone pavers 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.

### 3.06 PROTECTION

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

**END OF SECTION**