

**SECTION 09 63 40
STONE FLOORING**

SPEC WRITER NOTE: Delete // // if not applicable to project. Also delete any other item or paragraph not applicable in the section and renumber the paragraphs.

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section includes requirements for interior stone flooring, set on concrete substrates.

1.2 RELATED WORK:

- // A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE DESIGN REQUIREMENTS.//
- B. Concrete Subfloors: Section 03 30 00, CAST-IN-PLACE CONCRETE
- C. Stone variety, finish, cut, thickness, size, grout and cement color: Section 09 06 00, SCHEDULE FOR FINISHES.
- D. Joint sealants for sealing control and expansion joints in stonework: Section 07 92 00, JOINT SEALANTS.

1.3 SUBMITTAL:

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES, furnish the following:
- //B. Sustainable Design Submittals as described below:
- //1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.// //
- //C. Stone Samples: Submit samples for each stone type required, exhibiting the full range of color characteristics expected.
1. Submit two (2) each 305 x 305 mm (12 x 12 inches) samples in each color and finish specified.
 2. In the case of more variegated stones, color photos are to be submitted in addition to the number of samples to show the full range of color and markings to be expected.
- D. Shop Drawings: Show fabrication and installation details. Include dimensions and profiles of stone units including special stone shapes. See construction documents for the paving pattern.
- E. Product Data: For each stone type and each manufactured product shown on construction documents or specified. For each stone variety used on Project, include physical property data.
- F. Mortar Samples: Full range of exposed color and texture.
- G. Grout Samples: Full range of exposed color and texture.

//H. Sealant Samples: For each type and color of joint sealant required.//

//I. Sealant Compatibility Test Report: Submit test report from sealant manufacturer, in accordance with Section 07 92 00, JOINT SEALANTS stating that sealants will not stain stone.//

J. Material Test Reports: From a qualified independent testing agency for each stone type.

K. Cold Weather Procedures: Detailed description of methods, materials, and equipment.

L. Installer qualifications.

M. Fabricator qualifications.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.

B. Store masonry materials under waterproof covers on planking clear of ground, and protect from handling damage, dirt stain, water and wind.

1.5 QUALITY ASSURANCE:

A. Installer Qualifications: Engage an installer with a minimum of three (3) years' previous experience with stone installations similar in material, design, and extent to that indicated for the Project. Submit installer qualifications.

B. Fabricator Qualifications: Engage a fabricator with a minimum of three (3) years previous experience with stone fabrication for projects similar in material, design, and extent to that indicated for the Project. Submit fabricator qualifications.

SPEC WRITER NOTE: Mock-up must be approved by Contracting Officer Representative (COR) in the project's design phase before including requirement in specification.

//C. Mockups: Build mockup of typical areas as shown on the construction documents.

1. Size: 1219 mm x 1219 mm (48 inches x 48 inches).

2. Color Consistency: Demonstrate color consistency with mockup; color range is not to exceed range of color established by samples.

3. Include sealant joints.

4. Mockups may become part of completed work if undisturbed at the time of Substantial Completion.//

1.6 PROJECT CONDITIONS:

- A. Maintain air and material temperatures to comply with requirements of installation material manufacturers, but not less than 10 degrees C (50 degrees F).
- B. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
- C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.7 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. The American Concrete Institute (ACI) American Society of Civil Engineers (ASCE), and The Masonry Society (TMS):
ACI 530.1/ASCE 6/TMS 602 Specification for Masonry Structures
- C. American National Standards Institute (ANSI):
A108/A118/A136-13.....Installation of Ceramic Tile
- D. ASTM International (ASTM):
A1064/A1064M-14.....Carbon-Steel Wire and Welded Wire
Reinforcement, Plain and Deformed, for Concrete
C114-13.....Test Methods for Chemical Analysis of Hydraulic
Cement
C144-11.....Aggregate for Masonry Mortar
C150/C150M-12.....Portland Cement
C207-06(R2011).....Hydrated Lime for Masonry Purposes
C241/C241M-13.....Abrasion Resistance of Stone Subjected to Foot
Traffic
C270-14.....Mortar for Unit Masonry
C503/C503M-10.....Marble Dimension Stone
C568/C568M-10.....Limestone Dimension Stone
C615/C615M-11.....Granite Dimension Stone
C616/C616M-10.....Quartz-Based Dimension Stone
C629/C629M-10.....Slate Dimension Stone
C1353/C1353M-09(R2013)..Test Method for Abrasion Resistance of
Dimension Stone Subjected to Foot Traffic Using
a Rotary Platform, Double-Head Abraser
C1526-08(R2014).....Serpentine Dimension Stone
C1527/C1527M-11.....Travertine Dimension Stone

D4397-10.....Polyethylene Sheeting for Construction,
Industrial, and Agricultural Applications

E. Code of Federal Regulation (CFR):

40 CFR 59.....Determination of Volatile Matter Content, Water
Content, Density Volume Solids, and Weight
Solids of Surface Coating

F. Tile Council of North America (TCNA):

TCNA Handbook-14.....Handbook for Ceramic, Glass, and Stone Tile
Installation

DCOF Acutest-2012.....Dynamic Coefficient of Friction Test

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Source Limitations for Stone: Obtain each variety of stone from a
single quarry with resources to provide materials with consistent
quality in appearance and physical properties.

SPEC WRITER NOTE: Coordinate stone type,
finish, cut, thickness and size with
Section 09 06 00, SCHEDULE FOR FINISHES.

2.2 STONE MATERIALS:

- //A. Granite: Comply with ASTM C615/C615M. //
- //B. Limestone: Comply with ASTM C568/C568M. //
- //C. Marble: Comply with ASTM C503/C503M. //
- //D. Quartz Based Stone: Comply with ASTM C616/C616M. //
- //E. Serpentine: Comply with ASTM C1526. //
- //F. Slate: Comply with ASTM C629/C629M. //
- //G. Travertine: Comply with ASTM C1527/C1527M. Cut, vein. //

2.3 PERFORMANCE REQUIREMENTS:

//A. Slip Resistance: Coefficient of friction when measured per TCNA DCOF
AcuTest to be equal to or greater than 0.42 for level interior stone
floors that will be walked on when wet. //

SPEC WRITER NOTE: Use abrasion resistance
value of 8 for slate. Use abrasion
resistance of 10 for all other stone
materials.

//B. Abrasion Resistance: Minimum value of // 8 // // 10 // based on
testing according to ASTM C241/C241M or ASTM C1353/C1353M. //

2.4 MORTAR MATERIALS:

A. Portland Cement: ASTM C150/C150M, Type I or Type II.

1. Low Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement Lime Mix: Packaged blend of portland cement complying with ASTM C150/C150M, Type I or Type III, and hydrated lime complying with ASTM C207, Type S.
- D. Colored Portland Cement Lime Mix: Packaged blend of portland cement, hydrated lime, and mortar pigments. See Section 09 06 00, SCHEDULE OF FINISHES for cement color.
- E. Aggregate: ASTM C144; except for joints narrower than 6 mm (1/4 inch) use aggregate graded with 100 percent passing 1.8 mm (No. 16) sieve. Provide // white // // natural-colored // aggregates to achieve required mortar color.
- F. Latex Additive: // Manufacturer's standard // // acrylic-resin // // or // // styrene-butadiene-rubber // water emulsion, serving as replacement for part of all gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement mortar bed, and not containing a retarder.

SPEC WRITER NOTE: Retain paragraph below for thin set method of installing stone tile.

//G. Thin Set Mortar:

- // 1. Dry Set Portland Cement Mortar (Thinset) ANSI A118.1. //
- // 2. Latex Portland Cement Mortar (Thinset) ANSI A118.4. // //

H. Water: Potable.

I. Job colored mortar is not acceptable.

SPEC WRITER NOTE: Standard cement grouts and polymer modified grouts are packaged products and are available either sanded or unsanded. Avoid sanded grouts for stone with honed or polished finish. Sanded grout is used for joints 3 mm (1/8 inch) or wider. Unsanded grout is used for joints 3 mm (1/8 inch) or narrower.

2.4 GROUT MATERIALS:

A. Standard Cement Grout: ANSI A118.6.

- // 1. Unsanded. //
- // 2. Sanded. //

//B. Polymer Modified Cement Grout: ANSI A118.7.

- // 1. Unsanded. //

// 2. Sanded. // //

//C. Water Cleanable Epoxy Grout: ANSI A118.3. //

D. Color as specified in Section 09 06 00, SCHEDULE FOR FINISHES.

SPEC WRITER NOTE: Waterproof membrane can be used in thinset and thickset applications.

//2.5 WATERPROOF MEMBRANE:

A. Manufacturer's standard product that complies with ANSI 118.10 and is recommended by the manufacturer for the application specified. Include reinforcement protection board and accessories recommended by the manufacturer. //

SPEC WRITER NOTE: Provide cleavage membrane and reinforcing wire for large stone units or if concrete substrate is subject to movement and deflection.

2.6 ACCESSORIES:

//A. Cleavage Membrane: Polyethylene sheeting, ASTM D4397, 0.10 mm (4 mils). //

//B. Reinforcing Wire: ASTM A1064/A1064M except for minimum wire size.

C. Cleaner as recommended by stone producer.

D. Water-Cleanable Epoxy Adhesive: ANSI A118.3.

//1. Adhesives to have a VOC content of // 65 // // // g/L or less when calculated according to 40 CFR 59 (EPA Method 24). //

2.7 MORTAR AND GROUT MIXES

A. Mortar: Comply with referenced standards and manufacturers' written instructions for mix proportions, mixing equipment, speeds, containers, time, and other procedures needed to produce mortar of uniform quality and with optimum performance characteristics.

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

2. Combine mortar materials and mix in a mechanical batch mixer unless otherwise indicated. Discard mortar when it has reached initial set.

3. Mixing Pointing Mortar: Mix cementitious and aggregate materials together before adding any water. Add only enough water to produce a damp, unworkable mix that retains its form when pressed into a ball. Maintain mortar in this dampened condition for one (1) to two (2) hours. Add remaining water in small portions until mortar reaches

desired consistency. Use mortar within 30 minutes of final mixing. Do not retemper or use partially hardened mortar.

SPEC WRITER NOTE: Use Type N for interior applications and Type S for exterior applications.

- B. Portland Cement-Lime Setting Mortar: ASTM C270, Proportion Specification, // Type N // // Type S //. Use amount of water to produce a stiff mixture with a moist surface when bed is ready to receive stone.
- C. Latex-Modified Portland Cement Setting Mortar: Proportion and mix portland cement, aggregate, and latex additive to comply with latex-additive manufacturer's written instructions and to produce a stiff mixture with a moist surface when bed is ready to receive stone.
- D. Mortar-Bed Bond Coat: Mix cement and // water // // latex additive // to a creamy consistency.
- E. Latex-Modified Portland Cement Bond Coat: Proportion and mix portland cement, aggregate, and latex additive to comply with latex-additive manufacturer's written instructions.
- F. Pointing Mortar: Comply with requirements indicated above for setting mortar, including type and the following:
 - //1. Packaged Portland Cement-Lime Mix Mortar: Use portland cement-lime mix of selected color. //
 - //2. Colored-Aggregate Pointing Mortar: Produce color required by combining colored aggregates with portland cement of selected color. //
- G. Joint Grout: Comply with mixing requirements in referenced ANSI standards and with manufacturer's written instructions. // Provide grout with a VOC content of 65 g/L or less when calculated according to 40 CFR 59 (EPA Method 24). //

2.8 STONE FABRICATION:

- A. Select stone for intended use to prevent fabricated units from containing cracks, seams, and starts that could impair structural integrity or function. Do not use stone with discoloration or other visible defects.
- B. Cut stone to produce pieces of thickness, size, and shape as specified in Section 09 06 00, SCHEDULE FOR FINISHES.

PART 3 - EXECUTION**3.1 EXAMINATION:**

- A. Examine surfaces indicated to receive stone.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION:

- A. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.
- B. Remove substances from concrete substrates that could impair mortar bond.
- C. Clean dirty or stained stone surfaces before setting.
 - 1. Scrub with fiber brushes; drench with clear water.
 - 2. Use mild cleaning compounds.

3.3 INSTALLATION, GENERAL:

- A. Do necessary field cutting as stone is set. Cut lines straight and true and finish field-cut edges to match shop-cut edges.
 - 1. Use power saws with diamond blades to cut stones.
- B. Set stone to comply with construction documents and Shop Drawings.
- C. Scribe and field-cut stone as necessary to fit at obstructions. Produce neat joints of size as indicated on construction documents.
- D. Expansion and Control Joint Installation: Locate and install according to construction documents and Shop Drawings.

3.4 INSTALLATION TOLERANCES:

- A. Variation in Line: Do not exceed 3 mm in 3 m (1/8 inch in 10 feet), 6 mm in 6 m (1/4 inch in 20 feet), or 10 mm (3/8 inch) maximum.
- B. Variation in Joint Width: Do not vary joint thickness more than 1.5 mm (1/16 inch) or 1/4 of nominal joint width, whichever is less.
- C. Variation in Surface Plane: Do not exceed 3 mm in 3 m (1/8 inch in 10 feet), 6 mm in 6 m (1/4 inch in 20 feet) or 10 mm (3/8 inch) maximum from level or slope indicated.
- D. Variation in Place Between Adjacent Units (Lipping): Do not exceed 0.8 mm (1/32 inch) difference between planes of adjacent units.

3.5 INSTALLATION OF STONE DIRECTLY OVER CONCRETE:

- A. Saturate concrete with clean water several hours before placing setting bed. Remove surface water about one (1) hour before placing setting bed.
- B. Apply mortar bed bond coat to damp concrete and broom to provide an even coating that completely covers the concrete. Do not exceed 1.5 mm

(1/16 inch) thickness. Limit area of mortar-bed bond coat to avoid its drying out before placing setting bed.

1. Place reinforcing wire mesh over concrete, lapped at joints by at least one (1) full mesh and supported so mesh becomes embedded in middle of setting bed. Hold edges back from vertical surfaces about 13 mm (1/2 inch).
- C. Apply mortar bed immediately after applying mortar bed bond coat. Spread, tamp and screed to uniform thickness at elevations required for setting stone to finished elevations and indicated on drawings.
- D. Mix and place only that amount of mortar bed that can be covered with stone before initial set. Cut back, bevel edge, and discard material that has reached initial set before stone can be placed.
- E. Place stone before initial set of mortar occurs. Immediately before placing stone on setting bed, apply uniform 1.5 mm (1/16 inch) thick bond coat to bed or to back of each stone unit.
- F. Tamp and beat stone with a wooden block or rubber mallet.
 1. Set each unit in a single operation before initial set of mortar; do not return to areas already set.
- G. Rake out joints to depth required to receive grout or pointing mortar as units are set.
- H. Point joints after setting.

SPEC WRITER NOTE: Retain paragraph below
for thinset method of installing stone
tile.

//I. Install stone tile to conform to TCNA Detail F113-14.

1. Thinset Mortar: // Dry set // // Latex // // Medium Bed Latex //.

3.6 INSTALLATION OF STONE OVER // CLEAVAGE MEMBRANE // // WATERPROOFING //:

- A. Place cleavage membrane over substrates, lapped at least 100 mm (4 inches) at joints.
- //B. Install waterproof membrane and protection board to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate. Do not install tile or setting materials over waterproofing until waterproofing has cured and been determined to be watertight. //
- C. Place reinforcing wire fabric over membrane protection board, lapped at least one (1) full mesh at joints and supported so mesh becomes embedded in middle of setting bed. Hold edges back from vertical surfaces about 13 mm (1/2 inch).

- D. Place mortar bed over // cleavage membrane // // waterproofing and protection board // to uniform thickness at elevations required with reinforcing wire fabric fully embedded in middle of mortar bed.
- E. Mix and place only that amount of mortar bed that can be covered with stone before initial set.
- F. Apply uniform 1.5 mm (1/16 inch) thick bond coat to bed or to back of each stone unit then place stone before initial set of mortar occurs.
- G. Tamp and beat stone with a wooden block or rubber mallet. Set each unit in a single operation before initial set of mortar.
- H. Rake out joints to depth required to receive grout as units are set.
- I. Point joints after setting.

3.7 GROUTING:

- A. Grout stone joints to comply with ANSI A108.10 and with manufacturer's written instructions.
 - 1. Do not use sanded grout for polished stone.
 - 2. Grout joints as soon as possible after initial set of setting bed. Finish joints by tooling to produce a slightly concave polished joint, free of drying cracks.
 - 3. Maintain grout in damp condition for seven (7) days.

3.8 ADJUSTING AND CLEANING:

- A. Remove and replace damaged stone. Repair stone using methods recommended by stone producer.
- B. Remove and replace defective joints.
- C. Remove and replace stone not matching final samples // and mockups //.
- D. Replacement stone is not to show evidence of replacement.
- E. In-Progress Cleaning: Clean stone as work progresses. Remove mortar and stains before tooling joints.
- F. Final Cleaning: Clean stone as recommended by fabricator or stone producer.

3.9 PROTECTION:

- A. Prohibit traffic from installed stone for a minimum of 72 hours.
- B. Protect during construction with non-staining kraft paper, and cover with a layer of untreated plywood where adjoining areas require construction work access.

- - - E N D - - -