

SECTION 321440 - STONE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes dimension stone **[paving] [stair treads] [and risers]**
- B. Related Sections include the following:
 - 1. Division 7 Section "Joint Sealants" for sealing control and expansion joints in stone paving and flooring with elastomeric sealants.

1.3 PERFORMANCE REQUIREMENTS

Stone Abrasion Resistance: Minimum value of 19, based on testing according to ASTM C 241 or ASTM C 1353, unless a higher value is required by the referenced building stone standard.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Each variety of stone. Include data on physical properties required by referenced ASTM standards.]
 - 2. Stone accessories and other manufactured products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.
- C. Grout Samples for Initial Selection: For each type of grout indicated.
- D. Samples for Verification:
 - 1. For each stone type indicated, in sets of Samples not less than 12 inches square. Include two (2) or more Samples in each set and show the full range of variations in appearance characteristics expected in completed Work.
 - 2. For each color of grout required.
- E. Qualification Data: For Installer and fabricator.

- F. Maintenance Data: For stone paving to include in maintenance manuals. Include Product Data for stone-care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An installer who employs experienced mechanics and stone fitters who are skilled in installing stone paving and flooring similar in material, design, and extent to those indicated for this Project and whose projects have a record of successful in-service performance.
- B. Fabricator Qualifications: Shop that employs skilled workers who fabricate stone paving and flooring similar to those indicated for this Project and whose products have a record of successful in-service performance.
- C. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.
 - 1. Obtain each variety of stone from a single quarry, whether specified in this Section or in another Section of the Specifications.
- D. Source Limitations for Other Materials: Obtain each type of cementitious material, grout, admixture, stone accessory, sealant, and other material from a single manufacturer.
- E. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution and set quality standard for fabrication and installation.
 - 1. Build mockups [**of size indicated**].
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. 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.
- B. Store stone on pallets with nonstaining separators and nonstaining, waterproof covers. Ventilate under covers to prevent condensation.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

1.7 PROJECT CONDITIONS

- A. Do not set stone when air or material temperature is below 40 deg F.

- B. Maintain minimum ambient temperatures of 40 deg F during installation and for 7 days after completion unless higher temperatures are required by fabricator's or supplier's instructions.
- C. Cold-Weather Requirements for Stone Paving:
 - 1. Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds.
 - 2. Protect stone paving against freezing when atmospheric temperature is 40 deg F and falling. Heat materials to provide mortar and grout temperatures between 40 and 120 deg F.
 - 3. Provide the following protection for completed portions of work for 24 hours after installation when mean daily air temperature is as indicated:
 - a. Below 40 deg F, cover with weather-resistant membrane.
 - b. Below 25 deg F, cover with insulating blankets.
 - c. Below 20 deg F, provide enclosure and temporary heat to maintain temperature above 32 deg F.
- D. Hot-Weather Requirements for Stone Paving: Protect stone paving when temperature and humidity conditions produce excessive evaporation of setting beds and grout. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and above.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Portland Cement-Lime Mix:
 - a. <Insert manufacturer's name.>
 - 2. Mortar Pigments:
 - a. <Insert manufacturer's name.>
 - 3. Latex-Portland Cement Grout:
 - a. <Insert manufacturer's name.>
 - 4. Paver Pedestals:
 - a. <Insert manufacturer's name.>
 - 5. Stone Floor Sealers:
 - a. <Insert manufacturer's name.>

2.2 STONE, GENERAL

- A. Varieties and Sources: Subject to compliance with requirements, provide stone varieties from sources specified in Part 2 "Stone Types" Article.
- B. Varieties and Sources: Subject to compliance with requirements, provide stone of varieties and from sources complying with Division 4 Section "Dimension Stone Cladding."
- C. Match Architect's samples for variety, color, finish, and other stone characteristics relating to aesthetic effects.
- D. Provide stone that is free of cracks, seams, and starts impairing structural integrity or function.
- E. Provide stone from a single quarry for each variety of stone required.
- F. Quarry stone in a manner to ensure that as-quarried block orientations yield finished stone with required characteristics.

2.3 STONE TYPES

- A. Quartz-Based Stone: Provide quartz-based dimension stone complying with ASTM C 616 and as follows:
 - 1. Classification: II Quarzitic Sandstone
 - 2. Varieties and Sources:
 - a. **[Bloom Run Sandstone] [Roaring Run Sandstone]** by Russell Stone Products
2640 Greenville Pike Grampian, PA 16838 PH:1-814-236-2449 or 1-434-760-1229
 - 3. Finish: **[Sand blasted] [As indicated] [Match Architect's sample]**.

2.4 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II.
 - 1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207 Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or III, and hydrated lime complying with ASTM C 207.
 - 1. For pigmented mortar, use a colored portland cement-lime mix as required to produce color indicated or, if not indicated, as selected from manufacturer's standard formulations.
 - a. Pigments shall be composed of natural or synthetic iron oxides, compounded for use in mortar mixes, and with a record of satisfactory performance in stone mortars.

b. Pigments shall not exceed 10 percent of portland cement by weight.

D. Aggregate: ASTM C 144 and as follows:

1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.
2. White Aggregates: Natural white sand or ground white stone.
3. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.

a. Match Architect's sample.

E. Mortar Pigments: Natural or synthetic iron oxides, compounded for use in mortar mixes and with a record of satisfactory performance in stone mortars.

F. Latex additive: Serving as replacement for part of or all gaging water, of type specifically recommended by latex-additive manufacturer for use with job-mixed portland cement mortar and not containing a retarder.

G. Water: Potable.

2.5 GROUT

A. Grout Colors: Match Architect's samples

B. Sand-Portland Cement Grout: ANSI A108.10.

C. Latex-Portland Cement Grout: ANSI A118.6, for materials described in Paragraph H-2.4, composed as follows:

1. Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to produce the following:
 - a. Sanded grout mixture for joints 1/8 inch and wider.

2.6 ACCESSORIES

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

B. Paver Pedestals: Comply with Division 7 Section "[Self-Adhering Sheet] [Elastomeric Sheet] [Thermoplastic Sheet] [Cold Fluid-Applied] [Hot Fluid-Applied] Waterproofing."

C. Spacers: Resilient plastic, nonstaining to stone, sized to suit joint thicknesses.

D. Cleavage Membrane: Polyethylene sheeting, ASTM D 4397, 4.0 mils thick[; or asphalt felt, ASTM D 226, Type I (No. 15)].

E. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.

F. Divider Strips and Edging: Metal or combination of metal and PVC or neoprene base, designed specifically for flooring applications, in longest lengths available, and as follows:

1. Height: [Match stone thickness] [Equal to stone thickness plus depth of setting bed].
 2. Width: [0.063 inch] [1/8 inch] [1/4 inch] [3/8 inch].
 3. Control-Joint Filler: Neoprene, in color selected by Architect from manufacturer's full range.
- G. Cleaner: Stone cleaner specifically formulated for stone types, finishes, and applications indicated, as recommended by stone producer[**and, if a sealer is specified, by sealer manufacturer**]. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.
- H. Sealer: Colorless, slip- and stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.

2.7 STONE FABRICATION

- A. General: Fabricate stone paving and flooring in sizes and shapes necessary to comply with requirements indicated, including details on Drawings and Shop Drawings.
- B. Cut stone to produce pieces of thickness, size, and shape indicated and to comply with fabrication and construction tolerances recommended by applicable stone association.
1. Pattern: Rectilinear
 2. Pattern: Random, rectangular pattern composed of units not less than [11 ½ inches] and no more than [35 1/2 inches] in nominal dimension.
 3. Thickness of Stone Paving and Flooring: Provide thickness indicated, but not less than [1-1/2 inches] [2 1/4 inches] <Insert thickness>.
 4. Thickness of Stone Paving and Flooring: As indicated on Drawings.
 5. Stone Edges: [Square] .
 6. Cut stone to produce uniform joints, ½ inch wide, in locations indicated.
 7. Clean sawed backs of stones to remove rust stains and iron particles.
- C. Pattern Arrangement: Fabricate and arrange stone units with veining and other natural markings to comply with the following requirements:
1. Arrange units in blend pattern.
- D. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.
1. 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.

2.8 MORTAR AND GROUT MIXES

- A. Mortar: 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.

1. 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.
 2. 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.
 3. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding any water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two 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 material.
- B. Portland Cement-Lime Setting Mortar: [ASTM C 270] Proportion Specification, Type S.
- C. Latex-Modified Portland Cement Setting Mortar: Proportion and mix portland cement, aggregate, and latex additive to comply with written instructions of latex-additive manufacturer and as necessary to produce stiff mixture with a moist surface when bed is ready to receive stone.
- D. Mortar Bed Bond Coat: Mix neat cement and [**latex additive**] [**water**] 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. Cement-Paste Bond Coat: Mix either neat cement and water or cement, sand, and water to a consistency similar to that of thick cream.
- G. Pointing Mortar: Provide pointing mortar mixed to match Architect's sample and complying with requirements indicated above for setting mortar, including type and the following:
1. 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.
 2. Packaged Portland Cement-Lime Mix Mortar: Use portland cement-lime mix of selected color.
 3. Colored-Aggregate Pointing Mortar: Produce color required by combining colored aggregates with portland cement of selected color.
- H. Joint Grout: Comply with mixing requirements of referenced ANSI standards and manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces indicated to receive stone paving and flooring, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance.

1. For the record, prepare a written report, endorsed by Installer, listing conditions detrimental to performance of stone paving and flooring.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean concrete substrates by removing all dirt, dust, debris, and loose particles.
- B. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.
- C. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. 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.

3.3 INSTALLATION, GENERAL

- A. Do necessary field cutting as stone is set. Use power saws with diamond blades to cut stone. Cut lines straight and true, with edges eased slightly to prevent snipping.
- B. Set stone to comply with Drawings and Shop Drawings
- C. Scribe and field-cut stone as necessary to fit at obstructions. Produce tight and neat joints.
- D. Stone over Waterproofing: Carefully place stone and setting materials over waterproofing so protection materials are not displaced and waterproofing is not punctured or otherwise damaged. Replace protection materials that become displaced and arrange for repair of damaged waterproofing before covering with stone.
 1. Provide cork joint filler, where indicated, at waterproofing that is turned up on vertical surfaces or, if not indicated, provide temporary filler or protection until stone paving installation is complete.
- E. Expansion- and Control-Joint Installation: Locate and install according to Drawings and Shop Drawings. Joint-sealant materials and installation are specified in Division 7 Section "Joint Sealants."

3.4 INSTALLATION TOLERANCES

- A. Variation in Line: For positions shown in plan for edges of paving, flooring, ramps, steps, changes in color or finish, and continuous joint lines, do not exceed **1/8 inch in 96 inches, 1/4 inch in 20 feet**, or **3/8 inch** maximum.
- B. Variation in Joint Width: Do not vary joint thickness more than **1/16 inch** or 1/4 of nominal joint width, whichever is less.
- C. Variation in Surface Plane of Paving and Flooring: Do not exceed **1/8 inch in 10 feet, 1/4 inch in 20 feet**, or **3/8 inch** maximum from level or slope indicated.

- D. Variation in Plane between Adjacent Units (Lipping): Do not exceed **1/16-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 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 **1/16-inch** thickness. Limit area of mortar bed bond coat to avoid its drying out before placing setting bed.
 - 1. Place reinforcing wire fabric over concrete, lapped at joints by at least one full mesh and supported so mesh becomes embedded in middle of setting bed. Hold edges back from vertical surfaces approximately **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 indicated.
- 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 **1/16-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 to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each unit in a single operation before initial set of mortar; do not return to areas already set and disturb stone for purposes of realigning finished surfaces or adjusting joints.
- G. Rake out joints to depth required to receive pointing mortar as units are set.
- H. Point joints after setting. Fill full with mortar type and color indicated. Sponge joints flat, uniform, and smooth, without visible voids.

3.6 INSTALLATION OF STONE OVER [CLEAVAGE MEMBRANE] [OR] [WATERPROOFING]

- A. Place cleavage membrane over substrates indicated to receive stone, lapped at least **4 inches** at joints.
- B. Place reinforcing wire fabric over [**membrane**] [**protection course**], lapped at least one full mesh at joints and supported so mesh becomes embedded in middle of setting bed. Hold edges back from vertical surfaces approximately **1/2 inch**.
- C. Place mortar bed over [**membrane**] [**protection course**] with reinforcing wire fabric fully embedded in middle of mortar bed. Spread, tamp, and screed to uniform thickness at elevations required for setting stone to finished elevations indicated.

- 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 **1/16-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 to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each unit in a single operation before initial set of mortar; do not return to areas already set and disturb stone for purposes of realigning finished surfaces or adjusting joints.
- G. Rake out joints to depth required to receive pointing mortar as units are set.
- H. Point joints after setting. Fill full with mortar type and color indicated. Sponge joints flat, uniform, and smooth, without visible voids.

3.7 INSTALLATION OF STONE PAVING ON PEDESTALS OVER WATERPROOFING

- A. Comply with Division 7 Section "[**Self-Adhering Sheet**] [**Elastomeric Sheet**] [**Thermoplastic Sheet**] [**Cold Fluid-Applied**] [**Hot Fluid-Applied**] Waterproofing."
- B. Accurately install [**fixed**] [**adjustable**]-height pedestals and other accessories to elevations required. Adjust for final level and slope with shims.
 - 1. Fill pedestal with concrete mix, strike smooth with top of pedestal, and cure according to ACI 301.
- C. Loosely lay stone paving units on pedestals, maintaining a uniform, open joint width. Tightly seat stone units against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.
 - 1. Lay out stone units to avoid less than half-width units at perimeter or other terminations.
- D. Install stone paving units to not vary more than **1/16 inch** in elevation between adjacent units.

3.8 STONE STAIR TREAD [**AND RISER**] INSTALLATION

- A. Install stone stair treads [**and risers**] to comply with "Installation of Stone Directly over Concrete" Article.

3.9 GROUTING OF STONE PAVING

- A. Grout stone joints to comply with ANSI A108.10 and manufacturer's written instructions.
- B. Grout joints as soon as possible after initial set of setting bed. Force grout into joints, taking care not to smear grout on adjoining stone and other surfaces. After initial set of grout, finish joints by tooling to produce a slightly concave joint, free of drying cracks.

- C. Cure grout by maintaining in a damp condition for seven days except as otherwise recommended by latex-additive manufacturer.

3.10 ADJUSTING AND CLEANING

- A. Remove and replace stone paving and flooring of the following description:
 - 1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
 - 2. Defective joints.
 - 3. Stone paving, flooring, and joints not matching approved samples and mockups.
 - 4. Stone paving and flooring not complying with other requirements indicated.
- B. Replace in a manner that results in stone paving's and flooring's matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean stone paving and flooring as work progresses. Remove mortar fins and smears before tooling joints.
- D. Clean stone paving and flooring after setting and grouting are complete. Use procedures recommended by stone fabricator for types of application.
- E. Apply sealer to cleaned stone flooring according to sealer manufacturer's written instructions.

3.11 PROTECTION

- A. Prohibit traffic from installed stone for a minimum of 72 hours.
- B. Protect stone paving during construction with nonstaining, rigid materials capable of handling site workers and other possible damaging events. Where adjoining areas require construction work access, cover stone paving and flooring with a minimum of **3/4-inch** untreated plywood over nonstaining craft paper.

END OF SECTION 321414