SP-151028a
(New)

SPECIAL PROVISIONS
FOR
EXTERIOR STONE

Polk County
STP-U-1945(839)--70-77

Effective Date
February 20, 2018

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

PART 1 GENERAL

1.01 DESCRIPTION

A. This Special Provision specifies requirements for stone maintenance of stone assemblies consisting of stone restoration for the bridge including but not limited to, the following:
   1. Carved limestone units for the replacement of the existing damaged limestone face of the bridge and elements of the balustrade construction.
   2. Carved granite section for the lower rail of the bridge balustrade construction that will separate the balusters and piers from bridge structure below.
   3. Repairing existing limestone using stone patching compound.
   4. Replace partial stone (dutchman repair).
   5. Cleaning existing limestone surfaces, including removal of the biological growth from limestone.
   6. Repointing existing masonry joints.
   7. Refacing limestone also called partial stone resurface.
   8. Limestone crack injection for limestone repair.
   9. Salt extraction from limestone (poultice).
   10. Masonry anchors, ties, flashing and accessories.
   11. Stainless steel anchor/pins used to connect the granite and limestone.

1.02 REFERENCE STANDARDS

A. ASTM C568/C568M - Standard Specification for Limestone Dimension Stone 2015

B. ASTM C615/C615M - Standard Specification for Granite Dimension Stone 2011

C. LII (HB) - Indiana Limestone Handbook; 2007, 22nd Edition.

D. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.

E. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

1.03 DEFINITIONS

A. Very Low-Pressure Spray: Under 100 psi.

B. Low-Pressure Spray: 100 to 400 psi.

C. Medium-Pressure Spray: 400 to 800 psi.

D. High-Pressure Spray: 800 to 1200 psi.

E. Stone Terminology: ASTM C 119.

F. Biological Growth: Algaic and other growths on masonry surfaces – most prevalent on limestone belt courses.

G. Cleaning: The removal of soil deposition from masonry surfaces. The intent of this project is to remove all soil and biological growth from limestone with a comprehensive cleaning program. The intention is to provide a light overall cleaning after the completion of all repointing, repair and other work associated with this project.

H. Efflorescence: White soluble salt encrustations on masonry surfaces.

I. Iron Stains: Depositional or natural reddish-brown to orange iron-based stains present primarily on wall surfaces.

J. Poultice: Commercially available or custom blended clay-based materials that are troweled on to a surface, covered with plastic sheeting and allowed to dry for a pre-determined time, usually 12 to 24 hours. Chemical reagents are sometimes added to the poultice and the drying action draws out stains and other foreign matter which are removed along with the poultice. After the poultice is removed the area must be cleaned by gentle washing.

K. Salt extraction: The removal of soluble salts from masonry elements. The scope of this project will include the removal of soluble salts from selected limestone surface areas on the bridge face.

L. Stain removal: The process of removing stains from a material by use of commercially available custom poultices designed specifically for each application.

M. Stone Patching Compound: The removal of severely deteriorated original stone and replacement with a composite mix that has been formulated to closely match the color, texture, consistency and other physical properties of the surrounding stone.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for application and use. Include test data substantiating that products comply with requirements.

B. Shop Drawings: For the following requirements for limestone and granite:
   1. Replacement stone units, profiles of the carved stone and their jointing showing relation of existing to new units.
   2. Setting number of each new stone unit and its location on the structure in annotated plans and elevations.
   3. Provisions for the expansion joints and sealant joints.
   4. Provisions for flashing, lighting fixtures, conduits, and weep holes as required.
   5. Replacement and repair anchors, including drilled-in pins. Include details of anchors within individual stone units, with locations of anchors and dimensions of holes and recesses in stone required for anchors, including direction and angle of holes for pins.
   6. Proposed Construction Practices: If cold weather or hot weather masonry work is anticipated, submit methods proposed to show compliance with cold-weather and hot-weather procedure requirements of ACI 530.1/ASCE 6.

C. Samples for Verification: For the following:
   1. Limestone: Submit three 12 inch square samples showing the cut and color specified.
   2. Granite: Submit three 12 inch square samples showing the cut and color specified.
   3. Submit certifications of compliance demonstrating that limestone and granite masonry units meet or exceed the physical properties requirements of this specification.

4. Pointing Mortar: Submit sets of mortar for pointing in the form of sample mortar strips,
   a. 6 inches long by 1/4 inch wide, set in aluminum or plastic channels.
   b. Have each set contain a close color range of at least three samples of different mixes of colored sands and cements that produce a mortar matching the cleaned stone when cured and dry.
   c. Submit with precise measurements on ingredients, proportions, gradations, and sources of colored sands from which each sample was made.
   d. Test Results: Submit certified test results of ASTM standards specified.
5. Stone Patching Compound: Submit sets of stone patching compound Samples in the form of plugs (patches in drilled holes) in sample units of limestone representative of the range of limestone colors on the building.
   a. Have each set contain a close color range of at least three Samples of different mixes of patching compound that matches the variations in existing stone when cured and dry.
6. Include similar samples of accessories involving color selection.

1.05 QUALITY ASSURANCE

A. Stone Mason Qualifications: Engage an experienced stone mason and cleaning firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in- service performance. Experience installing standard unit masonry or new stone masonry is not sufficient experience for stone restoration work.
   1. Prequalification is required for the Masonry Cleaning Contractor and Masonry Repair Contractor.
   2. At Contractor's option, work may be divided between two specialist firms: one for cleaning work and one for repair work.
   3. Field Supervision: Mason shall maintain experienced full-time supervisors on Project site during times that stone restoration and cleaning work is in progress. Supervisors shall not be changed during Project except for causes beyond control of restoration specialist firm.
   4. Stone Mason Worker Qualifications: Persons who are experienced in restoration work of types they will be performing. When stone units are being patched, assign at least one worker among those performing patching work who is trained and certified by manufacturer of patching compound to apply its products.
   5. Material-specific qualifications:
      a. For all technicians that will be installing patching mortar, provide certification of having completed Jahn Training Course, offered regularly by Cathedral Stone Products.
      b. Comply with manufacturer’s written instructions for minimum and maximum temperature and humidity requirements for storage. Note: if such work is to be completed during colder months, the Contractor will be required either to furnish an interior storage location or to maintain temperature and humidity requirements by means of heated, temporary enclosures.

B. Chemical-Cleaner Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, and with factory-trained representatives who are available for consultation and Project-site inspection and assistance at no additional cost.

C. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage due to worker fatigue.

D. Restoration Program: Prepare a written, detailed description of materials, methods, equipment, and sequence of operations to be used for each phase of restoration work including protection of surrounding materials and Project site.
   1. Include methods for keeping pointing mortar damp during curing period.

2. If materials and methods other than those indicated are proposed for any phase of restoration work, add to the Quality-Control Program a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project and worker's ability to use such materials and methods properly.
3. This building will be occupied during this project and protection of public access points and public locations on site is required.

E. Cleaning Program: Prepare a written cleaning program that describes cleaning process in detail, including materials, methods, and equipment to be used, protection of surrounding materials, and control of runoff during operations.
1. If materials and methods other than those indicated are proposed for any phase of restoration work, add to the Quality-Control Program a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project and worker's ability to use such materials and methods properly.
2. This building will be occupied during this project and protection of public access points and public locations on site is required.

F. Cleaning and Repair Appearance Standard: Cleaned and repaired surfaces are to have a uniform appearance as viewed from 20 feet away by Engineer. Perform additional general cleaning of small areas that are noticeably different, so that surface blends smoothly into surrounding areas.

G. Mockups: Prepare mockups of restoration and cleaning to demonstrate aesthetic effects and set quality standards for materials and execution and for fabrication and installation.
1. Stone Repair: Prepare sample areas for each type of stone indicated to have repair work performed. If not otherwise indicated, size each mockup not smaller than two adjacent whole units or approximately 48 inches in least dimension. Create sample areas in existing walls, to demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:
   a. Crack Injection: Apply crack injection in two separate areas, each approximately 36 inches long.
   b. Stone Patching Compound: One example of the typical location to be determined by the Engineer.
2. Repointing: Rake out joints in two separate areas, each approximately 36 inches high by 48 inches wide for each type of repointing required and repoint one of the areas.
3. General Cleaning: Clean an area approximately 10 square feet for each type of limestone and surface condition.
   a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not use cleaners and methods known to have deleterious effect.
   b. Allow a waiting period of not less than 7 days after completion of sample cleaning to permit a study of sample panels for negative reactions.
4. Approval of mockups does not constitute approval of deviations from the contract documents contained in mockups unless Engineer specifically approves such deviations in writing.
5. Approved mockups may become part of the completed Work if undisturbed at time of
   a. Substantial Completion.

H. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to stone restoration and cleaning including, but not limited to, the following:
   a. Construction Schedule: Verify disassembly procedures, availability of materials, Restoration Specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
   b. Materials, material application, sequencing, tolerances, and required clearances.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver other materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than 2 days.

D. Store sand where grading and other required characteristics can be maintained and contamination avoided.

E. Store stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.

F. Protect stone components during handling and installation to prevent chipping, cracking, or other damage.

1.07 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and occupied weather conditions permit stone restoration and cleaning work to be performed according to manufacturers' written instructions and specified requirements.

B. Repair stone units and repoint mortar joints only when air temperature is between 40°F and 90°F and is predicted to remain so for at least 7 days after completion of the Work unless otherwise indicated.

C. Cold-Weather Requirements: Comply with the following procedures for stone repair and mortar-joint pointing unless otherwise indicated:
   1. When air temperature is below 40°F, heat mortar ingredients, repair materials, and existing stone to produce temperatures between 40°F and 120°F.
   2. When mean daily air temperature is below 40°F, provide enclosure and heat to maintain temperatures above 32°F within the enclosure for 7 days after repair and pointing.

D. Hot-Weather Requirements: Protect stone repair and mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar and patching materials. Provide artificial shade and wind breaks and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90°F and above unless otherwise indicated.

E. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.

F. Clean stone surfaces only when air temperature is 40°F and above and is predicted to remain so for at least 7 days after completion of cleaning.

G. Environmental Requirements/Conditions: Ensure that all treatments comply with institutional, local, state and federal regulations. Apply, contain and dispose of all treatments in accordance with applicable institutional, local, state and federal regulations.

1.08 COORDINATION

A. Coordinate stone restoration and cleaning with public circulation patterns at Project site. Some work is near public circulation patterns and vehicles. Public circulation patterns cannot be closed off entirely, and in places can be only temporarily redirected around small areas of work. Plan and execute the Work accordingly.

B. Lower levels of the scaffolding sections will need to be protected from public access or behind the construction fence.

1.09 SEQUENCING AND SCHEDULING

A. Order replacement materials at earliest possible date to avoid delaying completion of the Work.

B. Order sand and gray portland cement for pointing mortar immediately after approval of mockups. Take delivery of and store at Project site a sufficient quantity to complete Project.

C. Perform stone restoration work in the following sequence:
   1. Remove plant growth.
   2. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
   3. Clean stone surfaces.
   4. Rake out mortar from joints surrounding stone to be replaced and from joints adjacent to stone repairs along joints.
   5. Repair stonework, including replacing existing stone with new stone.
   6. Rake out mortar from joints to be occupied.
   7. Point mortar and sealant joints.
   8. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.
   9. Inspect for open mortar joints and repair before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
   10. Clean stone surfaces.

D. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in stone to comply with "Stone Patching Compound" Article. Patch holes in mortar joints to comply with "Repointing Stonework" Article.

PART 2 - MATERIALS

2.01 STONE MATERIALS

A. Limestone: Indiana Oolitic Limestone; complying with ASTM C568/C568M Classification III - High Density.
   1. Quarry Information: Bedford limestone also known as Salem limestone geological formation primarily quarried in south central Indiana, USA, between the cities of Bloomington, Indiana and Bedford, Indiana.
   2. Grade: Select.
   3. Color: Buff.
   4. Grain Direction: Horizontal.
   5. Acceptable Fabricators:
      a. Bybee Stone Company; www.bybeestone.com.
      b. Becker & Becker Stone Company; www.beckerandbeckerstone.com.
      c. Indiana Limestone Company; www.indianalimestonecompany.com.
      d. Mankato Kasota Stone, Inc; www.mankato-kasota-stone.com.
      e. Vetter Stone Co; www.vetterstone.com
   6. Physical Properties:
      a. Compressive Strength: ultimate compressive strength 4000 Psi minimum per ASTM C 170.
      b. Modulus of Rupture: Modulus of rupture for dry specimens 700 Psi minimum per ASTM C 99.
      c. Absorption: water absorption 7.50% per ASTM C 97.
      d. Bulk Specific Gravity: range of bulk specific gravity 2.1 minimum to 2.75 maximum per ASTM C 97.

B. Granite; complying with ASTM C615/C615M.
   1. Quarry Information: Milbank, South Dakota.
   2. Surface Texture: Rub and Sand.
   3. Color: The basis for design shall be Carnelian as supplied by Cold Spring Granite Inc., Cold Springs, Minnesota.

a. Other potentially acceptable sources of stone subject to sample submittal and acceptance by the Engineer are North Carolina Granite Corporation, Mount Airy, North Carolina, color; 013 Dakota Rose or Dakota Granite, Milbank, South Dakota, color; Dakota Mahogany.
b. Acceptance of alternate sources of stone shall require that the submitted color blend closely matches the color listed as a basis for design.

4. Acceptable Fabricators:
   a. Cold Spring Granite Inc.; www.coldspringgranite.com.
   b. Dakota Granite; www.dakotagranite.com.
   c. New England Stone; www.newenglandstone.com.
   d. North Carolina Granite Corporation; www.ncgranite.com.
5. Physical Properties:
   a. Compressive Strength: average compressive strength 19,990 Psi per ASTM C 170.
   b. Modulus of Rupture: average modulus of rupture 1690 Psi per ASTM C 99.
   c. Absorption: average absorption 0.12% per ASTM C 97.
   d. Bulk Specific Gravity: average bulk density 166.8 per ASTM C 97.

2.02 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type II, white & gray where required for color matching of exposed mortar.
   1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.

B. Setting Mortar: ASTM C270, Type N, using the Proportion Method.

C. Pointing Mortar: Type N using the Property Method in ASTM C270.

D. Hydrated Lime: ASTM C 207, Type S.

E. Mortar Sand: ASTM C 144 unless otherwise indicated.
   1. Color: Provide natural sand of color necessary to produce required mortar color.
   2. For pointing mortar, provide sand with rounded edges and use aggregate graded with 100% passing No. 16 sieve.
   3. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
   4. For joints narrower than 1/4 inch, use aggregate graded with 100% passing No. 16 sieve.

F. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.

G. Do not use admixtures of any kind in mortar, unless otherwise indicated.

H. Water: Potable.

2.03 MANUFACTURED REPAIR MATERIALS

A. Stone Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching stone.
   1. Products: Subject to compliance with requirements, provide one of the following or approved equal:
      a. Cathedral Stone Products, Inc.; occupied Restoration Mortars.
      b. Conproco Corporation; Mimic/Matrix.
      c. Edison Coatings, Inc.; Custom System 45.
   2. Use formulation that is vapor and water permeable (equal to or more than the stone), exhibits low shrinkage, has lower modulus of elasticity than the stone units being repaired, and develops high bond strength to all types of stone.
   3. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
   4. Formulate patching compound in colors, textures, and grain to match stone being patched. Provide not less than three colors to enable matching each piece of stone.

B. Cementitious Crack Filler: An ultrafine superplasticized grout that can be injected into cracks, is suitable for application to wet or dry cracks, exhibits low shrinkage, and develops high bond strength to all types of stone.
   1. Products: Subject to compliance with requirements, provide one of the following or approved equal:
      a. Cathedral Stone Products, Inc.; Jahn Injection Grout.
      b. Conproco Corporation; Terra Cotta Finish.
      c. Edison Coatings, Inc.; Pump-X 53-Series.

C. Stone-to-Stone Adhesive: Two-part polyester or epoxy-resin stone adhesive with a 15 to 45 minute cure at 70°F or one-part cementitious stone adhesive, recommended by adhesive manufacturer for type of stone repair indicated, and matching stone color.
   1. Products: Subject to compliance with requirements, provide one of the following or approved equal:
      a. Two-Part Polyester or Epoxy-Resin Stone Adhesive:
         1) Bonstone Materials Corporation; Fast Set 41.
         2) Edison Coatings, Inc.; Flexi-Weld 520T.
      b. One-Part Cementitious Stone Adhesive:
         1) Cathedral Stone Products, Inc.; Jahn Restoration Adhesive.

2.04 CLEANING MATERIALS

A. Water: Potable.

B. Heavy Limestone Cleaner, for the removal of asphalt and tar
   1. Test sample six inches by six inches is required to determine the best product for tar removal before the full cleaning process is started. The Engineer and Contracting Authority will review the results of the cleaning product tested by the contractor.
   2. Products: Subject to compliance with requirements, provide one of the following. (Note products require the collection of material over the river. Do not discharge rinse water into sewers and waterways):
      a. PROSOCO, Sure Klean Asphalt & Tar Remover.
      b. PROSOCO, Sure Klean Fast Acting Stripper.
      c. Price Research, Asphalt, Tar and grease Remover.
      d. Diedrich Technologies Inc.; Diedrich 505 Special Coatings Stripper followed by Diedrich Aspir-Solv to remove the residual stain.

C. General Limestone Cleaner, Two-Part Limestone Cleaner: Manufacturer's standard system consisting of potassium or sodium hydroxide based, alkaline prewash cleaner and acidic afterwash cleaner that does not contain hydrofluoric acid.
   1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following]:
      a. ABR Products, Inc.; 500 Limestone Prewash Cleaner followed by 500 Limestone Afterwash.
      b. Diedrich Technologies Inc.; Diedrich 707X Limestone Cleaner Pre-Rinse and Diedrich 808X Black Encrustation Remover - Super Strong followed by 707N Limestone Neutralizer After-Rinse.
      c. PROSOCO; Sure Klean 766 Limestone Prewash followed by SureKlean Limestone & Masonry Afterwash.

D. Efflorescence (Salt) Removal - Poultice materials:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Kaolinite clay: Georgia Tile 6 Kaolin Clay: (Campbell’s Ceramic Supply, http://www.claysupply.com).
      b. Attapulgite Clay:
         1) (Englehard Attapulgite-C, Microsorb 60/90 LUM: 601-354-0818).
         2) (George C. Brandt, Inc. Min-U-Gel FG: 816-472-5400).

2.05 ACCESSORY MATERIALS

A. Stone Pins: Type and size indicated or, if not indicated, 3/4 inch diameter anchors shall be used with embedment of at least 6" deep, unless noted otherwise for each side of the stone attachment. Fabricate anchors and pins from Type 304 stainless steel. Install every eighteen inches for the piers the length of the bridge and at each turn or square balustrade.

B. Flashing Materials: Tin-zinc coated copper, 20 ounce weight of copper material in either sheets or coils:
   1. Ounce-weight material conforming to ASTM specification B370.
   2. Where tin-zinc coated material is specified or noted on the drawings, copper shall be coated both sides with Tin/Zinc alloy a minimum of 0.0005 inches thick per side. Composition of the alloy shall be approximately 50% zinc and 50% tin with trace elements controlled for durability, corrosion resistance and color.
   3. The tin-zinc alloy shall be applied to copper by the hot-dip process and shall have a have a satin finish.
   4. Solder:
      a. Where used on tin-zinc coated copper, solder shall conform to ASTM specification B32 and shall be pure tin OR lead-free, high-tin. If leaded solder is allowed a 60% minimum of tin is required.
      b. Before soldering tin-zinc coated copper, surfaces to receive soldering should be chemically and/or mechanically cleaned to produce clean, bright alloy.
      c. To ease soldering, a tin-bearing flux may be applied to all surfaces to receive solder.

C. Sealant Materials:
   1. Provide manufacturer's standard chemically curing, elastomeric sealant(s) of base polymer and characteristics indicated below that comply with applicable requirements from manufacture.
      a. Single-component, nonsag urethane sealant.
   2. Colors: Provide colors of exposed sealants to match colors of stonework adjoining installed sealant unless otherwise indicated.

D. Joint-Sealant Backing:
   1. Cylindrical Sealant Backings: ASTM C 1330, Type C closed-cell material with a surface skin, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

E. Masking Tape: Nonstaining, nonabsorbent material, compatible with pointing mortar, joint primers, sealants, and surfaces adjacent to joints; that will easily come off entirely, including adhesive.

F. Polyethylene plastic.

G. Miscellaneous Products: Select materials and methods of use based on the following, subject to approval of a mockup:
   1. Previous effectiveness in performing the work involved.
   2. Little possibility of damaging exposed surfaces.
   3. Consistency of each application.
   4. Uniformity of the resulting overall appearance.
   5. Do not use products or tools that could do the following:
      a. Remove, alter, or in any way harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
      b. Leave a residue on surfaces.

2.06 MORTAR MIXES

A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.

1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand 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 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.

B. Do not use admixtures in mortar unless otherwise indicated.

C. Mortar Proportions: Mix mortar materials in the following proportions:
   1. Pointing Mortar for Stone: 1 part white portland cement, 1 part lime, and 6 parts sand.
      a. Add mortar pigments to produce mortar colors required.
   2. Rebuilding (Setting) Mortar: 1 part white portland cement, 1 part lime, and 6 parts sand.
      a. Comply with ASTM C 270, Proportion Specification, Type N unless otherwise indicated, with cementitious material limited to portland cement and lime.

PART 3 - CONSTRUCTION

3.01 PROTECTION

Protect persons, motor vehicles, surrounding surfaces of structure being restored, building site, plants, and surrounding buildings from harm resulting from stone restoration work.

A. Comply with chemical-cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
   1. Cover adjacent surfaces with materials that are proven to resist chemical cleaners used unless chemical cleaners being used will not damage adjacent surfaces. Use materials that contain only waterproof, UV-resistant adhesives. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
   2. Keep wall wet below area being cleaned to prevent streaking from runoff.
   3. Do not clean stone during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
   4. Neutralize and collect alkaline and acid wastes for disposal off Contracting Authority's property.
   5. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

B. Prevent mortar from staining face of surrounding stone and other surfaces.
   1. Cover sills, ledges, and projections to protect from mortar droppings.
   2. Keep wall area wet below rebuilding and pointing work to discourage mortar from adhering.
   3. Immediately remove mortar in contact with exposed stone and other surfaces.
   4. Clean mortar splatters from scaffolding at end of each day.

3.02 UNUSED ANCHOR REMOVAL

A. Remove stone anchors, brackets, wood nailers, and other extraneous items no longer in use unless identified as historically significant or indicated to remain.
   1. Remove items carefully to avoid spalling or cracking stone.
   2. Where directed, if an item cannot be removed without damaging surrounding stone, do the following:
      a. Cut or grind off item approximately 3/4 inch beneath surface and core drill a recess of same depth in surrounding stone as close around item as practical.

b. Immediately paint exposed end of item with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.

3. Patch the hole where each item was removed unless directed to remove and replace the stone unit.

3.03 STONE REMOVAL AND REPLACEMENT

A. At locations indicated, remove stone that has deteriorated or is damaged beyond repair or is to be reused. Carefully demolish or remove entire units from joint to joint, without damaging surrounding stone, in a manner that permits replacement with full-size units.

B. Support and protect remaining stonework that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.

C. Notify Engineer of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing stone or unit masonry backup, rotted wood, rusted metal, and other deteriorated items.

D. Remove in an undamaged condition as many whole stone units as possible.
   1. Remove mortar, loose particles, and soil from stone by cleaning with hand chisels, brushes, and water.
   2. Remove sealants by cutting close to stone with utility knife and cleaning with solvents.
   3. Store stone for reuse. Store off ground, on skids, and protected from weather.

E. Clean stone surrounding removal areas by removing mortar, dust, and loose particles in preparation for replacement.

F. Replace removed damaged stone with other removed stone [and salvaged stone] in good quality, where possible, or with new stone matching existing stone, including size. Do not use broken units unless they can be cut to usable size.

G. Do not allow face bedding of stone. Before setting, inspect to verify that each stone has been cut so that, when it is set in final position, natural bedding planes are essentially horizontal except for arches, where bedding planes are essentially radial or vertical, but perpendicular to the wall]. Reject and replace stone with vertical bedding planes except as required for arches, lintels, and copings.

H. Install replacement stone into bonding and coursing pattern of existing stone. If cutting is required, use a motor-driven saw designed to cut stone with clean, sharp, unchipped edges. Finish edges to blend with appearance of edges of existing stone.
   1. Maintain joint width for replacement stone to match existing joints.
   2. Use setting buttons or shims to set stone accurately spaced with uniform joints.

I. Set replacement stone with completely filled bed, head, and collar joints. Butter vertical joints for full width before setting and set units in full bed of mortar unless otherwise indicated. Replace existing anchors with new anchors of size and type indicated.
   1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing stonework.
   2. Rake out mortar used for laying stone before mortar sets and point new mortar joints in
      a. repaired area to comply with requirements for repointing existing stone, and at same time as repointing of surrounding area.
   3. When mortar is sufficiently hard to support units, remove shims and other devices interfering with pointing of joints.

3.04 PAINTING STEEL UNCOVERED DURING THE WORK

A. Inspect steel exposed during stone removal. Where Engineer determines that it is structural, or for other reasons cannot be totally removed, prepare and paint it as follows:
   1. Remove paint, rust, and other contaminants according to SSPC-SP 3, "Power Tool Cleaning", as applicable to meet paint manufacturer's recommended preparation.

2. Immediately paint exposed steel with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended rate of application (dry film thickness per coat).

B. If on inspection and rust removal, the cross section of a steel member is found to be reduced from rust by more than 1/16 inch, notify Engineer before proceeding.

3.05 PARTIAL STONE REPLACEMENT

A. Remove defective portion of existing stone unit (backing stone). Carefully remove defective portion of stone by making vertical and horizontal saw cuts at face of backing stone and demolishing defective material to depth required for fitting partial replacement (dutchman).
   1. Make edges of backing stone at cuts smooth and square to each other and to finished surface; essentially rectangular. Make back of removal area flat and parallel to stone face.
   2. Do not overcut at corners and intersections. Hand trim to produce clean sharp corners with no rounding and no damage to existing work to remain.
   3. If existing stone that is to remain becomes damaged, remove damaged area and enlarge partial replacement as required.

B. Remove mortar from joints that abut area of stone removal to same depth as stone was removed. Remove loose mortar particles and other debris from surfaces to be bonded and surfaces of adjacent stone units that will receive mortar by cleaning with stiff-fiber brush.

C. Cut and trim partial replacement to accurately fit area where material was removed from backing stone. Fabricate to size required to produce joints between partial replacement and backing stone of no more than 1/16 inch in width, and joints between partial replacement and other stones that match existing joints between stones. Cut partial replacement so that, when it is set in final position, natural bedding planes will match the orientation of bedding planes of the backing stone unless otherwise indicated.

D. Pinning: Before applying adhesive, prepare for mechanical anchorage consisting of 1/4-inch diameter, stainless-steel pins set into 1/4-inch-diameter holes drilled at a 45-degree downward angle through face of partial replacement and into backing stone. Center and space pins between 3 and 5 inches apart and at least 2 inches from any edge. Insert pins at least 2 inches into backing stone and 2 inches into partial replacement with end countersunk at least 3/4 inch from exposed face of partial replacement.

E. Concealed Pinning: Before applying adhesive, prepare for concealed mechanical anchorage consisting of 1/4-inch-diameter, stainless-steel pins set into 1/4- inch- diameter holes drilled into backing stone and into, but not through, the partial replacement. Center and space pins between 3 and 5 inches apart and at least 2 inches from any edge. Insert pins at least 2 inches into backing stone and 2 inches into partial replacement, but no closer than 3/4 inch from exposed face of partial replacement.

F. Apply stone-to-stone adhesive to comply with adhesive manufacturer's written instructions. Coat bonding surfaces of backing stone and partial replacement, completely filling all crevices and voids.

G. Apply partial replacement while adhesive is still tacky and hold securely in place until adhesive has cured. Use shims, clamps, wedges, or other devices as necessary to align face of partial replacement with face of backing stone.

H. Clean adhesive residue from exposed surfaces and patch chipped areas and exposed drill holes] as specified in "Stone Patching" Article.

3.06 PARTIAL STONE RESURFACE

A. Remove defective portion of existing limestone face. Carefully remove defective portion of stone by grinding or craving the face of the limestone.

1. Blend edges of face of the stone at cuts smooth and square to each other and to finished surface; essentially rectangular. Feather the face of the stone to be in plane with the adjacent granite.
2. Do not overcut at corners and intersections. Hand trim to produce clean sharp corners with no rounding and no damage to existing work to remain.
3. The existing stone to remain in place.

3.07 STONE-FRAGMENT REPAIR

A. Carefully remove cracked or fallen stone fragment indicated to be repaired. Reuse only stone fragment that is in sound condition.

B. Remove soil, loose particles, mortar, and other debris or foreign material, from fragment surfaces to be bonded and from parent stone where fragment had broken off, by cleaning with stiff-fiber brush.

C. Pinning: Before applying adhesive, prepare for mechanical anchorage consisting of 1/4-inch diameter, stainless-steel pins set into 1/4-inch- diameter holes drilled at a 45-degree downward angle through face of fragment and into parent stone. Center and space pins between 3 and 5 inches apart and at least 2 inches from any edge. Insert pins at least 2 inches into parent stone and 2 inches into fragment with end countersunk at least 3/4 inch from exposed face of fragment.

D. Concealed Pinning: Before applying adhesive, prepare for concealed mechanical anchorage consisting of 1/4-inch- diameter, stainless-steel pins set into 1/4- inch- diameter holes drilled into parent stone and into, but not through, the fragment.[Center and space pins between 3 and 5 inches apart and at least 2 inches from any edge. Insert pins at least 2 inches into parent stone and 2 inches into fragment, but no closer than 3/4 inch from exposed face of fragment.

E. Apply stone-to-stone adhesive to comply with adhesive manufacturer's written instructions. Coat bonding surfaces of fragment and parent stone, completely filling all crevices and voids.

F. Fit stone fragment onto parent stone while adhesive is still tacky and hold fragment securely in place until adhesive has cured. Use shims, clamps, wedges, or other devices as necessary to align face of fragment with face of parent stone.

G. Clean adhesive residue from exposed surfaces and patch chipped areas and exposed drill holes as specified in "Stone Patching" Article.

3.08 CRACK INJECTION

A. General: Comply with cementitious crack-filler manufacturer's written instructions.

B. Drill 1/4-inch-diameter injection holes as follows:
   1. Transverse Cracks Less Than 3/8 inch Wide: Drill holes through center of crack at 12 to 18 inches on-center.
   2. Transverse Cracks More Than 3/8 inch Wide: Drill holes through center of crack at 18 to 36 inches on-center.
   3. Delaminations: Drill holes at approximately 18 inches on-center both vertically and horizontally.
   4. Drill holes 2 inches deep. Where possible drill holes in mortar joints.

C. Clean out drill holes and cracks with compressed air and water. Remove dirt and organic matter, loose material, sealants, and failed crack repair materials.

D. Place plastic injection ports in drilled holes and seal face of cracks between injection ports with clay or other nonstaining, removable plugging material. Leave openings at upper ends of cracks for air release.

E. Inject cementitious crack filler through ports sequentially, beginning at one end of area and working to opposite end; where possible, begin at lower end of injection area and work upward. Inject filler until it extrudes from adjacent ports. After port has been injected, plug with clay or

other suitable material and begin injecting filler at adjacent port, repeating process until all ports have been injected.

F. Clean cementitious crack filler from face of stone before it sets by scrubbing with water.

G. After cementitious crack filler has set, remove injection ports, plugging material, and excess filler. Patch injection holes and surface of cracks as specified in "Stone Patching" Article.

3.09 STONE PATCHING COMPOUND

A. Patch the following stone units unless another type of replacement or repair is indicated:
   1. Units indicated to be patched.
   2. Units with chipped edges or corners.
   3. Units with small areas of deep deterioration.

B. Remove and replace existing patches unless otherwise indicated or approved by Engineer.

C. Remove deteriorated material and remove adjacent material that has begun to deteriorate. Carefully remove additional material so patch will not have feathered edges but will have square or slightly undercut edges on area to be patched and will be at least 1/4 inch thick, but not less than recommended by patching compound manufacturer.

D. Mask adjacent mortar joint or rake out for repointing if patch will extend to edge of stone unit.

E. Mix patching compound in individual batches to match each stone unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.

F. Brush-coat stone surfaces with slurry coat of patching compound according to manufacturer's written instructions.

G. Place patching compound in layers as recommended by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.
   1. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of the stone. Shape and finish surface before or after curing, as determined by testing, to best match existing stone.
   2. Build patch up 1/4 inch above surrounding stone and carve surface to match adjoining stone after patching compound has hardened.

H. Keep each layer damp for 72 hours or until patching compound has set.

I. Remove and replace patches with hairline cracks or that show separation from stone at edges, and those that do not match adjoining stone in color or texture.

3.10 CLEANING STONE, GENERAL AND HEAVY

A. Proceed with cleaning in an orderly manner; work from bottom to top of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water will not wash over cleaned, dry surfaces.

B. Use only those cleaning methods indicated for each stone material and location.
   1. Do not use wire brushes or brushes that are not resistant to chemical cleaner being used. Do not use plastic-bristle brushes if natural-fiber brushes will resist chemical cleaner being used.
   2. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage stone.
      a. Equip units with pressure gages.
   3. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone-shaped spray tip.
   4. For water-spray application, use fan-shaped spray tip that disperses water at an angle of 25 to 50 degrees.
   5. For heated water-spray application, use equipment capable of maintaining temperature between 140°F and 160°F at flow rates indicated.

6. For steam application, use steam generator capable of delivering live steam at nozzle.

C. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging stone surfaces.

D. Water Application Methods:
   1. Water-Soak Application: Soak stone surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
   2. Water-Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches from surface of stone and apply water in horizontal back and forth sweeping motion, overlapping previous strokes to produce uniform coverage.

E. Chemical-Cleaner Application Methods: Apply chemical cleaners to stone surfaces to comply with chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not spray apply at pressures exceeding 50 psi. Do not allow chemicals to remain on surface for periods longer than those indicated or recommended by manufacturer.

F. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
   1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.

G. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

3.11 PRELIMINARY CLEANING

A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from stone surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing to dry as long as possible before removal. Remove loose soil or debris from open joints to whatever depth they occur.

B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to cleaning methods being used. Extraneous substances include paint, calking, asphalt, and tar.
   1. Carefully remove heavy accumulations of material from surface of stone with sharp chisel. Do not scratch or chip stone surface.
   2. Remove asphalt and tar with solvent-type paint remover.
      a. Comply with requirements in "Paint Removal" Article.
      b. Apply paint remover only to asphalt and tar by brush without prewetting.
      c. Allow paint remover to remain on surface for 10 to 30 minutes.
      d. Repeat application if needed.

3.12 CLEANING STONEWORK

A. Cold-Water Soak:
   1. Apply cold water by intermittent spraying to keep surface moist.
   2. Use perforated hoses or other means that will apply a fine water mist to entire surface being cleaned.
   3. Apply water in cycles with at least 30 minutes between cycles.
   4. Continue spraying until surface encrustation has softened sufficiently to permit its removal by water wash, as indicated by cleaning tests.
   5. Continue spraying for 72 hours.
   6. Remove soil and softened surface encrustation from stone with cold water applied by low-pressure spray.

B. Cold-Water Wash: Use cold water applied by medium-pressure spray.

C. Detergent Cleaning:
   1. Wet stone with water applied by low-pressure spray.
   2. Scrub stone with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that stone surface remains wet.
   3. Rinse with water applied by medium-pressure spray to remove detergent solution and soil.
   4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

D. Mold, Mildew, and Algae Removal:
   1. Wet stone with water applied by low-pressure spray.
   2. Apply mold, mildew, and algae remover by brush or low-pressure spray.
   3. Scrub stone with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and
      a. crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that stone surface remains wet.
   4. Rinse with water applied by medium-pressure spray to remove mold, mildew, and algae remover and soil.
   5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

E. Acidic Chemical Cleaning:
   1. Wet stone with cold water applied by low-pressure spray.
   2. Apply cleaner to stone in two applications by brush. Let cleaner remain on surface for period indicated below:
      a. As recommended by chemical-cleaner manufacturer.
      b. As established by mockup.
   3. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
   4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

F. Two-Part Limestone Chemical Cleaning:
   1. Wet stone with cold water applied by low-pressure spray.
   2. Apply alkaline prewash cleaner to stone by brush or roller. Let cleaner remain on surface for period recommended by chemical-cleaner manufacturer unless otherwise indicated.
   3. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
   4. Apply acidic afterwash cleaner to stone in two applications, while surface is still wet, using low-pressure spray equipment, deep-nap roller or soft-fiber brush. Let neutralizer remain on surface for period recommended by manufacturer unless otherwise indicated.
   5. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
   6. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once.

3.13 EFFLORESCENCE (SALT) REMOVAL

A. Work in this section is intended to remove soluble salts in the form of efflorescence and subflorescence. Assume three applications for bid purposes. The exact number of applications will be determined by testing to be completed during construction. Contractor will be required to retain representative samples of used poultice material after each application, and to provide samples of that material to the Engineer.
   1. Use pure attapulgite clay for poultice. No additional reagents required. Mix all materials off site.
   2. Add water until material achieves a trowelable, plastic consistency.
   3. Pre-wet surface with clean, potable water.
   4. Apply mix to surface, approximately ¼ to ½ inch thickness.

5. Cover with poly plastic. Seal with low-adhesion duct tape at perimeter of plastic.
6. Allow to dwell on surface 24 hours.
7. Remove plastic. Allow poultice to dry until it cracks and breaks adhesion with the masonry surface; drying to this stage may take a week or longer depending on relative humidity and temperature.
8. Remove any adhering poultice material with plastic trowels. Retain at least 8 ounces of used poultice material after removal for testing. Contain and dispose of remainder as necessary.
9. Repeat process three times for salt removal and record each application in the daily field report.
10. Rinse surface with clean water to remove clay haze

3.14 REPOINTING STONEWORK

A. Rake out and repoint joints to the following extent:
   1. All joints in areas indicated.
   2. Cracked joints where cracks are 1/8 inch or more in width and of any depth.
   3. Joints where they are worn back 1/4 inch or more from surface.
   4. Joints where they are deteriorated to point that mortar can be easily removed by hand, without tools.
   5. Joints where they have been filled with substances other than mortar.
   6. Joints indicated as sealant-filled joints.

B. Rake out joints as follows, according to procedures demonstrated in approved mockup:
   1. Remove mortar from joints to depth of 2 times joint width, but not less than 1/2 inch or not less than that required to expose sound, unweathered mortar.
   2. Remove mortar from stone surfaces within raked-out joints to provide reveals with square backs and to expose stone for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
   3. Do not spall edges of stone units or widen joints. Replace or patch damaged stone units as directed by Engineer.
      a. Cut out center of mortar bed joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar by hand with chisel and resilient mallet. Strictly adhere to approved quality-control program.

C. Notify Engineer of unforeseen detrimental conditions including voids in mortar joints, cracks, loose stone, rotted wood, rusted metal, and other deteriorated items.

D. Pointing with Mortar:
   1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
   2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Fully compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
   3. After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 3/8 inch. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing stone has worn or rounded edges, slightly recess finished mortar surface below face of stone to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed stone surfaces or to featheredge the mortar.
   4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
   5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.

a. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
b. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.

6. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

E. Pointing with Sealant:
1. After raking out, keep joints dry and free of mortar and debris.
2. Clean and prepare joint surfaces according to manufacture. Prime joint surfaces unless sealant manufacturer recommends against priming. Do not allow primer to spill or migrate onto adjoining surfaces.
3. Fill sealant joints with specified joint sealant according to manufacture recommendations and the following:
a. Install cylindrical sealant backing beneath the sealant except where space is insufficient. There, install bond-breaker tape.
b. Install sealant using only proven installation techniques that will ensure that sealant will be deposited in a uniform, continuous ribbon, without gaps or air pockets, and with complete wetting of the joint bond surfaces equally on both sides. Fill joint flush with surrounding stonework and matching the contour of adjoining mortar joints.
c. Install sealant as recommended by sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead:
1) Fill joints to a depth equal to joint width, but not more than 1/2 inch deep or less than 1/4 inch deep.
d. Immediately after first tooling, apply ground-mortar aggregate to sealant, gently pushing aggregate into the surface of sealant. Retool sealant to form smooth, uniform beads, slightly concave. Remove excess sealant and aggregate from surfaces adjacent to joint.
e. Do not allow sealant to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces, particularly rough textures. Remove excess and spillage of sealant promptly as the work progresses. Clean adjoining surfaces by the means necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes, as demonstrated in an approved mockup.
4. Cure sealant according to manufacture recommendations.

F. Where repointing work precedes cleaning of existing stone, allow mortar to harden at least 30 days before beginning cleaning work.

3.15 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed stone surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water, spray applied at low pressure.
1. Do not use metal scrapers or brushes.
2. Do not use acidic cleaners on the limestone.

B. Wash adjacent woodwork and other nonstone surfaces. Use detergent and soft brushes or cloths.

C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.

D. Sweep and rake adjacent pavement and grounds to remove mortar and debris. Where necessary, pressure wash pavement surfaces to remove mortar, dust, dirt, and stains.

3.16 FIELD QUALITY CONTROL

A. Engineer's Project Representatives: Engineer will assign Project Representatives to help carry out Engineer's responsibilities at the site, including observing progress and quality of portion of

the work completed. Allow Engineer's Project Representatives and Contracting Authority's Project Representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the work completed.

PART 4 - METHOD OF MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. Replacement Limestone will be measured by the cubic yard of acceptable stone installed.

B. Balustrade Railing will be measured by the linear foot of acceptable limestone and granite installed and consists of the following items:
   1. Tin-zinc coated copper flashing.
   2. Stainless steel stone pins.
   3. Balustrade top rail - limestone.
   4. Square balustrade next to the piers and between piers - limestone.
   5. Turned balustrade between bottom/top rail and piers - limestone.
   6. Balustrade bottom rail - granite.
   7. Primary pier - limestone.
   8. Intermediate pier - limestone.
   9. Abutment pier - limestone and granite

C. Reset Existing Limestone Unit will be measured by each unit of acceptable limestone reset on the bridge.

D. Repointing Mortar will be measured by the linear foot of acceptable mortar joint installed between the limestone.

E. Repointing stone with sealant will be measured by the linear foot of acceptable sealant joint installed between the limestone.

F. Limestone Refacing will be measured by the square foot of acceptable application of refacing completed on the limestone.

G. Limestone Cleaning will be measured by the square foot of acceptable application of cleaning solution completed on the limestone.

H. Limestone Crack Injection will be measured by the linear foot of acceptable cementitious crack filler installed.

I. Poultice for Salt for the removal of soluble salts in the form of efflorescence and subflorescence will be measured by the square foot of three acceptable applications of poultice completed on the limestone.

J. Stone Patching Compound will be measured by the square foot of acceptable patching (1 square foot of surface by 1 inch deep) completed on the limestone.

K. Limestone Dutchman will be measured by the square foot of acceptable limestone repair (1 square foot of surface by 2 inches deep) completed on the limestone.

L. Scaffolding will be measured by lump sum cost of scaffolding used for access to the bridge for the primary use of stone repair and replacement.

PART 5 - BASIS OF PAYMENT

5.01 BASIS OF PAYMENT

A. Limestone, Granite, Reset of Limestone, Stone Cleaning, Stone Repairs satisfactorily completed and in place will be paid for at the contract unit price. See the list of the items above under the method of measurement for the list of units. This payment shall be full compensation for all labor, materials, equipment, services, and incidentals necessary to perform the work of this section.