# SECTION 04 20 00 UNIT MASONRY

## PART 1 - GENERAL

### 1.01 DESCRIPTION

A. Under this Section, the Contractor shall furnish all labor, materials and equipment for Unit Masonry, including accessory items of work herein described, as shown on the Plans, as specified and/or directed.

### 1.02 APPLICABLE SPECIFICATIONS, CODES AND STANDARDS

A. Reference to standard specifications for the following organizations is intended to specify minimum standards for quality of materials and performance of workmanship, and for standard test methods.
   1. American Society for Testing and Material (ASTM) Latest Edition.
   2. American Concrete Institute (ACI) and American Society of Civil Engineers (ASCE), Building Code Requirements For Masonry Structures, Latest Edition.
   3. National Concrete Masonry Association (NCMA) Specifications, Latest Edition.

### 1.03 SUBMITTALS: Submit the following.

A. Design Data:
   1. Pre-mixed mortar mix design
   2. Grout mix design

B. Manufacturer's Catalog Data:
   1. Masonry accessories
   2. Reinforcement
   3. Pre-mixed mortar
   4. Control joints
   5. Expansion joints
   6. Water-repellent admixture
   7. Flashing
   8. Grout

   Submit for each type.

C. Drawings:
   1. Reinforcing steel
   2. Accessories

   Indicate splicing, laps, shapes, dimensions, and details of reinforcing bars and accessories. Include details of anchors, adjustable wall ties, positioning devices, bond beams, and lintels. Do not scale drawings to determine lengths of bars.

D. Manufacturer's Instructions:
   1. Masonry cement

   If masonry cement is used, submit the manufacturer's printed instructions on proportions of water and aggregates and on mixing to obtain the type of mortar required.

E. Samples:
   1. Masonry units
   2. Mortar colors

   Submit five representative full size masonry units showing full range of color, texture, finish, and dimensions, two samples of each color of mortar, and two samples of each type of wall reinforcement, anchor, and wall tie.

F. Factory Test Reports:
   1. Efflorescence test

   Submit efflorescence test reports on masonry units that are to be exposed to weathering. Schedule tests far enough in advance of starting masonry work to permit retesting if necessary. Test five pairs of specimens of each type of masonry unit for efflorescence in accordance with ASTM C67. If any pair is rated "effloresced," reject the units represented by the samples.

G. Certificates of Compliance: The Contractor shall submit to the Engineer prior to delivery, manufacturer's or supplier's certification of compliance of units with specified standards, as determined by an acceptable testing agency conforming to the applicable requirements of ASTM.
   1. Masonry cement
   2. Grout
   3. Pre-mixed mortar
   4. Compressive strength tests for block

## 1.04 QUALITY ASSURANCE

A. Appearance: Do not change source or supply of materials after the work has started if the appearance of the finished work would be affected. Units should be sound and free from cracks or other defects that would interfere with proper setting, impair strength and performance of construction, or be objectionable in appearance.

## 1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver cementitious materials to the site in unbroken containers, plainly marked and labeled with manufacturers' names and brands. Store cementitious materials in dry, weathertight sheds or enclosures and handle so as to prevent entry of foreign materials and damage by water or dampness. Store masonry units off the ground and handle with care to avoid chipping and breakage. Protect materials from damage and, except for sand, keep dry until used. Cover sand to prevent intrusion of water and foreign materials and to prevent drying. Do not use materials containing frost or ice.

## 1.06 ENVIRONMENTAL CONDITIONS

A. Cold Weather Construction: During cold weather, that is when the air temperature is below 40 degrees F and falling, or when it appears that the air temperature will drop to 40 degrees F or below within 24 hours, do not lay masonry unless the work is protected from freezing as specified below. Surfaces receiving mortar shall be free of ice and frost. Comply with the requirements specified below for the respective air temperatures:
   1. Air Temperature 40 to 25 Degrees F: Heat sand or mixing water to produce mortar temperature between 40 and 120 degrees F.
   2. Air Temperature 25 to 20 Degrees F: Heat sand and mixing water to produce mortar temperature between 40 and 120 degrees F. Use salamanders or other heat sources on both sides of walls under construction. Use windbreaks when wind is in excess of 15 mph.
   3. Air Temperature 20 Degrees F and Below: Heat sand and mixing water to produce mortar temperature between 40 and 120 degrees F. Provide enclosures and auxiliary heat to maintain air temperature above 32 degrees F on both sides of walls under construction. Ascertain that temperatures of masonry units are not less than 20 degrees F when units are laid.

B. Cold Weather Protection: Protect newly laid masonry as specified below for the respective mean daily air temperature (MDAT), that is, the average of the daytime high temperature and the forecasted nighttime low temperature.
   1. MDAT 40 to 25 Degrees F: Protect masonry from rain and snow by covering with weather-resistive membrane for 24 hours after laying.
   2. MDAT 25 to 20 Degrees F: Completely cover newly-laid masonry with insulating blankets and weather-resistive membrane for 24 hours.
   3. MDAT 20 Degrees F and Below: Maintain temperature of masonry above 32 degrees F for 24 hours by providing enclosures and supplementary heat or other approved means.

## 1.07 SCHEDULING

A. Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching.

# PART 2 - PRODUCTS

## 2.01 MASONRY UNITS

A. Concrete Masonry Units: Units shall be of modular dimensions and be steam cured, or approved equal. Exterior concrete masonry units shall have water-repellant admixture added during manufacture.
   1. Hollow Load-Bearing Units: ASTM C90, Grade N-I or N-II, made with lightweight or normal weight aggregate. Provide load-bearing units for exterior walls, foundation walls, load-bearing walls, and shear walls. Minimum compressive strength shall not be less than 2000 psi.

2. Hollow Non-Load-Bearing Units: ASTM C129, Type I or II, made with lightweight or normal weight aggregate. Load-bearing units may be provided in lieu of non-load-bearing units.
3. Solid Load-Bearing Units: ASTM C145, Grade S-I or S-II, except units exposed to weather shall be Grade N-I or N-II, and made with lightweight or normal weight aggregates. Provide solid units or masonry bearing under structural framing members as indicated.
4. Special Shapes: Provide special shapes such as closures, header units, and jamb units as necessary to complete the work. Special shapes shall conform to the requirements for the units with which they are used.

B. Water-Repellant Admixture: Polymeric type formulated to reduce porosity and water transmission. Construct panels of masonry units and mortar which contain the water-repellant admixture. When tested in accordance with ASTM E72, such panels shall be flexural strength not less than 20 percent greater, and compressive strength not less than 3 percent greater, than similar panels which do not contain the admixture. When tested in accordance with ASTM E514, panels shall exhibit no water visible on back of test panel and no leaks through the panel after 24 hours, and not more than 25 percent of wall area shall be damp after 72 hours.

2.02 MORTAR

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

B. Hydrated Lime: ASTM C207, Type S.

C. Masonry Cement: ASTM C91, except that for masonry cement used in mortar for exterior walls, the air content of the mortar specimen shall be not more than 16 percent by volume in lieu of 22 percent. Containers shall bear complete instructions for proportioning and mixing to obtain the required types of mortar.

D. Sand: ASTM C144.

E. Water: Clean, potable, and free from substances which could adversely affect the mortar.

F. Mortar Types: ASTM C270, Type M for foundation walls, bearing walls, exterior walls; Type N or S for non-load-bearing, non-shear-wall interior masonry; and Type S for all other masonry work; except where higher compressive strength is indicated on structural drawings. Air content shall be limited to 12 percent.

G. Pre-Mixed Mortar: ASTM C270, Type S, compressive strength of 1800 psi in 28 days. Air content shall be limited to 12 percent.

H. Admixtures: No air-entraining admixtures, anti-freeze compounds or calcium chlorides shall be included in mortar. Where colored mortar is indicated, add pigment to obtain the color indicated. Mortar colors shall consist of inorganic compounds not to exceed 15% of the weight of the cement. Admixtures may be used in mortar to retard curing and provide up to 36 hours of workability,

provided the admixture does not adversely affect bonding or compressive strength.

2.03 GROUT

A. Grout for reinforced masonry shall be proportioned and mixed in accordance with ASTM C476. Fine grout (with sand aggregate) shall be used in grout spaces where minimum horizontal dimension is less than 4 inches. Coarse grout (with pea gravel) may be used elsewhere. Samples shall be tested in accordance with applicable portions of ASTM C1019 and shall exhibit a minimum ultimate compressive strength of 2500 psi at 28 days. Do not use admixtures that contain calcium chlorides, air-entrainment or antifreeze compounds.

2.04 ACCESSORIES

A. Horizontal Joint Reinforcement: Fabricate from cold drawn steel wire, ASTM A82. Wire shall be hot-dipped galvanized after fabrication in accordance with ASTM A153 (1.5 oz of zinc per square foot). Reinforcement shall be truss type with two or more longitudinal wires welded to a continuous diagonal cross wire, or ladder type with perpendicular cross wires not more than 16 inches o.c. Provide flat sections 10 feet long, and preformed corners and tees approximately 30 inches long. Overall width shall be approximately 2-inches less than nominal thickness of wall.
   1. Single-Wythe: For single-wythe walls and partitions, provide two 9-gauge (0.1483-inch) longitudinal wires and 9-gauge cross wires.

B. Anchors and Ties: Provide approved designs of stainless steel, zinc-coated steel, or noncorrosive metal having the equivalent total strength of steel types. Zinc coat steel by the hot-dip process after fabrication to a minimum of 1.25 ounces of zinc per square foot of surface when tested in accordance with ASTM A90.
   1. Corrugated Metal Ties: Not less than 7/8-inch wide by approximately 7 inches long and not lighter than 22 gauge.
   2. Rigid Steel Anchors: Not less than 1-1/2 inches wide, 1/4-inch thick, and 24 inches long with each end bent not less than 2 inches.
   3. Wire Mesh: Minimum 20 gauge, 1/2-inch mesh, galvanized wire, 1 inch less in width than width of masonry.
   4. Dovetail Flat Bar or Wire Anchors: Flat bar: corrugated sheet steel, not lighter than 16 gauge, and 7/8-inch wide, with end turned up 1/4 inch. Wire: not lighter than 6 gauge, 7/8-inch wide with wire looped and closed. Dovetail slots and inserts are specified in Section 03 31 18, "Cast-in-Place Concrete, Minor Construction".

C. Fastenings: Build in bolts, metal wall plugs, and other metal fastenings furnished under other sections for securing furring and other items.

D. Reinforcing Bars: Vertical steel and dowel reinforcing shall be 60,000 psi and conform to ASTM A615 as specified in Section 03 21 00.

E. Through-Wall Flashing: Provide one of the following types except that flashing indicated to terminate in reglets shall be metal or coated-metal flashing and

except that the material shall be one which is not adversely affected by the material used for dampproofing.

1. Coated-Copper Flashing: 5-ounce, electrolytic copper sheet, uniformly coated on both sides with acid-proof, alkali-proof, elastic bituminous compound. Factory apply coating to a weight of not less than 6 ounces per square foot (approximately 3 ounces per square foot on each side).
2. Minimum 5-Ounce Copper or Stainless Steel Flashing: Copper, ASTM B370, 6-ounce weight; stainless steel, ASTM A167, Type 301, 302, 304, or 316, 0.006-inch thick, No. 2 or No. 2D finish. Provide with factory-fabricated deformations that mechanically bond flashing against horizontal movement in all directions. Deformations shall consist of dimples, diagonal corrugations, or a combination of dimples and transverse corrugations.
3. Plastic Flashing: Homogeneous, waterproof, impermeable, elastomeric sheeting not less than 0.030-inch thick. Sheeting shall have not less than 1000 pounds per square inch tensile strength, nor more than 7 percent tension set at 50 percent elongation when tested in accordance with ASTM D412. Suitably stabilize sheeting to resist exposure without visible deterioration when tested not less than 400 hours in accordance with ASTM D822. The material, after being exposed for not less than 1/2 hour to a temperature of minus 20 degrees F, shall show no cracking or flaking when, at that temperature, it is bent 180 degrees over a 1/32-inch diameter mandrel and then bent at the same point over the same size mandrel in the opposite direction 360 degrees and not be subject to rapid ultraviolet degradation.
4. Reinforced Membrane Flashing: Polyester film core with a reinforcing fiberglass scrim bonded to one side. The membrane shall be impervious to moisture, flexible, and not affected by caustic alkalis. The material, after being exposed for not less than 1/2 hour to a temperature of 32 degrees F, shall show no cracking when, at that temperature, it is bent 180 degrees over a 1/16-inch diameter mandrel and then bent at the same point over the same size mandrel in the opposite direction 360 degrees.
5. Embossed Membrane Flashing: Polyester film embossed in a small hexagon pattern, impervious to moisture and resistant to corrosion. Film shall not become brittle and shall remain flexible for thermal movements within wall.

F. Wicking for Weep Holes: Fiberglass, 1/4 inch in diameter, each piece not less than 18 inches long.

## PART 3 - EXECUTION

### 3.01 PREPARATION

A. Protection:
1. Stains: Protect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber

brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

2. Loads: Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed.
3. Provide temporary bracing as required to prevent damage during construction.
4. Polyester Embossed Film: Provide protective boards for polyester film during job installation to ensure no damage from building debris.

B. Surface Preparation: Surfaces on which masonry is to be placed shall be smooth, clean, and free of foreign substances when mortar is applied.

## 3.02 WORKMANSHIP

A. Carry masonry up level and plumb. Furnish and use story poles or gauge rods throughout the work. Changes in coursing or bonding after the work is started will not be permitted. Do not carry one section of the walls up in advance of the others. Step back unfinished work for joining with new work. Toothing will not be permitted. Check heights of masonry with an instrument at each floor and at sills and heads of openings to maintain the level of the walls. Build in door and window frames, louvered openings, anchors, pipes, ducts, and conduits as the masonry work progresses. Fill spaces around metal door frames solidly with mortar. Handle masonry units with care to avoid chipping, cracking, and spalling of faces and edges. Drilling, cutting, fitting, and patching to accommodate the work of others shall be performed by masonry mechanics. Cut masonry with masonry saws for exposed work. Structural steelwork, bolts, anchors, inserts, plugs, ties, lintels, and miscellaneous metalwork specified elsewhere shall be placed in position as the work progresses. Provide chases of approved dimensions for pipes and other purposes where indicated and where necessary. Inspect scaffolding regularly to ensure that it is amply strong, well braced, and securely tied in position. Do not overload scaffolding.

## 3.03 MORTAR MIXING

A. Measure mortar materials in 1 cu. ft. containers to maintain control and accuracy of proportions. Do not measure materials with shovels. Mix mortar in a mechanical batch mixer for not less than 3 nor more than 5 minutes after all ingredients are in so as to produce a uniform mixture. Add water gradually as required to produce a workable consistency. Do not load mixer beyond its rated capacity. Keep mortar boxes, pans, and mixer drums clean and free of debris and dried mortar. Retemper mortar which has stiffened because of evaporation by adding water and mixing to obtain a workable consistency. Do not use or retemper mortar which has not been placed in final position within 2-1/2 hours after the initial mixing. Do not use antifreeze compounds, salts, or other substances to lower the freezing point of mortar.

1. Mortar: Mix mortar in accordance with ASTM C270 to obtain type mortar required. When masonry cement is used, conform to printed mixing instructions of the masonry cement manufacturer. During mixing, add water-repellant admixture in quantity recommended by the admixture manufacturer to mortar which will be used in exterior concrete masonry unit walls.

2. Grout: ASTM C476. Provide fine grout in grout spaces less than 2 inches in any horizontal dimension or in which clearance between reinforcing and masonry is less than 3/4 inch. Provide coarse grout in grout spaces 2 inches or greater in all horizontal dimensions provided the clearance between reinforcing and masonry is not less than 3/4 inch.

## 3.04 MORTAR JOINTS

A. Uniform thickness of 3/8 inch unless otherwise indicated. Tool exposed joints slightly concave with a round or other suitable jointer when the mortar is thumb print hard. For horizontal joints, jointers shall be at least 16 inches long for concrete masonry. Jointers shall be slightly larger than the width of the joint so that complete contact is made along the edges of the units, compressing and sealing the surface of the joint. Strike flush joints that will not be exposed. Tool vertical joints first. Brush joints to remove all loose and excess mortar. Horizontal joints shall be level; vertical joints shall be plumb and in alignment from top to bottom of wall within a tolerance of plus or minus 1/2 inch in 40 feet.

## 3.05 TOLERANCES

A. Masonry work shall be within the following limits:
   1. Face of Concrete Masonry Unit: 1/16 inch from face of adjacent unit.
   2. Variation From True Plane: 1/4 inch in 10 feet and 1/2 inch maximum in 20 feet or more.
   3. Variation From Plumb: 1/4 inch in each story, noncumulative and 1/2 inch maximum in two stories or more.
   4. Variation From Level: 1/8 inch in 3 feet, 1/4 inch in 10 feet, and 1/2-inch maximum.
   5. Variation in Wall Thickness: Plus or minus 1/4 inch.

## 3.06 CONCRETE MASONRY UNIT WORK

A. Lay the first course in a full bed of mortar for the full width of the unit. Lay succeeding courses in running bond unless otherwise indicated. Form bed-joints by applying the mortar to the entire top surfaces of the inner and outer face shells. Form head joints by applying the mortar for a width of about 1 inch to the ends of the adjoining units. The mortar shall be of such thickness that it will be forced out of the joints as the units are placed in position. Where anchors, bolts, and ties occur within the cells of the units, place metal lath in the joint at the bottom of such cells, and fill the cells with mortar or grout as the work progresses. Use cut block for bonding walls, working out the coursing, topping out walls under sloping slabs, distributing concentrated loads, and elsewhere as required. No wetting of concrete masonry units is permitted.
   1. Special Concrete Masonry Unit Work: Where exposed concrete masonry unit walls and partitions are indicated, provide special concrete masonry unit work. Select units for uniformity of size, texture, true plane, and undamaged edges and ends of exposed surfaces. Place units plumb, parallel, and with properly tooled joints of maximum 3/8-inch thickness. Keep exposed surfaces clean and free from blemishes or defects. Lay units in running bond pattern.

2. Reinforced Concrete Masonry Unit Walls: Where vertical reinforcement occurs, fill cores solid with grout. Lay units in such a manner as to preserve the unobstructed vertical continuity of cores to be filled. The cells to be grouted must be fully bedded in mortar, including the webs to prevent leakage. Remove mortar fins protruding from joints before grout is placed. Minimum clear dimensions of vertical cores shall be 2 by 3 inches. Position reinforcing accurately as indicated before placing grout. As masonry work progresses, secure vertical reinforcing in place at vertical intervals not to exceed 160 bar diameters. Grouting shall be performed as soon as possible after placing units so shrinkage cracking at the joints is minimized and so the grout bonds with the mortar. Use puddling rod or vibrator to consolidate the grout. Minimum clear distance between masonry and vertical reinforcement shall be not less than 1/2 inch. Unless indicated or specified otherwise, form splices by lapping bars not less than 40 bar diameters and wire tying them together.

## 3.07 BONDING AND ANCHORING

A. Unless indicated otherwise, extend partitions from the floor to the bottom of the construction above. Structurally bond or anchor walls and partitions to each other. Securely anchor non-load-bearing partitions and interior walls to the construction above as indicated and in a manner that provides lateral stability while permitting unrestricted deflection of construction above. Completely embed anchors in mortar joints. Partial height partitions, less than height of ceiling, should be capped with solid (not filled) masonry units.
   1. Corners of Load-Bearing Walls: Provide a true masonry bond in each course, except where indicated or specified otherwise.
   2. Intersections of Load-Bearing Walls: Provide a true masonry bond in each course, or anchor with rigid steel anchors not more than 2 feet apart vertically, unless otherwise indicated.
   3. Intersections of Non-Load-Bearing Partitions With Other Walls or Partitions: Tie with wire mesh ties at vertical intervals of not more than 2 feet or with masonry bonding in alternate courses, unless otherwise indicated.
   4. Masonry Walls Facing or Abutting Concrete Members: Anchor masonry to the concrete with dovetail or wire-type anchors inserted in slots or inserts built into the concrete, unless otherwise indicated. Locate anchors not more than 18 inches o.c. vertically and not more than 24 inches o.c. horizontally.

## 3.08 THROUGH-WALL FLASHING

A. Provide as recommended by manufacturer. Unless indicated otherwise, extend flashing from a point 1/4-inch outside of the exterior face of walls, upward across wall cavity not less than 6 inches and into reglets or mortar of bed joint for backing wythe. Bend down the exterior edge to form a drip. Flashing shall be terminated 3/4-inch back from interior face of walls and turned back on itself not less than 1/2-inch extended beyond interior face of wall and turned up not less than 2 inches. Secure flashing in reglets to ensure a permanent watertight joint as indicated. Provide flashing in lengths as long as practicable. Lap ends not less than 1-1/2 inches for interlocking type and 4 inches for other types. Seal

laps as necessary to ensure watertight construction. Provide dams at ends of flashing where masonry abuts concrete and where flashing ends within the masonry.

3.09 WEEP HOLES

A. Wherever through-wall flashing occurs, provide weep holes to drain the flashing to the exterior. Weep holes shall be open head joints 24 inches o.c., clear round holes not less than 1/4 inch in diameter and 24 inches o.c., or 1/4-inch diameter wicking 16 inches o.c. Wicking shall extend from the exterior face of the masonry to and approximately 2 inches upward into the cavity or collar joint.

3.10 HORIZONTAL JOINT REINFORCEMENT

A. Provide reinforcement in first bed joint above foundation walls or grade beams, in first and second bed joints above and below openings and extending 24 inches beyond openings each side in walls and partitions of concrete masonry units. Provide additional reinforcement in every course. Reinforcement shall be continuous except at control joints and expansion joints. Reinforcement above and below openings shall extend not less than 24 inches beyond each side of openings. Provide reinforcement in the longest available lengths, utilizing the minimum number of splices. Overlap ends not less than 6 inches. Provide welded L-shaped assemblies and welded T-shaped assemblies to match the straight reinforcement, at corners and intersections of walls and partitions. Provide mortar cover for the wire of at least 5/8 inch for exterior face of wall and 1/2 inch for interior face of wall.

3.11 CONCRETE MASONRY UNIT LINTELS AND BOND BEAMS

A. Provide special units, fill cells solidly with grout, and provide not less than two No. 5 reinforcing bars, unless indicated otherwise. Reinforcing shall overlap a minimum of 40 bar diameters at splices. Terminate bond beams and reinforcing on each side of expansion joints and control joints. Concrete masonry units used for lintels and bond beams shall have exposed surfaces of the same material and texture as the adjoining masonry units. Lintels shall be straight and true and shall have at least 8 inches of bearing at each end. Cells under lintel bearing on each side of openings shall be filled solid with grout or concrete for 2 courses or as indicated. Allow lintels to set at least 6 days before shoring is removed. During mixing, add water-repellant admixture in quantity recommended by the admixture manufacturer to concrete and grout which will be used to fill lintels and bond beams in exterior walls.

3.12 CONTROL JOINTS

A. Provide where indicated in concrete masonry-unit walls. Provide sawed type or built-in type as required. Joints shall occur directly opposite each other on both faces of the wall and shall be filled with sealant as specified in Section 07 92 00, "Joint Sealants", or a properly formed synthetic rubber or vinyl plastic sealing strip as

## 3.13 EXPANSION JOINTS

A. Fill joints with a permanently flexible preformed filler material and a sealant as specified in Section 07 92 00, "Joint Sealants".

## 3.14 GROUT PLACEMENT

A. Grouting is required at voids where reinforcing is provided and in below grade foundation walls. Refer to drawings for locations.

B. Place grout from the interior side of walls, except as approved otherwise. Protect sills, ledges, offsets, and other surfaces from grout droppings. Remove grout from such surfaces immediately. Grout shall be well mixed to prevent segregation and shall be sufficiently fluid to flow into joints and around reinforcing without leaving voids. Place grout by pumping or pouring from buckets equipped with spouts in lifts not exceeding 4 feet. Waiting time before subsequent pours of grout shall be thirty (30) to sixty (60) minutes, to prevent rupture of the masonry due to hydraulic pressure on the lower mortar joints and/or concrete blocks and to allow for settlement, shrinkage and absorption of excess water by the units. Keep pours at 1-1/2 inches below the top of masonry units in top course, except at the finish course. Puddle or agitate grout thoroughly to eliminate voids. Remove masonry displaced by grouting operation and re-lay in alignment with fresh mortar.

## 3.15 FORMS AND SHORING

A. Construct to the shape, lines, and dimensions of members indicated and make sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry. Do not remove until members have cured.

## 3.16 PARGING

A. Parge the outside of masonry basement walls in contact with the earth with two coats of Type M mortar, each 3/8-inch thick. Cross-scratch the first coat and allow to cure at least 24 hours. Trowel smooth the second coat, bevel at top, and cove out to edge of footing. Extend parging not more than 4 inches above grade, unless indicated otherwise, and keep damp for at least 3 days.

## 3.17 CLEANING

A. Protection: Protect work which may be damaged, stained, or discolored during cleaning operations.

B. Pointing: Upon completion of masonry work and before cleaning, cut out defective mortar joints and tuck point joints and all holes solidly with prehydrated mortar.

C. Cleaning: Clean exposed masonry surfaces with clear water and stiff fiber brushes and rinse with clear water. Where stains, mortar, or other soil remain, continue scrubbing with warm water and detergent. Immediately after cleaning

each area, rinse thoroughly with clear water. Restore damaged, stained, and discolored work to original condition or provide new work.

END OF SECTION

# SECTION 04 43 12
# STONE MASONRY VENEER

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Anchored cut stone veneer at exterior walls.

B. Metal anchors and accessories for anchored veneer.

C. Setting mortar.

### 1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Joint reinforcement, Ties, Anchors, and Through-wall flashing.

B. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Flashings.

D. Section 07 92 00 - Joint Sealants: Sealing joints indicated to be left open for sealant.

E. Section 32 94 00 - Stainless Steel Cable Plant Support System: Trellis for greenscape.

### 1.03 REFERENCE STANDARDS

A. ASTM A580/A580M - Standard Specification for Stainless Steel Wire; 2018.

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

C. ASTM C1242 - Standard Guide for Selection, Design, and Installation of Dimension Stone Attachment Systems; 2018a.

D. ASTM C1528/C1528M - Standard Guide for Selection of Dimension Stone; 2018.

E. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.

### 1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on stone units, supplier, mortar, and reinforcement.

C. Samples: Submit two stone samples illustrating minimum and maximum stone sizes, color range, texture, and markings.

### 1.05 QUALITY ASSURANCE

A. Stone Fabricator Qualifications: Company specializing in fabricating cut stone with minimum ten years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type required by this section, with minimum 5 years of documented experience.

### 1.06 MOCK-UP

A. Construct stone wall mock-up, 4 feet long by 4 feet wide; include stone anchor accessories, corner condition, and typical control joint in mock-up.

## PART 2 PRODUCTS

### 2.01 STONE

A. Stone, General: See recommendations in ASTM C1528/C1528M.

B. Stone Selection Basis of Design Manhattan Schist Custom Mix from Saracino Industries or approved equal. Intent of stone selection is to match the type, streak, color, texture, grain, and size range of the stone masonry on the existing building.

Saracino Industries Inc.,

Granite Quarries, Stone Sales and Fabrication
PO Nox 426, Hawthorne, NY 10532
(845) 628-0400/ (914) 330-7110

1. Stone Size:
   - 80% Mix – Average Stone
     Stone Face: 2.5" – 3.5" high by 11" – 14" wide
   - 5% Mix - Large Stone
     Stone Face: 4" – 5" high by 9" to 10" wide
   - 5% Mix – Small Stone
     Stone Face: 2.5" – 4" high by 3" to 4" wide
   - 5% Mix – Extra Large Stone
     Stone Face: 13" – 15" high by 5"-8" wide
   - 5% Mix – Extra -Extra Large Stone
     Stone Face: 18" - 20" high by 6" -9" wide
2. Stone Color
   - 60% Mix – Dark Grey to Black with **end grain** exposed.
     Dark grey to black stone may be uniform or include horizonal banding of quartz (white) or mica. Munsell Color (Rock Book): N2, N3, 5Y 2/1, 5GY 2/1.
   - 20% Mix – Medium Grey with **end grain** exposed.
     Grey stones may include horizonal banding of quartz (white) or mica or an overall striation (Schist). Munsell Color (Rock Book): N4, N5, 5G 6/1
   - 10% Mix – Light Grey with **end grain** exposed.
     Light grey stone may be uniform or include horizonal banding of quartz (white). Munsell Color (Rock Book): N6, N7, 5B 7/1
   - 10% Mix – Brown/ Tan with **end grain** exposed.
     Ferrous compounds included for orange banding/ inclusions and quartz (white or orange). Munsell Color (Rock Book): 10YR 7/4, 10YR 6/2, 10YR 8/2. Orange inclusions Munsell Color (Rock Book): 5YR 5/6.

## 2.02 MORTAR APPLICATIONS

A. Materials:
   1. Portland cement: ASTM C 150, Type I, non-staining.

B. Use only white Portland cement for building mortar.

C. Do not use masonry cement.
   1. Lime: Hydrated ASTM C 207, Type S, or Lime Putty, ASTM C 1489.
   2. Natural Hydraulic Lime: High calcium NHL3.5 or NHL 2, conforming to European Norms (EN 459).
   3. Edison Coatings, Inc., Biolime, NHL3.5 or NHL2
   4. Limeworks.us, St. Astier NHL3.5 or NHL2
   5. U.S. Heritage Group, Otterbein – Calcidur NHL3.5 or NHL2
   6. Sand: ASTM C 144. Clean, sharp sand free of loam, silt, soluble salts, organic matter, or other deleterious substances.
      a. Use a custom blend of sands to match historic mortar texture and color or as directed by the Architect or Director's Representative.
      b. Sieve and mix sands to achieve color and texture match.
   7. Water: Clean, potable and free of excessive minerals or compounds detrimental to mortars and masonry units.
   8. Admixtures: None permitted.

D. Mortar Mix for Stone Masonry (North Wing – Color 2): Use ONLY Natural Hydraulic Lime mortar mix on building masonry conforming to European Norms (EN459), achieving a

compressive strength of not more than 250 psi after 28 days and 900 psi at 12-months, and conforming to the following proportions (by volume):
1. 1 part Natural Hydraulic Lime NHL3.5
2. 2.5 parts sand.
3. Small bits (“blebs”) of cured lime putty mixed in

E. Mortar Color: Color to match adjacent mortar on existing building.

F. Scratch Coat Mortars: Scratch coat mortars for application directly to metal lath.
1. Site-Mixed: ASTM C270, Type N, using the Proportion Method.

**2.03 ACCESSORIES - ANCHORED VENEER**

A. Horizontal Joint Reinforcement: Truss type; stainless steel wire complying with ASTM A580/A580M Type 304, 3/16 inch diameter side rods with 0.1483 inch diameter cross ties.

B. Wall Ties: Formed steel wire, at least ___ inch diameter, stainless steel complying with ASTM A580/A580M, eye and pintle type, with provision for vertical adjustment after attachment.

C. Flashings: As specified in Section 07 62 00.

D. Weep/Cavity Vents: Polyethylene tubing.

**2.04 STONE FABRICATION - ANCHORED VENEER**

A. Bed and Joint Surfaces:
1. Cut or sawn full square for full thickness of unit.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify that support work and site conditions are ready to receive work of this section.
1. Per ASTM C1242, exterior walls to receive thin natural stone veneers should be designed with a stiffness ratio of L/1000 minimum.

B. Verify that substrates to receive mortar scratch coat or setting bed comply with stone veneer manufacturer's instructions.
1. Concrete Masonry: Verify joints are cut flush and surface is ready to receive mortar setting bed. Verify no bituminous or water repellent coatings exist on masonry surface.

**3.02 PREPARATION - ANCHORED VENEER**

A. Establish lines, levels, and coursing. Protect from disturbance.

**3.03 INSTALLATION - ANCHORED VENEER**

A. Size stone units to fit opening dimensions and perimeter conditions.

B. Maintain stone coursing to match existing conditions (Manor Hall).

C. Arrange stone coursing in running bond with consistent joint width.

D. Set stone in full mortar setting bed to fully support stone over bearing surface. Use setting buttons or shims to maintain correct joint width.

E. Install weep/cavity vents in vertical stone joints per manufacturer's instruction; immediately above horizontal flashings, above shelf angles and supports, and at top of each cavity space; do not permit mortar accumulation in cavity space.

**3.04 REINFORCEMENT AND ANCHORAGE - ANCHORED VENEER**

A. Install horizontal joint reinforcement 16 inches on center.

B. Place horizontal joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place joint reinforcement continuous in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. In addition, place wall ties at maximum 3 inches on center each way around perimeter of openings, within 12 inches of openings.

**3.05 INSTALLATION - WATER-RESISTIVE BARRIER**

A. Where required by thin stone veneer fabricator's instructions or by local codes, install two layers of water-resistive barrier in accordance with water-resistive barrier manufacturer's instructions. Integrate water-resistive barrier with all flashing accessories, adjacent water-resistive barriers, doors, windows, penetrations, and cladding transitions.

**3.06 INSTALLATION - MASONRY FLASHINGS**

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

**3.07 CONTROL AND EXPANSION JOINTS**

A. Form joints as detailed on drawings and per manufacturer's isntructions.

**3.08 TOLERANCES**

A. Install masonry within the site tolerances found in TMS 402/602.

**3.09 CLEANING**

A. Remove excess mortar as work progresses, and upon completion of work.

B. Use non-metallic tools in cleaning operations.

**3.10 PROTECTION**

A. During temporary storage on site, at the end of working day, and during rainy weather, cover stone work exposed to weather with non-staining waterproof coverings, securely anchored.

**END OF SECTION**

# SECTION 04 90 00

# MASONRY RESTORATION

## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

A. Construction Drawings apply to this Section.

B. 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 masonry repair and restoration work as indicated on the Drawings:
   1. Brick Masonry repointing and repair.
   2. Stone Masonry repointing, restoration, and reconstruction
   3. Composite Mortar repair of brick.
   4. Composite Mortar repair of Brownstone
   5. Cleaning of Masonry

B. Related Sections:
   1. Section 02 10 00 Selective Demolition, Removals and Salvage

### 1.3 REFERENCES

A. ASTM C144: Standard Specification for Aggregate for Masonry Mortar

B. ASTM C150: Standard Specification for Portland Cement

C. ASTM C207: Standard Specification for Hydrated Lime for Masonry Purposes

D. BIA Technical Note 8A (M1-88): Standard Specification for Portland Cement-Lime Mortar for Brick Masonry.

### 1.4 SUBMITTALS

A. Qualification Data: Submit qualifications of the masonry contractor and masonry restoration specialist to establish that they meet the requirements specified in the Quality Assurance article.

B. Product Data:
   1. Portland cement.
   2. Lime and/or Natural Hydraulic Lime (NHL)
   3. Pre-mixed mortars (if used)
   4. Composite Patching Mortars

C. Samples: Mortar
   1. Mortar: Cured samples set in ½-inch by 6-inch plastic or aluminum channels. One sample for **each** mortar mix required. Note that **four (4)** distinct custom mortar mixes are required for the Work.
   2. Sand: Provide one pound of each type and grade of sand specified. Include sieve analysis with each sample.

## 1.5 QUALITY ASSURANCE

A. Masonry Contractor: The Contractor for the Work of this Section shall be regularly engaged in the restoration of historic masonry, including use of materials and techniques for removing mortars and masonry units and applying patching compounds. In the acceptance or rejection of the Work of this Section, no allowance will be given for lack of skill on the part of any worker.

B. Masonry Restoration Specialist: Engage a mason for the Work of this Section who is specially trained in the restoration of historic masonry and who has at least five years experience in repointing and patching brick and stone masonry.
   1. All cutting (raking), pointing, brick removal and resetting, work shall be performed exclusively by the approved masonry restoration specialist.
   2. The use of unskilled or semi-skilled laborers for the Work of this Section shall be limited to carting and mixing materials.

C. Masons, Installers, or Field Supervisors: *Must be certified by the material supplier to install the specified brick and stone composite repair mortars* in Part 2.3 of this section. All personnel involved with the work of this Section shall provide individual certificates to the Director's Representative documenting the successful completion of required training by the material manufacturer.

## 1.6 QUALITY CONTROL

A. Field Samples (Mock-Ups):
   1. Prepare field samples at locations designated by the Director's Representative. Do not proceed further with the Work of this Section until field samples are approved.
      a. Engage the approved Masonry Restoration Specialist to prepare the field samples.
      b. Utilize only approved materials and methods. Comply with product manufacturer's instructions and other requirements of this Section to prepare field samples.
   2. Cure field sample for 72 hours prior to review by the Director's Representative or Architect.
   3. Field sample must demonstrate full range of variability in color, texture, and tooling of mortar joint.
   4. Approved field samples will be used as quality control standards for acceptance or rejection of the Work of this Section.
      a. Maintain and protect approved field samples from damage, deterioration, or alteration for the duration of the Contract.
   5. Field Sample Sizes:
      a. Brick masonry repointing: 1' by 2' section
      b. Stone masonry repointing 2' x 2' section
      c. Brick composite mortar patch: 1 brick
      d. Brownstone composite mortar patch 1 sample

B. Material Container Labels: Material containers shall bear the manufacturer's label indicating manufacturer's name, trade name of product, lot number, shelf life of product, and mix ratio (if applicable).

C. Source of Materials: Obtain materials for masonry restoration from a single source for each type of material required to ensure a match in quality, color, and texture.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaged Products:
   1. Deliver materials to the site in manufacturer's original, sealed containers. Do not deliver materials which have exceeded shelf life limitation set forth by the manufacturer.
   2. Comply with manufacturer's printed instructions for storing and protecting materials.
   3. Protect packaged products from water, dampness and high humidity.

B. Bulk Aggregate: Store in a manner which will keep aggregate clean and protected from the weather elements.
   1. Keep different colored aggregates segregated.

C. Discard and remove from the site any deteriorated or contaminated materials.

## 1.8 ENVIRONMENTAL CONDITIONS

A. General: Perform work only when surface and ambient air temperatures, relative humidity and other conditions comply with the manufacturer's printed instructions and the requirements of this Section. In the event of conflicting instructions or directions, the more stringent requirements shall apply.
   1. Do not apply materials to surfaces coated with frost or ice.
   2. Protect materials from excessively rapid drying or curing.

B. Pointing and Setting Mortars (Portland cement-Lime-sand mixes): Do not mix or use mortars when surface or ambient air temperature is below 40 degrees F, or when the air temperature is forecasted to drop below 40 degrees F within 72 hours after filling mortar joints.
   1. Remove and replace mortar that has been damaged by freezing.

C. Pointing and Setting Mortars (Natural Hydraulic Lime mixes): Do not mix or use mortars when surface or ambient air temperature is below 40 degrees F, or when the air temperature is forecasted to drop below 40 degrees F for three (3) weeks after filling mortar joints.
   1. Natural Hydraulic Lime (NHL) mortars have a longer curing time than Portland cement mortars. Work using NHL mortar must be scheduled when the risk of frost or freezing is minimal.

# PART 2 PRODUCTS

## 2.1 MORTAR

A. Materials:
   1. Portland cement: ASTM C 150, Type I, non-staining.
      a. Use only ***white*** Portland cement for building mortar.
      b. Do not use masonry cement.
   2. Lime: Hydrated ASTM C 207, Type S, *or* Lime Putty, ASTM C 1489.
   3. Natural Hydraulic Lime: High calcium NHL3.5 conforming to European Norms (EN 459).
      a. Edison Coatings, Inc., Biolime, NHL3.5
      b. Limeworks.us, St. Astier NHL3.5
      c. U.S. Heritage Group, Otterbein – Calcidur NHL3.5
   4. Sand: ASTM C 144. Clean, sharp sand free of loam, silt, soluble salts, organic matter, or other deleterious substances.
      a. Use a custom blend of sands to match historic mortar texture and color or as directed by the Architect or Director's Representative.
      b. Sieve and mix sands to achieve color and texture match.
   5. Water: Clean, potable, and free of excessive minerals or compounds detrimental to mortars and masonry units.
   6. Admixtures: None permitted.

B. Mortar Mix for Brick Masonry: Use ONLY Natural Hydraulic Lime mortar mix on building masonry conforming to European Norms (EN459), achieving a compressive strength of not more than 200 psi after 28 days, and 600 psi at 12=months and conforming to the following proportions (by volume):
   1. 1 part Natural Hydraulic Lime NHL3.5
   2. 3 parts sand.

C. Mortar Mix for Stone Masonry (South Wing – Color 1)): Use ONLY Natural Hydraulic Lime mortar mix on building masonry conforming to European Norms (EN459), achieving a compressive strength of not more than 250 psi after 28 days and 900 psi at 12-months, and conforming to the following proportions (by volume):
   1. 1 part Natural Hydraulic Lime NHL3.5
   2. 2.5 parts sand.
   3. Small bits ("blebs") of cured lime putty mixed in

D. Mortar Mix for Stone Masonry (North Wing – Color 2): Use ONLY Natural Hydraulic Lime mortar mix on building masonry conforming to European Norms (EN459), achieving a compressive strength of not more than 250 psi after 28 days and 900 psi at 12-months, and conforming to the following proportions (by volume):
   1. 1 part Natural Hydraulic Lime NHL3.5
   2. 2.5 parts sand.
   3. Small bits ("blebs") of cured lime putty mixed in

E. Mortar Mix for Brownstone Masonry Steps : Use ONLY Natural Hydraulic Lime mortar mix on building masonry conforming to European Norms (EN459), achieving a compressive strength of not more than 250 psi after 28 days and 900 psi at 12-months, and conforming to the following proportions (by volume):
   1. 1 part Natural Hydraulic Lime NHL3.5
   2. 2.5 parts sand.

F. Measuring and mixing of mortar:
   1. Measure mortar ingredients carefully so that proportions are controlled and maintained throughout all work periods. Use containers of known volume. Do not measure by shovel.
   2. Mix cementitious materials and aggregate for at least (5) minutes by hand in a clean tub or drum mixer, adding the minimum amount of water consistent with proper workability.
   3. Where mortar has lost water content due to evaporation, re-tempering is permitted *only* within 1-1/2 hours of initial mixing.

F. Proportioning of Mortar:
   1. Proportion masonry mortars by volume as indicated above and in accordance with requirements of ASTM C270.

G. Pre-Mixed Mortars
   1. Where type O mortar, or mortar for brick masonry is specified, the Contractor may substitute a natural hydraulic lime or lime putty premixed mortar meeting all the requirements of Type O mortar using NHL 2 “feebly hydraulic lime” or NHL3.5 “moderately hydraulic lime”, subject to approval by the Director’s Representative.
   2. Provide one of the following, or approved equal:
      a. Edison Coatings, Inc., Biomix 20. www.edisoncoatings.com
      b. US Heritage Group, Heritage Lime Putty Mortar – Type O. www.usheritage.com

H. Pre-Mixed Mortar – Type N.
   1. Where type N mortar is specified, the Contractor may substitute a natural hydraulic lime premixed mortar mix meeting all the requirements of Type N mortar using NHL3.5 “moderately hydraulic lime, subject to approval by the Director’s Representative.
   2. Provide one of the following, or approved equal:
      a. Edison Coatings, Inc., Biomix 35. www.edisoncoatings.com
      b. Limeworks.us, Ecologic DGM50. www.limeworks.us
      c. US Heritage Group, Hydraulic Lime Mortar 3.5. www.usheritage.com
   3. Custom Colors: Note that at least four (4) distinctive colors shall be required for repointing and setting mortars.

## 2.2 MATERIALS NOT PERMITTED

A. The use of anti-freeze, air-entraining or other substances which will alter the setting or bonding properties of the mortar shall not be permitted.

B. Pre-Packaged Mortar Mixes containing masonry cement are not permitted.

## 2.3 COMPOSITE REPAIR MORTARS - BRICK

A. Composite repair mortar shall be used for the repair of damaged surfaces of exposed brick: Use a permeable single-component custom formulated mortar *or* two-component latex modified custom formulated mortar designed specifically for the repair and restoration of brick or terra cotta, attaining a 28 day compressive strength of 1500 to 2200 psi.
   1. Custom color shall match cleaned sample of existing brick.

B. Composite repair mortars shall be supplied by a manufacturer regularly engaged in supplying custom-formulated mortars for patching masonry on historic properties. Acceptable products include the following, or approve equal:
   1. Jahn M-100 Terra Cotta/Brick by cathedral Stone Products, Inc. www.cathedralstone.com
   2. Custom System 45-BR by Edison Coatings, Inc. www.edisoncoatings.com

## 2.4 COMPOSITE REPAIR MORTAR – BROWNSTONE

A. Composite repair mortar shall be used for the repair of damaged surfaces of exposed brownstone: Use a permeable single-component custom formulated mortar or two-component latex modified custom formulated mortar designed specifically for the repair and restoration of brownstone and sandstone, attaining a 28 day compressive strength of 1800 to 2700 psi.
   1. Custom color to match cleaned sample of existing brownstone.

B. Composite repair mortars shall be supplied by a manufacturer regularly engaged in supplying custom-formulated mortars for patching masonry on historic properties. Acceptable products include the following, or approve equal:
   1. Jahn M-70 Brownstone/Limestone/Sandstone by cathedral Stone Products, Inc. www.cathedralstone.com
   2. Custom System 45-SD by Edison Coatings, Inc. www.edisoncoatings.com

## 2.5 BRICK

A. Provide replacement brick, either salvaged or new where quantity of salvaged existing historic brick is inadequate to complete rebuilding and restoration work.
   1. Manor Hall: Where exposed, DO NOT use modern commercial brick or cored brick to match hand-made colonial era bricks. Use only salvaged solid bricks of similar dimensions and color.
   2. Caretaker's Cottage: Brick to be standard size (2-1/4" x 3-5/8" x 8") face brick, ASTM C216 or building brick, ASTM C62, SW (for severe weathering exposure). Use only solid or frogged bricks per ASTM C216/62. Cored bricks will not be permitted.

## 2.6 MISCELLANEOUS TOOLS AND EQUIPMENT

A. Joint Preparation (Raking): Use only hand tools for all raking and cutting work. Do not use drills, masonry saws or grinders.
   1. Chisels: Use fine, sharp splitter, cape or plugging chisels with a maximum blade thickness of 1/2 the width of the mortar joint.

B. Bedding/Tooling Joints: long, thin, tuckpointers no broader than 3/4 of the width of the mortar joint.
   1. Use contoured tuckpointers to reproduce special joint profiles.

C. Air Compressor: Outfitted with filters to remove water, oil and abrasive particles from air used to power tools or clean debris out of masonry joints.

D. Moisture Retaining Cover: Provide one of the following, complying with ASTM C 171.
   1. Waterproof paper, non-staining.
   2. Polyethylene film.
   3. Polyethylene-coated burlap.

E Cleaning:
   1. For heavy soiling, Biological and atmospheric staining: Use D/2 Architectural Biocide (D/2 Biological Solutions, Inc., www.d2bio.com)
   2. Non-ionic surfactant detergents
   3. Stiff natural fiber or nylon bristle brushes only. Use of wire brushes is *strictly prohibited*.

# PART 3 EXECUTION

## 3.1 EXAMINATION

A. Visually inspect and note the condition of masonry and mortar joints and surfaces at areas indicated on the Drawings and at other locations where deterioration may exist.
   1. Probe deteriorated surfaces to assess the extent of damage.

B. Review findings and establish the extent of repairs with the Director's Representative or Architect prior to commencing the Work of this Section.

## 3.2 PROTECTION

A. Cover and protect adjacent surfaces from airborne dust and debris with suitable drop cloths, barriers or other protective devices.
   1. Protect glass, sills and ledges from damage caused by flying debris or dropped tools.
   2. Protect roof surfaces from mortar droppings and flying debris or dropped tools.

B. Protect surface of masonry not being worked on at all times during and after installation to prevent damage, deterioration, staining or freezing of masonry construction.

C. Collect and properly dispose of debris resulting from joint or surface preparation work at the end of each day.

## 3.3 COORDINATION

A. Coordinate removal and installation of cap (counter) flashing with repointing work.
   1. Fill raggle with lead wedges and lead wool. Do not fill with mortar.

B. Masonry Restoration should be performed ***after*** low-pressure washing and scrubbing.

## 3.4 MASONRY REPOINTING

A. Preparing Joints:
   1. Remove mortar from joints to a depth of 1-1/2 times the joint width or until sound mortar, whichever is less, but not less than 3/4-inch deep.
   2. Remove mortar with sharp chisels using hand tools only. Pneumatic air hammers, drills, saws and grinders are not permitted, *except as noted below*.
      a. Sharpen chisels frequently to prevent chipping.
      b. Work from existing voids toward sound mortar to prevent chipping. Do not drive or wedge chisels directly into full mortar joints or pry against masonry units.
      c. Use hand tools exclusively to clean mortar from surfaces of masonry units that will remain.
      d. *Rotary grinders may be used only to score the center of horizontal joints in brick masonry where hand tools or chisels are not effective. Written permission is required prior to use of any power tools to remove mortar.*
      e. *Pneumatic air chipping hammers may be used only on stone masonry with existing Portland cement mortars where hand tools are ineffective. The Contractor shall take extreme care when using power tools to avoid chipping*

*and marring the surface of historic masonry units. Written permission is required prior to use of any power tools to remove mortar.*

3. Do not damage faces or edges (arrises) of stone or brick masonry units that are to remain. If the Contractor's methods are damaging masonry units, all mortar removal work shall cease and not resume until such methods are adjusted to meet the quality standard of the approved field sample.
   a. Repair or replace stone or brick masonry units that are damaged by mortar removal operations at no additional cost.
4. Thoroughly clean mortar from all surfaces of adjoining masonry units so that new mortar will be in direct contact with masonry units.
   a. Remove dust and debris from within joints using compressed air.
5. Cut edges of sound mortar to create surfaces that are roughly perpendicular and uniform. Do not leave feathered edges or deep undercuts that might interfere with proper filling of the joint or bonding between new and old mortar.

B. Mixing Mortar: Combine mortar materials in a clean tub and mix thoroughly by hand. Use only enough water as necessary to obtain a workable, plastic mixture that adheres, without sagging, to a trowel.
1. Two mortar mixes are required as indicated in Part 2.1 of this Section, for use on this project. Differences in mortar mixtures shall be limited to variations in the percentages of cement, lime and sand:
   a. Type N: Stone masonry
   b. Type O: Brick Masonry
2. Measure all materials by volume; do not measure by shovel.
3. Prepare mortar in quantities that can be placed before mortar starts to set. Do not re-temper mortar. Discard mortar that has begun to set prior to placement.

C. Pre-Wetting: Thoroughly wet surfaces of masonry units that will be filled with mortar a minimum of 24 hours prior to and immediately before beginning pointing work. Surfaces of masonry units shall be damp but free of any standing water.

D. Pointing (Filling) Joints:
1. Tightly pack mortar into joints in layers and without any voids using narrow pointing trowels that fit within the mortar joint. Do not bag fill or slush grout joints.
   a. Fill deep recesses to a uniform depth with adjoining areas before installing final layer of mortar.
   b. Promptly remove splatters or smears from exposed masonry surfaces with a trowel and clear water.
2. When pointing work within a repaired area will extend beyond one day, or other delay in the work, stagger layers of mortar so that

there are no through joints in pointing. Stagger joints in layers so that joints are at least 3 inches apart.

E. Tooling Joints:
1. Tool joints after final layer has become "thumbprint" hard.
2. Produce joints with profiles that match original mortar joints or as specified herein.
   a. Near-flush Joint**:** At coursed rubble masonry, raked slightly to reveal arises of stone.
   b. Ruled or Scribed Joint: At brick masonry, matching existing
3. Firmly compress mortar so that it forms a dense, smooth and uniform surface free of voids. Do not overwork joint surface; excessive tooling will draw binder to the surface and may cause powdering or surface scaling. Improperly tooled joints will be rejected.
4. Do not spread mortar over edges or onto exposed surfaces of masonry units. Do not featheredge mortar over adjacent sound mortar.
5. Approximately When thumbprint hard, before joints have fully cured, lightly brush or pat tooled joints with a soft fiber brush to produce a slight stippled surface texture, exposing aggregate, similar to weathered joints.

F. Curing:
1. Keep freshly pointed joints damp for a minimum of 72 hours after placement with a moisture-retaining covering. Do not apply water directly to mortar. Place covering against joints and masonry without fasteners and without damaging the tooled joint or adjacent masonry. Extend covering at least six inches beyond perimeter of repair.
2. Maintain environmental conditions specified above until mortar has fully cured.

G. Cleaning and Adjustment:
1. Within 48 hours after placing mortar, clean stone masonry surfaces to remove mortar stains and smears.
   a. Use wooden scrapers or short fiber bristle brushes and clean, potable water to remove residues without damaging mortar or masonry.
   b. Do not use wire brushes.
   c. Do not use chemical cleaners or an acid wash.
2. Repair cracks, holes and other defects in the finished surface of pointed joints within 72 hours of initial placement.

H. Defective Work
1. Cut out and replace defective masonry as indicated by the Director’s Representative and at no additional cost to the State.
2. Clean and repoint repairs as required.

## 3.5 MASONRY REBUILDING - BRICK

A. Dismantling
   1. Carefully dismantle by hand brick masonry in areas indicated on plans, using only hand tools such as sharp-pointed chisels. Avoid damage to other existing areas. Remove brick masonry in whole units. DO NOT saw cut brick masonry where openings are altered or created.
   2. Remove bricks so new brick can key into existing work unless otherwise indicated, matching the coursing and bond of the original work. Remove all deteriorated, damaged or cut bricks at perimeter of area indicated to be rebuilt in order to bond new brickwork to existing.

B. Salvage
   1. Clean mortar from bricks for salvage and reuse. Obtain maximum amount of whole bricks possible for reuse.
   2. Identify and salvage for reuse as possible all original bricks on site. Use salvaged bricks in areas exposed to the exterior and where most visible first, with best face exposed where visible.
   3. Limit use of new brick to areas concealed from view and chimney reconstruction.

C. Bricklaying
   1. Wet or soak brick before installing so that bricks are nearly saturated but surface dry when laid.
   2. Lay brick in bond pattern to match existing or original. Match coursing and wall thickness.
      a. Do not shove or pound units into place.
      b. Do not slush head joints.
   3. Tooth brickwork into existing work at locations where walls are indicated to be rebuilt.
   4. Lay up brick masonry level and plumb in full beds of mortar except where matching existing line and level at existing construction which is not level and plumb.
   5. Lay brick masonry so that each course shall key into and be flush with existing work.
   6. Insure accurate size of masonry openings to fit window and door frames.
   7. Use wooden arch centering to produce appropriate radius for segmental arches.

D. Lintels & Wood Inserts.
   1. Install lintels, sills, headers, blocking, etc. imbedded in masonry walls as walls are being erected so that they are set in a full mortar bed.

E. Mixing Mortar, Tooling, Curing, Cleaning and Adjustment, Defective Work:
   1. Comply with Specifications for Masonry Repointing above.

## 3.5 MASONRY REBUILDING - STONE

A. General
   1. Rebuild stone masonry in locations indicated on Drawings and as required using salvaged stone units and new stone units where no salvaged stone units are available. Use all care necessary to avoid damaging stone units. Repair and replace stone units damaged during work of this Section as directed by Director's Representative or Architect at no additional cost.

B. Dismantling
   1. Carefully dismantle by hand stone masonry in areas indicated on plans, using only hand tools such as sharp-pointed chisels. Avoid damage to other existing areas. Remove stone masonry in whole units. DO NOT saw cut stone masonry where openings are altered or created.
   2. Use of Pneumatic and Electric Tools: Use of pneumatic and electric chisels and grinders will be permitted on the dismantling stone masonry *ONLY where laid in Portland cement mortars* where hand tools are ineffective and where the Contractor demonstrates to the Director's Representatives satisfaction that pneumatic and electric tools can be used without damage to masonry units.
   3. Remove stones so new stones can key into existing work unless otherwise indicated, matching the coursing and bond of the original work.

C. Salvage
   1. Clean mortar from stones for salvage and reuse.
   2. Salvage for reuse as possible all original stones on site. Place stones on a pallet and store on site for re-installation.

E. Laying stone in mortar:
   1. Wet or soak stones before installing so that they are nearly saturated but surface dry when laid.
   2. Match original bonding pattern, coursing, and wall thickness.
      a. Do not shove or pound units into place.
      b. Do not slush head joints.
   3. Tooth stonework into existing work at locations where walls are indicated to be partially rebuilt.
   4. Lay up stone masonry to original level and plumbness in full beds of mortar except where matching existing line and level at existing construction which is not level and plumb.
   5. Lay stone masonry so that each course shall key into and be flush with existing work.
   6. Install a mortar cap with a slight crown for positive drainage.

G. Mixing Mortar, Tooling, Curing, Cleaning and Adjustment, Defective Work:
   1. Comply with Specifications for Masonry Repointing above.

## 3.6 BROWNSTONE RESTORATION

A. General:
   1. Handling Stones: Use nylon straps for lifting large stones. Avoid use of prybars and metal tools in lifting and handling stones. Use nylon or wood wedges in setting stones. Use rubber mallets to tap and adjust stones into place
   2. Store stones on wood pallets or skids and separate stones with wood blocking or wedges to prevent stone-to stone contact.

A. Preparation: Re-Setting Brownstone Steps
   1. Remove and salvage brownstone stair treads
   2. Install temporary shoring to support landing stones.
   3. Clean mortar from substrate. Re-set or repoint any damaged masonry in substrate.
   4. Install through-wall flashing over substrate/foundation.

B. Repair and Reset Brownstone
   1. Clean all stone before setting. Remove old mortar from salvaged stone and scrub stone with non-ionic detergent and water using stiff natural bristle brushes. Thoroughly rinse all stone with clean water.
   2. Prep stones and install small composite repairs in deep voids per composite mortar manufacturer's instructions. Let cure prior to handling stones
   3. Re-install stone stair treads on setting mortar in original locations and orientation. as indicated on drawings.
   4. Repoint joints in stone masonry. Follow specifications for repointing stone masonry.

## 3.7 COMPOSITE REPAIR MORTARS

A. General: Comply with manufacturer's written recommendations.
   1. Prior to preparation, determine the limits of composite mortar patching with the Architect or Director's Representative.

B. Preparation
   1. Where patching adjacent to joints, completely remove mortar from joints, patch brick to original form, allow patching material to cure for at least 7 days before pointing.
   2. Carefully remove friable and deteriorated brick/sone. Remove additional sound brick/stone where required to achieve a minimum depth of patch of ¼". Do not use hammer drills or other percussive tools to avoid damage from vibration. Take all precautions to protect sound portions of units being patched and adjacent masonry units from damage during preparation for patching.
   3. Anchors: For deep repairs, drill holes in brick using a rotary drill and insert lead shields and stainless steel screws. Drill holes and insert screws to a depth that will allow at least 3/8" of cover with patching material.

4. Cleaning: Flush all loose material with water or air pressure. Clean surface to receive patch free of dust, dirt, oil, grease and other contaminants or coatings that might adversely affect adhesion of patching material to the substrate.

C. Application
1. Wetting: Thoroughly rinse surfaces with clean water to ensure that substrate will not rapidly absorb water from composite patching material.
2. Provide a built-up system starting with a thin slurry coat followed by several scratch coats (number determined by depth of patch) and finish coat in accordance with manufacturer's recommendations.
3. Surface of patch is to **match plane and profile of original bricks or stone. Do not use patching material in mortar joints, but repoint joints separately.**
4. Cured patch surface must match the original/cleaned brick or stone color and texture.
5. Remove excess patching material from masonry surfaces to leave clean, without streaks or stains.

## 3.7 CLEANING

A. Keep surfaces clean by removing excess mortar and patching material before they fully cure and as the Work progresses.
1. Use wooden scrapers or short fiber bristle brushes and clean, potable water to remove residues without damaging mortar or masonry.
2. Do not use wire brushes.
3. Do not use chemical cleaners or an acid wash

**END OF SECTION**