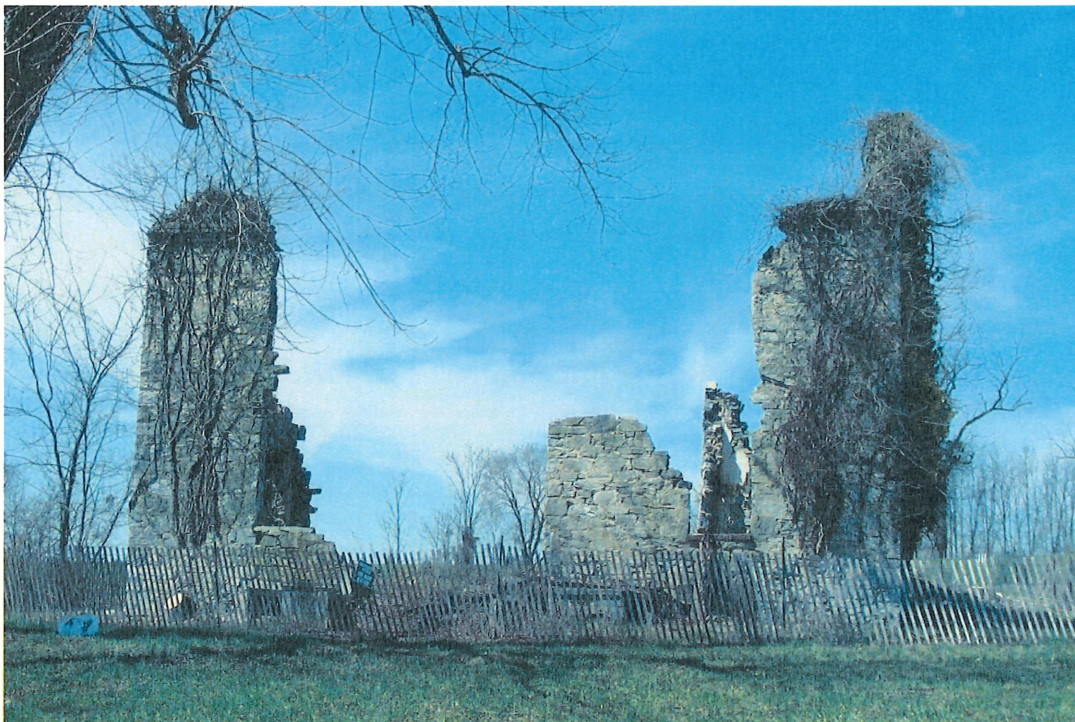


STABILIZE HISTORIC ALLSTADT/MOLER HOUSE RUINS

PMIS 136976

Harpers Ferry National Historical Park
Harpers Ferry, West Virginia

LONG TERM STABILIZATION DOCUMENTS



HISTORIC PRESERVATION TRAINING CENTER

Department of Interior
National Park Service
4801A Urbana Pike
Frederick, MD 21704





SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.
- B. Cast-in-place concrete includes the following:
 - 1. Foundations and footings.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, water stops, joint systems, curing compounds, dry-shake finish materials, and others if requested by CO/COTR.
- C. Shop drawings for reinforcement prepared under the supervision of a Professional Structural Engineer registered in West Virginia detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 and ACI Detailing Manual SP-66, showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.
- D. Samples of materials as requested by CO/COTR, including names, sources and descriptions, as follows:
 - 1. Color finishes.
 - 2. Normal weight aggregates.
- E. Laboratory test reports for concrete materials and mix design test.
- F. Material certificates in lieu of material laboratory test reports when permitted by the CO/COTR. Manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements, shall sign material certificates. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

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1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
 1. Use one brand of cement throughout Project unless otherwise acceptable to the CO/COTR.
- B. Fly Ash: ASTM C 618, Type F.
- C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.
 1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
 2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to the CO/COTR.
- D. Lightweight Aggregates: ASTM C 330.
- E. Water: Potable.
- F. Fiber Reinforcement: Polypropylene fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116, Type III, not less than $\frac{3}{4}$ inches long.
- G. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.
- H. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- I. Water-Reducing Admixture: ASTM C 494, Type A.
- J. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.
- K. Water Reducing, Accelerating Admixture: ASTM C 494, Type E.
- L. Water Reducing, Retarding Admixture: ASTM C 494, Type D.

2.4 RELATED MATERIALS

- A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9-oz./sq. yd., complying with AASHTO M 182, Class 2.
- B. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

- E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
1. Reinforced foundation systems: Not less than 1 inch and not more than 3 inches .
 2. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2 - 3 inch slump concrete.
- F. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by the CO/COTR. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the CO/COTR before using in Work.

2.6 ADMIXTURES

- A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
- B. Use high-range water-reducing admixture in pumped concrete and concrete with water-cement ratios below 0.50.
- C. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:
1. Concrete structures exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:
 - a. 4.5 percent (moderate exposure); 5.5 percent (severe exposure) for 1-1/2 inch maximum aggregate.
 - b. 4.5 percent (moderate exposure); 6.0 percent (severe exposure) for 1 inch maximum aggregate.
 - c. 5.0 percent (moderate exposure); 6.0 percent (severe exposure) for 3/4 inch maximum aggregate.
 - d. 5.5 percent (moderate exposure); 7.0 percent (severe exposure) for 1/2 inch maximum aggregate.
 2. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener. 2 to 4 percent air.
- D. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.7 CONCRETE MIXING



3.3 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by the CO/COTR.
- D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

3.4 INSTALLING EMBEDDED ITEMS

- A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.



3.5 PREPARING FORM SURFACES

- A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.
- B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Do not pour concrete until concrete inspector has approved reinforcing steel and formwork. Provide a minimum of 24 hours notice of all required inspections.
- B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.



3.7 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than 7 days.
- C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.
- D. Provide moisture curing by the following methods:
 - 1. Keep concrete surface continuously wet by covering with water.
 - 2. Use continuous water-fog spray.
 - 3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch lap over adjacent absorptive covers.
- E. Provide moisture-retaining cover curing as follows:
 - 1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- F. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:
 - 1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within two hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - 2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.
- G. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.



3.8 REUSING FORMS

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3. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
 4. When total quantity of a given class of concrete is less than 50 cu. yd., the CO/COTR may waive strength testing if adequate evidence of satisfactory strength is provided.
 5. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
 6. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
- E. Inspection. Inspection agency shall use contract documents and approved shop drawings and approved amendments to inspect all reinforcement for correct size, location, spacing, cleanliness, cover and splice lengths.
- F. Inspection: Inspection reports shall be submitted within one week and shall include deficiencies noted and corrective action taken.
- G. Test results shall be reported in writing to the CO/COTR, ready-mix producer, and Contractor within 24-hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28-days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
- H. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- I. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the CO/COTR. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.
- J. Certification: the Contractor's testing and inspection agency shall submit a letter of certification stamped and sealed by the registered professional engineer responsible for all inspection and testing work specified herein, certifying that all cast-in-place concrete has been constructed in accordance with the contract documents and approved shop drawings and approved amendments.

END OF SECTION 03300



SECTION 04200 - UNIT MASONRY

PART 1 - GENERAL

A. RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Brick unit masonry.
2. Masonry waste disposal.

1.3 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following installed compressive strengths (f_m) at 28 days.

1. For Brick Unit Masonry: As follows, based on gross area:

- a. $f_m = 2000$ psi.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and (ACI 530.1/ASCE 6) Sections 1.4, 2.1.2, 3.1.2, and 4.1.2.

B. Product data for each different masonry unit, accessory, and other manufactured product specified.

C. Samples for initial selection of the following:

1. Unit masonry samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.

D. Samples for verification of the following:

- a. Full-size units for each different exposed masonry unit required showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.

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- 2. Masonry mortar samples for each color required showing the full range of colors expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on the Project.
 - 3. Accessories embedded in the masonry.
- E. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to specifically identify exact materials used. Include mix proportions for mortar and grout and source of aggregates.
- 1. Submittal is for information only. Neither receipt of list nor acceptance of mockup constitutes approval of deviations from Contract Documents unless such deviations are specifically brought to the attention of the Contracting Officer and approved in writing.
- F. Material certificates for the following, signed by manufacturer and Contractor, certifying that each material complies with requirements.
- 1. Each different cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
 - 2. Each type and size of joint reinforcement.
- G. Material test reports from a qualified independent testing agency, employed and paid by Contractor or manufacturer, indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:
- 1. Mortar complying with property requirements of ASTM C 270.
 - 2. Grout mixes. Include description of type and proportions of grout ingredients.
 - 3. Masonry units.
- H. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

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- A. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Contracting Officer's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM C 1093, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
 - B. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one source and by a single manufacturer for each different product required.
 - C. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Mockup: Prior to installing unit masonry, construct sample wall panels to verify selections made under sample submittals and to demonstrate aesthetic effects as well as other qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

1. Locate mockups on site in the locations indicated or, if not indicated, as directed by Contracting Officer.
2. Build mockup of typical wall area as shown on Drawings.
3. Build mockups for the following types of masonry in sizes approximately 48 inches long by 48 inches high by full thickness, including face and back-up wythes as well as accessories.
4. Clean exposed faces of mockups with masonry cleaner indicated.
5. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
6. Notify Contracting Officer one week in advance of the dates and times when mockups will be constructed.
7. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - a. Acceptance of mockups is for color, texture, and blending of masonry units; relationship of mortar colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Contracting Officer in writing.
 - b. Acceptance of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Contracting Officer in writing.
 - c. When directed, demolish and remove mockups from Project site.
 - d. Accepted mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle in accordance with (ACI 530.1/ASCE 6) Sections 2.1.4, 3.1.3, and 4.1.4.



1.7 PROJECT CONDITIONS

- A. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt on completed masonry.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen sub grade or setting beds. Remove and replace unit masonry damaged by frost or freezing conditions. Comply with the following requirements:
1. Cold-Weather Construction: No cold weather construction is permitted.
 2. Cold-Weather Protection: When the mean daily temperature is within the limits indicated, provide the following protection:
 - a. 40 to 25 deg F: Cover masonry with a weather-resistant membrane for 48 hours after construction.
 - b. 25 to 20 deg F: Cover masonry with insulating blankets or provide enclosure and heat for 48 hours after construction to prevent freezing. Install wind breaks when wind velocity exceeds 15 mi./h.
 - c. 20 deg F and Below: Provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 48 hours after construction.
 3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried out, but not less than 7 days after completion of cleaning.
- D. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade

and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and above.

PART 2 - PRODUCTS

2.1 BRICK

- A. All brick is to be existing brick salvaged from the site. New brick may be used if the quantity of salvaged undamaged bricks is not adequate to complete the work with the approval of the Contracting Officer.

2.2 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Brick:

- a. Acme Brick Company.
 - b. Belden Brick Company.
 - c. Cherokee Sanford Group, Inc.
 - d. Cushwa: Victor Cushwa & Sons, Inc.
 - e. D'Hanis Brick and Tile Company.
 - f. Endicott Clay Products Company.
 - g. Glen-Gery Corporation.
 - h. Henderson Brick.
 - i. Merry Brothers Brick & Tile Company.
 - j. Pacific Coast Building Products; Interstate Brick Division.
 - k. Robinson Brick Company.
 - l. Summit Brick & Tile.

- 5. Portland Cement, and Lime:

- m. Essroc Materials, Inc.

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- n. Glen-Gery Corporation.
 - o. Lafarge Corporation.
 - p. Lehigh Portland Cement Company.
 - q. Riverton Corporation (The).

2. Joint Reinforcement, Ties, and Anchors:

- a. Dur-O-Wal, Inc.
- b. Heckman Building Products, Inc.
- c. Hohmann & Barnard, Inc.
- d. Masonry Reinforcing Corporation of America.
- e. National Wire Products Industries.
- f. Southern Construction Products.

2.3 BRICK

A. General: Provide shapes indicated and as follows for each form of brick required.

- 1. Provide units without cores or frogs and with exposed surfaces finished for ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces.

B. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.

- 1. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
- 2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

C. Face Brick: ASTM C 216 and as follows:

- 1. Grade and Unit Compressive Strength: Provide units with grade and minimum average net-area compressive strength indicated below:
 - a. Grade: SW.
 - b. Not less than the unit compressive strengths required to produce clay masonry construction of compressive strength indicated.
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2. Initial Rate of Absorption: Between 5 and 20 g/30 sq. in. per minute when tested per ASTM C 67.
 3. Surface Coloring: Brick with surface coloring, other than flashed or sand-finished brick, shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet.
 4. Size: To match existing.
 5. Application: Use where brick is exposed, unless otherwise indicated.
 6. Where shown to "match existing," provide face brick matching color, texture, and size of existing adjacent brickwork.
 7. Color and Texture: Match Contracting Officer's samples.
 8. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

D. Building (Common) Brick: ASTM C 62 and as follows:

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1. Grade and Unit Compressive Strength: Provide units with grade and minimum average net-area compressive strength indicated below:
 - a. Grade: NW, MW, or SW.
 - b. Not less than the unit compressive strengths required to produce clay masonry construction of compressive strength indicated.
 2. Size: Bricks manufactured to the following actual dimensions within tolerances specified in ASTM C 216:
 - a. Match size of existing brick.
 3. Application: Use where brick is indicated for concealed locations.

2.4 MORTAR AND GROUT MATERIALS

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- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - B. Hydrated Lime: ASTM C 207, Type S.
 - C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.
 - D. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch, use aggregate graded with 100 percent passing the No. 16 sieve.
 1. White-Mortar Aggregates: Natural white sand or ground white stone.

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- E. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this Article; combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.
 - F. Water: Potable.
 - G. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

2.5 JOINT REINFORCEMENT

- A. General: Provide joint reinforcement formed from the following:
 - 1. Stainless-steel wire, ASTM A 580, Type 304 or 316
- B. For multiwythe masonry, provide type as follows:
 - 1. Ladder design with perpendicular cross rods spaced not more than 16 inches o.c.
 - 2. Truss design with continuous diagonal cross rods spaced not more than 16 inches o.c.
 - 3. Adjustable (2-piece) tab design with single pair of side rods and rectangular box-type cross ties spaced not more than 16 inches o.c., with side rods spaced for embedment within each face shell of back-up wythe and with separate adjustable ties engaging the cross ties and extended to engage the outer wythe by at least 1-1/2 inches and spaced not more than 16 inches o.c.
 - a. Use where horizontal joints of facing wythe do not align with those of back-up and where indicated.
 - b. Use where facing wythe is of different material than back-up wythe.



2.10 MASONRY CLEANERS

- C. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.
- D. Proprietary Chemical Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. 202 New Masonry Detergent; Diedrich Technologies, Inc.
 - b. 200 Lime Solv; Diedrich Technologies, Inc.
 - c. 202V Vana-Stop; Diedrich Technologies, Inc.

- d. Sure Klean No. 600 Detergent; ProSoCo, Inc.
- e. Sure Klean No. 101 Lime Solvent; ProSoCo., Inc.
- f. Sure Klean Vana Trol; ProSoCo, Inc.

2.6 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar indicated below:
 - 1. Limit cementitious materials in mortar to portland cement and lime.
 - 2. For masonry below grade, in contact with earth, and where indicated, use type indicated below:
 - a. Type: S.
 - 3. For exterior, above-grade use type indicated below:
 - a. Type: N.
- C. Colored-Aggregate Mortar: Produce required mortar color by using natural colored aggregates combined with selected cementitious materials.
 - 1. Mix to match Architect's sample.

2.7 SOURCE QUALITY CONTROL

- A. The Contractor will employ and pay a qualified independent testing agency to perform the following testing for source quality control. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
- B. Brick Tests: For each type and grade of brick indicated, units will be tested per (ACI 530.1/ASCE 6) Section 1.6.2.1.

PART 3 - EXECUTION

3.1 EXAMINATION

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- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of unit masonry. Do not proceed with installation until unsatisfactory conditions have been corrected.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of unit masonry.

3.2 INSTALLATION, GENERAL

- A. Comply with (ACI 530.1/ASCE 6) Section 2.3.1.3, 2.3.2, 2.3.3, 3.3.2, 3.3.3, 4.3.2, and 4.3.3.

3.3 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces of walls, and arrises, do not exceed 1/4 inch in 10 feet, nor 3/8 inch in 20 feet, nor 1/2 inch in 40 feet or more. For vertical alignment of head joints, do not exceed plus or minus 1/4 inch in 10 feet, nor 1/2 inch maximum.
- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet, nor 1/2 inch in 40 feet or more.
- C. Variation in Mortar-Joint Thickness: Do not vary from bed-joint thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary bed-joint thickness from bed-joint thickness of adjacent course by more than 1/8 inch. Do not vary from head-joint thickness indicated by more than plus or minus 1/8 inch. Do not vary head-joint thickness from adjacent head-joint thickness by more than 1/8 inch. Do not vary from collar-joint thickness indicated by more than minus 1/4 inch or plus 3/8 inch.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.
- B. Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.
- C. Bond Pattern for Exposed Masonry: Lay exposed masonry in a bond pattern to match the existing.
- D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- E. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar prior to laying fresh masonry.



3.5 MORTAR BEDDING AND JOINTING

- A. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not furrow bed joints or slush head joints.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.6 STRUCTURAL BONDING OF MULTI-WYTHE MASONRY

- A. Use individual metal ties installed in horizontal joints to bond wythes together. Provide ties as shown, but not less than 1 metal tie for 4 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
- B. Use continuous horizontal-joint reinforcement installed in horizontal mortar joints for bond tie between wythes.
- C. Use either of the structural bonding systems specified above.
- D. Corners: Provide interlocking masonry unit bond in each course at corners.
 - 1. Provide continuity with horizontal-joint reinforcement at corners by using prefabricated "L" units in addition to masonry bonding.
- E. Intersecting and Abutting Walls: Provide same type of bonding specified for structural bonding between wythes and space as follows:
 - 1. Provide continuity with horizontal-joint reinforcement by using prefabricated "T" units.



3.7 HORIZONTAL-JOINT REINFORCEMENT

- A. General: Provide continuous horizontal-joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcing a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Provide reinforcement in mortar joint 1 block course above and below wall openings and extending 12 inches beyond opening.
 - a. Reinforcement above is in addition to continuous reinforcement.
- B. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections.



3.8 FIELD QUALITY CONTROL

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- A. The Contractor will employ and pay a qualified independent testing agency to perform the following testing for field quality control. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
 - B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. (460 sq. m) of wall area or portion thereof.
 - C. Mortar properties will be tested per property specification of ASTM C 270.
 - D. Mortar composition and properties will be evaluated per ASTM C 780.
 - E. Prism-Test Method: For each type of wall construction indicated, masonry prisms will be tested per ASTM E 447, Method B, and as follows:
 - 1. Prepare one set of prisms for testing at seven days and one set for testing at 28 days.
 - F. Evaluation of Quality-Control Tests: In the absence of other indications of noncompliance with requirements, masonry will be considered satisfactory if results from construction quality-control tests comply with minimum requirements indicated.

3.18 REPAIRING, POINTING, AND CLEANING

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- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units; install in fresh mortar or grout, pointed to eliminate evidence of replacement.
 - B. Pointing: During the tooling of joints, enlarge voids and holes and completely fill with mortar. Point-up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for application of sealants.
 - C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.
 - D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Contracting Officer's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - 4. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
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5. Clean brick by bucket and brush hand-cleaning method described in BIA Technical Note No. 20 Revised, using the following masonry cleaner:

- a. Job-mixed detergent solution.

- E. Protection: Provide final protection and maintain conditions that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

3.19 MASONRY WASTE DISPOSAL

- A. Recycling: Undamaged, excess new masonry materials are Contractor's property and shall be removed from the Project site for his use. Existing salvages masonry materials are the Government's property and will be stored at a location approved by the Contracting Officer.
 - B. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be recycled, as described above, and legally dispose of off Government's property.

END OF SECTION 04200



SECTION 04300 - STONE MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes stone masonry structures constructed in conformity with the lines, grades and dimensions shown in the contract documents. .

1.3 SUBMITTALS

- A. Samples for Initial Selection: For colored mortar and other items involving color selection.
- B. Samples for Verification:
 - 1. For each color of mortar required. Provide mortar samples to match color of existing mortar as directed by Contracting Officer. Mortar may be colored using pigments or aggregate. Label Samples to indicate types and amounts of pigments used.
- C. Qualification Data: For qualified Installer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs experienced stone masons and stone fitters.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build demonstration panel at a corner. Demonstration panel to be part of the work indicated on the drawings. Use mortar color selected by Contracting Officer from submitted samples.
 - 2. Approval of mockups is for blending of stone; relationship of mortar and colors to stone colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Once approved the panel will be the standard for comparison of new work.
 - b. Unapproved work will be replaced at no cost to the government.
 - 3. The size of the stone masonry sample wall shall not be less than 6 feet long x 4 feet high.

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4. Build mockup of infill stone into existing to show raking/ prepping of joints, finished joints, blending and placement of infill stone.
 - a. Once approved the panel will be the standard for comparison of new work.
 - b. Unapproved work will be replaced at no cost to the government.

D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.



1.6 PROJECT CONDITIONS

- A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone masonry when construction is not in progress.
 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining the face of stone masonry.
 1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on the ground and over the wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.
- C. Cold-Weather Requirements: No cold-weather masonry construction is permitted.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.



1.7 COORDINATION

- A. Advise installers of other work about specific requirements for placement of items to be built into stone masonry.

PART 2 - PRODUCTS

2.1 STONE

- A. All stone to be used from existing stone onsite.

2.2 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color to match existing mortar determined by Contracting Officer.

- 1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.

- B. Hydrated Lime: ASTM C 207, Type S.

- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or III, and hydrated lime complying with ASTM C 207.

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Essroc, Italcementi Group; Capitol PCL Blend.
 - b. Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
 - c. Lafarge North America; Eaglebond.
 - d. Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

- D. Aggregate: ASTM C 144 and as follows:

- 1. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.

- a. Match existing mortar sample determined by Contracting Officer.

- E. Water: Potable.

2.3 MASONRY CLEANERS

- A. Proprietary Chemical Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cleaner manufacturer and stone producer.

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1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Diedrich Technologies, Inc.
- b. Dominion Restoration Products.
- c. EaCo Chem, Inc.
- d. Hydrochemical Techniques, Inc.
- e. Prosoco, Inc.

2.4 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride.
2. Limit cementitious materials in mortar to white Portland cement and white lime.
3. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.

- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

- C. Mortar for Stone Masonry: Comply with ASTM C 270, Specification.

1. Mortar for Setting Stone: Type N.
2. Mortar for Pointing Stone: Type N.

- D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match existing mortar color selected by Contracting Officer.

2.5 FABRICATION

- A. General: Select stones that fit the voids and require as little dressing as possible

- B. Select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated.

- C. Carefully inspect stone for compliance with requirements for appearance, material, and fabrication.

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- D. Shape stone for type of masonry (pattern) as follows:
 - 1. Coursed rubble.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.2 SETTING OF STONE MASONRY, GENERAL

- A. All masonry shall be constructed by experienced workmen. Face stones shall be set so as to produce the effect indicated herein for the class of masonry specified and to correspond with the sample wall section approved by the Contracting Officer.
- B. Beds and Joints:
 - 1. Beds and joints shall be between 1/4 inch to 1 inch and match the existing construction.
- C. Bunching: Care shall be taken to prevent the bunching of small stones or stones of the same size. When weathered or colored stones, or stones of varying texture, are being used, care shall be exercised to distribute the various kinds of stones uniformly throughout the exposed faces of the work. Large stones shall be used for the bottom courses. In general, the stones shall decrease in size from the bottom to the top of the work.
- D. Arrange stones in coursed rubble pattern with joint widths within tolerances indicated. Insert small stones into spaces between larger stones as needed to produce joints as uniform in width as practical.
- E. Bedding: The stone shall be kept free from dirt, oil or any other injurious material which may prevent the proper adhesion of the mortar or detract from the appearance of the exposed surface. Stones shall be laid on their natural beds in full beds of mortar, and the other joints shall be flushed with mortar. The Contracting Officer may direct the lifting and resetting of stones to assure proper bedding.
- F. Placement: The exposed faces of individual stones shall be parallel to the faces of the walls in which the stones are set. The stones shall be so handled as not to jar or displace the stones already set. Suitable equipment shall be provided for setting stones larger than those that can be handled by two men. The rolling or turning of stones on the walls will not be permitted. If a stone is loosened after the mortar has taken initial set, it shall be removed, the mortar cleaned off, and the stone re-laid with fresh mortar.
- G. Headers: Header stones shall be distributed uniformly throughout the wall so as to form at least 1/5 of the faces. Headers shall extend entirely through the walls.

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- H. Cleaning: Immediately after being laid, and while mortar is fresh, all face stone shall be thoroughly cleaned of mortar stains and shall be kept clean until the work is completed. Before final acceptance, if directed by the Contracting Officer, the surfaces of the masonry shall be cleaned using water and brushes and, if necessary, a chemical cleaner.
 - I. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 1/4 inch at narrowest points or more than 1 inch at widest points.

3.3 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
 - B. Variation from Level: For bed joints and lines of exposed lintels, sills and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
 - C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet or more.
 - D. Measure variation from level, plumb, and position shown in plan as variation of the average plane of the face of each stone from level, plumb, or dimensioned plane.
 - E. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.
 - F. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.
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3.4 POINTING

- A. Point only those areas indicated on the drawings or as approved by the Contracting Officer.
 - B. Beds and joints shall be raked out, before mortar is set, to a depth equal to 2-1/2 times their width but not less than 3/4 inch deeper than the surface of the finished joint nor less than that required to expose sound unweathered mortar, then cleaned and pointed with pointing mortar. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Joint surfaces should be rinsed with water to remove dust and mortar particles. Time the rinsing application so that at the time of pointing, excess water has evaporated or run off and joint surfaces are damp but free of standing water.
 - C. Point stone joints by placing and compacting pointing mortar in layers not more than 3/8 inch deep. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer. The pointing mortar shall be well driven into the joints with hardwood ramming wedges or other approved method. The stone masonry shall be kept wet while pointing is being done, and in hot or dry weather, the pointed masonry shall be protected from the sun, and kept wet for 24 hours.
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- D. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:

1. Joint Profile: Concave, slightly below edges of stone.

3.5 ADJUSTING AND CLEANING

- A. Remove and replace stone masonry of the following description:

1. Broken, chipped, or otherwise damaged stone.
2. Defective joints.
3. Stone masonry not matching approved samples and mockups.
4. Stone masonry not complying with other requirements indicated.

- B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

- C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.

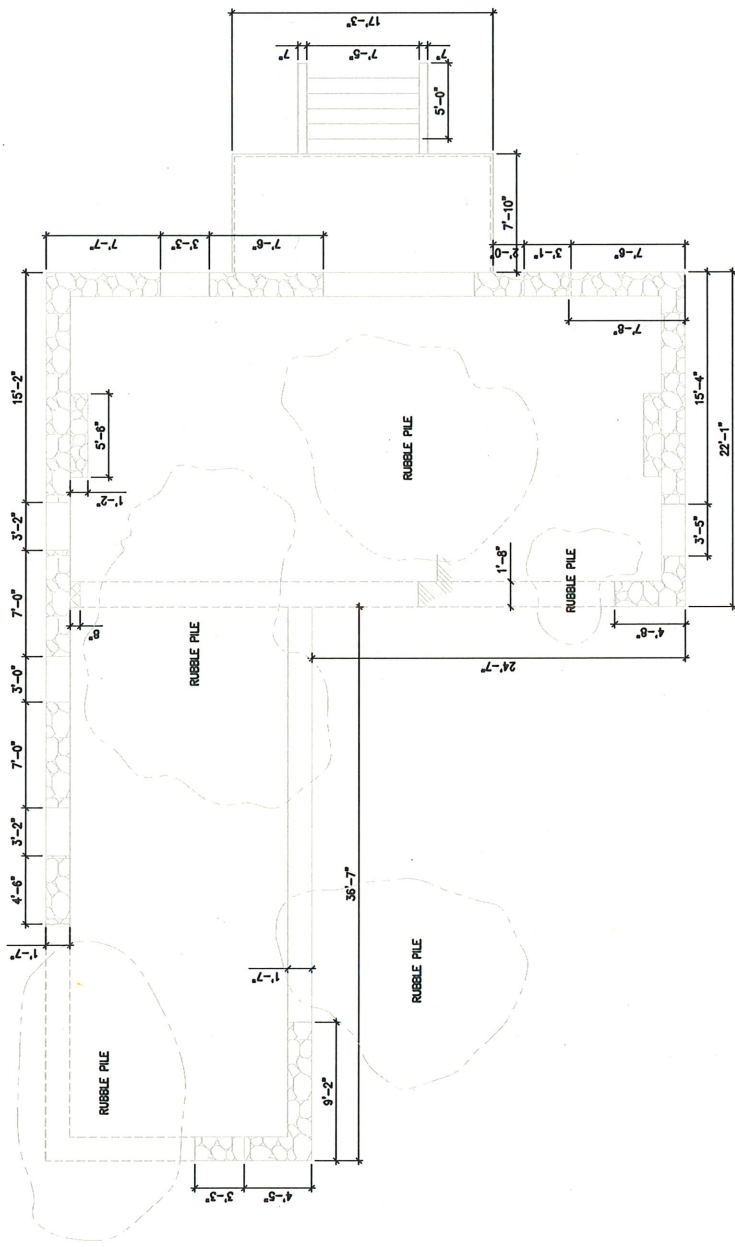
- D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
5. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20 Revised II, using job-mixed detergent solution.

3.6 EXCESS MATERIALS AND WASTE

- A. Excess Stone: Stack excess stone where directed by Contracting Officer for Government's use.
- B. Excess Masonry Waste: Remove excess clean masonry waste and other waste, and legally dispose of off Government's property.

END OF SECTION 04300



1 EXISTING PLAN
 S1.1 SCALE 1/8"=1'-0"
 NOTES:
 1. DIMENSIONS SHOWN ARE FROM ROUGH FIELD MEASUREMENT AND ARE FOR INFORMATION ONLY. ALL DIMENSIONS ARE TO BE VERIFIED IN THE FIELD.

DESIGNED:	CN	DATE:	07/20/09
CHIEF:	CK	TECH. REVIEW:	
SUB SHEET NO.	S1.1		
TITLE OF SHEET	EXISTING PLAN		
DRAWING NO.	—		
PMIS/PRG NO.	—		
SHEET	—		
OF	—		

Aleksei Ruins—Harpers Ferry
 National Historical Park



National Park Service
U.S. Department of the Interior

Historic Preservation
Training Center

4801A Urbana Pike
Frederick, MD 21704

301 663-8206 phone
301 663-8032 fax

Historic Preservation Training Center Transmittal

To: Peter Dessauer, HAFE
From: Kari Grabinski, HPTC *kg*
Date: March 4, 2010
Project: Stabilize Historic Allstadt/Moler House Ruins
Subject: Long-Term Stabilization Plan

Enclosed please find:

- Three (3) sets of the Long-Term Stabilization Construction Drawings (dated 12/18/09)
 - One (1) set with and (2) sets without engineer's signature and seal
- Three (3) copies of Section 03300 - Cast-In-Place Concrete specification (dated 12/18/09)
- Three (3) copies of Section 04200 - Unit Masonry specification (dated 12/18/09)
- Three (3) copies of Section 04300 - Stone Masonry specification (dated 12/18/09)
- Three (3) copies of the HABS Documentation Level III Sketch Plan (dated 7/20/09) (to coordinate with the HALS photographic documentation delivered on October 5, 2009).
- Three (3) copies of the Annual Maintenance and Inspection Plan (dated 12/21/09)
- One (1) compact disc containing electronic files of the above-referenced documents (dated 3/4/10)

This is the final deliverable required under the structural engineer's contract.
Please let me know if you have any questions.
Thank you.