HOKIE STONE GUIDELINES

These guidelines are presented in four sections for easier viewing. Clicking on the desired section will load the section for you to view.

SECTION 1 – Specifications

SECTION 2 – Details

SECTION 3 – Checklist

SECTION 4 - Meeting
HOKIE 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. Scope – Provide the labor, supervision, materials, equipment, services and perform the
      operations required and necessary to properly install Hokie stone masonry as shown on
      the drawings and as herein specified, including but not limited to the following:
      1. Laying out the work
      2. Receiving stone furnished by the Owner
      3. Constructing mockups
      4. Cutting stone to proper size and shape to incorporate into the work
      5. Installing embedded or through-wall flashing
      6. Verifying that related wall construction work is properly installed
      7. Laying up the stonework as shown and coordinated with other trades
      8. Pointing joints
      9. Cleanup

   B. Related Sections:
      1. Division 03 Section "Cast-In-Place Concrete" for back-up construction and
         dovetail slots in concrete for anchoring stone.
      2. Division 04 Section "Unit Masonry" for back-up construction, through-wall
         flashing, and veneer anchors. [Must coordinate two-piece flashing system
         with Division 04 Section "Unit Masonry"]
      3. Division 04 Section "Cast Stone" for cast stone lintels and trim
      4. Division 07 Section "Sheet Metal Flashing and Trim" for exposed sheet metal
         flashing.
      5. Division 07 Section "Weather Resistive Barrier" for the weather resistive barrier
         installed on the back-up construction as shown on the Project Drawings.
      6. Division 07 Section "Joint Sealers" for sealant and lead joint covers for
         stonework.
      7. [Other]

   C. Products installed, but not furnished, in this Section include:
      1. Steel lintels and shelf angles for stone masonry specified in Division 05 Section
         "Metal Fabrications."
      2. [Other]
1.3 DEFINITIONS

A. Hokie Stone: Hokie stone is a coined term indicting a mixture of local dolomitic limestone and its particular jointing that dominates the architectural character of Virginia Tech's main campus buildings.

B. Insulated Cavity Wall Construction: Construction method consisting of stone facing separated from the back-up masonry or concrete by rigid insulation and a cavity space and may include a drainage mat.

C. Expansion Joint: A break or space in construction to allow volumetric expansion and contraction of the various adjacent building systems. The joint is caulked with sealant to deter water penetration.

1.4 SUBMITTALS

A. Product Data: Submit product data including annotated manufacturer's literature for each product proposed for use in the work, showing compliance with the specified requirements. Include test results and instructions for handling, storage and application of each material.
   1. Submit details of each type of anchor, tie, and fastener and description of its use.
   2. Submit test results for sand showing compliance with the gradation, organic impurities, soundness, fine materials, and deleterious substance requirements of ASTM C 144.
   3. Include test reports and certifications substantiating that products including, but not limited to, cement, lime, pigments, and accessories comply with specified requirements.
   4. Submit proposed mixture proportions and test results (slump and compressive strength) for grout showing compliance with ASTM C 476.
   5. Submit proposed materials and specific procedures for temporary protection of substrates, hot weather construction methods, and cold weather construction methods.
   6. Submit proposed cleaning products.
   7. Submit proposed mortar and grout mixing procedures.

B. Samples for Selection:
   1. Provide pointing mortar sample bars prior to construction of on-site mockup for color section.
   2. Accessories: Submit a sample of each type of anchor and accessory.

C. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturer's product names, sources of supply and other information as required to identify materials used. Include mix proportions for mortar and source of aggregates.
   1. Submittal is for information only. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
D. Quality Assurance Submittals:
   1. Stone Masonry Contractor or Subcontractor Qualification Data: Submit qualifications to demonstrate their capabilities and experience. Include list of at least 3 completed stone masonry projects with project names and addresses, names and addresses of Architects and Owners.
   2. Submit name, contact information, and a brief project résumé for the project manager and the full-time on-site supervisor.
   3. Draft of Warranty: Before beginning the work, submit the Special Project Warranty specified below sufficiently in advance so that it can be reviewed, commented upon and corrected before the work is begun. Do not begin work until the required warranty is accepted.

E. Closeout Submittals:
   1. Project record documents: Submit documentation and drawings as necessary to explain and document deviations from the Contract Documents or problems encountered in the work and how they were resolved together with the acceptance of such resolutions by the Architect.
   2. Warranty: Submit completed warranty as specified.

1.5 QUALITY ASSURANCE

A. General Quality Objective:
   1. Hokie stone masonry construction is a major identifying characteristic of Virginia Tech's campus. The public at-large as well as the academic community has a special interest and appreciation for the unique character of this style of construction. Because of the great public interest in this work, only the best possible aesthetic and physical results will be acceptable to Virginia Tech irrespective of what otherwise would be acceptable in an ordinary commercial masonry project.
   2. Information in the Contract Documents establish requirements for both aesthetic effects and performance of the stonework. Aesthetic effects relative to formal characteristics are indicated by dimensions, arrangement, alignment and profiles of components and assemblies as they relate to sight lines, to one another, and to adjoining construction.
      a. Do not modify intended aesthetic effects, as judged solely by the Architect, except with Architect's written approval and only to the extent exclusively needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.
      b. Supplemental Standards
         1. Standard guidelines for construction of Hokie stone masonry are provided in Virginia Tech's "Stone Standards" and are available upon request.

B. Contractor's Knowledge of the Work:
   1. It is required that the stone masonry installer has visited the site before Contractor's bid submittal and both the Contractor and the stone masonry installer are thoroughly familiar with the specific conditions relating to the building
under construction, with the particular characteristics of Hokie stone masonry and with the requirements of this section.

2. On-site orientation:
   a. Before work may begin, ensure that each supervisor and mason who will perform the work is thoroughly familiar with the specific conditions relating to the building under construction, with the particular characteristics of Hokie stone masonry, and with the requirements of this section.
   b. As a courtesy and aid to the Contractor, the Owner will offer a 1-day on-campus orientation for supervisors and workers. This orientation will address Hokie stone masonry in general but will not authorize any change to the Contract requirements. A minimum of five (5) days notice shall be provided to the Owner to arrange the orientation. A count of how many persons will attend must be provided at that time.

C. Stone Masonry Installer: Engage an experienced stone masonry installation firm who has completed work similar in scope and size to that indicated for this Project with more than 5 years of successful in-service performance. Have the stone masonry installer maintain a steady work crew consisting of qualified masons who fully understand the requirements of the job.
   1. Field Supervision: The stone masonry installer shall maintain an experienced full-time supervisor on the Project site while stone masonry work is in progress. Performance of the work without a knowledgeable and experienced full-time supervisor is prohibited.
   2. Masons: Only experienced stone masons shall perform the work.
   3. Knowledge of Contract Documents: Ensure that workers and supervisory personnel are familiar with and have ready access to the site to up-to-date drawings and specifications pertaining to this work.
   4. The full-time supervisor must have the ability to communicate clearly and concisely with all workmen, the Architect, and the Owner.

D. Change of Firm or Personnel: Only the approved stone masonry installer and supervisors may work on the project. Fourteen calendar days before making any change to the firm or staff, such change, including a statement of qualifications as required above, must be submitted for approval. Failure to comply with this provision will, at the Architect's discretion, be sufficient cause to reject the work.

E. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality from single manufacturer for each cementitious component and from single source or producer for each aggregate.

F. Mockups: Prepare a full size field mockup to demonstrate aesthetic effects and qualities of materials and execution. Detailed illustrations of the required mockup are included in the Contract Drawings. Use materials and methods proposed for completed work. Construct the mockup as sequenced for the anticipated construction, coordinated with the trades involved.
   1. Construct mockups in accordance with the Project Drawings and with materials and workmanship in accordance with this specification.
   2. Locate mockups where shown in the Project Drawings or in a location approved by the Architect and Owner where they will not interfere with or be obstructed by construction during the entire construction period.
3. Notify Architect 14 days in advance of the dates and times when mockups will be prepared.
4. Obtain Architect’s acceptance of mockups before starting work.
5. Maintain accepted mockups during construction in an undisturbed condition as a standard for judging completed work.
6. Mockups shall always include an area of uninterrupted masonry wall at least 6 feet tall by 5 feet wide at an elevation of at least 5 feet above grade for quality assurance testing.
7. Approval of mockups will be based in part on color and blending of stone, relationship of mortar and sealant colors to stone colors, tooling of joints, and other aesthetic and technical qualities of workmanship.
   a. Approval of mockups is also for other material and construction qualities Architect specifically approves in writing.
   b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
8. At the Owner’s option, the mockup may be tested in accordance with ASTM C1801, “Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces,” prior to construction once the mockup has been completed and allowed to cure for seven (7) days. At a test pressure of 10 psf, the water penetration rate is not to exceed 10 L/hr. The water penetration rate for the mockup wall obtained through this testing will serve as the standard for any ASTM C 1801 testing conducted on the building within one (1) year after substantial completion.

G. At the Owner’s expense, an inspector will be on-site each day during the stone masonry construction to observe the work. A copy of the Hokie Stone Masonry Inspection Checklist may be obtained from the Owner for a list of quality assurance items that will be reviewed by the project inspector.

H. Preinstallation Conference: Hold a preinstallation conference with the Owner, the Architect, and the stone-masonry subcontractor and its full-time supervisor(s). Review the work, including but not limited to preparation, tools, methods, tolerances, required clearances, setting, grouting, curing, and related work.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Deliver materials to the Project site undamaged, in manufacturer’s original and unopened containers, labeled with manufacture date, type, and name of product and manufacturer. Handle materials in accordance with manufacturer’s instructions.
B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
C. Store aggregates under cover where grading and other required characteristics can be maintained and contamination avoided.
D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.
E. Hokie Stone: The Owner provides quarrying, blocking, cutting, and delivery of stone to the Contractor at the building site.
1. Stone will be furnished to the Contractor, cut to an approximate 6-inch average thickness. The stone shall be installed having a thickness of 4 inches minimum and 7 inches maximum. The Contractor is responsible for field dressing stone to meet these dimension requirements. Stone will be delivered on pallets to the site.

2. The Owner will deliver stone within the following limitations:
   a. Two business days notice to the Owner is required for a stone delivery.
   b. Deliveries will be made on a business day after 4:30 p.m.
   c. The Contractor is to have a suitable fork truck or equivalent at the building site with an operator to unload the stone truck within a reasonable time period.
   d. It is the responsibility of the Contractor to specify the number of pallets desired for each delivery and to provide an accessible drop zone for the amount of stone requested.
   e. Each pallet holds approximately 1 ton or 30 square feet of Hokie stone.
   f. Deliveries will consist of a minimum of 10 pallets (10 nominal tons) up to a maximum of 28 pallets per day. In addition, the Owner, as stone is quarried and packaged, will be making regular deliveries of stone to the site once the site is secured.
   g. The Contractor is to make provisions for on-site storage of up to 50-percent of the total required stone.

3. Handle stone to prevent breakage, chipping, staining, deterioration, and damage.

4. Stone shall be stored off the ground and under cover until installation to prevent soiling of bedding surfaces.

1.7 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. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. 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: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction
requirements contained in ACI 530.1/ASCE 6/TMS 602. Contractor shall submit specific procedures and materials necessary to implement the ACI criteria prior to construction.

1. 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 the masonry surfaces have dried.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Contractor shall submit specific procedures and materials necessary to implement the ACI criteria prior to construction.

E. Site Conditions: Some work is near public circulation patterns. The public circulation patterns cannot be closed off entirely, and in places only temporarily redirected around small areas of work. The Contractor is required to plan and execute the work accordingly. Protection of the public is the highest priority.

1.8 COORDINATION
A. Coordinate the work of other trades involved with construction of Hokie-stone-finished walls to ensure proper sequencing and construction.

B. Coordinate back-up masonry and framing, wall waterproofing, through-wall flashing, insulation, drainage panel installation (if any), weep hole location, and stonework to provide a fully functional drainage wall.

C. Coordinate installation of two-piece flashings to be installed under Division 04 Sections "Unit Masonry" and "Hokie Stone Masonry" (i.e., unit masonry installer and stone masonry installer).

D. Coordinate installation of veneer anchors with Division 04 Section "Unit Masonry."

1.9 SPECIAL PROJECT WARRANTY
A. Furnish Special Project Warranty for the work of this section, signed by the Contractor and the stone masonry installer (subcontractor). Warrant installation, workmanship, and materials (other than stone) against all visible and latent construction defects for a period of [2 years].

B. Replace or remedy any defects in the work during the warranty period to the acceptance of the Owner, and at no additional cost.

PART 2 – PRODUCTS

2.1 HOKIE STONE
A. General: Hokie stone will be furnished by the Owner in the proportion of approximately 15-percent black and 85-percent "grey buff". Note that stones furnished are cut to approximate size. Cutting to final size, as necessary to fit into specific wall locations, is the responsibility of the Contractor at time of installation and as follows:

B. Adjust stones (cut) to fit into required stone pattern, jointing, and distribution of colors.

1. Cut and face corner stones to result in a straight vertical line at corner.

2. Cut off head and bed projections that may interfere with required joint width.
2.2 MORTAR AND GROUT 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 indicated. Do not use masonry cements, gypsum portland cements, or blended cements.
   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. Pigments for Pointing Mortar: Do not use coloring pigments unless specifically approved by the Owner. Use white or gray cement and color-selected or color-blended sand to produce mortar color acceptable to the Architect and Owner.

D. Aggregate: Supply mortar sands meeting the requirements of ASTM C 144 and as follows:
   1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve and color-selected or color-blended to produce mortar color acceptable to Architect and Owner.
   2. White Aggregates: Natural white sand or ground white stone.
   3. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
   4. Sand may contain no more than 50 parts per million of chloride ions. At the Owner's option, the chloride content of the sand may be determined when mixed to produce mortar and tested in accordance with ASTM C 1152, "Standard Test Method for Acid-Soluble Chloride in Mortar and Concrete."

E. Water: Potable.

F. Admixtures: Use no admixtures without specific written approval by Architect for each admixture, based upon submitted performance and test data and history of previous successful use. Do not use calcium chloride, air-entraining admixtures, antifreeze compounds, corrosion-promoting substances, or any admixtures containing these materials.
2.3 VENEER ANCHORS
A. Materials:
   1. Stainless-Steel Wire: ASTM A 580 Type 304.

B. Size: Sufficient to extend at least halfway through stone masonry and with at least 1-inch cover on outside face.

C. Wire Veneer Anchors: Wire ties formed from W2.8 or 0.187-inch diameter, stainless-steel wire.
   1. Ties are bent in the form of triangular loops designed to be attached to masonry joint reinforcement specified in Division 04 Section "Unit Masonry" with 3/8-inch diameter vertical rods passing through ties and through eyes projecting from masonry joint reinforcement.
   2. [Alternative systems may be proposed and reviewed on a case by case basis.]

2.4 JUMPER STONE ANCHORS
A. Anchors fabricated with tabs or dowels designed to engage kerfs or holes in stone units and holes for fasteners or postinstalled anchor bolts for fastening to substrates or framing as indicated. Anchors must be adjustable to accommodate different stone widths and building tolerances.

B. Materials: Fabricate anchors from stainless steel, ASTM A 240 Type 304. Fabricate dowels from stainless steel, ASTM A270, Type 304.

C. Anchors shall consist of a ¾-inch diameter smooth dowel formed into a receiver compatible with the vertical rods of the specified veneer anchorage system and capable of developing 100% of the anchor capacity threaded into a collar. Another ¾-inch diameter smooth dowel shall be threaded into the other side of the same collar and welded to a 1/8-inch thick semi-circular disk with radius ¾-inch.

2.5 EMBEDDED FLASHING MATERIALS
A. Metal Flashing: Provide 2-piece metal flashing as follows:
   1. Material shall be one of the following [Architect to select one]:
      a. Stainless Steel: ASTM A 240/A 240M, Type 304, 26 gauge.
      b. Copper: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick.
      c. Lead Coated Copper: Provide lead coating in accordance with ASTM B 101 20.02/sq.ft.

   2. Flashing materials embedded in backup systems are specified in Division 04 Section "Unit Masonry Assemblies." However, stone masonry flashing materials shall be coordinated with unit masonry flashings to provide a functional two-piece flashing system.

   3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Lap joints a minimum of 4 inches and solder or seal. Provided expansion joints in the metal at expansion joints in the veneer.
4. Metal Drip Edges: Fabricate from same material as through-wall flashing.
5. Corrugated or textured flashings are not permitted. Only flat sheet metal stock is permitted in masonry flashings.

B. Solder and Sealants for Sheet Metal Flashings:
1. Solder for Stainless Steel: ASTM B 32, Grade Sn50, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Solder for Copper and Lead Coated Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
3. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

C. Refer to Division 5 Section "Metal Fabrications" for requirements regarding procedures to electrochemically isolate flashing systems from steel support elements where required.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Jointing Tool: Durable tool configured to produce joints matching existing joints and as directed by the Architect. Replace worn jointing tools as often as necessary.

B. Masking Tape: Nonstaining, nonabsorbent type, compatible with joint primers, sealants, and surfaces adjacent to joints. Use only a masking tape that will easily come off entirely, including adhesive.

C. Weep Hole/Vent Products: Use the following unless otherwise indicated:
1. Wicking Material: Absorbent rope, made from cotton 1/4-inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity behind stone masonry. Use only for weep holes.
2. If required, install cavity vents as shown on the Contract Drawings. Cavity vents shall be designed so as not to permit water infiltration into the cavity.

D. Mortar Dropping Collection Mesh: Fluid-conducting polymer mesh placed in cavity on top of flashing intended to catch and permanently suspend mortar droppings above weep holes.

E. Drainage Panel for Cavity Wall: Drainage panels in masonry cavity shall be installed as shown on the Contract Drawings. Prefabricated, composite drainage panels, made with nonbiodegradable, molded-plastic drainage core, filter fabric face, and nonbiodegradable plastic backing sheet; usually used as to conduct water as part of a foundation wall drainage system.
1. Minimum flow rate: 15 gpm/foot at 1 hydraulic gradient and 3600 psf normal pressure when tested according to ASTM D 4716.
2. Filter fabric: Nonwoven geotextile fabric of polypropylene (PP) or polyester fibers, or combination of both, with extra material at edges to lap adjoining drainage panels.
3. Backing sheet: Nonbiodegradable non-perforated plastic film, with extra material at edges to lap adjoining drainage panels.
4. Sources: One of the following:
   a. Amerdrain 520 by American Wick Drain Corp.
   b. Hydaway 300 by Monsanto Co.
   c. Miradrain MD-6200 by Nicolion Corp.; Miraf Div.

H. [Other(s)]

2.7 CAVITY WALL INSULATION
A. Extruded-polystyrene board insulation of thickness shown on the Project Drawings, formed from polystyrene base resin complying with ASTM C 578, Type VI, 1.8-lb/cu. ft. minimum density 40-lb/sq. in, minimum compressive strength, and 0.3-percent water absorption, approximate R-factor of 5.0 for 1-inch.
B. Adhesive: Type recommended by insulation board manufacturer for application indicated.
C. Joint sealants or tapes to be as required by the insulation board manufacturer. If recommended as “optional,” the option must be taken and the joints sealed per the manufacturer’s instructions.

2.8 JOINT SEALANTS
A. Silicone sealant as described in Division 07 “Joint Sealers.”

2.9 MASONRY CLEANERS
A. Proprietary Acidic Cleaner: Cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from limestone masonry surfaces without discoloring or damaging the stone. Cleaner shall be expressly approved for use on limestone by manufacturer.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Vana Trol, by Prosoco, Inc.
      b. NMD80, by EaCo Chem, Inc.
      c. 202V Vana-Stop, by Diedrich Technologies, Inc.

2.10 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 portland cement and lime.
B. Mortar for Stone Masonry: Comply with ASTM C 270, Proportion Specification and as required below.
1. Mortar for Setting Stone: Type S with proportions of 1 part cement, ½ part lime, and 4-1/2 parts sand.

2. Setting mortar shall be mixed to and used at a masonry mortar consistency. "Dry pack" type setting mortar is not permitted. To ensure setting mortar is of workable consistency, the mortar penetration resistance shall be determined in accordance with ASTM C 780, Annex 3, a minimum of once per day by the Owner’s inspector. The acceptable range for the mortar penetration resistance is from 1.24 psi to 2.44 psi. Setting mortar with penetration resistance outside of this range shall not be used.

3. Mortar for Pointing Stone: Type N with proportions of 1 part cement, 1 part lime, and 6 parts sand.

2.11 GROUT MIXES
A. Grout proportions shall be in accordance with ASTM C 476 for fine grout.

PART 3 – EXECUTION

3.1 GENERAL
A. Comply with manufacturer’s written instructions for products.
B. Perform preparation, construction, and clean-up procedures in accordance with the materials and methods demonstrated by the accepted mockups. Do not begin general work until the Architect has approved the mockup panel.
C. Build work to dimensions and profiles indicated. Rebuild areas where unsound units have been removed. Build chases and recesses shown or required for the work of other trades. Build in anchors as required for attaching other work.
D. Coordinate with the Owner the installation of special stone units. Special stone units consist of over-sized units requiring a crane for setting, ground face units used for mounting fixtures, built-in monuments, and any other special type stones used in Hokie stone buildings.
E. Unless otherwise specified, herein Hokie stone masonry shall comply with ACI 530.1 Standard Specification for Masonry Construction.

3.2 EXAMINATION
A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
B. Examine substrate to verify that dovetail slots, inserts, reinforcement, veneer anchors, and other items installed in substrates and required for or extending into stone masonry are correctly installed.
C. Examine supports intended to receive flashing and stone masonry for compliance with requirements for installation tolerances and other conditions affecting performance.
D. Examine through-wall flashing to verify that it is correctly installed and in good condition.
E. All conditions not meeting with requirements necessary to properly install the stone masonry veneer shall be documented in writing and submitted to the General Contractor, Architect, and or Owner. Installation of stone masonry shall constitute acceptance of conditions by the stone masonry subcontractor.
F. Conditions shown in the Contract Drawings that conflict with the requirements of this specification section shall be brought to the attention of the Architect immediately.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PROTECTION

A. Provide and maintain effective, non-staining protection for adjacent surfaces and areas below the work during performance of the work. Protect surfaces from damage and from contact with droppings from the work. Use proven methods as appropriate to the surface being protected, and as acceptable to the Architect before the methods are initiated.

B. Protect persons, motor vehicles, surrounding surfaces of work being constructed, construction site, plants, and surrounding structures from dust, spillage, debris, and injury resulting from the work. Provide methods and procedures to ensure the safety of the public.

3.4 BACKUP PREPARATION

A. Install specified weather resistive barrier on concrete and unit masonry backup in accordance with Division 07.

B. Install cavity insulation as shown on the Project Drawings.

3.5 GENERAL INSTALLATION OF HOKIE STONE AND TOI FRANCES

A. Perform installation using methods and materials used for accepted mockups.

B. Prior to use in the wall, clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before wetting. Clean stone by thoroughly scrubbing with fiber brushes and then rinsing with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

C. Lay Out:
   1. Lay out wall courses in advance of setting in wall so as to ensure accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets.
   2. Lay out walls in advance to distribute with random appearance the mix of stone colors and sizes. In color distribution, consider the various hues in the 85-percent "grey-buff" stone as well as the black stones.
   3. Take stone simultaneously from at least 3 open pallets of delivered stone to facilitate a good distribution of stone colors.

D. Cutting and Shaping:
   1. Cut stones to size and shape required to meet visual guidelines for stone pattern, jointing, and color-distribution specified below.
   2. Cut and face corner stones to result in a straight vertical line at corner.
   3. Cut off head and bed projections that may interfere with required joint width.
   4. Cut stone with the intent to set stone on its natural bed, not face bedded, and with natural bedding horizontal.
E. Reject stones with the following defects unless they can be trimmed to remove the defect:
1. Cracked stones.
2. Soft or mud seams or other visibly unacceptable defects.
3. Bed widths less than 4 inches or greater than 7 inches.

F. Mortar Mixing:
1. Measurement: Measure cementitious materials and aggregate by volume. Do not measure by shovel; use known measure, clearly marked.
2. Mixing Setting Mortar: Mix materials in a clean, mechanical batch mixer. All cementitious materials and aggregate shall be mixed between three (3) and five (5) minutes with the maximum amount of water to produce a workable consistency.
3. Mixing Pointing Mortar: Thoroughly mix cementitious materials and aggregate for five (5) minutes, 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.

G. Lay-Up:
1. Set masonry with full head and bed joints.
2. Endeavor to set stones only on their natural bed, not face bedded.
3. Shimming and chocking of stone is permitted. Shims and chocks shall consist of Hokie stone fragments (spalls or small pieces of stone.) Water-soaked wooden wedges may be used for shimming only on the exterior face of the wall, but shall project sufficiently to allow complete and easy removal.
4. Rake back head and bed joints after mortar has achieved initial set. Rake joints to uniform depths with square bottoms and clean sides. Depth of rake for pointing shall be of sufficient depth to apply three (3) equal lifts without a projecting profile. The minimum depth of the rake shall be 3/4 inch but not less than the joint width.
5. Install anchors, pins, and other attachments required to properly secure stonework in place.
6. Lay walls to comply with specified construction tolerances and coordinate with other construction.

H. Solidly grout between stone and backup construction below grade.

I. Built-In Work
1. Provide openings, chases, recesses, and other spaces as required for accommodating work of other trades. Close up openings in stonework after other construction is in place with stonework that matches that already set, maintaining tolerances.
2. Build-in items indicated under this and other sections of the Specifications. Fill in solidly around built-in items with stonework that matches that already set, maintaining masonry tolerances.
3. Lay up expansion joints as work progresses. Do not cut expansion joints into veneer.

J. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

K. Stopping and Resuming Work: Do not tooth. Clean exposed surfaces of set masonry and remove loose masonry units and mortar prior to laying fresh masonry.

L. Tolerances: Except as required to properly align with existing construction, keep to the following tolerances:

1. Variation from Plumb: For vertical lines and surfaces of columns, 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 external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4-inch in 20 feet, nor 1/2-inch in 40 feet or more.

2. Variation from Level: For horizontal joints and lines of exposed lintels, sills, parapets, cornices, horizontal grooves, and other conspicuous lines, do not exceed 1/4-inch in 20 feet, nor 1/2-inch in 40 feet or more.

3. Variation in mortar joint thickness: Do not vary joint thickness by more than plus 1/2-inch or minus 1/4-inch from the specified thickness of 3/4 inch.

M. Provide sealant joints of widths and at locations indicated. Install sealant primers on joint surfaces as recommended by sealant manufacturer based on sealant adhesion testing.

1. Install vertical expansion joints at locations of through-building expansion joints and at 60' intervals along uninterrupted stone masonry walls or where indicated on the drawings.

2. Keep sealant joints free of mortar and other rigid materials.

3. Sealant joints are specified in Division 07 Section "Joint: Sealants."

N. Install embedded flashing and weep holes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated in the Drawings.

1. At multiwythe masonry walls, including cavity walls, extend flashing through stone masonry, turned up a minimum of 4 inches, and shingle under flashing extending through inner wythe to comply with requirements in Division 04 Section "Unit Masonry."

2. At concrete backing, extend flashing through stone masonry, turned up a minimum of 8 inches, and insert in reglet or other approved mechanism. Reglets are specified in Division 07 Section "Sheet Metal Flashing and Trim."

3. At lintels and shelf angles, extend flashing full length of angles into masonry at each end. Flashings shall be fabricated with integral end dams.

4. At sills, extend flashing not less than 4 inches beyond windows or to end of precast window surrounds.

5. At ends of head and sill flashing install custom fabricated end dams not less than 4 inches tall.

6. Seal all laps as indicated by flashing manufacturer such that water does not penetrate the flashing.
7. Extend metal drip edges at least 1/2-inch out from wall, with outer edge bent down 30 degrees and hemmed.

O. Place mortar droppings collection mesh in cavities to comply with manufacturer's instructions.

P. If used, place cavity drainage material in cavities to comply with the manufacturer's instructions.

Q. Place weep holes in joints containing flashing.
   1. Use wicking material as specified.
   2. Turn wicking down at lip of sill to be as inconspicuous as possible.
   3. Space weeps at 24 inches o.c.
   4. 

R. If used, install cavity vents at 24 inches o.c.

3.6 VISUAL GUIDELINES FOR STONE PATTERN, JOINTING, AND COLOR DISTRIBUTION

A. Stone Shape:
   1. No stone height less than 4 inches.
   2. No stone length less than 4 inches.
   3. Use stones with depths of 4 to 7 inches; no stone will depth less than 4 inches along bedding surfaces or greater than 7 inches shall be installed (except head return at corners).
   4. Minimum head return of 6 inches at corners and jambs.
   5. Ratio of each stone height to length of 1:4 maximum.
   7. Randomly distribute large (jumper) stones throughout wall.
   8. Orient quarry drill holes vertically so as not to hold water.

B. Joint Pattern:
   1. Set stone with plumb and level joints. Verify with level and plumb line.
   2. Set stone with shoulders of stones (front edge of joints) aligned at face of wall shown on Drawings.
   3. Make no vertical joints greater than 3 stones high.
   4. Make no horizontal joints greater than 6'-0" long.
   5. Minimum offset of 2 inches to the next, parallel joint.
   6. Bond and interlock each course at corners.

C. Joint width and Tooling: Nominal 3/4-inch joint width with 1/2-inch flat flush-struck tooling.
3.7 INSTALLATION OF ANCHORS

A. Anchor stone masonry to unit masonry with specified anchors unless otherwise indicated. For proprietary anchors, follow manufacturer's instructions except as specified herein.

B. Embed veneer anchors in mortar joints of stone masonry at least halfway through stone masonry and with at least 1\(\frac{1}{2}\) -inch cover on outside face.

C. Space anchors not more than 16 inches o.c. vertically and 24 inches o.c. horizontally, with not less than 1 anchor per 2.0 sq. ft. of wall area. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.

D. Anchor large stone with stone anchors as required below. Install anchors by fastening to substrate and inserting tabs and dowels into kerfs and holes in stone units. Overcut dowel holes and kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with mortar.

1. Individual stones with an area greater than 2.0 ft\(^2\) shall be attached in the following manner:
   a. Height 16" or less: Install stone anchors in the top of the stone as required to maintain 16" o.c. anchor spacing;
   b. Height 16" to 30": Install stone anchors in the top of the stone at 24" o.c. anchor spacing and one stone anchor at the midpoint of each head joint on each side of stone;
   c. Height greater than 30": Install stone anchors in the top and each side of the stone as required to maintain 16" o.c. spacing vertically and 24" o.c. spacing horizontally.

E. Provide 2-inch cavity between stone masonry and backup construction unless otherwise indicated. Keep cavity free of excessive mortar droppings and extraneous debris.

3.8 POINTING

A. General:

1. Perform pointing using methods and materials used for accepted mockups. Verify that joints have been raked out prior to pointing. Do not rake out during pointing.

2. Flush joints with water as necessary to remove dirt and loose debris. Allow joints to dry to a saturated surface dry condition before pointing.

B. Apply mortar in layers. For each layer, thoroughly compact the mortar and allow it to become thumb-print hard prior to application of next layer.

1. Apply first layer, of maximum 1/2-inch thickness, to areas where mortar was removed to the greatest depth to create a uniform depth for subsequent layers.

2. After joints have been filled to a uniform depth, place remaining pointing mortar in similar, continuous layers. Build up layers to a uniformly flat surface aligning with the shoulder arises of the stone and compacting the pointing mortar against the stone surfaces.

3. Do not feather mortar beyond shoulders of joint onto face of stone.
C. Tooling: Tool joints while mortar is still plastic but thumb-print hard with pointing tool, compressing the mortar into the joint.
   1. Tool flush, flat, smooth, and in straight vertical and horizontal lines.
   2. Where width of joint is wider than jointing tool, eliminate raised edges. Keep straight line at width of jointing tool.

D. Excessive shrinkage cracking is an indication of improper mixing, materials, or installation and will not be accepted. Excessive shrinkage cracking shall be repaired by repointing. Repointing will require mortar removal to a depth equal to the width of the joint and replacement in layers as described in Sections 3.7B and 3.7C.

E. Remove all traces of surplus mortar as the work progresses.

3.9 ADJUSTING AND CLEANING

A. Remove and replace stone masonry of the following description:
   1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
   2. Defective joints.
   3. Stone 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. Stone masonry shall be cleaned at the end of each day by dry brooming; for large mortar smears, use of clean water and a scrub brush may be required.

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 cut or cast stone trim and panels and non-masonry surfaces from contact with cleaner by covering them with approved protection methods.
   4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
   5. Clean mortar smears from stone masonry with proprietary acidic cleaner applied according to manufacturer’s written instructions unless high pressure washing is recommended.
   6. High pressure washing of completed stone masonry is prohibited.
   7. Final rinse of cleaner from wall to be accomplished by either bucket and brush method or low pressure wash of not more than 300 psi.
3.9 EXCESS MATERIALS AND WASTE

A. Excess or Rejected Stone: Stack excess stone where directed by Owner for Owner’s use.

B. Disposal as Fill Material: Where approved by Owner in writing and in accordance with approved location and as specified herein, dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches in greatest dimension.
   2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earth Moving."
   3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner’s property.

END OF SECTION 04300
SECTION A-A
FLASHING AT REINFORCED WALLS

1. MIN. GROUTED CAVITY

5" NOMINAL STONE W/ 7" MAX. WIDTH

2" MIN., 3" MAX. NOMINAL CAVITY

WATER RESISTIVE BARRIER
CAVITY INSULATION W/ TAPED JOINTS
CAVITY
DRAINAGE LAYER
VENNER ANCHORS @ 16" O.C. MAX.
VERTICALLY AND 24" O.C. MAX.
HORIZONTALLY, MAX. 2.0 S.F.
VENNER PER TIE (SEE NOTE 6)

THROUGH WALL FLASHING
CAVITY NET BELOW INSULATION (SEE NOTE 5)
FLASHING PAN W/ HEMMED DRIP EDGE
BED FLASHING IN MASTIC OR SEALANT
ROPE WEEPS

CUT STONE OR SHELF ANGLE (SEE NOTE 4)

BARRIER WALL
(OPTIONAL CONSTRUCTION)

CAVITY WALL
(PREFERRED CONSTRUCTION)

12 GA. CORROSION RESISTANT WIRE "TIE LOOPED THROUGH ANCHOR TIE. MINIMUM 15" WIRE TIE LEGS ARE BENT TO FOLLOW STONE MORTAR JOINT. WIRE TIE IS BENT 90 DEGREES AT LAST 2" OF EACH LEG.

2" GROUTED COLLAR JOINT
THROUGH WALL FLASHING
FLASHING PAN W/ HEMMED DRIP EDGE
BED FLASHING IN MASTIC OR SEALANT

CUT STONE OR SHELF ANGLE (SEE NOTE 4)
GROUT SOLID BELOW GRADE
HOKIE STONE VISUAL GUIDELINES
PARTIAL ELEVATION TYPICAL PATTERN

DIAGRAM OF STONE TERMINOLOGY
TYPICAL WALL NOTES:

1. DESIGNER HAS THE OPTION OF TWO WALL SECTIONS: BARRIER WALLS AND CAVITY WALLS.

2. FOR CAVITY WALLS (THE PREFERRED METHOD OF CONSTRUCTION), CONSTRUCTION METHODS WILL NECESSITATE FREQUENT MORTAR AND STONE BRIDGES BETWEEN THE EXTERIOR VENEER AND THE CAVITY INSULATION. IT IS IMPORTANT FOR THE DESIGNER NOT ONLY TO DESIGN FOR WATER TO BE EVACUATED FROM THE CAVITY BY MEANS OF FLASHING AND WEEPS BUT ALSO CONSIDER THE WEATHER RESISTIVE BARRIER TO BE CYCLODICALLY WETTED DURING SERVICE CONDITIONS. DESIGNER MUST CONSIDER ISSUES RELATED TO CONDENSATION WITHIN THE WALL SYSTEM. DESIGNER MUST ALSO DETERMINE IF AND HOW THE CAVITIES ARE TO BE VENTED.


4. ALL FLASHINGS MUST BE INSTALLED ON SMOOTH BEDDING SURFACES SUCH AS STEEL SHELF AND CUT OR CAST STONE ELEMENTS. DESIGNER SHALL MAKE PROVISIONS FOR WATER INFILTRATION BELOW FLASHINGS.

5. CAVITY NET SHALL BE DETAINED NO MORE THAN HALF THE TURNED UP HEIGHT OF THE FLASHING TO PREVENT DAMMING AT THE RETURN OF THE BACK-UP CYTHE.

6. ADJUSTABLE MASONRY ANCHORS SHALL BE DESIGNED BY THE ARCHITECT AND STRUCTURAL ENGINEER TO RESIST THE DESIGN LATERAL FORCES.

7. WHERE THROUGH WALL FLASHINGS MAY BE HIDDEN ON INTERIOR SIDE OF BUILDING, TURN FLASHING UP ON INSIDE OF WALL A MINIMUM OF ¾". IF CMU IS EXPOSED ON BUILDING INTERIOR, HOLD FLASHING BACK ¾" FROM INSIDE FACE. FLASHING SHALL BE TRIMMED TO PROVIDE AN UNOBSCECTED CAVITY AT REINFORCEMENT. SEE STRUCTURAL DRAWINGS FOR LOCATIONS AND SPACINGS OF REINFORCEMENT AND SECTION A-A ON SHEET 1 OF 12 FOR INSTALLATION OF FLASHING AROUND REINFORCEMENT.

8. BACKUP CMU CYTHES IN BARRIER WALLS SHALL BE GROUTED SOLID. THROUGH WALL FLASHING FOR SOLID GROUTED WALLS SHALL BE TERMINATED ¾" FROM THE OUTSIDE FACE OF THE WALL.

9. THROUGH WALL FLASHINGS ARE SHOWN AS TWO PIECE ELEMENTS TO REDUCE THE POTENTIAL FOR DAMAGE TO THE FLASHING DURING CONSTRUCTION. ALTERNATIVES SUCH AS SURFACE MOUNTED SYSTEMS WHICH ALLOW THE FLASHING TO BE INSTALLED AS THE HOKIE STONE CONSTRUCTION PROGRESSES ARE PERMITTED, BUT WILL BE EVALUATED ON A CASE BY CASE BASIS.
NOTE 1: WATER RESISTIVE BARRIER MUST BE DETAILED SUCH THAT IT MAINTAINS CONTINUITY THROUGHOUT TRANSITIONS BETWEEN WALL SYSTEM AND ROOF MEMBRANE.

INSULATION WITH TAPED JOINTS
DRAINAGE LAYER
WATER RESISTIVE BARRIER
HOKIE STONE VENEER
THROUGH WALL FLASHING
MORTAR NET
FLASHING PAN W/ RECEIVER
TERMINATION BAR & SEALANT
FULLY ADHERED EPDM ROOFING SYSTEM

SECTION A-A
TYPICAL ROOF TO WALL THROUGH WALL FLASHING

CUSTOM FABRICATED FLASHING PAN WITH SOLDERED OR WELDED END DAM AND FLAT SEAMED TRANSITION TO PARAPET CAP FLASHING MUST ACCOMMODATE FLASHING SLOPE FROM PARAPET

ISOMETRIC

MASONRY THROUGH WALL FLASHING
HOKIE STONE VENEER WALL NOT SHOWN FOR CLARITY

ROOF SYSTEM
PARAPET CAP AND FLASHING (PARAPET NOT SHOWN FOR CLARITY), SEE PARAPET CAP DETAILS FOR SPECIFIC REQUIREMENTS.
 SECTION B-B
TYPICAL ROOF TO WALL THROUGH WALL FLASHING

NOTE 1:
STEP Flashing to be minimum
16 oz. Copper, 20 oz. Lead
Coated Copper or 26 gauge Stainless Steel

CONCRETE MASONRY BACKUP WALL WITH WATER RESISTING BARRIER ABOVE
HOKIE STONE VENEER
2 PIECE THROUGH WALL FLASHING
COUNTER FLASHING
STEP FLASHING
SLATE SHINGLES
ROOF SYSTEM (NOT SHOWN FOR CLARITY)

ISOMETRIC

CUSTOM FABRICATED FLASHING PAN WITH WELDED CORNERS AND END DAMS AND LEADING EDGE FORMED TO COVER COUNTERFLASHING

INDIVIDUAL STEP FLASHING SEGMENTS MINIMUM WIDTH 2" GREATER THAN LENGTH OF SLATE EXPOSURE.

INSTALL KICKOUT FLASHING AT GUTTER

NOTE:
HOKIE STONE VENEER
NOT SHOWN FOR CLARITY
SECTION

OPTIONAL CAVITY VENT
TAPERED PRECAST WALL CAP STONE (SEE NOTE 2)
SLOPING MORTAR BED
HOKIE STONE VENEER
WALL CAVITY (SEE NOTE 3)

SILICONE SEALANT AND BACKER ROD AT STONE JOINTS ONLY

PRECAST COPING STONE
(GEOMETRY AND JOINT SPACING WILL VARY BASED ON ARCHITECTURAL DESIGN)

2"x3"x¾" SETTING SHIM PLACED AT 2'-0" BETWEEN SPOT MORTAR BEDS

ALTERNATE ANCHORAGE DETAIL
SLOPING MORTAR BED

CONTINUOUS REINFORCED AND GROUTED BOND BEAM

CMU WALL

TAPERED PRECAST STONE WALL CAP

HOKIE STONE VENEER

ISOMETRIC

DETAI 1
EXTERIOR Drip

INSTALL SEALANT ON TOP SIDE OF FLASHING AT FRONT EDGE ONLY.
LEAVE 1" SECTION OF SEALANT OUT AT 5'-0" INTERVALS TO VENT PARAPET CAP STONE

DO NOT INSTALL SEALANT ABOVE FLASHING ON ROOF SIDE OF PARAPET
PARAPET CAP FLASHING WITH COUNTERFLASHING RECEIVER, SEE BUTTON DETAIL
SEALANT
COUNTERFLASHING
STAINLESS STEEL TERMINATION BAR & FASTENER
FULLY ADHERED EPDM ROOF MEMBRANE (SEE NOTE 4)

DETAI 2
ROOFSIDE COUNTERFLASHING

RECEIVER
BUTTON
FLASHING

2" MIN.
PARAPET NOTES:
1) UNLESS SPECIFICALLY REQUIRED, ALL COPING STONES SHALL BE "DRY SET" ON HORIZONTAL SURFACES WITHOUT ANCHORS PENETRATING PARAPET CAP FLASHING. STRUCTURAL ENGINEER OF RECORD SHALL VERIFY CAP STONE CAN BE INSTALLED ON HORIZONTAL SURFACES WITHOUT ANCHORS BASED ON FRICTIONAL/GRAVITY RESISTANCE AGAINST SEISMIC OR WIND LOADS. IF ANCHORS REQUIRED BY DESIGN, UTILIZE ALTERNATE ANCHORAGE DETAIL. IF REQUIRED, EXACT LOCATIONS, SIZES AND MATERIALS WILL BE DEPICTED ON BOTH THE STRUCTURAL AND ARCHITECTURAL PLANS.
2) ALL HORSESTONE WALLS WILL BE "TOPPED OUT" WITH PRECAST WALL CAP STONES TO PROVIDE A SMOOTH SURFACE FOR CAP FLASHING. CAP STONE SHALL BE TAPERED AND THE ELEVATION SHALL BE SLIGHTLY HIGHER (UP TO 3") TO ALLOW WATER TO SLOPE TO THE ROOF SIDE OF FLASHING. FLASHING TO BE SET IN SLOPING BED OF FRESH MORTAR AT CMU WALL.
3) WALL CAVITY MAY BE EITHER SOLID CROUTED OR CONSTRUCTED AS AN INSULATED CAVITY WALL (CAVITY WALL SHOWN). SEE WALL CAVITY DETAILS FOR SPECIFIC CRITERIA.
4) HEIGHT OF FULLY ADHERED EPDM ROOFING SHALL BE LIMITED TO 5' ABOVE ROOF SURFACE. PARAPET WALLS TALLER THAN 5' SHALL UTILIZE VENTED METAL RAINSCREEN WALLS TO PROTECT BACKSIDES OF PARAPETS FROM EXPOSURE TO WATER.
5) SIZE AND SHAPE OF COPING STONE WILL VARY BUT STONE GEOMETRY SHOULD SHED MAJORITY WATER TO THE ROOF SIDE OF BUILDING.

STANDING SEAM (PARAPET JOINTS ONLY)

OR

FLAT SEAM

PARAPET FLASHING SEAM DETAIL
SECTION A-A

STONE ANCHOR BLOCKOUT OR SLOT COMPLETELY FILLED W/ MORTAR PRIOR TO SETTING

ALTERNATE ANCHORAGE BLOCKOUT
SECTION C-C

ANCHOR SLEEVE OF SAME MATERIAL AND GAUGE AS CAP FLASHING
SOLDERED OR WELDED JOINT AROUND PERIMETER
#4 BAR SPACED PER STRUCTURAL ENGINEER

PARAPET CAP FLASHING

ALTERNATE ANCHORAGE DETAIL
SECTION B-B
JAMB DETAIL

DRAINAGE LAYER

CAVITY INSULATION
W/ TAPE JOINTS

HOKE STONE VENEER

PRIMARY WATER RESISTIVE
BARRIER AND/OR AIR BARRIER
(SEE NOTE 4)

RAKE BACK MORTAR JOINT 1"
AND INSTALL SEALANT AROUND
PERIMETER OR SURROUND

PRECAST CONCRETE SURROUND JAMB
(SEE NOTE 2 & 5)

PRECAST CONCRETE SILL BELOW

WINDOW PERIMETER SEALANT
(SEE NOTE 3)

INTERIOR FINISHES AND FRAMING

8" CMU WITH VERTICAL
JAMB REINFORCEMENT

WINDOW ANCHORS
(SEE NOTE 8)

PLASTIC WINDOW SHIMS

PRIMARY SEALANT & BACKER ROD BETWEEN
WINDOW SYSTEM AND WATER RESISTIVE BARRIER,
LOCATION VARIES (SEE NOTE 6)

P.T. BLOCKING

SEALANT

ALUMINUM WINDOW SYSTEM
WINDOW NOTES:

BECAUSE OF THE NUMBER OF DIFFERENT MATERIALS, WINDOW SYSTEMS AND EXTERIOR WALL COMPONENTS, AS WELL AS THE COUNTLESS NUMBER OF CONFIGURATIONS OF THESE ELEMENTS, IT IS NOT POSSIBLE TO ESTABLISH A TYPICAL PUNCH WINDOW OR CURTAIN WALL CONFIGURATION FOR THE SURROUNDING MASONRY. DETAILS PROVIDED ARE FOR EXAMPLE ONLY. HOWEVER, BASED ON NORMAL CONSTRUCTION PROCEDURES, THE DESIGNER SHOULD CONSIDER THE FOLLOWING:

1. THE DESIGN SHOULD ANTICIPATE THE INSTALLATION OF THE WINDOW SYSTEMS PRIOR TO THE ERECTION OF THE STONE VENEER SYSTEM. IF A SPECIFIC CONSTRUCTION ORDER IS REQUIRED TO MAINTAIN CONTINUITY OF THE AIR OR WATER RESISTIVE BARRIERS, THE REQUIRED CONSTRUCTION ORDER SHALL BE INCLUDED IN THE DESIGN PLANS AND SPECIFICATIONS.

2. THE DESIGNER MUST INDICATE IF LIMESTONE WINDOW SURROUNDS ARE TO BE SUPPORTED BY THE PRIMARY BUILDING FRAME OR INDIRECTLY BY THE SURROUNDING VENEER. IF SUPPORTED DIRECTLY, THE ARCHITECT MUST PROVIDE DETAILS DEPICTING HOW TO SEAL THE AIR/WATER BARRIERS AND HOW TO TRANSITION FLASHINGS IN THESE AREAS.

3. WINDOWS, STOREFRONTS AND CURTAINWALLS SHOULD NOT BE SEALED DIRECTLY TO IOKIE STONE VENEER DUE TO THE IRREGULARITY OF THE STONE.

4. THE WATER RESISTIVE BARRIER (WRB) ON THE CONCRETE MASONRY WALLS SHOULD BE TIED DIRECTLY INTO THE WINDOW SYSTEM PRIOR TO THE INSTALLATION OF THE VENEER. INTERRUPTIONS IN THE WRB DUE TO THROUGH WALL FLASHINGS SHOULD BE SPECIFICALLY DETAILED BY THE ARCHITECT. CONSIDERATION SHOULD BE GIVEN AS TO HOW ANCHORS OR OTHER PENETRATIONS ARE SEALED AROUND THE WRB.

5. PRECAST STONE SHOULD BE SHAPED SO AS TO NOT DIRECT WATER INTO THE BUILDING. ANCHORS AND LATERAL TIES FOR THE SUPPORT OF PRECAST SURROUNDS MUST NOT BE INSTALLED BELOW FLASHINGS UNLESS SPECIFICALLY DETAILED TO PREVENT DAMAGE TO SHEET METAL.

6. WINDOW SYSTEMS MUST BE CONSTRUCTED WITH END CAPS ON OPEN ENDED EXTRUSIONS FOR INSTALLATION OF PERIMETER SEALANTS. PERIMETER SEALANTS MUST BE IN ALIGNMENT AROUND ENTIRE PERIMETER OF THE WINDOW SYSTEM. PRIMARY WINDOW SEALANT JOINTS MUST BE TIED INTO THE FLASHING PAN AND WRB TO FORM CONTINUOUS BARRIER FOR AIR AND MOISTURE INFILTRATION.

7. A FLASHING PAN OR WINDOW RECEPTOR SHOULD BE CONSTRUCTED TO COLLECT WATER FROM THE WINDOW SYSTEM AND DIRECT IT TO THE SILL FLASHING SYSTEM. FLASHING PAN MATERIALS, WINDOWS AND WALL FLASHINGS SHOULD BE ELECTROCHEMICALLY COMPATIBLE OR OTHERWISE PROTECTED FROM GALVANIC CORROSION.

8. WHERE POSSIBLE, ANCHORS FOR THE WINDOW SYSTEM SHOULD BE PLACED OUTSIDE OF THE FLASHING PAN SYSTEM AND WRB. IF THEY MUST BE PLACED THROUGH FLASHINGS, SPECIFIC PROVISIONS FOR SEALING PENETRATIONS MUST BE DETAILED BY THE ARCHITECT.

9. PROVISIONS MUST BE MADE TO SUPPORT THE FLASHING PAN AND PRECAST SILL ON THE BACKUP WALL. ALTERNATIVE DETAILING OPTIONS EXIST SUCH AS STEEL ANGLE SUPPORTS.

10. HEAD AND SILL FLASHINGS SHALL BE FABRICATED AS A PAN WITH WELDED OR SOLDERED CORNERS.
INTRODUCTION

This document is intended to serve as a tool for Virginia Tech's Design and Construction department as well as the Hokie Stone Masonry Inspectors. While not specifically intended as such, it may also prove to be a useful tool for other construction inspectors, masonry contractors, general contractors, architects and engineers to assist in the development, organization and implementation of the contract documents. The items herein relate only to Hokie stone masonry and not brick veneer or concrete masonry. Items to be inspected are listed, occasionally with specific criteria as it relates to the standard specifications or details.

The checklist is divided into four parts:

I  Preconstruction
II Preparation for Field Work
III Construction Inspection & Testing
IV Post Construction & Closeout

The checklist is structured so that it may be amended, annotated or expanded over time, based on issues identified by masonry inspectors on active projects.
I. PRECONSTRUCTION

<table>
<thead>
<tr>
<th>A. Specification Review – Review the project manual for the following:</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is a separate specification section provided for Hokie stone?</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td></td>
</tr>
<tr>
<td>2. Does the information in the specification for Hokie stone masonry comply with the requirements of Virginia Tech's standard specifications of the same name?</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td></td>
</tr>
<tr>
<td>3. Are the through-wall flashings required either surface mounted or two piece elements?</td>
<td>□</td>
<td>□</td>
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<tr>
<td>4. Is the Hokie stone veneer specified to be a cavity wall?</td>
<td>□</td>
<td>□</td>
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</tr>
<tr>
<td>5. Are the provisions for the two piece through-wall flashing clearly coordinated between the &quot;Hokie Stone&quot; specification and the &quot;Unit Masonry&quot; specification?</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td></td>
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<tr>
<td>6. Are silicone sealants specified in the Division 7 Specification for &quot;Joint Sealants&quot;?</td>
<td>□</td>
<td>□</td>
<td>□</td>
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<tr>
<td>7. Are sealant adhesion tests required prior to and/or during construction?</td>
<td>□</td>
<td>□</td>
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<tr>
<td>8. Are the anchor specifications clearly coordinated between Division 3 section for &quot;Cast in Place Concrete&quot; and the Division 4 sections for &quot;Unit Masonry&quot; and &quot;Hokie Stone Masonry&quot;?</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td></td>
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<tr>
<td>9. Have the responsibilities of any other on-site testing agencies been clearly delineated in the Division 1 Specifications?</td>
<td>□</td>
<td>□</td>
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<tr>
<td>10. Are all approved addenda included in the project manual?</td>
<td>□</td>
<td>□</td>
<td>□</td>
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<tr>
<td>11. Are all Hokie stone steel support systems specified in the Division 5 &quot;Metal Fabrications&quot; section?</td>
<td>□</td>
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<tr>
<td>12. Are all steel elements exposed to weather or used in conjunction with Hokie stone veneer specified to be hot dip galvanized?</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>13. Are flashing systems to be isolated from metal fabrications? Is it clearly delineated in the Division 5 &quot;Metal Fabrications&quot; section?</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td></td>
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<tr>
<td>14. Are acceptable unit masonry tolerances specified in Division 4?</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td></td>
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<tr>
<td>15. Are acceptable structural steel tolerances specified in Division 5?</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td></td>
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<tr>
<td>16. Are acceptable concrete tolerances specified in Division 3?</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>17. Is the required water/air barrier clearly defined in the specifications?</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
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</tr>
<tr>
<td>18. Is the method of installation for the water/air barrier around anchors and throughwall flashing clearly explained?</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>19. Is the cavity insulation specified in the Hokie Stone Masonry Specifications?</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>20. Are the joints of the insulation specified to be sealed?</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>21. Are the requirements for temporary bracing of backup walls clearly outlined?</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>22. Does the Division 5 Specification for &quot;Metal Fabrications&quot; require shop drawings depicting the location, size, connections, materials and design calculations for steel supporting masonry veneer?</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>23. Do the specifications specifically require shelf angles to be designed for torsion and shimmed to prevent rotation?</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>24. Are the mortar aggregates specified to be tested and certified at the source by the owner's testing lab?</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>
B. Submittal Review – Review the project submittals for the following:

1. Were material samples submitted for:
   - a. Veneer anchors & fasteners
   - b. Jumper stone anchors & fasteners
   - c. Mortar bars for color
   - d. Weeps & vents
   - e. Cavity net
   - f. Drainage panel, if required
   - g. Cavity wall insulation, adhesive & sealant
   - h. Masonry cleaner
   - i. Masonry sand samples
   - j. Flashing

2. Was product data submitted for:
   - a. Veneer anchors & fasteners
   - b. Jumper stone anchors & fasteners
   - c. Cement certifications complying with ASTM C150
   - d. Lime certification complying with ASTM C207
   - e. Mortar pigments
   - f. Weeps & vents
   - g. Drainage panel
   - h. Cavity wall insulation, adhesive & sealer
   - i. Masonry cleaners
   - j. Mortar admixtures

3. Were procedures submitted for:
   - a. Mortar mixture proportions
   - b. Grout mixture proportions
   - c. Mortar and grout mixing procedures
   - d. Cold weather construction methods
   - e. Warm weather construction methods
   - f. List of materials for mockup
   - g. List of materials and procedures for temporary protection of substrates
4. Were test results submitted for:
   a. Mortar sands complying with ASTM C144
      i. Gradation
      ii. Organic impurities
      iii. Soundness
      iv. Fine materials
      v. Deleterious substances
   b. Preconstruction grout tests
      i. Minimum compressive strength of 2000 psi per ASTM C1014
      ii. Grout slump of 8 to 11 inches per ASTM C143

5. Was required documentation submitted for:
   a. Stone masonry contractor qualifications
   b. Contact information & resume for project manager & superintendent
   c. Draft of special project warranty

6. Are all the necessary submittals provided in referenced sections including:
   a. Cast-in-place concrete
   b. Unit masonry
   c. Cast stone
   d. Sheet metal flashings & trim
   e. Air/water barriers
   f. Joint sealers
   g. Metal fabrications
   h. Others

7. Is the Hokie stone veneer depicted in the shop drawings for:
   a. Unit masonry
   b. Windows/doors/storefronts/curtainwalls
   c. Concrete foundations
C. Drawing Review – Review the project architectural and structural drawings for the following:

1. Are Virginia Tech’s standard Hokie stone masonry details referenced or reproduced in the drawing set?  
2. Is the mockup panel for the project fully detailed in the plans and properly located on the site plan?  
3. Does the mock-up panel layout include:  
   a) Horizontal flashing line  
   b) Punch window  
   c) Parapet cap and flashing  
   d) Vertical expansion joint  
   e) Precast elements  
   f) Outside corner  
4. Do the drawings name and date the issue of code and supplement to which the design conforms?  
5. Are all the elevations shown, including partial elevations at setbacks?  
6. Are there corresponding exterior wall sections for every condition shown on the elevations?  
7. Can all the flashings be clearly seen in the wall sections as a separate line with a specific beginning and end point?  
8. Are the flashing drip edges depicted on the elevations?  
9. Is there a specific or common detail provided for every flashing termination or transition in the drawings?  
10. Do all flashing penetrations have a corresponding detail to the plans?  
11. Do drawings indicate the location of expansion joints on all of the elevations?  
12. Do expansion joints in masonry coincide with overall building expansion joints?  
13. Do drawings contain details of expansion and control joints?  
14. Is mortar net shown at flashings with the height dimension less than the flashing height?
15. Are vents required and properly indicated on the drawings?  

16. Is the veneer cavity grouted solid below grade?  

17. Do drawings indicate "grade" at a minimum of 4" below foundation base flashing?  

18. Do drawings show the size, type, location and spacing of anchors and wall ties?  

19. Do drawings indicate size and location of all structural elements necessary for stone support?  

20. Do drawings indicate the type and thickness of insulation that is to be used in the cavity?  

21. Do drawings indicate nominal 2" to 3" air space?  

22. Do drawings show a nominal 5" veneer thickness?  

23. Do drawings indicate location of all sealants, including between cast stone window surrounds and stone veneer?  

24. Are intricate masonry patterns or ornamental details properly detailed on the drawings?  

25. Do drawings clearly depict a water/air barrier on exterior walls?  

26. Do drawings show all copings, sills, and cornices projected and containing a drip?  

27. Do drawings indicate realistic dimensions on details for plumbing and chase walls?  

28. Is a cavity drainage mat depicted?  

29. Is the water/air barrier shown tied into the windows and storefronts?  

30. Is the anticipated sequence of construction regarding the windows and veneer clear or specifically detailed on the drawings?  

31. Are end dams depicted?
Hokie Stone Masonry Checklist

32. Are isometric details provided for flashing transitions and corner conditions at punch openings?  
   -  [ ]  [ ]  [ ]

33. Are flashings shown above steel and precast lintels?  
   -  [ ]  [ ]  [ ]

34. Are cast stone surrounds designed to drain to the exterior rather than into window heads?  
   -  [ ]  [ ]  [ ]

35. Are locations of hose bibs, exterior lights, and electrical outlets shown on the elevations?  
   -  [ ]  [ ]  [ ]

36. Are anchorage details shown for veneer, cast stone and other cladding elements?  
   -  [ ]  [ ]  [ ]

37. Are anchors shown penetrating water/air barriers or flashing?  
   -  [ ]  [ ]  [ ]

38. Are flashings consistently shown seated on flat uniform surfaces (not on Hokie stone veneer)?  
   -  [ ]  [ ]  [ ]

39. Are flashings shown with projecting drip edges?  
   -  [ ]  [ ]  [ ]

40. Are through-wall flashings shown as either two pieces or a surface applied one piece element?  
   -  [ ]  [ ]  [ ]

41. Are the flashing lap splices for flashings detailed as well as at vertical expansion joint crossings?  
   -  [ ]  [ ]  [ ]
D. Mockup Panel Review – Review the mockup panel for the following:

1. Has a tentative schedule for mockup construction been discussed and coordinated, such that this project inspector can observe all construction methods and materials? □ □ □

2. Is mockup scheduled to be inspected prior to the start of unit masonry construction? □ □ □

3. Do all materials match approved submittals and submitted list of mockup materials? □ □ □

4. Are backup materials installed in accordance with the drawings and manufacturer’s directions? See Section A.3 of Construction Inspection Checklist. □ □ □

5. Are masonry support elements installed in accordance with the contract documents? See Section A.4 of Construction Inspection Checklist. □ □ □

6. Are veneer expansion joints and CMU control joints constructed in the mock-up? □ □ □

7. Are 2-piece or surface mounted 1-piece flashings utilized and installed as specified? See A.5 of Construction Inspection Checklist. □ □ □

8. Is the veneer cavity constructed as specified and detailed? See Section A.8 of the Construction Inspection Checklist. □ □ □

9. Is the stone veneer constructed in accordance with the plans and specifications? See Section A.9 of the Construction Inspection Checklist. □ □ □


11. Are the sealant joints located as shown on details and as specified? See Section A.13 of Construction Inspection Checklist: □ □ □
12. Is final mockup construction in accordance with required horizontal and vertical alignment requirements and tolerances? See Section A.14 of the Construction Inspection Checklist.

13. Observe cleaning trial on mockup
   a. Clean one-half of mockup with detergent and bucket/brush method, clean one-half of mockup with approved cleaning solution.
   b. Verify that adjacent surfaces not to be cleaned or that could be damaged by the cleaning product or process are protected in accordance with proposed methods.
   c. Verify temperatures and wind speed are acceptable for cleaning.
   d. Remove visible mortar stains with hardwood paddles and non-metallic chisels.
   e. Ensure that water is applied to the stone masonry prior to application of the cleaning solution.
   f. Verify that cleaning solution is diluted in accordance with the manufacturer's maximum dilution directions.
   g. Verify that cleaning solution is applied in accordance with the manufacturer's directions.
   h. Ensure that the wall is rinsed with low pressure water after cleaning (300 psi maximum).
   i. Verify that stone and mortar joints are undamaged after cleaning.
   j. Verify that cleaning removed noticeable mortar smears and other construction stains.
   k. Inspect differences between cleaning methods. Architect to select which method most appropriate for use on project.
14. At the Owner's option, observe ASTM C1601 testing on the mockup 7 days after completion of the mockup. Water penetration rates at a test pressure of 10 psf are not to exceed 5 L/hr.
### II. PREPARATION FOR FIELD WORK

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<tr>
<th></th>
<th>Yes</th>
<th>No</th>
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<th>Comments</th>
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<tbody>
<tr>
<td>1. Has a copy of the design plans and project drawings in the Inspector's trailer been reviewed by the Inspector?</td>
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<tr>
<td>2. Does the submittal log include the list of submittals in the Inspector's checklist?</td>
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<td>3. Have final accepted copies of window, steel, concrete and masonry shop drawings been reviewed by the Inspector?</td>
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<tr>
<td>4. Has a materials storage area been designated which provides adequate protection from weather and construction traffic for the Hokie stone, cement, lime and aggregates?</td>
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<td>5. Has a separate set of architectural elevation drawings been created to record daily veneer progress?</td>
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<td>6. Has the preconstruction meeting been held and the minutes been circulated?</td>
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<td>7. Has a contact list been generated for the stone masonry contractor's project team?</td>
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<tr>
<td>8. Has a walkthrough of the site been performed with the stone masonry contractor where he has accepted the conditions of the backup?</td>
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<tr>
<td>9. Has an installation list been generated to delineate the stone mason's scope of work from the block mason's scope?</td>
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<td>10. Have the hot weather, cold weather, mixing and protection requirements been reviewed by the Inspector?</td>
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<tr>
<td>11. Have the submittals been reviewed by the Inspector?</td>
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<td>12. Has a daily report format been approved?</td>
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<tr>
<td>13. Has a routing list for daily inspection reports been generated including names of persons to sign and date?</td>
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</table>
Hokie Stone Masonry Checklist

14. Has the stone mason's schedule been submitted, approved and reviewed by the Inspector?

15. Has a periodic meeting schedule been established?

16. Do mortar materials match submitted materials and certifications?

17. Are grout, mortar and stone materials being stored off of the ground and under cover?

18. Are masonry sands isolated to prevent contamination and stored under covers?

19. Has a rejected stone repository been established?

20. Has a schedule been established to remove rejected stone from the repository and returned to Virginia Tech?

21. Has mockup been accepted by the Architect and University?

22. Have rejected materials been removed from the site?

23. Does the batching station have volumetric measuring equipment that has been checked by the inspector?

24. Has a source of potable water been provided?

25. Are walls prepared to receive anchors?

26. Are substrates clean and within moisture limits?

27. Are structural frames within tolerances?

28. Are footings and ledges level, the specified size and in correct locations?

29. Are approved samples submittals on file in Inspector's office?

30. Has the installation of the flashing systems been reviewed with the stone masonry contractor for attachment, lap joints, end dams and face projections, and other aspects of the construction?
### III. CONSTRUCTION INSPECTION & TESTING

<table>
<thead>
<tr>
<th>Reviewer</th>
<th>Yes</th>
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<th>Comments</th>
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#### A. Construction Inspection – To Be Performed Daily unless noted otherwise:

1. Verify that approved cold and hot weather procedures are implemented as required based on current weather conditions.

2. Verify specified materials are being used, that there is adequate inventory, and that they are still being stored correctly:
   - a. Cement & lime
   - b. Sand
   - c. Sealants
   - d. Flashings
   - e. Anchors & ties
   - f. Accessories & pigments

3. Inspect the backup materials:
   - a. Joints in masonry backup area struck flush.
   - b. Concrete surfaces are free of projections.
   - c. Water/air barrier in place and properly tied in at edges.
   - d. Water/air barrier properly sealed around anchors.
   - e. Laps are properly layered and sealed
   - f. Insulation properly adhered and joints sealed
   - g. Drainage mat installed and secured
   - h. Supports for cast stone surrounds are sealed.
   - i. Penetrations such as windows are properly tied into water/air barrier.
   - j. Exposed steel sections in cavity are galvanized or covered with water/air barrier.
<table>
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<tr>
<th>Reviewer</th>
<th>k. Joints between floors are anchored and sealed.</th>
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<tbody>
<tr>
<td>Yes</td>
<td>No</td>
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<td>N/A</td>
<td>Comments</td>
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4. Inspect masonry support elements:
   a. Footings and masonry shelves clean and dry.  
   b. Steel shelf angles or supporting elements located correctly and installed level.  
   c. Steel supports properly connected and shimmed to resist rotation.  
   d. Steel support angles devoid of flange stiffeners or have custom fabricated flashings and units be created for these locations.  
   e. Steel supports are galvanized.  
   f. Load bearing cast stone surrounds are properly attached.  

5. Inspect masonry flashing:
   a. All one piece surface applied and two piece flashing systems are flat stock metal.  
   b. Flashings embedded in existing CMU walls are undamaged.  
   c. Flashing pans are sized correctly for wall thickness.  
   d. Flashing end dams and transitions are custom fabricated with soldered or welded joints.  
   e. All flashing terminations are end dammed.  
   f. Window head and sill flashings extend beyond window corniers.  
   g. Flashings have a hemmed drip edge and project beyond face of wall.  
   h. Flashings are set on a flat smooth surface.  
   i. Flashing segments are adequately lapped and sealed.  
   j. Flashing penetrations match approved details.  
   k. Rope weeps and mortar net installed.
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**Hokie Stone Masonry Checklist**

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WDP Project No. 04125
### Hokie Stone Masonry Checklist

**Reviewer**

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<tbody>
<tr>
<td>b. Ties, pintels and other anchor components are not cut, damaged, bent or disfigured from their original delivered shape and condition.</td>
<td>☐</td>
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<tr>
<td>c. Ties oriented with both legs extending into stone veneer.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>d. Ties do not conflict with flashings.</td>
<td>☐</td>
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<tr>
<td>8. Periodically inspect the veneer cavity.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>a. Cavity is free of non-masonry materials.</td>
<td>☐</td>
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<tr>
<td>b. Cavity is free of excessive mortar and stone debris that is not used to shim stone.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>c. Inspector can insert a 1&quot;x1&quot; rod into the cavity at least 2' deep every 12&quot; along a wall.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>d. &quot;Dry pack&quot; stone setting procedures are not used.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>e. Veneer cavities below flashing at grade are grouted solid.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>9. Verify the following with respect to the stone:</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>a. Stones with cracks or other visible durability problems that cannot be trimmed out are not used.</td>
<td>☐</td>
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<td>b. Stones are clean and free of deleterious materials on bedding surfaces.</td>
<td>☐</td>
<td>☐</td>
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<td>c. Maximum ratio of stone height to length is 1:4; minimum 1:1</td>
<td>☐</td>
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<tr>
<td>d. Stones are cornered at roughly 90°.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>e. Stone bedding surfaces are greater than 4&quot;, maximum stone depth is 7&quot;.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>f. Drill holes oriented vertically, opening down, maximum size for stone depths or projection?</td>
<td>☐</td>
<td>☐</td>
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<td>g. Projecting (jumper) stones randomly distributed.</td>
<td>☐</td>
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<tr>
<td>h. Stone color randomly distributed (approximately 85% gray/buff and 15% black).</td>
<td>☐</td>
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i. Verify kerfs cut into large stones for anchors located properly and filled with mortar.

10. Verify the following with respect to the setting mortar:

   a. Periodically observe mixing to verify mixture proportions are properly measured by volume:
      1) Type S – 1 part cement : 1/2 part lime : 4-1/2 parts sand
      2) Type N – 1 part cement : 1 part lime : 6 parts sand
   b. Sand is clean and uncontaminated.

c. Proportions measured using containers of known volume, not by shovel.

d. Volumes of containers are verified by Inspector and marked on containers.

e. Sand is clean and uncontaminated.

f. Mortar mixed in accordance with submitted procedures in a mechanical mixer.

g. Mortar penetration resistance is sampled at least twice a day and verified to be between 1.24 psi and 2.44 psi when measured in accordance with ASTM C780 Annex 3.

11. Verify the following with respect to the pointing mortar:

   b. a. Periodically observe mixing to verify mixture proportions are properly measured by volume:
      1) Type S – 1 part cement : 1/2 part lime : 4-1/2 parts sand
      2) Type N – 1 part cement : 1 part lime : 6 parts sand
   b. Sand is clean and uncontaminated.

c. Proportions measured using containers of known volume, not by shovel.

d. Mortar mixed in accordance with Specification Section 04430 3.5.F.3.
e. Pointing mortar is retempered within allowable time limits.

12. Verify the following with respect to the mortar joints:

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
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<td>b.</td>
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<td>c.</td>
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<td>o.</td>
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</table>

f. When thumbprint hard, joints raked back a minimum of 3/4" but not less than the joint width.

13. Verify the following with respect to the sealant joints:

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
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</thead>
<tbody>
<tr>
<td>a.</td>
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</tbody>
</table>

a. Located in accordance with the elevation drawings.
<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>b. Joint width is roughly as dimensioned in plans.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>c. Joint is clear and free of mortar droppings.</td>
<td>☐</td>
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<tr>
<td>d. Backer rod installed at a depth to provide correct geometry and is fit tightly in joint.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>e. Primer is installed (if required).</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>f. Material is what was specified.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>g. Sealant is well-tooled and well-bonded to substrate.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>14. Inspect walls and geometry at 1/4 heights of wall.</td>
<td></td>
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<tr>
<td>a. Plumb: 1/4&quot; in 10', 3/8&quot; in 20', 1/2&quot; in 40' or more. For conspicuous vertical lines (such as corners and sealant joints), 1/4&quot; in 20' and 1/2&quot; in 40' or more.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>b. Level: For conspicuous lines (such as sills, lintels, etc.), 1/4&quot; in 20' and 1/2&quot; in 40' or more.</td>
<td>☐</td>
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<tr>
<td>c. Corners to be faced on two sides and maintain a uniform line.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>15. Have all RFI's been answered?</td>
<td>☐</td>
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</table>
### IV. POST CONSTRUCTION & CLOSEOUT

<table>
<thead>
<tr>
<th>A. Completed Walls Should Be Inspected:</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Verify that there is no excessive shrinkage cracking in pointing mortar.</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>2. Verify that the stone masonry wall is plumb and level within these tolerances:</td>
<td>☐</td>
<td>☐</td>
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<td></td>
</tr>
<tr>
<td>a. Plumb: 1/4&quot; in 10', 3/8&quot; in 20', 1/2&quot; in 40' or more. For conspicuous vertical lines (such as corners and sealant joints), 1/4&quot; in 20' and 1/2&quot; in 40' or more.</td>
<td>☐</td>
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<tr>
<td>b. Level: For conspicuous lines (such as sills, lintels, etc.), 1/4&quot; in 20' and 1/2&quot; in 40' or more.</td>
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<tr>
<td>3. Observe cleaning.</td>
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<tr>
<td>a. Prior to cleaning, verify acceptance of cleaning products, procedures, and results of the cleaning trial on the mockup.</td>
<td>☐</td>
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<tr>
<td>b. Verify temperatures and wind speed are acceptable for cleaning.</td>
<td>☐</td>
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<tr>
<td>c. Verify that adjacent surfaces not to be cleaned or that could be damaged by the cleaning product or process are adequately protected prior to commencement of cleaning.</td>
<td>☐</td>
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<tr>
<td>d. Remove visible mortar stains with hardwood paddles and non-metallic chisels.</td>
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<tr>
<td>e. Ensure that water is applied to the stone masonry prior to application of the cleaning solution.</td>
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<tr>
<td>f. Verify that cleaning solution is diluted to the maximum, permissible level in accordance with the manufacturer's directions.</td>
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<tr>
<td>g. Verify that cleaning solution is applied in accordance with the manufacturer's directions.</td>
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<td>h. Ensure that the wall is rinsed after cleaning with low pressure water (300 psi maximum).</td>
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<td></td>
<td>i. Verify that stone and mortar joints are undamaged after cleaning.</td>
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<td></td>
<td>j. Verify that cleaning removed noticeable mortar smears and other construction stains. The mockup is the standard to judge the adequacy of the cleaning results.</td>
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<td></td>
<td>4. At the Owner's option, observe ASTM C1601 testing on representative areas of the veneer at not less than 7 days and not more than 1 year after completion of the stone masonry (including cleaning). Water penetration rates at a test pressure of 10 psf are not to exceed those measured during ASTM C1601 testing on the mockup.</td>
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<td>5. Inspect base flashings to ensure weeps are required distance above grade.</td>
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<td>6. Verify alignment between top of veneer and top of backup wall is sufficient to provide required slope of parapet cap flashings.</td>
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<td>7. Verify sealants are installed in control joints and between cast stone and Hokie stone veneer walls.</td>
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<td>8. Develop final punch list for corrections to the exterior veneer.</td>
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<td>9. Test any mortar samples taken during construction.</td>
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<th></th>
<th>Yes</th>
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### B. Closeout Documentation:

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<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>1. Are all change orders implemented and approved relate to the exterior veneer?</td>
<td>☐</td>
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<tr>
<td>2. Verify as-built drawings include any changes or modifications to the exterior veneer.</td>
<td>☐</td>
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<tr>
<td>3. Verify all punch list items are corrected.</td>
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<tr>
<td>4. Has special projects warranty been issued?</td>
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<tr>
<td>5. Have all material warranties (such as sealants) been assembled?</td>
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</table>
Hokie Stone Installation Meeting Format and Agenda

ATTENDEES:

General Contractor
General Contractor
Virginia Tech
Virginia Tech
Testing Subconsultant
Testing Subconsultant
Design Architect
Design Architect
Unit Masonry Subcontractor
Unit Masonry Subcontractor
Stone Masonry Subcontractor
Stone Masonry Subcontractor
Stone Masonry Subcontractor
Flashing Metal Fabricator
Air/Moisture Barrier Installer
Window Installer
Precast Installer
Sealant Installer
Roofing Installer
Project Manager
Site Superintendent
Project Manager
Project Manager
Project Manager
Project Manager
On-Site Representative
Project Manager
Site Superintendent
Project Manager
Site Superintendent
Site Foreman

MEETING AGENDA

A. PRELIMINARIES

1. Assign a person to take minutes for the meeting.

2. Distribute sign in sheet a) Name; b) Firm; c) Address; d) Phone; e) Fax; f) Cell Phone; g) E-mail Address.

3. Round table introductions.

B. SCHEDULE

1. What are the dates of the following milestones?

   a. Mockup construction
   b. Concrete or steel framing completion
   c. Unit masonry start and completion
   d. Window start and completion
   e. Air/water barrier start and completion
   f. Stone masonry start and completion
   g. Sealant start and completion
C. SEQUENCE OF CONSTRUCTION
1. After framing is completed, what is the order of construction around exterior of building?
2. Generally, what is the sequence of construction in work areas (i.e. air/water barrier, windows, veneer, cast stone, sealants, etc.)?
3. For windows and penetrations, how must trades be sequenced?

D. ADMINISTRATIVE PROCEDURES
1. Coordination of trades through General Contractor.
2. Schedule of values and payment applications
3. RFI's
4. Change orders
5. Submittals
6. Work restrictions
7. Warranties
8. Preinstallation conferences
9. Daily Inspector reports:
   a. Format
   b. Distribution
   c. Signatures
10. Progress meetings

E. SUBMITTALS
1. Material samples
2. Product data
3. Certifications
4. Hot & cold weather procedures
5. Protection procedures
6. Mortar proportions and mixing procedures
7. Testing of masonry sands
F.  SITE WORK
1. Where are subcontractor staging areas?
2. Protection of pedestrian traffic:
   a. Adjacent structures entrances and sidewalk barriers.
   b. Location and protection around stone cutting areas.
   c. Vehicle traffic.
3. Mortar batching area and material storage.
4. Scaffold systems:
   a. Locations
   b. Usage
   c. Maintenance
   d. Enclosures
5. Site cleaning.
6. Stone repository.

G.  CONSTRUCTION ISSUES
1. Changes to Hokie stone cavity wall construction:
   a. Cavity – clear vs. dry pack.
   b. Joint sizes reduced – maximum.
   c. Pointing procedures modified – three lifts flush struck.
   d. Stone dimensions – minimum 4" width, maximum 7" width.
   e. Two piece flashings:
      i. Flat stock
      ii. Custom fabricated transitions
      iii. Soldered seams
      iv. Hemmed drip edges and counterflashing receivers
   f. Parapet details.
   g. Air/water barriers.
   h. Tie spacing.
   i. Mortar consistency.
2. Mockup panel:
   a. Location
   b. Duration of construction
   c. Schedule and inspection
   d. Cleaning
   e. Architect review and acceptance
   f. Water testing
   g. Maintaining and disposal
3. On-site testing and inspection:
   a. Distribution of Inspector's checklist
   b. Mortar penetration resistance
   c. Grout slump
   d. Mortar cubes
   e. Sand gradation tests
4. Storage of materials:
   a. Cementitious materials
   b. Aggregates
   c. Stone
   d. Admixtures
   e. Reinforcement, anchors and ties
5. Flashings:
   a. Coordination between masons for installing two piece flashings.
   b. Coordination between window installer and stone mason for window sill flashing.
   c. Custom fabricated elements.
   d. Sealing and electrochemical isolation.
   e. Drip edges, weeps and cavity net.
   f. Shelf angle or support conflicts.
   g. Level installation surface.
6. Window installation:
   a. Tie in to air/water barrier phased with veneer
   b. Window surrounds
   c. Window corners and flashing pans
   d. Window anchors
   e. Sealant installation
7. Sealants:
   a. Sealant testing
   b. Concealed joints
   c. Expansion joints
   d. Warranty
8. Parapets:
   a. Parapet flashings
   b. Setting procedures
   c. Anchors
   d. Roofing termination and counterflashing
9. Air/water barrier:
   a. Continuity with roofing
   b. Veneer anchorage
   c. Penetrations and openings