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**04 00 00 MASONRY**

Masonry is a prominent part of the built environment at NAU. A materials palette was established for use for all new construction as part of the campus master planning. Materials included in the palette are the only materials allowed for use in the exterior of all new buildings and renovations. Brick, sandstone and stone veneer are the masonry elements described and shown in the website accessible through the following link: <https://www4.nau.edu/cas/Plan-Dev/bldgmtrlpalette.html>. Along with the acceptable materials list the approved local suppliers for LEED accreditation are listed. It is recommended DP view the actual samples, located in Facility Services prior to final color selection.

Masonry work constructed on campus shall conform, at a minimum to the requirements set forth in Division 1, Section 01 41 00 of these specifications. Inspections required per Division 1, Section 01 41 00 of these specifications.

Design Basis

All structures are to be designed with a useful lifetime of 100 years. A low cost design approach in areas that cannot be "seen" undermines the philosophy of building at NAU, and in the end, is usually much more costly in maintenance and in remedial corrective action. Every effort should be taken by the DP to properly specify and detail masonry veneers, applications, joints and fastening systems to protect against moisture infiltration, efflorescence, cracking and the resulting excessive maintenance caused by improperly designed masonry wall systems.

Sample Panels/ Mock up Walls

For all new and infill masonry work adjacent to existing walls, require that a 36 square foot sample wall (mock up) be constructed on site near the proposed work area to evaluate the selected brick and the cured mortar colors for matching. DP shall require the contractor to allow for a minimum of 3 weeks curing time to elapse prior to evaluation of the mortar color.

On new construction, a minimum 36 square foot sample wall (mock up) should be constructed to establish the standard of acceptance for all elements of the work, including but not limited to: window and door frame installation details, mortar color, flashing, coursing, pattern, control joints, tie-in with other materials and finishes, accessories, etc. This sample wall is required for all masonry work whether brick, CMU or stone is proposed. The sample panel shall be approved by the owner and the Design Professional prior to ordering materials and commencement of masonry work. DP shall require the contractor to allow for a minimum of 3 weeks curing time to elapse prior to evaluation of the mortar color.

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Cold Weather Masonry

Masonry work shall conform to the latest revision to the following standards for cold weather masonry work: *Building Code Requirements for Masonry Structures* (ACI 530.1 /ASCE 6/ TMS 602).

These standards list the preparation, installation and protection procedures necessary when constructing masonry in cold weather.

1. Specification for Masonry Structures (ACI 530.1/ASCE 6/TMS 602)
2. Cold Weather Masonry Construction, PCA IS248
3. Hot and Cold Weather Masonry Construction, PCA LT232 (published by the Masonry Industry Council)

In general when the ambient temperature is less than forty degrees F. masonry work shall not be constructed without heat, heated materials, and/or protection.

Hot Weather Masonry

Masonry work shall conform to the following standards for hot weather construction *Building Code Requirements for Masonry Structures* (ACI 530/ASCE 5/TMS 402). In general this means that when the ambient temperature is greater than 100 degrees F (or 90 degrees F with 8 mph wind), masonry work shall not be constructed without consideration for cooling masonry, controlling moisture uptake from units, and providing moist curing as well as necessary mortar protection.

In all cases with masonry work, the low humidity typical of the mountain campus environment leads to masonry units with high suction rates. Masons should test for and adjust the moisture of masonry units by wetting them to compensate for low humidity and high suction rates. The amount of wetting will depend on the rate of absorption of the brick at the time of laying. When being laid, the brick shall have suction sufficient to hold the mortar and to pull the excess water from the mortar, and shall be sufficiently damp so that the mortar will remain plastic enough to permit the brick to be leveled and plumbed after being laid without breaking the mortar bond.

The type of mortar joint should be specified. Tooled joints are required. Raked and weathered joints (or any joints which leave an exposed horizontal masonry unit edge at the joint) are not permitted for exterior masonry.

Controlling efflorescence

DP should design to prevent efflorescence and include construction specifications for moisture protection during construction for all masonry. Designs shall prevent moisture from entering finished masonry walls with flashing and avoid unprotected horizontal sills. Designs shall seal out moisture, and every feature should drain or

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dry without absorbing moisture. Design wall systems with appropriate measures to prevent moisture transfer from building interiors. Include initial cleaning of masonry by the mason or contractor after first winter after building acceptance in contract specifications.

The tops of all exposed masonry walls shall receive a watertight cap or coping, i.e., sheet metal or precast concrete, to prohibit moisture infiltration and efflorescence.

Masonry work that does not conform to the following tolerances shall be repaired or replaced as directed by the Design Professional. Tolerances are based on ACTUAL DIMENSIONS.

- Variations from plumb.
- In lines or surfaces of columns, walls, and arises: in 10 feet -  $\frac{1}{4}$ "; in any story or 20 feet maximum -  $\frac{3}{8}$ "; in four stories or more -  $\frac{1}{2}$ ".
- For external corners, control joints and other conspicuous lines: in any story or 20 feet maximum -  $\frac{1}{4}$ "; in 40 feet or more -  $\frac{1}{2}$ ".
- Variations from the level or the grades indicated on the drawings:
- For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines: in any bay or 20 feet maximum -  $\frac{1}{4}$ "; in 40 feet or more -  $\frac{1}{2}$ ".
- Variation of the linear building lines from established position in plan and related portion of columns, walls and partitions.
- In any bay or 20 feet maximum -  $\frac{1}{2}$ "; in 40 feet or more -  $\frac{3}{4}$ ".
- Variation in cross-sectional dimensions of columns and in the thickness of walls is plus or minus  $\frac{1}{4}$ ".

04 01 20 Maintenance of Masonry

Cleaning

All masonry work shall be cleaned and sealed before final inspection and acceptance. Acid wash is **not** usually an acceptable method of cleaning. Contractor shall be required to submit proposed procedures and to provide samples of materials where cleaning methods have been tested prior to beginning cleaning operations.

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Restoration

Masonry restoration on any building in the designated historic district must comply with Arizona Historical Society requirements. Special attention shall be paid to match existing stone, brick, mortar colors and mortar joints.

Repair and Replacement

Extra stock materials shall be provided for brick, CMU, veneer, cladding and structural stone masonry per NAU Technical Standards Section 01 78 46 Extra Stock materials. These materials shall be used by NAU Facility Services Maintenance Department to replace worn or broken areas in masonry building components.

04 05 13 Masonry Mortar

DP shall require that all mortar used for masonry construction shall meet the mortar and proportion specifications of ASTM C270. For re-pointing historic structures, DP shall evaluate structural integrity and justify mortar choices using test results for the adjacent masonry units. Type S, N, or O may be selected. Choosing a mortar that is stronger than the masonry may result in cracking of brick or stone units.

Mortar Coloring Materials

Mortar colorants may be used as desired. Final color selection shall be determined from review of a selection of mock-up panels to be constructed by the contractor. Mock-up panels shall remain on-site for job duration. Premixed/proportioned mortars ordered in large quantities and stored in bags or in a silo on site are recommended for colored mortars. Addition of color to mortar by hand or by the shovel method results in inconsistency in mortar color and is prohibited at NAU.

04 05 23 Masonry Accessories

Masonry Anchors and Tie Systems

Anchors or ties (including veneer anchors) embedded within masonry systems shall be galvanized and placed in such a way that they are completely covered with mortar.

DP to include anchoring and mechanical fastening details in masonry drawings per structural evaluation and design of wall systems.

Anchors and ties will be designed for steel stud, concrete and concrete masonry unit walls. Veneer back-up for concrete masonry units, or structural steel studs will include a 3/4" substrate/backerboard (equal to or better than "WonderBoard®").

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Control Joints

Control joints shall be incorporated into straight wall masonry construction which exceeds forty feet. Spacing of control joints shall be specified by the DP.

DP to specify control and expansion joints with widths not less than 3/8" to allow for installation of backer rod and sealant.

Joint Reinforcement

Joint reinforcement is required and shall meet the zone specific seismic requirement detailed in the International Building Code. DP to specify at a minimum nine gauge, mill galvanized horizontal wire reinforcing.

Flashing

Provide designs for through-wall concealed flashing at all shelf angles, lintels, ledges and other obstructions to cause downward flow of moisture within the wall. Inspection will be required prior to covering over flashing to confirm proper placement. Flashing above doors, mechanical room louvers, and windows to be seamless and end dammed. Detail all through wall flashing to prevent contact with sealant.

Weepholes

DP shall specify at a minimum ¼ inch diameter by four inch long polyethylene plastic tubing for weep holes.

Lintels

Provide masonry or steel lintels wherever openings are more than one foot wide for brick size units and two foot for block size units. Provide steel, precast or formed-in-place masonry lintels for all larger openings. Cure precast lintels before handling and installation. Provide appropriate formwork and false work support for formed-in-place lintels.

Caulking and Sealants

DP to specify waterproofing sealer with a minimum of five years guarantee for performance without breakdown from UV exposure.

All joints that require a caulking should receive special attention during construction.

DP to indicate that all joints be filled as soon as possible during construction and noted on the as built plans to be included in a CAS Maintenance Program.

Admixtures

The use of mortar or grout admixtures, other than color pigments, shall not be allowed. Specifically prohibit the use of any mortar retarding agents due to their unpredictable nature.

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**04 20 00 UNIT MASONRY**

Part 1 – General

Unit masonry selected for building exteriors shall be in accordance with the materials palette discussed in 04 00 00.

The DP shall specify certain precautions to ensure that finished unit masonry is, and shall remain, free from efflorescence and discoloration. These precautions shall include: materials handling (storage of masonry on pallets with covers to keep masonry clean and dry), covering unfinished work and protection from moisture, sealants such as blocktite or mortar mixes, washing and waterproofing of walls, and specification of ASTM Test E-67 (efflorescence test) on large projects. DP shall specify that brick and concrete unit installations shall carry a two-year warranty against efflorescence.

Part 3 – Execution

Composite walls with integral insulation are the preferred for walls with exterior masonry. Walls may be steel stud, cast-in place or precast concrete or concrete masonry unit structural walls with a brick, CMU, or stone veneer. Wall designs will include a moisture management system to direct water away from wall crown this includes roofs and overhangs for covered walls and precast concrete or metal copings for parapets. Slope sills, projections and other horizontal surfaces and to carry moisture out from walls.

A two inch minimum air space shall be maintained between face brick and cavity insulation. Cavity shall be unobstructed, free from mortar drippings.

Workmanship

All mortar joints should be full joints.

Partially completed walls should be covered at the end of each working day, or when work is not in progress, with a strong weather resistant material to prevent contamination. Covers shall drape over both sides and be securely fastened.

All materials should be stored in a dry area. To prevent contamination of materials, masonry units, cements, limes and sand should not be stored on the ground.

Attic Stock

Extra stock materials shall be provided for brick, CMU, veneer, cladding and structural stone masonry in accordance with the NAU Technical Standards Section 01 78 46 Extra Stock materials.

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**04 21 00 Clay Unit and Brick Veneer**

Brick Masonry

Brick selected for building exteriors shall be in accordance with the materials palette discussed in 04 00 00.

Materials shall conform to ASTM standard specifications including C216 (Facing Brick), C652 (Hollow Brick) and C270 (Mortar for Unit Masonry) C62 (Building Brick), ASTM C902 (Pedestrian and Light Traffic Paving Brick). All materials shall be rated for Severe Weathering or (SW) class.

Wall designs will include a moisture management system to direct water away from wall crown this includes roofs and overhangs for covered walls and precast concrete or metal copings for parapets.

Slope sills, projections and other horizontal surfaces and to carry moisture out from walls.

To minimize brick color variations, the project should be fired and supplied in one continuous run. If variations in color exist within the run, the differently shaded bricks shall be randomly intermixed as the wall is constructed. Obvious delineations in the brick color are not acceptable.

Brick masonry construction is the preferred method for a majority of buildings on campus. Brick will be selected during project design and specified in the bid documents.

Brick Veneer Masonry

To minimize brick color variations, the project should be fired and supplied in one continuous run. If variations in color exist within the run, the differently shaded bricks shall be randomly intermixed as the wall is constructed. Obvious delineations in the brick color are not acceptable. Sample panel shall include an example pattern of intermixed or same run brick.

**04 22 00 Concrete Unit Masonry**

Concrete unit masonry is an accepted method of construction. Decorative CMU's, splitface, or founders block are some types of concrete units currently in use.

Pedway Construction

Concrete unit paving stones are preferred for flat work in traffic areas (see section 32 13 16 for details), especially for pedway construction. Colors and unit type shall be consistent with those currently in use.



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**04 23 00 Glass Unit Masonry**

Glass unit masonry (glass block) selected for building exteriors shall be in accordance with the materials palette discussed in 04 00 00.

Glass block is currently specified at NAU for day lighting and insulated light transmission for open public space lighting and private or semi-private applications.

In all cases maximum translucency is desired but applications where modesty is required (such as restrooms) or in applications that benefit from natural light without visual or physical noise (such as administrative offices), special glass block finishes are necessary.

Smooth faced block to transmit the most light and allow visibility is suggested for public spaces where privacy is not required. Designers should specify smooth clear faces that maximize solar collection and visual clarity or designs that do not compromise light transmission.

Block that has a non-directional pattern or creates a distortion will provide the best privacy. Select a block that maximizes transmission and still provides privacy. Examples of block that provide suitable privacy include Decora® and Icescapes® from Pittsburg Corning.

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**04 40 00 STONE ASSEMBLIES**

Part 1 – General

Stone selected for building exteriors shall be in accordance with the materials palette discussed in 04 00 00.

All exterior stone veneer shall be designed to use mechanically fastened stone rather than adhesive attachment for its primary attachment method. The preferred backing wall is CMU.

**04 41 00 Dry – Place Stone**

**04 42 00 Exterior Stone Cladding**

All exterior stone cladding shall be designed to use mechanically fastened stone rather than adhesive attachment for its primary attachment method.

**04 43 00 Stone Masonry**

Stone masonry walls are composite walls and shall be constructed in conformance with 04 20 00.

**\*\*END OF SECTION\*\***