

## 04 40 00 – Stone Assemblies

### 1. General

- A. “Duke” Stone is provided by the University from its own quarry located near Hillsborough, N.C. Availability of the stone shall be verified as early in the project design process as possible. A sample panel(s) of Duke Stone shall be provided for each project. Duke Stone shall be compatible with adjacent building stone design, with respect to color range, size and texture. Use of Duke Stone on projects in the vicinity of the original West Campus is encouraged, with use depending upon architectural compatibility of the proposed project and availability of funding.
- B. Duke Stone is provided at cost (F.O.B. at the Duke Quarry near Hillsborough, N.C.) by the University to the Contractor. The Contractor shall load and transport rubble stone to the job site. All stone shall be weighed during transportation and a record of the weight shall be reported to the quarry foreman. The Contractor shall install all stone so as to match the stonework of an approved sample wall panel. For estimating purposes, a ton of stone shall place approximately 18 square feet in wall.
- C. The Contractor shall erect a sample wall panel, 4 feet high, 6 feet long, and 12 inches thick, on site at a location approved by the Consulting Architect/Engineer. The panel shall be similar to Duke Chapel stonework, with raised molded joints.
- D. All stone shall be clean and free of any adhering or loose particles of stone. All stones shall be laid on their natural beds, with 20 percent of stone being split face and 80 percent seam face, mixed proportionately to show variations of stone coloring. All stones shall have more bed than rise (length of stone equal or greater to 1 1/2 times the rise). Walls shall be of the thickness shown on drawings. Tops of laid stones shall be approximately level. All stone coursings are to be level.
- E. All solid stone walls shall be built up against wood formwork to provide true planes and plumb walls on interior surfaces. Formwork shall be substantially constructed to maintain its position until the respective walls are complete and are ready to receive parging. The joints between board formwork and stone shall be filled solidly with mortar as the stonework progresses.
- F. Where stone walls are laid against concrete retaining walls, joints between stones and retaining wall shall be completely filled with mortar.
- G. The stonework of Duke Chapel shall be followed as a sample of workmanship, stone size and color.

- H. Flagstone used in the West Campus walks shall match the texture, color and size of existing units. Bluestone or other smooth-faced stone is slippery when wet and shall not be used on exterior walks.
- I. Limestone shall match color and texture of existing units on campus and be of sufficient density to provide durable and adequate weathering characteristics. Soft limestone shall not be permitted on heavily traveled stairs. Stone or masonry copings shall be pitched toward the roof.
- J. See Appendix **A044000** for additional stone information.
- K. Mortar
1. Mortar for setting face stone shall be mixed in the proportion, by volume, of 1 part Portland cement, 1/4 part hydrated lime or lime putty, 3 parts damp loose sand and the minimum amount of water required to produce a stiff, workable mix. Mortar for pointing joints in face stonework shall be mixed in the proportion of 1 part gray waterproof Portland cement and 1 part fine white sand.
- L. Flashing
1. Fabric flashing shall be installed in stone walls as work progresses where indicated on drawings and where required for watertight construction. Weight of copper sheet in fabric flashing shall be not less than 3 ounces per square foot. One of the following products or approved equal shall be used:
    - a. Sandell Copper Flashing
    - b. Wasco Copper-Fabric Flashing
    - c. Afco Copper Fabric
  2. Flashing shall be protected from tears and punctures during all operations. Flashing shall be applied only after proper surface preparation. All foreign matter, rubbish, debris, etc. shall be removed; all joints, holes, and cracks shall be filled to provide a smooth, solid bearing surface; and all projections shall be removed and surfaces made smooth and flush. Complete installation shall conform to manufacturer's instructions. Flashing over openings shall be in one piece (continuous) or shall have joints lapped 4 inches and sealed. Flashing over lintels shall extend the full length of lintels. All flashing in walls shall be bedded in mortar on underside and masonry units above shall be bedded in mortar on top side.
- M. Accessories
1. Metal lintels, inserts, hangers and other such items shall be maintained plumb and true to line at all times. Dovetail anchors shall be AA Wire Products Dovetail Flex-o-

Lok galvanized steel 3/16 inch diameter or approved equal, formed to fit securely into dovetail slots provided in concrete.

#### N. Anchoring

1. Stones shall be anchored to concrete with steel anchors spaced vertically, approximately 12 inches on center in beams and 24 inches on center in retaining walls. Anchors shall be set into dovetail slots. Dovetail anchor slots shall be installed in forms of concrete beams and retaining walls to be faced with stone where height of concrete section is 16 inches or more in beams and throughout the full length of retaining walls. Slots shall be installed vertically on 24 inch centers and extended to the full height of the concrete section, with breaks only for the installation of flashing.

#### O. Bonding

1. All stones shall be well bonded, with not less than 20% of the total face area having full depth bond stones. The face stone shall be bonded to backing stone. No continuous vertical joint on the back of face stone between headers will be permitted. All walls shall be backed-up as the face work is laid.

#### P. Parging

1. After the formwork has been removed from the back of solid stone walls, the surface shall be carefully pointed with mortar, filling all cracks and holes and then given a spray coat of an approved concrete bonding agent. After the bonding agent has properly dried, the surfaces shall be parged with mortar to a thickness of not less than 1/2 inch and steel troweled to a hard finish surface, free of depression, roughness and honeycombed areas. After application of the parging coat, the surfaces shall be damp cured for a period of not less than seventy-two hours.

#### Q. Waterproofing Additive

1. Parging mortar shall be provided with a waterproofing additive as manufactured by one of the following manufacturers or approved equal:
  - a. Chem-Masters Corporation
  - b. Dewey and Almy Chemical Division of W.R. Grace and Company.
  - c. Sonneborn Building Products, Inc.

#### R. Bonding Agent

1. Bonding agent must meet the requirements of Military Specifications MIL-B-19235 (Docks). Use of the bonding agent shall be in strict accordance with the manufacturer's instructions. Bonding agent shall be one of the following products:

- a. Weld-Crete, manufactured by Larsen Products Corporation
- b. Daraweld, manufactured by Dewey and Almy Chemical Division of W.R. Grace and Company
- c. Thorobond, manufactured by Standard Dry Wall Products, Inc.

S. Pointing

1. Pointing shall not be done until a section or wall is complete to the top, and then the wall shall be pointed from the top down. Horizontal joints shall be cut with a level. Final cleaning of walls shall be done during the pointing operation unless otherwise specifically approved by the consulting Architect/Engineer.