

BE - BUILDING ENVELOPE

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BE.1 GENERAL INFORMATION

The building exterior shall be consistent with objectives as stated in *A Vision Statement for the Planning and Design of the University of Virginia Buildings and Grounds*, as included at the beginning of these facilities design guidelines.

The building envelope shall incorporate materials and detailing consistent with a building life span of not less than 50 years, with optimized energy conservation and management, and environmental sensitivity.

BE.2 CONCRETE

BE.2.1 GENERAL

Except for mud concrete, minimum concrete strength shall be 3,000 psi.

Exposed aggregate surfaces shall not be used.

Specifications shall state that positive measures are to be taken to assure that exposed concrete surfaces are not vandalized before initial set. Refinishing of vandalized surfaces shall be performed by Contractor at no cost to the University.

The use of wet curing shall be required. If approved, the use of a curing compound is to be limited where application of moisture is impractical, where application of such compounds will not jeopardize appearance of concrete or bond to additional concrete, and where concrete surface is to be finished with paint, tiles, waterproofing, roofing or chemical seal. Use type 1 curing compound (except use of type 2 on surfaces exposed to sunlight) applied with uniform thickness and other recommendations by manufacturers.

BE.2.2 FIBER REINFORCED CONCRETE

The use of polypropylene fibrillated fiber for secondary reinforcement to control surface cracking in exposed concrete slabs on grade is encouraged, and is acceptable for other exposed concrete when approved in writing by the Facilities Management Senior Structural/Civil Engineer. Polypropylene fibrillated fiber is not a substitute for reinforcing for structural and expansion/contraction requirements.

BE.2.3 PLASTICIZER ADMIXTURE

Water reducing admixtures, conforming to ASTM C-494, shall be used for structural slabs and for irregular shaped structural elements that are exposed as finished architectural surfaces.

BE.2.4 ARCHITECTURAL CONCRETE

The Contractor shall be required to provide a sample panel of exterior exposed concrete walls prior to construction showing all of the required finishing techniques, i.e., finishes, texture of formed material, sandblasting, etc.

The concrete used in sample panels will be provided from the project concrete supplier and shall represent the approved mix for strength and texture.

BE.2.5 POST TENSIONED STRUCTURAL CONCRETE

During the design of post-tensioned structural members, the Architect/Engineer shall give special consideration to the architectural finish appearance of the jacking-ends, insert requirements, and the tendons/reinforcing steel cover.

BE.2.6 PENETRATIONS AND OPENINGS IN CONCRETE

Penetrations and openings shall be located on structural drawings. Penetrations and openings larger than 6" shall have appropriate diagonal reinforcement around them.

BE.2.7 ANCHOR BOLTS

Provide headed anchor bolts, enclosed by two to three closely spaced ties around the bolt to prevent cracking and/or spalling of concrete.

BE.2.8 SLAB ON GRADE

Slab on grade floors in buildings shall be a minimum of 5" thick with WWF 6x6-W2.9xW2.9 (minimum reinforcing) for all academic, public use and service buildings. Excluding public use, mechanical, laundry and storage rooms, slab on grade floors in residential or dormitory buildings shall be a minimum of 4" thick with WWF 6x6- W1.4xW1.4 (minimum reinforcing). Those excluded uses shall comply with 5" thickness and reinforcing stated above. Reinforcing top cover shall be 1" minimum and 2" maximum.

BE.10 SUPERSTRUCTURE

BE.10.1 GEOTECHNICAL DESIGN; EARTH PRESSURE LATERAL LOADS

BE.10.1.1 Building Frame Design: Building framing shall be designed to resist Earth Pressure Lateral Loads internally. Assumption shall be that the excavation support systems shall facilitate below grade building construction, but in the long term may transfer partial or all Earth Pressure Lateral Loads to building frame designed to resist it internally.

BE.10.1.2 Global Stability: In situations of unbalanced Earth Pressure Lateral Loads against a building/structure, calculations shall be performed to verify Global stability of excavation at critical stages of construction, whether excavation support systems are used or not, and for the completed building/structure condition after final grading.

BE.10.2 FLOOR AND ROOF CONSTRUCTION

Structural framing for research laboratories, and other uses where instrumentation is sensitive to building vibration, shall be designed for resistance of vibration. The Basis of Design Narrative shall establish vibration criteria in the Preliminary Design to be reflected in structural calculations and construction details.

Structures requiring design compatibility with magnetically and electrically sensitive equipment in research and medical facilities shall be demonstrated to have structural materials and techniques compatible with such identified or commonly used equipment.

BE.10.3 BEARING CONNECTIONS

Use “N” Bearing Type Connections (unless required otherwise) for framed connections with 2 bolts minimum.

BE.20 EXTERIOR ENCLOSURE

BE.20.1 EXTERIOR WALLS

BE.20.1.1 General

The use of metal stud framing in brick veneer exterior walls is not acceptable. Exceptions require approval premised on detailed information regarding moisture barriers and stainless steel anchorage.

BE.20.1.2 Brick Selection

During the **Preliminary Design** phase, the Architect/Engineer shall select an acceptable brick, mortar and joint tooling, approved by the Architect for the University as part of the agreed design criteria, in context with the surrounding buildings and/or precinct.

If fewer than three brick manufacturers and/or mortars are so selected, performance specifications for size, type of brick, color, range, strength and permeability shall be used, citing as the basis of design one or more manufacturer's brick products. In like manner the mortar shall be selected and specified.

The specifications shall require the contractor to erect one or more wall panels (4'-0" x 4'-0" minimum or wall panel mock up) of the selected and proposed bricks, and mortar, including masonry backup, wall ties, insulation and limestone/precast stone trim, etc., applicable to the project. The Architect, subject to overview of the Architect for the University, will approve the panel for workmanship and conformance with the approved selection of brick and mortar. The Architect for the University shall be advised of the Architect's decision prior to notification of the Contractor.

Where the brick and/or mortar is to match an existing brick, the specifications shall indicate that matching a predetermined existing 100 brick wall area delineated on site prior to issuing bid documents.

BE.20.1.3 Brick Types

Wood mold brick in standard and oversized sizes shall be used on all University buildings. Wire cut brick shall in general be used for all University of Virginia College at Wise projects.

Additions to existing buildings shall match the existing brick in size, color, texture and compressive strength.

BE.20.1.4 Existing Brick

Removal of existing brick for use on additions or renovations shall be carefully executed to prevent cracks, splits, spawls and damage to the surface integrity of the units.

BE.20.1.5 Parapet Walls

All parapet walls up to 3'-0" height above roofing shall be flashed from coping to roofing. The inside face of parapets exceeding 3'-0" height above roofing shall be brick faced or faced with an approved exterior material other than exposed concrete masonry units.

BE.20.1.6 Veneer Masonry

Face brick and other masonry veneers shall be backed with masonry units. See **BE.20.1.1**.

Cut stone, rough stone and slate shall be used only for trim, not as the basic wall material.

BE.20.1.7 Masonry Thresholds

Brick or stone thresholds in conjunction with metal thresholds shall rest entirely on the building foundation walls.

BE.20.1.8 Mortar

The Curator and Architect for the Academical Village shall approve mortars specified for Historic buildings.

Color pigments where used shall be premixed.

BE.20.1.9 Water Repellent Coatings

Water repellent coatings on above grade masonry shall not be used.

BE.20.1.10 Masonry Accessories

Water stops shall be built-in rubber type.

Dovetail slots, and anchors shall be used for masonry veneer over concrete walls.

Weep holes shall be rope wicks.

BE.20.1.11 Cladding/Siding

Metal clad buildings shall be used only for utility type structures not located in the Historic District, Central Grounds, or in view from publicly traveled streets and walkways, unless expressly approved by the Architect for the University.

Wood siding is an acceptable material only in ancillary areas such as dormers.

BE.20.1.12 Flashing

All through wall flashing shall be 16-oz. minimum copper or equivalent fabric coated copper. Other metals or vinyl flashing shall not be used.

All coping flashing shall be through wall type.

BE.20.1.13 Sealants, Caulking and Seals

Color and appearance are to be approved by the Architect for the University as part of the overall design review.

BE.20.1.14 Portland Cement Plaster

Portland cement plaster stucco, with or without aggregate, may be used for base and finish coats on masonry, roughened monolithic concrete, and metal lath. It is often used over exterior columns at the University.

It shall not be used over wood lath, fiberboard lath, gypsum lath, gypsum tile or other types of base coat.

Portland cement plaster shall be used where humidity, wetting and drying, and freezing and thawing is likely to occur.

BE.20.2 EXTERIOR PAINTING

BE.20.2.1 Exterior Color Standards

White shall be used, with no exceptions, for all trim.

While the University respects the artistic freedom inherent in the architectural design process, it requires that all designers work within the traditional pattern that has evolved here since the early nineteenth century.

A color schedule for all exterior materials shall be submitted for approval by the Architect for the University.

BE.20.2.2 Paint Removal

Paint removal by open flame shall not be permitted. Where paint is removed by a heating process, a fire extinguisher must be available at the work site.

BE.20.2.3 Lead Based Paint Removal

The location of existing lead paint shall be made known to the Architect/Engineer based upon a performed paint analysis by the University. Many of the University's older buildings have exterior lead based paint. Where the Architect/Engineer has technical cause or concern that lead paint exists on a project, the Project Manager shall be notified in writing.

Lead paint removal shall be coordinated with the University Environmental Health and Safety Office.

BE.20.3 EXTERIOR WINDOWS

BE.20.3.1 General

Metal windows and storefront shall have thermal break frames and insulating glass.

Crank operators shall not be used on operable windows.

Aside from the required use in the Historic District, the use of wood windows shall be approved by the Architect for the University and the Director of Facilities Planning and Construction

BE.20.3.2 Glazing/Storm Sash

For all buildings, the use of double-glazing is required, with a vacuum seal and low E glass.

In some renovations, the use of interior mounted storm sash is acceptable. When provided, interior storm sash, or glazing, shall be hinged or otherwise readily accessible for window maintenance.

BE.20.4 EXTERIOR DOORS

BE.20.4.1 General

All main entrance doors along accessible routes shall be equipped with sensor or push button activated automatic doors. The location of push button activators shall be coordinated with the Facilities Management Accessibility Manager through the Project Manager. Use of a mat activator, which has not been favorable, shall require approval of the Facilities Management Accessibility Manager. Horton 7000 series that has proven to be reliable and easily maintained should be one the required manufacturers for competitive bidding. Consultation with the Accessibility Manager may determine other manufacturers with which Facilities Management has had favorable experience.

BE.20.4.1 (continued)

All doors shall have a minimum width of 3'-0" and a height of 7'-0".

Plastic laminate exterior doors are not acceptable.

All doors, hardware, hardware adjustment, closers, etc., shall provide for access and use by the physically disabled.

See **GR.5.3** CARD READER REQUIREMENTS.

BE.20.4.2 Metal Doors And Frames

Metal doors shall be insulated.

Hollow metal doors shall have 16 gage facing skins, galvanized, 1 3/4-inch thick minimum.

Hollow metal frames shall be 16 gage, galvanized and fully grouted. Knockdown frames are prohibited.

Other metal door materials shall be anodized aluminum or stainless steel where warranted by aesthetic and budget considerations.

BE.20.4.3 Wood Doors

Solid core wood doors shall be five ply, 1 3/4-inch thick minimum. Paneled wood doors shall be detailed and manufactured to withstand weather exposure. Use of paneled style door is restricted to the Historic District and existing buildings when it is in keeping with the established architectural treatment and in new construction where specific approval by the Architect for the University has been given in the schematic or preliminary design process.

Metal frames in conjunction with the approved use of wood exterior doors shall be used in all cases except in the Historic District, or where directed by the Architect for the University and/or the Director of Facilities Planning and Construction.

BE.30 ROOFING

BE.30.1 ROOFING POLICY

Where these guidelines are more restrictive than the Construction and Professional Services Manual (CPSM) or the Higher Education Capital Outlay Manual (HECOM) the Facilities Design Guidelines govern. Waivers premised on acceptable standards in the CPSM or HECOM, or for specific systems the Architect/Engineer professionally prefers, require approval by the Chief Facilities Officer after review by the Facilities Planning and Construction Roofing Project Manager.

While the selection of a roofing system relates to specific project requirements, consideration shall be given to the University's maintenance of roofing systems using, on occasions, its own qualified personnel to repair or replace roofing and related components.

No roofing work shall be permitted before 8:00 a.m. within any student residential area.

In addition to broad requirements for protection of building occupants and existing buildings and site improvements, roofing specifications shall require the contractor to take reasonable precautions to protect building occupants from fumes and other hazards associated with the roofing work.

Consultation with the Roofing Project Manager is required for new construction and replacement roofing. A broader "ROOFING POLICY" available from the Roofing Project Manager provides insights to University concerns while addressing methods of procurement and/or product specifications not applicable to Architect/Engineer designed projects for competitive bidding.

BE.30.2 ROOFING SYSTEMS

Design criteria for a visible roofing system are determined by the Architect for the University. Roofing systems for new construction or additions at the University of Virginia and at the University of Virginia College at Wise typically shall be sloped roofing systems.

Obtain primary and secondary roofing and insulation materials from the roof system manufacturer to ensure a single source responsibility for entire roofing system.

Minimum manufacturer's warranty period for low-slope roofing systems is 15-year, no limit, full system warranty.

(**BE.30.2** continued)

Minimum manufacturer's warranty for pre-formed metal panel roofing systems is 20-year, non-prorated water tightness and finish warranties.

Minimum manufacturer's warranty for three-tab fiberglass or dimensional shingles is 25-year warranty.

Low-rise roofing assemblies shall have a wind uplift rating of Class I-90.

BE.30.2.1 Low-slope Membranes

Where applicable to existing buildings or so established by the design criteria, low-slope membrane roofing is governed by the following material requirements unless otherwise approved by the Roofing Project Manager.

.1) Ethylene Propylene Diene Monomer (EPDM)

The University preferred low-slope system roofing is a black single-ply, 60-mil thickness fully adhered system. A reinforced membrane is preferred and shall be used where there is high grease content of exhaust air at roof level

A ballasted system is acceptable pending Facilities Management approval. Health Systems Physical Plant prohibits a ballasted system for University of Virginia Health Systems facilities. Minimum requirements include 10-12 pounds of ballast per square foot, double-washed, rounded and smooth river gravel, with a diameter not to exceed 1½".

A mechanically fastened system is prohibited.

.2) Built-up Roofing

Acceptable system is coal tar bitumen, 4-ply minimum system with aggregate surfacing for use on heating plants or similar facilities.

Use of built-up roofing on other facilities requires specific approval by the Roofing Project Manager.

.3) Hybrid Roofing

Where approved by the Roofing Project Manager, an acceptable system is a 4-ply asphalt built-up roof, with a granule surfaced modified bitumen cap sheet having a minimum cap sheet thickness of 150 mils.

BE.30.2.2 Steep-Slope Roofing

Where applicable to existing buildings or so established by the design criteria, steep-slope roofing is governed by the following material requirements unless otherwise approved by the Roofing Project Manager.

Exceptions to these material requirements may be applicable to structures listed in Category HP, HISTORIC PRESERVATION.

.1) Slate

Slate shingles are common on the Grounds of the University of Virginia, primarily because of matching the significance of the historic buildings on the Grounds and the basic long life of the material. When designing an addition to an existing building or partially replacing slate roofing on an existing building that has slate shingles, new slate shall match the existing.

Specify genuine unfading blue-black slate, ASTM C406, Grade S-1, of size, thickness, texture, exposure style, shape and color to match existing. Unless specifically established in design criteria, new slate roofing shall be similarly specified. All slate shall be hard, dense, sound, and rock punched for two nails.

No cracked slate shall be used. No broken corners on covered ends shall be allowed. All exposed corners shall be partially full. Slate used at the University is typically 3/8" thick nominally, with face dimensions of 10 inches wide by 16 inches long. No corner break shall exceed 1/2" in either dimension. Slates shall have the following physical properties:

Modulus of rupture:	9,000 psi per ASTM C120
Water absorption rate:	0.25% per ASTM C121
Depth of softening/acid resistance:	0.001 inches per ASTM C127

60 mil, self-adhesive polymer-modified bituminous sheet ice and water barrier, with slip resistant mineral granule surface, shall extend continuously from outer edges of eaves and gutters to 30" minimum beyond the line of the exterior wall below, 30" from rake edges and roof penetrations, and 36" to both sides of valleys. Use 30-pound unperforated asphalt saturated roofing felt.

Closed valleys are prohibited.

New slate roofs shall be installed over 3/4" tongue and groove, solid lumber decking. Use of plywood as nailing deck is prohibited.

(BE..20.2.2 continued)

.2) Metal

Aluminum or steel architectural standing seam, manufactured roof panel system with Kynar finish.

Copper, field-formed double-lock standing seam.

Terne-coated stainless steel, field-formed double lock standing seam.

.3) Shingles

Excluding slate shingles, shingle roofs including wood shingles and shakes, are seldom used on University of Virginia or University of Virginia College at Wise projects. Exceptions include in-kind replacement of existing roofing.

If determined by approved design criteria to be applicable, three-tab fiberglass or dimensional shingles may be used. Any other type of shingle requires the added approval of the Roofing Project Manager.

BE.30.2.3 Unacceptable Roofing Systems

The following roofing systems are permitted for use at the University only with the specific project approval of the Roofing Project Manager:

- Sprayed-on polyurethane foam
- Modified Bitumen systems, with the exception of the hybrid system in **BE.30.2.1.3**
- TPO: Thermoplastic Olefin (polyolefin)
- Cold applied roof systems
- Roof systems that are torch applied
- Protected Roof Membrane systems (PMR's), also referred to as inverted roof assemblies

Application of a new roofing system over an existing system (roof-overs) is not permitted.

BE.30.2.4 Blocking and Miscellaneous Carpentry

Oriented strand board (OSB) or particleboard shall be permitted only with specific approval by the Roofing Project Manager.

All wood blocking and panel materials shall be pressure preservative treated.

Power-driven screw-type fasteners shall be used to fasten wood to wood, or wood to masonry.

BE.30.2.5 Insulation

Specific project approval by the Roofing Project Manager is required for the use of the following:

- Phenolic foam insulation
- Organic fiberboard insulation, including use as tapered edges
- Non-structural glass mat face, noncombustible, water resistant treated gypsum core panels in ballasted roof systems

Maximum single board thickness for flat insulation shall be 2-inches.

Polyisocyanurate board insulation shall have a nominal average compressible strength of 25 psi. Material provided shall be labeled to show compliance with this requirement.

Board insulation shall be installed with a minimum of two layers. The first layer shall be set with the long joints in a straight line and the end joints staggered in running bond. Subsequent layers shall be applied in the same manner with the joints staggered from the first layer to prevent thermal bridging. Fit boards together with no gaps to achieve a complete thermal envelope.

CFC's (chlorinated fluorocarbons are permitted in insulation blowing agent only with specific project approval by the Roofing Project Manager.

Pull tests shall be required for all mechanical fasteners. Mechanical fasteners may be used for post-tensioned concrete decks or pre-stressed concrete panels subject to specific project approval by the Roofing Project Manager.

BE.30.3 ROOF DRAINAGE, GUTTER AND DOWNSPOUTS

All buildings shall have a positive means of conducting rainwater from the roof to an underground stormwater system.

On sloped roofs, adequately sized and securely installed gutters and downspouts of minimum 16 ga. copper shall be specified, unless otherwise established by Facilities Management. A minimum slope of 1/16 inch per foot for gutters is required. A minimum of two downspouts for each drain area shall be provided.

Downspouts shall be securely fastened to the vertical plane, emptying into a cast iron boot at grade connected to a storm water system.

Where a building is located near tree, down leader protective baskets shall be provided to keep leaves away from drain inlets in gutters.

BE.30.3 (continued)

Built-in or concealed gutters are discouraged for new construction. Where used specific approval shall be in the established design criteria (see GENERAL REQUIREMENTS **GR.3.6**) or so amended design criteria. Built-in metal gutter liner shall be terne-coated stainless steel, non-magnetic, with both sides coated with a minimum terne alloy. Minimum thickness shall be 0.015-inches (28 gage). Built-in gutter liners shall have ¾" wide formed expansion folds spaced every two linear feet prior to fabrication of gutter profile.

BE.30.4 **ROOF SPECIALTIES AND ACCESSORIES**

Metal flashing, counter flashing, cleats, drip edges, exposed metal trim/ridge cap, cant strips and exposed metal valleys shall be:

- Lead coated copper, 16 oz. (0.216-inch thick) unless otherwise indicated.

Terne-coated stainless steel, non-magnetic, sheet, both sides coated with a minimum terne alloy. Minimum thickness 0.015-inch thick (28 gage) unless otherwise indicated.

Copper sheet metal shall be used for in flashing, scuppers, and eyebrow roof vents.

Snow guards are required for all roofs with a slope of 6 in 12 or greater and over all entrances regardless of slope. A minimum of three staggered rows is required. Snow guards shall be copper, stainless steel or bronze, butterfly type. Wire snow guards are acceptable only with specific project approval by the Roofing Project Manager.

Built-in reglets shall be used for all wall-flashing terminations. Surface applied reglets shall only be used on existing buildings where installation of built-in reglets is not possible.

Solder all non-expansion joints in metal work.

BE.40 ROOF EQUIPMENT AND OPENINGS

BE.40.1 ROOFTOP EQUIPMENT

See GENERAL REQUIREMENTS, **GR.5.5** Building Systems Access and Equipment.

Abandoned equipment shall be removed and the decking repaired on re-roofing projects.

Where rooftop equipment is utilized the clearance under rooftop equipment and horizontal supporting members shall be 18-inches for equipment up to 24-inches wide, and 24-inches for equipment over 24-inches in width. Supports shall be mounted and fastened to structural deck or framing, not insulation.

Use of sleepers for rooftop equipment is prohibited.

Equipment curbs shall not be placed in drainage valleys. Crickets shall be installed on upslope sides of equipment curbs.

BE.40.2 ROOF HATCHES

Where roof hatches are used, they shall be insulated and lockable. Roof hatches shall feature thermal breaks. See GENERAL REQUIREMENTS, **GR.5.5** Building Systems Access and Equipment.

BE.40.3 SKYLIGHT STRUCTURES/CLERESTORY WINDOWS

The use of skylight structures, unit skylights and clerestory windows shall be approved as part of the schematic or preliminary design process. University approvals include the Architect for the University and/or the Director of Facilities Planning and Construction.

When approved, skylights shall have exterior grills or guards to provide fall protection.

Drawings and specifications for skylights or clerestory windows shall indicate dimensioning, flashing, sealants, gaskets, joints and other quality criteria intended to prevent leaks and minimize maintenance. All skylights shall have a minimum 5" high curb on sloped roofs; 12" on flat roofs.