

FACILITY DESIGN GUIDELINES

University of Virginia Facilities Management & University Building Official



Eleventh Edition with 2016 Amendments
June 2016

FACILITY DESIGN GUIDELINES

Office of the University Building Official and University Facilities Management

This *Eleventh Edition of the University of Virginia Facility Design Guidelines* has been comprehensively updated to reflect current construction practices and the needs of the University for efficient and well-designed buildings. The format has been restructured to improve the flow of information and redundant language has been eliminated throughout. All previous requirements were evaluated to determine whether or not they are applicable to current standards and practices and previously long chapters have been separated into smaller chapters of more limited scope. Finally, chapters and subsections have been renamed utilizing a revised numbering system similar to that commonly used in reference standards. The 2016 Amendments included minor updates to various sections; section numbering and the overall document length remained the same.

It should be noted that requirements found within the *Virginia Uniform Statewide Building Code* and/or its referenced standards are not repeated within these guidelines and have been removed. The *Virginia Uniform Statewide Building Code* and its referenced standards are applicable to all University of Virginia buildings without exception. If any part of these guidelines unintentionally conflict with current or future state regulations, the most restrictive requirements shall apply.

The *Facility Design Guidelines* are intended to be used by architects, landscape architects, and engineers involved in the preparation of construction documents for the University of Virginia. The Guidelines are also a reference for University project managers, construction administration managers, and other personnel whose responsibilities relate to construction and renovations. The *Guidelines* are meant to apply institutional lessons-learned through design, construction and in-house services.

The *Guidelines* provide procedural and technical requirements broadly applicable to all design and construction. As part of the contractual agreement between the design professional and the University, conscientious application of the *Guidelines* is a tool to expedite the design and construction process in a cooperative, partnering effort. It is intended that the *Guidelines* be incorporated into the design documents. Thus, they shall be followed for all University projects unless due process is used for waivers or modifications. There may be particular project circumstances that warrant alternatives to these *Guidelines*. Such recommendations will be considered and shall be processed via the Determination and Findings process and approved by Facilities Management Chief Facilities Officer.

Recommendations are welcome from users for simplifications, additions and modifications. Please email suggestions to fdg-suggestions@virginia.edu.

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CHAPTER 1 – GENERAL REQUIREMENTS

1.1 GENERAL INFORMATION

University of Virginia *Facilities Design Guidelines* shall apply to all design projects unless specifically waived by the Chief Facilities Officer. Exceptions to the *Guidelines* shall be submitted by the Project Manager to the Chief Facilities Officer through the University Building Official (OUBO) with a “Determinations and Finding Report.”

1.1.1 DEFINITIONS/TERMS

Grounds: Comprised of North Grounds, West Grounds, Central Grounds and the Jefferson Park Avenue precinct of the University of Virginia Health System as illustrated in **Figure 1**.

Historic Grounds: Area bounded by Jefferson Park Avenue, McCormick Road, University Avenue and Hospital Drive (up to and including facades of Cobb Hall, McKim Hall, Barringer Wing and Old Medical School buildings along Hospital Drive), as illustrated in **Figure 2**. Portions of Rugby Road are also designated as a historic district.

The Academical Village: Original Jefferson designed buildings and grounds, including the land bounded by McCormick Road, University Avenue and Hospital Drive; also including the South Lawn in front of Cabell Hall, as illustrated in **Figure 3**.

Central Grounds: The area bounded by Emmet Street, University Avenue, Hospital Drive and Jefferson Park Avenue is the Historic Grounds and the Academic Village, as illustrated in **Figure 4**.

University of Virginia Health System (Health System) Area: The School of Medicine, School of Nursing, Health Sciences Library and Medical Center are components of the Jefferson Park Avenue precinct bounded by Hospital Drive, University Avenue, Jefferson Park Avenue, the CSX Railroad, the Norfolk Southern Railroad and Brandon Avenue. Additionally, the Health System includes the Moser Radiation Therapy Center at 2871 Ivy Road, U.S. 250 West and other off-site clinical facilities.

Architect/Engineer (A/E): The Architect or Engineer of record who contracts with the University as the prime design professional to provide architectural or engineering services for a project. The term includes any associates or consultants employed by the A/E of record in the provision of project design services.

Project Manager (PM): The University’s designated representative for the project. This term is synonymous with “University of Virginia Project Manager” as defined in the most current version of Higher Education Capital Outlay Manual (HECOM).

1.1.2 DOCUMENTS

Documents shall conform to the CADD version currently in use by Facilities Management and confirm the mode of transmission prior to project initiation. Specific drawing requirements shall be in accordance with the most current version of HECOM.

Contract bid documents are to be dated with the actual date of final submission incorporating the review comments by the Office of the University Building Official and other applicable University reviews. All project specifications shall be provided in PDF format (preferred) or the most current version of Microsoft Word format.

Facilities Management's base map is based on a set control datum. This control datum shall be used for all electronic mediums that pertain to mapping, civil and site work. Mapping shall be in accordance with National Map Accuracy Standards, based on Virginia State Plane Coordinate System, South Zone and North American Datum 1983 (NAD83). Vertical control is based on the North American Vertical Datum 1988 (NAVD88). NAVD88 Control Monuments have been established in various locations on the University Grounds using this datum. All construction or survey work shall be performed based on the most recent established control.

1.1.3 LIFE SAFETY DRAWINGS FOR HEALTH SYSTEM PROJECTS

To maintain accreditation, the University must maintain up to date Life Safety Drawings. Accurate as-built life safety drawings shall be provided to HSPP for all Health System projects, regardless of occupancy or project size, prior to application for temporary occupancy approval.

The life safety drawings must contain these minimum requirements to meet accreditation standards:

- Legend that clearly identifies features of life safety
- Areas of the building that are fully sprinklered
- Locations of all hazardous storage areas
- Locations of all rated barriers
- Locations of all smoke barriers
- Suite boundaries, including the size of the identified suites. Both sleeping (max 5000 sq feet) and non-sleeping (max 10,000 sq feet)
- Locations of designated smoke compartments
- Locations of chutes and shafts

1.2 CODES, UVA REVIEWS, PERMITS

1.2.1 GENERAL REQUIREMENTS

1.2.1.1 VIRGINIA UNIFORM STATEWIDE BUILDING CODE

The Building Code for all University projects on Commonwealth property is the current edition of the Virginia Uniform Statewide Building Code (VUSBC) with supplemental requirements, clarifications and modifications as indicated in this Manual. Refer to Section **1.2.1.3 Accessibility** for accessibility standards for state-owned facilities and associated clarifications. The provisions of the VUSBC are based on nationally-recognized model building codes and fire

codes published by the International Code Council, Inc. These model codes are adopted by reference into the VUSBC. The VUSBC is divided into 3 stand-alone parts:

Part I - The Virginia Construction Code

Regulations specific to the construction of new buildings and additions.

Part II – The Virginia Rehabilitation Code

Regulations specific to the rehabilitation of existing buildings, including renovations and change of occupancy.

Part III – The Virginia Maintenance Code

(Not applicable to UVa construction and renovation projects)

The applicable code shall be the code in effect at the time the HECO-5 Preliminary Designs are approved and authorization is given to proceed with development of the Construction Documents. If Preliminary Designs are approved during the four (4) months prior to the effective date of a new edition of the VUSBC, the applicable Code shall be designated by the University Building Official.

1.2.1.2 OTHER FEDERAL OR STATE REGULATIONS

Certain projects may be required to comply with other federal or state regulations. Those requirements may take precedence, equal or exceed the construction, health, safety and welfare standards regulated by VUSBC, and are approved after review by OUBO. These include:

Title II, Americans with Disabilities Act of 1990

Virginia Statewide Fire Prevention Code (SFPC)

Virginia Industrialized Building Safety Regulations (IBSR)

Virginia Manufactured Home Safety Regulations (MHSR)

Virginia Amusement Device Regulations (VADR)

Virginia Public Building Safety Regulations

Virginia Fire Safety Regulations

Virginia Department of Environmental Quality - Erosion and Sediment Control Regulations

Virginia Department of Environmental Quality - Stormwater Management Regulations

Virginia Department of Health Regulations

Section 504 of the Rehabilitation Act of 1973 (HUD)

Fair Housing Act Accessibility Guidelines (HUD)

Facilities Guidelines Institute (FGI) for the Design and Construction of Healthcare Facilities

1.2.1.3 ACCESSIBILITY

The Americans with Disabilities Act, 1990: Title II, Subtitle A (and not Title III) applies to all state owned buildings and structures. The accessibility standards to be used are the 2010 Standards for Accessible Design (**2010 ADA Standards**) published September 15, 2010, excluding the 2010 Standards for Public Accommodations and Commercial Facilities: Title III (Pages 15-30), and as clarified herein.

In addition, the following standards and regulations shall be used in planning and designing new construction, renovations or replacements for University projects on Commonwealth property:

1. Where standards conflict between this document and 2010 ADA Standards, the standard that is more stringent (i.e. more favorable to the disabled) shall govern.
2. *Non-Discrimination under State Grants and Programs*: These regulations, promulgated by the Board for Rights of Virginians with Disabilities and effective on October 1, 1990, implement Va. Code Section **51.5-40**.

1.2.1.3.1 ADDITIONAL GUIDELINES FOR ACCESSIBILITY AND USABILITY

The following additional guidelines apply to all relevant University projects:

1. Van parking is required in new parking areas and, where feasible, in renovated parking construction.
2. Automatic door openers are required at major entrances along accessible routes.
3. The use of accessibility approved lever-handled door hardware is required in new construction and renovations without regard to the numbers of doors involved.
4. Facilities shall be designed so that accessibility does not stand out or draw attention to it when other architectural alternatives are available. As an example, restroom lavatories shall be of uniform design with all lavatories meeting accessibility standards rather than just one unit meeting the standards. This would not apply to toilet stalls, urinals, or water closets.
5. Teaching and research laboratories shall have a minimum of five percent, but not less than one, work station for each type of facility (fume hood, bench, sink, etc.). Compliance may be achieved using readily adjustable modular casework and equipment.
6. Platform lifts for the disabled are prohibited in new construction. The University Subcommittee for Accessibility must approve use of platform lifts in renovation projects, where ramps are not feasible.
7. All stairways shall be accessible to the disabled.

1.2.1.3.2 CLARIFICATIONS FOR UNIVERSITY OWNED BUILDINGS

Accessible facilities must be provided at the completion of construction. Adaptable facilities do not meet the requirements for accessibility unless demonstrated to OUBO to be readily implemented on demand.

1.2.1.3.3 ELEVATOR ACCESS

As clarification of 2010 ADA Standards Section 206.2.3, Accessible Routes, Multistory Buildings and Facilities, all passenger elevators shall be accessible to the disabled, and multistory residential facilities shall include at least one accessible route to each floor level and each mezzanine in a building. Exception 4 does not apply to residential facilities.

1.2.1.4 LIFE SAFETY CODE

The requirements of the Life Safety Code, NFPA 101, apply only to the University Hospital and clinical facilities accredited by the Joint Commission on Accreditation of Healthcare Organizations (Joint Commission) and accepting federal Medicare and Medicaid funds. In case of conflict, the most stringent requirements apply. Should there be a conflict with VUSBC that critically affects accreditation by the Joint Commission this must be resolved with the University Building Official.

1.2.1.5 DEMOLITION

Demolition or renovation work, which occurs on the floor below or above the primary construction site, shall be shown sufficiently to convey the extent of work necessary to maintain or maximize functional occupancy of the effected space.

1.2.1.6 REACTIVATED PROJECTS

Prior to reactivating a project that has been inactive for a period during which the effective Code has changed, the University Building Official shall determine which Code applies. The Plans and Specifications shall be revised as necessary to comply.

1.2.1.7 MODIFICATIONS TO CODE REQUIREMENTS

If a modification to the VUSBC is thought to be necessary, the A/E shall request such modification in writing with the preliminary design submittal. The request shall clearly state the nature of the problem and the supporting rationale and justification for the modification. All requests to waive or grant a modification to the requirements of the VUSBC will be addressed to the University Building Official using a Determinations and Findings Report (D&F) for Code Modifications.

1.2.1.8 USE GROUP GUIDELINES

The following guidance shall be used for buildings and structures at the University:

1. Buildings for business training and vocational training shall be classified and designed for the Use Group corresponding to the training taught.
2. Academic buildings which include classroom-type education functions (including associated professor/teacher office spaces) where large groups of students must change classes on a schedule must incorporate a seventy-two inch (72") minimum corridor width at classrooms.
3. The occupant load for each space in a building must be calculated from VUSBC Table 1004.1.1 based on the use of the space (which may differ from the Use Group Classification). For instance, the occupant load of a break room in an office suite would be calculated as "Assembly without fixed seats."

4. Dormitories, Fraternity and Sorority Houses, and similar dwelling units with sleeping accommodations shall provide one of the following:
 - a. Written University policy that prohibits the use of the residences as lodging for persons/groups/occupants for periods less than 30 days; or
 - b. Design that complies with the most stringent requirements of both VUSBC Use Group R-1 (Hotels) and Group R-2 (Dormitory), exclusive of minimum required plumbing facilities, which are to be based on Use Group R-2.
5. Cabins, beach houses, lodges and similar dwelling units with sleeping accommodations rented to family groups:
 - a. Residences for rent less for than 30 days with a maximum occupant load of 16 shall comply with the requirements for Use Group R-3.
 - b. Residences for rent for less than 30 days with a maximum occupant load of greater than 16 shall comply with the requirements for Use Group R-1.

1.2.2 REVIEWS AND APPROVALS

Submit documents via Geospatial Engineering Services using the **Print and Review Transmittal**.

1.2.2.1 FIRE SAFETY

Fire Safety reviews will be conducted by the University Review Unit for all construction projects. The Office of the University Building Official (OUBO) shall submit Capital Project (\$2M+) review comments and Working Drawings to the appropriate Regional State Fire Marshal's office for their use in inspection of these projects and record purposes.

By University policy, all renovation projects are required to provide fire and life safety improvements up to ten percent (10%) of the construction cost or to the extent required by Code, whichever is greater.

Fire suppression, fire detection and fire alarm Shop Drawings shall be reviewed and approved prior to the work being installed. Where a complete fire protection system is designed and shown on the Final Documents, the Drawings and/or Specifications shall state that deviations in materials, locations, configurations or sizes proposed by the contractor are subject to being reviewed under the provisions of Section 26 of the Contract General Conditions as a "substitution."

When the fire suppression, fire detection and fire alarm systems are not complete on the Final Documents, then Shop Drawings or Submittal data shall first be reviewed and approved by the A/E. The reviewed documents, with any added notations by the A/E, shall be submitted to the University Building Official's office for final review and approval.

1.2.2.2 OTHER REQUIRED REVIEWS

The following departments provide applicable review comments in parallel with the Office of the University Building Official. OUBO incorporates these review comments in their specific discipline reviews when received prior to release of comments. All architectural and engineering consultants shall provide written comment response to the Project Manager for distribution to OUBO and respective review agencies listed below:

1. Facilities Management Operations & Maintenance Department (HVAC, fire systems, elevator, landscape, building services)
2. Facilities Management Energy & Utilities Department (sustainability, Systems Control Center, recycling, environmental compliance, utility systems, power systems, chiller plants, heat plants)
3. Facilities Management Health System Physical Plant
4. Office of Emergency Preparedness
5. University Police Department
6. Environmental Health and Safety
7. Documents for deferred submittal items shall be submitted to the registered design professional in responsible charge who shall review them and forward them to the building official with a notation indicating that the deferred submittal documents have been reviewed and found to be in general conformance to the design of the building. The deferred submittal items shall not be installed until the deferred submittal documents have been approved by the building official.

1.2.3 PERMITS

Construction on University (state-owned) property requires a building permit whether constructed by Virginia licensed contractors, Facilities Management personnel, or other allowed “self-service” University personnel. Facilities Management Directive 562F, or a subsequent update, describes the procedures applicable to building permits and project permits (under the “Annual Permit” authorization). This directive further defines construction-related work that does not require a building or project permit. If there is a question as to applicability of a building permit or a project permit, consult with the OUBO.

Building permits are to be submitted as follows. Under Virginia law, Contractors may NOT start construction without an approved building permit:

1. Download and complete the current **HECO-17** building permit form as an Excel format file.
2. Submit the building permit electronically to **BuildingPermitRequest@virginia.edu** for processing by OUBO.
3. Projects in or affecting patient healthcare facilities require Infection Control Risk Assessment (ICRA) and Interim Life Safety Measures (ILSM) documentation to be submitted and approved by Health System Physical Plant (HSPP) prior to permit approval. The Project Manager is responsible to ensure HSPP has the ability to review the design documents.
4. Properties under the ownership of the University of Virginia Foundation or the University of Virginia Physicians Group (UPG) require building permits for construction from the City of Charlottesville, County of Albemarle, or other applicable Building Official in whose jurisdiction the property is located. Design documents for these properties may, however, be subject to review for Facilities Design Guideline requirements and constructability by the OUBO if it is known at the time of construction that the building will be acquired as a University owned and operated building.
5. Construction projects at the Mountain Lake Biological Station are issued building permits by the Giles County Building Official. These projects are reviewed by the OUBO for compliance with the Facilities Design Guidelines and constructability.

1.3 SITE PLANNING REQUIREMENTS

1.3.1 GENERAL REQUIREMENTS

1.3.1.1 SITING AND RELATIONSHIP TO CONTIGUOUS SITES

Approved precinct studies/criteria developed by the Office of the Architect for the University shall be incorporated into building and site design. Sustainable site practices such as pervious pavement, vegetated roofs and low impact design stormwater management are encouraged. Efficient and safe vehicular, pedestrian and service access shall be achieved with pedestrian safety having priority. Provide for emergency access for fire, ambulance, police and service vehicles; including access for policing the building perimeter and pedestrian paths. See **1.4.3 Security**.

No building roof and sky silhouette in the Central Grounds area, the Health Systems precinct or readily visible on a line of sight with the Rotunda shall rise higher than the visual spring line of the Rotunda dome (elevation 631.75 feet above sea level).

1.3.1.2 POLICY FOR PARKING SPACE PLANNING

In addition to the VUSBC and ADA, refer to the **Parking Policy for Capital Projects** which applies to all new buildings, additions and major renovations. Parking on site and off site in designated University parking lots or structures may be considered in meeting parking requirements when committed to employees, students and public visitors using the building(s). Parking plans may be developed for entire complexes that address the total parking spaces available for all buildings and their associated Use Groups. Determination of site parking shall be achieved in programming, but not later than Preliminary Design, as coordinated through the Project Manager in consultation with the Office of the Architect for the University.

Accessible parking spaces shall be located closest to the nearest accessible entrance on an accessible route and no more than 250 feet from the accessible entrance.

1.3.1.3 MINIMUM STANDARDS FOR PARKING SPACES

The following minimum parking space dimensions are standards for use in the design of parking decks, parking garages and parking lots on University property. Parking configurations and aisle widths shall be designed to meet or exceed the minimum dimensions recommended by recognized parking design standards. Consideration shall be given to the duration of parking/turnover rate in the sizing of spaces and aisles and to the protection of columns and walls by the use of wheel stops, bollards or guardrails.

Parking Decks, Lots and Garages Utilizing Self-Parking		
Vehicle type	Minimum Width	Minimum Length
Standard cars	8'-6"	18'-0"
Compact cars*	8'-0"	15'-0"
Handicapped spaces**	See 2010 ADA Standards 502	

*Compact car spaces may be incorporated/designated when restrictions by walls, columns, piers, or other restraints impede the use of standard size spaces.

** Locate H/C spaces to minimize H/C users' exposure to crossing traffic.

1.3.1.4 SITE INVESTIGATION

The A/E shall not rely on University records pertaining to site conditions as existing records are not guaranteed to be accurate. In coordination with the Project Manager, the A/E shall determine any site investigation, including underground utilities and/or structures, warranted to reasonably prevent conflict or unforeseen project cost.

1.3.1.5 BUILDING CONSTRUCTION IN A FLOOD PLAIN

Executive Memorandum 2-97 prohibits the construction of new University-owned buildings within the 100-year flood plain unless a modification is granted by the University Building Official, and after consultation with the State Coordinator for the National Flood Insurance Program.

1.3.2 STORMWATER MANAGEMENT / EROSION AND SEDIMENT CONTROL

1.3.2.1 GENERAL REQUIREMENTS

All projects involving land-disturbing activity subject to Virginia Stormwater Management (SWM) and Erosion and Sediment and Control (E&SC) Laws and Regulations shall be bound by the DEQ-approved UVA Annual Standards and Specifications for SWM/E&SC. Additionally, they shall follow the guidelines of the Energy & Utilities Master Plan – Stormwater section – or appropriate watershed master plan for Meadow Creek or Moore's Creek.

Consideration of stormwater requirements should be made early in the project planning and design process. The University will ensure that their projects are located, designed and constructed to protect the water quality and living resources of local streams and rivers and the Chesapeake Bay.

Projects are encouraged to manage the water quality and quantity control requirements on-site using low impact development (LID) techniques that attempt to reconnect stormwater to the natural hydrologic cycle. Alternatively, use of a regional SWM facility may be used if all of the following conditions are met:

1. The project will have less than one acre of land disturbance,
2. The regional facility has adequate capacity for the project,
3. A Stormwater D&F is approved, and
4. On-site pretreatment is provided.

1.3.2.2 EROSION AND SEDIMENT CONTROL PLANS

Disturbance of land exceeding 10,000 square feet in Albemarle County or 6,000 square feet in the City of Charlottesville requires submission of an E&SC plan and narrative to the UVA Annual Standards and Specifications Administrator for approval at the Construction Documents stage of plan development. Preparation and submission of the plan and narrative shall follow the requirements of the Virginia E&SC Handbook, latest edition. Approval of the plan shall be secured prior to Advertisement. In addition, the project manager must notify UVA's Annual Standards and Specifications Administrator regarding the project's certified responsible land responsible disturber (RDL) as well as provide the target ground breaking date two (2) weeks prior to disturbance.

1.3.2.3 STORMWATER MANAGEMENT PLANS

Site-specific SWM plans shall be prepared for all projects involving a regulated land-disturbing activity that requires:

1. A Virginia Stormwater Management Program (VSMP) General Permit for Discharges of Stormwater from Construction Activities;
2. Land-disturbing activity within a watershed of a regional water quality SWM facility; or
3. Incorporates the use of LID practices and/or a constructed Best Management Practice (BMP)

SWM Plans shall be submitted to UVA's Annual Standards and Specifications Administrator for approval with the E&SC plan, if required. The SWM plan is not a substitute for the E&SC plan. Approval of the plan shall be secured prior to the Advertisement.

1.3.2.4 CONSTRUCTION GENERAL PERMITS

Projects resulting in land disturbance equal to or greater than one (1) acre must be covered under a VSMP General Permit for Discharges of Stormwater from Construction Activities (VAR10). The project's general contractor should apply for coverage under this permit. Information can be found on DEQ's website. Preparation of a Stormwater Pollution Prevention Plan (SWPPP) is a requirement of the general permit. Permit coverage is not a substitute for the E&SC or SWM plans.

1.3.2.5 PLANS AND SPECIFICATIONS

Requirements shall be included in the specifications to assign to the general contractor (as part of the contract) the responsibility of E&SC and SWM at all sites (on or off the University's property) of borrowing, wasting or stockpiling of soil products. A statement similar to the following shall be used:

“The contractor shall be responsible for satisfying any and all erosion and sediment control (ESC) and stormwater management (SWM) requirements for any land disturbing activities, including but not limited to, on-site or off-site borrow, on-site or off-site stockpiling or disposal of waste materials. Before undertaking any land disturbing activity for which the plans do not specifically address erosion control and stormwater management, the contractor shall contact the UVA Annual Standards and Specifications Administrator to determine what E&SC and SWM measures are necessary. The contractor shall completely satisfy all requirements of the E&SC and SWM regulations before continuing with the concerned activity.”

1.3.3 EXCAVATION PERMITS

Construction documents shall incorporate requirements that the Contractor is to call MISS UTILITY seventy-two (72) hours prior to all planned hand or machine excavation, and to submit the University of Virginia Facilities Management Energy & Utilities Department Distribution Division a **Request for Excavation Permit** within two hours of notifying MISS UTILITY. Drawings must be submitted with the permit request per the requirements on the form. Excavations of any depth are to be included.

The excavation permit will be issued when all known underground utilities have been identified, located and field marked. The permit is applicable to and valid for University property only. Field location of utilities is valid for fifteen (15) calendar days from the date of issuance. After fifteen (15) calendar days, a new permit will be required to verify locations and markings.

Applicable utilities systems include: electric, telephone, street lights, coaxial and other cable systems, water, steam, chilled water, natural gas, sanitary sewers, storm sewers and compressed air. Construction documents shall indicate that if an unmarked line is encountered or utility line damaged, the contractor must contact the Facilities Management Trouble Call Line at 434-924-1777 (24 hours per day).

In addition to University requirements, excavation permits may be required from the City of Charlottesville or Albemarle County as appropriate or Virginia Department of Transportation for excavation or other work performed within the right-of-way of streets and sidewalks maintained by those entities. Clearly identify such streets and/or sidewalks on the construction documents, and shall clearly affix responsibility to the organization, individual or group to perform excavations.

1.4 BUILDING PLANNING REQUIREMENTS

1.4.1 GENERAL REQUIREMENTS

1.4.1.1 BUILDING EFFICIENCY RATIOS

Building Efficiency Ratio of 65-75%: Classroom, Dormitory with shared toilets, Office, Laboratory, Assembly, Dining facility, and combinations of the above

Building Efficiency Ratio per Industry Standard: Service building, Warehouse, Garage, Dormitory with per-suite toilets, Apartment, Townhouse

1.4.1.2 FIRE DETECTION, SUPPRESSION AND SIGNALING SYSTEMS

All new construction must include fire detection and suppression systems. Projects within existing facilities must include fire detection and suppression systems, but the cost of added fire detection in existing facilities need not exceed 3% of the renovation project construction cost.

Academic buildings with classroom and associated office space where large groups of students change class on a regular schedule, and buildings housing research, testing and science laboratories, must include a fire protection signaling system.

1.4.1.3 FLOOR AND ROOF DESIGN LOADS

Where the live loads for each floor or portion thereof has been designed to exceed 50 PSF, such design live loads shall be conspicuously posted in that part of each story in which they apply, using durable signs.

1.4.2 SPACE PLANNING

Space planning of offices and conference rooms shall be based on the **University of Virginia Space Planning Guidelines (Appendix E)** and in consultation with the Assistant Director for Space Management. Space planning of classrooms and furnishings is established on a per-project basis in consultation with the Assistant Director. In existing buildings, reconfiguration to standards should be weighed against the impact on historic material and a cost/benefit analysis.

The A/E may not make assumptions or exceptions to the information outlined in Appendix E.

1.4.2.1 ROOM AND DOOR NUMBER ASSIGNMENT PROCEDURE

All rooms must have State Council of Higher Education (SCHEV) room numbers assigned by the Assistant Director for Space Management or, in the Health System, by the Office of Facilities Planning and Capital Development. The A/E, through the Project Manager, shall provide CAD files or half-size copies of floor plans not later than at the Preliminary Design submission for the assignment for room number assignments. Assigned room numbers shall be incorporated in the Construction Document submission. Any room configuration changes subsequent to room number assignment must be resubmitted for revised numbering.

Door numbers shall relate to assigned room numbers. A single door shall be numbered to match the room, such as 1001, 1001A or J1001 (where assigned room numbers have a suffix or prefix). Multiple doors in a room shall be numbered in a logical sequence such as 1001A, 1001B, or 1001A-1, 1001A-2.

During the bid phase the A/E shall provide a final CAD plan to the appropriate Space Administrator (Academic or Health Systems). Only relevant CAD layers should be visible in the file – i.e. walls, windows, doors, interior ramps, stairs, elevators, shafts, toilets, partitions (low/half walls, retractable wall systems, modular partitioning), roof outline, assigned SCHEV room numbering, room name, and occupancy load.

Where room and door numbering signage is provided by the contractor it shall be installed prior to final inspection for occupancy or substantial completion.

1.4.3 SECURITY

1.4.3.1 DESIGN FOR CRIME PREVENTION

Projects shall be submitted to the Office of Emergency Preparedness to review campus safety, security, card access and security camera locations. The Office of Emergency preparedness will coordinate review by the Department of Police and the General Safety and Security Committee into a single review process. The Project Manager should schedule this review around the completion of Schematic Design.

Particular concerns include landscaping, building entrances, walkways and parking areas, which shall be adequately lighted and free of areas hidden from view that could encourage criminal activity. Line of sight and accessibility for police personnel shall be given design consideration, including proposed or future surveillance cameras.

The design process shall evaluate the following Design Checklist for Crime Prevention:

1. Make it difficult for people to harm the building, its occupants, and contents.
2. Use barriers to keep service vehicles from having easy access to areas not intended for vehicular traffic?
3. Provide adequate lighting.
4. Ensure emergency telephones are readily available. (See **1.4.3.6 Emergency Telephones**)
5. Prevent unauthorized access from inside and outside the building to roofs, attics, adjacent buildings, and utility tunnels.
6. Design landscaping to contribute to security.
7. Incorporate Crime Prevention through Environmental Design (CPTED) concepts (See Appendix E) in the project design.

Parking under a building is not permitted and parking near a building is subject to scrutiny.

Underground utility structures (tunnels) required to have fire and emergency ingress or egress shall be alarmed to send signals to the police or a manned security post, and to FM Systems Control Center as well as to audible devices at the point of entry and elsewhere within the building or on the building exterior. These alarmed points of entry shall be keyed so that authorized personnel can interrupt and reactivate the alarm circuit when the opening is closed.

1.4.3.2 SECURITY ACCESS (CARD READER) SYSTEM

All new buildings, renovation projects exceeding \$5,000,000 in project cost, or existing buildings with a building code change of use, shall include a security access (card reader) system for all exterior doors, and for such interior doors as determined by the Building Committee. The security access system shall be installed and operational prior to the issuance of a Certificate of Use and Occupancy.

The A/E, through the Project Manager, shall determine the design and operational compatibility of the security access system in consultation with the Office of the Vice President for Business

Operations (Academic buildings) or Clinical Engineering and Biomedical Communications (Health System buildings). The system shall be compatible with the University's existing door security system(s). Submittals shall include product data and shop drawings. The system and components must be fully coordinated and integrated with all other building finishes, systems and components. The system shall be submitted to the Office of the University Building Official, and to the Office of Vice President for Business Operations (Academic buildings) or ID Services (Health System buildings) for review and approval.

See also **1.4.3.5** Electronic Access Controls.

1.4.3.3 SURVEILLANCE CAMERA SYSTEMS

For all new buildings, renovation projects exceeding \$5,000,000 in project cost, or existing buildings with a building code change of use, the Office of Emergency Preparedness security review shall consider applicability of exterior and interior surveillance cameras to overall campus safety and security.

When exterior surveillance cameras are requested, the project shall provide infrastructure as follows:

1. Conduit from selected exterior locations to accessible points inside the building
2. Power accessible to selected camera locations
3. Backboards at selected utility room locations, with power, data connection and adequate spatial requirements to accommodate and support the installation of a University compatible security camera system
4. The required exterior security camera infrastructure shall be installed and operational prior to the issuance of a Certificate of Use and Occupancy.

The University Architect's Office shall advise on the appearance and location of exterior surveillance cameras, consistent with achieving intended functionality.

The Department of Police will generally provide monitoring of security camera systems, but this service may require projects to provide additional monitoring capacity at the Department's central monitoring facility.

1.4.3.4 ON ALERT ELECTRONIC MESSAGE BOARDS

All new or renovated classrooms or places of assembly with 75 or more persons shall provide a University furnished, contractor installed emergency notification system and Ethernet connection.

Major renovations (10,000 square feet or \$1,000,000 construction) shall incorporate security access systems. Smaller renovations will be determined on a case-by-case basis. Consultation during design with the University of Virginia Police Department and/or Hospital Security, as appropriate, shall seek to assure the adequacy of the proposed design including incorporation of Crime Prevention through Environmental Design (CPTED) concepts in **Appendix D**.

Power for security systems and devices is to be from an emergency circuit where available.

1.4.3.5 ELECTRONIC ACCESS CONTROLS

1.4.3.5.1 GENERAL

Exterior doors in new construction and major renovations (plus select interior doors as requested by building occupants) shall be equipped with electronic access controls connected to the University's one card system. Through standing contract with the CBORD Group, Inc., the University electronic access control uses CBORD's Squadron access control panels. Squadron panels communicate with the University's CBORD CSGold servers over the University network, granting real-time access based on privileges assigned through the one card system.

1.4.3.5.2 PERIMETER CONTROLS

Effective design and implementation of any electronic access control system requires an understanding of the intended use and typical daily operation of the facility. In order to be effective, the entire building perimeter must be addressed to determine the most cost effective combination and layering of access control, including:

1. Primary entrance (during & after hours use). Typically equipped with card reader to allow after hours entrance, door is electronically locked & unlocked by predetermined schedule. Free egress at all times. Components include:
 - a. card reader
 - b. electronic locking hardware
 - c. door position switch
 - d. request-to-exit detector
 - e. local alarm sounder
2. Secondary entrance (accessible during normal business hours only). No after-hours access, door is electronically locked & unlocked by predetermined schedule. Free egress at all times. Components include:
 - a. electronic locking hardware
 - b. door position switch
 - c. request-to-exit detector
 - d. local alarm sounder
3. "Exit Only" door. Mechanically locked at all times, may be configured for local alarm activation upon door opening ("Emergency Exit" only). Components include:
 - a. door position switch
 - b. local alarm sounder
 - c. request-to-exit detector (not installed if designed for emergency exit only)

When determining whether card reader, electronic locking/unlocking, or monitoring should be specified, it is important to evaluate occupancy and use patterns for the facility. Where possible, points of highest traffic shall be equipped with electronic hardware for daily locking/unlocking. Card readers shall be installed on well-lit, easily identifiable and visible entrances. Monitoring and local audible ("prop") alarms shall be configured for all entrances to discourage propping of doors after hours. Keys shall not be issued to these doors, eliminating problems and costs associated with lost/misplaced/stolen keys and associated rekeying expenses. Lost cards can be immediately deactivated and new credentials issued without impacting other facility users.

1.4.3.5.3 SELECTION OF ELECTRONIC DOOR HARDWARE

The A/E shall follow the guidelines below when specifying electronic door hardware:

1. Function shall be fail secure:
 - a. Hardware provides free mechanical egress
 - b. No connection required to building fire alarm system

Note: certain life safety or fire code provisions may dictate the use of fail-safe hardware and interconnection with the building fire alarm system for specific doors. These exceptions must be coordinated with the Project Manager and reviewed by the University's access control specialist.
2. Electric locks, electric strikes and electric trim shall be 24Vdc. Provide filtered & regulated 24Vdc to power electric strikes, locks and trim.
3. Electric latch retraction devices (See **5.3 Interior Doors** for approved equipment list):
 - a. Typically require a manufacturer-specific power supply high in-rush current dictates conductor size and maximum cable length to power supply.
 - i. Max cable length may dictate installation of power supply near door
 - ii. Where possible, mount power supply in access control closet
 - b. Power supply to be mounted in central access control closet, adjacent to Squadron controls, with 120V AC cord and plug connection.
 - c. Specify hardware which includes battery backup integral to power supply
4. ADA doors with power operators shall be equipped with electric strike or electric latch retraction device and be interconnected with the electronic access controls.
5. If pulls are desired on both leaves of double doors, both leaves shall receive electronic hardware (i.e. both doors unlock/unlatch on card swipe).
 - a. If electric hardware is not desired on both leaves, the inactive leaf shall not be equipped with an exterior pull.
 - b. Double doors with a single active leaf and one inactive leaf must be configured to ensure positive automatic latching of the inactive leaf whenever the active leaf is closed and latched. Manual head/foot bolts are not permitted on doors with electronic access controls.
6. Magnetic locks are discouraged due to increased life safety concerns (connection to fire system, local physical bypass switch, etc.).

1.4.3.5.4 SPECIALTY HARDWARE

In addition to standard electronic hardware, which can be activated/controlled via relay contact closure or application of power, specialty products: Schlage AD-300 networked wired locks and Schlage AD-400 networked wireless locks are integrated with and fully configurable through CSGold. These specialty hardware options require far less door & frame prep than standard hardwired installations, and can in some instances significantly reduce installation costs.

1.4.3.5.5 INFRASTRUCTURE REQUIRED

The A/E shall provide infrastructure for access control projects to include the following:

1. A dedicated location for installation of access controls per the following requirements:
 - a. Provide a dedicated room/closet with:
 - i. Locking door with electronic hardware and card reader
 - ii. Minimum 32 SF available wall surface area
 - iii. Controlled temperature and humidity
 - iv. Minimum two (2) each dedicated 120V, 20 amp quad receptacle on emergency circuit with generator backup (if available). Facilities with large numbers of controlled doors or extensive use of latch retraction devices may require additional circuits or outlets.
 - v. Network (data) drop per V1000RX or V1000EVO controller
 - vi. Open paths/sleeves to pull cable from controls to door locations
 - b. Controls shall be installed per schematics in **APPENDIX E** and the following:
 - i. Squadron controls shall be installed per the latest edition of CBORD Squadron Access Control Installation Guide.
 - ii. All cable shall be neatly routed around Squadron modules through finger duct (see schematics in **APPENDIX E**).
 - iii. Composite cable outer jacket shall be stripped the minimum amount necessary to create adequate slack for termination of individual cable elements. Outer jacket shall be labeled with door number / designation at both ends of cable.
 - iv. Squadron connectors (V100, V200, V300) shall be labeled with door number/designation via self-adhesive label applied to face of module.
 - v. Fuses in low voltage power supplies (Altronix) shall be labeled with door or module designation of the device powered.
 - vi. Power supplies serving electric latch retraction exit devices shall be labeled with door number / designation via self-adhesive label applied to the outer cover of the power supply.
 - vii. Outer jacket of cables feeding individual exit devices shall be labeled with door number/designation at both ends.
2. Open raceways (EMT or LFMC only) with pull string from accessible and dedicated 8"x8" junction box to points of termination within the door and doorframe. Refer to **APPENDIX D** for sample details. These are representative sketches intended to convey preferred routes for cable and typical installation details for various components and local conditions. In addition to these line drawings, the following points shall be verified during design and construction:
 - a. AC power shall not be run in the same conduit or junction box as low voltage access control cable
 - b. Conduit routed to door frame shall have the minimum number of wide radius bends required to reach the desired location. In no instance shall bends exceed 180 degrees without an intermediate (and accessible) junction box or pull "L"
 - i. Minimum conduit size to accommodate composite cable is 1" C
 - ii. Minimum conduit size to accommodate up to three individual cables separated from the composite cable is ¾" C
 - iii. Minimum conduit size to accommodate one or two cables separated from the composite cable is ½" C
 - c. Install pull strings from junction box to point of termination in all conduits

- d. Grouted frames shall be equipped with mortar boxes around electric hinges, electric power transfers, electric strikes, door contacts, etc.
- e. Use factory installed raceway within hollow metal frames
- f. Where ADA operators are installed:
 - i. ADA push button must be hardwired to the ADA operator
 - ii. Card reader shall be installed adjacent to ADA pushbutton, and may share a common conduit run to the 8"x8" junction box

1.4.3.5.6 CONTRACTOR-FURNISHED COMPONENTS

The contractor shall furnish the following components and services with respect to access control projects (See **5.3 Interior Doors** for approved equipment list):

- 1. Card readers
- 2. Alarm horns/sounders
- 3. Request-to-exit devices (motion detectors)
- 4. Door position switches (door contacts), normally open
- 5. Modular DC power supplies serving:
 - a. Squadron controls
 - b. Request-to-exit devices (motion detectors)
 - c. Alarm horns/sounders
 - d. Electric strikes/locks
 - e. Note: power supplies for latch retraction hardware shall be provided by hardware supplier
- 6. Cable

1.4.3.6 EMERGENCY TELEPHONES

New buildings, new parking lots and major site work projects shall provide location(s) for emergency telephone(s) that are accessible, hands-free operated and located on or near lighted walkways providing visibility and comfort in their use. The Project Manager shall determine approved locations and type of installation in consultation with the University Safety and Security Committee.

Two types of emergency telephone styles are applicable. In all installations the telephone shall be University provided and installed on or in the assembly. Power for emergency telephones is to be an emergency circuit where available:

- 1. The type applicable to most locations is a Facilities Management fabricated and installed assembly as illustrated in **Figure 5**; installation will include all necessary wiring, cabling, the telephone and the light fixture.
- 2. For areas determined by the University Safety and Security Committee and large parking lots (more than 49 cars), the use of a pre-manufactured "tower" type emergency telephone assembly is appropriate. For each 99 parking spaces, an additional emergency telephone is required. The University Landscape Architect must approve "tower" type assemblies taller than 8' for large parking lots where visibility over vans and similar taller vehicles is required.

Where “tower” type emergency telephones are specified, the design shall be similar to GAI-Tronics Corporation Model 234 Stanchion and/or model ETP-MT/R by Talk-A-Phone Co., and shall be ADA compliant. Color(s) shall be approved by the University Landscape Architect.

1.4.4 HAZARDS

1.4.4.1 ASBESTOS ABATEMENT

1.4.4.1.1 GENERAL ASBESTOS ABATEMENT DISCOVERY REQUIREMENTS

Buildings constructed prior to 1988 are presumed to have Asbestos-Containing Materials (ACM) until such materials have been tested and found not to contain asbestos. The University shall test for ACM prior to submittal of the Preliminary Design in accordance with UVa policy on ACM Management through the Office of Environmental Health & Safety (OEHS). An asbestos survey/inspection report must be made available to the project A/E for information and use in preparing the project documents and cost estimate for asbestos abatement. The A/E is responsible to the University to coordinate the design with the asbestos abatement work in order to prevent conflicts, claims and work stoppages.

If asbestos-containing materials are found, the University’s licensed asbestos designer in concert with the A/E will prepare an Asbestos Abatement Specification. Based on the asbestos survey/inspection report and the Asbestos Abatement Specification, the construction documents shall indicate all locations where ACM have been found and/or where ACM are to be disturbed.

The demolition plan sheets and the architectural floor plan sheets for each floor shall have an *Asbestos Disclosure Statement* indicating one of the following:

1. “An asbestos inspection was performed and no asbestos-containing materials were found. The asbestos survey/inspection report is available to the Contractor(s) for demolition and construction.”
2. “An asbestos inspection was performed and asbestos-containing materials were found generally in the areas indicated. However, the Work in this Project is not intended to disturb the existing asbestos-containing materials. The asbestos survey/inspection report and the Asbestos Management Plan are available to the Contractor(s) for demolition and construction.”
3. “An asbestos inspection was performed and asbestos-containing materials were found generally in the areas indicated. The asbestos survey/inspection report is available to the Contractor(s). The asbestos-containing materials shall be removed prior to any other Work being performed in these areas. The Asbestos Abatement Specification is included in the documents. OEHS will mark-up the Asbestos Management Plan to show the “As-Built” conditions at the conclusion of the Work.”
4. “An asbestos inspection was performed and asbestos-containing materials were found generally in the areas indicated. The asbestos survey/inspection report and the Asbestos Abatement Specification are available to the Contractor(s) for demolition and construction. Asbestos-containing materials shall not be disturbed in this Work except where specifically indicated and required for connections to utilities. Where such connections are required, the UVa PM and OEHS will determine approved

procedures as specified. The asbestos-containing materials that are to remain and the new non asbestos-containing material shall be labeled accordingly. OEHS will mark-up the Asbestos Management Plan to show the “As-Built” conditions at the conclusion of the Work.”

In addition, the use of materials that contain asbestos shall be prohibited in any new construction or renovation work. See section II (e) of the **General Conditions of the Contract for Capital Outlay Projects** for asbestos-related work insurance requirements.

1.4.4.1.2 ASBESTOS REMOVAL

All ACM that may be disturbed as a result of the Work must be removed or properly repaired. The University has two contracting options for use in removal of asbestos:

1. A separate contract for removal of the asbestos prior to renovation, demolition or addition; or,
2. A contract where the abatement is an integral part of the renovation, addition or demolition project in which the general contractor is licensed as an asbestos contractor or hires a licensed asbestos abatement Subcontractor to perform the work.

1.4.4.1.3 REMOVAL AND REPLACEMENT OF SPRAYED-ON FIREPROOFING

The A/E, in consultation with the University, shall verify early in the design phase with the Office of the University Building Official the original purpose of any fireproofing material to be removed or replaced and what, if anything, must be done to restore the fire resistive characteristics. If sprayed-on ACM is to be replaced, the A/E shall submit copies of the proposed specifications for the intended replacement material and any bridging encapsulate for review. The bridging encapsulate must be correctly matched with the replacement material to ensure maximum bonding strength and to maintain the intended fire rating integrity of the assembly. See also **4.2.4 Spray Fireproofing Design and Specification**.

1.4.4.1.4 ASBESTOS RELATED WORK INSURANCE REQUIREMENTS

See SECTION 11(e) of the **General Conditions of the Contract for Capital Outlay Projects** requires the asbestos contractor or subcontractor, as the case may be, to name the A/E as an additional insured on the contractor’s liability insurance with asbestos coverage. Where the A/E for the renovation project prepares the asbestos project drawings, the requirement of SECTION 11(d) to name the A/E as an insured party is waived. Professional Liability/Errors and Omissions insurance, with asbestos coverage, in an amount not less than \$1M is required.

1.4.4.1.5 CONFLICT OF INTEREST POLICIES

All laboratories utilized for asbestos sampling analyses for project purposes shall have no direct business or financial relationship with the contractors conducting asbestos abatement activities.

1.4.4.2 SPECIAL PROCEDURES FOR LEAD CONTAINING PAINT

In renovation and demolition projects OEHS shall conduct a survey for lead-containing paint, documenting all quantities and locations found. Where lead-containing paint is suspected or pre-determined, an estimated cost for any special procedures required shall be included in the cost estimate supporting the construction budget or budget request.

The construction documents for all renovation, demolition and addition projects shall indicate all locations where lead-containing paint is to be disturbed or to remain, and shall include a *Lead-Containing Paint Disclosure Statement* indicating one of the following:

1. "A lead-containing paint inspection was performed and no lead-containing paint was found."
2. "A lead-containing paint inspection was performed and lead-containing paint was found in indicated areas. However, the work in this project is not intended to disturb existing lead-containing paint."
3. "A lead-containing paint inspection was performed and lead-containing paint was found in the areas indicated. The contractor shall be responsible for compliance with all VOSHA regulations regarding lead-containing paint protection for workers."

Following removal of lead-containing paint, additional TCLP tests in accordance with EPA guidelines shall be done on these materials to determine disposal requirements as hazardous waste or as ordinary construction debris. It is unlawful for materials identified as hazardous waste to be disposed of with ordinary construction debris.

1.4.4.3 CONFINED SPACE REQUIREMENTS

All structures shall be designed in an effort to minimize confined spaces where configuration, size or location hinders the activities of the employees who must enter and work in the space and the space is not designed for continuous occupancy (examples include underground vaults and tanks). Where newly-created confined space is unavoidable, the following guidelines must be considered to reduce the hazards associated with the space:

1. Install a remote monitoring and inspection system and automated cleaning system to eliminate or minimize the need for entry.
2. Provide mechanical ventilation to avoid build-up of contaminants or combustible atmospheres.
3. Design adequate means of entry and exit to accommodate persons who may be required to wear personal protective equipment, a breathing apparatus, and protective clothing.
4. Design suitable illumination on emergency power (no timer switches) for safe entry, conducting work and exiting.
5. Eliminate fall hazards. Provide fixed ladders, guardrails, platforms and anchor points for personal fall arrest systems, and provide non-slip work surfaces (e.g., textured flooring).

1.4.4.4 EMERGENCY GENERATORS & FUEL BURNING EQUIPMENT

All fuel burning equipment requires evaluation for inclusion in the University of Virginia Federal Title V Air Permit and for permitting as a new stationary source (**9VAC5-80**). The Project Manager is to provide the Associate Director for Environmental Resources with the following information to facilitate the environmental review and permit applications:

1. Copy of the manufacturer's specifications
2. Copy of any available emissions data from the manufacturer
3. Size/capacity (kW, hp or btu/hr)
4. Manufacturer, model number and serial number
5. Fuel type
6. Fuel tank specifications
7. Generator/boiler and tank location
8. Installation completion date

The manufacturer's specifications must be provided for each new piece of fuel burning equipment before they are purchased. FM Environmental Resources shall be notified of any removal, replacement or modifications of any fuel burning equipment in order to maintain the University's permit documentation accordingly.

The Contractor shall submit the emissions certificate from the manufacturer documenting the air emissions performance.

Generator fuel shall be ultra-low sulfur diesel (max sulfur of 15 ppm) and shall meet regulatory requirements. A fuel certification shall be provided by the Contractor and include:

1. Name of supplier
2. Date of fuel received
3. Volume of fuel delivered in shipment
4. Statement that oil complies with ASTM specs for No. 2 fuel oil
5. Sulfur content of oil and method used to determine sulfur content

Exhaust stacks shall be installed so as to not cause or contribute to a condition of air pollution back into the building of interest or adjacent sensitive locations (e.g., stack height is 10 feet above rooftop, vertical discharge, avoiding discharge into nearby outside air intakes or windows).

Provide cam locks on the load side of the generator breaker for the purpose of load bank testing and temporary generator installation in the event of a generator failure. Provide 2 - #14 AWG conductors from the transfer switch to the generator to enable a contact to disconnect the load bank if building power is interrupted during load bank testing.

Professional designers under contract to the University for a specific project are responsible for compliance with all legislated requirements.

See **3.1.5 Petroleum Storage Tanks**.

1.4.4.5 HAZARDOUS WASTE STORAGE

In addition to code requirements (including rated enclosure, dedicated ventilation and floor containment system), the A/E must adhere to the following guidelines when designing a hazardous waste shipping, receiving and/or storage area:

1. Doors to the area must be equipped with locks to prevent unauthorized entry.
2. Waste containers must be adequately segregated and contained. Provide minimum 3' of aisle space between shelving and waste containers.

In addition to code required equipment (including fire suppression, extinguishers, emergency shower and eyewash), a spill kit must be provided in hazardous waste storage areas.

1.4.4.6 FALL HAZARDS

Structures shall be designed to eliminate fall hazards for persons engaged in maintenance, repairs and related activity. Where exposures to fall hazards are unavoidable, incorporate the following into building design:

1. Anchorages to which personal fall arrest equipment is attached shall be capable of supporting at least 5,000 lbs (22.2 kN) per employee attached as required by the Occupational Health and Safety Administration (OSHA Standard 1926.502).
2. Install guardrails and toe boards where people are exposed to falls $\geq 4'$. Standard railings with standard toe boards shall be installed on all exposed sides except at the entrance to the opening. The railings and toe boards shall be constructed in accordance with the ANSI standard A1264.1-1995.

1.4.4.7 SOURCES OF NOXIOUS OR TOXIC FUMES

Projects shall be designed to prevent noxious/toxic fumes from entering occupied spaces, recognizing some buildings have more stringent needs (such as where large numbers of persons gather or in medical research buildings). All new buildings and those projects involving major renovations and upgrading of heating, ventilation, and air conditioning systems shall incorporate the following:

1. Site and building design shall include consideration of outside air intakes for heating, ventilation and air conditioning related to sources of noxious or toxic fumes. The A/E and Project Manager are required to understand existing conditions and/or prevailing winds and account for these factors in the project design.
2. Outside air intakes shall be sufficiently above exterior grade (30'-0" or at third story level) and remote from loading docks, emergency or ambulance vehicle entrances, etc., on all new buildings and major renovations to avoid intake of noxious or toxic fumes associated with vehicles, maintenance equipment, electrical generators, similar sources of fumes permanently or intermittently associated with building functions and maintenance, and to discourage malicious contamination. Consideration also shall include proximity to wind-blown dust from streets, fields and ground care activities, designated tobacco smoking areas, combustion by-products, and biogenic materials related to evaporative cooling towers or intentional human contamination.
3. Dedicated mailrooms shall be exhausted and shall be under negative pressure.

1.4.5 REQUIREMENTS FOR SPECIFIC USES

1.4.5.1 CUSTODIAL ROOMS

Provide one custodial room for each 15,000 to 18,000 gross square feet, with a minimum of one room per floor. Locate closets adjacent to restrooms and elevators. Valves, electric panels and equipment, thermostats, and terminal boards for telephone, data or other low voltage equipment shall NOT be placed in custodial rooms.

Provide a central custodial room in each building on a level accessible from a service or loading dock entrance, containing a minimum area of 130 square feet (20 square feet in trailers), to accommodate the following:

1. Floor space for one (1) wheeled cart and one (1) floor machine
2. 18 linear feet of heavy duty metal shelving 24 inches deep with 18" vertical separation between shelves, not exceeding 7'-2" from floor to top shelf
3. 3' x 3' floor sink with drain and (3) mop holders, with impermeable surface 2' minimum above the sink on any adjacent wall
4. Broom hanger strip to accommodate minimum of (3) brooms
5. Space to accommodate (2) stepladders
6. Space for small desk with data/telephone outlet
7. Two (2) GFCI type duplex electrical outlets centered 18" above the floor in accessible locations (one adjacent to corridor door)
8. Motion detector switch for overhead light fixture
9. Water resistant epoxy flooring (turned up 4") with a floor drain. Floor shall slope 1/4" per foot floor to the drain throughout the room.
10. Four (4) metal hooks mounted on inside of corridor door. If door is fire-rated, hooks may be located adjacent to the door.

See **6.4.5.4 Distribution and General Exhaust.**

1.4.5.2 INFORMATION TECHNOLOGY SERVICES (ITS)

The Project Manager shall coordinate ITS requirements with Information Technology and Communications during Programming and Schematic Design. ITS equipment rooms shall be dedicated for ITS use only (telephone, data and entertainment video services). These rooms shall not be used to support any other building utility.

The University IT Building and Cabling Standard is applicable to newly installed systems. All systems shall meet this standard unless specific exceptions are obtained directly from the Office of UVA IT Enterprise Infrastructure.

Telecommunications room/closets shall include the following:

1. Minimum size 6' x 8' (serving up to 100 outlets). Room size must accommodate projected number of outlets served including not less than 33% growth.
2. Minimum height 9'
3. No suspended ceiling unless required by building code
4. A lockable 3' x 6'-8" out-swinging door. If in-swinging door is required by building code, the room size may need to be increased.
5. 50 foot-candles illumination level at 3' above floor, light fixtures mounted 8'-6" minimum clear above floor (no wall mounted light fixtures)
6. Maintain ambient room temperature < 75 degrees (typical heat load < 6,000 watts), 30-75% relative humidity, slight positive pressure. HVAC requirements maintained 24/7 year-round.
7. Fire-treated 3/4" plywood installed from floor to 8' above floor on minimum 3 walls of room

8. Stacked vertically where possible and interconnected by four (4) four-inch (4") bushed sleeve floor penetrations extending one inch (1") above the floor
9. Interconnected horizontally at minimum of every three floors with a cable tray above suspended ceiling (or conduit where ceiling is not accessible), with a run distance not exceeding 90 meters.
10. Within 90 meters cable run distance of the most remote site. Multiple closets are required if this distance cannot be achieved with one closet.

Cable tray, when provided, shall be a minimum of 12" x 4" deep. See **6.6.3.1 Telecommunications**, for additional technical requirements, such as electrical power outlets, building entrance termination, grounding, cable tray, conduit and outlets.

1.4.5.3 LACTATION ROOM DESIGN

Under The Patient Protection and Affordable Care Act (PPACA), the University is required to provide an area, other than a bathroom, that is private and free from intrusion from coworkers and the public, which may be used by an employee to express (pump) breast milk. The space can be temporarily assigned or converted for the duration of a mother's need; departments should reference the following guidelines when retrofitting existing spaces to serve this purpose. The A/E shall incorporate the following guidelines when planning lactation rooms in new buildings or major renovations:

1. Size: 50 SF
2. Location: A safe, accessible area
3. Access Privacy: Install a user-operated, indicator deadbolt that displays an "occupied" message to discourage interruptions.
4. Sound Privacy: Extend wall framing to the structure above to minimize sound transmission; install sound attenuation; installation of fabric panels on the walls is encouraged.
5. Furniture: Provide a table to be used as a work surface. Provide a comfortable, adjustable task chair with arms.
6. Electrical: Provide an electrical outlet to power breast pump and refrigerator.
7. Plumbing: Provide a sink and faucet combination deep enough to wash bottles and pump parts. Specify a goose neck or kitchen type faucets.
8. Lighting: Specify task lighting over the work area.
9. HVAC: Locate individual thermostat in room for user control and thermal comfort.
10. Equipment: Install a compact refrigerator for milk storage.
11. Accessories: Provide trash can, paper towel dispenser, coat hook, mirror and hand sanitizer

1.4.5.4 UVA RECYCLING SPACE GUIDELINES

All projects shall comply with **UVA's Recycling Station Guidelines**. For all capital projects and renovation projects involving significant spatial reconfiguration, the Project Manager shall coordinate with **UVA Recycling** to determine additional trash and recycling space requirements specific to the tenants' needs and building requirements.

1.4.5.5 VIVARIUMS

Vivarium and other research or clinically related animal holding facilities are required to meet architectural, mechanical, electrical and plumbing standards established by the current edition of the **Guide for the Care and Use of Laboratory Animals**, Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council and National Academy Press.

1.4.6 BUILDING DEDICATION PLAQUES

Building dedicatory plaques are included as part of all new building projects. See the **Commemorative Plaques** on the Office of the Architect for the University of Virginia web site for design guidelines. The University shall procure and install the plaque.

Unless approved by the President of the University, building identification shall not be engraved onto or included in the fabric of the building, such as in a cornerstone, engraved stone or surface mounted lettering.

1.5 PROJECT CLOSE OUT

1.5.1 FINAL CLEANING

Final cleaning shall include, but not be limited to, cleaning in compliance with manufacturer's instructions, interior and exterior glass, mirrors, floors, other interior finishes, mechanical and electrical equipment, removal of stains and foreign substances exposed to view, vacuuming of clean soft surfaces, polishing of transparent or glossy surfaces, and other such requirements to leave the project area in finished condition. Final cleaning shall be inspected by Building Services with the Construction Administrative Manager or Project Manager.

Contractor shall be responsible for resilient floor stripping and finishes. A Green Seal floor finish shall be required. The contractor must consult with Building Services Management Team prior to the start of project floor care step.

1.5.2 SITE RESTORATION

The contractor shall restore all existing gravel areas, paved areas, walks, drives, storm drains, etc. to their original condition.

The contractor shall restore all grassed or turf areas disturbed by construction activities, including areas used for access, staging, parking and storage in accordance with established requirements in the construction documents and found acceptable to the University's Landscape Superintendent. General instructions to restore grassed or turf areas to original condition are not acceptable. Copies of the University's Turf Restoration Specifications are available through the Project Manager.

When the Project Manager directs that finish landscaping is to be accomplished by separate contract, the construction documents shall include specific requirements for leaving the site ready for landscaping.

1.5.3 OPERATION AND MAINTENANCE MANUALS/DATA

The contractor shall submit all operations and maintenance manuals to the A/E for review and approval. The A/E approved manuals shall be submitted to the Construction Administration Manager prior to final demonstration of the equipment.

For new buildings or major renovations, the contractor shall provide a cabinet for maintenance manuals in a visible, secure location sized to contain a complete set of operations and maintenance manuals.

Provide one complete set of manuals in both digital and printed format (two printed copies for Health System projects) to be delivered to the A/E for submission to Facilities Management through the Construction Administration Manager. Each set of manuals is to be in individually bound volumes based upon CSI standard specification headings.

Manual binders shall accommodate 8.5 by 11-inch pages, be stiff-backed, plastic or canvas covered three ring type loose-leaf binders with the project name and division permanently lettered on the spine. When larger pages are necessary, they shall be neatly folded to 8.5 by 11 inches as pullouts or foldouts.

Each copy of the manuals shall include:

1. Names, addresses and trades of all applicable subcontractors, manufacturers and equipment
2. Complete maintenance instructions from the manufacturer's local representative for each item of operable equipment, as well as the name, address and telephone number of the installing subcontractor
3. Catalog data on all items submitted and other pertinent data such as mortar colors, brick selected, and colors selected for all finished materials and fabrics
4. Catalog data on all furnished plumbing fixtures, valves, water heaters, heating equipment, light fixtures and similar equipment and systems. Manufacturer's promotional literature is not acceptable
5. Manufacturer's name, model number, service manual, spare parts list and descriptive literature for all components used
6. Preventive maintenance instructions and schedules for all major equipment
7. List of most frequently encountered breakdowns and repairs/trouble shooting manual(s)
8. Instructions for starting and operating the actual system as installed
9. Detailed one-line, color-coded wiring diagrams
10. Schedules on contractor's As-Built drawings and subsequent A/E's Record Drawings shall indicate the actual make, model and size for each piece of equipment used.
11. Sections for major equipment to be included in the Preventive Maintenance Systems Equipment Lists (See **1.5.5 Preventative Maintenance Systems Equipment Lists**) should be identified by unique ID number to be provided by Facilities Management CMMS staff.

1.5.4 SPARE PARTS AND MAINTENANCE MATERIALS

Spare parts and maintenance materials shall be turned over to the Construction Administration Manager at final inspection. Keys, other than those provided by Facilities Management, shall be

delivered to the Construction Administration Manager at the final inspection. Construction documents shall state these requirements. See **5.3.3 Locksets**.

1.5.5 PREVENTATIVE MAINTENANCE SYSTEMS EQUIPMENT LISTS

The contractor shall furnish a data sheet inventory of all installed equipment and building components to include elevators, fire protection systems, fire detection systems, pressure vessels, emergency lighting, emergency electrical generators, monitoring systems, electrical, HVAC and refrigeration, roofing, water and sewer, heat distribution, carpentry, plumbing for the preventive maintenance system and stormwater management practices. All items should be identified by unique ID number to be provided by Facilities Management CMMS and Environmental Resources staff. The contractor shall provide all special tools and test equipment required for maintenance.

1.5.6 WARRANTIES AND GUARANTEES

All warranties and guarantees shall be drawn in the name of the Commonwealth of Virginia and the Rector and Board of Visitors of the University of Virginia, and shall be delivered in print and digital format by the A/E to the Construction Administration Manager.

The contractor shall submit PDF files of warranties and guarantees and one commercial quality, hardback binder sized to accommodate 8.5 by 11 inch pages, with a table of contents and one (1) copy of each warranty or guarantee. Marked tabs shall separate warranties and guarantees in sections following the order of the specifications.

Training shall be provided to Building Services staff if new or unusual floor finishes are installed. Specification manuals for floor care shall be provided to Building Services Superintendent and Associate Director.

1.5.7 BENEFICIAL OCCUPANCY/FINAL INSPECTION

See **6.1.7 Commissioning**.

Prior to beneficial occupancy of a project, the building(s) must be inspected and accepted, on both interior and exterior, by the Project Manager, Construction Administration Manager, A/E and the Office of the University Building Official. Exterior lighting shall be operational and exposed earth adjacent to buildings and walkways serving buildings shall be graded and protected to prevent erosion. Trash receptacle pads shall be in place and accessible to collection equipment. Any continuing construction activity on the balance of the project, including equipment and vehicle access, shall be identified on a list.

The contractor is responsible for the final inspection held in the presence of the Project Manager, the Construction Administration Manager and the A/E. The responsible Facilities Operations or Health Systems Physical Plant Zone Maintenance Supervisor shall be a participant.

Inspection of Capital Outlay projects by both the Office of the University Building Official and a representative of the State Fire Marshal is required. The Project Manager or Construction Administration Manager will coordinate this inspection(s) as determined with the A/E.

CHAPTER 2 – HISTORIC PRESERVATION

2.1 HISTORIC PRESERVATION GENERAL

The Historic District consists of buildings within the **Central Grounds Area**, including **Thomas Jefferson's Academical Village**, that are considered historic landmarks. In addition, many other buildings within the University are classified as historic landmarks or components of designated historic districts. A list of historic buildings within the University by preservation priority is included in the **2007 Historic Preservation Framework Plan**.

2.2 PRESERVATION GUIDELINES

The management and conservation of historic resources is a priority requiring cooperation between departments and disciplines throughout all phases of the work. Observe the following guidelines on all projects related to historic resources at the University:

1. Historically significant structures and landscapes must be recognized and acknowledged to promote appreciation, understanding and respect for them.
2. Pursue an active program of studying and recording the University's historic resources.
3. Historic Structure Reports, Building Assessment Studies and Cultural Landscape Reports should be performed as needed on buildings and landscapes as a part of project planning.
4. An active public outreach program involving presentations by preservation staff should be developed to communicate the findings and goals of the Preservation Framework Plan to Facilities Management, the schools and departments within the University, and to the broader Charlottesville community.
5. The permanent collection of records and information chronicling the development and evolution of the University's historic resources should be maintained and enhanced.
6. An active program for listing resources on the National Register of Historic Places should be pursued.
7. Archaeology must be incorporated into projects involving ground disturbances.
8. A design review process involving preservation specialists on the University staff should be implemented to evaluate proposed repairs on, alterations to and improvements of historic resources. Revisions to projects may be necessary to avoid altering or damaging the integrity of a building or landscape.

See the **website of the Office of the Architect** for the Historic Preservation Framework Plan, Historic Structures Report and other preservation-related information.

2.2.1 CARE AND MAINTENANCE

In the on-going process of maintenance, the most appropriate action is the one which achieves the desired goal with the least negative effect on the historic resource. Historic resources are the product of practices and materials not commonly employed in contemporary construction; therefore

the use of traditional methods, techniques and skills for conservation should be embraced by the University to ensure appropriate repair and maintenance of historic buildings.

1. Active conservation of historic buildings and landscapes is an integral part of planning for repair and maintenance.
2. Employ the least intrusive methods of stabilization and repair when dealing with historic building fabric.
3. Retain original fabric and character-defining features. Missing original features should be replicated faithfully without reproducing original failures or shortcomings.
4. The University should maintain its staff of skilled tradespeople who are knowledgeable in traditional materials and construction practices and are capable of performing maintenance and repairs in a manner which is equal to or better than that found in the original construction of historic buildings.
5. Completed work must visually match work from the resource's period of significance.
6. Photographic and written documentation should be incorporated into all phases of work conducted on historic buildings and landscapes.

2.2.2 ADAPTIVE USE OF BUILDINGS AND LANDSCAPES

Improvements and alterations to historic resources should have minimal effect on the integrity of the building and/or landscape while extending the life and use of the resource. Alterations to accommodate ephemeral uses and occupancy should be reversible. Permanent improvements to accommodate changes in use should be executed to a degree of quality equal to or exceeding that of the original construction.

1. Evaluate the effect of proposed alterations to the integrity of the historic resource based on the significance of the building or landscape in question.
2. Consider The original design of a building or site and its significant features when planning for reuse or adaptation. Ideally the use of buildings should be compatible with their original function/plan to minimize changes to layout.
3. Ensure the installation and/or replacement of services and systems does not adversely affect the integrity of buildings and landscapes.
4. Reverse past alterations that detract from the integrity of the historic resource when circumstances allow.
5. Mothball vacant or underutilized historic buildings according to standards put forward by the National Park Service in Preservation Brief 31 to protect structures from deterioration, and maintain them until appropriate use allows for their occupancy and repair.
6. Architectural fragments, significant elements and pieces of building systems removed from structures should be recorded, archived and protected for future research and study.

2.3 ARCHAEOLOGICAL CONCERNS

On occasion, the University discovers subsurface archaeological materials requiring immediate, expedient investigation as to their merits and the means by which they will be removed or preserved. It is the University's responsibility to advise the A/E of known or suspected sites having archaeological significance, as well as the intent of the University to perform an archaeological investigation.

In the event of a discovery during construction, notify the Project Manager immediately and he/she will make provisions for site investigation.

CHAPTER 3 – SITEWORK

3.1 SITEWORK GENERAL

3.1.1 INTRODUCTION

All projects involving sitework or landscaping shall be reviewed by the University Landscape Architect, Facilities Management Landscape Superintendent, and Arboretum and Landscape Committee. Exterior signage shall be reviewed by the Architect for the University. The Project Manager shall also coordinate review by the University Police Department and the University Safety and Security Committee for security and safety issues. Facilities Management Department of Energy and Utilities reviews sitework documents related to site utilities, location of utilities with respect to landscaping and established practices for installation.

Other sections affecting sitework and landscape design include: **1.3.2 Stormwater Management / Erosion and Sediment Control**, **1.4.4.1.2 Asbestos Removal**, **1.4.4.2 Special Procedures for Lead Containing Paint**, and **4.5.7 Rooftop Equipment**. Additional information can be found at www.virginia.edu/architectoffice.

3.1.2 UTILITY SEPARATION

In addition to applicable code requirements for domestic water, a minimum of twelve inches (12") vertically and five feet (5'-0") horizontally, wall-to-wall, shall be provided between any two utilities and utilities structures.

3.1.3 CONSTRUCTION SITE FENCING

Standard construction site fencing should be 8' chain link fencing with a top rail and green vision screening. For projects in the Central Grounds that are highly visible and with a duration exceeding one year, the Project Manager should consult with the building committee to consider the use of UVA 8' plywood fence and associated details.

3.1.4 UTILITY TRENCH CUTS IN ROADWAYS

Utility trench cuts in roadways shall be limited to 200' maximum and shall be covered with traffic-rated steel plates at the close of construction activities each day.

3.1.5 PETROLEUM STORAGE TANKS

Underground storage tanks (USTs) are not permitted without approval by the CFO. Only double-walled USTs will be considered. All associated underground piping shall be double-walled.

Drawings and specifications for any tank, either aboveground or underground, shall be reviewed and approved by the University FM Environmental Resources for compliance with Department of Environmental Quality (DEQ) requirements and the University's more restrictive Spill Prevention, Countermeasures and Control plan. Documentation of OEHS approval is required prior to issuance of a building permit.

Copies of permits, inspection reports and approvals shall be provided by the Project Manager to FM Environmental Resources to document compliance with regulatory agencies. DEQ additionally requires the University to obtain building permits from the University Building Official for removal and replacement of tanks.

Technical standards related to storage tanks are contained in the State Water Control Board Regulations: **9VAC25-580** Underground Storage Tanks (UST): Technical Standards and Corrective Action Requirements and **9VAC25-91**, *Facility* and Aboveground Storage Tank (AST) Regulation.

3.1.6 OIL INTERCEPTORS

Oil interceptors shall be provided for all parking garages and large parking lots where wash-down maintenance is performed. Interceptors shall be designed according to established standards for size and water quality control. There shall be adequate access for cleaning all areas of the separator with a vacuum pump and compartments shall be constructed horizontally. A minimum of one access point into each compartment within the separator shall be provided. Access points shall be no further than ten feet (10') apart regardless of the number of compartments. Access covers shall have a minimum opening dimension of twenty-four inches (24") in diameter.

3.2 SITE PREPARATION

3.2.1 SITE CLEARING AND BUILDING REMOVAL

All logs, stumps, brush, wood and refuse shall be disposed of away from University Grounds in an approved landfill. On-site burning is prohibited. When buildings are to be removed, procedural requirements and approval are required prior to demolition. The Project Manager, through Space and Real Estate Management, shall have obtained required State approval. The University shall perform an asbestos and lead paint survey and the information shall be included in the construction documents.

3.2.2 DUST, MUD AND DIRT CONTROL

The site shall be prepared in accordance with **1.3.2 Stormwater Management / Erosion and Sediment Control**. This includes controlling dust, dirt, and mud. The regulations governing sediment control can be found in the Erosion and Sediment Control regulations **9VAC25-840** et seq. as amended. Regulations governing dust emissions can be found in **9VAC5-40-90** and **9VAC5-50-90**.

3.2.3 PLANT PROTECTION

Trees, shrubs and planting beds within the Contract Limit Lines are to be protected with rigid fencing (wood or chain link) to prevent damage from external construction activities. Selection of trees to be

protected shall be coordinated through the Facilities Management Landscape Superintendent. All tree removal requires prior approval by the Arboretum and Landscaping Committee. The parking of vehicles and storage of any construction materials shall not occur under the drip lines of trees to be protected.

3.2.4 EARTHWORK

Earthwork specifications shall include soil and aggregate material definitions for all materials used on the project. The soil materials shall be defined by a recognized soil classification system, such as the Unified Soil Classification System or the AASHTO Soil Classification System. The aggregates shall include gradations required for each material.

3.2.4.1 GEOTECHNICAL REPORT

A Geotechnical/Soils Report shall be included in the Appendix to the Specifications as well as a disclaimer stating that the report is not part of the construction documents. The report should include the following:

1. Subsurface profiles (boring logs) and limits showing the extent of rock, existing fill materials, water and existing unsuitable bearing materials;
2. A statement noting whether over-excavation and replacement with suitable materials is required;
3. Definition of suitable materials for structural fill, general fill and backfill. Note: Suitable materials that become saturated are not automatically rendered unsuitable;
4. For projects requiring a stormwater management plan, site soils should be classified in accordance with the US Department of Agriculture's hydrological soil group criteria;
5. The Geotechnical Report/Engineer shall set a tolerance from the optimum moisture content to account for field conditions during construction.

3.2.4.2 EARTHWORK SPECIFICATIONS

1. Specifications for fill materials shall state whether they are included in the Base Price/Bid or will be an extra cost item.
2. Rock excavation shall be included in the Base Price/Bid to the extent that locations are sufficiently identified in the Geotechnical/Soils Report.
3. The specifications shall list the tests required (i.e. ASTM, AASHTO, VDOT, or other test procedures) and stipulate the values to be achieved.

3.3 SITE DEVELOPMENT

3.3.1 PLANTING

The selection of plant material and the planting and maintenance of trees, shrubs and herbaceous plants must be consistent with the current American Standard for Nursery Stock (AAN). Warranty period is one year minimum. The contractor's responsibilities include the protection of plantings, pest control, pruning, watering and plant material during warranty period. All plant material soil conditions must be inspected by the Facilities Management Landscape Superintendent.

3.3.1.1 SOIL PREPARATION

Soils in areas to be planted that are compacted above 85% maximum density shall be mechanically loosened to a minimum uniform depth of twenty-four inches (24") below final grade. Inadequate soil conditions must be addressed prior to planting.

3.3.1.2 PLANTING PROCEDURES

The width of each planting hole should be three times (3x) the size of the root ball. The depth of the hole shall be two inches (2") less than the distance from the bottom of the root ball to the root collar. The bottom and sides of the each hole should be scarified to encourage root development. Upon planting, all plants must be inspected to ensure that the root collar is exposed.

3.3.1.3 UNDERGROUND UTILITY OFFSETS

New utilities should be located so that the construction will not damage or destroy the plants to remain. Utility trenching shall not be located closer than one foot (1'-0") for each (1") in diameter, with a minimum of five feet (5'-0") and a maximum of twenty feet (20'-0") for trees to remain. Damaged trees and plants shall be restored to the satisfaction of the Facilities Management Landscape Superintendent.

To preserve trees and manage underground utilities, new trees shall not be planted:

1. Within ten feet (10'-0") of any existing underground utility lines with joints
2. Within five feet (5'-0") of any existing underground utility lines without joints (joints may occur when they are at least ten feet from the tree center in both directions)
3. Where new storm and sanitary sewer piping alignment cannot be avoided within ten feet (10'-0") of an existing or new tree, use HDPE butt-welded pressure piping.

3.3.2 SITE LIGHTING

All exterior steps, roadways and main pathways shall be lighted. All fixtures shall be cut-off type, designed to meet Illumination Engineering Society (IES) standards for cut-off optics, unless otherwise directed. Point-by-point foot-candle calculations of the site lighting and voltage drop calculations for site lighting circuits shall be provided with the contract document submission; foot-candle calculations shall include the IES design level/classification used. All exterior lighting fixtures shall use metal halide HID or LED lamps only. Lens shall be impact-resistant tempered glass with a minimum 0.125" thickness. All new or replacement site lighting in proximity to the University's astronomy observation facilities shall be reviewed by the Department of Astronomy. See **Figure 8** for Observatory-Sensitive Zone.

In an effort to minimize light pollution caused by light spill from buildings and sites, all capital projects are required to submit footcandle values that illustrate the amount of light emittance produced by site lighting, exterior building-mounted fixtures, and exterior light spill from interior fixtures, including interior light scattered at the surface of the exterior glazing. Footcandle values shall be submitted along calculation planes in 20' increments parallel to the building's exterior walls and roof, using a grid of points with 10' centers, until footcandle values reach 0. Two goals should be: 1) as little light as possible passing through the horizontal plane above the building; and,

2) also minimizing the light passing through the vertical planes surrounding the building, above ground level. The A/E shall identify the costs of the light pollution study as a line item for review by the University PM prior to conducting the study.

3.3.2.1 ILLUMINATION REQUIREMENTS—HORIZONTAL AND VERTICAL

Unless noted otherwise below, all lighting levels and ratios shall be per IES standards/ VUSBC.

Illumination Requirements			
Location/Area	Horiz fc levels*	Vert fc levels*	Ratio
Walks, ramp, parking, pedestrian areas	0.5 avg, 0.125 min	0.5 – 0.8 avg	4:1 avg to min
Exterior steps	0.2 min, top to bot	none	4:1 avg to min

* Horizontal and Vertical foot-candle (fc) levels are measured at grade.

3.3.2.2 LIGHT FIXTURES AND DESIGN REQUIREMENTS

Photometric data shall be provided that shows the percentage of up light. Foot-candle calculations shall include the IES design level/classifications used.

3.3.2.2.1 LIGHT FIXTURES AND SPECIAL REQUIREMENTS FOR ON-GROUNDS FACILITIES

All exterior lighting fixtures on Grounds shall conform to the **Office of University Architect's Exterior Lighting Study** and the **Office of the Architect's Landscape Typologies and Standards (OAU-LTS)**.

Site lighting poles and fixtures will be Owner-Furnished and Owner-Installed (OFOI). The Owner, Facilities Management Department of Energy and Utilities, will provide pole and light fixture and will make final connections. The Contractor shall provide necessary conduit and shall stub out of the building to a handhole box, and shall provide the contactor, controller photocell and wiring to the handhole. The Owner will install all conduit, wiring, foundations and poles and fixtures beyond the handhole. The Contractor shall coordinate with Owner for notification as to the schedule. All other lighting, such as building mounted, patio, courtyard and exterior steps and bollard light fixtures, shall be Contractor-Furnished and Contractor-Installed (CFCI); the Owner will not install these fixtures.

3.3.2.2.2 LIGHT FIXTURES AND SPECIAL REQUIREMENTS FOR OFF-GROUNDS FACILITIES

Light fixtures and poles shall be cast iron. When approved by the Director of Facilities Planning and Construction, aluminum poles of similar design may be used in locations where it can be demonstrated that vehicular impact is not probable. All lighting fixtures shall be furnished and

installed by contractor (CFCl). See **Figure 6** for cast iron fixtures for major pathways and shoebox-type fixtures for parking lots and roadways.

Acceptable Fixture Manufacturers include:

1. Spring City Edgewater EFED-###-MH-UVA with frosted panels
2. Holophane UVA ### MOOx63RG Antique Octagon
3. King KS6-S-R-EAO-V-###-MH-277-UVA Cutoff

Lamp wattage and IES distribution type to be determined by layout.

Acceptable Pole Manufacturers:

1. Spring City 12 ESCT/7 Series
2. Holophane "West Point", 12'
3. King Luminaire 20" Octagonal, 12'

3.3.2.3 INSTALLATION REQUIREMENTS

Site lighting fixtures are to be powered with underground copper wiring in one and one-fourth inch (1-1/4") PVC conduit. Burial depth shall be eighteen inches (18") minimum. Circuit wire sizes shall be such that site lighting voltage drops do not exceed two percent (2%) for new site lighting circuits and 3% total for existing circuits to which lights are added. Site lighting shall be photocell controlled in logical groups. Individual unit photocell controls are to be used only where grouping of lights is not practical.

All pole and post-mounted lighting fixtures shall be numbered on the construction documents and on the erected fixture. Fixture ID number and label size/style can be obtained from Facilities Management Department of Energy and Utilities.

3.3.3 PAVING AND CURBS

Minimum slope for all paved surfaces shall be 1%. Maximum slopes for streets, service drives and parking lots shall be eight percent (8%). Guidance on acceptable paver types may be found in OAU-LTS.

Curbs shall comply with 6" standard CG-2 of Virginia Department of Transportation (VDOT). Curb and gutter complying with VDOT CG-6 Standard six-inch (6") Curb and Gutter shall be used to match an existing condition or within City of Charlottesville streets. Painted striped crosswalks shall be provided at all road intersections. The University encourages the use of pervious paver systems over impervious whenever possible.

Pavement thickness at utility trenches shall be a minimum of one-and-one-half times (1.5x) existing pavement thickness or, as noted above, whichever is higher. Backfill in utility trenches under pavements shall be VDOT #21A above top of bedding to underside of pavement.

Unless modified by documented site conditions and geotechnical recommendations, asphalt paving shall be:

Course/VDOT Specification	Roads	Parking	Pedestrian walks
Surface/SM-2A or 9 -52A"	2"	1 ½ "	2"
Binder/BM-2 or 25 – 0"	3"	2"	Not applicable
Sub-base/21A	10"	6"	6"
Sub-grade compaction	*98%	95%	95%

**Maximum dry density (ASTM D698, Method D)*

3.3.4 SIDEWALKS AND STAIRS

The choice of sidewalks shall be in consultation with the University Landscape Architect. Sidewalks will be separated from curbs by planting areas for pedestrian safety, except where restricted by urban site needs.

See **Figure 9** for concrete sidewalks. The color for concrete shall be Canvas by Soloman as specified in OAU-LTS. Any other color shall be approved by Office of the Architect for the University. Where sidewalks abut existing structures, expansion joints shall be provided. Brick sidewalks shall be constructed on concrete per **Figure 10**. Provide positive drainage one and one-half to two percent (1.5 to 2.0%) to prevent water accumulation on exterior stairs. Where post-mounted handrails occur, detail the embedment to minimize deterioration of the posts and/or the concrete slab.

3.3.5 SITE FURNISHINGS

The standards for BICYCLE RACKS, BENCHES, TRASH and RECYCLE RECEPTACLES, BOLLARDS and DUMPTER PADS are covered in OAU-LTS.

3.4 SITE STORM AND SANITARY DRAINAGE SYSTEMS

3.4.1 BUILDING AND SITE STORM DRAINAGE

See section **1.3.2 Stormwater Management / Erosion and Sediment Control** for projects required to address storm water management.

3.4.1.1 BUILDING AND ROOF DRAINAGE

Drainage piping shall be located as approved by the Facilities Management Energy and Utilities Department and other applicable authorities when located in streets, right-of ways or easements not on University property. All building roof drainage, including external downspouts, areaway drains and foundation drains shall be connected to a storm water management practice, cistern or the storm sewer system.

If connecting to the storm sewer system, connections shall preferably be made to a manhole or a drop inlet directly. Where the preferred connection is not feasible or economically justified, the connection shall be to the storm sewer with a “Y” a maximum of 50 feet away from the building. Provide cleanout at roof drain and at a change in direction of any drainage piping. Where a storm system is not available, a new system shall be provided.

3.4.1.2 STORM INLETS AND STRUCTURES

The following requirements apply to storm inlets and structures:

1. VDOT standard structures are to be used. In historic precincts, smaller dimensioned structures may be approved on a case-by-case basis.
2. Curb inlets shall be used for all surface drainage for roadways and parking lots unless vegetated swales or bio retention filters are used
3. All grates for yard inlets shall meet handicapped accessibility standards.
4. Grate inlets shall be used for all lawn areas.
5. Dome top inlets are preferred in landscaped areas.
6. Inlet grates shall be bicycle-safe and orientated with the long axis perpendicular to the direction of traffic.
7. The tops of all structures shall be flush with the pavement surface.
8. Inlet structure grating shall be heavy-duty traffic rated providing a minimum 24” clear opening for access.
9. For pipe diameters up to eighteen inches (18”) or a depth of four feet (4’-0”), the minimum inside size for drop inlets shall be twenty-four inches (24”). For pipe diameters greater than eighteen inches (18”) or deeper than four feet (4’-0”), drop inlets shall be forty-eight inches (48”).
10. Area drains, clean outs and yard drains with minimum pipe size and cover shall use shallow cast iron fittings or heavy-duty HS 20 traffic fittings.

3.4.2 SITE STORM AND SANITARY SYSTEMS

Sanitary piping shall not be located within areas of flooding or drainage channels.

3.4.2.1 PIPING AND INSTALLATION

Storm mains shall be a minimum of fifteen inches (15”) in diameter. Lines serving yard drains shall be eight inches (8”) to twelve inches (12”). Roof, area and foundation drains shall be four inches (4”) to six inches (6”) for single drain laterals and eight inches (8”) to twelve inches (12”) for multiple drain collector laterals. Sanitary pipe shall be a minimum of four inches (4”) for laterals and eight inches (8”) for mains.

Storm mains fifteen inches (15”) and above should be Class III reinforced concrete pipe. HDPE pressure pipe, HDPE double wall corrugated pipe or solvent weld jointed schedule 40 PVC may be used for mains under 24”. Foundation and retaining wall drains shall be perforated solid wall schedule 40 PVC with solvent joints wrapped in geotextile fabric with a stone dust bed and cover. Under slab drains can be flexible PVC.

Sanitary piping shall be cast iron (CI), ductile iron (DI), HDPE pressure pipe or solvent weld jointed schedule 40 PVC. HDPE and PVC are not allowed at the Heating plant.

Specify a minimum cover of twenty-four inches (24") for storm pipe and thirty-six inches (36") for sanitary. See **3.3.1.3 Underground Utility Offsets** for piping within ten feet (10') of new or existing trees. The minimum slope shall result in a self-cleaning velocity (2 fps minimum) for the diameter used. Pipe on a twenty percent (20%) or greater slope shall be secured with concrete anchors.

3.4.2.2 MANHOLES AND CLEANOUTS

Provide manholes on storm and sanitary systems adjacent to all buildings to which laterals from the building are directly connected. Laterals shall be a maximum of fifty feet (50'). Where sanitary laterals exceed twenty feet (20'), a clean out shall be provided just outside the building. The cleanouts shall be installed in a concrete pad flush with the surface and be HS 20 rated.

Manholes shall occur at changes in direction and in straight runs at a maximum of 400 feet in storm lines and 200 feet (200') in sanitary lines. Manholes shall have a minimum forty-eight inch (48") inside diameter with shaped flow troughs at the bottom. Manhole frame and cover shall be heavy-duty traffic rated, providing a minimum twenty-four inch (24") clear opening for access.

Sanitary manholes with an invert change of eighteen inch (18")or two times (2x) the inlet pipe diameter—whichever is greater—shall be provided with drop piping outside the manhole. Joints in precast manholes (inside and outside) shall be filled with non-shrink grout and finished smooth. Manholes shall be coated from inside with vapor/moisture penetration preventing epoxy coating and from the outside with bitumastic/coal tar based waterproof coating.

Pipe connections to manholes shall be made with flexible rubber boots. At existing structures install sleeve prior to connection. For sanitary manholes use flexible, mechanical clamps, grout and water stop for a leak-proof connection.

3.5 EXTERIOR DOMESTIC AND CHILLED WATER PIPING

Underground water distribution pipe shall be asphalt coated, cement lined ductile iron, Class 52 or higher with flexible restrained joints. All fittings and hardware shall be epoxy coated. Branch lines two inch (2") and smaller can be type K copper with silver soldered joints. All mains shall be a minimum of six inch (6") diameter. The entry point into buildings shall be made with factory flanged ductile iron pipe, class 53 or higher.

New chilled and domestic water branches shall preferably be connected to existing mains with full size tees; reducing tees or wet taps can only be used with prior approval of UVa Energy & Utilities Department. Full size resilient seal gate valves shall be provided on both branches after tees (upstream of reducers).

Buried chilled water supply pipes shall be insulated. Field installed rigid foam glass with a 50 mil poly jacket is preferred however a pre-insulated double wall pipe system can be used with prior approval of UVa Energy & Utilities Department.

Domestic water piping shall have a minimum three-foot (3') cover; chilled water lines shall have a minimum four-foot (4') cover. All buried domestic and chilled water lines shall have VDOT #10 "stone dust" or a sand bed and cover. All buried domestic and chilled water lines shall be pressure tested at 200psig for two (2) hours. Domestic water lines shall be bacteria tested.

CHAPTER 4 – BUILDING ENVELOPE

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.

4.1 CONCRETE

Minimum concrete strength shall be 3,000 PSI. Exposed aggregate surfaces shall not be used for exterior surfaces due to freeze-thaw

Wet curing is required. Use of a curing compound must be approved and is limited to instances 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.

4.1.1 ARCHITECTURAL CONCRETE

The Contractor shall provide a sample panel for exterior exposed concrete walls prior to construction showing all finishes, texture of formed material, sandblasting, etc. Concrete used in sample panels shall be provided from the project concrete supplier and shall represent the approved mix for strength and texture.

4.1.2 CAST IN PLACE CONCRETE

Specifications shall include the following requirements:

1. ACI 301, Specifications for Structural Concrete shall be incorporated by reference.
2. Field tests of fresh concrete shall include ASTM C172 (Sampling), ASTM C143 (Slump), ASTM C31 (Specimens), ASTM 231 or ASTM C173 (Air Content), and ASTM C138 (Density).
3. The University shall engage the Services of the concrete testing laboratory to perform the sampling, cylinder preparation and delivery, testing and reporting. The Contractor shall be responsible for adequate advance Notice to the testing laboratory for the Contractor's concrete pours/placement.

4.1.3 FIBER REINFORCED CONCRETE

Use of fibrillated polypropylene fiber for secondary reinforcement to control surface cracking in exposed concrete slabs on grade is encouraged. However, fibrillated polypropylene fiber is not a substitute for reinforcing for structural and expansion/contraction requirements.

4.1.4 POST TENSIONED STRUCTURAL CONCRETE

The A/E shall give special consideration to the finished appearance of jacking-ends, insert requirements, and tendons and reinforcing steel cover of post-tensioned structural members.

4.1.5 SLAB ON GRADE

Slab on grade floors in all academic, public use and service buildings; and public use, mechanical, laundry and storage rooms in residential/dormitory buildings; shall be minimum five inches (5") thick with WWF 6x6- W2.9xW2.9 reinforcing. Slab on grade floors in residential/dormitory buildings, other than rooms noted above, shall be minimum four inches (4") thick with WWF 6x6- W1.4xW1.4 reinforcing. Reinforcing top cover shall be one inch (1") minimum to two inches (2") maximum.

4.2 SUPERSTRUCTURE

4.2.1 GEOTECHNICAL DESIGN AND EARTH PRESSURE LATERAL LOADS

Building framing shall be designed to resist Earth Pressure Lateral Loads internally. 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.

4.2.2 STRUCTURAL COMPATIBILITY WITH EQUIPMENT—VIBRATION, MAGNETICS, ELECTRICAL SENSITIVITY

Structural framing for research laboratories and other uses with sensitive instrumentation shall be designed to resist vibration. The Basis of Design Narrative shall note the vibration criteria used to develop structural calculations and construction details.

Research and medical facility structures intended to house magnetically and electrically sensitive equipment must be designed using compatible structural materials and techniques.

4.2.3 ADDITION OF LOADS TO EXISTING STRUCTURES

Prior to mounting any antennae, microwave dishes, HVAC equipment or other items on the roof of an existing building, the adequacy of the structural framing to support the additional live, dead, wind lateral loads, vibration, and overturning moments at attachments shall be checked by a licensed Structural Engineer. Rooftop additions as described above are subject to approval by the Office of the Architect and the AARB.

4.2.4 SPRAY FIREPROOFING DESIGN AND SPECIFICATION

4.2.4.1 GENERAL

Final Construction Documents shall clearly show locations, rating and type of spray fireproofing on the drawings, on typical and special details, and in the specifications.

The spray fireproofing applicator shall be qualified and/or licensed on the manufacturer product. Proof of qualification and/or licensure shall be submitted to the University.

At the intersection of structural steel members with different thicknesses of spray fireproofing provide spray fireproofing equal to the greater thickness on all members for a distance of two feet minimum from the intersection of the members.

Spray fireproofing shall meet or exceed the fire rating on all clips, hangers, light gauge framing, support sleeves and other attachments covered at the area of attachment to a structural member.

4.2.4.2 TESTING REQUIREMENTS

All spray fireproofing shall be tested after installation according to manufacturer's requirements. The University shall arrange and pay for services for field and laboratory tests and reports. The Contractor shall schedule the tests while the material is accessible. If additional tests are required as a result of non-compliance with the specifications, the additional tests and reports shall be paid for by the Contractor.

4.2.4.3 REMOVAL AND REPLACEMENT

Plans and specifications shall be submitted to the Office of the University Building Official, including any final construction documents, amendments/addenda, or change orders which may relate to the fire resistive characteristics of the structure. On every submittal, indicate construction date, original and present uses, height in floors and feet, whether the building is sprinklered, and any other information that may assist the University Building Official in his/her determination.

If asbestos-containing material (ACM) is to be replaced, copies of the specifications for the intended replacement material and the bridging encapsulate specified by the asbestos project designer shall be submitted to the Office of the University Building Official for review. Independent testing laboratory reports shall be sent through the A/E to the Office of the University Building Official.

4.3 EXTERIOR ENCLOSURE

4.3.1 EXTERIOR WALLS

The use of metal stud framing in brick and other masonry veneer exterior walls is not acceptable. Exceptions require prior approval, including detailed information regarding moisture barriers, stainless steel anchorage and the use of 18-gauge (minimum) studs.

4.3.1.1 THERMAL AND MOISTURE PROOFING

University buildings shall not be designed with basement floor levels below the water table. The following criteria shall be met for other conditions:

1. Soils with little or no obvious water content

- a. Waterproof walls and provide protection board.
- b. Provide perforated type drainage pipe with gravel surrounding.
- c. Backfill with suitable material that has some porosity.

2. Damp to wet soils with no obvious water source

- a. Waterproof walls and provide protection board. If geotechnical type drainboard is used, protection board may not be required.
- b. Provide perforated drainage pipe and (if necessary) surround with full height gravel to the underside of the impervious soil or material.
- c. Provide impervious soil or material at finish grade.

4.3.1.2 BRICK SELECTION

During the Preliminary Design phase, the A/E shall select brick, mortar and joint tooling, to be approved by the Architect for the University.

Wood mould brick shall be used on most University buildings. Wire cut brick shall in general be used for all University of Virginia College at Wise projects. Removal of existing brick for use on additions or renovations shall be carefully executed to prevent cracks, splits, spalls and damage to the surface integrity of the units.

Additions to existing buildings shall match the existing brick in size, color, texture and compressive strength. If new brick and/or mortar are to match an existing pattern, the specifications shall identify the wall area of roughly 100 bricks to be matched. Mortars with color pigments shall be premixed.

The specifications shall require the contractor to erect one or more wall panels (4'-0" x 4'-0" minimum) of the selected bricks, mortar, masonry backup, wall ties, insulation and limestone/precast stone trim, etc. The A/E and the University Architect will approve the panel for workmanship and conformance with the approved selection of brick and mortar.

4.3.1.3 WALL DETAILS

Parapets: All parapet walls up to three feet (3'-0") height above roofing shall be flashed from coping to roofing.

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

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

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.

Cladding and Siding: Metal clad buildings shall be used only for utility type structures not located on the Historic Grounds, Central Grounds or in view from publicly traveled streets and walkways,

unless approved by the Architect for the University. Wood siding is an acceptable material only in ancillary areas such as dormers.

Flashing: All through wall flashing shall be 16-oz. minimum copper or equivalent fabric-coated copper. Stainless steel through wall flashing may be used with prior approval of the Office of the Architect (OAU) for the University. If stainless steel flashing is used, it shall be Type 304 Stainless Steel meeting the requirements of ASTM A666, and shall be a minimum of 0.018 in. (0.4572 mm) thick. Other metals or vinyl flashing shall not be used. All coping flashing shall be through wall type.

Sealants, Caulking and Seals: The color and appearance of sealants and caulk are to be approved by the Architect for the University as part of the overall design review.

Portland Cement Plaster: Portland cement plaster stucco, with or without aggregate, may be used for base and finish coats over masonry, roughened monolithic concrete and metal lath. It shall not be used over wood lath, fiberboard lath, gypsum lath, gypsum tile or other types of base coat.

4.3.2 EXTERIOR PAINT

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

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.

4.3.3 EXTERIOR WINDOWS

Metal windows and storefront shall have thermal break frames and insulating glass. For all buildings, the use of double-glazing is required, with a vacuum seal and low E glass.

Aside from the required use on the Historic Grounds, the use of wood windows must be approved by the Architect for the University and the Director of Facilities, Planning and Construction.

Crank operators shall not be used on operable windows. If an interior mounted storm sash is provided, it shall be hinged or otherwise readily accessible for window maintenance.

4.3.4 EXTERIOR DOORS

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 Office of University Building Official through the Project Manager. Use of mat activators is not recommended. See **1.4.3 Security**.

All doors shall have a minimum width of three feet (3'-0") and a height of seven feet (7'-0").

Plastic laminate exterior doors are not acceptable.

4.3.4.1 METAL DOORS/FRAMES

Metal doors shall be insulated. Hollow metal doors shall have 16-gauge facing skins, be galvanized, and be one and three-fourths inch (1-3/4") thick minimum. Knockdown frames are prohibited.

4.3.4.2 WOOD DOORS

Solid core wood doors shall be five ply, one and three-fourths inch (1-3/4") thick minimum. Paneled wood doors shall be detailed and manufactured to withstand weather exposure. Use of paneled style door is restricted to the Historic Grounds when pre-approved by the Architect for the University.

4.4 ROOFING

Consultation with the University Roofing Project Manager is mandatory for all projects with new roofing as well as reroofing projects.

4.4.1 LOW-SLOPE ROOFS AND ACCEPTABLE ROOFING SYSTEMS

All low-slope roofs shall obtain primary and secondary roofing and insulation materials from the roof system manufacturer to ensure a single-source responsibility for entire roofing system.

4.4.1.1 ROOF SLOPE

1. Specify that all roofs shall slope 1/4" per foot, minimum, to drains on all new roofs.
2. Specify that all valleys shall slope a minimum of 1/8" per foot.

4.4.1.2 WIND UPLIFT

Complete roof assemblies shall comply with ANSI/SPRI WD-1 and ASCE 7.

4.4.1.3 INSULATION

Polyisocyanurate board insulation shall have a nominal average compressible strength of 25 psi.

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

Board insulation shall be installed with a minimum of two layers per manufacturer's installation instructions. Fit boards together with no gaps and stagger joints in both directions to achieve a complete thermal envelope.

The following items require preapproval by the University Roofing Project Manager: CFC's (chlorinated fluorocarbons) insulation blowing agent, phenolic foam insulation and organic fiberboard insulation (including use as tapered edges).

Mechanical fasteners for post-tensioned concrete decks or pre-stressed concrete panels require preapproval by the University Roofing Project Manager. Pull tests shall be required for all mechanical fasteners.

4.4.1.4 ACCEPTABLE LOW SLOPE ROOFING SYSTEMS

EPDM: The University's preferred low-slope roof system is a reinforced black EPDM membrane , 60-mil thickness, fully adhered. Other single-ply membrane systems require preapproval by the University Roofing Project Manager and an approved Determinations & Findings report (D&F).

Built-Up Roofing: A hybrid BUR is acceptable for heating plants and similar facilities where preapproved by the University Roofing Project Manager. The acceptable system is a 3-ply asphalt built-up roof with a granule-surfaced modified bitumen cap sheet having a minimum cap sheet thickness of 150 mils.

Solar Reflective Membranes: For projects seeking LEED Certification or where a membrane with greater solar reflectivity is desired, preapproval with the University Roofing Project Manager and an approved D&F is required. TPO roofs are not allowed. If approved, the roof must be protected from discoloration during construction and washed and left white at the completion of work.

4.4.2 STEEP-SLOPE ROOFS AND ACCEPTABLE ROOFING SYSTEMS

4.4.2.1 GENERAL REQUIREMENTS

1. 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 un-perforated asphalt saturated roofing felt.
2. Closed valleys are prohibited. Exceptions may be applicable for historic structures.

4.4.2.2 ACCEPTABLE STEEP-SLOPE ROOFING SYSTEMS

1. Slate
 - a. Slate from Arvonnia, Buckingham County, Virginia.
 - b. Specify genuine unfading blue-black slate, ASTM C406, Grade S-1, of size, thickness, texture, exposure style, shape and color to match existing. All slate shall be hard, dense, sound, and rock punched for two nails.
 - c. 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-inch thick nominally, with face dimensions of 10-inches wide by 16-inches long. No corner break shall exceed 1/2-inch in either dimension. Slates shall have the following physical properties:
2. Modulus of rupture: 9,000 psi per ASTM C120
3. Water absorption rate: 0.25% per ASTM C121
4. Depth of softening/acid resistance: 0.001-inches per ASTM C217
 - a. New slate roofs shall be installed over ¾" tongue and groove, solid lumber decking. Use of plywood as nailing deck is prohibited.
5. Metal
 - a. Terne-coated stainless steel; field-formed double-lock standing-seam
 - b. Copper; field-formed double-lock standing-seam

- c. Aluminum or steel; architectural standing seam manufactured roof panel system, PVDF finish
- 6. Shingles (other than slate)
 - a. Use of wood shingles or shakes is prohibited, except for in-kind replacement of existing roofing.
 - b. Three-tab fiberglass or dimensional shingles may be used with preapproval the Office of the University Architect.

4.4.3 VEGETATED ROOFS AND ACCEPTABLE ROOFING SYSTEMS

See The Office of the University Architect’s **Vegetated Roof Standards** for additional requirements.

4.4.3.1 GENERAL REQUIREMENTS

1. During conceptual design, the objectives for installation of a vegetated roof must be defined (stormwater benefit, aesthetics, amenity space, etc). The specific design of the landscaped roof must be preapproved by the University Roofing Project Manager.
2. Extensive system: engineered growth medium is 4”-6” in depth
Semi-intensive system: engineered growth medium is 6”-10” in depth
Intensive system: engineered growth medium exceeds 10” in depth
3. Avoid full shade exposure for extensive systems.
4. Design and details must be developed by an experienced vegetated roof consultant., who must be a member of the design team starting in conceptual design phase.
5. Design must provide reasonable, safe access for landscape maintenance personnel and must be approved by the University Landscape Superintendent.
6. Provide access to roof top equipment such as drains, skylights, etc., avoiding frequent foot traffic over planted areas.
7. Vegetated roof installation must be minimum 1,000 sf. Area requirement may be waived for a publicly accessible demonstration installation.

4.4.3.2 ACCEPTABLE VEGETATED ROOFING SYSTEMS

1. Acceptable Roof System Types
 - a. Modular Tray Extensive: 1’x2’ trays with interlocking capability and positive drainage cells, made with recycled content. Trays shall be set on a slip sheet/root barrier of 45-60 mil with bonded seams, of a material compatible with roofing membrane system. Trays shall be pre-grown for 1 growing season, exposed tray edges shall be protected with sturdy aluminum “L” shaped edging (4.5”x3”), and growth media shall cover tray edges by 1” depth.
 - b. Integral Vegetated Roof: comprehensive assembly including fully-adhered waterproofing membrane, protection course/root barrier, moisture resistant insulation and aeration layer, drainage/water retention elements, filter fabric, engineered growth media, and plants.
2. Acceptable Waterproofing Membrane Types
 - a. Hot Fluid Applied Polymer Modified Asphalt: minimum 25% recycled content, applied in two layers with nominal 215 mil minimum thickness fabric reinforcement between layers, ASTM D6622.

- b. Consideration of an alternate membrane must be approved by the University Roofing Project Manager.

4.4.3.3 WARRANTY

1. Provide single-source, full assembly vegetated roof system replacement in the event of membrane failure; to include membrane plus all overburden, including soil media and plant replacement, for minimum 20 years.
2. Provide 50% vigorous plant coverage warranty in 1 year, 80% vigorous plant coverage in 2 years.

4.4.3.4 ENGINEERED GROWTH MEDIUM

1. Design must be specific to the depth of medium and type of plants specified, meet German FLL requirements for engineered growth medium and submit certified laboratory tests for approval.
2. Extensive, typical range: 60-100% expanded slate or clay, 0-35% coarse sand, 0-25% organic material (compost)
3. Intensive, typical range: 35-60% expanded slate or clay, 25-50% coarse sand, 5-20% organic material (compost)

4.4.3.5 LEAK DETECTION

Provide electric field vector mapping leak detection systems as required by the University Roofing Project Manager and Facilities Management. Components of the vegetated roof system, including the membrane, must be compatible with the leak detection system.

4.4.3.6 IRRIGATION

1. Intensive or Semi-intensive: sub-surface automatic drip system with moisture sensor controls.
2. Extensive: at a minimum, provide a hose-bib for irrigation during establishment and dry periods. High-visibility extensive systems shall be provided permanent irrigation. All irrigation systems to be approved by the University Landscape Superintendent.
3. Tap non-potable irrigation sources such as condensate or storm water cisterns. Irrigation piping material to be stainless steel or PVC schedule 40. Galvanized and copper piping are not acceptable due to potential leachate damage to plants.

4.4.3.7 INSTALLATION

1. Installation shall be by qualified, certified, experienced vegetated roof contractor. Coordinate installation such that other trades have limited, managed access to the area receiving a vegetated roof to avoid damage to the waterproofing membrane.
2. The vegetated roof design consultant shall inspect and approve installation of all layers of the system, and shall submit approval(s) to the University Roofing Project Manager.
3. Prior to installation of waterproofing membrane, the vegetated roof contractor and a representative of the University shall visually inspect the substrate surface to verify it is clean, dry, smooth and acceptable for the membrane installation.

4. Waterproofing membrane to be water-tested, witnessed, confirmed in writing and approved by the University prior to installation of any over burden of vegetated roof system components.
5. UV or temperature sensitive roofing materials must be protected prior to and during vegetated roof installation.
6. Planting shall be installed in an appropriate season. Sedum pots shall be planted March-April-May, or in fall if acceptable to the University Landscape Superintendent. Pre-grown trays and carpets may not be installed in freezing temperatures. Sedum carpets must be installed immediately upon arrival at project site.

4.4.4 UNACCEPTABLE ROOFING SYSTEMS

The following roofing systems are not permitted for use at the University unless preapproved by the University Roofing Project manager:

1. Ballasted single-ply membranes
 - a. Where accepted, minimum requirements include 10-12 pounds of ballast per square foot, double-washed, rounded and smooth river gravel, with a diameter not to exceed 1 1/2-inches.
 - b. Ballasted systems are prohibited on any Health System facility, without exception.
2. Mechanically fastened single-ply membranes
3. Sprayed-on polyurethane foam
4. Modified bitumen systems, except the Built-Up Roofing system noted in **4.4.1.4**.
5. Cold applied roof systems
6. Any roof systems that are torch applied
7. Protected roof membrane (PMR) systems, also referred to as inverted roof membrane assemblies (IRMA), except as noted in **4.4.3**.
8. Application of a new roofing system over an existing system; roof-over or re-cover

4.4.5 STEEL ROOF DECK

1. Corrosion protection is critical to maintain the structural integrity of the roof deck from moisture leaks through the roofing membrane. NRCA Bulletin 15-91 provides guidance on protection.
2. The steel roof deck is required to be Factory Galvanized, G-60 or G-90 (ASTM A924-94) or Factory coating with aluminum zinc alloy (ASTM A792).
3. 'Primer paint' coated deck is not allowed on University projects.

4.4.6 BLOCKING AND MISCELLANEOUS CARPENTRY

1. Oriented strand board (OSB) or particleboard shall be permitted only with specific approval by the University Roofing Project Manager.
2. All wood blocking and panel materials shall be noncombustible or fire-treated.
3. Power-driven screw-type fasteners shall be used to fasten wood to wood, or wood to masonry.

4.5 ROOF DRAINAGE, EQUIPMENT, AND ACCESSORIES

4.5.1 GENERAL

1. All buildings shall have a positive means of conducting rainwater from the roof to a stormwater management practice, cistern, or the storm sewer system.
2. When an entire flat roof system is being replaced on a roof where there are no secondary (emergency) roof drains or scuppers, secondary drainage shall be provided as part of the re-roofing project.
3. Metal flashing, counter flashing, cleats, clips, drip edges, exposed metal trim/ridge cap, cant strips, scuppers, eyebrow roof vents, and exposed metal valleys shall be:
 - a. Terne-coated stainless steel
 - b. Copper
4. Continuous cleats are required.
5. Built-in reglets shall be used for all new wall-flashing terminations. Surface applied reglets shall only be used on existing buildings where installation of built-in reglets is not possible.
6. Solder all non-expansion joints in metal work. Avoid lap joints where possible. Lap joints are not allowed for built in gutters.

4.5.2 ATTACHED GUTTERS

On sloped roofs, adequately sized and securely installed gutters of minimum 16-gauge copper shall be specified. Stainless steel or PVDF-coated steel may be used on additions to existing buildings with similar existing gutters, and may be used on new buildings where the context does not heavily reference traditional style and/or materials. 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.

4.5.3 BUILT-IN GUTTERS

Built-in gutters are only permitted with an approved D&F. Where approved, built-in metal gutter liner shall be terne-coated stainless steel or copper.

4.5.4 DOWNSPOUTS

1. Downspouts shall be a minimum of 16-gauge, shall be adequately sized and securely fastened to the vertical plane, and shall empty into a cast iron boot at grade connected to a storm water system. For existing facilities where this is not possible, water will be directed away from the building and new splash blocks will be provided.
2. Where a building is located near trees, down leader protective baskets shall be provided to keep leaves away from drain inlets in gutters.

4.5.5 SNOW GUARDS

1. Snow guards are required for all roofs with a slope of 6 in 12 or greater and over all entrances regardless of slope.
2. On slate roofs and hand formed standing seam roofs a minimum of three staggered rows of guards are required. Snow guards shall be copper, stainless steel, or bronze butterfly type.
3. Wire snow guards are not acceptable.

4. On standing-seam metal roofs, use metal snow rail systems that are attached to the standing seams. "Butterfly" snow guards mounted on top of the standing seams is not acceptable.

4.5.6 SAFETY TIE-BACK ANCHORS

OSHA approved fall protection including safety tie-back anchors shall be installed on all new roofing and reroofing projects. Tie-backs as required by the University Roofing Project Manager shall be securely anchored to the building structure.

4.5.7 ROOFTOP EQUIPMENT

Rooftop mounted equipment (excluding fume hood exhausts, power roof ventilators, and similar equipment functionally required on the roof) is discouraged. Rooftop equipment in new construction is subject to approval by the Chief Facilities Officer and must be screened from view of other buildings, streets and walkways.

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

Where new rooftop equipment or repair/replacement of existing rooftop equipment is approved, the project must incorporate the following:

1. Provide adequate space and appropriate lighting for access and maintenance of the equipment. New roofs and major renovations must have access via enclosed stairway. In renovations, ladder or hatchway access is acceptable only if stairway is impractical. Elevated equipment must have permanently installed ladders and platforms to all equipment access panels and items requiring ongoing maintenance.
2. Provide durable walk pads from roof access point to and around all rooftop equipment. Walk pads must be at least 2' wide and extend 6' from the equipment on the sides requiring service accessibility.
3. Provide 12" clearance under rooftop equipment and horizontal supporting members to finished roof (24" clearance if the equipment is > 24" wide). Supports shall be mounted and fastened to structural deck or framing, not insulation.
4. Use of wood sleepers for rooftop equipment is prohibited.
5. Equipment curbs shall not be placed in drainage valleys. Crickets shall be installed on upslope sides of equipment curbs.

Install roof anchors on all new buildings that require windows and skylights to be washed via suspension system (such as boatswain's chair, rope descent, or temporary scaffolding) and for other equipment maintenance activities that would be considered a fall hazard.

4.5.8 ROOF HATCHES

Where roof hatches are used, they shall be insulated, lockable, and feature thermal breaks.

4.5.9 SKYLIGHT STRUCTURES AND CLERESTORY WINDOWS

1. 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.

2. Skylights shall have exterior grills or guards to provide fall protection. Fall protection shall be consistent with OSHA recommendations.
3. 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.

CHAPTER 5 – INTERIORS

5.1 DESIGN AND FINISH CRITERIA

In general, building entrances, lobbies and significant public areas require design input and approval by the Architect for the University, coordinated by the Project Manager. The Architect for the University may designate other building areas to be included.

As a public university, extravagant and higher maintenance interior finishes are discouraged. Interior flooring, wall coverings and ceilings shall be selected from manufacturer's standard material selection; Custom material selections may not be used.

5.2 PARTITIONS

5.2.1 GENERAL

Metal stud or masonry partitions shall be used for all non-bearing partitions. Metal stud minimum thickness for non-bearing partitions shall be 20-gauge-Drywall (minimum thickness 0.0296 in), sixteen inches (16") on center. Bearing partitions shall be 20-gauge-Structural or heavier depending on loading and shall be designed in accordance with AISI S100.

Demountable partitions and accordion folding partitions are prohibited.

5.2.2 FIRE RATED ASSEMBLIES AND FIRE STOPPING

The A/E shall incorporate into specifications the requirement that the contractor shall notify the owner's representative of non-compliant or omitted fire stopping encountered during construction. Specifications shall include requirements for closing all openings in fire-rated assemblies at the close of work each day.

5.2.3 OPEN OFFICE PARTITIONS

The University utilizes established contracts for the design, purchase and installation of open office partitions and associated components. The A/E shall review the vendor's drawings and specifications for coordination and interface with electrical systems and incorporate the system design into the contract documents.

5.2.4 GLAZING

Glazing for interior partitions shall have a minimum thickness of one-fourth inch (1/4"). Glazing in interior partitions which are seven feet (7'-0") or less above the finished floor shall be tempered glass. Cross rails are required in glazed partitions at handrail height. Glass specified to have

Underwriter's Laboratory (UL) Listing shall have the label left on the glass. The University will remove the labels after acceptance of the building or renovation.

5.3 INTERIOR DOORS

5.3.1 GENERAL

Doors shall have a minimum width of three feet (3'-0") and minimum height of seven feet (7'-0"). Wood doors shall be five plies, solid core with a minimum thickness of one and three-fourths inch (1¾"), and a lifetime warranty. Metal doorframes shall be welded construction. Clear glazed vision panels shall be used in all classroom and stair doors.

The following door types are not accepted: folding doors, pocket doors, hollow core wood doors, and plastic laminated doors. Dutch doors are prohibited in the Health System.

5.3.2 MISCELLANEOUS DOOR HARDWARE

Doors wider than three feet (3'-0") or which have closers shall have ball bearing hinges. Floor pivot hinges are prohibited. All door closers shall be of the heavy-duty type, of cast iron bodies and have at least a 10-year warranty. Aluminum bodies are prohibited. Closers shall be mounted to doors with through-bolts. Floor closers and concealed overhead closers are prohibited.

Wall-mounted doorknob bumpers shall be backed by intermediate steel plates or channel reinforcement. Floor stops are prohibited.

Doors subject to abuse by equipment associated with building function shall have kick plates.

5.3.3 LOCKSETS

The University, with the exception of the Housing Division which uses a Best 7-pin system, utilizes a Corbin Great-Great-Great-Grand Master 7-pin keying system. Locksets shall accommodate University purchased and installed cylinders and cores.

Facilities Management lock shop personnel shall accomplish the procurement, keying and installation of cylinders and cores. Construction cores may be installed by the contractor during construction, but will be removed prior to beneficial occupancy.

Locksets shall be extra heavy-duty, manufactured by Corbin/Ruswin, Best or Yale. All interior locksets shall have lever handles with removable core mortised locks in the Corbin ML2000 series, LWA Design and C-7 Keyway, or similar designs in Best and Yale.

Classroom, lecture hall, teaching laboratory and laboratory corridor access doors shall be equipped with locksets enabling occupants to readily secure door(s) from within the room. The basis of design for these locksets is Corbin/Ruswin model ML2067, apartment function (deadbolt by key outside or by thumb turn inside, inside grip simultaneously retracts latch bolt and deadbolt permitting egress without unlocking door).

For classrooms, lecture halls and assembly rooms requiring more than one exit, electronic locking shall be provided from (a) University-agreed switch location(s) within these spaces, including where occupancy loads or agreed design parameters require panic hardware.

All panic hardware devices shall be heavy-duty, grade 1 push bar type capable of accepting a Corbin 7-pin cylinder and core (Best 7-pin cylinder and core in housing projects), through bolted with sex bolts where possible, manufactured by Von Duprin, Corbin/Russwin or Sargent. The basis of design for panic hardware is Von Duprin model 9900 (and 9900E where electronic locking is applicable). Where electric latch retraction is required, exit device shall be Von Duprin EL98/99 or EL 33/35 series, no substitution.

See **1.4.3.5 Electronic Access Controls** for major entrances.

Unless exempted by an approved Determinations and Findings Report, exterior doors serving students, faculty, staff and general public are to be card reader controlled. University student, faculty and staff identification systems are 24 VDC.

Hardware finish shall be Builder's Hardware Manufacturing Association (BHMA) 630.

Push button combination locksets or similar types of security hardware may be authorized where required by program. Such locks, when authorized by the Project Manager, shall have an override keyed to the University's system.

Use of combination door locks requires approval by the Facilities Management Locksmith (Academic facilities), Director of Health Systems Physical Plant (Health Systems facilities) and the University Department of Police. Use of combination locks otherwise is prohibited.

5.3.4 HEALTH SYSTEM DOOR LOCKING HARDWARE WITH ELECTRONIC ACCESS CONTROL

When utilizing the following types of electronic access controls, use of the specified manufacturer and model is required to coordinate with existing electronic access control systems.

1. Single Door without Power Assist Device
 - a. Electric Strike (Modified Frame)
 - i. Full mortise lock and lever (Corbin-Russwin ML 2000 Series)
 - ii. Electric strike (Folger Adams 712-75 Electric Strike)
 - b. Electric Lock: Full mortise with request to exit function (Corbin Russwin ML 200901 ECL)
 - c. Exit Door: Request to exit and panic bar with electric latch retraction (Von Duprin EL99NL)
2. Double Door without Power Assist Device
 - a. Electric Mortise Lock: Full mortise and vertical rod device combination (Von Duprin EL99 Concealed Vertical Rod)
 - b. Exit Device with Electric Latch Retraction: Two vertical rod devices, same direction with no overlapping astragal (Von Duprin EL99 Concealed Vertical Rod)
3. Double Door with Power Assist Devices
 - a. Door operator action initiated by card reader and wall plate
 - i. Auto opener, sensor and touchless wall plate (Horton)

- ii. Two vertical rod devices, same direction with no overlapping astragal (Von Duprin EL99 Concealed Vertical Rod)
 - b. Door operator action initiated by card reader action only
 - i. Auto opener, sensor and relay for instant and delayed action (Horton)
 - ii. Two vertical rod devices, same direction with no overlapping astragal (Von Duprin EL99 Concealed Vertical Rod)
- 4. Dual Door (egress both directions) without Power Assist Device
 - a. Card Reader Unlock
 - i. Concealed vertical rod device on secure side with no overlapping astragal (Von Duprin EL99 Concealed Vertical Rod)
 - ii. Concealed vertical rod device to meet requirement for special locking arrangement of non-secure side with no overlapping astragal (Von Duprin Chexit Controlled Exit Device, Board Contains Infinite Delay)
 - b. Door Operator action initiated by card reader action only
 - i. Auto opener, sensor, and relay for instant and delayed action (Horton)
 - ii. Two Vertical Rod Devices, same direction with no overlapping astragal (Von Duprin EL99 Concealed Vertical Rod)
- 5. Access Control
 - a. Readers are to be HID R40 for wall mount; HID R10 for mullion mounted
 - b. All reader request should be directed to the Manager Clinical Engineering Services

5.3.5 ACADEMIC DIVISION DOOR LOCKING HARDWARE WITH ELECTRONIC ACCESS CONTROL

When utilizing the following types of electronic access controls, use of the specified manufacturer and model is required to coordinate with existing electronic access control systems.

1. Electric strike for mortise & cylindrical locks: Von Duprin 6000 series
2. Electric strike, surface mount for rim exit device: HES Genesis series 9600, 9500, or 9400 (surface mounted for use with rim exit device)
3. Electric mortise lock:
 - a. Academic buildings: Corbin Russwin ML20900 series with M92 option (request to exit)
 - b. Residence Halls: Best 45HW series with DEU (fail secure) and IDH (integrated door hardware) options
4. Electric cylindrical lock
 - a. Academic buildings: Corbin Russwin CL33900 series with M92 option (request to exit)
 - b. Residence Halls: Best 9KW series with DEU (fail secure) and RQE (request to exit) options
5. Electric latch retraction exit device:
 - a. Von Duprin 98/99 series with RX option
 - b. Von Duprin 33A/35A series with RX option (for narrow stile doors)
 - c. Trim shall be night latch operation with lever handle, less cylinder
 - d. PS914 power supply with 900-BBK (battery backup) and 900-KL (key lock) options
 - i. Note: multiple option boards available for various configurations, including:
 - 1) 900-2RS (controls two devices independently)
 - 2) 900-4RL (controls four devices independently)
 - 3) 900-FA (fire alarm)
 - ii. Note: limit cable runs to 200' max with 12-gauge wire

6. Electric trim (for use with Von Duprin exit device)
 - a. 98/99 series: E996L, night latch operation with lever handle, less cylinder
 - b. 33A/35A series: E360L, lever handle (cylinder unavailable)
7. Wireless Locks:
 - a. Schlage AD series (mortise, mortise-deadbolt, or cylindrical),
 - i. Classrooms, labs and offices: Function 70
 - ii. Classrooms requiring deadbolt for shelter-in-place: Function 40
 - iii. Residence rooms: Function 50
 - b. Schlage AD400-993 exit trim for Von Duprin 98/99 series
 - c. Credential Reader:
 - i. MSK (Residence Halls)
 - ii. MS (Academic)
 - d. Schlage wireless system accessories:
 - i. PIM400-485 Panel Interface Module
 - ii. GCK400/ECK400 Wireless Gate & Elevator Kit
 - iii. ANT400-REM Remote Antenna Module
8. Electric power transfer: Von Duprin EPT-10
9. Electrified hinge:
 - a. Butt hinge: Command Access ETH6WH (2 wires 18 ga, remainder 28 ga)
 - b. Continuous hinge: Hager Roton Continuous Geared Hinge, RETW (Removable Electric Through-Wire) option
10. DC power supplies:
 - a. Altronix ALX1012ULXPD16 (12 Vdc)
 - b. Altronix ALX1024ULXPD16 (24 Vdc)
11. Card Readers
 - a. Mercury MR5 (Academic & Residence Hall non-student rooms)
 - b. Mercury MR20 (Residence Hall student rooms)
 - c. HID iCLASS® R40 (smartcard reader). Requires prior approval of Business Operations. Smartcard issue incurs additional cost which must be funded by requestor.
 - d. HID iCLASS® RK40 (smartcard reader/keypad). Requires prior approval of Business Operations. Smartcard issue incurs additional cost which must be funded by requestor.
12. Custom modular access control cable, Smartwire® by Windy City Wire®:
 - a. Outer Jacket PURPLE color in LOW SMOKE/PLENUM with text "UVA Access Control: Call 434-982-5735"
 - b. Element #1: 22-08 Shielded PLNM, Yellow Stripe-text "Card Reader"
 - c. Element #2: 22-06 Nonshielded PLNM, Orange Stripe-text "Motion/REX"
 - d. Element #3: 22-04 Nonshielded PLNM, Green Stripe-text "Door Contact/Spare"
 - e. Element #4: 18-04 Nonshielded PLNM, Purple Stripe-text "Lock Power"
13. Access control system: CBORD Squadron®
 - a. EAC installer must provide evidence of training/certification in installation and wiring of CBORD Squadron® access control system
 - b. System configuration and architecture must be reviewed and approved by the University prior to installation
14. Electric surge suppression: AC circuits supplying electronic access controls must be protected with inline surge suppression. Ditek Corporation DTK-120HW
15. Relays
 - a. BEA BR3 programmable relay: Used with ADA operator to provide request-to-exit, door unlatch, and door open sequence from interior actuator.

- b. Altronix RB1224 double-pole double-throw relay: Used with ADA operator to disable exterior actuator when door is locked.

5.4 INTERIOR SPECIALTIES

5.4.1 FIRE EXTINGUISHERS

Fire extinguisher cabinets shall be incorporated into all projects where required by code, sized for the required extinguisher. Specifications shall state the required extinguisher type and size. Extinguishers shall be University provided and installed. Fire Extinguisher Cabinets in the Medical Center require a wall mounted blue light installed above the cabinet.

5.4.2 INTERIOR SIGNAGE

Interior signage shall be provided by contract or by Facilities Management personnel as directed by the Project Manager. The Project Manager shall provide the University interior signage standards to the project design team. Wall mounted directories are required for new buildings, additions and renovated structures (where existing directories are not adaptable).

5.4.3 TOILET AND BATH ACCESSORIES

The A/E in consultation with the Project Manager shall consider the established practices of Facilities Operations, Health System Physical Plant or Student Housing Division in the selection of soap dispensers, paper towel dispensers and toilet paper holders.

The Health System shall have infrared controls that are hard-wired, with battery backup, on all hand washing sinks in public areas and paddle blades on sinks in clinical areas.

The following accessories shall be provided:

1. Not less than one (1) soap dispenser per two (2) lavatories in each restroom.
2. A 3" minimum width metal shelf above all lavatories not mounted above a countertop. Shelf shall be finished to match adjacent accessory trim and approximately 18" in length. The shelf may be integral with the mirror.
3. Mirrors shall be specified with a minimum ten-year warranty against silver spoilage.
4. Free-standing waste receptacles with a minimum capacity of 32 gallons in all toilets having more than one lavatory.
5. A/E shall specify that toilet tissue dispensers to be University-furnished, contractor installed per Building Services' specifications.
6. The University does not provide sanitary napkin dispensers. Sanitary napkin disposals shall be provided in all women's toilet stalls.

5.4.4 TOILET PARTITIONS

Steel, ASTM A424, Type I, commercial quality overhead braced toilet partitions are required. Alternative materials (plastic laminate, marble and high-density polymer resin) are to be approved

through the Project Manager prior to the submission of the Preliminary Design for review. Exposed particleboard or wood toilet partitions are prohibited.

5.4.5 WALL AND CORNER GUARDS

Wall and corner guards are required in corridors and other areas where service carts, moveable equipment, hospital patient stretchers or beds and similar equipment will be used.

5.4.6 CHALKBOARDS

Use chalkboards of laminated porcelain/ceramic enamel coated steel face material. Slate chalkboards are prohibited in the Health System.

All chalkboards will have trim of aluminum or wood, full width chalk trays, and tack strip with map rails as an integral part of the chalkboard assembly head trim in all classrooms. Map rail combo hook/clips are suggested for each board supplied. Include accessories for map rail use. A 50-year warranty or better is recommended for classroom chalkboards. Chalkboard color of black is recommended in classroom application.

5.4.7 CUBICLE CURTAINS

University of Virginia Health Sciences Center may utilize separate contract(s) for purchasing cubicle curtains. The A/E must incorporate the products from the selected vendor(s) into the project design and determine, with the Project Manager, the responsibilities of the contractor to be incorporated in the construction documents.

5.4.8 DRINKING FOUNTAIN WITH BOTTLE FILL STATION

In new construction and major renovation projects, provide at least one drinking fountain with an integrated water bottle fill station located in a public area of the building.

5.5 STAIRWAYS

All stairs that are not a means of egress shall be constructed to the same criteria as a means of egress stair.

5.6 INTERIOR FINISHES

5.6.1 WALL FINISHES

The minimum single layer thickness of gypsum wallboard shall be five-eighths inch (5/8") for walls.

5.6.1.1 PAINT SELECTION AND COLOR

Paint finishes shall be satin, except for the Health System, which shall be eggshell. Trim finish shall be semi-gloss. Other paint finishes may be acceptable with approval through the Project Manager. Paint selections are to be made during the design process. Health System paint colors shall be approved by Health Systems Facilities Planning and Capital Development.

5.6.1.2 WALL COVERINGS

Wall coverings with textures capable of harboring dirt and/or organic contamination are prohibited in patient care facilities.

Specify five percent (5%) quantities in whole rolls of wall covering materials for each project in which they are used. Additional materials are to be turned over to the Construction Administration Manager.

Vinyl coated wall coverings shall be medium weight (14 to 20 oz. per square yard) in areas with average traffic (offices, reception areas, hospital rooms and dining rooms) and heavy weight (24 to 32 oz. per square yard) for areas where there is heavy traffic or wear (corridors, classrooms, gymnasiums and service areas).

5.6.2 FLOOR FINISHES

5.6.2.1 CONCRETE FLOORS

All exposed concrete floors shall be sealed.

5.6.2.2 CERAMIC AND QUARRY TILE

Ceramic tile floor and base shall be used in restrooms and showers with non-slip floor surfacing. Cement backer board shall be used in all metal stud partition systems. Detailing shall minimize moisture penetration. Quarry tile floor and base shall be used in laundries and food preparation areas and shall have integral non-ferrous non-slip surfacing.

5.6.2.3 HARDWOOD FLOORING

Hardwood flooring, excluding athletic flooring, requires Facilities Management approval coordinated by the Project Manager. Weather protected entrances shall be installed to prevent water damage. When approved for use over a concrete slab, a moisture barrier is required. Wood flooring is not allowed in patient care areas.

5.6.2.4 RESILIENT FLOORING

Resilient tile flooring shall be twelve by twelve inch (12"x12") vinyl composition tile, of homogeneous solid composition, with a minimum thickness of one-eighth inch (1/8"). Specify American Biltrite Texas Granite solid vinyl tile for use in Medical Center projects.

Sheet flooring shall be vinyl commercially-graded flooring, with a minimum thickness of one-eighth inch (1/8"). Prior written approval is required for Medical Center projects utilizing sheet flooring.

The Facilities Management Building Services Division provides final floor finishing, except in the Health System where Environmental Services shall provide final floor finishing. Coordinate through the Project Manager regarding requirements to be incorporated into the construction documents.

5.6.2.5 RESILIENT BASE

The standard resilient base in University facilities is a heavy-duty vinyl or rubber base with a minimum thickness of 0.125 inches and a minimum height of four inches (4"). For areas subject to heavy-wheeled equipment traffic or frequent maintenance buffing equipment, the minimum height shall be six inches (6"). Outside corners shall be specified as premolded.

5.6.2.6 CARPET

The use of separate padding under carpet is prohibited except when authorized by Facilities Management. Carpet in the Health System is prohibited in all clinical areas.

5.6.3 CEILING FINISHES

5.6.3.1 GENERAL

Access to all utilities above the ceiling shall be provided regardless of ceiling type used. Access panels shall be shown on the contract documents. The A/E shall provide clear requirements in the plans and specifications for the proper reinforcement and support of lighting fixtures and access panels in finished ceilings.

5.6.3.2 SUSPENDED ACOUSTICAL TILE

When using acoustical tile systems in alterations, they should match any existing tiles in the area. Armstrong is the suggested provider in the Health System. Large interlocking tiles require prior written approval.

CHAPTER 6 – BUILDING SERVICES

6.1 BUILDING SERVICES GENERAL

6.1.1 INTRODUCTION

Heating ventilation and air conditioning (HVAC) equipment, electrical systems, elevator systems and building equipment shall be as energy efficient as possible. Based on the Governor's Executive Order #82, EPA ENERGY STAR equipment shall be provided whenever available.

University buildings shall be designed for at least a 40-year life with minimum life cycle cost rather than low first cost. All building components should be new and the most current model with readily available replacement parts for the expected life of each item.

6.1.2 CONNECTIONS TO MECHANICAL, PLUMBING, ELECTRICAL AND CIVIL UTILITIES

All utilities to a proposed building site are to be furnished from University central distribution systems, unless either unavailable or demonstrated to be impractical in terms of design or cost. Facilities Management may determine that systems designs shall accommodate development of new or future central distribution systems subject to available funds or potential supplemental funds. Utilities not available or impractical from central distribution systems must be generated at the proposed building.

Specifications shall include requirements that alterations or connections to any University domestic water, steam, hot water, chilled water, sanitary, storm, electrical, plumbing, fire protection, gas, compressed air, vacuum, medical gases, energy management systems and exterior utilities, both distribution and internal, shall be coordinated with Facilities Management Energy and Utilities Department through the Project Manager.

For systems serving a building area greater than a renovation project area, or affecting other occupied facilities, specifications shall require that Facilities Operations (Health System Physical Plant for the Health System) be notified through the Construction Administration Manager not less than ten (10) working days before such systems may be affected.

Spaces designated as unfinished in new construction shall have plumbing, HVAC and electrical utilities stubbed into them so that when they are finished in the future no demolition is required in the space and outside of it to provide utilities.

6.1.3 METERING UTILITIES

All utilities in all buildings shall be metered and shall be connected to building automation systems to be monitored and totaled at the Systems Control Center.

All meters shall be owner furnished and contractor installed and shall be installed and operational prior to connection of utilities. The operation and calibration of all meters shall be verified and corrected, if necessary, within ten (10) working days of connection to utilities.

See also **6.3.1.2 Domestic Water Metering; 6.4.2.3 Meters, Gauges, Indicators and Thermostats; 6.6.2.4 Electricity Metering; 6.7 Electronic Monitoring and Controls; and Appendix B.**

6.1.4 AESTHETIC CONCERNS

All mechanical and electrical equipment and utilities shall be concealed, both on the interior and exterior of buildings, except in mechanical rooms and in laboratories that do not have suspended ceilings.

6.1.5 SOUND PRESSURE LEVEL REQUIREMENTS

Sound pressure levels around exterior mechanical and electrical equipment shall not exceed the limits set forth in the City of Charlottesville or Albemarle County Noise Ordinance, or the dBA/time limitations set forth in the Occupational Noise Exposure/Hearing Conservation Amendment latest edition. The Project Manager shall direct questions regarding noise generating equipment and processes or spaces requiring extraordinary attenuation (taping rooms, audiometric exam rooms, etc.) to the University's Office of Environmental Health and Safety.

When placing noise-generating equipment, the A/E shall consider uses of surrounding spaces that may dictate sound levels lower than those specified above.

HVAC systems noise levels shall meet Room Criteria (RC) noise levels specified as per *ASHRAE 2011* (or most recent) *HVAC Applications Handbook*, Chapter 48 Noise and Vibration Control.

6.1.6 OPERATIONS AND MAINTENANCE MANUALS

See **1.5.4 Spare Parts and Maintenance Materials.**

6.1.7 COMMISSIONING

All new and replacement mechanical, plumbing, electrical and fire protection systems shall be commissioned per the requirements in LEED, ASHRAE Standard-0, and procedures as directed by the Project Manager. Requirements in those standards for testing after one year in service shall be included. In addition, all fire and smoke dampers shall be tested for operability after one year in service.

Specifications shall stipulate that until commissioning is satisfactorily completed, no heating, ventilation and air conditioning system will be accepted by the University. The warranty period on all equipment will begin only after acceptance by the University.

6.1.8 TRAINING AND DEMONSTRATION OF SYSTEMS

After commissioning is complete, but prior to beneficial occupancy or substantial completion, the contractor shall provide field training for designated Facilities Management personnel who are

responsible for the operation and maintenance of HVAC, electrical, emergency safety equipment, fire protection/detection equipment and systems and stormwater management practices. Classroom training can be held prior to commissioning. Field training shall include a demonstration of all required maintenance activities and proper operation of all control sequences. Dedicated training shall be provided on equipment or systems that are new technologies or new to the University. The A/E shall schedule all training and demonstration activities no less than two (2) weeks in advance.

Training shall cover the use and maintenance of specialty diagnostic tools and specialty diagnostic tools shall be provided to the owner.

6.2 ELEVATORS

The A/E is encouraged to consult with the Elevator Maintenance Supervisor by arrangement with the Project Manager. Recommendations may include proven manufacturers to be included in specifications. Cab door heights over eight feet (8'-0") shall be prohibited unless approved by the Operations Department. Additional specification requirements are noted in **Appendix C Elevators**.

6.2.1 ELEVATOR MACHINE ROOMS AND PITS

Elevator equipment rooms shall be maintained at a maximum of seventy-six degrees (76° F) and shall not be used for access to roofs or other parts of the building unless elevator equipment is fenced or walled. Electric fused disconnect switches or circuit breakers for elevator and cab lights shall be adjacent to the door jamb of the main door to the machine room.

Machine room less type elevator machinery and controls may be used only with written approval of the Elevator Maintenance Supervisor, Facilities Management Operations Department. All machinery and equipment shall be accessible by maintenance personnel in a manner similar to the access afforded for maintenance in a typical elevator machine room.

Traction-type elevators shall have machinery located overhead. Roped hydraulic elevators shall not be used. Written approval from the Elevator Maintenance Supervisor is required for a basement machine installation.

Elevator pits for hydraulic elevators shall have sump pits for use of a portable sump pump by Facilities Management personnel. Drainage from the elevator pit shall not be connected to any building drainage or sewer system. Sump pits shall be equipped with a float sensor connected to Facilities Management Systems Control. Underground hydraulic piping for elevators shall be Schedule 80.

6.2.2 CONTROL SYSTEMS

Elevator controls shall be solid-state "selective collective automatic operation," as defined in ASME/ANSI A17.1. Controller shall be non-proprietary and shall not require a battery to maintain programming. Control system shall be microprocessor based for dispatch and motor control, capable of computer-based monitoring with terminals for connection.

6.2.3 DIAGNOSTIC REQUIREMENTS

For microprocessor-controlled systems, specifications shall require that diagnostic tools be functional for the lifetime of the equipment without requiring recharging or reprogramming. The use of proprietary equipment shall be prohibited by the specifications.

6.2.4 WARRANTY SERVICE REQUIREMENTS

The specifications shall be explicit regarding:

Contractor shall provide two (2) sets of prints and one (1) electronic copy of schematic wiring diagrams and access codes or passwords required for all maintenance functions, including diagnostics, adjustments and parameter reprogramming. Tools may be hand held or built into the control systems and shall function for the lifetime of the equipment without recharging or reprogramming. Contractor shall provide any special tools, prints and technical operation of equipment that cannot be obtained from multiple suppliers to the University upon completion of the project. Specifications shall be explicit that all tools, adjusters, manuals and schematic wiring diagrams become the property of the University to be used at their discretion related to installed elevators.

Prior to the end of the warranty period, the elevator contractor shall readjust the elevator as required to meet all performance parameters specified. A written report shall be submitted by the elevator contractor to the University Service Contract Manager.

6.2.5 FINAL ACCEPTANCE

Include the following statement in elevator specifications: "As a part of final acceptance of the project and in accordance with the contract general conditions, the contractor shall have a qualified elevator inspector (QEI) conduct a full acceptance inspection and test in accordance with ASME/ANSI A17.1 before final acceptance by the owner. The contractor shall obtain from the elevator contractor and/or manufacturer and furnish to the owner all data affecting the elevator installation or modification, including 'as-installed' circuit and control wiring diagrams and maintenance manuals."

6.2.6 ELEVATOR TYPES AND COMPONENTS

Compliance with requirements for non-proprietary components is mandatory and essential to the University for its safe and expedient operation and maintenance of elevators throughout multiple buildings.

6.2.7 ELEVATOR CAB SIZE

All new buildings provided with elevator service shall have at least one elevator sized and configured to accommodate an ambulance type stretcher (76 inch x 24 inch) in the horizontal position. Where existing elevators are replaced, the above criteria shall be met where possible.

6.2.8 AUTOMATIC POWER DISCONNECTION

To prevent people from being trapped in an elevator when power is automatically disconnected in accord with the requirements of ASME/ANSI A17.1, provide a pre-action system and controls necessary to accomplish the following:

Heat detectors shall provide a signal to initiate Phase I Fireman's Service Emergency Recall Operation. Provide an elevator travel time delay, equivalent to the elapsed time for an elevator to travel from its farthest stop to the designated recall level plus ten (10) seconds before power to the elevator equipment is disconnected and pre-action sprinkler is activated. (Elevator Travel Time Delay = the time for an elevator to close its doors, under Phase I conditions, return to the designated recall level and open its doors. If there are multiple elevators, the elevator having the greatest travel time shall be used in determining the time delay.

6.3 PLUMBING

6.3.1 DOMESTIC WATER

6.3.1.1 WATER SUPPLY AND TREATMENT

Domestic water is obtained from the University distribution system. New service lines shall be valved at the point of connection to the main and at entry to the building. The use of domestic water for process cooling is prohibited. Note in specifications that water lines shall be disinfected and tested for bacteria at the completion of project.

Pressure reducing valves (PRV) shall be provided in all buildings at the domestic water entrance just downstream of the meter. Provide a full size bypass loop around the PRV and meter and a strainer with blow down valve upstream of the meter bypass loop. A backflow preventer (BFP) downstream of the meter bypass loop is required, with a bypass BFP that can accommodate full flow conditions. Isolation valves shall be installed so that either BFP can be removed. Back flow preventers shall be mounted a maximum of five feet (5') above the floor and shall be readily accessible for maintenance.

Vacuum breakers used for mop sinks and food service shall be pressure type in accordance with ASSE 1020.

See **3.5 Exterior Domestic and Chilled Water Piping** for requirements also applicable to exterior domestic water piping.

6.3.1.2 DOMESTIC WATER METERING

Meters shall be installed at each building and shall be capable of showing cumulative gallons and of measuring the maximum and minimum anticipated flow rates. Irrigation systems, boiler, chiller and cooling tower make-up and blow down shall be metered separately. Fire protection service shall not be through the domestic metered water system.

See **6.7 Electronic Monitoring and Controls** and **Appendix B: Utility Metering Requirements**.

6.3.1.3 DOMESTIC HOT WATER

Medium temperature hot water (MTHW) or steam shall be used to generate domestic hot water, except where centrally generated domestic hot water is available or where loads are very small.

Parts of the University Health System receive domestic hot water at 140 degrees Fahrenheit (140° F) which is generated by the Central Heating Plant and delivered over a distribution system. One hundred and forty degree Fahrenheit (140° F) domestic hot water is also produced in the Hospital Building. Contact Facilities Management Energy and Utilities or Health Systems Physical Plant for specific locations served. Any necessary water heaters used in Health System buildings shall be double wall.

To conserve energy, domestic hot water storage systems and domestic hot water recirculation pumps shall have an input from the BAS so they can be turned back or off during scheduled unoccupied times. Also, use chemical sterilization and/or booster heater systems for dishwashing needs instead of higher temperature supply hot water.

Instantaneous or semi-instantaneous heaters shall be used for all domestic hot water loads. Provide temperature control devices for domestic water heaters. Domestic hot water storage tanks, where approved, should be set to 140 degrees Fahrenheit (140° F).

6.3.2 MATERIALS AND SYSTEMS

All domestic water piping inside buildings shall be type L hard drawn copper with soldered joints. Mechanical joints may be used on domestic cold water downstream of the PRV. Supports and other metal parts subject to use shall be galvanized. All fittings shall be Class 150.

Shut off valves are required at the main service entrance into buildings, on each floor, on take-offs from all vertical risers, on branch lines from the mains and at the connection to each piece of equipment.

Domestic water pipe shall not be installed in or under concrete slabs on grade, except where necessitated by building entrances or under sidewalks. Pipe sleeves shall extend two inches (2") above the floor to serve as a dam in any area where flooding is possible due to nearby plumbing fixtures or mechanical equipment.

All specified fixtures shall have WaterSense label. See **Figure 14**. Urinals shall be 0.125 GPF (1 pint) type. Water closets shall be 1.28 GPF or dual flush type where appropriate. See also **5.4.8 Drinking Fountain with Bottle Fill Station**.

All piping systems shall be hydrostatically tested after installation. The test pressure shall be 200 PSI or 1 1/2 times the working pressure, whichever is greater. Components not suitable for a 200 PSIG test may be tested at a lower pressure and then valved off for the 200 PSIG test. Test duration on pipe with soldered joints shall be at least two (2) hours; the test duration on pipe with mechanical joints shall be 24 hours.

6.3.3 IDENTIFICATION

All piping and equipment in mechanical equipment rooms and central plants shall be completely painted according to the "Scheme for the Identification of Piping Systems," ANSI A13.1 and the "Safety Code Color for Marking Physical Hazards," ANSI Z53.1, latest revisions.

All piping in buildings shall be identified by means of alphabetical stencils and color codes, showing contents of the piping and the direction of flow. Piping shall be identified at 30-foot (30') intervals, on both sides of penetrations through walls and floors, and at each directional change.

All valves shall also be identified with stamped brass tags or discs secured with non-ferrous beaded chain. Valve numbers shall be engraved or stamped as large as possible on tags (1 inch by 2 inches) or discs (1.25 inch diameter) attached to the valves by 10-gauge brass "S" hooks. Provide a framed valve schedule in mechanical rooms.

6.3.4 WATER DISTRIBUTION

Note the following details when preparing plans and specifications:

1. Insulation on domestic water lines shall be continuous through floors, walls and studs.
2. Closed water piping systems shall have air vents to purge any trapped air.
3. Valves shall be compatible with piping materials. Non-ferrous full port ball valves up to four inches (4") can be used on domestic water. Non-ferrous or ductile iron butterfly valves can be used on two and one-half inches (2 ½") and above. Gate valves shall not be used except where provided with backflow prevention devices.
4. Drain valves shall be installed in accessible locations at all low points in the piping system to permit drainage and servicing.
5. Dielectric fittings shall not be used and six-inch (6") long brass nipples shall be used when connecting piping of dissimilar metals.
6. When plumbing fixtures are removed but not replaced, domestic water pipes shall be removed to within five (5) pipe diameters of the main to prevent leaving a long dead leg, and terminated with a capped ball valve. Where plumbing fixtures are removed but the water pipes will be reused the pipes shall be capped to prevent debris from entering pipes.
7. Aerators for lavatories in toilets, kitchens, and similar use shall be 1.5 GPM maximum. Aerators shall not be used in the hospital where they would create a legionella risk.
8. Hose bibs shall be spaced at a maximum of 100 feet (100') around the entire building.

6.3.5 STORM AND SANITARY WASTE SYSTEMS

The University-owned sanitary sewerage system connects to city-maintained sewerage lines and the Rivanna Water and Sewer Authority's treatment plants.

Sanitary cleanouts shall be located with a minimum floor clearance of 15 inches (15") from adjoining walls or built-in features, such as toilet stalls or casework. Unless approved as an exception for servicing vertical risers, cleanouts shall not be located in vertical surfaces. Where wall clean outs are allowed, the access shall be within one inch (1") of the wall. Also provide cleanouts on sanitary and storm lines on exterior lines within 5 feet (5') of the building.

All storm lines shall be continuous from the inlet to the storm system outside the building; high level drains and drains from sloped roofs shall not discharge onto lower roofs unless needed for a Green Roof or LEED credit. The construction manager and contractor shall inform UVA's Annual Standards and Specifications Manager prior to installing stormwater management practices (BMPs) so they may be inspected.

Pumped discharge lines from sewage and storm ejectors shall not be combined with gravity drains inside buildings. Pumped and gravity drains shall run separately to the nearest manhole.

All gravity storm and sanitary drains shall be cast iron except for an acid resistant material where justified and for under slab and footing drains. Pumped storm and sanitary lines shall be copper; type L inside the building and type K outside. Footing drains exterior to the building shall be schedule 40 PVC or cast iron; foundation drains under the slab can be DWV PVC.

6.3.6 PIPING SYSTEMS FOR GASES

Piped gas systems shall be thoroughly identified and coded and all fuel gas pipe downstream of the meter shall be above grade. Natural gas outlets shall not be installed in bio-safety cabinets or other contained rooms or areas that are not fully exhausted. Natural gas shut-off valves shall be provided at the entrance to the room in which the gas is being used.

Piping of any gases in Health System (Hospital and Medical School) projects will require special coordination with Health Systems Physical Plant. All medical gas outlets shall be D.I.S.S. type. All piping, tubing and fittings shall be pre-cleaned. Copper shall be type K.

Vacuum pumps shall be CLAW, variable speed, oil lubricated or dry rotary vane type; liquid ring vacuum pumps shall not be used.

Air compressors shall be variable speed.

6.3.7 EMERGENCY SHOWER AND EYEWASH EQUIPMENT

Emergency eyewash and shower stations are required in areas where chemical, biological, radiological or physical hazards including battery charging stations and chemical treatment for hydronic systems exist that may expose the eyes or body to corrosive, infectious or other injurious materials. The location of emergency irrigation equipment shall be made upon consultation with OEHS and will adhere to applicable regulations and consensus guidelines (e.g. The National Research Council's/Prudent Practices for Handling Hazardous Chemicals in Laboratories/National Academy Press, most recent edition). The specifications and installation of emergency irrigation equipment shall comply with the latest version of ANSI Standard Z358.1. Tempering valves are required and should be set to discharge 85 degree Fahrenheit (85° F). All spaces where Biosafety Level 2 or Animal Biosafety Level 2 (housing) and above materials are manipulated require a permanently installed eyewash and a hand wash sink.

Safety showers should be highly visible. Showers with pull down bars are preferred over chain pulls. Provide floor drains below emergency showers.

ANSI-approved eyewash facilities shall be provided in at least one sink in each laboratory or work area (i.e., shop areas, mechanical rooms, etc.) if substances used there are known to present a potential eye hazard. The project team should work with OEHS and the customer to ensure that sink functions that will occur in the laboratory do not obscure the presence of the eyewash fountain or obstruct access.

6.3.8 DRINKING FOUNTIONS AND BOTTLE FILL STATIONS

In new construction or significant renovations to existing buildings, at least one drinking fountain in a public area shall incorporate a bottle fill station. Alternatively, a stand-alone bottle fill station shall be specified in the design.

6.4 HEATING, VENTILATION, AND AIR CONDITIONING

6.4.1 DESIGN PARAMETERS

6.4.1.1 ENERGY PERFORMANCE

1. The minimum energy performance for all new construction shall be the minimum required for LEED certification but no more than ten percent (10%) less than the energy use allowed by the currently adopted version of IECC or ASHRAE 90.1.
2. The maximum allowable fan energy shall be ten percent (10%) less than the values listed in ASHRAE 90.1. Humidification for human comfort is not allowed.
3. Use hot water temperature reset controls.

6.4.1.2 DESIGN CONDITIONS

Design heating and cooling systems using the following criteria:

1. Heating: Use the median of annual extremes for outside temperature included in the most recent ASHRAE Handbook Fundamentals data. Use Inside Design Condition Criteria in **Figure 11** for inside temperatures.
2. Cooling: Use two and one-half percent (2.5%) figures for outside Wet Bulb and two and one-half percent (2-1/2%) figures for Dry Bulb temperatures included in **Figure 11** or the most recent ASHRAE Handbook Fundamentals data. Use Inside Design Condition Criteria in **Figure 11** for inside design temperature.
3. For any Occupancy/Use not shown in the Inside Design Condition Criteria, **Figure 11**, consult ASHRAE Handbooks or other applicable references for suggested criteria and obtain CFO approval of conditions proposed for use in design.

6.4.1.3 CONTROLS AND SYSTEMS

1. Mount supply and return fan VFDs close enough together so the readouts can be seen at the same time without moving.
2. VAV systems that simply reduce outside airflow in proportion to supply airflow shall not be used. Spaces of different uses (such as offices and classrooms) may only be served by the same AHU if CO₂ sensors or other approved controls are provided in adequate quantity and location to ensure code required outside air to all spaces.

3. Constant volume systems shall only be used where required by program or where variable volume air control is impractical. Constant volume recirculating systems shall have a means to pre-cool and dehumidify outside air before being mixed with the return air rather than cooling the entire supply airstream to dehumidify and then reheating. A chilled water coil, heat recovery device or other method approved by Facilities Management may be used.
4. Individual offices shall have means of ensuring acceptable temperature control (user adjustable thermostat and control device, appropriate zoning or other designed means). Where air terminal devices serve multiple offices provide a temperature sensor in each office, averaged to control the air terminal device.
5. Untempered outside air shall not be supplied directly to occupied spaces or into the returns of fan coil units.

6.4.1.4 IDENTIFICATION

1. Piping and equipment in mechanical equipment rooms and central plants shall be completely painted according to the "Scheme for the Identification of Piping Systems", ANSI A13.1 and the "Safety Code Color for Marking Physical Hazards," ANSI Z53.1, latest revisions. Piping in buildings shall be identified by means of alphabetical stencils and color codes, showing contents of the piping and the direction of flow. Piping shall be identified at thirty foot (30') intervals, on both sides of penetrations through walls and floors, and at each directional change.
2. Valves shall be identified with valve numbers engraved or stamped as large as possible on brass tags (1 inch by 2 inches) or brass discs (1.25 inch diameter) attached to the valves by 10-gauge brass "S" hooks. Provide a framed valve schedule in mechanical rooms.
3. Motor driven equipment, HVAC components and major electrical boxes shall be individually numbered on the drawings by the A/E and have corresponding number plates on the equipment. (Example: For unit heaters, use UH-1, UH-2, etc., even though both units are of the same size and type.) All designations shall be integrated with and distinguished from existing designations.
4. The construction documents shall require the contractor to color identify all equipment using the numbering system shown on the drawings with a color that contrasts with the equipment finish. In finished areas, identification shall be located on the inside surfaces of access doors; in unfinished areas, on outside surfaces. Gravographic plastic or comparable plastic tags shall be used and permanently attached at both the equipment and the disconnect/VFD.
5. New equipment containing 50 pounds or more of refrigerant should have a nameplate attached which identifies the manufacturer, model and serial numbers, date of manufacture, type of refrigerant, and maximum quantity (full charge) of refrigerant in the system.

6.4.2 CHEMICAL CLEANING AND CHEMICAL WATER TREATMENT OF BOILERS AND HVAC SYSTEMS

1. The boilers, the HVAC systems, all system piping, and all system related equipment shall be thoroughly flushed out with pre-cleaning chemicals per the manufacturer's instructions.

2. In individual buildings, only closed loop systems, such as secondary heating water and process water, shall have chemical treatment (chemical treatment for fluids from central systems will be provided at the heating or chiller plant).
3. The contractor is responsible for providing all equipment, fittings, tubes, valves, connections, labor, chemicals, and miscellaneous hardware for the boiler boil-out, for the flushing, cleaning and associated water treatment and for the initial chemical water treatment for the boilers and HVAC systems.
4. The contractor is responsible for providing all equipment, fittings, tubes, valves, connections, labor, chemicals and miscellaneous hardware for the boiler boil-out, for the flushing, cleaning and associated water treatment and for the initial chemical water treatment for the boilers and HVAC systems.
5. The University provides chemicals to be used for the initial treatment of the system after flushing and cleaning have been completed.
6. The A/E must specify that the contractor notify the University approximately thirty (30) days before the boil-out/cleaning of the system and the application of the chemicals are started. The University's Water Treatment Consultant shall observe and monitor the boil-out/cleaning of the system and the initial charge of chemicals required for placing the equipment in normal service.
7. The Construction Documents shall require that after cleaning and chemically treating boilers and HVAC systems, the contractor shall furnish the University, in writing, the following information:
 - a. Date of initial treatment.
 - b. Type of chemical(s) used for treatment.
 - c. Estimated date that further treatment or testing will be required.

6.4.2.1 DISTRIBUTION

1. Taps shall be provided to measure flow rate (GPM) at each pump and at each heat exchanger; however, circuit setters shall not be used on variable volume systems. Wells for thermometers shall be provided before and after each heat exchanger.
2. Hydronic pipe shall not be installed in or under concrete slabs on grade, except where necessitated by building entrances or under sidewalks.
3. Shut off valves are required at the main service entrance into buildings and on each floor at take-offs from all vertical risers. Full port ball valves can be used on pipe up to 4"; butterfly valves can be used on pipe 2-1/2" and larger. Gate valves shall not be used. All air handler coils, reheat coils, convectors and fan coil units shall incorporate isolation valves.
4. Strainers shall be provided at the inlet to all pumps and loads. All strainers shall be provided with blow down valves (use ball valves). Blow down lines shall be extended so the valve and valve handle are clear of the pipe insulation. The outlet shall be clear of adjacent pipe and other obstructions.
5. Hydronic pipe shall be steel or Type L hard drawn copper. Joints shall be soldered, brazed, threaded, welded, or flanged. Mechanical joints can be approved on a case-by-case basis and only on services 140°F and below. All fittings shall be Class 150 or higher.
6. 6" long (between threads) brass nipples shall be used when joining dissimilar metals. Dielectric fittings, unions, and flanges shall not be used.

6.4.2.2 TESTING AND BALANCING

1. All HVAC systems shall be tested and balanced in accordance with a standard of a recognized testing laboratory.
2. All piping shall be tested at 200 PSI or 1 1/2 times (1.5x) the design pressure, whichever is the greatest. Test duration shall be at least two (2) hours; where mechanical joints (such as Pro-Press) are allowed, the hydro test shall be held for 24 hours. Pressure tests shall be witnessed by the Energy and Utilities Department System Manager, the Maintenance Superintendent or their designees.
3. All welds in high pressure steam, pumped condensate and HTHW piping shall be x-rayed from primary to secondary systems. The x-rays of the welds shall satisfy ASME B-31.1.
4. In steam PRV stations, the pipe up to the shut off valves downstream of the first stage PRV's shall be pressure tested and x-rayed per the requirements of HPS.
5. Testing and balancing of building chilled and hot water distribution pumps shall use the revenue meters and not the DP across pumps. A portable meter with less than 1% error shall be used on branches which do not have full flow; a suitable meter can be borrowed from the University if available.

6.4.2.3 METERS, GAUGES, INDICATORS AND THERMOSTATS

Meters shall be installed at each building on each utility.

1. See **6.7.1 Application**.
2. See **Appendix B: Utility Metering Requirements**.
3. Gauges shall be specified on supply/return of pumps, chillers, converters and where lines enter and exit mechanical rooms.
4. Thermometers shall be specified on supply/return water chillers, air-handling units, fan coil units and at other points.
5. Where non-digital readout gauges are used, the following shall apply:
6. Gauges for general use shall have screw-type recalibration, bronze bushed movements and single unit construction.
 - a. In main mechanical rooms, provide four and one-half inch (4.5") diameter gauges for all steam pressures, and mounted a maximum of eight feet, zero inches (8'-0") above the operating floor.
 - b. Gauges shall be calibrated for static head.
 - c. All gauges shall be non-pulsating.
 - d. Pipe taps for gauges shall be between the 3 and 9 o'clock positions.
 - e. Isolation valves for gauges shall be ball valves rather than gauge cocks.
7. Temperature gauges are acceptable where mercury thermometers would be difficult to read.
8. Gauges and thermometers shall read to twice the operating pressure or temperature.

6.4.3 MECHANICAL LOCATION AND EQUIPMENT

See **4.5.7 Rooftop Equipment** and **6.4.5.1 Sources/Outside Air**.

6.4.3.1 MECHANICAL ROOMS

The A/E shall, in the earliest stages of design development, be responsible for establishing and/or verifying programmatic requirements for mechanical rooms in order to provide for replacing the largest piece of equipment without removing permanent walls or large items of equipment or equipment essential to the ongoing day to day building use. In phased projects, mechanical rooms shall be sized to include equipment for all the phases.

Concrete floors in mechanical rooms shall be sealed.

6.4.3.2 FIRE SEPARATION OF EQUIPMENT

Direct fired heating equipment and make-up air heating equipment shall be separated from other air handling equipment by a one (1) hour fire-resistance rated wall except for combination heating and cooling equipment.

Buildings with critical loads as identified by the Energy and Utilities Department shall have external taps for the connection of a portable boiler and/or chiller.

Attic spaces may be used for air handling equipment; however, compressors, condensers and distribution pumps shall not be located in attics. Attic access shall be from interior stairs (or elevator where practical), which shall be large enough and suitable for replacement of the largest component of the mechanical equipment. Attic mechanical spaces shall be equipped with space for storage of mechanical drawings, maintenance manuals, filters, etc. Floor moisture detectors shall be tied to University's Systems Control Center energy management system and all AHUs in attics shall have protection so a large leak will not flood floors below.

6.4.3.3 EQUIPMENT

All coils, pumps and fan coil units shall have adequate isolation valves to allow replacement without a total system drain down. Shut off valves on chilled water, heating hot water, steam, condensate, and glycol shall be ball or butterfly. Butterfly valves six inches (6") and larger shall have gear operators. All sizes of valves installed higher than seven feet (7') shall have chain drives. Triple duty valves are acceptable on constant volume pumps but discouraged on variable volume pumps.

All air handler units shall be provided with a single point of electrical hook up when appropriate to size or type. All other air handlers shall show all circuits and voltages necessary for fans, lights, etc.

Floor mounted pumps shall have suction diffusers.

Flexible pipe joints shall be braided stainless steel rather than rubber.

Cogged V-belts shall be specified for constant speed motors, HTD type belts shall be specified for motors with VFDs.

Pipe sleeves shall extend two inches (2") above the floor to serve as a dam in all areas where plumbing fixtures or mechanical equipment present a possibility of flooding.

6.4.3.4 VIBRATION AND SOUND ISOLATION REQUIREMENTS

Mechanical and electrical equipment, associated piping and ductwork shall be mounted on vibration isolators to minimize transmission of vibration and noise to the building structure or spaces. All motors over five (5) horsepower must be solidly attached to a base common with the driven unit to minimize alignment problems. Solid sheaves and band belts shall be used to minimize vibration in multiple V-belt driven equipment. All rotating equipment shall be balanced, both statically and dynamically. The structure supporting the equipment shall not have any natural frequencies within plus or minus twenty percent (+/-20%) of the normal operating speeds. The equipment, while operating, shall not exceed a self-excited radial vibration velocity of one-tenth inch (0.10") per second or an axial vibration velocity of 0.05 inch per second when measured with a vibration meter. Vibration test pickups shall be placed on bearing caps in the horizontal, vertical and axial directions or on equipment mounting feet if the bearing caps are concealed.

Walls and floors enclosing mechanical rooms adjacent to occupied spaces shall have a sound attenuation factor of ten (10) decibels or greater, above the determined or probable airborne noise level of the operating equipment. In no such applications shall the rating be less than a 55-decibel STC.

6.4.4 HEATING

6.4.4.1 SOURCES

1. High Pressure Steam (HPS), Medium Pressure Steam (MPS), Low Pressure Steam (LPS): Steam is available to most Health System (Hospital and Medical School) buildings at 180 PSIG. In many buildings in the Central Grounds, steam is available at 125 PSIG. All HPS piping shall be designed for 270 PSIG-saturated steam (413° F). HPS from the University system shall be dropped to LPS in a two-stage PRV station; the University defines the intermediate stage, usually 60 to 80 PSIG, as Medium Pressure Steam or MPS. Each stage shall have a 1/3 and 2/3 capacity PRV and a bypass. The MPS and LPS headers shall have pressure relief valves vented to atmosphere through the roof. Steam is generated year-round at the Central Heating Plant. Steam shall NOT be used as primary building heat where medium temperature hot water is or can be made available. Steam or MTHW shall be used for summer humidity control where required. Steam shall also be used for process use in laboratories, food preparation areas and domestic hot water generation systems. The maximum designed steam velocity shall be 7,200 FPM.

All uncontaminated steam condensate, including condensate from clean steam humidification systems must be returned to the system. All drip condensate from humidifiers shall be returned to the building condensate system. Steam from the central plant shall not be used directly for winter humidification. Plant steam or MTHW may be used to make clean steam for humidification. Water softener and automatic blow down are required. Clean steam generators shall be shut down in the summer.

2. Medium Temperature Hot Water (MTHW): The University maintains a MTHW loop originating at the Central Heating Plant. Much of the Health Systems area and Central Grounds area are served by this system. MTHW shall be used as the principal energy source for building heating systems in the Central Grounds. The temperature drop of the

MTHW in building heat exchangers shall be 60 degrees (60° F). Water temperature varies inversely with outside air temperature from 190 degrees to 230 degrees, and leaves the heating plant at 125 PSIG. Piping shall be designed for 180 PSI, 230 degrees Fahrenheit (230° F). Consult Facilities Management Energy and Utilities Department for MTHW reset chart, and to confirm the operating cycle in effect prior to beginning design.

3. Gas: Natural gas is available from the Gas Division of the Charlottesville Department of Public Works for distribution and shall be coordinated through Energy & Utilities Department. Natural gas piping systems within buildings shall be black steel. Outside distribution piping shall be approved plastic. All gas pipes downstream of the meter shall be above grade. The A/E must verify the capacity and pressure of the lines serving the area in which work is to be done.
4. The use of electric resistance as the primary source of heat is not allowed.

6.4.4.2 STEAM AND HOT WATER TUNNELS AND DISTRIBUTION SYSTEMS

All heating water above 180 degrees (180° F), steam and condensate mains shall be run in tunnels. Only hot water branches to individual buildings may be direct buried, with documented approval. Construction shall be designed to prevent the intrusion of water and other substances into box trenches or tunnels for a minimum of 25 years. Installation of chilled water lines and piping for toxic, flammable or hazardous gases is prohibited. Electrical or communications systems shall be limited to 120 volts and shall be installed in conduit.

The drawings for the distribution system shall include both a plan view and a profile view of the system indicating points of connection, anchorage points, loops, points of support, elevations (on profile view), junctions and crossovers/crossunders, valves, drip trap, vents and drains, with other utilities or obstructions and other pertinent data required for construction. Drawings shall also include typical and special details of supports, anchors, connections and other similar conditions.

Tunnels shall be five feet by six feet (5' x 6') if pipes are run only on one side or six feet by six feet (6' x 6') if pipes are run on both sides. Tunnel structure shall be designed for HS 20 traffic. Manholes for utility tunnels shall be provided with a ladder per **Figure 13**; consult Facilities Management Energy and Utilities Department for access requirements. Low points in steam and MTHW tunnels shall be drained by gravity or a pump with emergency backup. Drains shall run to daylight or the storm system. Provide a detail of the connection of the new steam box trench to the existing tunnel.

Steam and MTHW tunnels shall have factory applied bitumastic coating and protection board on outside and all joints shall be water proofed with sealant and twelve inch (12") wide adhered membrane. Tunnels installed at or below the water table shall be fully water proofed with a rubber (EPDM) membrane. The sides and bottom of precast box trenches shall have a bitumastic coating. The top shall be covered with a waterproof membrane that overlaps the bitumastic by at least a foot.

In box conduits all steel supports should be at least two inches (2") off of the bottom. Support members that touch the floor shall be stainless steel. All carbon steel supports in the box conduit shall have 2 coats of rust inhibiting paint.

Where the heating pipe is direct buried the piping shall be hydrostatically tested before insulating and before field joints are backfilled.

6.4.4.3 MATERIALS AND EQUIPMENT

6.4.4.3.1 PIPING, FITTINGS AND VALVES

All HPS, pumped condensate and MTHW pipe including direct buried/pre-insulated piping systems shall be A-106, fittings shall be class 300 malleable iron, cast steel or forged steel (not cast iron); flange bolts shall be grade B7 and flange gaskets shall be spiral wound metal or spiral wound PTFE that is rated for at least 500 degrees F. All steam condensate lines shall be Schedule 80 and all fittings on condensate lines shall be Class 300. Materials of construction and fabrication must lie within allowable stress values specified by the ASME Code. Design life will be 30 years.

Shutoff valves on MTHW shall be cast steel class 300 high performance lugged butterfly valves with M-filled Poly Tetra Fluro Ethylene (PTFE), MTFE, Tek-Fil or Xtreme seat and seals with double offset seats, or class 300 high performance full port ball valves with carbon steel body, stainless steel ball and stem, packed stem extension to allow for insulation and M-filled PTFE seat and seals. High performance ball valves on MTHW 2" and smaller shall be 3-piece with socket weld ends, ball valves 2 ½" and larger shall be 2-piece flanged. Valves for MTHW shall be adequate for 250 PSIG and 400 degrees (400° F) water. Globe valves can be used for throttling. Gate valves shall not be used. Acceptable manufacturers for high performance ball and butterfly valves are Adams, Bray, Jamesbury and Zwick.

Shutoff valves on HPS and pumped condensate shall be cast steel class 300 high performance lugged butterfly valves with M-filled Poly Tetra Fluro Ethylene (PTFE), MTFE, Tek-Fil or Xtreme seat and seals with either double or triple offset seats with a gear operator, or class 300 high performance full port ball valves with carbon steel body, stainless steel ball and stem, packed stem extension to allow for insulation and M-filled PTFE seat and seals. High performance ball valves on HPS and pumped condensate 2" and smaller shall be 3-piece with socket weld ends, ball valves 2 ½" and larger shall be 2-piece flanged with a gear operator. Valves for HPS shall be adequate for 270 PSIG saturated steam. Globe valves can be used for throttling. Gate valves shall not be used. Acceptable manufacturers for high performance ball and butterfly valves are Adams, Bray, Jamesbury and Zwick.

The shut off valves just downstream of the first stage PRV's and the pipe up to them, shall comply with the above construction.

Valves for MPS shall be class 150 with seats and seals rated for 200 PSIG saturated steam. Valves on the LPS shall be class 150. All sizes of butterfly valves on all steam pressures shall have gear operators. Flange gaskets on MPS and LPS shall be spiral wound PTFE rated for at least 500 degrees F.

Valves on the LTHW/secondary shall be class 150 ball or butterfly rated for at least 200 degrees F. Butterfly valves on heating hot water shall have metal seats and seals rated for at least 200 degrees; EPDM and other soft rubber seats and seals shall not be used. Flange gaskets on LTHW shall be spiral wound rated for at least 400 degrees F.

6.4.4.3.2 STEAM SYSTEMS

Main HPS service entrances shall have a block and bleed valve assembly. Steam Pressure Reducing Valves (PRV) shall be cast steel. Spence, Sarco and Armstrong are acceptable manufacturers for steam PRVs. The first stage PRVs shall be Class 300. Elbows (45 or 90) shall be provided between each PRV and one of the headers to allow for thermal contraction that occurs when a PRV is removed for service.

Steam strainers shall be installed horizontally so condensate does not collect.

Inverted bucket traps shall not be used. F&T traps are preferred for equipment loads and drip on LPS and MPS. Bimetallic traps are preferred for drip on HPS. Equipment traps shall have bypasses; drip traps shall not. Provide ¼" test ports with ball valves just upstream of the check valve after all steam traps. Provide a DDC temperature sensor on the condensate line downstream of equipment traps and program to alarm on detection of live steam or sub cooled condensate.

Specify pressure powered condensate pumps rather than electric. Pressure powered pumps shall be sized to operate with medium pressure steam. Electric condensate pumps where used shall be on emergency power.

6.4.4.3.3 HEAT EXCHANGERS

All MTHW to LTHW converters and steam to LTHW converters shall have 90/10 copper/nickel tubes and brass tube sheets. Baffles, where used, shall be Teflon. In MTHW to LTHW heat exchangers the MTHW shall be in the tubes. Provide thermometers (or temperature gauges) on all four legs of water-to-water heat exchangers, and on both fluid legs of steam converters. Provide elbows on the header connections to facilitate tube removal.

All fired or unfired pressure vessels whether a part of an equipment package or an entire piece of equipment shall be specified to comply with the ASME Code. The specifications shall require that the pressure vessel be so stamped in an easily identifiable location and that the manufacturer's data indicating ASME compliance be submitted. Comply with the Boiler and Pressure Vessel Rules and Regulations issued by DLI.

6.4.4.3.4 EXPANSION JOINTS

Expansion joints on heating pipe shall be class 300 packed slip type or ball joints, packable under pressure. Bellows type expansion joints shall not be used. Expansion joints on HPS, pumped condensate and MTHW shall have welded joints rather than flanges. Where appropriate slip expansion joints with an integral foot can be used in lieu of an expansion joint and separate anchor. Acceptable manufacturers are Adesco, Advanced Thermal Systems and Yarway. Provide calcium silicate insulation on the main body of the expansion joints and provide a removable flexible insulation blanket that over laps the calcium silicate by four inches (4") on each side. Install slip expansion joints so the pipe expands into the joint in the direction of flow. Install ball joints in the direction of flow per the manufacturer's instructions.

6.4.4.3.5 INSULATION

Insulation in steam and MTHW tunnels shall be fiberglass rated for 800 degrees Fahrenheit (800° F) with an aluminum jacket or calcium silicate with waterproof 30 pound felt jacketing; applied to fittings with waterproof adhesive and copper or stainless steel wires. Insulation on high pressure steam, pumped condensate, and MTHW in mechanical rooms shall be fiberglass rated for 800° F or calcium silicate with a glued canvas jacket. Insulation on pre-insulated direct-buried MTHW lines shall be rated for at least 300°F. The minimum insulation thickness on HPS and MTHW shall be four inches (4") on pipe six inches (6") and above and three inches (3") on pipe four inches (4") and smaller. Removable insulation blankets with double D-rings and straps shall be provided on all steam, condensate and hot water valves and fittings that cannot be properly fitted with fiberglass or calcium silicate insulation.

6.4.4.3.6 MISCELLANEOUS HEATING COMPONENTS

1. All duct reheat coils shall have access doors or panels to allow inspection and cleaning of coil inlet.
2. All fittings on secondary hot water systems shall be class 150 or better.
3. Humidifiers shall have insulated dispersion tubes. The outlets of dispersion tubes shall be oriented per the manufacturers instructions.

6.4.4.3.7 BOILERS

1. All new and replacement oil fired boilers that exceed 1 MM BTUH and gas fired boilers that exceed 10 MM BTUH fuel input require an air permit from DEQ prior to ordering the equipment. Coordinate with the Facilities Management Energy and Utilities Department through the Project Manager.
2. FM Environmental Resources shall be notified of any removal, replacement or new installation of boilers of any size.
3. All gas and fuel oil burners shall be low NOX.

6.4.4.4 BUILDING DISTRIBUTION AND CONTROLS

Fan coil units, perimeter radiation, preheat coils, reheat coils and all other heating in occupied spaces shall use a secondary heating water generated in an exchanger in the building rather than one of the sources in **6.4.5.1 Sources/Outside Air**. These secondary heating water systems shall be designed as part of a 4-pipe system rather than dual temperature systems.

Ethylene Glycol shall not be used. Propylene Glycol is acceptable.

In inpatient buildings and other critical buildings as specified provide valves and capped tees on the building steam system or LTHW loop for connection of a temporary boiler for emergency heat. The backup system shall be sized for all building loads, including domestic hot water, humidifiers, sterilizers, autoclaves, etc. Consult with the Project Manager, HSPP, and Facilities Management Energy and Utilities Department for specific requirements.

The secondary heating water for a building shall be between 90 and 190 degrees Fahrenheit (90-190° F) for heating. The re-heat water temperature shall be reset down in the summer and if practical controls shall be provided to shut off the re-heat pump(s) in extremely hot weather.

Hot water re-heat systems and combined pre-heat and re-heat systems shall be variable volume with 2-way control valves. The hot water pump speed shall be controlled by an end-of-line differential pressure sensor and the pump control sequence shall include pressure optimization. Characterized ball valves are preferred on loads up to four inches (4"). Valves on pre-heat coils shall be fail open, valves on re-heat coils shall be fail in place.

Blender sections shall be provided on all AHUs other than single pass units to ensure that the outside air and return air are adequately mixed. Pre-heat coils on single pass AHUs shall have a recirculation pump on the pre-heat coil supply or return connection. Face and bypass dampers shall not be used on pre-heat coils.

Automatic control valves on humidifiers shall be fail-in-place or fail-closed.

6.4.5 VENTILATION

6.4.5.1 SOURCES/OUTSIDE AIR

Outside air intakes shall not draw in exhaust air from adjacent systems, loading docks, parking lots, emergency generators, emergency or ambulance vehicle entrances, chemical storage, sewer manholes or other external sources of noxious or toxic fumes. Consideration also shall include proximity to wind-blown dust from streets, fields and ground care activities, designated tobacco smoking areas, combustion by-products and biogenic materials related to evaporative cooling towers or intentional human contamination. Outside air intakes shall be far enough above grade to discourage or prevent criminal contaminations.

An assessment shall be made during the design process to review the outside air intakes of buildings near the construction site for the purpose of determining the impact construction-generated emissions may have on the air intake quality of said buildings and to develop an air intake mitigation plan for University review, approval and coordination with the contractor if a plan is required (i.e., air intake locations for surrounding buildings on Site Plans, vulnerability assessment by OEHS and protection recommendations in Contract Documents, plan to ensure management efforts do not adversely affect adjacent building HVAC equipment, "scrubbers", additional filtration [charcoal], use of extension hoses to pipe exhaust to a more desirable location, temporarily relocating louvers, restriction on location of engine exhaust and volatile emissions, and special hours for deliveries, dumpster pick up, and toilet cleaning).

To avoid re-entrainment of hazardous or noxious sources of exhaust air into the building or into adjacent buildings' air intakes and other sensitive locations, wind tunnel testing or other modeling must be performed to ensure adequate dispersion of the exhaust sources. Any architectural barrier constructed to mask unwanted appearance of stacks, penthouse, mechanical equipment shall be evaluated for its effects on re-entrainment.

6.4.5.2 MATERIALS

Duct sealer shall be mold-resistant water based or oil based.

Internally lined duct is not permitted. Acoustical duct lining shall be epoxy, acrylic, synthetic latex or Mylar coated. During renovations all lined duct in the area being renovated shall be replaced.

Duct elbows must have turning vanes or an inside radius of at least 1/2 of the duct width. Transition elbows are not acceptable.

Filters shall be provided on both sides of heat recovery devices. A window and light shall be provided to allow viewing of filters without stepping into the exhaust air stream.

Perforated returns shall not be used.

6.4.5.3 CONTROLS

VAV boxes shall have a minimum flow of as little as ten percent (10%) to minimize the outside air provided to unoccupied spaces.

On recirculating AHU's the "Hand" position of the HOA switch shall be configured so that after a fire the unit can run to evacuate smoke without the unit smoke detector tripping. Any connection to the building fire alarm system shall be hard wired, not through the DDC system.

6.4.5.4 DISTRIBUTION AND GENERAL EXHAUST

See Division 1 of the Specifications for additional dust control requirements. Ventilation systems in health care facilities shall comply with ASHRAE 170.

Plenum returns are not permitted above suspended acoustic tile ceilings. (Where a plenum return is approved by a waiver to the Guidelines, lined "Z" ducts shall be provided on all return grills for sound attenuation). Plenum returns may be allowed in fully enclosed soffits for normal return air.

Outlets of multiple exhaust fans shall not be manifolded together unless backdraft protection is provided. Positively pressurized exhaust duct shall not be installed inside buildings except in mechanical rooms where non-lab exhaust connects directly to an exhaust plenum.

All roof top exhaust systems shall be vertical up discharge. The discharge velocity from the stacks of lab exhaust and other noxious exhaust shall be at least 3,000 fpm and the plume shall be high enough to clear nearby obstructions; this requirement applies to induced flow type fans as well as fans with straight stacks. Centrifugal fans with a vertical discharge are suitable for most lab exhaust; high dilution exhaust fans shall not be used. Outlets of rooftop exhaust fans for lab exhaust and other noxious exhaust shall be at least 7 feet above the top of the fan and at least 10 feet above the roof; this requirement applies to induced flow type fans as well as fans with straight stacks. Where exhaust fans have inlet bypass openings below the fan, the bottom of the bypass openings shall be above any nearby screens and obstructions and at least 7 feet above the roof.

Fans shall be positioned so as to allow ready access to all fans, motors, belts, drives, isolation dampers controls and attached duct work. Fans shall have adequate space for removal and replacement of fan and/or fan parts.

Minimal exhaust requirements above Code requirements are:

1. Dedicated mail rooms shall be fully exhausted.
2. Copy rooms: Not less than 0.5 cfm per square foot.
3. Areas with sinks and/or microwaves: 50 cfm each.

4. Custodial rooms and rooms having mop or service sinks: 75 cfm each.
5. Showers, bath tubs, whirlpools, spas, etc.: 50 cfm exhaust each; 50 cfm per person for fixtures designed for more than one occupant unless demonstrated that less exhaust is required due to diversity.
6. Electrical and communications closets shall be exhausted unless a dedicated FCU is used for cooling.
7. Machine rooms for hydraulic elevators: 50 cfm.
8. Battery charging rooms: Not less than 0.5 cfm per square foot.

6.4.5.5 FIRE AND SMOKE DAMPERS

Specifications shall provide the following minimum to demonstrate compliance with requirements of the Code:

1. Description of the acceptance testing requirements with requirement that tests are to be witnessed by the University Building Official's office, and responsible State Fire Marshal Office for Capital Projects.
2. All fire dampers shall be dynamic unless the University agrees that the AHU will stop functioning in case of a fire.
3. Fire damper access doors in large ducts shall be a minimum of 24" x 24".

Smoke damper actuation utilizing corridor detection is the preferred method for use in ducts that penetrate the corridor walls in the University Hospital.

6.4.5.6 SMOKE CONTROL SYSTEMS

Specifications shall provide a description of the acceptance testing requirements.

The A/E shall review the Shop Drawings for compliance with Code and shall:

1. Verify the Underwriters Laboratory (UL) listings and classifications for the materials, components and equipment provided for the project result in a Code compliant smoke control system.
2. Provide a sealed statement indicating that the Shop Drawings submitted for the smoke control systems satisfy the requirements of the Contract Documents, the VUSBC.
3. The A/E shall provide the University Building Official's office with the approved Shop Drawings and a copy of the sealed statement.

The University Building Official's office and responsible State Fire Marshal Office shall observe the installed components of the smoke control system(s) and witness the smoke control system(s) performance tests. The A/E and contractor shall certify that the smoke control system(s) is complete.

6.4.5.7 FUME HOODS AND LAB EXHAUST

Air velocity in the occupied space near the hood shall be no more than 50% of the required hood velocity in order to minimize the adverse influence of air motion near hoods

All new and renovated fume hoods shall be field tested per a modified ASHRAE 110 method per the University Industrial Hygienist's specification. Third party testing will be coordinated by EHS and the report will be submitted to and reviewed by the University Industrial Hygienist.

Proprietary variable volume fume hood controls, shall only be used in labs that have fume hoods, and where it is acceptable for the number of lab air changes per hour to be reduced when the fume hood sash is closed and when proximity sensor allows reduced hood airflow.

Based upon a risk assessment by the EHS, laboratory exhaust systems may necessitate the following:

1. A visual differential pressure indicator such as ball-in-tube; this shall only have a control output or audible alarm if directed.
2. A dedicated exhaust system and fans.
3. A positive means such as a sail switch to detect a loss of exhaust flow.
4. A redundant exhaust fan which will start automatically upon failure of the operating fan. The lead fan should be in the "hand" position and the backup fan should be in the "auto" position so it will start automatically upon loss of flow. Neither fan should have a stop function from the DDC system.
5. Positive means such as a bubble tight damper to shut off the supply air upon loss of exhaust to prevent positive pressure in the space.
6. All controls shall be hard wired so they will function properly even in the event of a failure of the BAS; however all failures shall alarm the BAS.
7. BSL3 containment laboratory design, operational parameters and procedures must be verified and documented prior to operation. The laboratory shall be designed such that under failure conditions the airflow will not be reversed. Airflow in biocontainment facilities BSL3 and ABSL3 shall be designed to move from "clean" areas toward the biocontainment space. The system shall be designed to maintain a negative pressure differential of at least 12.5 Pa (0.05 in. wg). Monitoring and control devices shall be provided to ensure that the pressure differential is maintained.
8. Supply air fans, exhaust air fans and all devices and equipment serving and/or associated with BSL3 and ABSL3, which are required to maintain biocontainment of the space shall be connected to an emergency electrical power system.

6.4.5.8 GAS DETECTION AND ALARMS

The design of any laboratory intending to use or store hazardous gas or gases should be reviewed by EHS to determine if detection, alarm and control systems should be incorporated into the laboratory design. All such systems shall be remotely monitored by the UVa Systems Control Center through the University approved BAS system present in the space for HVAC controls. The following information will be reviewed on a case-by-case basis to determine what systems are indicated for a particular application:

1. The hazardous properties of the gas
2. The physiological warning properties of the gas
3. The amounts and concentration of the gas in use
4. The process parameters of the experimental application

6.4.6 AIR CONDITIONING

6.4.6.1 SOURCES

All air conditioning shall use chilled water from a University central plant unless another source is approved by the Facilities Management Energy and Utilities Department and the Operations Department. If chilled water is not currently available to a site, but is planned to be available by the completion of a project, then that project shall be designed to utilize plant-chilled water.

Water-cooled equipment and condensing units using domestic, potable water on a single-pass cycle are prohibited. Where a process water system is needed, it shall be served by the building chilled water system through a heat exchanger and shall have filters after the process water pumps. Process water systems shall be capable of providing 60 psi differential pressure across the most remote load but can be an open loop with a tank or a closed loop.

6.4.6.2 REFRIGERATION SYSTEMS

Refrigerant sensors, which initiate both an audible and a visual alarm outside the room are required. All alarms shall be connected to the BAS. Rooms with the potential for a refrigerant leak shall be mechanically ventilated.

Refrigerant from all equipment, regardless of size, shall be recovered prior to disposal. Evacuated equipment must be labeled using either a special sticker or permanent marker noting that all refrigerant has been evacuated and the date of the evacuation. The contractor shall not demolish the equipment until notified in writing by Facilities Management that the refrigerant has been removed. When a waiver has been granted for the contractor to remove refrigerant the specifications shall call out ODS Section 608 of the Clean Air Act.

6.4.6.3 MATERIALS AND EQUIPMENT

See **3.5 Exterior Domestic and Chilled Water Piping**.

If copper is used, a brass nipple at least six inches (6") long shall be used where the copper joins the University ductile iron chilled water distribution pipes. Copper chilled water lines shall be type L hard drawn. Dielectric unions shall not be used.

Flange gaskets on chilled water shall be rubber, PTFE, EPDM or other similar material; paper/compressed fiber gaskets shall not be used.

Chilled water distribution piping inside buildings shall not be polyvinylchloride (PVC) pipe.

All fittings on chilled water pipe shall be Class 150 or better.

Pumps shall be enclosed in a waterproof insulated metal box, constructed of minimum 18-gage galvanized or stainless steel. Box shall be screwed, have bolts with wing nuts or quick connect latches to facilitate easy removal and reinstallation. The box shall be sturdy enough for a person to stand on.

Chilled water coils shall be sized for 42 degree (42° F) supply water temperature and 62 degree (62° F) return water temperature at peak load conditions however a lower return water temperature can be used if the coil size is excessive. During off peak conditions it is acceptable for the return water temperature to be above 62 degrees (>62° F).

Chilled water coils shall have a maximum of 450 feet per minute face velocity, 6 rows and a maximum of 12 fins per inch however more rows will be allowed if the air resistance is less than one-half inch (0.5") of water. The coil face area can be as large as needed to obtain the required performance however a lower return water temperature can be used if the coil size is excessive.

Chilled water coil control valves shall be two-way industrial grade pressure independent ("Delta P") valves, high performance butterfly valves, or characterized ball valves. Chilled water control valves on recirculating units shall be fail closed or fail in place, valves on single pass units shall be fail in place or fail open. Where "Delta P" valves are used, separate flow control devices such as circuit setters, balancing valves, etc. should not be used. All chilled water control valves shall have P&T taps on the inlet and outlet.

Cooling coil casings and drain pans shall be stainless steel. All structural supports, etc. in air handling units immediately downstream of humidifiers shall be stainless steel.

Cooling tower fans shall have variable frequency drives (VFDs) and aluminum fan blades. Condenser water pumps shall have VFDs unless Facilities Management Energy and Utilities Department agrees that an engineering and economic analysis indicates that they are not feasible or are not in accordance with manufacturers recommendations. Cooling tower make-up water shall be filtered.

6.4.6.4 CONTROLS

Chilled water loads shall be variable volume. In addition to using end of line differential pressure to control pump speed, the position of all chilled water valves should be polled to reset the end of line DP set point so that no chilled water valve is commanded more than 95% open. The end of line differential pressure can also be measured across the most remote control valve. All chilled water valves shall be commanded fully closed whenever the outside air temperature is below 55 degrees or when the unit is in economizer operation.

The chilled water service entrance shall have a thermal energy meter package on the supply and an automatic valve on the return as well as manual isolation valves. The Contractor shall provide a thermometer or temperature gauge on the supply and return. The Contractor shall provide pressure gauges and sensors on the supply and each side of the return valve. A supply pressure sensor, differential pressure sensor and pressure relief valve shall be provided at the most remote load. The Contractor shall provide a full size bypass around the building chilled water pump with a strainer and check valve, and temperature and pressure gauges and sensors downstream of the pump and bypass. A back up pump is only required for critical loads. A "bridge" connection between the supply and return shall not be provided.

6.4.7 COOLING COIL CONDENSATE

6.4.7.1 REMOVAL

The cooling coil condensate shall be piped to a cooling tower sump or a designated location in the landscaping. A French drain shall be utilized if it can be coordinated with landscaping if a French drain cannot be utilized, a sanitary drain or roof drain are acceptable alternatives.

6.4.7.2 MATERIALS

Cooling coil condensate lines shall be minimum three-quarter inch (3/4") diameter for units five (5) tons and below and one and one-quarter inch (1-1/4") diameter for units above five (5) tons. Cooling coil condensate lines can be type L or M copper or PVC. Galvanized steel pipe shall not be used. Cooling coil condensate lines shall have cleanouts that allow access of all branches of the condensate drain system. An air gap of at least two pipe diameters shall be provided at the discharge.

6.5 FIRE PROTECTION SYSTEMS

6.5.1 GENERAL

In addition to required building codes, automatic fire suppression sprinkler systems shall be installed in new buildings, additions and in renovations of existing buildings consistent with University administrative policy.

Knox-Boxes shall be 4100 series. Boxes may be ordered by contacting Office of Environmental Health and Safety.

For the Health System, automatic fire suppression sprinkler heads shall be concealed-type in all ceiling areas with custom color cover plates to match ceiling paint color. In mechanical areas and areas without ceilings they shall be brass.

In buildings of two or more stories, standpipes shall occur in each exit stair with fire department hose connections at each level. Floor Control Valve assemblies are required on all floors. C&O threads shall be used on fire hose connections in buildings located in City of Charlottesville and Albemarle County (C&O thread count shall be 3.28x8).

Renovations of spaces that have fire hose cabinets shall remove hoses.

Fire extinguishers and cabinets shall be specified by the A/E. Cabinets shall be Contractor purchased and installed. Extinguishers shall be Owner purchased and installed.

6.5.2 FIRE PROTECTION SPRINKLERS

In buildings requiring sprinklers, fire pumps or fire protection standpipes, a separate backflow preventer for fire protection shall be provided. Fire protection service shall not be through the domestic metered water system. Sprinkler control valves located above suspended ceilings shall be marked with a "Sprinkler Control Valve" sign on the ceiling panel.

6.5.2.1 SPRINKLER HEAD DATABASE

The University maintains a sprinkler head database for all sprinkler heads installed in its facilities, both existing and new. The database is to be updated whenever a new building is ready to occupy; whenever the fire protection system is added to, upgraded, or replaced in existing facilities; and whenever sprinkler heads in an existing system are replaced for whatever reason. At the completion of a project, the sprinkler contractor shall supply an “as built” inventory. Submit the *Sprinkler Inventory Form* to fireprotection@virginia.edu.

6.5.2.2 SPRINKLER DESIGN DOCUMENTS

The A/E shall provide project specific Drawings and Specifications that define a Code-compliant fire sprinkler system. Performance criteria do not meet this intent. Construction Documents shall indicate that changes to the design during construction shall be considered substitutions. Changes shall be submitted to the University Building Official for review. The A/E shall confirm that the fire sprinkler system is complete, functional and Code compliant.

Drawings shall provide the following minimum information to demonstrate compliance with the requirements of the VUSBC and NFPA 13:

1. Small scale drawing showing locations of water hydrants, test and flow hydrants (for water flow tests) and routing of underground pipe. Indicate the water flow tests results, the date and time taken, and who conducted the test.
2. Identification of all existing sprinkler systems and standpipe systems, including any new connections to existing systems.
3. Sprinkle riser diagram with appropriate fittings, accessories, sizes, alarms, valves, etc. noted.
4. Location of all system drains, inspector’s test station(s) and associated discharge/draining piping.

Specifications shall provide the following minimum to demonstrate compliance with the requirements of the VUSBC and NFPA 13:

1. Wording that the type of systems, the location of major components, the quantity, type, coverage, location of sprinklers and distribution systems are not to be altered by the Contractor without approval of the A/E and University Building Official.
2. Description of the acceptance testing requirements, and which of the acceptance tests are to be witnessed by the University Building Official’s office.

Shop Drawings (Working Drawing Plans, product data and calculations) are to be reviewed by the A/E for compliance with Final Construction Documents and the Code. Prior to submittal to OUBO, the A/E shall:

1. Provide a “sealed” statement, attached to the reviewed Shop Drawings, indicating that the fire suppression sprinkler Shop Drawings (Working Drawing Plans, product data and calculations) satisfy the requirements of the Contract Documents and the VUSBC and NFPA 13.
2. Provide the University Building Official with two copies of the approved complete fire suppression sprinkler Shop Drawings.

Fire suppression sprinkler systems are to be acceptance tested in accordance with Code requirements. The University Building Official's office shall observe the installed fire suppression sprinkler system and witness the fire suppression sprinkler system performance tests. The A/E and contractor shall certify that the fire suppression sprinkler system is complete prior to testing. Similar requirements to the above are required for fire suppression systems utilizing clean agents.

6.5.2.3 INSTALLATION, INSPECTION AND ACCEPTANCE

Fire department building and riser connections shall be coordinated through the UVA Fire Marshal (for Academic System buildings) or the Health System Physical Plant Fire Protection Inspector (for Health System buildings). The location of Post Indicator Valves and Fire Alarm Control Panels shall be approved by the authorized person from the Charlottesville Fire Department, or appropriate jurisdiction for projects not located on University Grounds. Signage noting the exterior location of the FDC and PIV shall be 12"x12".

Specifications shall indicate that following the completed installation, Facilities Management or its independent consultant will inspect the installation and report any deficiencies prior to final inspection by OUBO.

6.5.3 FIRE PUMPS

Where the building characteristics are such that the water supply requirements of a fire sprinkler system/standpipe system cannot be provided by a public water system, an automatically controlled fire pump shall be designed into the fire suppression system. The A/E shall provide project specific drawings and specifications that define a Code compliant fire sprinkler system that includes an automatic fire pump(s). Performance criteria do not meet this intent.

Fire pumps that are powered by fuel burning equipment must also follow the requirements in **1.4.4.4 Emergency Generators & Fuel Burning Equipment**.

6.5.3.1 FIRE PUMP DESIGN DOCUMENTS

Drawings shall provide the following minimum information to in addition to the requirements of the VUSBC, NFPA 13, and NFPA 20:

1. Show the location of electrical components of the fire pump, driver, fire pump controller, and ancillary electrical components, and provide details.
2. Show the location, size, and routing of the conduits and conductors serving the fire pump, driver, fire pump controller, and ancillary electrical components.
3. Provide details of the electrical components serving the fire pump, driver, fire pump controller, piping, components and piping specialties.
4. Where multiple fire pumps or multiple sources of power are required, provide a diagram that defines all of the applicable components and sequence of operation.

Specifications shall provide the following minimum information to in addition to the requirements of the VUSBC, NFPA 13, and NFPA 20:

1. Complete specifications to reflect the systems that are defined on the drawings.
2. Wording that indicates that Fire Pump and ancillary components are not to be altered or modified without the written approval of the A/E and the University Building Official. Changes to the design depicted within the Construction Documents shall be considered "Substitutions" in accord with the General Conditions of the Construction Contract and are to be documented by Change Order.
3. A description of the Acceptance Testing Requirements, to be witnessed by OUBO.
4. Where an existing fire pump is to be used in the project, the performance and condition is to be established and validated. Submit a copy of the recent Report of the Fire Pump Inspection, Testing and Maintenance compliant with the Virginia Statewide Fire Prevention Code.
5. Shop Drawings (product data, sketches and certified shop test pump curves) are to be reviewed by the A/E for compliance with the contract documents and Code, including verification of the Underwriters Laboratory (UL) listings and classifications for the materials, components and equipment provided. Two copies of the approved Shop Drawings, with a sealed statement that they satisfy the requirements of the Contract Documents and Code shall be provided to the University Building Official's office.
6. Fire pump(s) is (are) to be acceptance tested in accord with Code requirements. The University Building Official's office shall observe the installed fire pump(s) and ancillary components, and shall witness the fire pump(s) performance test. The A/E and Contractor shall certify that the fire pump installation is complete.

6.5.4 PROTECTION DURING CONSTRUCTION

In renovation projects where the building is to remain occupied during construction, the following measures shall be included in the Contract Documents:

All existing fire protection systems shall remain operational during construction. If temporary shutdown is necessary, the system shall be returned to operational condition as soon as possible and no later than the end of each working day prior to the Contractor leaving the job site. The Contractor is to notify the University Fire Marshal prior to any necessary shutdowns. Any necessary shutdowns shall not affect other areas not involved with this construction project.

All operational standpipes are to be maintained at all times.

Sprinkler systems in areas being renovated shall be operational when the Contractor leaves the site each day. A fire watch shall be provided at all times that a sprinkler system is inactive.

6.6 ELECTRICAL SYSTEMS

6.6.1 SERVICE AND DISTRIBUTION

6.6.1.1 POWER

New buildings or services shall be connected to the University's distribution system. Where existing buildings or services are connected directly to Dominion Virginia Power, renovation and addition projects shall convert these services to the University's distribution system. The Project Manager or A/E shall determine transformer ownership through the FM Utilities Department.

Where new buildings are added to the University's primary feeders, or a substantial change to an existing structure is made, calculations shall be submitted with the contract documents showing the existing load on the feeder, the new load and the feeder capacity.

6.6.1.2 MEDIUM-VOLTAGE TRANSFORMERS AND PRIMARY SWITCHES

All new or replacement transformers in the existing 4,160-volt service area shall have dual primary taps for 12,470/4,160 volts. All primary transformers shall have copper windings. Copper or aluminum windings may be used for outdoor liquid filled primary transformers. Primary taps shall be sized for 600A conductors, dry type.

Internal tank fuse links or fuses are prohibited. All primary overload protection shall be external to the transformer. All buildings shall be fed with two primary feeders, where dual primary feeders are available. Transformers serviced with dual feeder configuration shall have a separate external fused 15 KV selector switch. The basis of design for primary pad-mounted switches shall be S&C PMH type.

1. Exterior transformers shall be pad mounted, liquid-filled type with the following:
 - a. Dead front with 200 amp load-break bushing well inserts
 - b. Temperature rise of 65° C
 - c. OA cooled
 - d. Where exterior pad-mounted transformer and/or switches are used, Facilities Management in consultation with the Architect for the University shall approve their locations.
2. Interior transformers shall be dry-type with the following:
3. Temperature rise of 115° C maximum
4. HV BIL of 95 kV
5. A cast primary and either a vacuum pressure impregnated (VPI) or cast secondary is preferred
6. AA cooled with at least the provisions for FA cooling.

As an alternative, a silicone or other less-flammable liquid-filled transformer (as defined by NEC 450.23) may be used indoors. The liquid shall be Factory Mutual approved. Transformer characteristics shall be the same as for exterior liquid-filled transformers.

Electrical services for research, medical and other critical facilities shall be designed utilizing a double-ended transformer configuration with a secondary tiebreaker. They shall be designed with auto-tie operation. Dual transformers shall be designed to permit replacement of either unit without disturbing the other transformer.

6.6.1.3 DISTRIBUTION

6.6.1.3.1 PRIMARY CABLE

1. Shall be copper, single conductor cable, listed for 15 kV service.
2. Type MV-105, insulated to 133% insulation level, 220 mils. EPR is preferred.
3. All cable shall be suitable for use in wet or dry locations.
4. Shielding may be either a copper tape shield or corrugated drain wire system.
5. Cable shall be identified by phase markings on the outer jacket at intervals not to exceed two feet (2').

6. Cable shall be installed in concrete encased underground duct banks and electrical vaults. Direct burial of primary cable (>600V) is not allowed.
7. Primary cables run between manholes shall be either 500 or 750 kcmil, depending upon the UVa primary feeders involved. Cables from the last manhole to the primary switch may be smaller.

6.6.1.3.2 TERMINATIONS

1. All manhole medium voltage cable splices shall be made with re-connectable modular splice kits that meet ANSI/IEEE Standard 386.
2. In manholes and other accessible enclosures, wrap individual primary cables separately with fire retardant tape.

6.6.1.3.3 DUCTBANKS

1. Shall be a continuous concrete structure with reinforcing, #4 bars (minimum 2 bars) longitudinal at one (1) bar per twelve-inch (12") width of duct bank at bottom with minimum three-inch (3") cover.
2. Shall use six-inch (6") Schedule 40 PVC conduit for runs between manholes. Duct banks runs from last manhole to primary switch may use five-inch (5") conduits.
3. Top of duct bank shall be a minimum of twenty-four inches (24") below finished grade.
4. Shall slope to drain to prevent accumulation of water in the duct bank and shall not have any low points.
5. A utility marker tape shall be buried twelve inches (12") above each duct bank.
6. A mandrel shall be pulled through all duct banks prior to cable installation.
7. Concrete for duct banks and manholes shall have a minimum compressive strength of 3,000 psi at 28 days, meeting requirements of ACI 318 and ACI 301.

6.6.1.3.4 MANHOLES

1. At change of direction for main electrical line
2. At intervals not exceeding 300-feet in a straight run.
3. Minimum of 8' x 8' x 6'-6" (interior dimensions).
4. Minimum 3'-0" diameter frame and cover opening for access from outside.
5. Shall be waterproofed with coal tar bitumen.
6. Covers in paved areas shall be sealed.
7. Shall have 18" x 18" x 12" deep corner sump. Floor to slope gently to sump. Sump shall be drained through percolation (improved if required with stone filled pit) or through a drainpipe sloped to daylight with the end protected against rodent entry.
8. The light switch and fan switch shall be 20 amp, 120 volt devices with covers in a rain tight device box mounted near the manhole opening for easy access from outside.
9. A ground rod shall be provided at each manhole. Ground rod penetration shall be watertight.
10. Precast manholes shall not have more than two sections. The joint between sections shall be sealed watertight.
11. All construction including cover shall be HS 20 traffic rated.

6.6.1.3.5 SERVICE CONDUCTORS

Service conductors from transformer to building shall be concrete encased. Reinforcing shall be provided for large and/or lengthy runs.

6.6.2 BUILDING ELECTRICAL SYSTEMS

6.6.2.1 GENERAL

6.6.2.1.1 IDENTIFICATION

1. All electrical equipment and circuits shall be marked and labeled for identification and safety purposes.
2. Provide arc-flash labels indicating equipment name, system voltage, limited approach boundary, restricted approach boundary, arc flash boundary, incident energy values in cal/cm^2 , and the corresponding working distance in accordance with NEC 110.16 and NFPA 70E. Additionally, use red "DANGER" headers on all labels indicating an incident energy of $40 \text{ cal}/\text{cm}^2$ or more and orange "WARNING" headers on all labels less than $40 \text{ cal}/\text{cm}^2$, in accordance with ANSI Z535.4.
3. Laminated nameplates shall be used on the exterior surfaces of all electrical equipment.
4. Junction and pull boxes may be labeled using a black indelible marker. Label to be on the exterior of the cover unless box is exposed in finished locations.
5. Receptacles and other wiring devices are to have a label on the back of the cover plate indicating circuit(s) to device.
6. Emergency receptacles shall have a label on the cover plate indicating the panel board and the circuit number.
7. Emergency light fixtures shall be identified by a permanent red dot/circle on the frame.
8. Conductor color-coding shall match the existing building convention. If none exists, the phase colors for 120/208V systems shall be red, blue and black; neutral shall be white. The phase colors for 277/480V shall be yellow, orange and brown; neutral shall be grey.

A copy of the one line diagram shall be laminated and be permanently mounted near the main switchgear. For renovation projects changes to the one line diagram shall be added and posted.

6.6.2.1.2 CALCULATIONS

The following calculations shall be submitted to UBO with the Contract Documents:

1. Building short circuit
2. Building load
3. Feeder voltage drop,
4. Generator load calculations.

An arc flash hazard analysis shall be submitted and reviewed by UBO prior to ordering electrical equipment.

Where a generator requires stepped load starting, the load sequence, time delays and how the stepping will be achieved shall be indicated on the drawings.

6.6.2.2 DEMOLITION

All wire shall be removed back to the last active device, junction box or panelboard. All exposed and/or accessible conduits and boxes shall be removed. When telecommunications systems are replaced, abandoned wire and cabling shall be removed with walls and ceilings restored to their pre-existing condition. Coordinate with ITS personnel through the Project Manager.

The Contractor shall coordinate the disposal of PCB ballasts and fluorescent lamps through the Project Manager. The Contractor shall coordinate the disposal of H-3 powered exit signs (ionizing radiation hazard) via OEHS only.

6.6.2.3 PANELBOARDS, SWITCHGEAR AND TRANSFORMERS

Bussing shall be copper. Separate neutral and equipment grounding busses shall be provided. Circuit breakers shall be bolt-on type. Load centers are not permitted. Series rated equipment is not allowed.

6.6.2.3.1 PANELBOARDS

Schedules shall be provided for all electrical construction involving panelboards and switchboards. Schedules shall indicate all loads, and their locations using final room numbers, served by each breaker. Spares shall be left in the OFF position.

All new panelboards shall have 20% spare capacity for future use. Provide four (4) one-inch (1") conduits stubbed out into an accessible ceiling space for new recessed mounted panelboards.

6.6.2.3.2 SWITCHGEAR

Building switches and switchgear shall be located in appropriate electrical rooms. Switches (and other electrical equipment) will be permitted, by exception, on the exterior of buildings with an approved D&F. Provide transient voltage surge suppression (TVSS) at main switchgear (for new buildings and major renovations).

6.6.2.3.3 LOW VOLTAGE TRANSFORMERS

Dry-type transformers shall have copper windings. Transformers shall meet or exceed the requirements of NEMA TP-1 for energy efficient transformers.

Transformers with the capacity to store 55 gallons or more of petroleum oil-based fluids are subject to University Spill Prevention, Control and Countermeasures (SPCC) Plan. Notify the Power System Distribution Manager and SPCC Program Manager or FM SPCC Coordinator of the new equipment so it may be added to the transformer inventory.

K-factor transformers shall be used where large quantities of harmonic producing loads are present.

6.6.2.4 ELECTRICITY METERING

See **APPENDIX B: Utility Metering Requirements.**

6.6.2.5 CONDUITS

1. All wiring shall be run in EMT conduit, surface metal raceway or cable tray.
2. Minimum conduit size shall be $\frac{3}{4}$ " C. In outdoor applications, use rigid galvanized steel where exposed and rigid non-metallic for underground installations. Use EMT for indoor applications excluding lighting fixture whips. Exceptions may be granted for renovation projects where the use of $\frac{3}{4}$ " conduit is not practical for a specific application, thereby allowing $\frac{1}{2}$ " conduit or other NEC approved methods to be installed. The use of MC Cable shall obtain prior approval from the OUBO electrical engineer.
3. EMT conduit from the communications or power or control wiring (under 50V) wall outlet box may terminate several inches above the ceiling where lay-in ceiling tile is used. Cabling above the ceiling shall be neatly bundled and attached to or independently supported from the building structure above. Wiring, conduit or cable shall not be laid on the ceiling system or attached to the ceiling suspension wire. Support from the building structure.
4. Flexible metal conduit (FMC) or liquid tight flexible conduit (LFMC) not exceeding 6 feet in length shall be used only for connections to motors or equipment subject to movement or vibration. Exceptions may be granted for renovation projects allowing over 6' of flexible conduit where:
 - a. In locations that are not accessible.
 - b. For the connection of light fixtures provided they have an insulated ground wire sized in accordance with NEC.
 - c. In connections to systems furniture and under floor power requirements for computer server room applications.
 - d. Other special circumstance with prior approval from the OUBO electrical engineer.
5. All empty conduits shall have a 65-lb test polymer (or equivalent) pull string tied off at both ends.
6. All conduits shall be concealed in finished areas.
7. Surface mounted raceways may be used for horizontal distribution of electrical and data cabling in computer rooms, computer classrooms and research laboratories. Pre-existing conditions of surface mounted wiring and conduit does not constitute permission to add surface mounted hardware and raceway.

6.6.2.6 WIRING

1. All conductors shall be copper with 75° C insulation or better.
2. All power and lighting circuit conductors shall be #12 AWG or larger. #8 AWG and larger shall be stranded conductors and #10 AWG and smaller shall be solid conductors.
3. Minimum control wires shall be #14 AWG and minimum signal wire no smaller than #18 AWG unless otherwise recommended by manufacturer.
4. No more than three single phase circuits or eight (8) current-carrying conductors shall be run in a single conduit.

6.6.2.7 DEVICES

Ground fault circuit interrupter outlets or breakers are required on all power outlets within six feet (6') of water sources. Where the presence of water or grounded surfaces contribute to a hazardous environment, ground fault protection is required.

All devices shall be 20A, heavy-duty specification (minimum) grade devices. Residential grade devices are not permitted.

Receptacles shall be mounted with the ground pole in the UP position unless otherwise directed.

Academic Building Requirements: Equipment and receptacles served from a generator shall be marked with a University approved colored faceplate.

Health System Requirements:

1. Light switches shall be ivory in color.
2. All receptacles used in the Health System shall be hospital grade.
3. Normal power receptacles shall be ivory in color and emergency power receptacles shall be red in color.
4. Cover plates shall be brushed aluminum, chrome or stainless steel with embossed circuit designations.

6.6.2.8 LIGHTING

For exterior fixture requirements, see **3.3.2 Site Lighting**.

The following energy conservation measures shall be used:

1. Building designs shall take maximum advantage of natural light. Ambient light sensors, dimmers and programmable controllers are to be used where large amounts of glazing are present.
2. In areas with glazing, occupancy sensors shall be set to Manual ON, Auto OFF and have integral light level sensor where appropriate. All others shall be set to Auto ON, Auto OFF.
3. Operation of the occupancy sensors; including Manual ON, Auto OFF operation; shall be verified by the commissioning agent.
4. For security purposes; public and semi-private spaces such as corridors, lobbies, classrooms, laboratories, conference rooms, offices and restrooms shall have a control device in the space to enable the lights after hours. Enabling this control device after hours should not enable the lights in the entire building. This control shall be verified by the commissioning agent.
5. Exterior lighting shall be controlled through the use of photocells, time clocks or other programmable means.
6. Minimize glare in offices or office areas where computers are used by implementing such methods as low-brightness luminaries, indirect lighting and/or minimizing luminance ratios between different surfaces.
7. Multiple circuits/switching shall be provided in classrooms and other large rooms to permit reduced power consumption.

8. Fluorescent, LED or metal halide lamps shall be used for lighting. The use of incandescent or halogen lamps shall be limited to applications approved by Facilities Management; they shall not be used for general lighting.
9. 12-hour timer switches with “hold on” option are to be used to control lights in mechanical rooms.
10. The use of 2’ x 2’ light fixtures shall be limited to those areas that are architecturally appropriate. Tandem wiring of lighting fixtures is not allowed.
11. Non-catalog and custom lighting fixtures shall not be used unless economically justified and approved by Facilities Management. Such fixtures shall be UL listed/labeled.

6.6.2.8.1 FLUORESCENT LAMPS

Fluorescent fixtures shall use T8, T5 or compact fluorescent lamps. Fluorescent lamps shall have a minimum CRI of 80. Lamp temperatures shall be 3500 °K unless otherwise directed by the Project Manager. All fluorescent ballasts shall be electronic except in areas where the usage requirements take precedence (i.e. vivarium). The total harmonic distortion shall be less than ten percent (10%). Lamps are to be the low-mercury content, “green tip” type, passing the EPA test for non-hazardous waste.

All T8 Lamps shall not exceed 1.8 mg of mercury per lamp, a rated life of not less than 40,000 hours with rapid start ballast, consuming no more than 25 watts (nominal). This can be met by one [Philips ALTO] or more manufacturers.

All T8 lamps must meet the listed specifications above, regardless of their application – new construction, renovation or re-lamping. For dimming applications, T5 lamps or specified T8 lamps with appropriate ballast shall be used.

Occupancy or motion sensor applications with specified T8 lamps shall incorporate rapid start ballasts.

The T5 lamps should be 28W fluorescent lamps with minimum lamp life of 25,000 hours (40,000 or more hours preferred), low mercury content.

6.6.2.8.2 LED LUMINAIRES AND LAMPS

All LED luminaires or LED luminaire replacement kits shall be tested in accordance with IESNA LM79, Approved method: Electrical and Photometric Measurements of Solid-State Lighting Products and IESNA LM80, Measuring Lumen Maintenance of LED Light Sources. The Warranty of all LED products shall be five (5) years minimum for both LED modules and drivers.

Exit signs shall be red LED type with diffused lenses. If Tritium powered exit signs (ionizing radiation hazard) are required, OEHS must be contacted prior to installation.

6.6.2.8.3 LIGHTING LEVELS AND CALCULATIONS

Interior lighting levels shall comply with the recommended footcandle (fc) levels found in IESNA Lighting Handbook, latest edition. Lighting levels for office spaces shall be 30 fc. Lighting levels for mechanical and electrical rooms shall be 20-30 fc. Lighting level for telecommunications rooms or closets shall be 50 fc. The use of task lighting is to be

maximized. The illuminance ratio for maximum to minimum light levels shall not exceed 10:1 in any occupied space.

Footcandle calculations for normal and emergency operation shall be submitted with the Contract Documents. Design fc, IES illuminance category, calculation plane height and any weighting factors used, shall be indicated on the fc calculations. Submit fixture cuts of all proposed fixtures at the Preliminary Design submittal. Submit any revised or added fixture cuts with the Contract Documents.

6.6.2.8.4 INSTALLATION REQUIREMENTS

Recessed light fixtures are to be suspended from the structure. Do not support solely from the ceiling suspension system.

The locations of light fixtures in mechanical spaces shall be field coordinated so that access to lights for relamping, maintenance and replacement is maintained with appropriate illumination levels. For safety reasons light fixtures will be located at or around equipment so that maintenance personnel will not obscure the required illumination.

6.6.2.8.5 CLASSROOM LIGHTING CONTROL TEMPLATE

Lighting control system shall be a six zone. Controls shall operate on 120V circuit installed per manufacturer's recommendations. System shall consist of controller up to four lighting circuit, daylight dimming control. The controller shall be wall mounted behind the podium. Wall stations shall be located by each door (on-off type for all lights) and on the wall behind the podium (dimming type allowing individual control for each lighting circuit). An occupancy sensor mounted on the ceiling shall turn off all lighting circuits in the room after predetermined time. Daylight sensors shall be provided to control lighting levels. Basis of design is Lutron Grafik Eye QS.

6.6.2.8.6 HEALTH SYSTEM REQUIREMENTS

1. All patient corridors shall use direct/indirect lights.
2. Some specialty fixtures may be allowed in public areas and high profile spaces.
3. Offices shall use direct/indirect lights.
4. Patient room light fixtures shall be multi-function, providing indirect ambient, direct reading, examination, and nurse/night light.
5. Exam lights shall be LED. Exam lights are typically owner furnished and contractor installed. Confirm specification and selection with the Health System Clinical Engineering Systems department.
6. Diagnostic and treatment areas shall use 2' x 4' fluorescents with T8 lamps and electronic ballasts. Where medical equipment such as MRI's require special lighting specifications, their use is approved.
7. Dimmable down lights may be incandescent or LED for clinical applications.
8. Non-dimmable down lights shall be fluorescent or LED.

6.6.2.9 MOTORS AND STARTERS

Motors ¾ hp and larger shall be 3-phase, using the highest available appropriate voltage. All such motors shall be equipped with permanently lubricated bearings.

All motors shall be NEMA Premium Efficiency type, complying with the requirements of the latest edition of NEMA MG 1, with a service factor of 1.1 or better. All motors between 1 and 200 hp shall exceed these standards where possible and economically justified.

Sheaves and V-belts on belt driven equipment shall be rated for 150 percent (150%) of motor horsepower. Belts shall be guarded to provide safety protection, ventilation and cool operation. Solid sheaves and band belts shall be used to minimize vibration in multiple V-belt driven equipment.

All motors, except light-duty fractional horsepower motors, shall be provided with motor controllers. Controllers shall provide under-voltage protection when used with momentary contact control devices and under-voltage release when used with maintained contact control devices. Controllers shall also provide phase-loss (single phasing) protection.

A lockable disconnecting means shall be provided at all motor locations within sight (50 ft.) and reach of motor location. All motors and their disconnecting means shall be clearly marked to identify the motor that the disconnect serves. Circuit breakers shall not serve as motor disconnecting means.

6.6.2.9.1 VARIABLE FREQUENCY DRIVES

All motor variable frequency drives (VFDs) shall meet IEEE standard 519. The VFD shall be able to communicate with Building Automation System controls, through BACNET or other acceptable communications protocol. Where multiple VFDs are fed from the same panelboard or MCC, the contractor shall provide a harmonic analysis, at that point, to show compliance with IEEE 519. Include analysis with drive submittals.

VFDs shall be pulse width modulated (PVM) type using IGBT technology. VFDs shall be provided with by-pass isolation switches. In the Health System, VFDs shall be 12 pulse for higher than 60hp and 6 pulse drives for less than 60 hp.

6.6.2.10 BUS DUCT INSTALLATIONS

Include the following paragraph in specifications for bus ducts:

“The bus duct shall not be energized until the A/E has received and reviewed a letter from the contractor and a Commonwealth of Virginia Licensed Professional Engineer provided by the contractor, certifying that the installation was inspected and it was determined that the entire bus duct system has been properly installed in accordance with the Final Construction Documents, including approved Shop Drawings and/or manufacturer’s instructions for this Project.”

The certification of this work shall include the torque pressure used to tighten bolts at all spliced joints in the bus duct system.

6.6.2.11 LIGHTNING PROTECTION SYSTEMS

For new facilities, roof replacements, and solar array installations the A/E shall evaluate the building to determine if a lightning protection system is required. Lightning protection systems shall be provided on structures with risk factor of 4 or greater as determined by NFPA 780.

A lightning protection system is not required where either:

1. Ten times the Annual Threat of Occurrence (10 x Nd) is less than the Tolerable Lightning Frequency (NC), as calculated in the Simplified Risk Assessment (L.5).
2. The total Risk (R) is less than the maximum Tolerable Risk (RT), as calculated in the Detailed Risk Assessment, for each type of loss relevant to the structure (L.6).

Provide a note on the project cover sheet or electrical cover sheet specifying the risk factors and specify if a lightning protection system is required. Risk evaluation documentation shall be made available upon request.

Photovoltaic array installations shall be provided a minimum of a lightning arrestor either at the array or at the output of the inverter to protect downstream equipment regardless of the risk factor.

6.6.2.11.1 LIGHTNING PROTECTION SYSTEM LABELING AND CERTIFICATION

Initial certification or re-certification by inspection is required for all lightning protection systems which are installed or modified as part of a construction project. The inspection shall be performed by either:

1. Underwriters Laboratories under the most recent edition of UL 96A: Standard for Installation Requirements for Lightning Protection Systems.
2. A Lightning Protection Institute certified inspector under the appropriate Lightning Protection Institute master certificate inspection.

The inspection shall certify the final installation to obtain a master label for all elements to include the facility and services entering the facility.

The installation contractor shall provide a third party master label inspection to OUBO prior to project close out. Should the contractor not be able to obtain a complete master label, the contractor shall provide the remaining certification at their expense prior to issuance of a final Certificate of Use and Occupancy or Building Permit Close Out. These are typically part of UL 96A, Chapter 13. Planning and coordination of inspections shall be conducted during the design phase, and shall be coordinated with OUBO.

6.6.3 SPECIAL SYSTEMS

6.6.3.1 TELECOMMUNICATIONS

See also **1.4.5.2 Information Technology Services (ITS)**, the **ITS guidelines** and **1.4.3.6 Emergency Telephones**.

The University owns its own telephone system and integrates its information technology and cabling for telecommunications under management by the Department of Information Technology and Communications.

Contractor shall provide a system of conduits, outlet boxes, backboards, etc., to support the installation of cabling by others, unless otherwise directed by the Project Manager in writing.

The conduit or raceway system shall be sized to accommodate the foreseeable uses of the building plus twenty-five percent (25%). Outlet boxes shall be a standard 4" x 4" outlet box with single gang plaster ring and 1" C to above accessible ceiling. Conduit end shall be bushed. All buildings, including residential facilities, require information technology outlets, unless otherwise directed by Project Manager in writing.

Telecommunications rooms/closets shall have a minimum of two (2) 20A, 125V receptacle circuits and one NEMA L14-30R receptacle circuit. Quad receptacles shall be located at 48 inches on center on all walls and shall be clearly labeled. Telecommunications room receptacles shall be served by emergency power where available.

Sleeves through floor assemblies for conduit, cabling or other penetrations shall extend at least one inch (1") above the finished floor. Provide a minimum of four (4) four-inch (4") penetrations per closet. In existing buildings the precise location of penetrations shall be marked on the site with an "X" mark on the floor or wall for review and approval by designated Facilities Management personnel prior to coring.

Provide a green grounding conductor back to the main service ground from each telephone backboard. Leave a minimum of twelve inch (12") slack at the backboard for connection to equipment by others.

6.6.3.2 TELECOMMUNICATION CABLING STANDARDS

The Council on Information Management has adopted Standards for Telecommunications Cabling that shall be used when preparing designs related to telecommunications wiring for University owned buildings.

The following standards of the Electronic Industries Association are referenced in the Telecommunications Cabling Standard:

ANSI/EIA/TIA-568-A Commercial Building Telecommunications Cabling Standard

ANSI/EIA/TIA-569 Commercial Building Telecommunications Pathways and Spaces

ANSI/EIA/TIA-570 Residential and Light Commercial Telecommunications Cabling Standard

ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure for Commercial Buildings

ANSI/EIA/TIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications

6.6.3.3 CABLE TELEVISION

Cable television services shall be provided in University residential facilities. Cable connection is obtained from the holder of the local cable franchise or from a University system as coordinated through the Project Manager.

Contractor shall provide a system of conduits, outlet boxes, backboards, etc. to support the installation of cabling by others unless directed otherwise by the Project Manager in writing.

Cable television services shall coordinate with Clinical Engineering in Health System areas.

6.6.3.4 SECURITY

The A/E shall determine in consultation with the Project Manager the application of security systems for each project. The issue of security is particularly applicable for computer operations, Health Systems facilities, residential facilities and exterior access doors.

The A/E through the Project Manager shall consult the University of Virginia Police Department during the design of security systems to insure that the proposed system meets Police Department recommendations for compatibility with existing systems and the adequacy of the proposed design.

Card reader access systems shall be required at a minimum of one major, visible building entrance as coordinated with the University Police through the Project Manager.

Security alarm systems are monitored at either the University Police Station on Route 250 West or at the Systems Control Center in the Leake Building. At a minimum, contractor shall provide a system of conduits, outlet boxes, backboards, etc., to support the installation of a security system by others unless directed otherwise by the Project Manager in writing.

6.6.3.5 CLASS 2 AND 3 ELECTRICAL CABLES

All cables including but not necessarily limited to data, voice, alarm, and security system cables and wires, installed in University-owned facilities shall be self-supported with an approved hanger device when cables or wires are not installed in an electrical raceway. Cables shall be supported at no greater than twelve-foot intervals and securely fastened to the building structure. All cabling not installed in conduit shall be plenum rated.

6.6.3.6 FIRE DETECTION AND ALARM SYSTEMS

6.6.3.6.1 CONSTRUCTION DOCUMENTS REQUIREMENTS

The A/E shall provide project specific drawings and specifications that define a Code compliant fire alarm system. Performance criteria do not meet this intent. The A/E shall confirm that the fire detection and alarm systems are complete, functional and Code compliant.

6.6.3.6.2 SPECIFICATIONS

1. Provide wording that the contractor shall not alter the location and type of fire alarm system initiating appliances, control and trouble signaling equipment, location of major components without written approval by the A/E and University Building Official.
2. Provide description of the acceptance testing requirements and which of the acceptance tests are to be witnessed by the University Building Official.

6.6.3.6.3 REQUIRED CALCULATIONS

1. Quantity and location of the audible alarms as indicated on the drawings to achieve the Code defined sound pressure levels in each of the respective spaces.
2. Required capacity of the secondary power supply attained.
3. Candela performance for alarm notification devices, including any provided with protective covers.

6.6.3.6.4 SHOP DRAWINGS

1. The A/E of record shall provide a “sealed” statement, attached to the reviewed Shop Drawings, indicating that the fire alarm Shop Drawings (Working Drawing Plans, product data, and calculations) satisfy the requirements of the Final Construction Documents and the Code [citing applicable National Fire Protection Association (NFPA) criteria].
2. Provide Office of the University Building Official with two (2) copies of the approved complete fire alarm Shop Drawings.
3. Provide the University Building Official a copy of the “sealed” statement when transmitted to Office of the University Building Official.

6.6.3.6.5 SYSTEM REQUIREMENTS

The fire alarm system shall be a Siemens XLS Firefinder Fire Alarm Control Panel. The fire alarm system shall be provided with tone and voice evacuation subsystem as an extension or integral part of a building fire alarm system. A digital message repeater shall also be provided with a microphone allowing for local paging from the annunciator. Renovations to existing systems must remain compatible with the existing fire alarm control panel. All initiating and notification appliances shall be UL listed to be used with the fire alarm system.

In vivaria, audible notification appliances provided shall not be in the audible range of rodents. UL listed appliances for that use shall be provided. Basis of design product is Silentone by Arrowmicht. With prior approval from OUBO, visual only notification appliances may be installed in vivaria and in their immediate vicinity.

All fire alarm systems and components should be serviceable by FM Fire Protection personnel or training shall be provided by the manufacturer at the expense of the installing contractor.

Where new devices will be added to an existing system, they shall match the types of, or be compatible with, the system already in place unless otherwise directed by the Project Manager in writing. Devices added to an existing system shall be listed as compatible for use by the system manufacturer.

Fire alarm equipment that is obsolete and is no longer manufactured at the time of the system installation or during the warranty period shall be replaced by the installation contractor at no additional cost to the University.

6.6.3.6.5.1 Fire Alarm System Monitoring

All buildings with fire alarm systems shall have either the fire alarm panel (FACP) or remote annunciator at the main entrance or other location approved by the local fire department.

All fire alarm systems in University facilities in Charlottesville shall be monitored by the Facilities Management Systems Control Center (SCC) through extension of existing Keltron system. All projects should ensure that dry-type contact relay pairs are available from building fire alarm panel(s) for alarm, trouble and supervisory conditions (points). Additional building information such as alarm on a floor-by-floor, or by-zone basis may be achieved through direct digital communication between Keltron system devices and building fire alarm system. In addition, where fire pumps are installed there shall be normally open dry contacts for signaling up to four additional points for the Fire Pump Running, Fire Pump Power Loss, Fire Pump Phase Reversal and Fire Pump Power Transfer.

Near the time of project commissioning, the owner will furnish and install suitable communications and interface devices to ensure points are monitored at SCC. The Project Managers shall ensure that the cost of the interface devices and associated labor are included in the base budget for all new construction. The transceiver shall be located next to the building main fire alarm control panel. Additional work may include running a conduit from transceiver to an antenna on exterior wall or roof for wireless signal. Project Manager should consult with the SCC Manager as early in the process as possible to determine the appropriate level of monitoring for the project and to determine if there may be any problems in establishing communication with the facility.

University remote facilities, not in Charlottesville, without a constantly attended monitoring center shall have a contract in place with a company that provides services to meet the definition of listed Remote Supervising Station Service in accordance with NFPA 72. The services shall include runner service to the facility. Equipment installation, inspection, testing and maintenance are the responsibility of University.

6.6.3.6.5.2 Installation Requirements

All wiring for new fire alarm/detection systems shall be installed in conduit. Junction box covers shall be painted red with letters "F/A" using a permanent marker on the cover.

Fire alarm signaling line and notification appliance circuits shall not be electrically loaded beyond eighty percent (80%) of full capacity to allow for future expansion of the system.

All fire alarm initiating devices, control modules, speaker, horn and strobe circuits shall be labeled to identify the device address, circuit origin and function, as applicable on the device.

Auxiliary devices that are interfaced with the fire system (such as magnetic door hardware, security interfaces, BAS, sound systems, and lighting) shall have their own dedicated power source and shall not be powered by the fire alarm system.

Spare parts shall be provided for each type of initiating, field control module and notification devices installed on the fire alarm system. A minimum of three of each type of device, or five percent (5%) of the total number of each type of device installed in the building, whichever is greater, shall be provided to the Project Manager.

Smoke detectors must be non-ionizing radiation brands or if ionizing radiation, then they must be domestic (USA).

Termination connections, other than terminals provided on devices affixed to the box, shall not be made in a junction or termination box smaller than 6"x6"x3", or the equivalent volume. Termination box covers shall be labeled. Connections shall be made using terminal strips or wire nuts.

6.6.3.6.5.3 Project Closeout and Inspections

The final version or revision of all intelligent fire alarm control panel software shall be turned over to the Project Manager for the University's Fire Protection Supervisor in addition to the record of completion form in an electronic media format such as a CD or USB Flash Drive.

Fire alarm systems are to be acceptance tested in accord to Code requirements. UVA Fire Protection Group shall observe the installed system and witness the fire alarm system performance tests prior to University Building Official office and responsible State Fire Marshal Office. The A/E and contractor shall certify that the fire alarm system is complete.

See **1.4.3.5 Electronic Access Controls**.

6.6.3.7 OTHER SPECIAL SYSTEMS

Other special systems such as nurse call, intercom, audio/visual or paging shall be provided on a project-by-project basis.

Health System nurse call and patient care shower electrical boxes shall be installed such that:

1. Patient shower pull station electrical boxes to be installed on the same wall as and to the left of the showerhead at 6'-6" to the center of the box.
2. Color touch screen VOIP annunciator, single or dual patient stations, staff or duty stations and intercom recommended equipment is RACO 942 with 822 cover (8" x 4" x 2 ½" box with 3-gang plaster ring).

3. Color touch screen VOIP console, code blue, shower pull station, toilet pull station, dome light, card reader, and push-to-open recommended equipment is RACO 231 with 782 cover (4" x 4" box with 1-gang ring).
4. Where a single manufacturer is identified, University Project Manager shall verify conformance with state procurement regulations.

6.6.4 ELECTRICAL TESTING

All electrical systems shall be tested prior to acceptance. All testing shall be in accordance with the International Electrical Testing Association (NETA) Acceptance Testing Specifications, manufacturer's recommendations or other approved testing standards. An independent testing company shall perform testing. Contractor shall notify the testing agency when the systems are ready for testing. Copies of test reports and any recommendations shall be furnished to the Project Manager. Facilities Management shall be notified in advance of testing and shall have the option of witnessing any or all tests.

All testing of electrical systems of a capacity of greater than 30 kW must be coordinated at least two (2) working days in advance with the Facilities Management Department of Operations or the Health Systems Physical Plant, as appropriate and coordinated by the Construction Administration Manager. Testing may be required to be performed during off-hours.

6.6.5 RECORD OR AS-BUILT DOCUMENTS

At a minimum, electrical as-built documents shall contain the following information:

1. Location of all underground electric lines, telephone lines, manholes, pull boxes, etc.
2. Location of all conduits in and/or under slab
3. Location of all device boxes in slab
4. Location/routing of all conduits greater than 1" and any associated pull boxes
5. Location of all transformers, panelboards, switchgear, etc.
6. Final one-line and/or riser diagram to include the final fuse sizes
7. Final circuit numbers for all devices and final panel schedules
8. Final manufacturer and make for all fixture types
9. Exterior lighting information as detailed in **3.3.2 Site Lighting**.
10. Final location of all exit and emergency lighting
11. Final locations of all fire alarm devices, terminal cabinets, etc.
12. Final locations of all telephone, and other low voltage system backboards

See **1.5.3 Operation and Maintenance Manuals/Data**.

6.7 ELECTRONIC MONITORING AND CONTROLS

6.7.1 APPLICATION

New building control systems shall integrate with UVa **Systems Control Center** (SCC) existing web-based systems for 24 hour monitoring and control. Only building automation system technologies from one of UVa's pre-approved building automation system vendors shall be used.

Systems that require remote monitoring and/or control, utilizing the existing approved computerized central systems, include, but are not limited to: (1) HVAC, (2) fuel burning equipment, and (3) emergency generators.

The extent and nature of controls and/or monitoring systems shall be determined and submitted for approval in the Preliminary Design phase of the project. The use of stand-alone pneumatic or electric controls requires an approved D&F. See also **Appendix B: Utility Metering Requirements**.

6.7.1.1 GENERAL GUIDELINES

1. The vendor of electronic monitoring and controls shall provide all control devices.
2. All controls shall be DDC and all actuation shall be electric.
3. A five-year warranty shall be specified on electric actuators.
4. During renovations all pneumatics in the area being renovated shall be replaced with DDC and electric actuation.
5. When DDC is used on air handler units (AHU), a laptop computer shelf with a required hook up shall be provided at each AHU, chiller, etc.
6. Individual offices shall have means of ensuring acceptable temperature control (user adjustable thermostat and control device, appropriate zoning or other designed means). Where air terminal devices serve multiple offices provide a temperature sensor in each office, averaged to control the air terminal device.
7. Only HEPA filters and filters for critical areas are to have DP sensors tied into the BAS. Provide Magnahelic or inclined manometer on all other filters.
8. The air tubing on VAV boxes shall be neoprene rather than rubber or plastic.
9. Controls such as carbon dioxide (CO₂) or occupancy sensors shall be used to modulate outside airflow in classrooms and auditoriums, unless demonstrated not to be cost effective. On units with CO₂ control, the sequence of operation shall specify when outside air dampers can be closed, and when fans can be shut off.
10. Units with CO₂ controls which serve only classroom(s) will be shut off during unoccupied hours when CO₂, temp, and relative humidity are satisfied; and restarted on demand by any of those sensors. An occupancy sensor will also restart AHU. When all classrooms on a given system are empty during normal occupied hours, the outside air damper shall not close but shall go to a minimum position as required by code, and the CO₂ level will be allowed to drop. If extreme conditions prevent the system from maintaining all set points, the CO₂ level will be allowed to drift. The EMS will monitor points as required to detect failure to maintain any set point.
11. Untempered outside air shall not be supplied directly to occupied spaces or into the returns of fan coil units.
12. Sequence will specify if fans run continuously or can be shut off. Supply, return, and exhaust fans shall be interlocked as required.
13. AHUs should have manual override to run unit with high outside airflow (for venting odors from new carpet/furniture, floods, etc.)
14. Where perimeter heat is needed at large windows and exterior walls, it shall be interlocked with AHU/zone control. Perimeter heat will normally be supplied from a closed building LTHW loop with a converter served by the University MTHW system.
15. Freeze protection shall be provided on all air handling units. Freezestats shall stop the supply and return fans, close the outside damper, and open the heating coil valve

directly, without relying on any controller or controls logic programming. Where DDC is used, the freezestat controls shall be completely independent of the DDC system.

6.7.1.2 CRITICAL LOADS

In buildings with critical loads, as determined by Facilities Management, all necessary components of the HVAC, control and communications systems shall be on emergency power. If emergency power is not available in the building the chilled water pump bypass valve (V-3) and cooling coil control valves on critical loads shall fail open in the event of a power failure to allow free flow from the distribution system; chilled water valves on non-critical loads shall fail closed.

Critical safeties on HVAC systems shall be hard wired rather than controlled by the DDC system.

Critical exhaust fans (Vivarium, BSL suites, rad hoods, perchloric acid hoods, etc.) that run continuously should not have a start/stop function on the DDC system. Provide a manual hand/off/auto switch and failure alarm to the DDC. Where two fans are provided the "lead" fan will be in the "hand" position and the "lag" fan will be in the "auto" position so the DDC system can start the "lag" fan automatically upon a failure of the "lead" fan.

6.7.1.3 SENSORS

Building automation system (BAS) sensors used for energy monitoring shall be "matched" with a minimum accuracy of one percent (1%) to provide information suitable for billing. Global outside air temperature humidity shall be obtained through the DDC system. DO NOT provide temperature and humidity sensors on the exterior of individual buildings.

6.7.1.4 SMOKE DETECTORS

Smoke detectors shall have three (3) sets of dry contacts for separate hard wired connection to the fire alarm system, the interlocked fan, and the DDC system.

6.7.1.5 ANIMAL HOLDING ROOMS

Provide temperature and humidity display for each animal holding room. Displays shall be NIST traceable, with NEMA type enclosures, equivalent to Vaisala HMT331/HMT/333. If displays are located inside the animal rooms they shall have a waterproof enclosure suitable for periodic wash downs. The sensors for these displays shall be the controlling sensors and should be suitable for high humidity environments with quick recovery for saturation events, equivalent to HMT337 series. If the humidifier is provided in the central station AHU, the humidity sensors shall be averaged for control.

6.7.1.6 BSL-3 LABS

BSL-3 labs shall have a means to completely shut off the supply air if exhaust air is lost to prevent a positive pressure in the space; this shall be via a hard wired connection, NOT through the DDC system. Bubble or gas tight dampers on the supply air may be appropriate in some situations.

A central UPS system or a number of local UPS systems should be used to back-up all building-wide low voltage systems that are essential for bsl-3 containment operation as well as critical research, patient care and other critical systems.

6.7.2 BIDDING PROCEDURES

The Project Manager shall solicit pricing proposals from UVa prequalified control system vendors as part of the primary project bid documents. As an alternative, the A/E and Project Manager, through the Facilities Planning and Construction Office of Contract Administration, may provide drawings and specifications to providers of approved BAS systems and negotiate pricing separately from the primary project bid documents. The selected BAS supplier shall be contracted and the primary project bid documents shall include assignment of this negotiated price to all bidders.

6.7.3 CONTRACT DOCUMENT GUIDELINES

The UVa **Building Automation System Standards** shall be included in the Contract Documents or incorporated by reference stating that the Controls Contractor must adhere to the latest version of the BAS Standards. Sequence of operations shall be per UVA **Standard Control Sequences**. Unless otherwise agreed in consultation with UVa the A/E will include the Building Automation System Guidelines (incorporate in Section 17000 or Section 25 0000 of the Specifications) from the **BAS Controls webpage** in the Contract Documents.

The A/E shall also incorporate the following in the Contract Documents:

1. Sequence of operations shall be noted on the control drawings. Specification shall require the Contractor to permanently mount a copy near the equipment.
2. AHU points list, airflow schematic, and sequence of operations shall be on the same sheet. AHU schedule (with gallons per minute) and detail shall also be on this same sheet, unless space prohibits.
3. Pumps point list, pump flow diagram and sequence of operations shall be on the same sheet. Pump schedule and detail shall be on this same sheet, unless space prohibits.
4. Building plans shall include chilled water, hot water/steam and airflow schematics. Designs for renovation projects shall update existing building schematics.
5. Provide a component coordination responsibility matrix specifying the HVAC, ATC and Electrical Contractor's scope of work for devices furnished, installed or wired by different divisions of specifications. The matrix should include the following headings: Device, Furnished By, Installed By, Power By, Control Wiring By, and Fire Alarm Wiring By.

At project completion, the Project Manager shall submit a table in Microsoft Excel format to SCC indicating the AHU, terminal device, exhaust fan if any, and other HVAC components serving each room, organized by room number.

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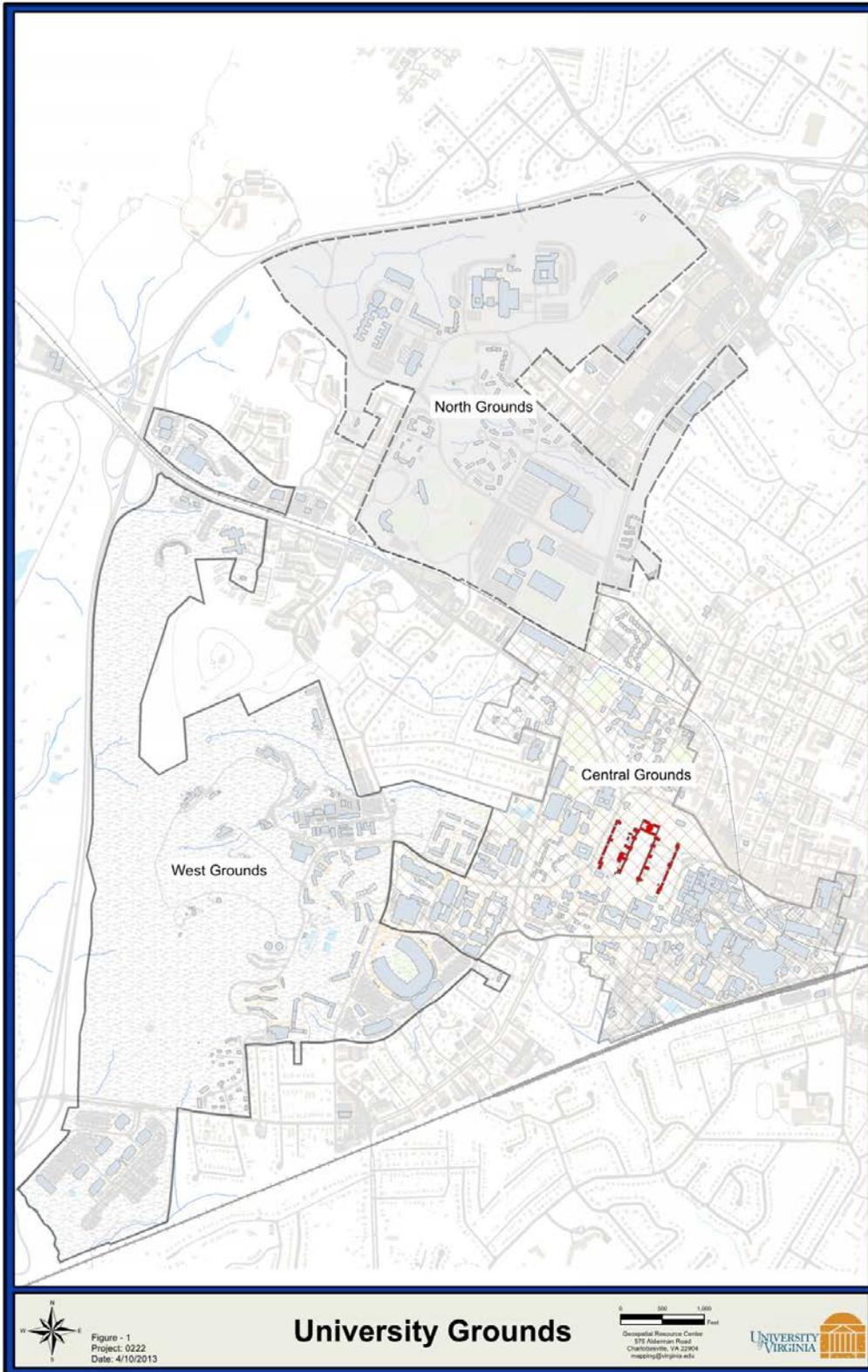


Figure 1: University Grounds

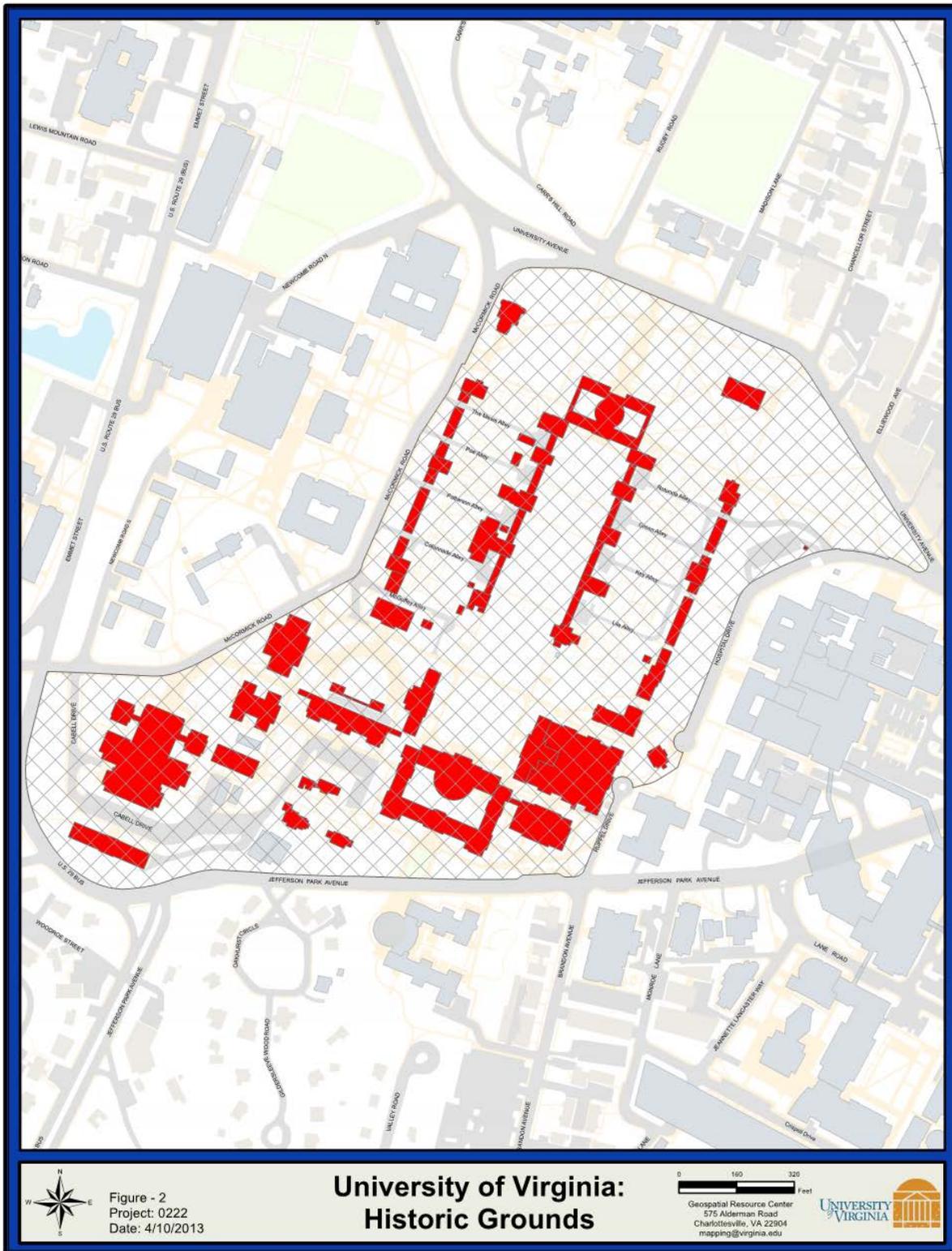


Figure 2: Historic Grounds

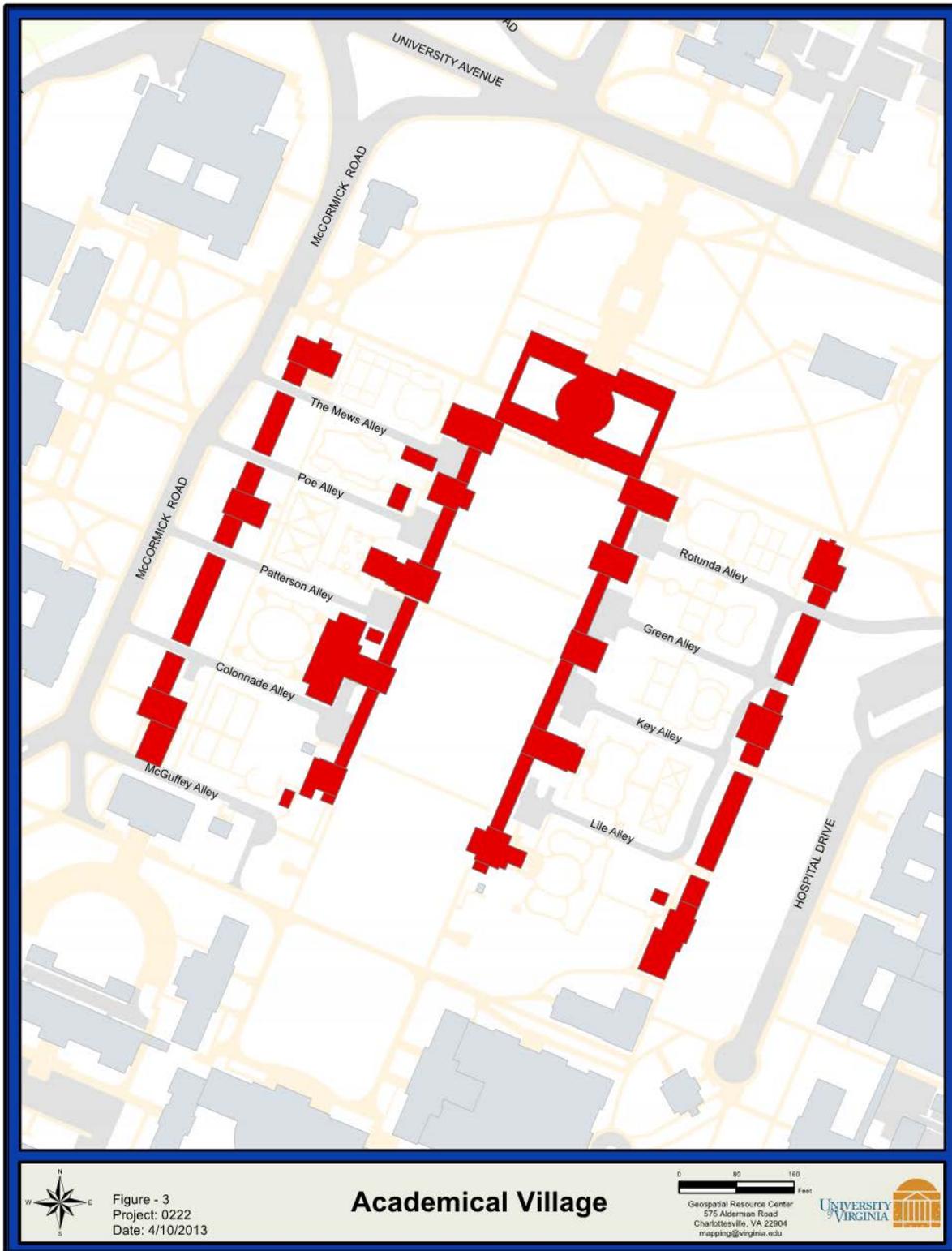


Figure 3: Academical Village

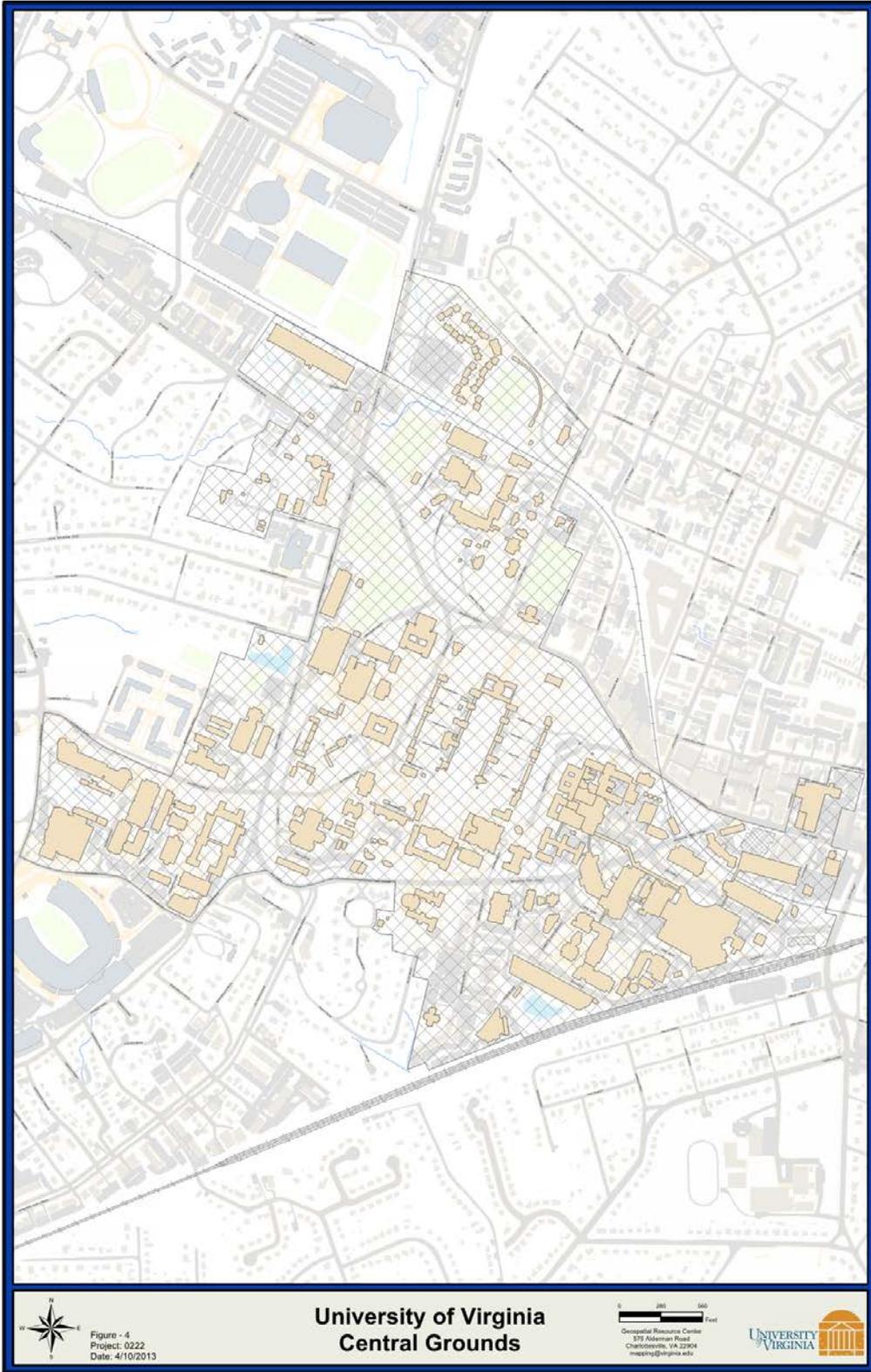


Figure 4: Central Grounds

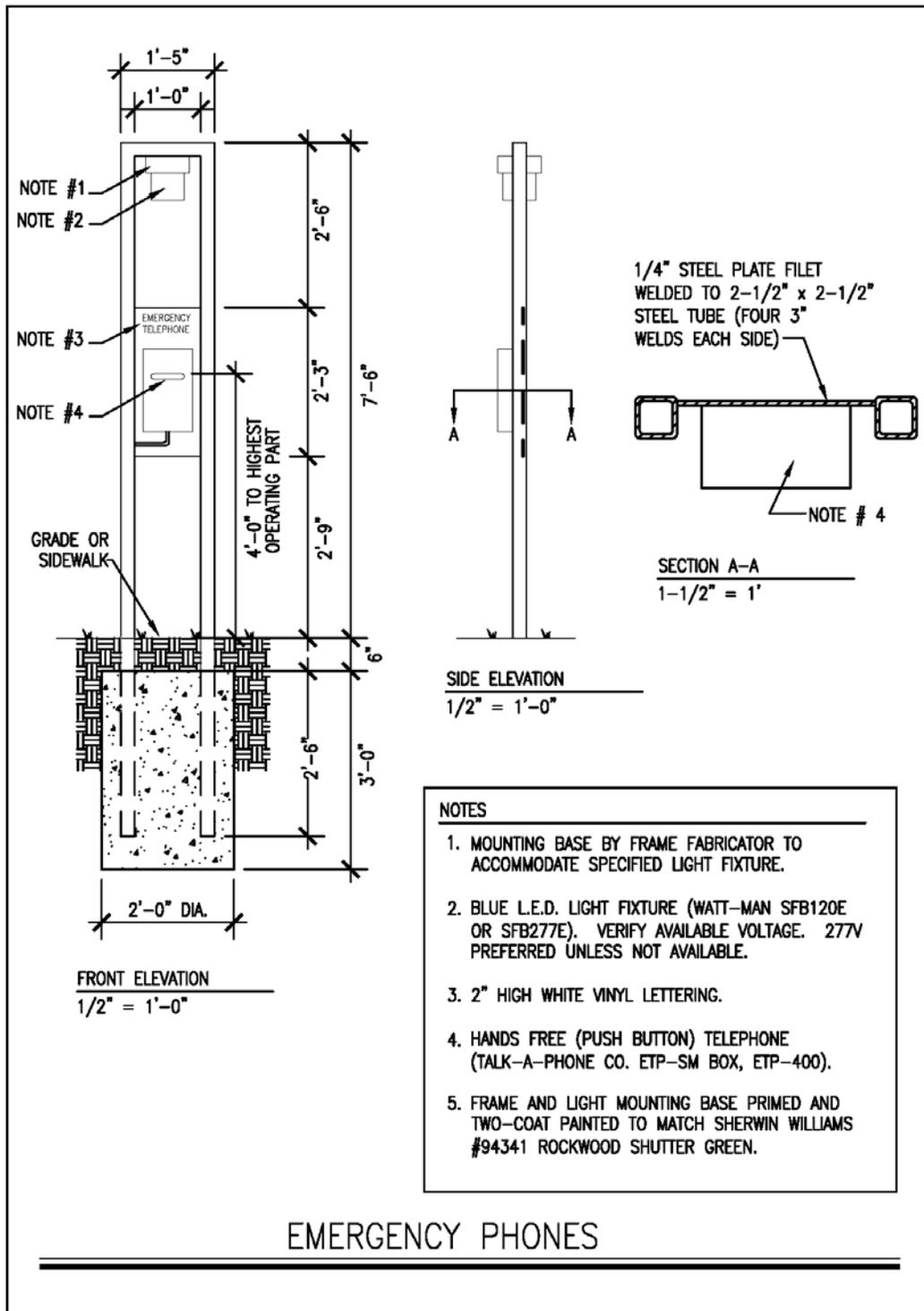


Figure 5: Emergency Phones

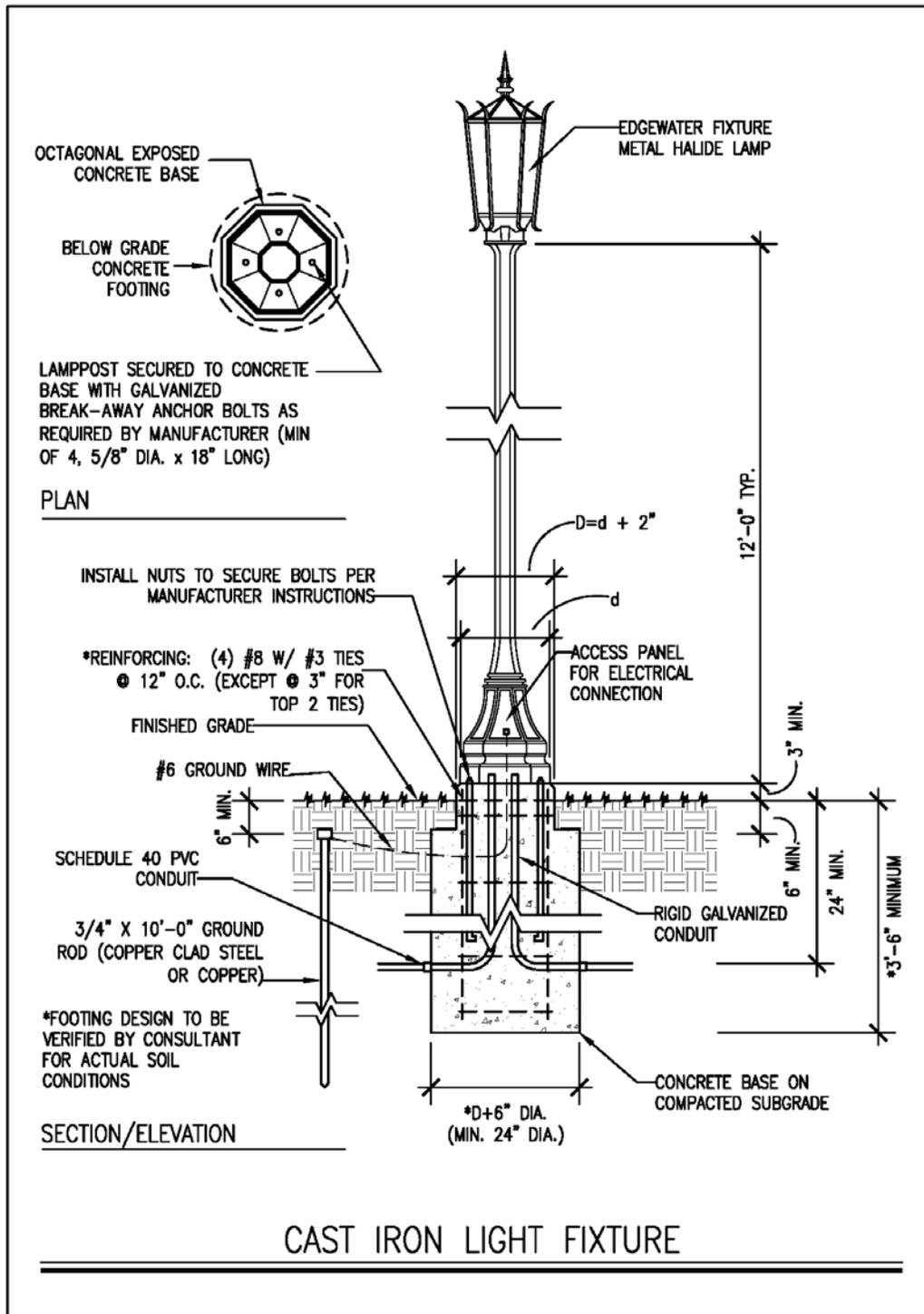


Figure 6: Cast Iron Light Fixture

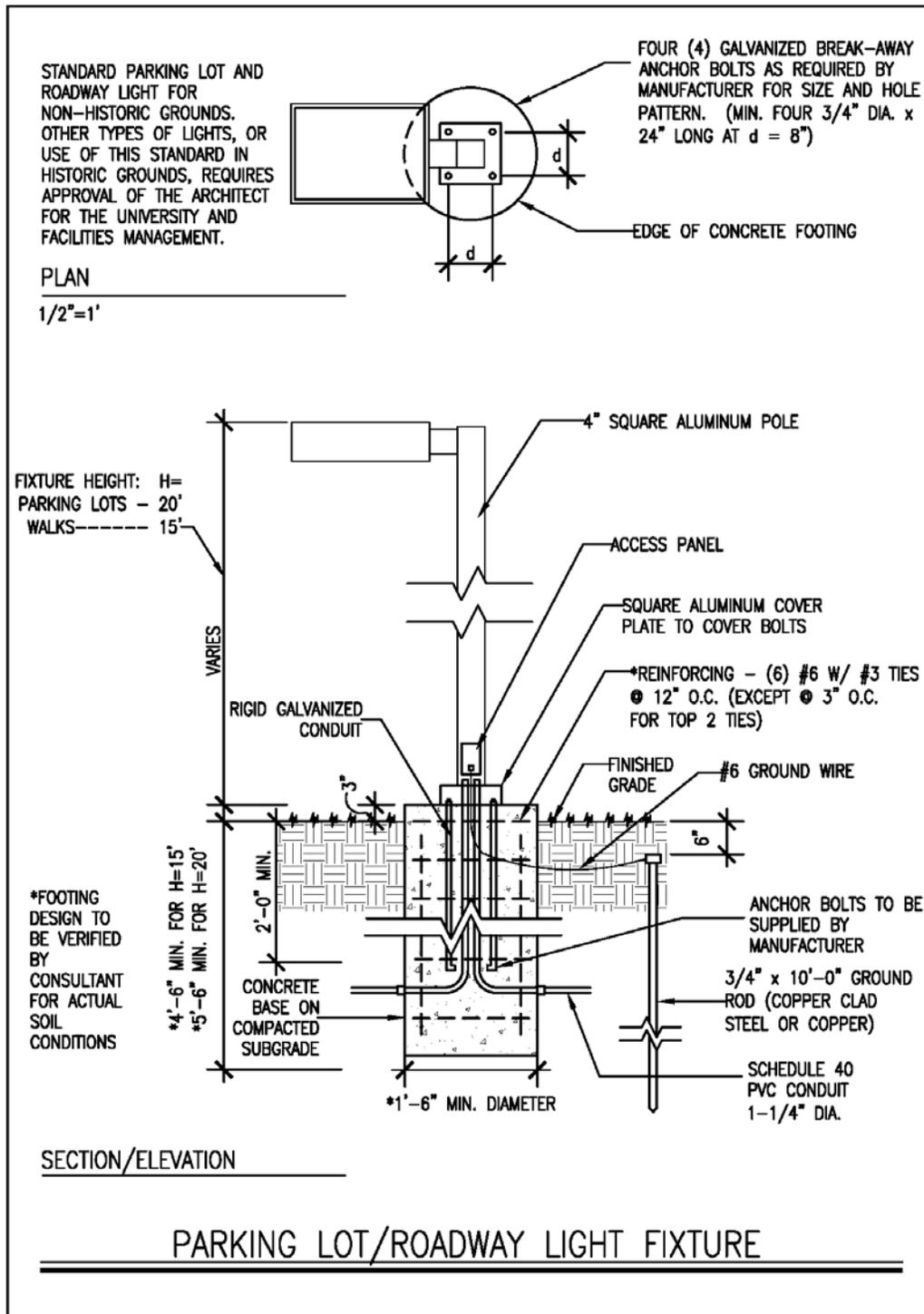


Figure 7: Parking Lot / Roadway Light Fixture

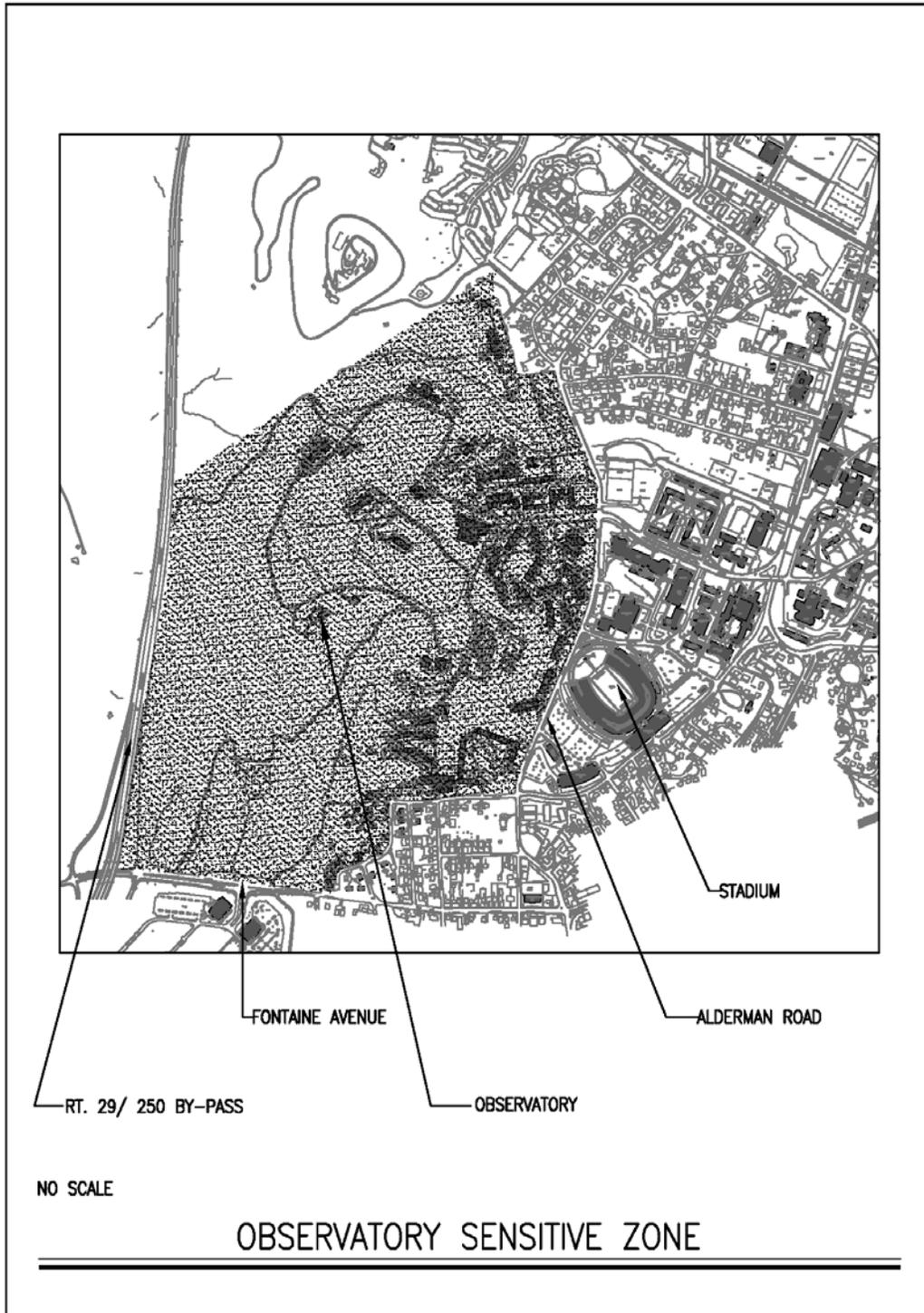
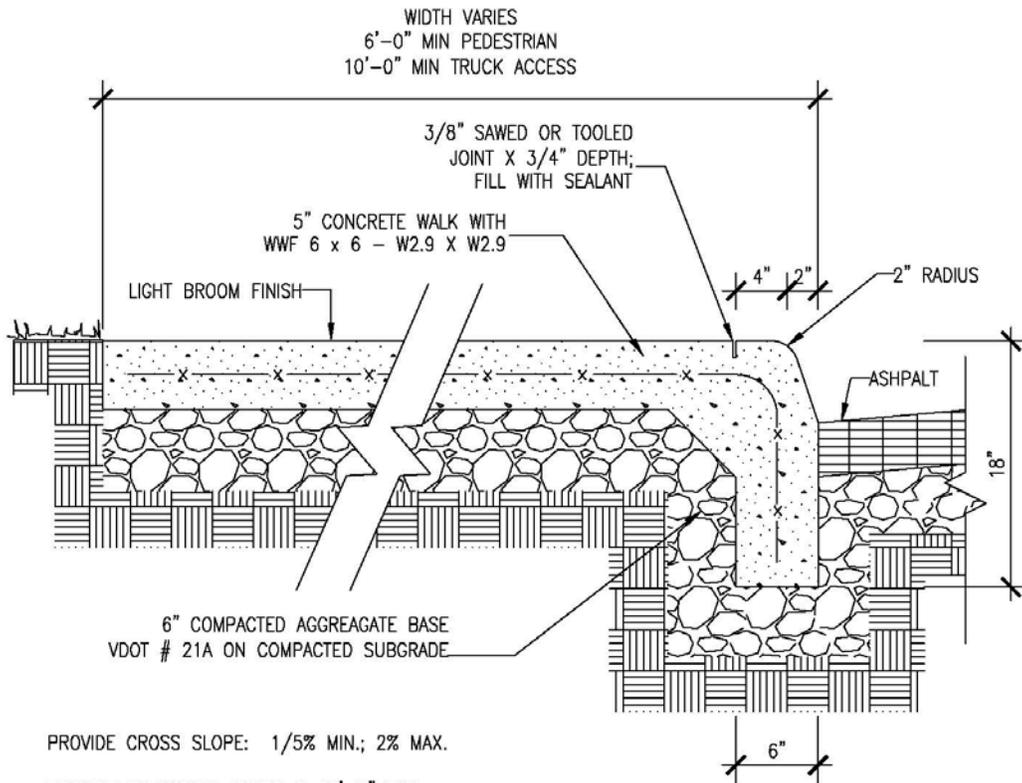


Figure 8: Observatory Sensitive Zone



PROVIDE CROSS SLOPE: 1/5% MIN.; 2% MAX.

PROVIDE EXPANSION JOINTS @ 30'-0" MAX

PROVIDE TOOLED OR SAWED JOINTS @ 6'-0" O.C. MAX

WHERE PERMITTED BY SITE LAYOUT, SEPARATE SIDEWALK FROM CURB WITH LANDSCAPE/GRASS FOR PEDESTRIAN SAFETY.

CONCRETE TO BE 3000 PSI AIR ENTRAINED

INTEGRAL CONCRETE SIDEWALK AND CURB

Figure 9: Integral Concrete Sidewalk and Curb

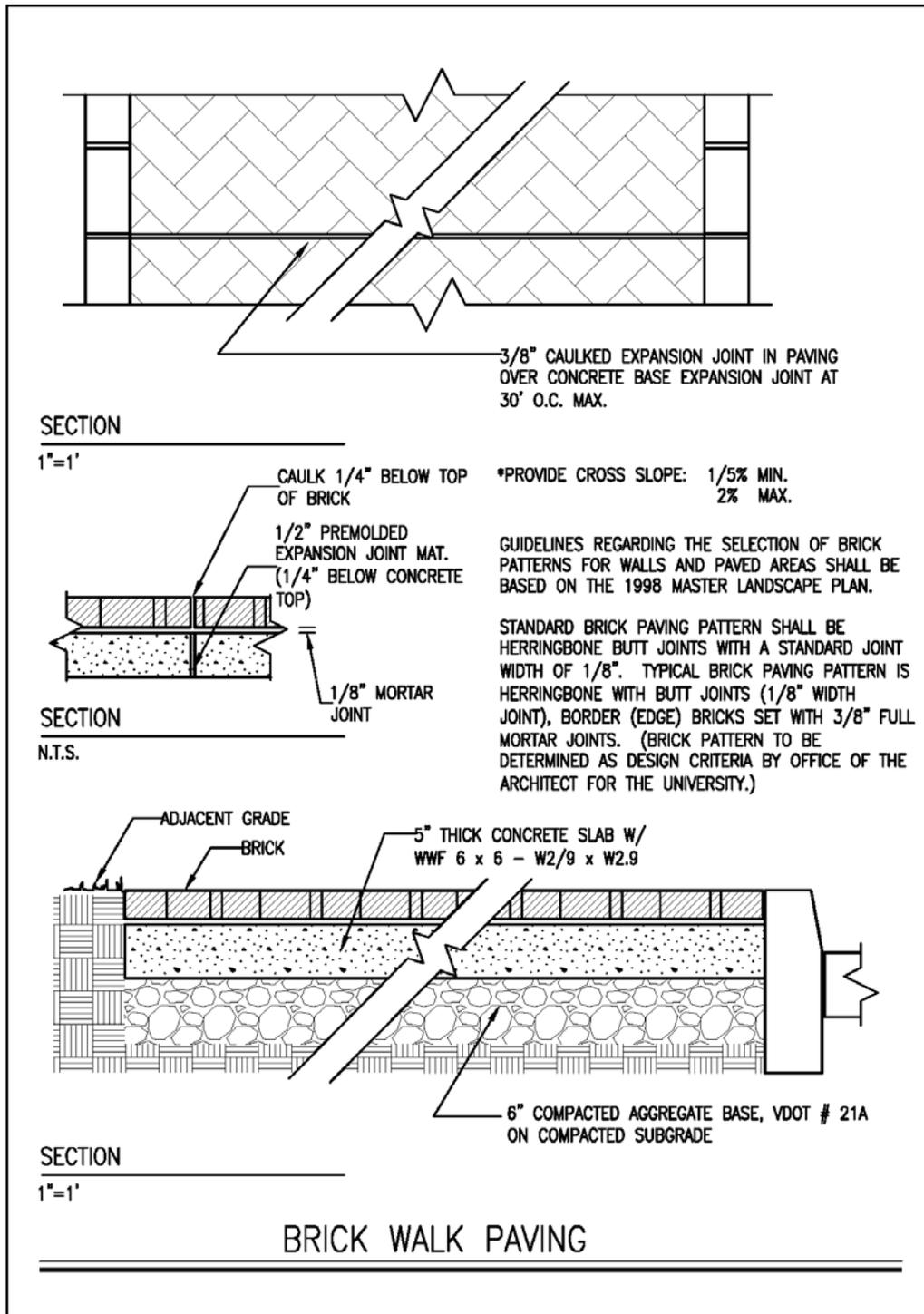


Figure 10: Brick Walk Paving

INSIDE DESIGN CONDITION CRITERIA		
Occupancy/Use	Summer (Cooling)	Winter (Heating)
Offices/Business	78°Fdb	70°Fdb
Classrooms/Lecture	78°Fdb	70°Fdb
Residential	78°Fdb	70°Fdb
Libraries *	78°Fdb	70°Fdb
Archival Storage in Libraries	Special	Special
Art Storage in Museums	Special	Special
Kitchens ***	85°Fdb or spot cooling	70°Fdb
Warehouse, Mechanical Rooms, Storage Rooms and Electrical Rooms	Ventilate with outside air unless otherwise approved	40-55°Fdb for freeze protection
Pools **	82°Fdb 50-60% RH Pool Water: 80°F	82°Fdb 50-60% RH Pool Water: 80°F
Hospitals	Consult the ASHRAE Guide or other applicable references	Consult the ASHRAE Guide or other applicable references
Laboratories (Educational) *	78°Fdb 30-60% RH	70°Fdb 30-60% RH
Laboratories (Research) *	75°Fdb 30-60% RH	72°Fdb 30-60% RH
Gymnasiums/Recreation, Indoor Tennis and Racquetball Courts, Weight Rooms and Aerobic Rooms ***	80°Fdb	68°Fdb
Locker Rooms/Showers ***	80°Fdb	70°Fdb

* Conditions may vary depending upon actual user justified requirements. Deviations must be approved by the CFO.

** Cooling for type occupancy/use must be justified to and approved by the CFO.

*** These occupancies/use types are not normally provided with cooling unless justified to and approved by the CFO. Where approved, design conditions shall not exceed those indicated.

Air conditioning systems shall be able to maintain an indoor relative humidity of no more than 60% regardless of the outdoor temperature and humidity, or percentage of outside air. Lower indoor humidity levels shall be maintained when justified by project criteria.

Figure 11: Inside Design Condition Criteria

COMPONENT COORDINATION						
(scope of work/responsibility matrix – current CSI sections may be used)						
	Device	Furnished By	Installed By	Power Wiring	Control/ Interlock Wiring	Fire Alarm Wiring
	Air Handler Devices					
1	Duct Smoke Detectors	16000	15000	N/A (from FA system)	N/A	16000
2	Duct Smoke Detector Auxiliary Contents	16000	16000	16000	17000	16000
3	Smoke Dampers at AHU's	15000	15000	N/A	17000	N/A
4	Smoke Damper Actuators at AHU's	15000	15000	16000	17000	N/A
5	Fire Dampers	15000	15000	N/A	N/A	N/A
6	Air Flow Stations	17000	15000	N/A	17000	N/A
7	Automatic Control Dampers (unless specified with unit)	17000	15000	N/A	17000	N/A
8	Automatic Control Damper Actuators	17000	17000	17000	17000	N/A
9	Variable Speed Drives	15000 or 16000	16000	16000	17000	N/A
10	Humidifiers	15000	15000	16000	17000	N/A
11	Humidifier Control Valve	15000	15000	N/A	17000	N/A
12	Humidifier Isolation Valve	17000	15000	N/A	17000	N/A
13	Humidifier Airflow Switch	15000	15000	N/A	17000	N/A
	VAV and Terminal Units					
14	Supply & Exhaust Terminal Boxes (VAV's)	15000	15000	16000	17000	N/A
15	Terminal Flow Pick-up	15000	15000	N/A	15000	N/A
16	Terminal Damper Actuator (if not provided by box manufacturer)	17000	15000	N/A	17000	N/A
17	Terminal DDC Controller	17000	15000	16000	17000	N/A
18	Terminal Reheat Valves	17000	15000	N/A	17000	N/A
Continued on next page						

Continued from previous page						
	Laboratory Controls					
19	Supply, Hood Exhaust & General Exhaust Air Valves	17000	15000	N/A	17000	N/A
20	Controls at Fume Hood	17000	17000	16000	17000	N/A
21	Isolation Room Controls	17000	17000	16000	17000	N/A
	Meters					
22	Water Flow Meters	17000	15000	16000	17000	N/A
23	Electrical Demand Meters	16000	16000	16000	17000	N/A
24	Steam Flow Meters	17000	15000	16000	17000	N/A
	Digital Control Panels					
25	DDC Panels if shown on Electrical Drawings	17000	17000	16000	17000	N/A
26	DDC Panels if NOT shown on Electrical Drawings	17000	17000	16000 if 120V	17000	N/A
	Control Air					
27	Air Compressor	17000	15000	16000	N/A	N/A
28	Air Dryer	17000	17000	16000	N/A	N/A
	Water Systems					
29	Hydronic Control Valves	17000	15000	N/A	17000	N/A
30	Water Flow Switches for Chiller	15000	15000	16000	17000	N/A
31	Cooling Tower	15000	15000	16000	17000	N/A
	Miscellaneous Systems					
32	Refrigerant Monitoring	17000	17000	16000	17000	N/A
33	Split System (Heat Pumps, etc.)	15000	15000	16000	17000	N/A
34	Chemical Feed Systems	15000	15000	16000	17000	N/A
35	Kitchen Hood System	15000	15000	16000	16000 or 17000	16000

Figure 12: Component Coordination Matrix

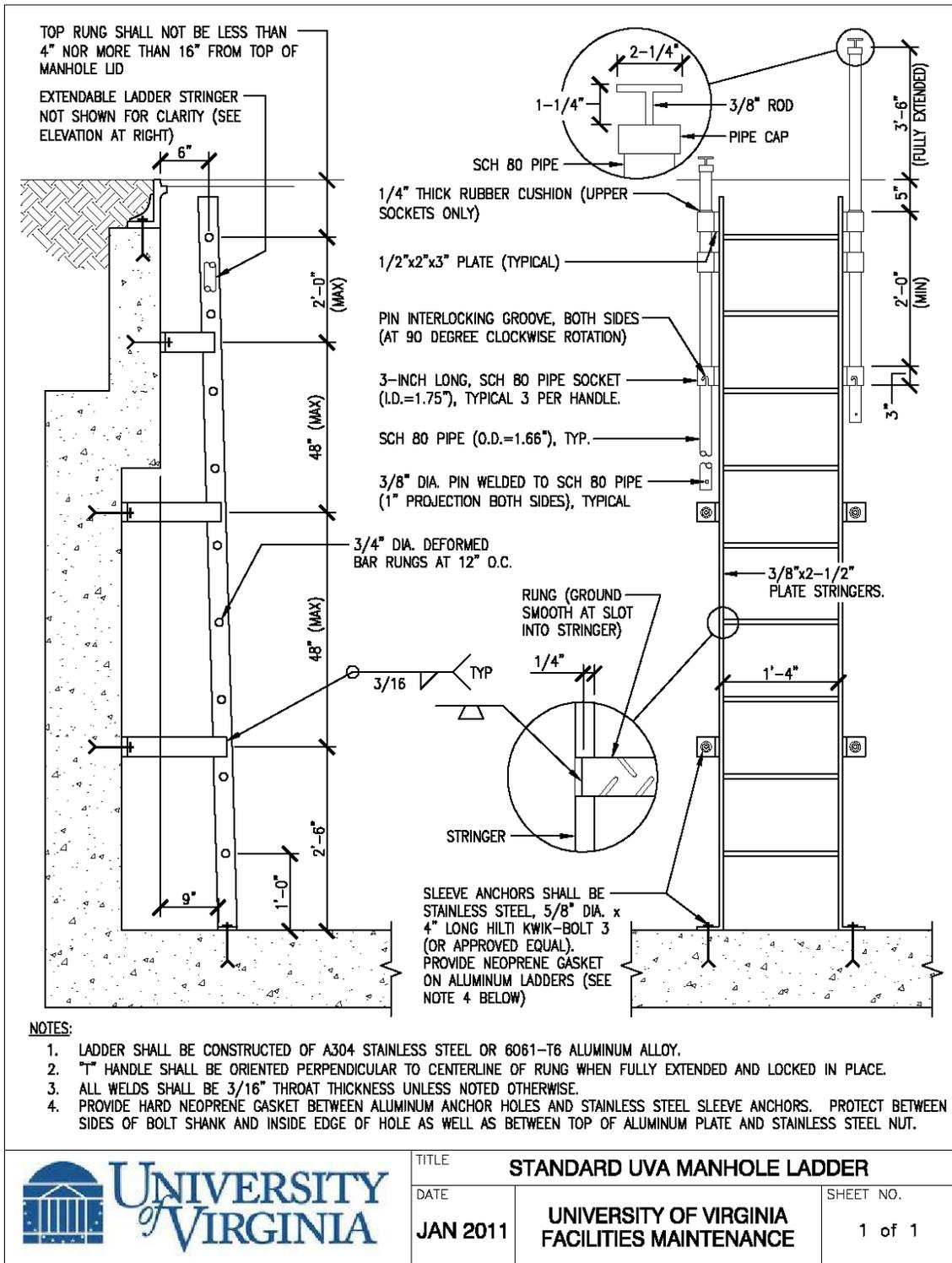


Figure 13: Standard UVA Manhole Ladder

PERFORMANCE GOALS FOR WATER-EFFICIENT EQUIPMENT IN NEW OR RENOVATED UNIVERSITY BUILDINGS			
TYPE OF BUILDING	TYPE of FIXTURE or EQUIPMENT	PLUMBING CODE (maximum allowed) or STANDARD WATER USE (GALS/USE)	GOAL: WATER EFFICIENT EQUIPMENT (GALLONS/USE)
Academic, Other Research, Athletics, Non-residential Buildings	Public bathroom faucets	0.5 gpm	0.5 gpm
Student Dorm, Residential, Academic, Other Research, Athletics	Residential faucets	2.2 gpm	0.5 gpm
Café, Cafeteria, Large & Small Kitchens, Student Dorm, Academic, Other Research, Athletics	Kitchen faucets	2.2 gpm	2.2 gpm
Student Dorm, Residential, Academic, Other Research, Athletics	Toilets	1.6 gpf	Dual-plumb new buildings for Recycled Water. High Efficiency Toilets (HETs): 1.28 gallon per flush(gpf) and MaP test score of 800-1000 g/f
Student Dorm, Residential, Academic, Other Research, Athletics	Urinals	1.0 gpf	Dual-plumb new buildings for Recycled Water. High Efficiency Urinals (HEUs): 0.125 gpf
Student Dorm, Residential, Academic, Other Research, Athletics	Showerheads	2.5 gpm	<2 gpm (need to specify building water pressure before ordering; tamper resistant)
Student Dorm, Residential, Academic, Other Research, Athletics	Washing machines	40 gals/load	15 gals/load
Student Dorm, Residential, Academic, Other Research, Athletics	Dish washers	6.5 gals/load	< 5 gals/load
Café, Cafeteria, large kitchen	Pre-rinse nozzles; need to pass Food Service Tech Center certification (FSTC)	1.6 gpm	1.15 gpm (must be tested by FSTC)
Café, Cafeteria, large kitchen	Food Steamers; need to pass Food Service Tech Center certification (FSTC)	Use once-through tap water (continuously added, ~ 30 gals/hr) to cook	Use recirculating steam to heat steamers, also called "boilerless steamers". Steamers must be tested by FSTC, use < 2 gals/hr
Café, Cafeteria, large kitchen	Ice machines; need to pass Food Service Tech Center certification (FSTC)	Water-cooled uses 200 gallons for cooling each pound of ice	Once-through tap water cooling prohibited; Use recirculating closed-loop chilled water or air
Café, Cafeteria, large kitchen	Commercial, industrial dishwashers	More than 1 gallon per rack	Maximum of 1 gallon per rack. Retrofit of nozzles to be efficient - Use Optimise (Hobart) or comparable
Academic, Other Research	House vacuum system: liquid ring (wet) vs. dry vacuum pumps	Liquid ring (domestic water continuously added)	Use dry vacuum pumps
Academic, Other Research	Glass ware washers	Inefficient glassware washers	Purchase efficient units, such as HAMO brand
Academic, Other Research	Lasers, electron microscopes, or other research equipment needing cooling	Once-through water-cooled	Use re-circulating closed-loop chilled water for cooling. Once-through tap or chilled water cooling prohibited.
Academic, Other Research	Autoclaves, sterilizers: without mizers vs. with mizers	Domestic water runs continuously at 2.2gpm 24 hrs, 7 days, all year	Install water mizers. Quench water runs only when >140 F wash wastewater detected (typically <6 hrs per day). If available, use recycled water for quenching.
Academic, Other Research	Reverse Osmosis/water treatment system standard 50% efficiency vs. with re-use of reject water	RO reject wastewater to sewer, no re-use	Capture RO reject water for non-potable re-use. RO reject water could be used for non-potable uses, e.g., quenching, toilet flushing, sewer trap priming.
All Buildings	Condensate from Large Air Handling Units	N/A	Cooling coil condensate should be drained to condenser water systems or landscaping.

For more information please contact: www.fm.Virginia.edu or www.epa.gov/watersense

Figure 14: Performance Goals for Water Efficient Equipment

APPENDIX B – UTILITY METERING REQUIREMENTS

Electricity	
Application	Meters shall be revenue-grade and have MODBUS/TCP interfaces accessible via direct Ethernet connection or via local metering bus. Substations and building primary switchgear shall have power quality meters. Building sub meters shall have energy meters. All meters shall have a local display of demand and totalized consumption.
Connectivity	<p>Installations shall be digitally integrated into the SCADA system via MODBUS/TCP protocol over Ethernet. Meters on building primary feeders will also be interfaced to the building automation system (BAS) for energy management use. At a minimum, apparent power, reactive power, total power, energy, and per-phase volts and current shall be mapped to the SCADA system. Consumption reading in the SCADA system and BAS shall match the meter's local display.</p> <p>The contractor shall be responsible for proper installation of the meter and for enabling energy consumption calculations during construction before the service is turned on, unless ordered by the Director of Utilities. The E&U department will estimate consumption during construction using design maximum values when meter data is not available.</p> <p>Temporary meters for construction use can be supplied by the E&U metering department without connection to the BAS and will be read monthly. The meter must be returned to the metering department within 10 days of service disconnection or construction contractor will be billed for a replacement meter.</p>
Approved Meters	<p>Power Quality Meters:</p> <ul style="list-style-type: none"> • Square D CM4000, PM870, or equivalent • ION 7650/7550 series • GE PQM II series <p>Energy Meters:</p> <ul style="list-style-type: none"> • Square D energy meter or equivalent • ION 6200 series
Domestic Water	
Application	Meters shall be EPDM rubber-lined electromagnetic flow meters on all services unless deemed "low consumption" by the University's metering department. Low consumption meters will be turbine or positive displacement. All meters shall have

	local display of volumetric flow rate and totalized consumption.
Connectivity	<p>Installations shall be digitally integrated into the building automation system (BAS) via BACNet protocol. Totalization, volumetric flow rate, and diagnostic data shall be mapped into the BAS. Totalization value in the BAS shall match the meter's local display.</p> <p>Turbine and positive displacement meter installations shall output to the BAS. The local meter value and BAS totalization value should match. This will be recalibrated during PM.</p> <p>The contractor shall be responsible for proper installation of the meter and for enabling consumption calculations during construction before the service is turned on, unless ordered by the Director of Utilities. The E&U department will estimate consumption during construction using design maximum values when meter data is not available.</p> <p>Temporary meters for construction use can be supplied by the E&U metering department without connection to the BAS and will be read monthly. The meter must be returned to the metering department within 10 days of service disconnection or construction contractor will be billed for a replacement meter.</p>
Approved Meters	<p>Magnetic Flow meters:</p> <ul style="list-style-type: none"> • Toshiba LF series • Johnson-Yokogawa ADMAG series • Siemens/Controlotron SITRANS F series

Chilled Water & Heating Hot Water	
Application	<p>Transit-time ultrasonic energy meters may be used on all pipe sizes and shall be used for services greater than 6". Services at or below 6" may use TEFLON-lined magnetic flow meters. Matched temperature sensors for energy meters shall be installed in thermowells. All meters shall have local display of energy demand, volumetric flow rate and totalized energy consumption. Meters shall have 10 unobstructed pipe diameters of straight pipe upstream and 5 pipe diameters downstream.</p>
Connectivity	<p>All installations shall be digitally integrated into the BAS via BACNet protocol. Totalization, energy and volumetric flow rates, supply/return temperatures and diagnostic data shall be mapped into the BAS. Meter shall calculate and display energy consumption without BAS support. Totalization values in the BAS shall match the meter's local display.</p> <p>The contractor shall be responsible for proper installation of the meter and for enabling energy consumption calculations during construction before the service is turned on, unless ordered by the Director of Utilities. The E&U department will estimate consumption during construction using design maximum values when the utility is in service and meter data is not available.</p>
Approved	<p>Ultrasonic flow/energy meters:</p>

Meters	<ul style="list-style-type: none"> • Flexim FLUXUS series • Siemens/Controlotron SITRANS F series • Dynasonics TFX series clamp-on (for <2" CHW services) <p>Magnetic flow meters:</p> <ul style="list-style-type: none"> • Toshiba LF-series • Johnson-Yokogawa ADMAG series • Siemens SITRANS F series
--------	---

Steam	
Application	<p>Meters shall be spring-loaded, variable area meters for applications up to 8". For service sizes greater than 8", vortex shedding meters shall be used. Meters shall have 10 unobstructed pipe diameters of straight pipe upstream and 5 pipe diameters downstream.</p> <p>Ceramic lined electromagnetic flow meters shall be installed for steam condensate and must be approved by the metering department when a steam flow meter cannot be installed.</p> <p>All meters shall have a local display of demand, totalized consumption, and compensation input values where applicable.</p>
Connectivity	<p>All installations shall be digitally integrated into the BAS via MODBUS or BACNet protocols. Totalization, flow rates, and diagnostic data shall be mapped into the BAS. Steam meters shall calculate and display energy or mass flow rate demand and total consumption without BAS support. Condensate meters shall calculate and display volumetric flow demand and consumption. Totalization values in the BAS shall match the meter's local display. Steam meter installations that require a flow computer for compensation calculations shall integrate the computer with the BAS via BACnet or MODSUB protocols.</p> <p>The contractor shall be responsible for proper installation of the meter and for enabling energy consumption calculations during construction before the service is turned on, unless ordered by the Director of Utilities. The E&U department will estimate consumption during construction using design maximum values when the utility is in service and meter data is not available.</p>
Approved Meters	<p>Spring-loaded variable area meters:</p> <ul style="list-style-type: none"> • Spirax-Sarco Gilflo, ILVA, or DIVA series <p>Flow Computers:</p> <ul style="list-style-type: none"> • Spirax-Sarco M800 series • KEP SuperTROL series <p>Vortex meters:</p> <ul style="list-style-type: none"> • EMCO Vortex-PhD series • Spirax-Sarco V-Bar series

	<ul style="list-style-type: none"> • Sierra Instruments Innova-Flo series <p>Magnetic flow meters:</p> <ul style="list-style-type: none"> • Toshiba LF-series • Johnson-Yokogawa ADMAG series • Siemens SITRANS F series
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Oil	
Application	Meters shall be ultrasonic transit-time meters for all applications. Meters shall have a local display of demand and totalized consumption.
Connectivity	<p>Installations shall be digitally integrated into the building automation system (BAS) via BACNet protocol. Totalization, volumetric flow rate, and diagnostic data shall be mapped into the BAS. Totalization value in the BAS shall match the meter's local display.</p> <p>The contractor shall be responsible for proper installation of the meter and for enabling consumption calculations during construction before the service is turned on, unless ordered by the Director of Utilities. The E&U department will estimate consumption during construction using design maximum values when meter data is not available.</p>
Approved Meters	<p>Ultrasonic flow meters:</p> <ul style="list-style-type: none"> • Siemens/Controlotron SITRANS series • Dynasonics TFX-series clamp-on

Natural Gas	
Application	Meters shall be vortex shedding meters for all applications. Meters shall have a local display of demand and totalized consumption.
Connectivity	<p>Installations shall be digitally integrated into the building automation system (BAS) via BACNet protocol. Totalization, volumetric flow rate, and diagnostic data shall be mapped into the BAS. Totalization value in the BAS shall match the meter's local display.</p> <p>The contractor shall be responsible for proper installation of the meter and for enabling consumption calculations during construction before the service is turned on, unless ordered by the Director of Utilities. The E&U department will estimate consumption during construction using design maximum values when meter data is not available.</p>
Approved Meters	<p>Vortex meters:</p> <ul style="list-style-type: none"> • Spirax-Sarco V-Bar series • EMCO Vortex-PhD series • Sierra Instruments Innova-Flo series

APPENDIX C - ELEVATORS

The following outline specifications supplement BSRV 6.2 ELEVATORS, and are to be incorporated into specifications for new and replacement hydraulic elevator work contracted by the University of Virginia.

C.1 GENERAL REQUIREMENTS FOR ALL ELEVATOR INSTALLATIONS

Under no circumstances will manufacturers or suppliers of proprietary equipment, systems, or software – other than those specifically noted in this Appendix – be accepted.

C.1.1 GOVERNING CODES

All work shall be comply with VUSBC and ASME A17.1. Electrical work shall conform to NFPA – 70. Smoke and heat detector installation shall comply with NFPA – 72. In the performance of the work all personnel shall comply with all VOSHA safety regulations as well as with all specific safety regulations required by the University. Installations must adhere to all requirements noted in this Appendix, IN ADDITION TO complying with the governing codes.

C.1.2 WARRANTY AND MAINTENANCE

All equipment shall carry a warranty period of one full year from the date of the University's acceptance. Defects or equipment failures occurring during that one year period shall be promptly corrected at no cost to the University. The contractor shall provide one full year of complete maintenance service as part of this warranty. This service shall include monthly maintenance inspections and emergency call-back service 24 hours a day, seven days a week. A fire service check chart will be kept in the machine room and fire recall will be tested once a month and recorded on this chart.

The service technician will be required to check in with the elevator maintenance supervisor and to check out leaving a copy of the time ticket showing all work performed.

C.1.3 MACHINE ROOM REQUIREMENTS

1. Lamp protection for required lighting
2. Type ABC-10lb fire extinguisher mounted on wall adjacent to entrance
3. Smoke detectors
4. Heat detectors located within 24" of each sprinkler head, if sprinklers are provided
5. Lockable shunt trip with breaker type over-current protection for elevator controller located adjacent to entrance in sight of equipment, and properly labeled
6. Lockable disconnect switch with breaker type over-current protection for car lighting, properly labeled and installed adjacent to door jamb of main door to machine room
7. Machine room walls to be painted bright white, and floor to be painted high gloss light gray
8. Pre-action system with timer shall be furnished and shall be located outside of the machine room enclosure

9. Provide GFI duplex receptacle
10. All piping for the hydraulic system shall be schedule 80 and shall use Victaulic piping and fittings. If hydraulic piping is installed in finished solid ceilings or underground, use threaded piping. Piping buried in the ground shall have a protective casing.
11. Cooling and heating shall be provided to meet operational requirements of equipment

C.1.4 HOISTWAY REQUIREMENTS

1. Cut outs for hall fixtures
2. Smoke detector at pit level
3. Heat detector if sprinkler is provided

C.1.5 PIT REQUIREMENTS

1. If sump pump is installed, provide water sensor (located within sump hole when applicable) with signal going to systems control. The hole for the sump with grating should be located at the back side of the hoistway.
2. Provide GFI duplex receptacle
3. Provide vertically installed 4' – 2 tube fluorescent fixtures (T-8 type), mounted on the side hoistway wall, centered on the door header. In multiple hoistways, light switches should be accessible from any elevator at top and bottom landings. All lights in hoistway should come on at the same time.
4. Provide over speed valve and shut off valve
5. Single non-GFCI receptacle for sump pump should be located at the pit ladder.

C.1.6 OTHER EQUIPMENT REQUIRED FOR ALL ELEVATOR INSTALLATIONS

LANDING CONTROL SYSTEM: The landing control system shall be provided by Motion Control Engineering (MCE) or G.A.L. Mfg. Corporation. Provide and install new landing control system utilizing a perforated stainless steel tape mounted in hoistway. System shall have neither rotating parts nor mechanical magnetic switches. All adjustments shall be from a digital keypad with LCD readout. All adjustments shall be self-explanatory on readout. System shall have a minimum resolution of 0.125 inches. System shall have binary floor encoding to ensure correct floor position at each floor. No mechanically adjusted or machine room encoders will be accepted.

GUIDE SHOES: All guide assemblies shall be roller guides furnished by ElSCO Roller Guides. The elevator jack assembly shall be located so as not to put undue pressure on any individual roller. The car must be balanced properly.

HOISTWAY DOOR EQUIPMENT: All door equipment shall be manufactured by GAL Mfg. Corp.

Emergency access shall be provided at each entrance. Top and bottom retaining devices shall be provided. Provide hoistway access switches at the top and bottom landings.

CAR DOOR OPERATOR: Door operators shall be furnished by GAL Mfg. Corp. The type shall be MOVFR, and shall be furnished with adjusting tool.

DOOR DETECTOR: The door detector shall be TriTronics Edge Corp.

DOOR RESTRICTOR: The door restrictor shall be furnished by G.A.L. Mfg. Corporation.

CAR OPERATING PANELS: All car panels shall be furnished by PTL Mfg. Corp or Innovation Industries. Provide ADA telephone and wiring to be mounted behind car operating panel. Phone shall be furnished by TalkaPhone.

Car operating panels shall be vandal resistant and comply with all ADA requirements. The following information shall be etched into the panel:

1. "Certificate of elevator inspection is located at Facilities Management 575 Alderman Road"
2. Elevator capacity pounds
3. Phase II operating instructions
4. "No Smoking"

HALL FIXTURES: All shall be 24 volt dc and furnished by PTL Mfg. Corp or Innovation Industries.

LIFT NET: Lift net shall be furnished by Integrated Display Services, and provided on all units.

ELEVATOR KEYS: All elevator keys shall be furnished by PTL MFG. Corp or Innovation Industries. Any area with patient care shall have hospital emergency service provided at every floor and the key switch shall be operated by a USE 4 key. All elevator fire service keys shall be barrel key type 'FEOK1'.

ROPES: Ropes shall be manufactured by Bethlehem Steel and be pre-stretched and pre-formed. All ropes shall be fastened with shackles using wedge sockets. Springs and bushings shall be installed on the car and counterweight shackles.

SAFETIES: Manufacturer shall be Hollister-Whitney.

C.1.7 TECHNICIAN TRAINING AND PROJECT CLOSE-OUT

The Contractor, in conjunction with the subcontractors and suppliers, shall provide the following training as part of the contracted work (including travel expenses required to attend off-site training):

1. A designated Facilities Management elevator technician shall attend the controller manufacturers training center.
 - a. M.C.E. Controller Class (Rancho Cordova, CA): Contractor shall provide airfare including one checked bag (departure from Charlottesville, VA; arrival in Sacramento, CA), hotel (Fairfield Inn & Suites by Marriott in Rancho Cordova, CA), ground transportation and/or rental car including gasoline costs, and all associated travel costs.
 - b. G.A.L. Controller Class (Bronx, NY): Contractor shall provide airfare including one checked bag (departure from Charlottesville, VA; arrival in LaGuardia, NY), hotel (Hampton Inn New York-LaGuardia in East Elmhurst, NY), ground transportation and/or rental car including gasoline costs, and all associated travel costs.
2. Instructions and training for the Owner's operations and maintenance personnel in proper operation and maintenance of the equipment and related controls provided or altered in the work.

Upon completion of the installation, the Contractor shall provide the following:

1. Two complete hard copy sets and one electronic copy of all Adjuster manuals, user's manuals, maintenance manuals, logic diagrams, computer software, access codes, password, wiring diagrams, electrical drawings, drive manuals, and all other materials required for on-going maintenance and use of the system.
2. Any hardware required to interface with, diagnose or maintain the system. If required, interface tools may be hand-held or built into the system, and shall function for the life of the system.
3. One spare board for every board in the elevator controller, group controller, selector and door operator (including the door operator drive).

C.2 HYDRAULIC ELEVATOR GUIDELINES

Roped hydraulic elevators are NOT permitted at the University.

C.2.1 CONTROLLER

All control equipment shall be provided by Motion Control Engineering (MCE) or G.A.L. Mfg. Corporation. The controller shall provide means to access the computer memory for diagnostic purposes without the need for any external devices or connections.

C.2.1.1 CONTROLLER OPERATION REQUIREMENTS

1. The elevator shall not require the functioning of the microprocessor to operate on car top inspection to provide a reliable means of moving the car if the microprocessor fails.
2. A motor limit timer function shall be provided which, in case of the pump motor being energized longer than a predetermined time, shall cause the car to descend to the lowest landing and park, open the doors automatically and then close them. Car calls shall be canceled and the car taken out of service automatically. Operation may be restored by cycling the main line disconnect switch or putting the car on access or inspection operation. Door reopening devices shall remain operative.
3. A valve limit timer shall be provided which shall automatically cut off current to the down valve solenoids if they have been energized longer than a predetermined time. The car calls shall then be canceled and the car taken out of service automatically. Operation may be restored by cycling the main line disconnect switch or putting the car on access or inspection operation. Door reopening devices shall remain operative.
4. A means of lowering the elevator shall be provided when there is a power failure. This operation shall bring the car to the lowest landing and allow passengers to exit the elevator. This operation requires a separate battery-operated power supply system.
5. The car call relays on the controller shall be furnished with a means of allowing a call to be registered at the controller without means of a wire jumper. The elevator installer shall add additional car call buttons in the controller, furnished by MCE or G.A.L. Mfg. Corporation.
6. Elevator control voltage shall be 24 dc.
7. Provide emergency light test button behind the locked door of the elevator car operating panel.

C.2.1.2 PROGRAMMABLE OPTION REQUIREMENTS

All available options or parameters shall be field programmable, without need for any external device or knowledge of any programming languages. Programmable options and parameters shall be stored in nonvolatile memory. As a minimum, there shall be a 32-character alphanumeric display used for programming and diagnostics. Programmable parameters and options shall include, but not limited to, the following:

1. Number of stops/openings served (each car)
2. Simplex/duplex
3. Single automatic push-button
4. Selective collective/single button collective
5. Programmable fire code options/fire floors (main, alternates)
6. Floor encoding (absolute PI)
7. Digital PIs/single wire PIs
8. Programmable door times
9. Programmable motor limit timer
10. Nudging
11. External car shutdown input (e.g. rescuator)
12. External Low Oil Sensor Input
13. External viscosity control input
14. Parking floors
15. Hall or car gong selection

C.2.2 OTHER HYDRAULIC ELEVATOR EQUIPMENT

PUMPING UNIT: The pump shall be manufactured by IMO Pump, and the pump motor by Imperial. The motor starter type shall be Siemens A/C Semiconductor Motor Starter, and the type of valve shall be Maxton. The pumping unit shall have the valve, pump, and motor located within the reservoir. The unit must be mounted on sound isolation pads.

C.3 GEARED ELEVATOR GUIDELINES

C.3.1 CONTROLLER AND VARIABLE FREQUENCY AC DRIVE UNIT

C.3.1.1 CONTROLLER

The controller shall be a fully programmable microprocessor based controller that provides selective collective simplex operation and Phase I and Phase II fire service. Installations must adhere to all following requirements noted, IN ADDITION TO complying with ASME 17.1 and other applicable governing codes. All control equipment shall be provided by MCE (Motion Control Engineering) or G.A.L. Mfg. Corporation.

C.3.1.1.1 MICROPROCESSOR

The microprocessor board shall be equipped with on-board diagnostics for ease of troubleshooting and field programmability of a minimum of eight (8) specific control variables. Field changes

should be stored permanently using non-volatile memory. The microprocessor board shall provide the following features:

1. On board diagnostic switches and alphanumeric display which provide user-friendly interaction between the serviceman and the controller.
2. On board Real Time Clock displaying date and time, able to be reset using on board switches.
3. Display of calls on a per floor basis with all types of calls entered and displayed using on board switches and buttons. The elevator installer shall add additional car call buttons in the controller.
4. Field programmability of specific timer values which may be viewed and altered through use of the on board switches and buttons.
5. Display of the status of all of the inputs, outputs, internal control variables and flags, listed in order of their mnemonics.

C.3.1.1.2 EXTERNAL DEVICES

Provide comprehensive means to access the computer memory for elevator diagnostic purposes without the need for any external devices, and provide permanent indicators to show important elevator status as an integral part of the controller. Systems that require attachment of external devices for troubleshooting must be submitted for approval before bids are submitted for review. Should a system requiring an external device be accepted, a minimum of one (1) external device, including any/all software, passwords, parameters, etc. needed for the operation of the device, shall be provided to the Owner. External devices that require recharging and/or periodic reprogramming are prohibited.

C.3.1.1.3 TIMERS

Provide an out of service timer which automatically takes the car out of service if the car is delayed leaving the landing while there are calls existing in the building. The car shall not respond to hall calls while in this mode of operation, and the detector screen input shall be unresponsive in the event that a faulty screen unit was delaying the car.

Provide door protection timers for both open and close directions that protect the door operator motor and prevent the car from being "stuck" at a landing. The door open protection timer shall cease attempting to open the door after a predetermined time in the event that the doors are prevented from reaching the open position. The door close protection timer shall reopen the doors for a short time in the event that the door-closing attempt fails to make up the door locks after a predetermined time.

A minimum of four different door standing open times shall be provided:

1. A car call time value shall predominate when a car call only is canceled.
2. A hall call time value shall predominate whenever a hall call is canceled.
3. In the event of a door reopen from the detector screen, a separate short door time value shall predominate.
4. If the doors are prevented from closing for longer than a predetermined time, door-nudging operation shall cause the doors to move at slow speed and reduced torque in

the close direction. The detector screen shall stop the door but not reverse it. A buzzer shall sound while nudging operation is activated.

Provide separate adjustable timing to establish independent minimum passenger transfer times for car stops, hall stops, main lobby stops and door reversal protection. A timer shall be provided to limit the amount of time a car is held at a floor due to a defective hall call or car call including stuck pushbuttons. Call demand at another floor shall cause the car to ignore the defective call and continue to provide service in the building.

C.3.1.1.4 CONTROLLER OPERATING REQUIREMENTS

1. The car shall not be permitted to start or run if any hoistway door or gate interlock is unlocked or if any hoistway door, car door or gate contact is not in the made position due to the following:
 - a. Failure of any single magnetically operated switch, contact, or relay to release in the intended manner
 - b. Failure of any static control device, speed measuring circuit, or speed pattern generating circuit to operate as intended
 - c. The occurrence of a single accidental ground or short circuit
2. While on car top inspection, the car shall not be permitted to start or run even if any hoistway door lock or car door contact is in the closed or made position due to the following:
 - a. Failure of any single magnetically operated switch, contactor or relay to release in the intended manner
 - b. Failure of any static control device to operate as intended
 - c. The occurrence of a single accidental ground
3. Dedicated permanent status indicators shall be provided on the controller to indicate the following:
 - a. When the safety circuit is open
 - b. When door locks are open
 - c. When the elevator is running at high speed
 - d. When the elevator is on independent service
 - e. When the elevator is on firefighters' service
 - f. When the elevator out of service timer has elapsed
 - g. When the elevator has failed to successfully complete its intended movement.
4. Hall call or car call registration and lamp acknowledgment shall be by means of a single wire per call besides the ground and power buss.
5. The car shall be equipped with two-way leveling to automatically bring the car within 1/4" of floor level regardless of load.
6. Provide a test switch. In the "test" position, this switch shall allow independent operation of the elevator without door open functioning for the purposes of adjustment or testing the elevator. The elevator shall not respond to hall calls in this mode of operation.
7. The control equipment shall have all control parameters stored permanently on erasable programmable read-only memory. (EEPROM)
8. The controller shall provide four (4) independent speed adjustments.

9. The power control shall be arranged to continuously monitor the performance of the elevator such that if the car speed exceeds 150 fpm during access, inspection, or leveling the car shall shut down immediately, requiring a reset operation.
10. A means shall be provided in the controller to register calls without the use of jumpers.
11. The elevator installer shall add additional car call buttons in the controller, furnished by MCE or G.A.L. Mfg. Corp.
12. Elevator control voltage shall be 24 dc.
13. Provide emergency light test button behind the locked door of the elevator car operating panel.

C.3.1.2 VARIABLE FREQUENCY AC DRIVE UNIT

New and replacement controllers shall include installation of a compatible variable frequency AC drive. Acceptable drive manufacturers are General Electric Company, Mitsubishi Electric, or approved equal. The variable frequency drive shall incorporate the following:

1. Three phase, full wave rectifier and capacitor bank to provide DC for the solid-state inverter. The solid state inverter shall utilize power semiconductor devices and a duty cycle modulation fundamental frequency of not less than one kilohertz to synthesize three phase, variable voltage, variable frequency output to operate the hoist motor in an essentially synchronous mode.
2. Provide a means to remove regenerated power from the drive DC power supply. This power shall be dissipated in resistors or returned to the three-phase AC power line. Failure of the system to remove the regenerated power shall cause drive output to be removed from the hoist motor.
3. Provide a contactor to disconnect the hoist motor from the output of the drive unit each time the elevator stops. This contactor shall be monitored and the elevator shall not start again if the contactor has not returned to the de-energized position when the elevator stops.
4. Acceptable ambient temperature extremes for the drive unit are -10 degrees C to +40 degrees C, and relative humidity (non-condensing) extremes are 20 to 90% RH.
5. The drive shall be capable of providing an adjustable DC current to the AC motor for an adjustable time in order to provide a braking pulse to use in the stopping sequence.
6. The drive shall have to ability to adjust or program the voltage/frequency curve as necessary to properly match the characteristics of the existing elevator hoist motor.
7. The drive shall not create excessive audible noise in the elevator motor.
8. The unit shall be self-cooling.

Standard functions shall include: slip compensation, current limiting, restart after instantaneous power failure, multi-speed, jump frequency, automatic acceleration/deceleration, 2-wire/3-wire control selection, high or low limiter, bias frequency, pattern operation, selection of terminal function, terminal link.

Standard protection shall include: stall prevention, over current, over voltage, under voltage, instantaneous power failure, inverter overload, inverter overheating, motor overload, CPU error, and short circuit for input terminal.

C.3.1.3 CAR CONFIGURATION

For both duplex (two car) operation, AND for group (multiple car) configurations, with a computer for each controller, operation shall assign cars on a real time basis using estimated time of arrival (ETA). Should one computer lose power or become inoperative in any way, all other computers shall be capable of accepting and answering all hall calls. When all computers are in operation only one of them shall assume the role of dispatching the hall calls to both elevators.

C.3.1.4 OPERATION REQUIREMENTS

1. **Independent Service:** The car shall be provided with a switch to remove it from operation, and shall operate in response to car calls only in an in car independent mode of operation.
2. **Door Nudging Operation:** Should the doors be held open due to a stuck call button or the failure of an electronic door reopening device for a predetermined adjustable time, a buzzer shall sound and the doors shall close at a reduced torque of 2.5 ft./lb. or less, permitting the car to run.
3. **Emergency Power Operation:** When emergency power is detected, cars shall return to the main lobby one elevator at a time, and remain there with doors open. As each car returns, the other cars shall be shut down so as not to overload the emergency power generator. Once all cars have returned to the lobby, one or more cars may be selected to run under emergency power, depending on the capability of the emergency power generator. Selection of the cars that run under emergency power shall be done automatically by the group system, and may be overridden through manual selection. The actual number of cars allowed to run under emergency power shall be a preprogrammed value and the number of cars allowed to run shall not exceed this value. The panel for the manual selection switches for each group of elevators will be installed at a location determined by the University.

APPENDIX D – SECURITY REFERENCES

D.1 CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN (CPTED)

D.1.1 CPTED INTRODUCTION - CONCEPTS

CPTED is the practice of designing and the effective use of the physical, built environment, to deter and reduce the incidence of crime; thereby, enhance the quality of life. The application of CPTED principles during the design processes is simple and seamless when incorporated into the early phases of design. If the site and the building are planned well, the opportunity for crime and bad behavior can be suppressed or eliminated.

The concepts of CPTED are based on three simple precepts:

- *Natural Access Control*
- *Natural Surveillance*
- *Territoriality*

These concepts should be considered during site planning and internal planning of the project. Issues of safety and security will be initially programmed and brought up during design development. The implementation of these concepts is achieved through developing and applying strategies during the design process. These strategies are unique and specific to each project; therefore the designer must thoughtfully evaluate the concepts and their application. The concepts presented here are theoretical and the designer must still comply with the requirement of the VUSBC.

1. Natural Access Control

Natural access control limits the opportunity for crime by taking steps to clearly differentiate between public space and private space. By selectively placing entrances and exits, fencing, lighting and landscape to limit access or control flow, natural access control occurs.

This design concept is directed to decreasing the opportunity for crime by placing obstacles to potential targets and therefore creating a perception of risk to the potential offender. People are physically guided through a space by the strategic design of streets sidewalks building entrances, landscaping and gateway. Within buildings the design of interior spaces and there interaction and adjacencies of programmatic functions have similar effects. Design elements are also useful tools to clearly indicate public routes and discourage access to private areas.

Natural access control also utilizes physical and mechanical means of controlling access through locks, alarm systems, signs, etc.

Locate common areas as centrally as possible or near major circulation paths within the project. Avoid remote locations for common areas.

2. Natural Surveillance

Natural surveillance is a design concept that limits the opportunity for **crime** by taking steps to increase the perception that people can be seen. Natural surveillance occurs by designing the placement of physical features, activities and people in such a way as to maximize visibility and foster positive social interaction among legitimate users of private and **public space**. This design concept is directed towards keeping intruders under observation, and therefore less likely to commit criminal acts making offenders behavior easily noticeable. Potential offenders feel increased scrutiny and limitations on their actions.

Natural surveillance utilizes design features to increase the visibility of a property or a building. Features that maximize the visibility of people, parking areas and building entrances include unobstructed doors and windows, pedestrian-friendly sidewalks and streets, and appropriate nighttime lighting.

Designers should provide a good visual connection between public and private environments or functions with the placement of high activities functions adjacent to potential isolated areas.

3. Territoriality

Territoriality is the concept of promoting social control through increased definition of space and reinforcing ownership. An environment designed to clearly delineate private space does two things. Owners have a vested interest and are more likely to challenge intruders or report them to the police. Second, the sense of owned space creates an environment where "strangers" or "intruders" stand out and are more easily identified. Additionally, these objectives can be achieved by assignment of space to designated users in previously unassigned locations. Territorial reinforcement measures make the normal user feel safe and make the potential offender aware of a substantial risk of apprehension or scrutiny.

By using buildings, fences, pavement, signs, lighting and landscaping to express ownership and define public, semi-public and private space, natural territorial reinforcement occurs.

People take more interest in something they own or when they feel intrinsically involved. Therefore, the environment should be designed to clearly delineate private spaces. Provide obvious defined entries, patios, balconies and terraces. Use low walls, landscape and paving patterns to delineate ownership and responsibility.

D.1.2 CPTED APPLICATION - STRATEGIES

Strategies are unique and site specific to each design. They must be developed to address the circumstances that are created as a consequence of the design process.

Listed below are some examples of design strategies for each of the concepts above. The list is not meant to be inclusive.

1. Natural Access Control

- a. Use a single, clearly identifiable, point of entry
- b. Use structures to divert persons to reception areas
- c. Incorporate **maze** entrances in public **restrooms** (where permitted by building program). This avoids the isolation that is produced by an anteroom or double door entry system
- d. Use low, thorny bushes beneath ground level windows.
- e. Eliminate design features that provide access to roofs or upper levels
- f. In front yards, use waist-level, picket-type fencing along residential property lines to control access, encourage surveillance
- g. Use a locking gate between front and backyards
- h. Use shoulder-level, open-type fencing along lateral residential property lines between side yards and extending to between back yards. They should be sufficiently unencumbered with landscaping to promote social interaction between neighbors
- i. Use substantial, high, closed fencing (for example, masonry) between a backyard and a public alley

Natural access control is used to complement mechanical and operational access control measures, such as target hardening.

2. Natural Surveillance

- a. Place windows overlooking sidewalks and parking lots
- b. Use passing vehicular traffic as a surveillance asset
- c. Create landscape designs that provide surveillance, especially in proximity to designated points of entry and opportunistic points of entry
- d. Use the shortest, least sight limiting fence appropriate for the situation
- e. Use transparent weather vestibules at building entrances
- f. When creating lighting design, avoid poorly placed lights that create blind-spots for potential observers and miss critical areas. Ensure potential problem areas are well-lit: pathways, stairs, entrances/exits, parking areas, ATMs, phone kiosks, mailboxes, bus stops, children's play areas, recreation areas, pools, laundry rooms, storage areas, dumpster and recycling areas, etc.
- g. Avoid too-bright security lighting that creates blinding glare and/or deep shadows, hindering the view for potential observers. Eyes adapt to night lighting and have trouble adjusting to severe lighting disparities. Using lower intensity lights often requires more fixtures
- h. Use shielded or cut-off luminaries to control glare
- i. Place lighting along pathways and other pedestrian-use areas at proper heights for lighting the faces of the people in the space (and to identify the faces of potential attackers)

Natural surveillance measures can be complemented by mechanical and organizational measures. For example, closed-circuit television (CCTV) cameras can be added in areas where window surveillance is unavailable.

3. Territoriality

- a. Maintained premises and landscaping such that it communicates an alert and active presence occupying the space
- b. Provide trees in residential areas. Research results indicate that, contrary to traditional

views within the law enforcement community, outdoor residential spaces with more trees are seen as significantly more attractive, safer, and more likely to be used than similar spaces without trees

- c. Restrict private activities to defined private areas
- d. Display security system signage at access points
- e. Avoid using cyclone fencing and razor-wire fence topping, as it communicates the absence of a physical presence, and cues a reduced risk of being detected
- f. Placing amenities such as seating or refreshments in common areas in a commercial or institutional setting helps to attract larger numbers of desired users
- g. Programming activities in common areas increases proper use, attracts more people and increases the perception that these areas are controlled

Territorial reinforcement measures make the normal user feel safe and make the potential offender aware of a substantial risk of apprehension or scrutiny.

D.1.3 CPTED RELATED FIXTURES

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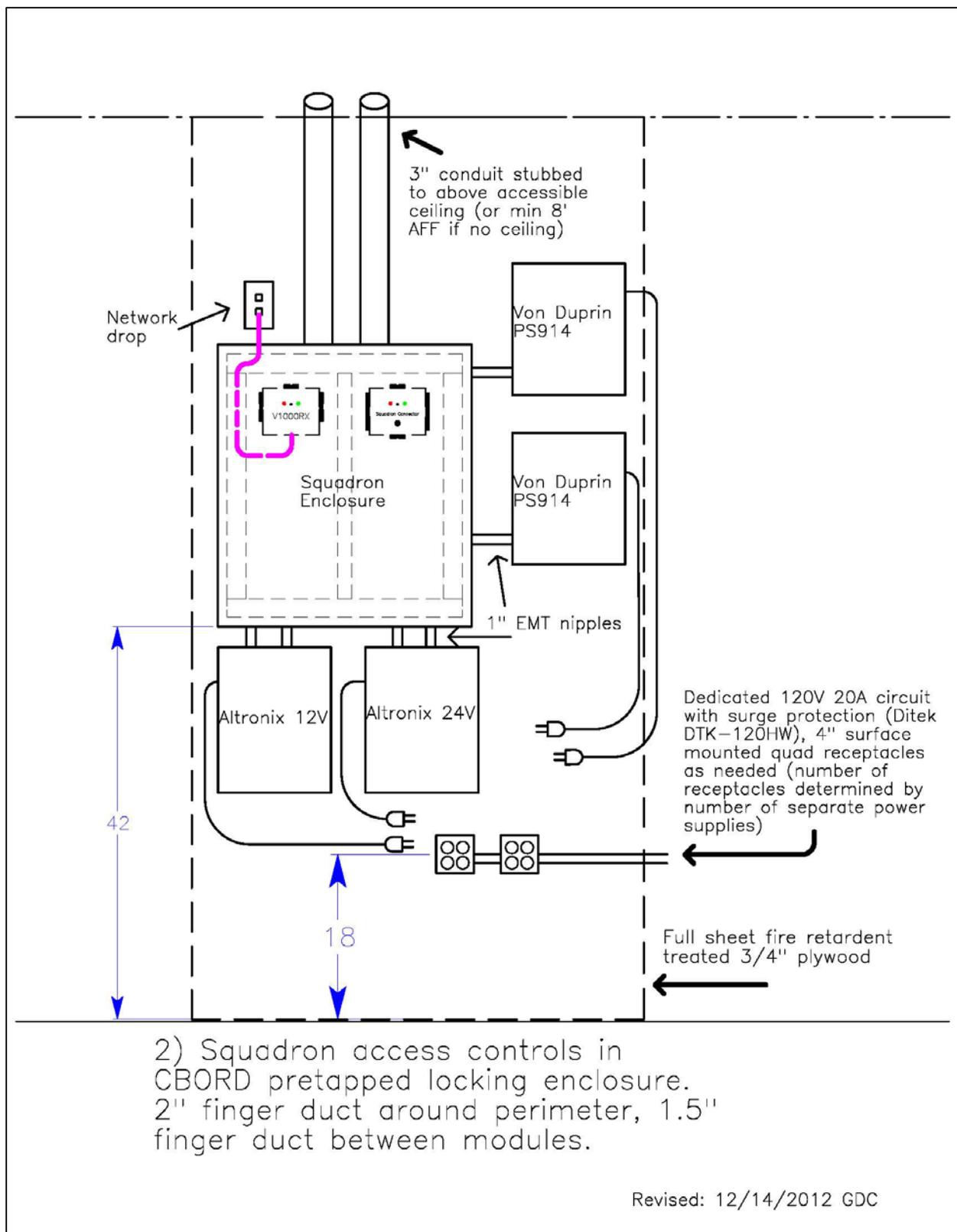
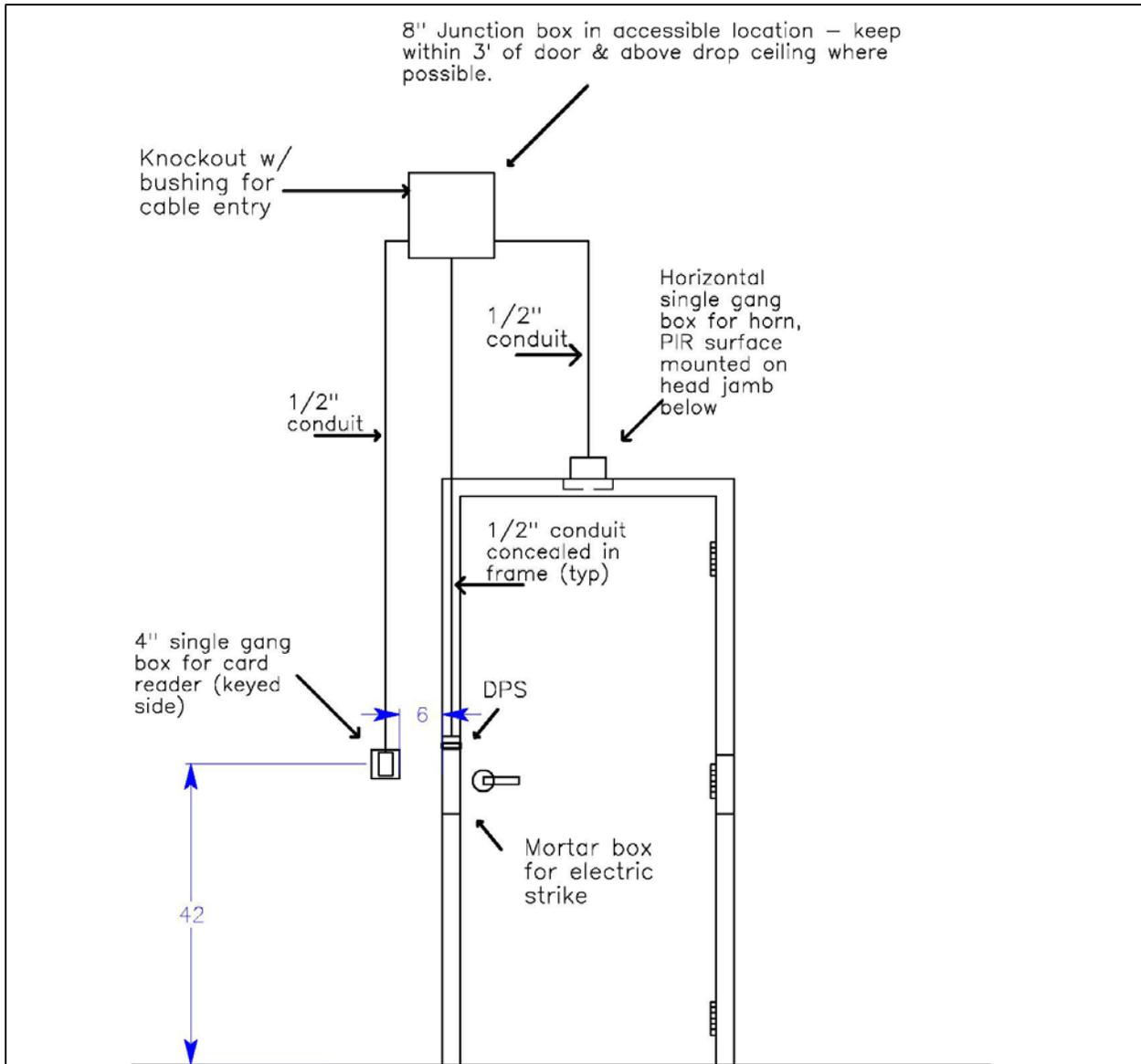


Figure 16: Squadron Controls in Enclosure



A) Single door w/electric strike, card reader, DPS, REX (PIR mounted on head jamb), and horn. If REX option is included in lock, add 1/2" conduit in hinge jamb, mortar box, and electric hinge or power transfer.

Revised: 12/14/2012
GDC

Figure 17: Single Door with Electric Strike

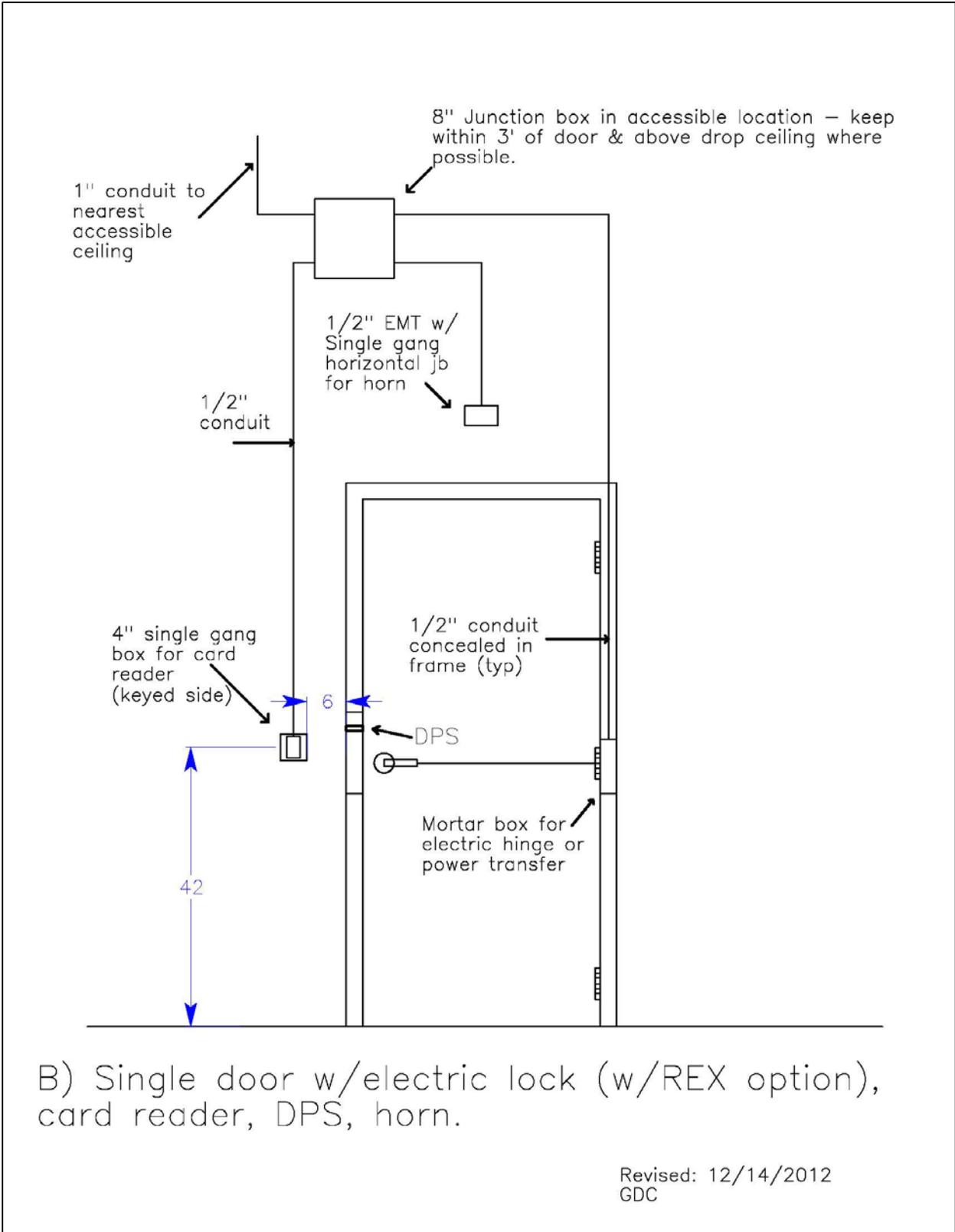


Figure 18: Single Door with Electric Lock

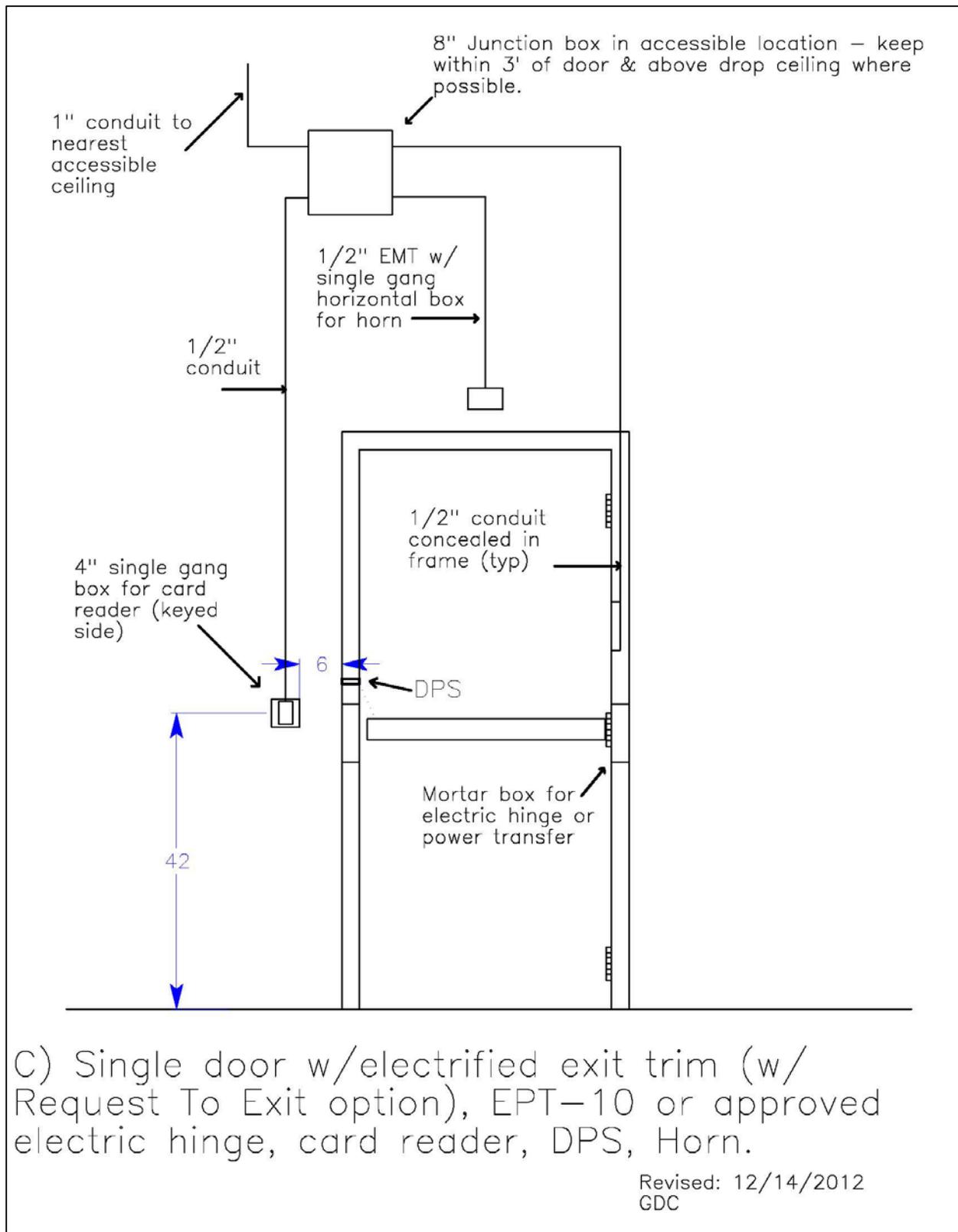


Figure 19: Single Door with Electric Trim

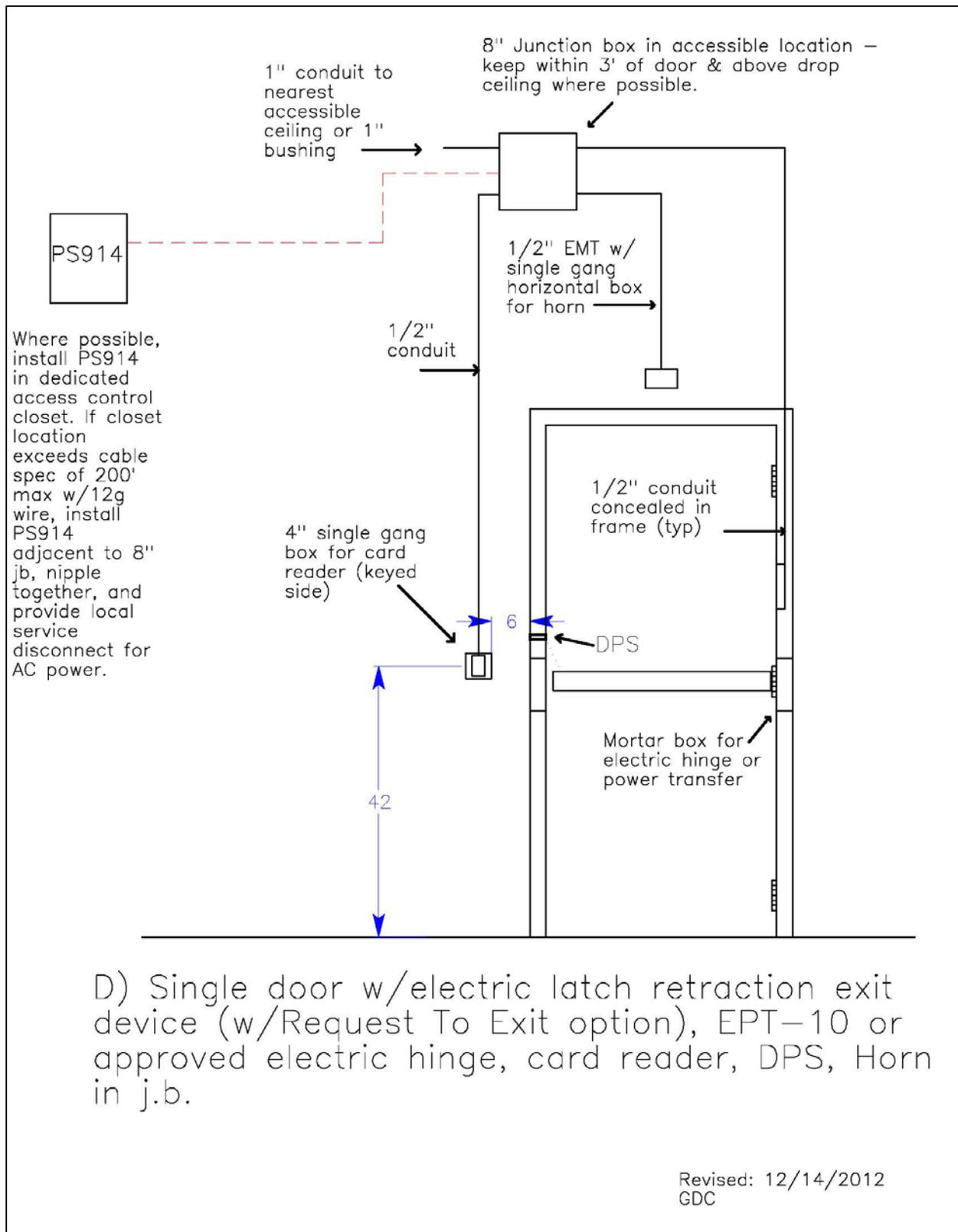
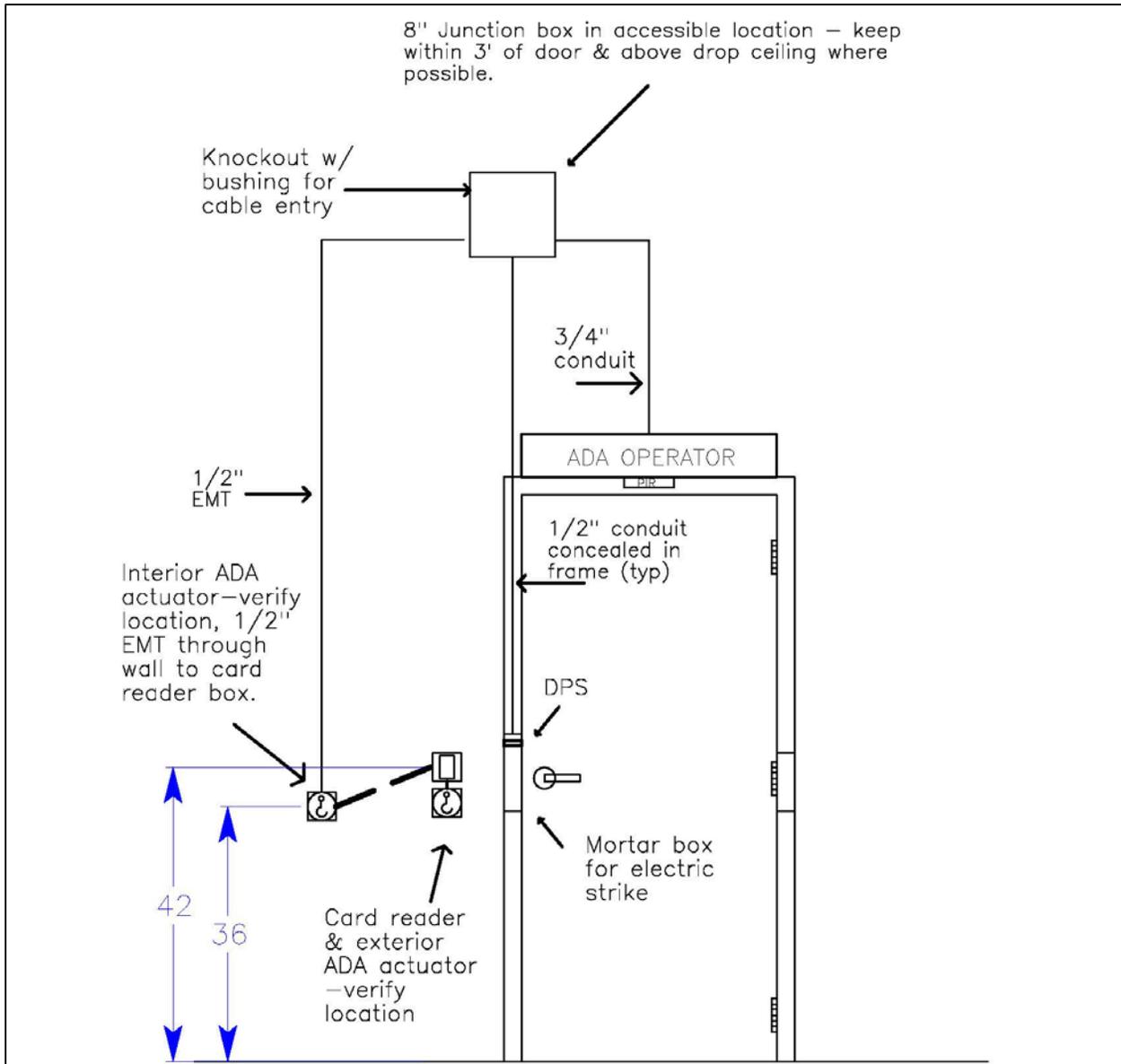


Figure 20: Single Door with Latch Retraction



E) Single door w/ADA operator, electric strike, card reader, DPS, REX (PIR mounted on ADA operator housing), and horn. If REX option is in lock, add 1/2" conduit in hinge jamb, mortar box, and electric hinge or power transfer.

Revised: 12/20/2012
GDC

Figure 21: Single Door with ADA & Electric Strike

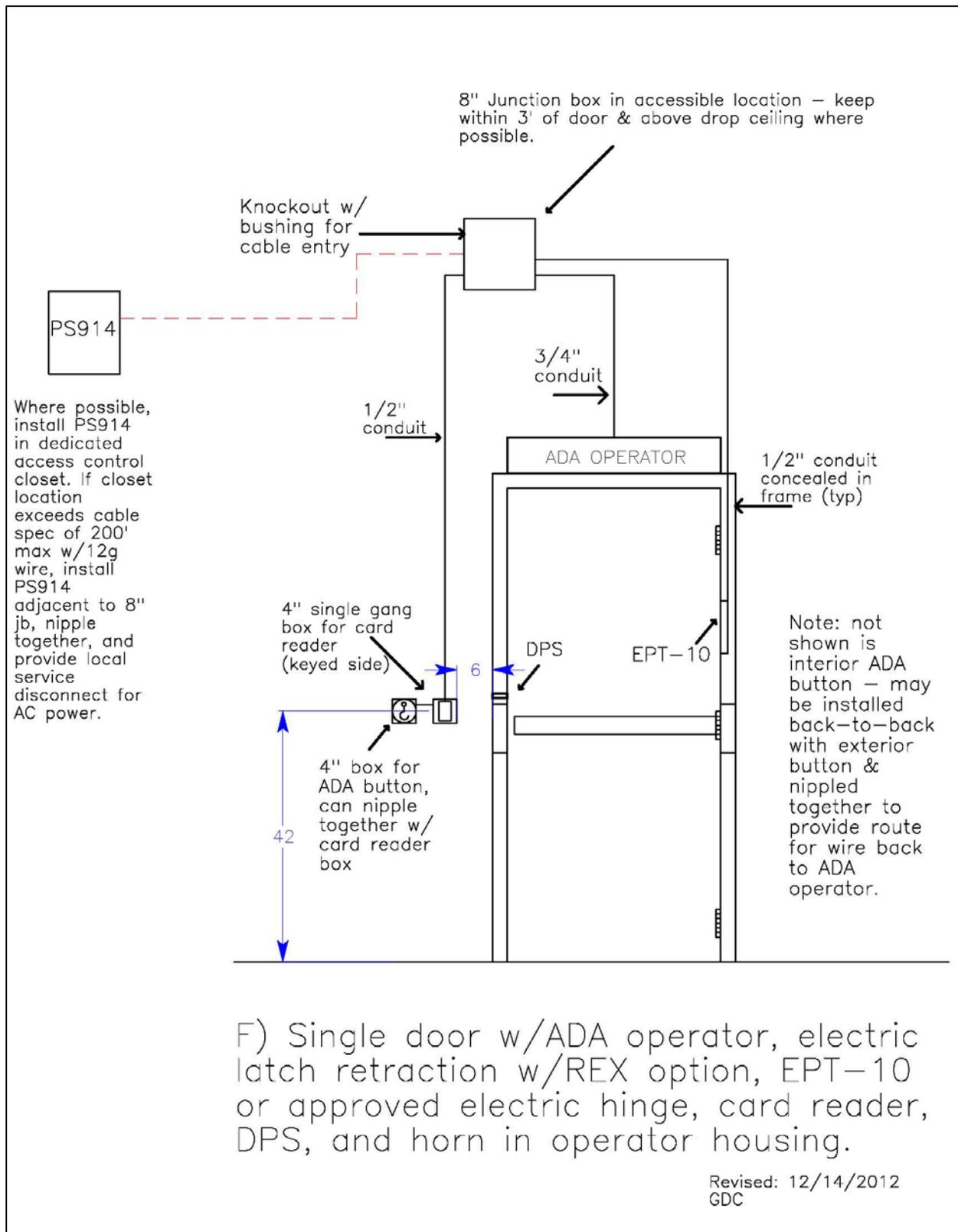


Figure 22: Single Door with ADA & Latch Retraction

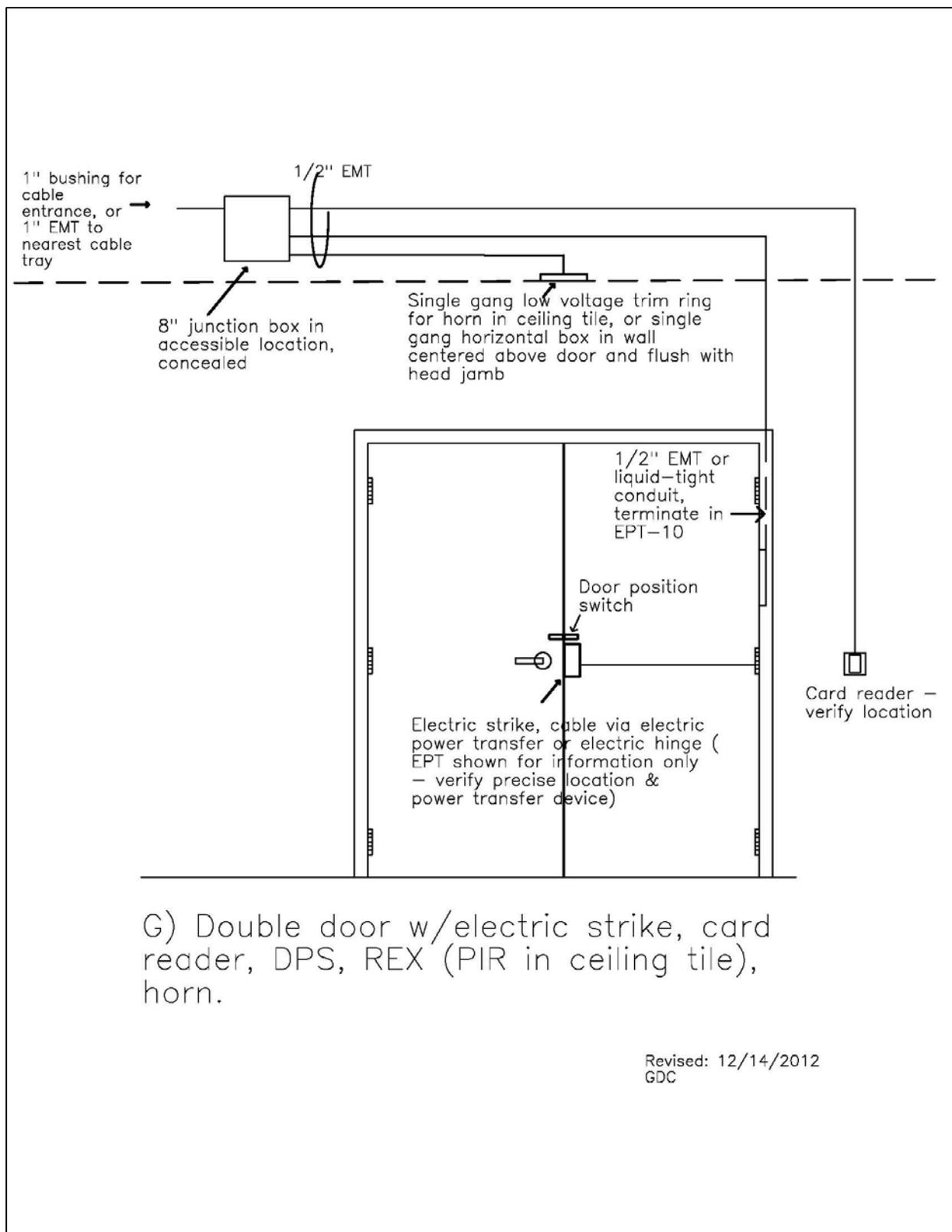
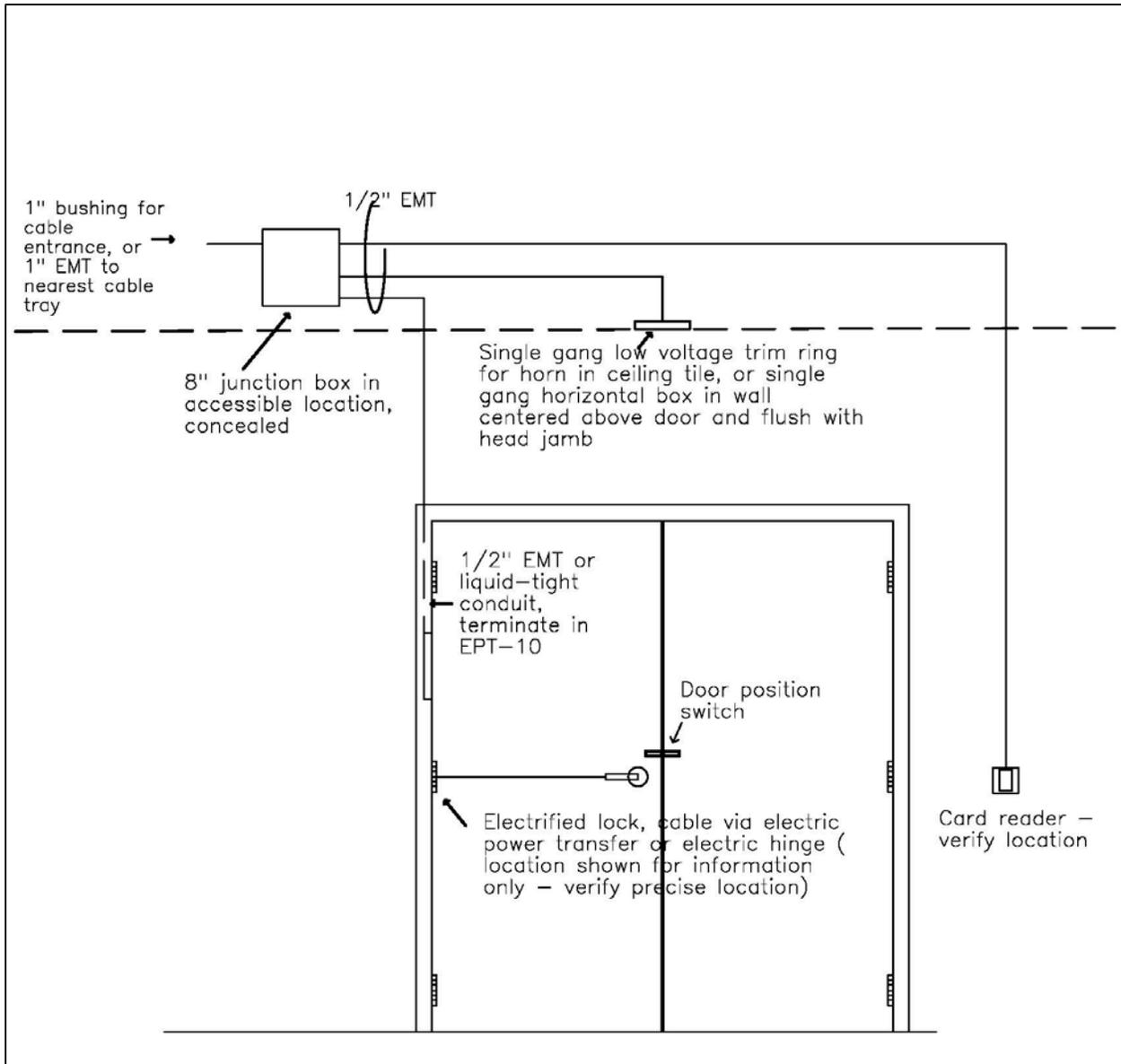


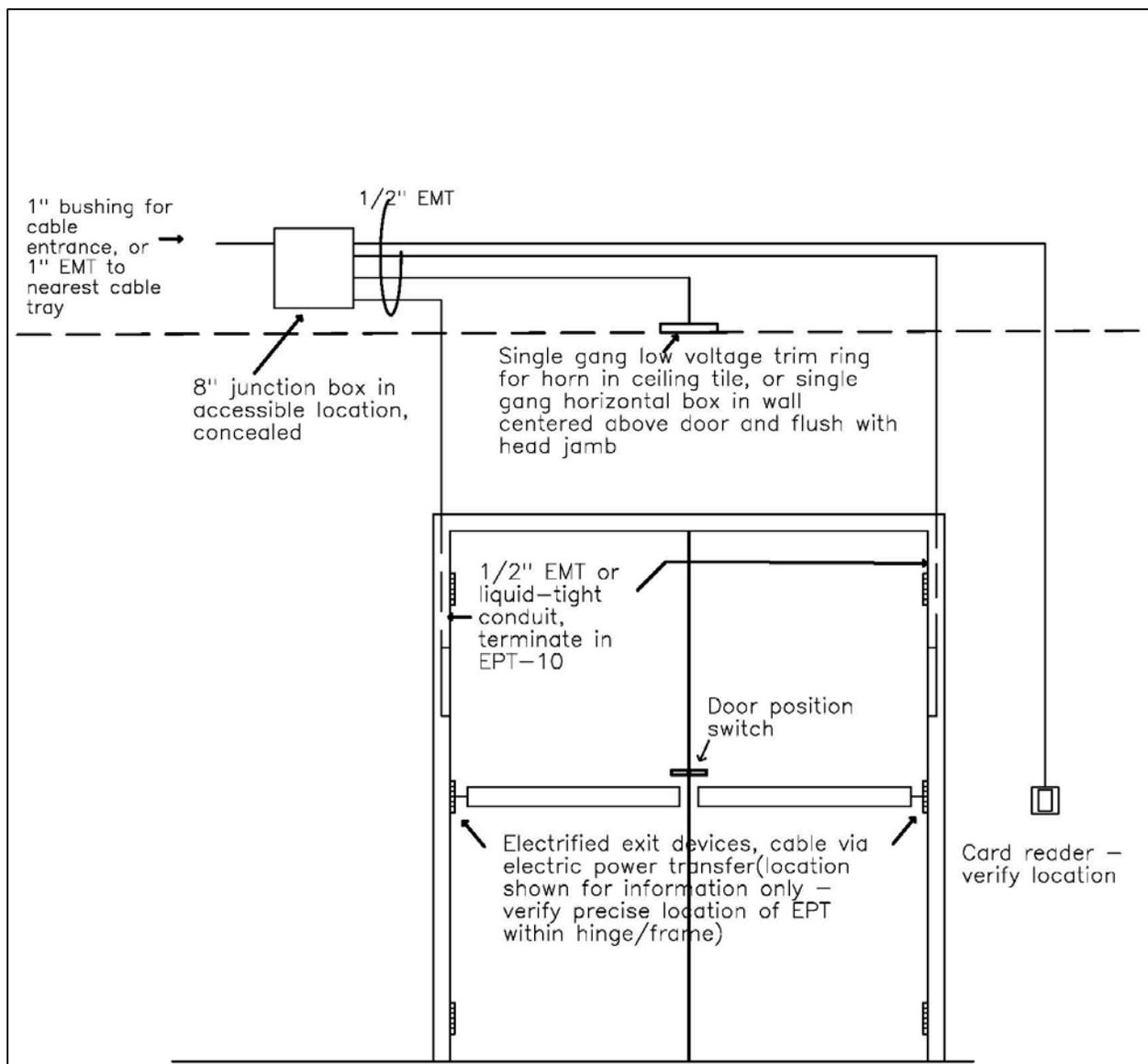
Figure 23: Double Door with Electric Strike



H) Double door w/electric lock, card reader, DPS, REX (in lock), horn.

Revised: 12/14/2012
GDC

Figure 24: Double Door with Electric Lock



1) Double door w/electrified exit trim, card reader, DPS, REX (in exit device), horn.

Revised: 12/14/2012
GDC

Figure 25: Double Door with Electric Trim

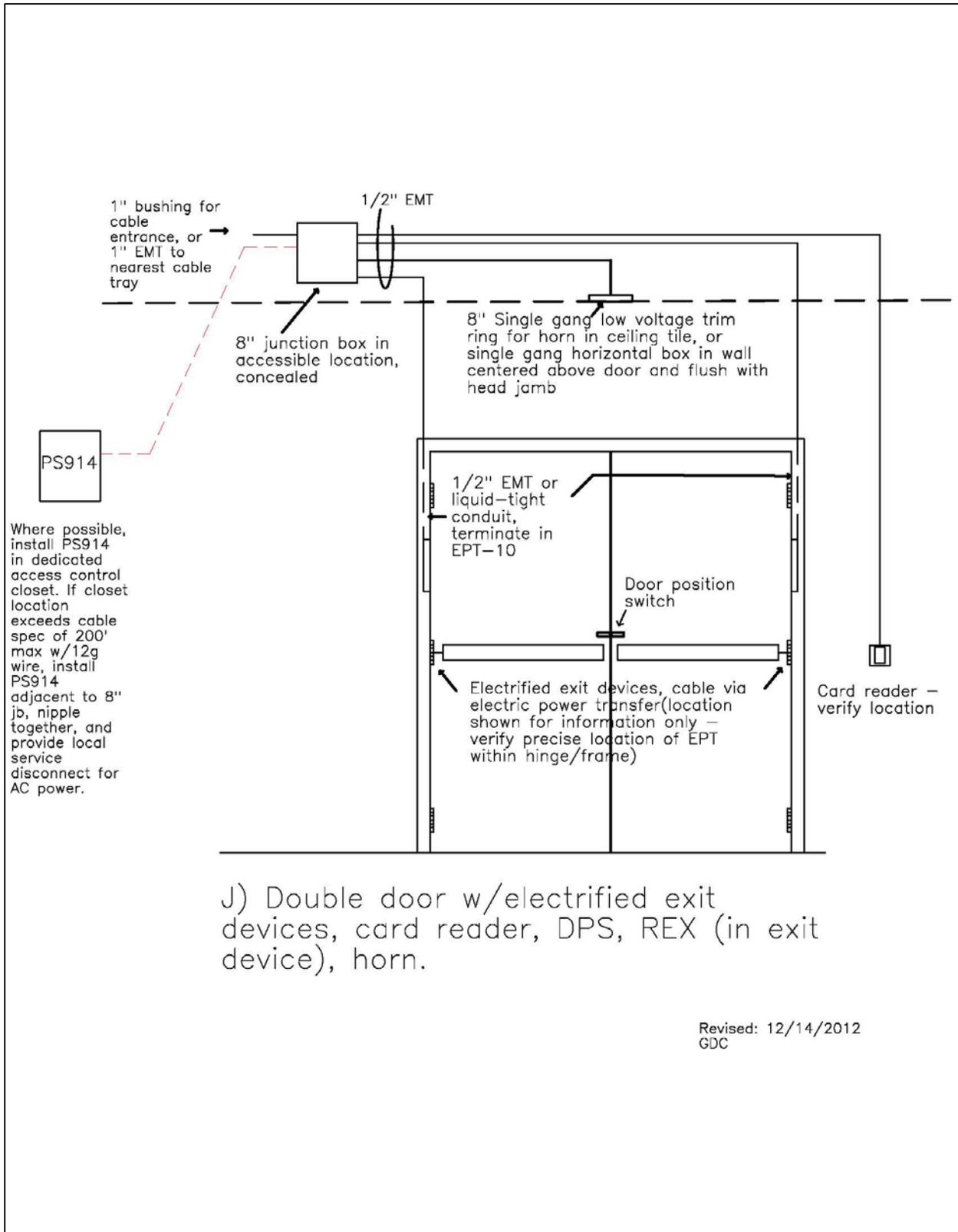


Figure 26: Double Door with Latch Retraction

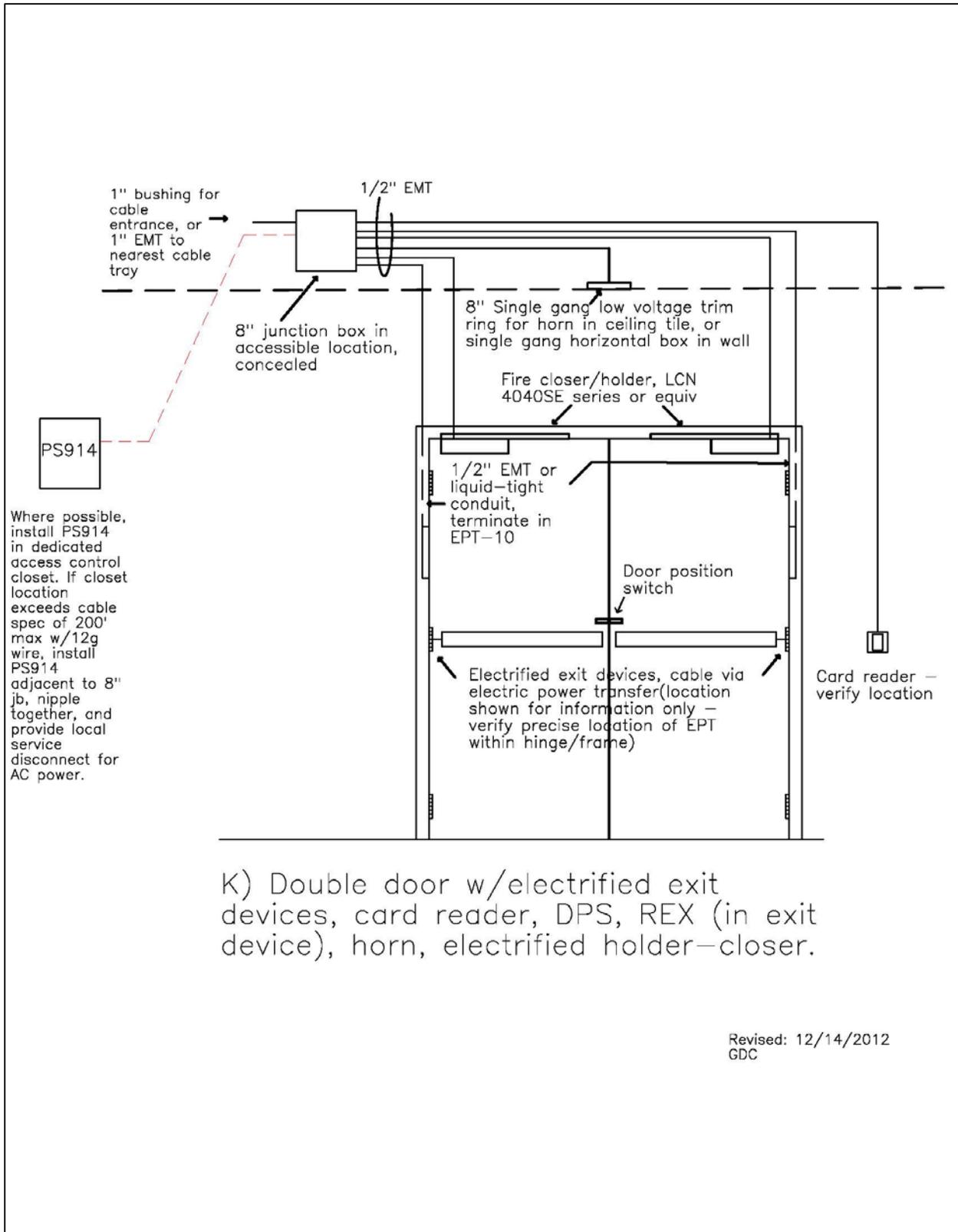


Figure 27: Double Door with Latch Retraction Holder

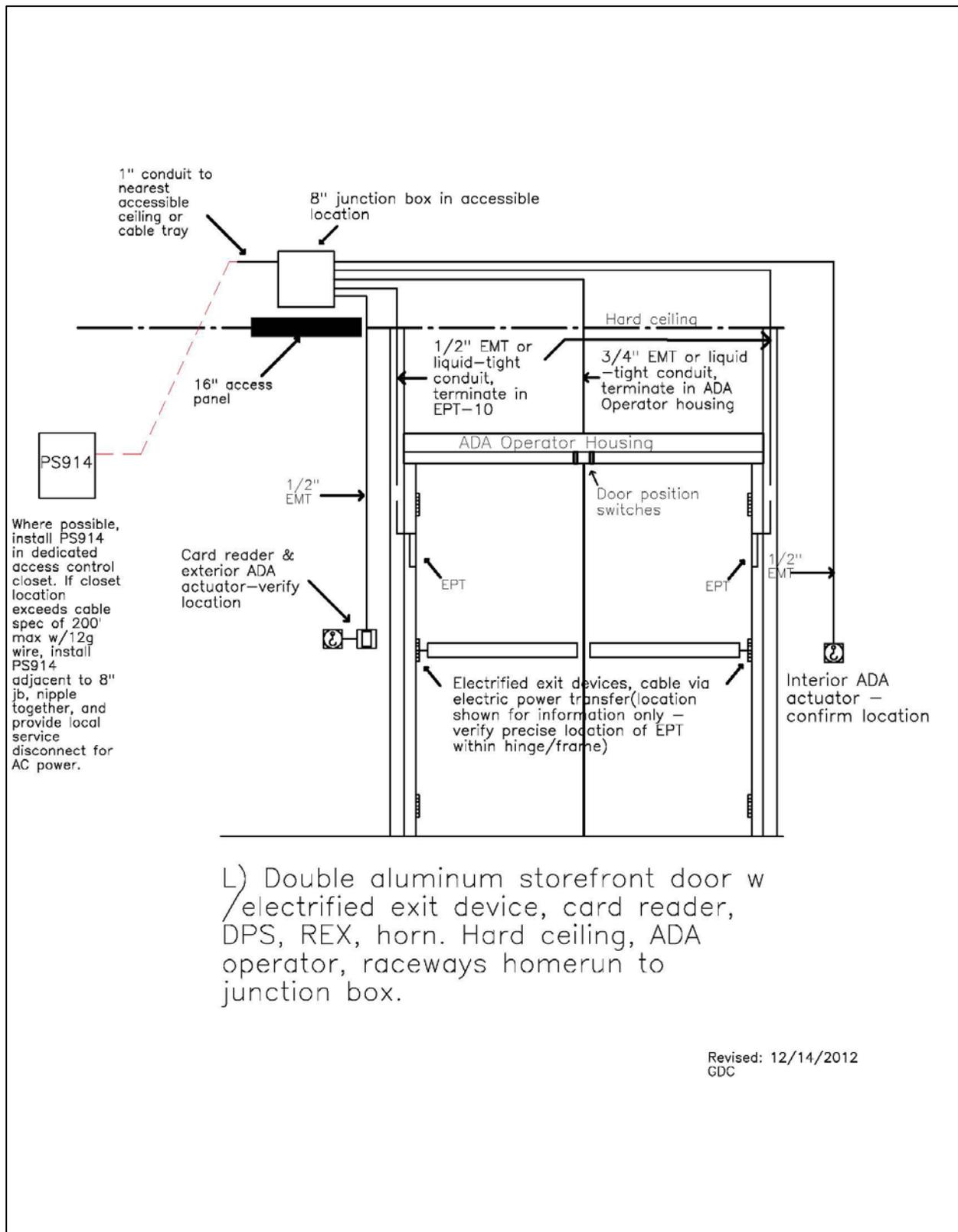


Figure 28: Double Door with ADA Latch Retraction Storefront

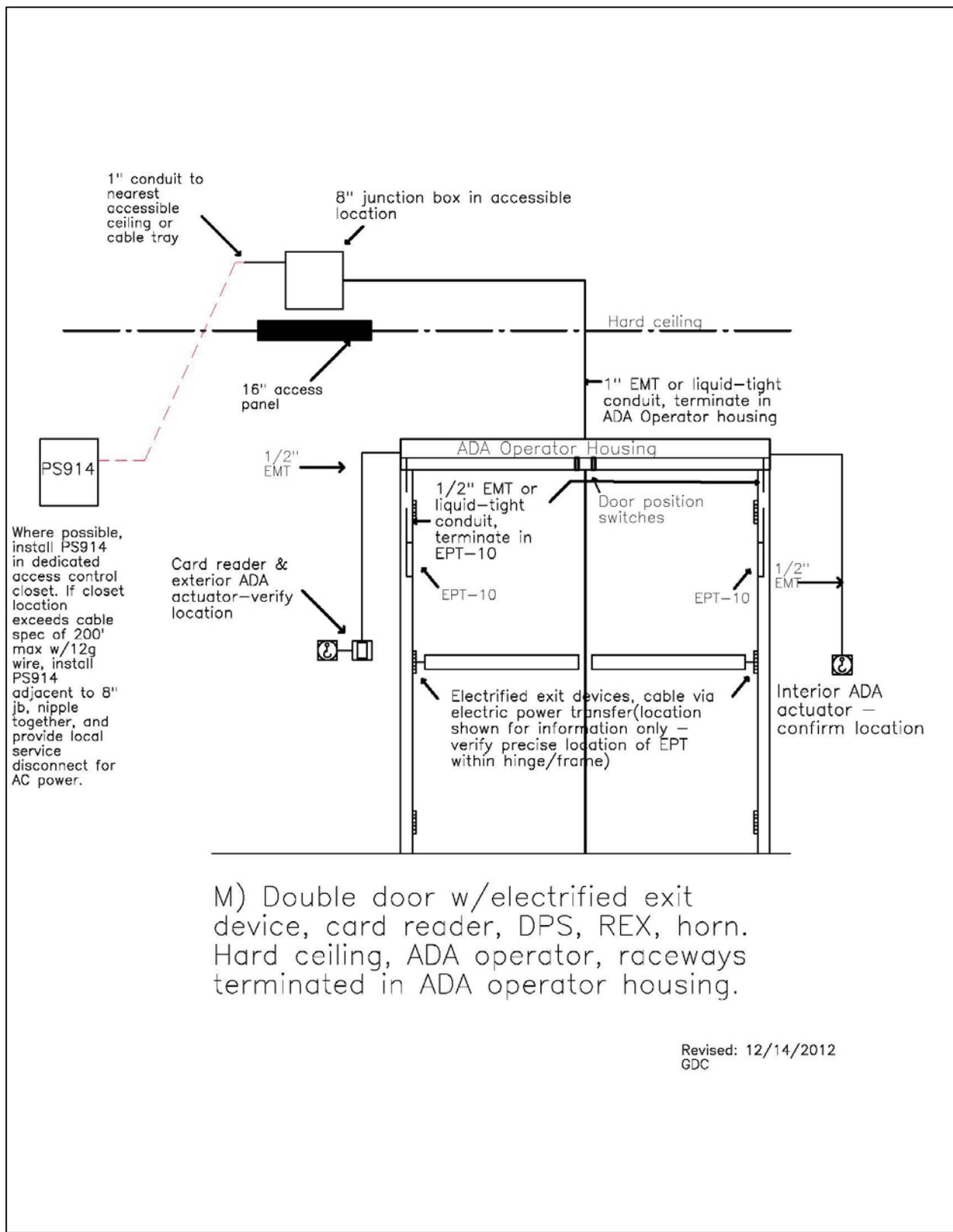
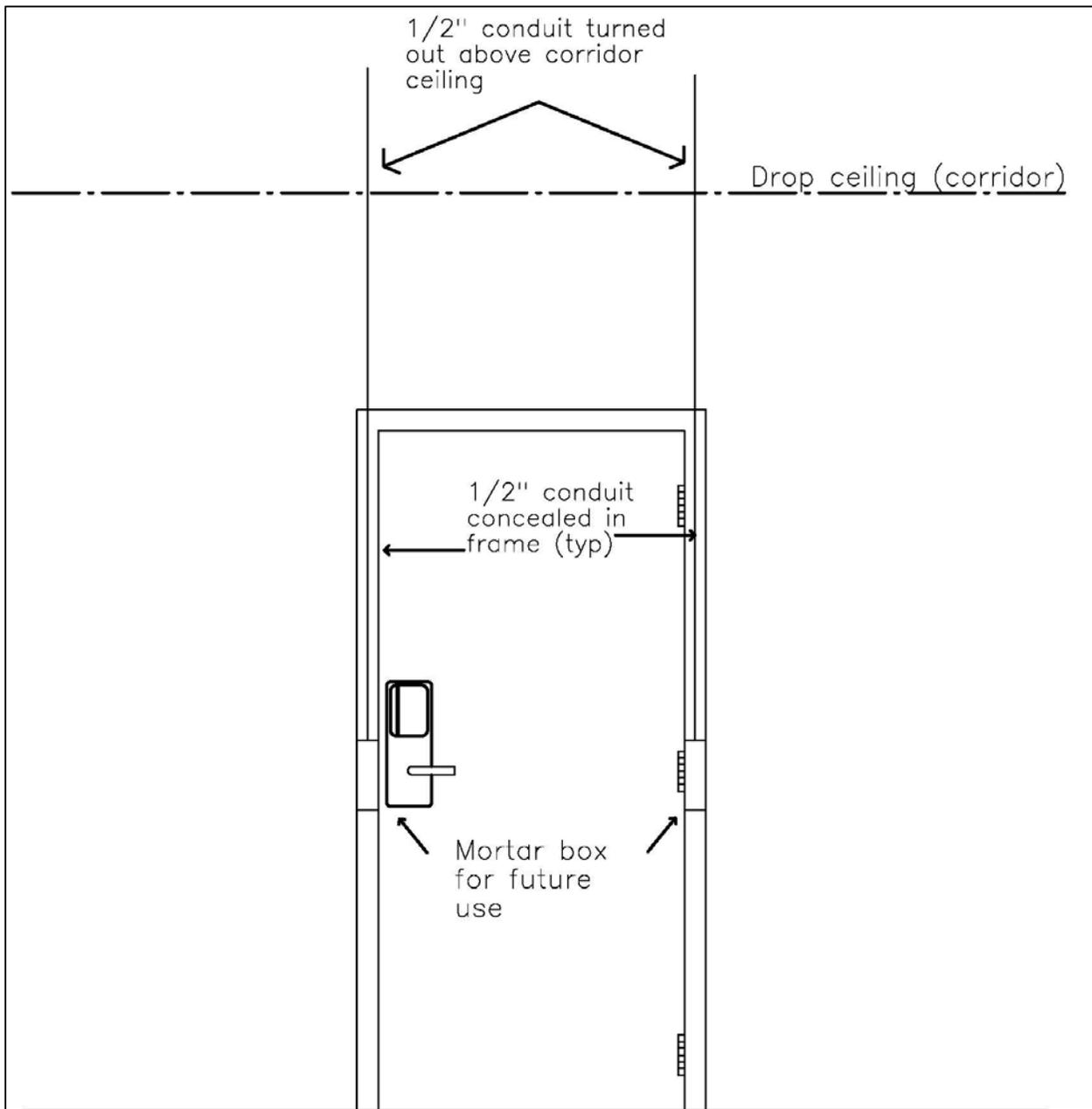


Figure 29: Double Door with Ada Latch Retraction Raceway via Operator



N) Residence room single door, AD400 wireless lock, frame prepped for future electric hinge & electric strike

Revised: 12/14/2012
GDC

Figure 30: Residence Room AD400 Lock

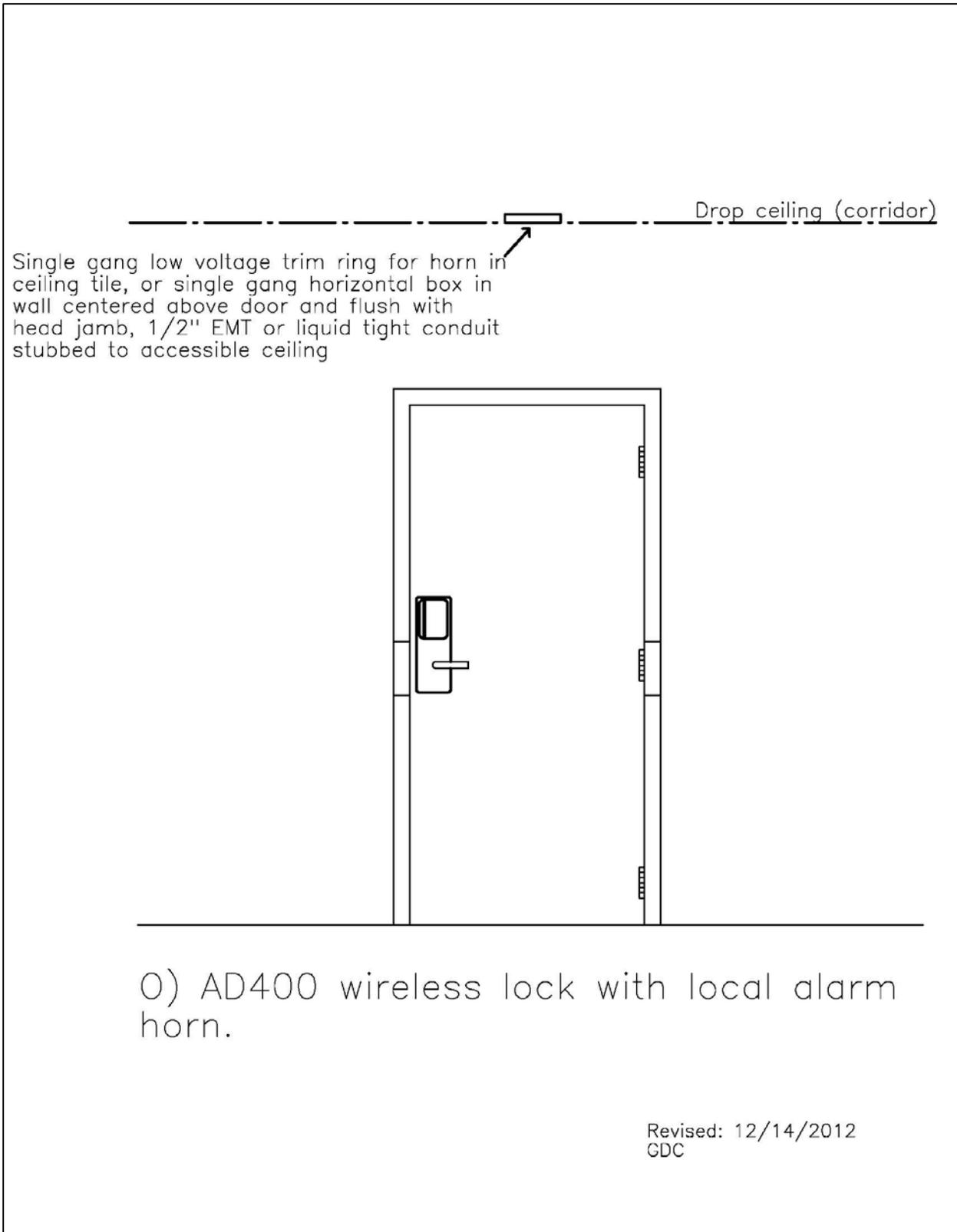


Figure 31: Wireless Lock with Local Alarm

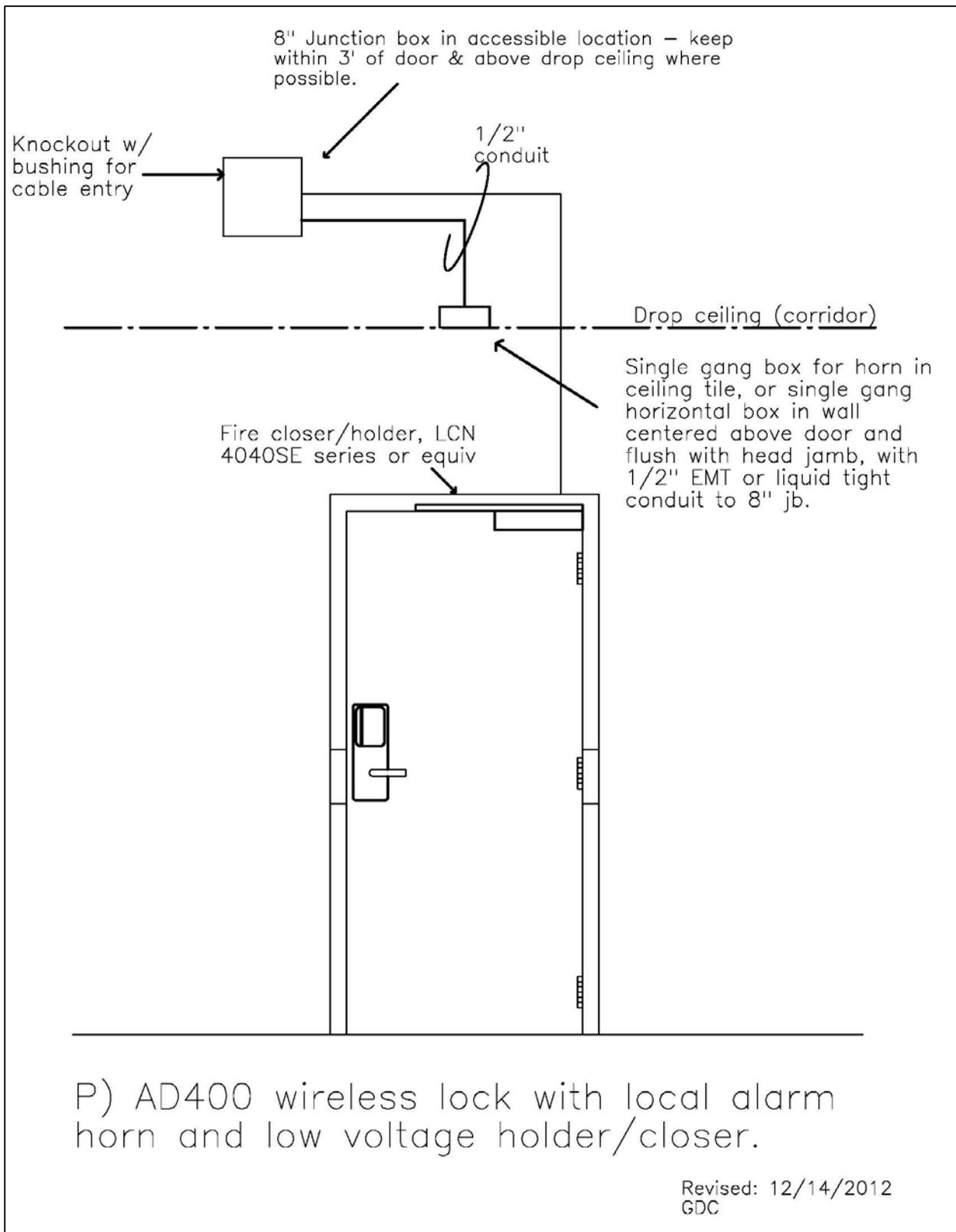


Figure 32: Wireless Lock with Horn, Holder, and Closer

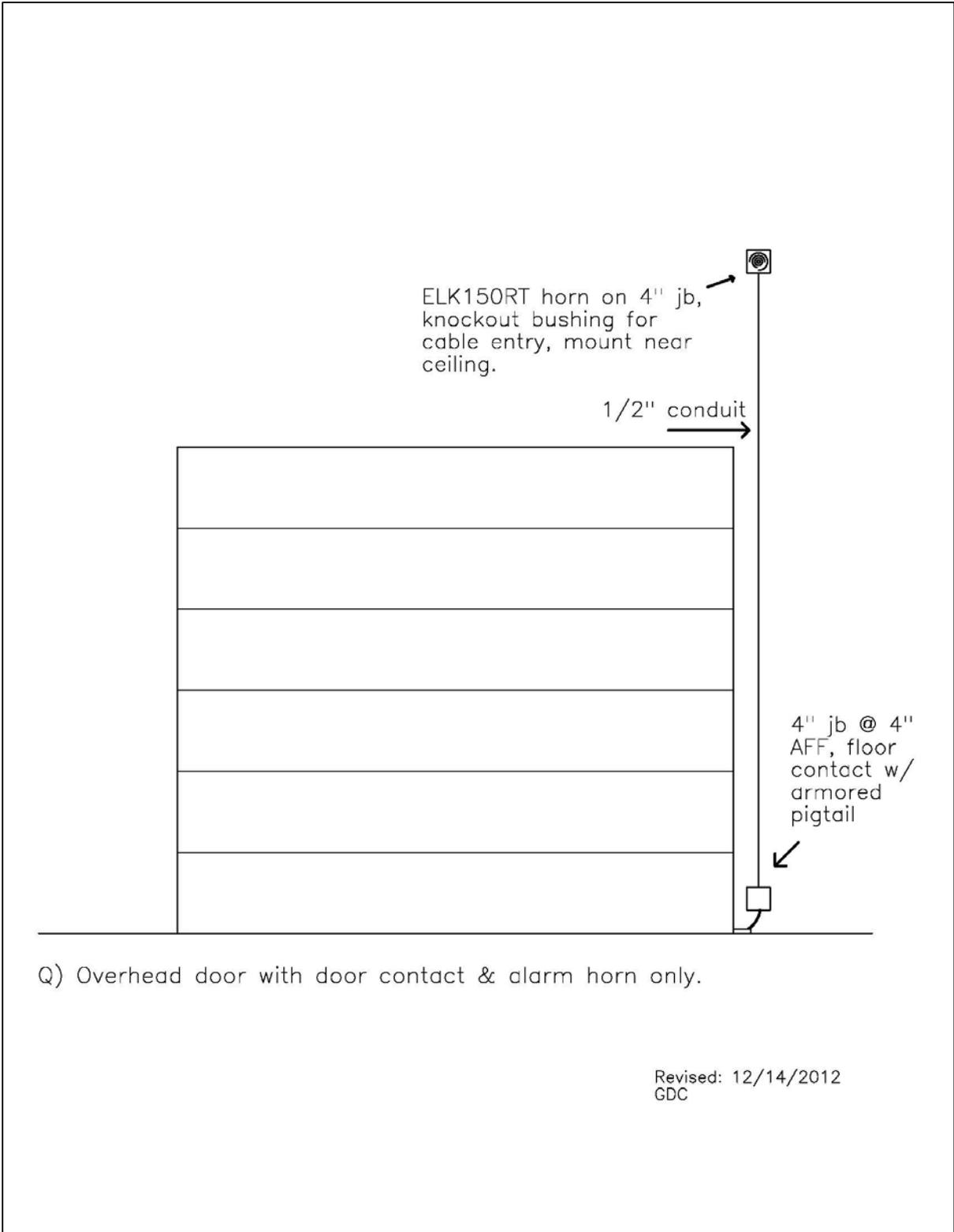
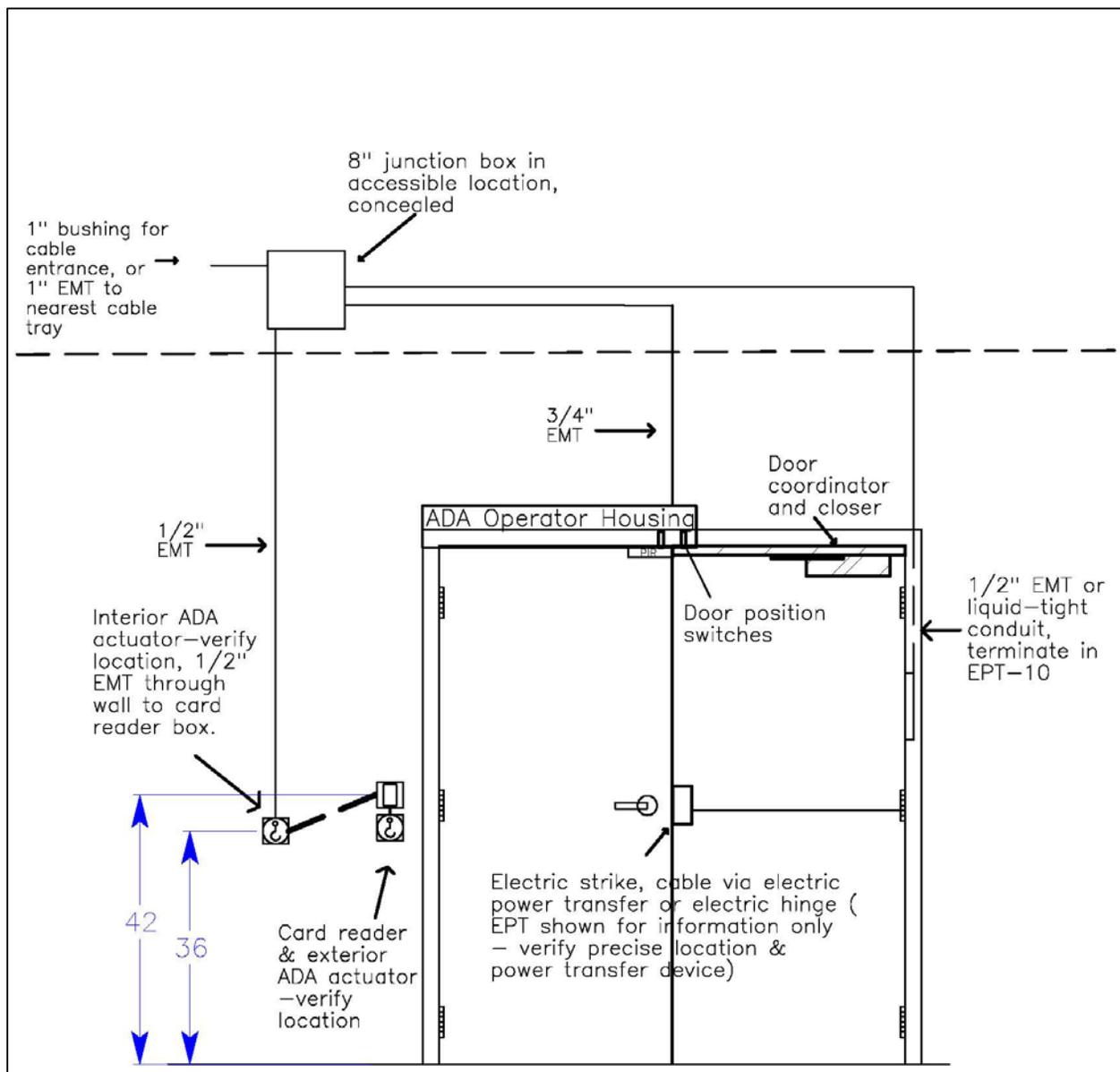


Figure 33: Overhead Door with Alarm



R) Double door w/ADA operator, electric strike, card reader, DPS, REX, horn.

Revised: 12/20/2012
GDC

Figure 34: Double Door with ADA, Strike, Reader, Rex, and Horn

APPENDIX E – UNIVERSITY OF VIRGINIA SPACE PLANNING GUIDELINES

E.1 GENERAL DESIGN GUIDELINES

The following guidelines are provided to assist deans, vice presidents, space managers, and others involved in the allocation of space to use space efficiency. See the table of Allocation Standards and the Office and Conference Room Diagrams for specific sizing and layout guidelines.

1. When practicable, an open office layout (i.e., cubicle) is preferred to allow for flexibility of space over time. A layout that emphasizes collaboration is encouraged.
2. Second offices are permitted only with justification, such as extreme geographical need.
 - a. The second office would be shared or smaller than the primary office, if approved.
 - b. A second office may not be in the same building or in geographic proximity to the primary office.
 - c. Approval of a second office is at the discretion of the Provost or his/her designee for academic units, and of the Vice President for administrative units.
3. Provide shared offices, office “hoteling”, or time-sharing space for part-time staff and academic instructional teaching lecturers (non-research).
4. Identify positions that can telecommute effectively. Where on-site space is needed provide shared, “hoteling”, or time-sharing office.
5. Emeritus faculty who are actively engaged in work serving the university may be provided office space at the discretion of the unit, if available.
6. In buildings with multiple departments, conference rooms and office service areas (copy/fax areas, lounges, and break rooms) must be shared amongst departments. The recommended utilization rate for conference rooms is 20-30 hrs/week.

E.2 OFFICE AND CONFERENCE ALLOCATION STANDARDS

The following State Council of Higher Education (SCHEV) space guidelines shall be used for the planning of all University facilities:

University of Virginia Office Allocation Standards			
Position Category	Recommended ASF	Recommended Space Type	Comments
Executive			
Executive Vice President	250-300	Private Office	
Provost	250-300	Private Office	
Vice President	250-300	Private Office	
Academic			
Dean	200-240	Private Office	
Assistant or Associate Dean	160	Private Office	
Department Chair	160	Private Office	
Senior Staff	120	Private Office	
Tenure Track Faculty	120-140	Private Office	In special circumstances, larger or smaller

(full-time)			offices may be needed. This is to be evaluated by the Dean.
Non-Tenure Faculty (full-time)	80-110	Private Office/Shared Office/Workstation	The office type recommended is to be evaluated by the Dean.
Part-time Tenure Track Faculty	80-110	Private Office/Shared Office/Workstation	The office type recommended is to be evaluated by the Dean.
Part-time Non-Tenure Track	80	Shared Office/Workstation	May assign shared office with 2 individuals housed in a 160 asf or 1 individual in a workstation. Encourage time-sharing or "hoteling" the office space.
Emeritus Faculty Active	120-140	Private Office	
Emeritus Faculty Non-Active	80	Shared Office/Workstation	May assign shared office with 2 individuals housed in a 160 asf or 1 individual in a workstation.
Other teaching: lectures, consulting, faculty, visiting faculty)	80	Shared Office/Workstation	Assign shared office with 2 individuals housed in 160 asf or 1 individual in a workstation.
Visiting scholar, fellows, research associate	80	Shared Office/Workstation	Assign shared office with 2 individuals housed in 160 asf or 1 individual in a workstation.
Graduate TAs/RAs	30-64	Workstation	Assigned when space is available in general to active Post-Doctoral students
University of Virginia Office Allocation Standards			
Position Category	Recommended ASF	Recommended Space Type	Comments
Administrative			
Assistant or Associate VP	160	Private Office	
Director Reporting to President or VP	160	Private Office	
Manager or Director	120	Private Office/Shared Office/Workstation	
Assistant or Associate Director	110	Private Office/Shared Office/Workstation	Assign a private office for assistant directors with 2 or more direct reports. Assign a shared office or a workstation if there are fewer than 2 direct reports.
Professional Staff (full-time)	80-110	Private/Shared Office/Workstation	Assign shared office with 2 individuals housed in 160 asf or 1 individual in a work-station. A small private office may be assigned if the nature of the work requires one.
Professional Staff (part-time)	64-70	Workstation	Encourage time-sharing or "hoteling" the office space.
Director Reporting to President or VP	160	Private Office	
Manager or Director	120	Private Office/Shared Office/Workstation	
Assistant or Associate Director	110	Private Office/Shared Office/Workstation	Assign a private office for assistant directors with 2 or more direct reports. Assign a shared office or a workstation if there are fewer than 2 direct reports.
Professional Staff (full-time)	80-110	Private/Shared Office/Workstation	Assign shared office with 2 individuals housed in 160 asf or 1 individual in a work-station. A small private office may be assigned if the nature of the work requires one.

Professional Staff (part-time)	64-70	Workstation	Encourage time-sharing or “hoteling” the office space.
Administrative Support Staff (full-time)	80	Shared Office/Workstation	
Administrative Support Staff (part-time)	64-70	Workstation	Encourage time-sharing or “hoteling” the office space.
Administrative Support Staff (full-time)	80	Shared Office/Workstation	
Administrative Support Staff (part-time)	64-70	Workstation	Encourage time-sharing or “hoteling” the office space.
Temporary Staff	30-64	Workstation	
Temporary Student Staff	30-64	Workstation	

Conference/Meeting Rooms				
Size by Seating Capacity	**Suggested Allocation Standard	ASF	Recommended # of Hours/Week	** General Comments
5-8	25 ASF/Seat	125-200	20-30	Moveable tables and chairs – no visual equipment or buffet serving area
10-12	27 ASF/Seat	270-324	20-30	Moveable tables and chairs with possibility to accommodate AV equipment, projection screen/white board, and cabinet w/counter for equipment storage/food and drink service.
15-20 Seats	30 ASF/Seat	450-600	20-30	Moveable tables and chairs with possibility to accommodate AV equipment, projection screen/white board, and cabinet w/counter for equipment storage/food and drink service.
20-25 Seats	30 ASF/Seat	600-750	20-30	Moveable tables and chairs with possibility to accommodate AV equipment, projection screen/white board, and cabinet w/counter for equipment storage/food and drink service.
28-35	30 ASF/Seat	900-1,050	20-30	Moveable tables and chairs with possibility to accommodate AV equipment, projection screen/white board, and cabinet w/counter for equipment storage/food and drink service.

E.3 OFFICE AND CONFERENCE ROOM DIAGRAMS

- Dean

200-240ASF

A Dean's office should be a single private office typically furnished with a desk, bookshelves, file cabinets, a printer, and a meeting area to accommodate 4-5 people.

Sample office layouts are provided below:

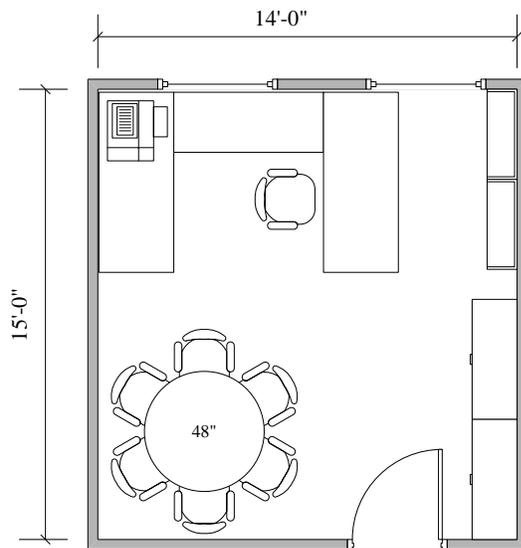


Figure A
210 ASF

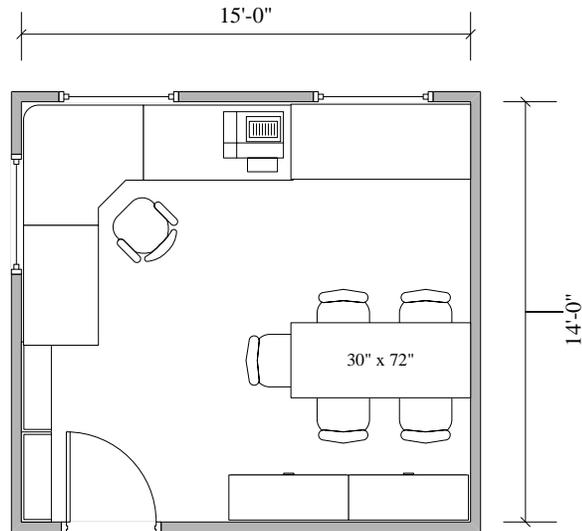


Figure B
210 ASF

- Assistant or Associate Dean
- Department Chair
- Assistant or Associate VP
- Director Reporting to President or VP

160 ASF

These positions are generally assigned a single private office typically furnished with a desk, bookshelves, file cabinets, and a meeting area to accommodate 2-3 people.

Sample office layouts are provided below:

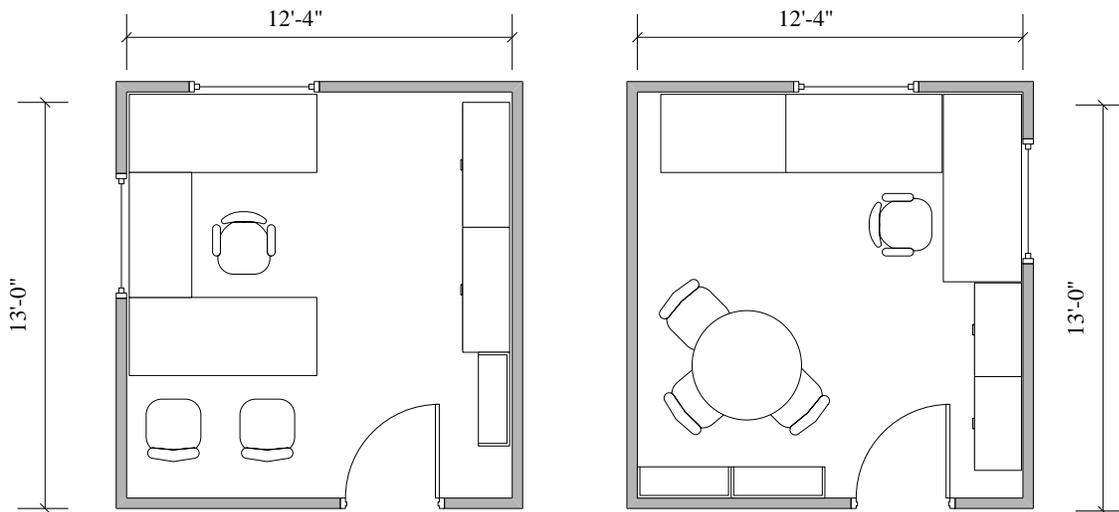


Figure A
160 ASF

Figure B
160 ASF

- Academic Senior Staff
- Administrative Manager or Director

120 ASF

These positions are generally assigned a single private office typically furnished with a desk, bookshelves, file cabinets, and a meeting area to accommodate 1-2 people.

Sample office layouts are provided below:

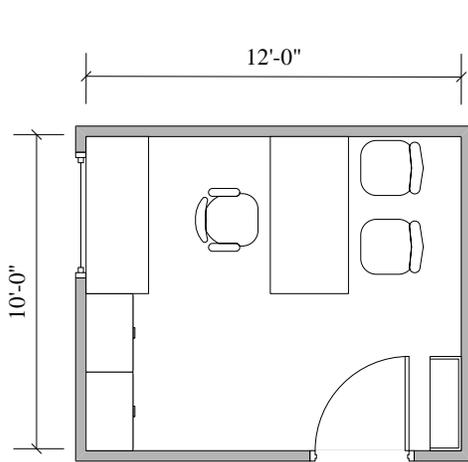


Figure A
120 ASF

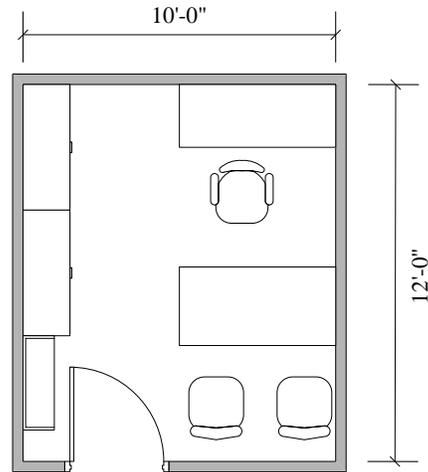


Figure B
120 ASF

• **Academic Tenured-Track Faculty (full-time)**

120-140 ASF

Academic tenured-track faculty are generally assigned a private office typically furnished with desk, bookshelves, file cabinets, and a meeting area to accommodate 1-2 people.

Sample office layouts are provided below:

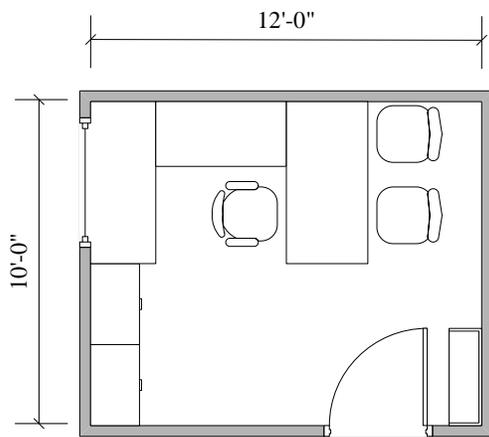


Figure A
120 ASF

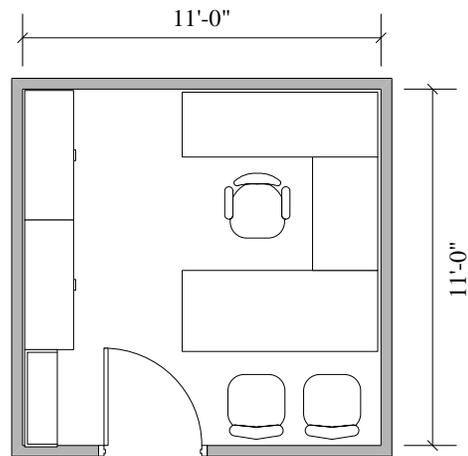


Figure B
121 ASF

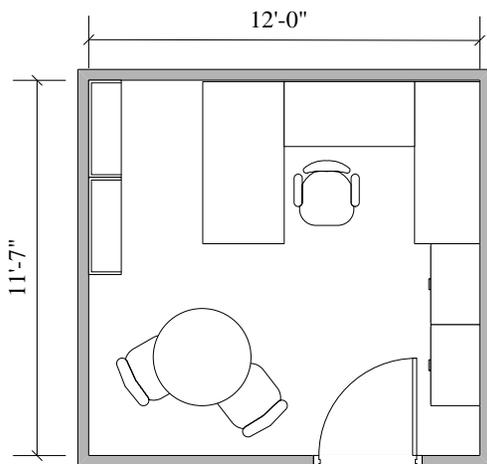


Figure C
140 ASF

- Academic Full-time Non-Tenure Track Faculty
- Academic Part-time Tenure Track
- Administrative Assistant or Associate Director
- Administrative Professional Staff

80-110 ASF

Academic full-time non-tenure track faculty and part-time tenure track faculty may be assigned a small private office, if available and at the discretion of the Dean. In general, full-time non-tenure track and part-time tenure track faculty are assigned a shared office of 160 asf with two individuals or an individual workstation.

Assistant/Associate Directors with two or more direct reports, may be assigned a private office , if available. Otherwise a shared office of 160 asf with two individuals or an individual workstation are generally assigned.

Sample office layouts are provided below:

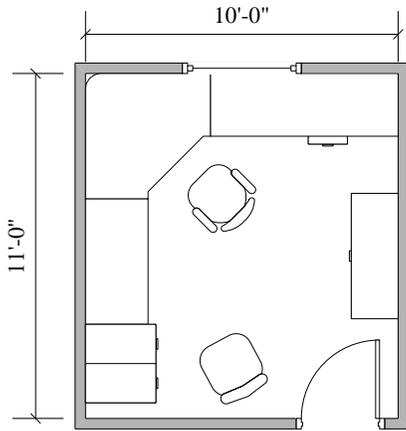


Figure A
Private Office
110 ASF

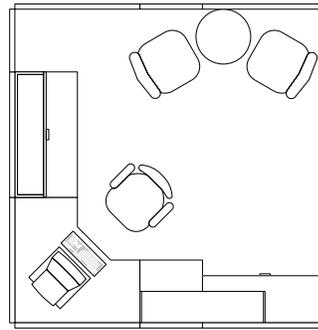


Figure B
Workstation
80-100 ASF

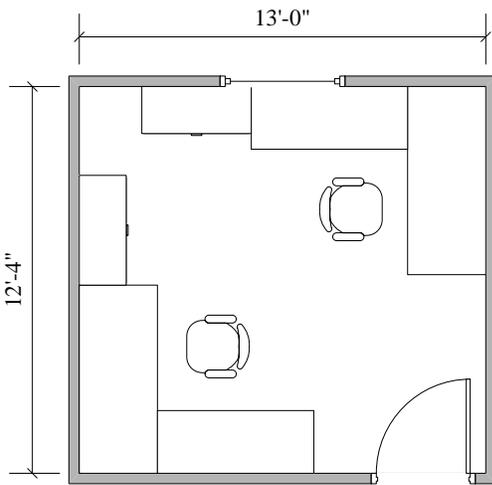


Figure C
Shared Office
160 ASF

- **Academic: Part-time non-tenure track faculty**
- **Lecturers**
- **Consulting Faculty**
- **Visiting Faculty**
- **Visiting Scholar**
- **Fellows**
- **Faculty / Research Associate**

80 ASF

In general, these positions are assigned a shared office of 160 asf with two individuals or an individual workstation. Another option, as space is available, is to create a community of lecturers, visiting or consulting faculty, etc., in similar disciplines as illustrated in Figure C. In special circumstances, as space is available and at the discretion of the Dean, a small private office may be assigned. For Academic Part-time non-tenure track faculty encourage time-sharing or "hoteling" the office space.

Sample office layouts are provided below:

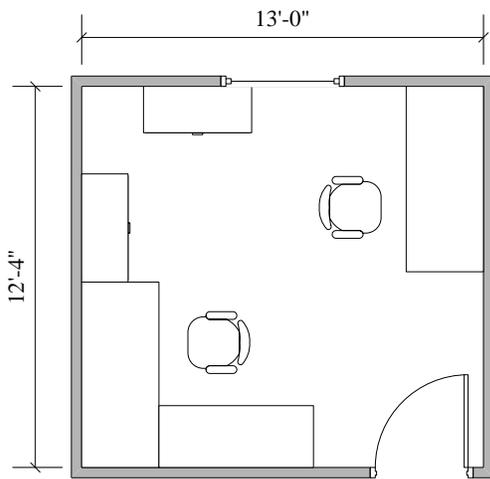


Figure A
Shared Office
160 ASF

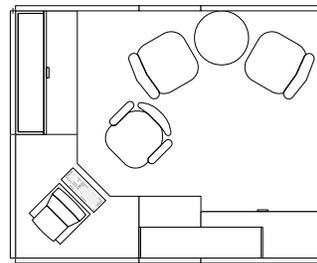


Figure B
Workstation
80 ASF

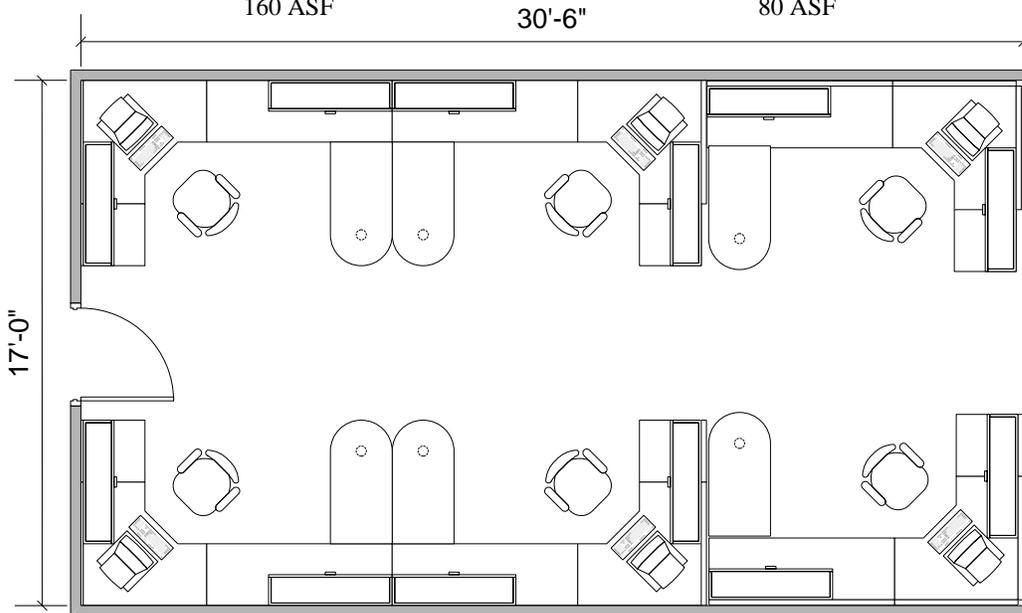


Figure C
Workstation Center
518 ASF

• **Academic: Emeritus Faculty (Active and Non-Active)**

80-140 ASF

Emeritus faculty significantly engaged in teaching, research or other work related to the university may be assigned a private office similar to that of a full-time tenure track faculty at the discretion of the Dean and as space is available. Refer to illustrations provided for full-time tenure track faculty offices.

Emeritus faculty engaged in teaching, research or other university-related work on a part-time basis or infrequently may be assigned a shared office of 160 asf with two individuals or an individual workstation at the discretion of the Dean and as space is available. Another option, as space is available, is to create a community of lecturers, visiting or consulting faculty, etc., in similar disciplines as illustrated in Figure C.

Sample office layouts are provided below:

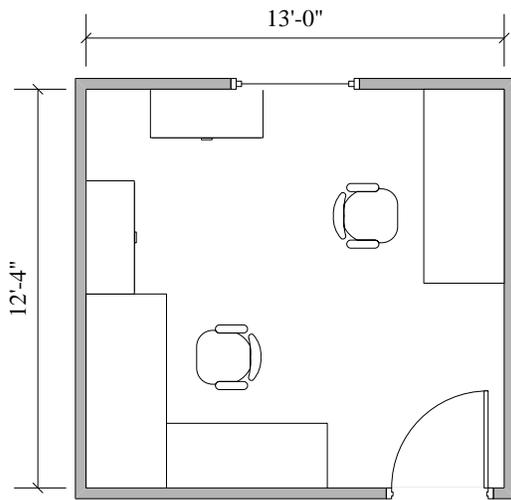


Figure A
Shared Office
160 ASF

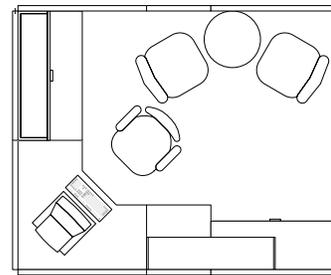


Figure B
Workstation
80 ASF

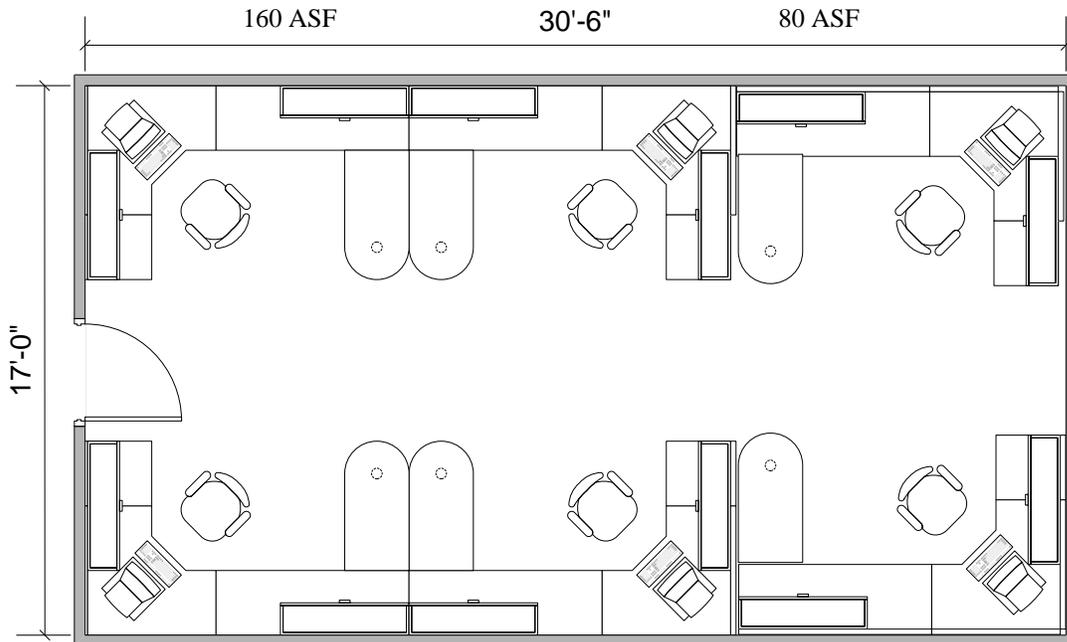


Figure C
Workstation Center
518 ASF

• **Administrative Support Staff**

80 ASF

Administrative support staff are generally assigned a shared office of 160 asf with two individuals or an individual workstation.

Sample office layouts are provided below:

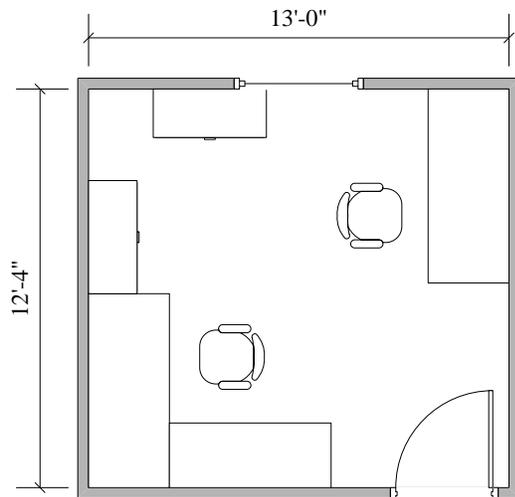


Figure A
Shared Office
160 ASF

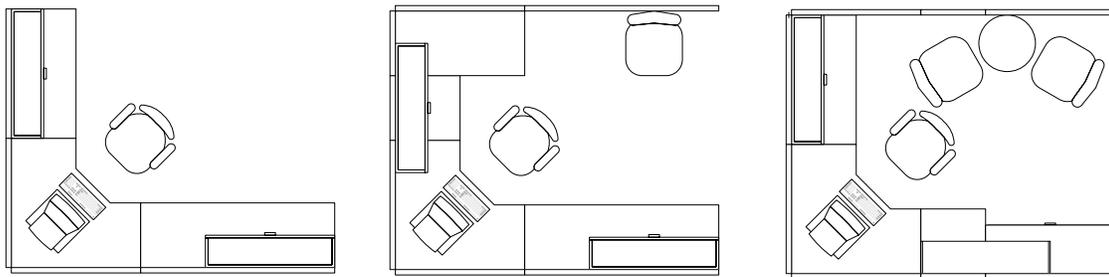


Figure B
Three example workstation
80 ASF

- Academic Graduate TA / RA
- Student Staff
- Temporary Staff

Academic graduate TAs and RAs who are active students are generally assigned shared office or workstations as space is available.

Student staff and temporary staff are generally assigned a small workstation.

Sample office layouts are provided below:

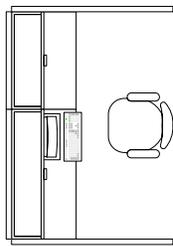


Figure A
Single Workstation
35 ASF

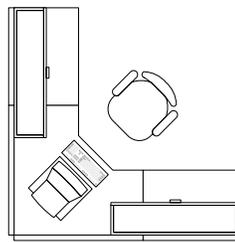


Figure B
Single Workstation
49 ASF

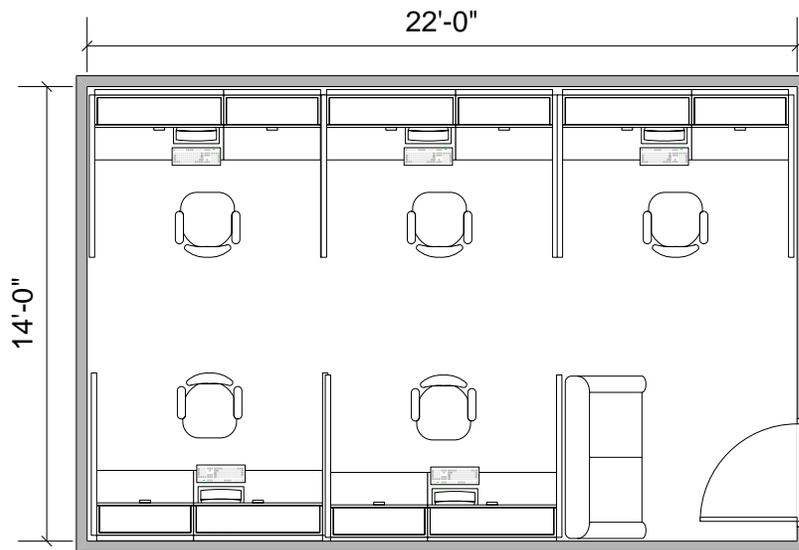


Figure C
Shared Grad TA/RA Office
308 ASF

- **Administrative Part-time Professional**
- **Administrative Part-time Staff**

64-70 ASF

Part-time staff are generally assigned a small workstation. Encourage time-sharing or "hoteling" the office space.

Sample office layouts are provided below:

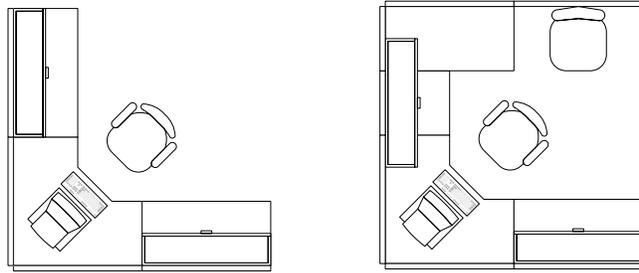


Figure A
Example Workstations
64 ASF

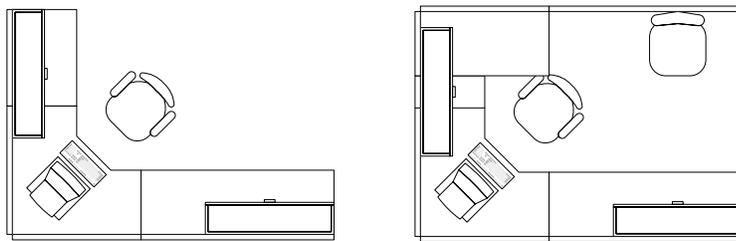
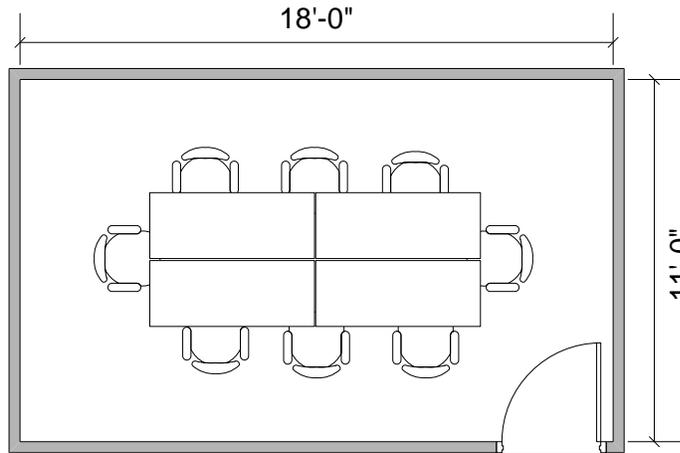


Figure B
Example Workstations
70 ASF

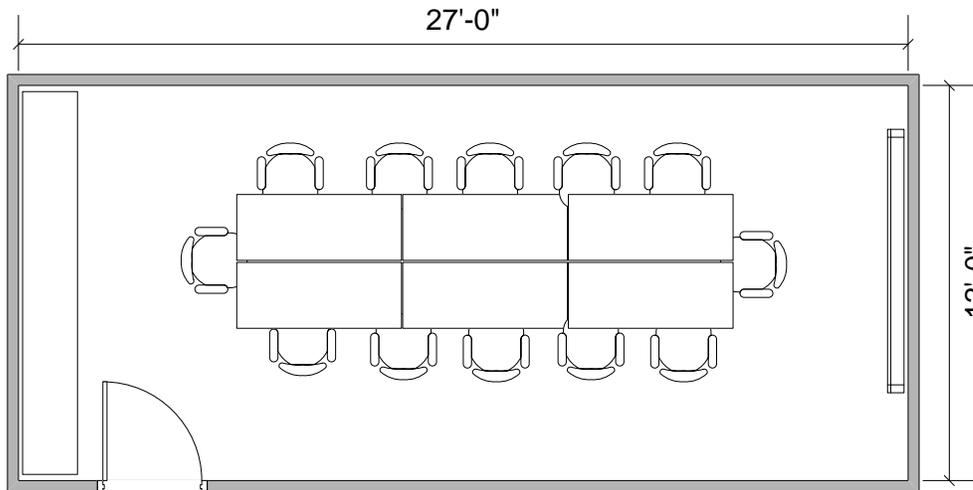
Conference / Meeting Room

- 8 Seats
 - 12 Seats
-

Sample layouts are provided below:



8 Seats @ 25 ASF/Seat
198 ASF



12 Seats @ 27 ASF/Seat
324 ASF

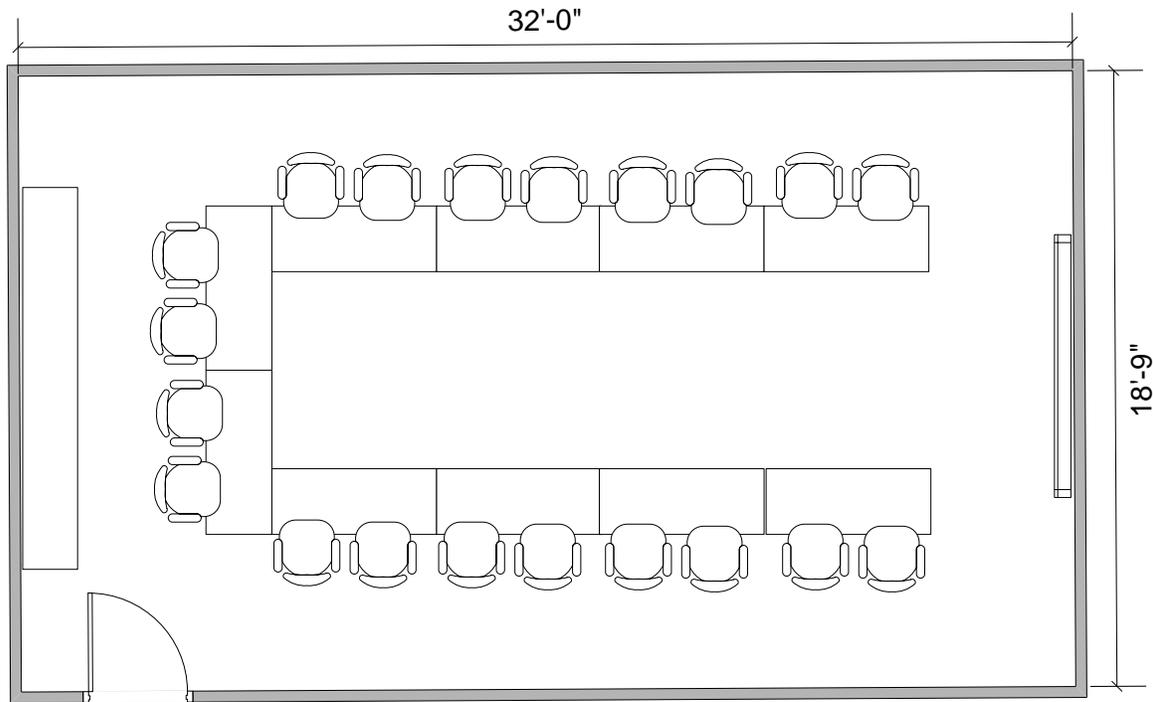
Provided with

- Audio/visual equipment, projection screen/marker board
- Cabinet w/ counter for housing audio/visual equipment, for storage, and for food and drink service

Conference / Meeting Room

- 20 Seats

Sample layouts are provided below:



20 Seats @ 30 ASF/Seat
600 ASF

Provided with

- Audio/visual equipment, projection screen/marker board
- Cabinet w/ counter for housing audio/visual equipment, for storage, and for food and drink service