VCU Finance and Administration

Design & Construction Standards



October 12, 2026

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Design & Construction Standards

Please note: This document contains VCU's Design & Construction Standards. It is evolving and subject to change as we continue to define these Standards unique to our University. If you have any comments, additions, and / or corrections to these Standards please contact Keith Van Inwegen at (804) 828-1204 or kvaninwegen@vcu.edu. Thank you.

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CHAPTER 1 – GENERAL REQUIREMENTS

1.1 Acronyms and Terms

Terms

Integrate — when used in the context of building automation, this means that the system in question will be controlled by the software.

Interface — when used in the context of building automation, this term means that the system in question will communicate with the software, but not necessarily by controlled by it.

Acronyms and Abbreviations

A/E	Architects / Engineers
ABB	ASEA Brown Boveri
ACI	American Concrete Institute
ACMs	Asbestos-Containing Materials
ADA	Americans with Disabilities Act
ADAAS	Assuring Dependability in Architecture-based Adaptive Systems
AFF	Above Finished Floor
AHJ	Authority-Having-Jurisdiction
AHU	Air Handler Units
AMCO	American Meter Company
ANSI	American National Standards Institute
ARR	Association of American Railroads
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, & Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSE	American Society of Safety Engineers
ASTM	American Society for Testing & Materials
AWWA	American Water Works Association
BAS	Building Automation System
BSCs	Biological Safety Cabinets
BTU	British Thermal Unit
CBSS	Chemical Biological Safety Section
CCTV	Closed-Circuit Television
CFCs	Chlorinated Fluorocarbons
CPSM	Construction & Professional Services Manual
CRSI	Concrete Reinforcing Steel Institute

CSA	Canadian Standards Association
DAPC	Division of Air Pollution Control
DC	Direct Current
DCC	Data Communications Channel
DDC	Direct Digital Control
DEB	Division of Engineering & Buildings
DHR	Virginia Department of Historic Resources
DOLI	Virginia Department of Labor & Industry
DVD	Digital Versatile Disc
DX	Direct Expansion
EPA	Environmental Protection Agency
FACP	Fire Alarm Control Panels
FRP	Fiber-Reinforced Plastic
FSC	Forest Stewardship Council
GBI	Green Building Initiative
GC	General Contractor
GFCI	Ground-Fault Circuit Interrupters
GPF	Gallons Per Flush
GPM	Gallons Per Minute
HART	Highway Addressable Remote Transducer
HCFCs	Hydro chlorofluorocarbons
HMMA	Hollow Metal Manufacturers Association
HUD	Housing & Urban Development
HVAC	Heating, Ventilation, & Air-Conditioning
HVLP	High Pressure Low Volume
IgCC	International Green Construction Code
ILSM	Interim Life Safety Measures
IPC	International Plumbing Code
JCAHO	Joint Commission on Accreditation of Healthcare Organizations
LBP	Lead-Based Paint
LCD	Liquid Crystal Display
LED	Light-Emitting Diode
LEED	Leadership in Energy & Environmental Design
MCC	Motor Control Center
MDP	Main Distribution Panel
NAE	Network Automation Engine
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association

NIST	National Institute of Standards & Technology
O&M	Operation & Maintenance
ODP	Open Drip Proof
OEHS	Office of Environmental Health & Safety
OS&Y	Outside Screw & Yoke
OSB	Oriented Strand Board
PCBs	Polychlorinated Biphenyls
PVC	Polyvinyl Chloride
QEI	Qualified Elevator Inspector
RACM	Regulated Asbestos-Containing Material
RCRA	Resource Conservation & Recovery Act
RFCI	Resilient Floor Covering Institute
SCAQMD	South Coast Air Quality Management District
SDI	Steel Door Institute
SWaM	Small, Women-owned, & Minority-owned Business
TAB	Test and Balance
TBD	To Be Determined
TCLP	Total Concentrate Leachate Procedure
TCNA	Tile Council of North America
TEAO	Totally Enclosed Air Over
TEFC	Totally Enclosed Fan Cooled
TMS	The Masonry Society
UPC	Uniform Plumbing Code
UPS	Uninterruptible Power Supply
USBC	Virginia Uniform Statewide Building Code
USC	United States Code
USGBC	United States Green Building Council
VAT	Vinyl Asbestos Tile
VCC	Virginia Construction Code
VCT	Vinyl Composition Tile
VCU	Virginia Commonwealth University
VCUAIT	Virginia Commonwealth University Academic Information Technology
VCUHS	Virginia Commonwealth University Health System
VOC	Volatile Organic Compounds
VoIP	Voice over Internet Protocol
VOSH	Virginia Occupational Safety & Health
VSD	Variable Speed Drives

1.2 Design Philosophy

The total cost of ownership should be considered as an important factor when specifying materials and equipment. It is incumbent upon the project design team to be cognizant of the long term costs and ease of maintenance for all systems and finishes.

Design features that require specialized equipment to maintain and/or are difficult to access shall be prohibited. This provision is to avoid items such as light fixtures that require scaffolding to be erected to be able to service.

1.3 Delegated Design

Any delegated design needs to be reviewed and approved by the VCU project manager prior to beginning design. During design, if the AE desires to specify any work as delegated, the AE is responsible for getting approval from the VCU project manager. Any delegated design items in the final working drawings that have not been approved by VCU will be the responsibility of the AE to fully design and specify at no additional fee.

1.4 General

Noisy, disruptive, construction work will typically not be allowed during the following times.

- Exams
- Clinic Days
- Commencement
- Open House Dates

Refer to the annual calendar on the VCU website: **http://events.vcu.edu**

If noisy operations will disrupt student study time, the work must be rescheduled. If work will block streets, that work must be rescheduled to times other than student move-in or move-out. Disruptive work must be scheduled after normal class times. If the work is in an occupied building and will disrupt ongoing classes, research, or office operations, work must be rescheduled. Work adjacent to residence halls is particularly sensitive, and must accommodate normal sleep times for students.

The VCU Project Manager shall coordinate with the VCU Campus Coordinator for work in the streets and sidewalks, since the VCU Campus Coordinator is familiar with other utility work in the public way. VCU Project Managers and or VCU Campus Coordinators, may be able to assist Contractors in obtaining "Work in the Streets" permits from the City of Richmond.

On occasion, Housing, Student Affairs, and other units will schedule outdoor events in open spaces on campus. The construction phase Project Manager shall verify that open space is unscheduled before turning it over to the Contractor.

1.5 Emergencies, Safety and Security

Prior to mobilization, the Contractor must provide the construction phase Project Manager a list of management personnel assigned to the project, including a 24-hour emergency point-of-contact.

VCU Physical Plant Operations Center	(804) 828-9364
VCU Police Emergency Number	(804) 828-1234
Fire / Medical Emergency	911 then (804) 828-9364
Monroe Park Campus Coordinator	(804) 828-7269 / (804) 400-2190
MCV Campus Coordinator	(804) 828-7248 / (804) 400-2192

Safety & Security

- Contractor's personnel are required to wear ID badges provided by the firm doing the work.
- The University does not permit Contractor's personnel to antagonize or shout at students, faculty, staff, or others.
- VCU is a research and medical institution, and has many hazardous areas. Contractor's personnel should observe and heed all warning signs.
- Jobsite security is the Contractor's responsibility (i.e. control access, shrinkage, etc.)

Worker Behavior & Decorum

Contractor's personnel shall refrain from contact with students, faculty, and staff; other than for interaction necessary for the execution of their contract responsibilities. Expressly prohibited is contact in the form of harassment, whistles, cat-calls, comments, gestures, or any form of uninvited communication. Violation of this policy, even once, will result in immediate and permanent removal of violators from the project site.

1.6 Administrative Requirements

1.6.1 Roles & Responsibilities

The following describes the roles and responsibilities for project decision-making for planning, design, construction, and project turnover.

Schematic Design

- The planning phase Project Manager shall deliver Schematic design documents in electronic format to the Director of Physical Plant (or designees as directed), at completion of the design phase. This is when the commissioning agent will be brought on board. The Director of Physical Plant shall be responsible for submitting comments to the planning phase Project Manager.

Preliminary Design & Working Drawings

- During this phase, the planning phase Project Manager shall conduct a review session with the Design & Construction Standards Committee at the end of each phase, and shall identify appropriate resource personnel for inclusion in the Building Committee design meetings. Project Managers must coordinate audio visual, data, telecommunications, and security during this phase, and inclusion in the cost estimate. Be specific to show the location and number of data drops. Check on janitorial closet space needs, ground storage space needs, and office maintenance and storage needs.

Construction

- Minority (SWaM) Utilization - It is the policy of the Commonwealth of Virginia to contribute to the establishment, preservation and strengthening of minority business enterprises, and to encourage the participation of minority businesses in State procurement activities. Towards that end, the Owner encourages firms to provide for the participation of minority owned businesses through partnerships, joint ventures, subcontracts, and other contractual opportunities.
- Drug-Free Workplace Required - Bidders are reminded that Section 2.2-4312 of the Code of Virginia, requires that during the performance of the contract resulting from this solicitation, the Contractor agrees to (i) provide drug-free workplace for the Contractor’s employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance, or marijuana is prohibited in the Contractor's workplace, and specify the actions that will be taken against employees for violations of such prohibition; advertisements for employees placed by or on behalf of the Contractor, that the Contractor maintains a drug-free workplace; and (iii) include the provisions of the foregoing clauses in every subcontract, or purchase order over $10,000, so that the provisions will be binding upon each subcontractor or vendor.
- “Drug-Free Workplace" means a site for the performance of work done in connection with a specific contract awarded to a Contractor, in accordance with this solicitation, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession, or use of any controlled substance, or marijuana during the performance of the contract.

Project Completion

- As-Built Documents - The Contractor shall complete and deliver As-Built documents within 6 months of project completion. VCU will retain a portion of the fee to ensure timely delivery of the documents. Failure to deliver As-Built documents on a timely basis, will be considered as criteria in future A/E and Contractor selections.
- Close-Out Documents - Operation and Maintenance (O&M) manuals are to be provided during O&M training for VCU Facility Management personnel. Specific warranty information is to be provided prior to, or at Substantial Completion.
- Attic Stock - Attic Stock is to be specified for each finish used per project. Specifiers should consult with the VCU Project Manager to determine the quantity of materials, and storage location.

1.6.2 eBuilder

eBuilder is VCU Facilities Management's project management platform. Project invoicing will be processed through eBuilder for professional services and construction.

1.7 Special Work Restrictions by Building

Certain VCU facilities are heavily used or are environmentally sensitive, that special provisions apply.

1.7.1 Sanger Hall

- Sanger Hall houses animal facilities, which are sensitive to noise, vibrations, temperature, and humidity fluctuations within the animal environments.
- Sanger Hall houses teaching and research facilities, which are also sensitive to noise and construction disruptions.
- Sanger Hall's loading dock must be kept clear of all Contractor vehicles, unless prior permission is granted.
- Sanger Hall houses an electron microscope in Sanger room 3-0067. This room is sensitive to vibration and electromagnetic interference.
- Unless specifically permitted, all construction work in Sanger Hall must be performed during nights and weekends.

1.7.2 West Hospital

Because West Hospital houses VCU Health System (VCUHS) Clinics, this building is subject to accreditation requirements for the Joint Commission on Accreditation of Healthcare Organizations (JCAHO). As such, the conduct of work including clean-up and temporary provisions, must be carefully monitored.

- Complete the highlighted portions of the VCUHS Construction and Renovations Permit and Assessment Worksheets. Project Managers should contact Carlos Brown when doing projects in West Hospital, because there are very few patient contact areas in West Hospital and a permit is not necessarily required for every project.
- Bring the design documents, the approved CO-17 Building Permit for Division of Engineering & Buildings (DEB) reviewed projects, and the semi-completed VCUHS Construction Permit, to the Permit Review meeting when held. If the project was not reviewed by DEB, the Director of Capital Outlay for VCUHS or the Director of Planning & Design for VCU, shall review the design for Code Compliance and sign on the VCUHS Code Official line of the VCUHS Construction Permit.
- Special Hospital Requirements Include:
    - All projects on levels 2 -10 within West Hospital, must have a completed and approved VCUHS Construction and Renovation Permit before work begins. Said Permit shall be presented to the VCU Health System Permit Review Committee for approval. This group meets every Wednesday at 2:00 PM in the Epidemiology Conference room on the second floor of North Hospital. The VCU Project Manager is responsible for completing and maintaining all paperwork, including the submission of daily Interim Life Safety Measures (ILSM) when applicable, the maintenance of the Containment Log, the submission of As-built drawings, and proper close-out of the project. The Director of Capital Programs for the Health System is available as a resource to assist the Project Manager with any questions.
    - Infection Control Procedures: (May impact the cost, and should be identified and establish prior to bid. This activity may occur prior to presenting the permit to the review board. Contact Epidemiology for assistance.
    - Strict adherence to these measures must be followed; all hospital staff are trained to enforce compliance with these standards, and will report any deviations to their supervisor.
    - Daily Interim Life Safety Measures Checklists: When these measures are required, a copy of the checklist must be completed by the Contractor and faxed to the Hospital's Safety Office by 9:00 AM the following morning. Use "TBD" if the dates of the ILSMs that are required are unknown at the time of permitting. Each Monday morning at 8:30 AM, an ILSM meeting is held in West Hospital room 624, in which the previous weeks ILSMs are checked and the current week's ILSMs are scheduled. Attendance is not mandatory, but the dates for your ILSMs must be presented. For assistance, contact the Director of Capital Programs with the information for presentation. These documents are critical for JHACO compliance.

- Health System's Contractor Training for the Foremen and Supervisors: A Copy of the training manual / DVD is located at 700 West Grace Street. This training is valid for one year from issuance of card.
- Hot Works Permits: Note requirements on permit.
- Daily Construction Containment Inspection Log: The log must be updated daily and maintained on-site.
- Badges for Non-Temporary Contractors: VCU badges are suitable.
- Project Closeout Documentation: See permit for requirements. Bring back to Permit Review Board for final signatures. All of the original ILSM sheets, and the complete Daily Containment Log must be included.
- A copy of the Construction Permit must be on-site at all times during construction.

1.7.3 Molecular Medicine Research Building

This building houses animals in the penthouse. Any potential for noise, vibration, temperature, or humidity fluctuations, should be reported to the construction phase Project Manager before work begins.

1.7.4 Massey Cancer Center / Dalton Oncology

Massey Cancer Center houses small animals. Any potential for noise, vibration, temperature, or humidity fluctuations, should be reported to the construction phase Project Manager. Because Massey Cancer Center houses VCUHS Clinics, is it subject to JCAHO accreditation requirements. As such, the conduct of work including clean-up and temporary provisions, must be carefully monitored.

1.7.5 Harris Hall

Harris Hall is very tightly scheduled. Classes often run continuously from 6 AM until 10 PM all weekdays. For this reason, it is difficult to schedule major shutdowns and difficult to schedule work.

1.7.6 Student Housing

Since VCU is in an urban environment, security is extremely important.

1.8 Traffic, Parking, Work in the Street/Sidewalk

1.8.1 Parking Policy

The Contractor is responsible for providing parking for their personnel. In an urban environment, parking is scarce and could be a significant issue that should be considered early in project planning, and in the cost estimate. No parking is allowed on

paved driveways or roads. Vehicles shall not be parked on grass, planted areas, or sidewalks. Vehicles shall not block any means of access or egress. The planning phase Project Manager shall notify VCU Parking and Transportation when parking lots will be disrupted as early as possible. However, these lots should not be closed until a firm construction date is known, and the Contractor is ready to mobilize.

1.8.2 Vehicular & Pedestrian Traffic Management Plan

A/E's and Project Managers should consider the impact of the project on surrounding vehicular and pedestrian traffic flow, and take the necessary steps (such as signage, barricades, and re-striping) to ameliorate problems. These efforts should be included in the schedule, and in the cost estimate. Temporary signage may be needed.

1.9 Permits

1.9.1 Hot Work Permit

Any activity in an existing or occupied facility that generates heat, e.g. welding, soldering, torch-cutting, etc., requires a Hot Work Permit. These permits are available through VCU Fire Safety, by contacting (804) 828-0040.

1.9.2 Building Permits

Because this is a Project of the Commonwealth of Virginia, codes or zoning ordinances of local political subdivisions do not apply. However, the Virginia Uniform Statewide Building Code (VUSBC) shall apply to the Work, and will be administered by the Building Official for State owned buildings. The CO-17 Building Permit will be obtained and paid for by the Owner. All other permits, local license fees, business fees, taxes, or similar assessments imposed by the appropriate political subdivision, shall be obtained and paid by the Contractor.

1.10 Shutdowns

1.10.1 Fire Protection System Shut-Downs

Shut down of fire suppression, fire alarm, and other fire protection systems, shall be coordinated with VCU Fire Safety through VCU Construction Management. A 14 day minimum notice is required, along with provision of a fire watch provided by the Contractor requesting the outage.

1.10.2 Exits

No work shall take place which obstructs the buildings means of egress, without first coordinating with VCU Fire Safety. Additional temporary partitions and doors may be required to eliminate dead-end conditions, and redirect exit access away from a blocked exit.

1.10.3 Electrical Shutdowns

Shut-down of electrical systems must be coordinated with end users, and Facilities Management through VCU Construction Management. A 14 day minimum notice is required. Critical systems may require a provision of alternate or temporary power. The A/E shall identify critical systems during design, and determine requirements to be included in the construction documents.

1.11 Sustainability

1.11.1 General

- The cumulative impact of the design, construction, and operation of built environments, has profound implications for human health, the environment, and the economy. VCU intends to minimize this impact, and will endeavor to create a positive impact whenever possible. A continuing focus on sustainable design of the built environment, will help VCU achieve its Sustainability goal for the year 2025 and 2050, per the VCU Climate Action Plan and VCU Quest for Distinction.
- While sustainable building features may cost more initially than those found in a typical building, implementation of sustainable construction methods typically generates a pay-back in a rather short period of time, and will continue to generate cost savings over the life of the specific sustainable building element.
- Costs, including projected energy and operational costs, must be evaluated as part of the design and value engineering project phases. Sustainable design elements that increase operational costs or generate significant or unusual maintenance activities, will require further justification and approval of VCU.
- Implementation and application of these guidelines are intended to reflect compliance with Commonwealth of Virginia Executive Order No. 19: Conservation and Efficiency in the Operation of State Government:
- http://www.governor.virginia.gov/PolicyOffice/ExecutiveOrders/2010/EO- 19.cfm

1.11.2 LEED (Leadership in Energy & Environmental Design) Certification

- All VCU new construction and renovations greater than 5000 square feet, will be designed to LEED Silver standards which include enhanced commissioning.

1.11.3 Parking Facilities

All new parking facilities shall implement the following sustainable features:

- Install photovoltaic solar panels on the top of parking decks, unless the sun is impeded and the top deck is shaded by nearby structures. Alternate green power

generation technologies may be implemented. Aim to achieve at least net zero power consumption, and preferably assist in powering of nearby structures.

- Facilitate covered bicycle racks, and provide compressed air for bicycle tire inflation.
- Facilitate free premium covered parking for scooters and motorcycles, preferably near vehicle entrances and exits of parking facilities.
- Facilitate free electric vehicles parking. (Minimum Number and or Percentage of spaces).
- Install at least two Level 2, 30 Amp, electric vehicle battery charging stations per parking garage.
- Facilitate preferred parking for alternate fuel vehicles and hybrid vehicles.
- Facilitate free parking for shared transportation vehicles.

Retrofitting of solar arrays to existing structures, requires engineering evaluation of existing structures to validate capacity to sustain additional gravity and wind loads.

Ideally, parking for scooters, motorcycles, and bicycles, will be located to minimize mixing these types of vehicles into the automobile and light truck traffic flow within the parking facility. Preferential parking locations stated herein are subordinate to providing the required number of accessible parking spaces, including van-accessible spaces and providing accessible routes serving all such accessible parking spaces, as required by accessibility codes and the ADA Accessibility Guidelines.

1.11.4 Sustainable Purchasing Guidelines

VCU shall specify the use of environmentally preferable sustainable purchasing guidelines for new construction and renovation projects, to encourage the purchase and use of materials, products, and services that incorporate social, community, and environmental responsibility.

Electric Powered & Electronic Equipment

- Achieve sustainable purchases of at least 40% (by cost) of total purchases of electric-powered equipment including, office equipment (computers, monitors, printers, copiers, scanners, fax machines, etc.), appliances (refrigerators, dishwashers, microwave ovens, water coolers, etc.), external power adapters, televisions, and other audiovisual equipment.
- Energy Star-rated appliances and equipment must be purchased (or leased) when an Energy Star designation is available. http://www.energystar.gov/index.cfm?c=products.pr_find_es_products.

All new copiers, faxes, printers, and other such office equipment purchased or leased equipment, must be recycled paper compatible.

Furniture

Achieve sustainable purchases of at least 40% of total purchases of furniture by cost. Sustainable purchases are those that meet one or more of the following criteria:

- Purchases contain at least 10% postconsumer and or 20% postindustrial material.
- Purchases contain at least 70% material salvaged off-site or outside the organization.
- Purchases contain at least 70% material salvaged on-site, through organization's material and equipment reuse program.
- Purchases contain at least 50% rapidly renewable material.
- Purchases contain at least 50% Forest Stewardship Council (FSC) certified wood.

Purchases contain at least 50% material harvested and processed, or extracted and processed within 500 miles of the project.

Mercury-Containing Lamps

Target for the overall average of mercury content in lamps of 90 pictograms per lumen-hour or less, which include lamps for both indoor and outdoor fixtures. At least 90% of installed lamps must comply with this target (as measured by the number of lamps).

Plumbing Fixture Guidelines

New buildings and future indoor plumbing renovations shall utilize the most current Uniform Plumbing Code (UPC) and International Plumbing Code (IPC) standards, or meet the latest EPA WaterSense Standards wherever possible for the particular application:

Plumbing Best Practices

The following are types of recommended high-performance plumbing fixtures and fittings:

- Dual flush toilets which meet EPA WaterSense Standards, must be used and labeled as such.
- Use low-flow flush toilets approved by the EPA WaterSense Standards.
- All faucets must be approved by the EPA WaterSense Standards.
- Use faucet aerators.
- Use kitchen faucet spray aerators.

Paints & Sealants

- Paints and coating shall have VOC emissions not exceeding the VOC and chemical component limits of Green Seal's Standard GS-11 requirements.
- Adhesives, sealants, and sealant primers must comply with South Coast Air Quality Management District (SCAQMD) Rule 1168, based on VOC limits effective July 1, 2005, and rule amendment dated January 2, 2005.
- Preference is for brushed or rolled on paint procedures. Avoid spraying of paints and sealants whenever possible.
- Painting and coating systems should be selected from products that can be maintained, repaired, and recoated using easily available low- VOC, low-odor materials.
- Where spray-application of paints and coatings must be used, preferred use of High Pressure Low Volume (HPLV), or similar spray systems that minimize over-spray. Effective isolation and ventilation of work areas is required.

1.11.5 Pest Management Plan

Refer to the VCU External and Internal Integrated Pest Management Plans for best practices during new construction. Inquire at Contract Administration for location of plans at (804) 828-1482.

1.12 Lactation Rooms

VCU has a Lactation Policy, see VCU policies for additional detail. This section outlines the VCU architectural requirements for lactation rooms in new construction and major renovations.

1. In new construction and major renovations, a minimum of one lactation room shall be provided.
2. The room shall be ADA accessible.
3. Architectural requirements:
    i. Occupancy: Single or multi stall occupancy shall be determined by the building program.
    ii. Size:
        1. Single Occupancy Room: approximately 80 square feet, ADA accessible
        2. Multi-Unit Room: not typically used at VCU.

iii. Location: Where possible, these rooms should be proximate to other wellness amenities and bathroom facilities. Lactation rooms should be located in a safe area accessible to all.

iv. Privacy & Sound Privacy:

1. Locking options should be considered during the project planning process. Two possible options are: a thumb turn lock with key override or card access control, managed centrally.
2. Sound separation from other spaces (STC rating of 45 minimum)

v. Materials:

1. Red list free for all materials including adhesives, sealants and coating.
2. Non porous flooring such as terrazzo and luxury vinyl tile may be used. Ease of maintenance is a high priority.
3. The space shall be suitable for the preparation and storage of food.

vi. Chair: Task and/or lounge chair. Provide fabric or material designed for easy cleaning or wiping.

vii. Table/Counter: Provide a minimum 24-inch deep by 32-in wide, with laminate or solid surface. Provide clear knee space beneath the counter. Electrical outlets above the work surface should be provided for the pump accessories.

viii. Sink: Provide space and sink for equipment cleaning.

ix. Lighting and HVAC: Natural or soft, dimmable uniform ambient lighting. Task lighting for sink and pump cleaning area.

x. Accessories (to be considered during the project planning process):

1. Trash can, paper towel dispenser, coat hooks, and full-length mirror are required.
2. Refrigerator or storage space for personal cooler, to be considered during the project planning process
3. Storage space a multi-user breast pump, to be considered during the project planning process
4. Location and electrical outlet for a microwave (to sterilize breast pump supplies), to be considered during the project planning process

xi. Scheduling: To be coordinated with the VCU Office Equity and Access Services.

CHAPTER 2 – SITE DEVELOPMENT

2.1 Tree Preservation and Protection

General

The purpose of this section is to provide protection for existing trees on public and/or private property during university sponsored construction projects. VCU will ensure tree protection measures meet or exceed city code where it applies.

Products

Non Woven Textile Fabric

A needle-punched nonwoven geo-textile composed of polypropylene fibers that form a network does not allow the fibers to shift. Examples of this type include Mirafi 140 NL, Thrace-LINQ 130 EX, or an approved equal. Fabric must be UV stabilized and resistant to most chemicals found in the soil, mildew and insect damage. Samples must be submitted and approved by the VCU project manager. Product Physical Properties:

Weight	Minimum 4 oz/yd2
Thickness	Minimum 35 mils
Grab Tensile Strength	Minimum 90 lbs UV
Resistance	70% (at 500 hrs)

Woven Textile Fabric

Woven geo-textile fabric with a minimum tensile strength of 200 lbs. shall be used under 6 inches of washed stone or suitable alternative whenever construction traffic must pass over the root systems of existing trees in unpaved areas. Landscape filter fabric shall be class 2 filter fabric as defined in the AASHTO M 288 Geotextile Specification.

Samples of filter fabric shall be submitted to the project manager for approval prior to installation.

Product Specification:

Type:	100% Polyester
Minimum Tensile Strength:	200 lb.
Elongation:	15% Min.
Minimum Burst Strength:	400 psi

Minimum Puncture Strength:	80 lb.
AOS (min/max):	30/130
Minimum ultra violet exposure strength:	140 lb
Fungus Resistance:	No growth

Tree Protection Barricade Fencing

Barricades shall be constructed of wood. Orange safety fencing, three feet high, or a suitable alternative may be used in lieu of wood rails if approved by the project manager. The installation of orange construction fencing in the right of way shall not inhibit driver and/or pedestrian vision at driveways and/or street intersections.

Execution

Trees designated for tree protection on VCU funded or VCU sponsored construction projects shall have their critical root zone protected by tree barricades installed according to the VCU Tree Preservation and Protection detail and where applicable, by the use of the VCU Bridging Tree Roots detail, the VCU Temporary Tree Protection detail, the VCU Curb Placement at Existing Tree detail and the VCU Rock Chimney detail. See appendix C, figures C37, C38, C39 & C40.

When trees are located within the street right of way, they shall be protected from damage and/or removal per the VCU Tree Protection Standard and/or City requirements, whichever is greater. Trees located on VCU property shall be protected according to the VCU Tree Preservation and Protection Standard. Any proposed construction adjacent to Public Right of Way involving trees or root systems in the right of way should be approved by the City Arborist.

This includes the following: Storm drainage, underground utilities, driveways, sidewalks, etc. The VCU Grounds Superintendent shall review and approve construction plans for trees on VCU property.

B. Boring and Trenching:

Open trenching, including pilot and/or receiving holes, closer to a tree than

Tree Diameter (D.B.H.)	Radial Distance (feet)
< 6”	5 ft.
6” – 9”	5 ft.
10” – 14”	10 ft.
15” – 19”	12 ft.

20” – 30”	15 ft.
Over 30”	20 ft.

Will be considered harmful to the trees unless a boring construction method is performed. Any exceptions must be approved by the Project Manager in coordination with the Grounds Superintendent. Utilities may be tunneled in the root zone at a 24” minimum depth providing that plans are approved showing the location and method.

Curb and Gutter Repair and Construction:

When working to install curb and/or guttering within 10 feet of any tree 12 inches or larger in diameter (D.B.H.) plywood forms or suitable alternative will be used. Clearing, grading, or digging will not be allowed beyond 6 inches from the proposed back of curb unless the Grounds Superintendent has provided approval. Root pruning will be in accordance with Paragraph L, entitled “Root Pruning.” If any portion of the trunk and/or root flare extends over the section being replaced, it cannot be damaged during construction even if a small portion of the old structure must be left in place.

Sidewalk Repair and Construction:

When working within 10 feet of any tree 12 inches or larger in diameter (D.B.H.), plywood forms or suitable alternative swill be used. Clearing, grading, or digging will not be allowed beyond 6 inches from the proposed edge of the sidewalk unless the Grounds Superintendent has provided approval. Root pruning will be in accordance with Tree Preservation and Protection Standards, Part 03-L entitled “Root Pruning.” If any portion of the trunk and/or root flare extends over the section being replaced, it cannot be damaged during construction even if a small portion of the old structure must be left in place. Narrow sections of sidewalk will be constructed in accordance with direction from the Project Manager and no less than 40 inches in width. Bridging of large roots will be in accordance with the VCU Bridging Roots Detail, Appendix C figure C38.

Barricade Fencing:

Barrier fences shall extend around the trunk as shown on the VCU Tree Protection detail to encompass the critical root zone. So defined, it shall encompass the trees with a radius of not less than one foot (1’) for every one inch (1”) of trunk diameter (critical root zone) unless otherwise detailed in plans. When a circular or nearly circular area of this radius cannot be protected due to project design constraints, then an asymmetrical critical root zone area shall be encompassed in the barricade fencing and shall be constructed around the tree which encompasses an equal area (square footage) of critical root zone. Barricade fencing shall not be placed closer than four feet (4’). Deviations from this must e approved on an individual basis by the project manager and Grounds Superintendent.

All tree protection barriers shall be installed prior to any grading or other land disturbing activity. They shall be constructed from any material substantial enough to designate the protected area and to protect the roots, trunk, and crown of the tree. Example: 2 x 4 standards and 1 x 4 rails; 3' high orange safety fencing, etc.

Trunk Protection:

See VCU Temporary Tree Protection Detail, Appendix C, figure C39. Batter boards and sand bags will be installed when working within 10 feet of any trees 12 inches or larger (D.B.H.). The purpose of these items will be to protect the trunk or root flare from damage during construction.

Temporary Access:

Permission may be granted to allow temporary (3 days) access across critical root zones

Mulch 8 to 12 inches deep with woven geo-textile as specified in "Tree Preservation and Protection," products, or approved equals laid underneath, shall be required in these areas to act as a cushion to prevent soil compaction. Mulch and fabric shall be removed after construction is complete.

Root Zone Protection:

Tools, materials or machinery in any portion shall not be stored within the critical root zone.

Fill Around Existing Trees to Remain:

No fill dirt greater than two inches (2") shall be allowed over the critical root zone of the tree. Deviations from this must be approved on an individual basis by the project manager and Grounds Superintendent.

Clearing within Critical Root Zone:

In the critical root zone, removal of any portions of old sidewalk, driveway, and/or curb shall be done with extreme care so as not to damage any portion of the branches, trunk, or roots.

In the critical root zone, any stumps, dead trees and shrub growth to be removed shall be cut flush or ground out. Stump grinding will be performed only when necessary with appropriate equipment to a depth of 12 inches. All holes will be backfilled completely the same day of the operation. Stumps to be ground out will be designated by the project manager. No grubbing is permitted in critical root zone areas.

Tree Damage:

Climbing irons, spurs or spikes shall not be used on trees to be pruned and are only allowed on trees to be removed. Any tree damage caused by the contractor is to be repaired immediately at no cost to the University and to the satisfaction of the University. Any damages resulting in the disfigurement and/or shortened life expectancy of a tree will be evaluated by the Grounds Superintendent, are to be removed as no expense to VCU, and replaced by trees of size and species designated at no additional cost to VCU; or the dollar value of such damaged trees as determined by the Grounds Superintendent is deducted from the monies owed the contractor. The tree values will be determined by using the guidelines in the Tree Evaluation Guide by The International Society of Arborculture (I.S.A.).

A minimum fine of $50 will be assessed for each incident of bark and cambium damage of 4 in. width or less where restrictions are violated. If damage is larger, damages will be assessed using I.S.A. Tree Evaluation Gide Procedures. Fines will be deducted from the monies owed by the contractor.

Discontinuance of Work:

Any practice obviously hazardous to people or harmful to the trees, as determined by VCU, shall be immediately discontinued by the Contractor upon receipt of either written or oral notice to discontinue such practice.

Root Pruning:

Root pruning shall be kept to an absolute minimum. In no case shall any root be pruned that is 1 ½ inches in diameter or greater without the express permission of the Project Manager or Grounds Superintendent.

All roots proposed to be cut shall be located in advance at a point 6-12 inches outside the proposed cut by using a shovel, a prove, a high pressure stream of water, air evacuation tool or other approved method. The cut is to be made no more than 6 inches behind the back of the curb, wall, or other structure to be built. Pruning shall only be performed to the minimum depth required the structure. The roots shall be cut cleanly leaving a smooth surface. Root pruning equipment shall always be kept sharp to ensure that roots are cut cleanly and are not broken or torn by dull or unsuitable equipment.

Pruning and Thinning of Existing Trees:

All pruning shall be in accordance with ANSI A300 for Tree Care Operations – Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices.

Tree Preservation:

The Grounds Superintendent must approve all tree removals from VCU owned property. The City Arborist must approve all tree removal from the city right of way. Signature of an authorized representative of the Grounds Superintendent or City Arborist on final construction plans and documents constitutes the express approval of the Grounds Superintendent or City Arborist

Clean Up:

Remove all barriers upon completion of project and fill the holes left by vertical posts of fencing with suitable soil. Restore area to original condition.

2.2 Civil and Site Work

2.2.1 Earthwork

The A/E shall consider the recommendations in the geotechnical/soils report in developing the design.

Drawing details of the following conditions will be required:

- Over-excavation and replacement with suitable materials.
- Subsurface profiles (boring logs) and limits showing the extent of rock, existing fill materials, water and existing unsuitable bearing materials.
- Specific drawing notes stating that earthwork details shall be included in the base bid. Earthwork beyond the extent indicated will be considered for an extra cost, only if necessary and approved by the A/E, and not a result of the contractor's failure to maintain site/excavation stability, drainage or protection from frost penetration.
- Earthwork specifications shall be definite, not general.
- Coordinate Specifications with the Drawings.
- Include a geotechnical/soils report in the Appendix to the Specifications (Project Manual) and a disclaimer stating that the report is not part of the Contract Documents each time this report is referenced.
- Specifications for materials and instructions shall state whether they are included in the base bid or will be an extra cost item.
- Rock excavation shall be included in the base bid to the extent that locations are sufficiently identified in the geotechnical/soils report. See Section 702C.

Earthwork specifications shall include soil and aggregate material definitions for all materials used in 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 definitions below are by the Unified system. The aggregates

shall include gradations required for each material. Note: Unedited master or standardized specifications often are too conservative in defining soil materials - often eliminating the on-site soils as acceptable materials, even for general fill/backfill. Quality control is also often not provided in the form of aggregate gradations. All A/E standard specifications shall be edited to conform to the following requirements:

- Structural fill/backfill - Generally restricted to GW, GP, GM, SM, SW, and SP unless other materials are specifically approved by the soils engineer or firm that conducted the on-site soils evaluations. SC, CL, and ML might be considered in some situations with the approval of the soils engineer.
- General fill/backfill - Includes all classifications of materials noted above.
- Unsuitable Materials - Includes OL, MH, CH, OH and PT, saturated material which in the judgment of the soils engineer cannot be aerated to be made acceptable, uncompacted fill (for structural bearing conditions), fill with unacceptable quantities of non-soil products, or other materials judged unsuitable by the soils engineer.
- Aggregates - They may include porous backfill, pipe bedding, under slab fill, any special blend or open-graded material required for a special bearing or drainage use.
- Moisture content of soil materials - Laboratory tests are generally conducted on samples to determine the maximum density of soils, usually achieved at optimum moisture content. Field conditions during construction prevent attaining and maintaining the optimum moisture content. This requires that a tolerance for departure from this optimum must be specified. This tolerance is generally specified in the range of plus or minus 3% to 5% from the optimum moisture content without significantly affecting the ability to achieve the specified density.
- Quality Assurance / Testing - The specifications shall list the tests required to be performed on the Work (i.e. ASTM, AASHTO, VDOT or other test procedures) and stipulate the values to be achieved.

2.2.2 Stormwater Management & Erosion and Sediment Control Requirements

Virginia Commonwealth University is subject to project review and compliance for state erosion and sediment control. Disturbance of land exceeding 10,000 square feet (or lesser area if adopted by the Local Soil and Water Conservation District) requires submission of an erosion and sediment control plan and narrative to VCU Planning & Design who will contract with a civil engineer to review E & S plans or to the local program authority of the locality within which the land disturbing activity is located for approval.

Disturbance of land exceeding one acre requires submission of a stormwater management plan with calculations to the University and the locality within which the land disturbing activity is located. This is not a substitute for the erosion and sediment

control plan, but is an additional requirement to manage the runoff and quality of the stormwater collected on the site. The local authority should be contacted for information on the required calculations and submissions for approval of the stormwater management plan or clarification of regulations. Approval of the plan shall be secured prior to the bid advertisement.

Any disturbance of land requires calculation of net changes in impermeable areas and must be reported to the University in order to be in compliance with regional storm water master plans approved by DCR. Facilities Management Directive 523 (pending) addresses the responsibilities involving review and approval of a project use of regional University storm water facilities (use of current capacities and/or alternative resolutions.

Disturbance of land exceeding five acres requires a discharge permit issued by the Department of Environmental Quality. This is not a substitute for the erosion and sediment control plan or the stormwater management plan, but an additional requirement. Contact the Department for permit applications and clarification of the regulations. The permit shall be approved prior to bid advertisement.

Disturbance of land exceeding one acre but less than five acres requires contractor to file, or cause responsible soil disturber to file, a Virginia Pollutant Discharge System General Permit Registration Statement for Storm Water Discharges from Construction Activities with DEQ on DEQ-Water Form swgp99-004-req and provide a copy of registration statement to the Virginia Commonwealth University.

Plans and Specifications: Requirements shall be included in the specifications to assign to the contractor (as part of the contract) the responsibility of erosion and sediment control and stormwater management 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 control (EC) and stormwater management (SWM) requirements for any land disturbing activities, including but not limited to, on-site or offsite borrow, on-site or offsite 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 Regional Office of the VIRGINIA COMMONWEALTH UNIVERSITY HECO MANUAL 82 Division of Soil and Water Conservation to determine what EC and SWM measures are necessary. The Contractor shall completely satisfy all requirements of the Division of Soil and Water Conservation before continuing with the concerned activity."

Note: This instruction may be added to one appropriate specs section - such as Erosion and Sediment control or Earthwork - with a reference made to that section each time borrow, waste or stockpiling is mentioned in other sections.

Computation and recordation of all new impermeable areas must be calculated. These quantifies shall be highlighted when submitting plans and specifications for the University's Review

2.3 Parking

2.3.1 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 Virginia Commonwealth University property. Parking configurations, aisles widths, etc., shall be designed to meet or exceed the minimum dimensions recommended by recognized standards for parking designs. 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, if applicable.

Type Vehicle	Minimum Width	Minimum Length	Minimum Area
(For Self-Park Decks)			
Standard Cars	8'-6" min.	18'-0"	153sf
Compact Cars*	8'-0"	15'-0"	120sf
Handicapped Spaces** -See ADAAG 502			
(For Self-Park Lots)			
Standard Cars	8'-6" min	18'-0"	153sf
Compact Cars *	8'-6"	15'-0"	127.5sf

2.3.2 Handicapped Spaces** See ADAAG 502

*Compact car spaces may be incorporated/designated where 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.

2.3.3 Policy for Parking Space Planning

The following policy applies to all new buildings, additions and conversions. The Planning Project Manager shall evaluate parking needs at the programming phase of the project and shall notify VCU Parking & Transportation (P&T) of the potential loss of parking spaces associated with construction. However, it is not advisable to provide a

firm date for P&T to evacuate the lot until we are certain that construction activity will commence immediately after the lot is vacated.

The University, through Parking & Transportation, maintains a parking inventory and the need for additional parking space associated with new construction is evaluated not on a building-by-building basis, but based on the supply and demand of the entire campus. Parking for the disabled must be provided closest to the building entrance.

If on-site parking is provided as part of the project, it should comply with the University's standards including fencing, lighting and landscaping.

All parking spaces even if constructed as part of a project, are owned and maintained by VCU's Parking and Transportation Unit.

2.4 Crime Prevention (CPTED)

Crime Prevention Through Environmental Design (CPTED is a multidisciplinary approach to deterring criminal behavior through environmental design. The VCU campuses should comply with CPTED standards. CPTED strategies rely upon the ability to influence offender decisions that precede criminal acts by affecting the built, social and administrative environment.

While VCU is interested in the protection of students, faculty and staff, the measures taken for security must be evaluated in the context of a collegiate environment. The campuses should convey a sense of welcome and openness and should not appear to be a "bunker."

The following considerations shall be applied to site and building design, unless precluded by the siting of buildings per the effective University Master Plan. These considerations are in addition to mandatory site lighting requirements found in this document. The University generally follows Crime Prevention through Environmental Design Principles.

2.4.1 Street and Site Planning

The siting of building(s) and the landscape design shall optimize lines of sight for police surveillance around all sides of the building(s) and where crowds can congregate.

Offsets in building(s) or courtyards are discouraged where they cannot optimize public or police surveillance. Video camera surveillance with monitoring capability shall be considered where sightlines do not provide this surveillance.

Where dictated by University site selection, buildings sited adjacent to wooded areas or properties not under University ownership shall consider appropriate measures to discourage unlawful entry and endangerment of University personnel, students and public visitors.

Create landscape designs that provide surveillance, especially in proximity to designated points of entry and opportunistic points of entry.

Ensure potential problem areas are well lit: Pathways, stairs, entrances/exits, parking areas, ATMs, bus stops, children's play areas, dumpster and recycling areas.

2.4.2 Parking

Parking areas shall be readily observed with landscaping that screens vehicles without preventing surveillance.

Siting for parking areas intended for night activities shall be optimized to reduce isolation from building entrances serving the night activities.

Parking structures shall be fenced/secured at grade levels, excluding required vehicular entrances and exits. If video camera surveillance is not provided, conduit shall be installed to accommodate future installation with provisions for adequate electrical power in the original design. Dead areas adjoining or in stairs or elevator lobbies shall be avoided.

Elevator and stair towers associated with parking structures shall be located on the perimeter of the structure adjacent to a traveled walkway or street, with optimum glazing or openings to optimize police surveillance.

2.4.3 Walkways

Landscape planting shall not obscure lines of sight from adjoining streets, public areas and occupied buildings in order to optimize security by police and public surveillance. Walkways that cannot accommodate these criteria may require additional width to improve sightlines and/or permit surveillance using bicycles and/or low-horsepower vehicles.

Landscape planting, walls, and fencing along walkways shall not provide hiding places for potential assailants. Use the shortest, least sight limiting fence appropriate for the situation.

2.4.4 Buildings and Structures

In addition to criteria for Street and Site Planning, and Parking, buildings and structures shall discourage unplanned access to other buildings through basements, underground utility structures, attics, corridors that do not lend themselves to security surveillance, or across roofs.

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 Facilities Management's Control Center as well to audible devices at the point of entry and elsewhere within 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.

2.4.5 ERTS & Phones

See 6.7 - Electronic Safety and Security

2.5 Pavements

A consistent pavement treatment for sidewalks is an important design element to unify VCU's two campuses. The use of brick pavers is a link to Richmond's historic past and is an attractive alternative to concrete. There are many areas on the Monroe Park Campus where old brick pavers have existed prior to the development of VCU. Where these old pavers have either settled or deteriorated and now represent a hazard to pedestrians, the University should replace these with the campus standard brick paver as detailed in this standard. Even though these sidewalks may be the responsibility of the City of Richmond, the University should take the lead in encouraging the replacement of the paving in these areas.

Installation of brick pavers in sidewalks within the city right-of-way requires the approval of the city's Urban Design Committee and must adhere to Department of Public Works standards. The city's standard paver is a two and a quarter inch thick brick paver over a one inch sand setting bed over a four inch thick concrete base. Agreement by the city to maintain the walks is contingent on this detail being followed. See Appendix C, figure C-1.

The campus standard brick paver is a 4" x 8" extruded brick paver. Other brick pavers exist on campus, some are old city bricks and some have been installed by the University as part of building projects. The goal is to eventually replace these with one paver for the entirety of each campus.

2.5.1 Brick Pavers

Installation of brick pavers in sidewalks within the city right-of-way requires the approval of the city's Urban Design Committee and must adhere to Department of Public Works standards. See Appendix C, figure C-1

- Pedestrian Brick Paver: 2 ¼" thick x 4" x 8" brick paver. Pine Hall Pathway Full Range.
- Vehicular Brick Paver (including crosswalks): 2 ¾" thick x 4" x 8" brick paver. Pine Hall English Edge Full Range.

The standard for the MCV Campus and most of the Monroe Park Campus shall be a full width brick sidewalk. The exceptions are the West Broad Street and Belvidere Street areas of the Monroe Park Campus, which have different standards in response to streetscape projects constructed by the City of Richmond. For courtyards and plazas

outside of the city right of way, other unit paving materials may be considered with the approval of the University Architect.

The standard paving pattern shall consist of a full width brick sidewalk with an eight inch brick border course along the curb and the edge of the walk. The field pattern shall be a herringbone pattern with the paver set at a 45º angle with the pattern pointing along the direction of travel. Some variations on this shall be permitted at entrances to buildings and prominent intersections. See Appendix C, figure C-4 for typical paving plan. Accent paving at building entrances should be of the standard brick paver and may take the form of accent bands and a change in field pattern. The use of accent colors is not allowed. Where brick sidewalks adjoin landscape beds, a concrete edge shall be used as an edge restraint

Along West Broad Street on the Monroe Park Campus between Bowe and Belvidere Streets, the standard paving detail shall be a pattern that is similar to the City's West Broad Street Streetscape Guidelines. A 5'-0" wide band of brick pavers with an 8 inch brick border shall run 7'-6" from the back of the curb with the remainder of the sidewalk concrete. The pattern of the brick shall be the same herringbone pattern as the campus standard sidewalk. Where there are tree wells, there shall be a two foot wide band of brick pavers along three sides of the tree well. See figure See Appendix C, figure C-5. The standard for Belvidere Street consists of a concrete sidewalk with planting strips that are bordered by brick pavers. See Appendix C, figure C-13.

Shafer Court has a paving pattern that combines 6'-0" squares of brick pavers and 3'-0" wide concrete bands. This style of paving should be limited to the area immediately adjacent to the Compass in Shafer Court between Hibbs Hall, Cabell Library and the Shafer Court Dining Center. See Appendix C, figure C-14.

2.5.2 Crosswalks

The urban nature of the campuses of VCU are such that faculty, staff and students frequently are required to cross city streets to get to their destination. Crosswalks that are constructed of brick pavers are a visible signal to drivers to be mindful of pedestrians. Brick paver crosswalks exist on the Monroe Park campus on Floyd Avenue and on Belvidere Street and the use of them on campus should be expanded.

There are several locations on campus where the main north-south pedestrian corridor crosses busy streets that are heavily travelled throughout the day. The intersections of Shafer and West Grace Streets, Shafer and West Franklin Streets, Linden Court and West Main Street and Linden Court and West Cary Street are major intersections that would benefit from brick paver crosswalks.

The construction of these crosswalks shall be a heavy duty clay paver of the same color and manufacturer as the standard brick paver for vehicular areas described previously.

This paver shall be set over a one inch sand setting bed over a six inch reinforced concrete base. The joints shall be swept with a polymeric sand which matches the color of the concrete bedding sand. The paver crosswalk shall be bordered by a twelve inch wide cast in place concrete border. See Appendix C, figures C-2 and C-8.

2.5.3 Chokers

In an urban setting such as VCU, chokers can enhance the streetscape by providing visual interest along asphalt roadways that crisscross the campus. Aside from their aesthetic value, chokers are highly functional. They help define parallel parking lanes as separate from the vehicular lanes of travel. Chokers prevent drivers from using parking lanes for travel thus creating a buffer between pedestrians using the sidewalk and moving vehicles. They also provide a measure of safety for pedestrians crossing the street by providing drivers with added visual definition at crosswalks.

The brick paving pattern for chokers at the MCV campus and Monroe Park Campus, excluding West Broad Street, shall be consistent with the herringbone field pattern of the adjacent brick sidewalk. An eight inch brick border course shall be constructed along the concrete curb. The brick pavers used in the construction of these chokers shall be of the same color and manufacturer as the standard brick paver for pedestrian areas described previously. See Appendix C, figure C-10.

Designers shall meet with the University Landscape Architect to discuss the specific aspects of projects requiring chokers to determine if they should be paved or landscaped. The context of the surrounding neighborhood shall be considered.

2.5.4 Curb Ramps

Curb ramps provide an accessible route for people with disabilities to safely transition from a curbed sidewalk to the roadway. Ramps shall be located at street crossings, parking lots, and other public rights-of-way requiring access such as bus stops. Although the most recent version of the Americans with Disabilities Act (ADA) does not require the tactile warning strips, the City of Richmond still does and the majority of curb ramps at VCU are in the public right of way. Therefore, unless the City rescinds this requirement, the following standard applies.

The standard ADA curb ramp detail shall consist of a 24” x 48” tactile warning strip by ADA solutions or equal that abuts the concrete curb. Color shall be gray unless approved by the University Architect. An eight inch brick border course shall surround the remaining three sides of the warning strip and continue along the concrete curb on either side of the warning strip. The remainder of the ramp shall be brick laid out in a herringbone field pattern consistent with the pattern of the sidewalk. See Appendix C, figures C-6, C-7, C-9, C-10, C-11 & C-12. The brick pavers used in the construction of these curb ramps shall be of the same color and manufacturer as the standard brick

paver for pedestrian areas described in section 2.5.1. The slope of the ramp shall be no greater that 1:12.

Refer to the most recent update of the Americans with Disabilities Act for federal regulations regarding the construction of ADA curb ramps.

For ADA curb ramps on concrete sidewalks, the detail is the same except the brick pavers are replaced with cast in place concrete.

2.5.5 Walkable Spaces

College campuses are inherently pedestrian oriented and the issue of walkability is one that must be addressed by creating a pedestrian friendly environment. VCU must address walkability within the framework of an urban campus in which high volumes of students and faculty will flood the sidewalks at multiple times throughout the day. There are several guiding principles of creating walkable spaces that are relevant to the Monroe Park and MCV campuses.

Protect the Pedestrian - Sidewalks are the primary pedestrian routes at VCU and proper planning is necessary to ensure they are functional and can accommodate the volume of pedestrians. Streetscape elements such as trees, light poles, signage, etc. can impede the pedestrian and should be located along the back of the curb line as much as possible so they are out of the main travel path. The area behind the tree wells is the main travel path and should be a minimum of five feet wide. There are many areas where this will be too narrow for the traffic flow and a wider sidewalk should be considered.

In areas where the sidewalk condition has deteriorated, whether it be heaving brick pavers or crumbling concrete, repairs should be made to reduce the hazard to the pedestrian.

Traffic calming should be encouraged throughout the campus as it has been shown that slower speeds for cars is safer for pedestrians. On street parking acts as a buffer to the sidewalk from moving traffic and should be encouraged. The use of chokers to define the parking lanes and reduce the distance pedestrians have to cross as well as provide for better visibility. Brick paver crosswalks increase the visibility of the crosswalk and can help calm traffic as well.

Plant Trees - Trees are an essential part of any streetscape and they contribute to the walkability of an urban campus. When located along the back of the curb they add to the protection of the pedestrian from traffic. Street trees contribute to traffic calming which reduces accidents while also providing an environmental benefit. The shade provided not only helps reduce cooling demand on buildings but also makes the walkways more pleasant on hot sunny days. They also help bring the street down to a more human scale.

Accessibility - Walkable spaces must accommodate those with disabilities and as such sidewalks, curb ramps, driveway crossings, benches and other basic amenities should be provided.

Lighting - Security at night begins with proper lighting. Public outdoor spaces such as streets, sidewalks, plazas etc. should be lighted. This lighting shall conform to the standards referenced in section 2.8 and should be of a sufficient level to deter crime and vandalism

Street Level Architecture - Buildings with street level activity including retail uses animate the sidewalk. Architecture that engages the street should be encouraged to entertain and create interest among the pedestrian.

Chokers - The use of chokers is encouraged to shorten the distance walked across streets. Choker are also a traffic calming strategy and pedestrians are better protected from traffic.

Linkages - Shafer Court and Linden Court were created specifically to link the campus together. This pedestrian highway is much wider than a typical sidewalk and removes the automobile from the equation. These spaces have also become places for students to gather and for students to interact with one another.

2.5.6 Courtyards

In its 1996 master plan, the university adopted the practice of designing buildings to meet the property line, having the sidewalk meet the building with no landscaped strip. This practice has enhanced the urban quality of the campuses and at the same time it has concentrated the open space in courtyards. These courtyards are buffered somewhat from the sounds of the city and offer privacy from the passing traffic. Below are the guiding principles for the design of courtyards.

- Pedestrian Circulation - The circulation patterns into and through the space should be considered. Students will typically follow the most direct path through a space and those desire lines should be incorporated into the design. This will reduce or eliminate students trampling landscaping or wearing paths in lawn areas.
- Seating Areas - A successful courtyard provides spaces for students to gather in groups both large and small. Seating can take the form of tables with attached seating or seat walls. Tables with seats allow students to sit for longer periods of time and work on laptop computers or eat lunch while seat walls are more informal and are used more as a short term option. These seating areas should use site furnishings that are part of this amenity standard. Although the space may not be visible from the street, the use of furnishings from the Campus Amenity Standards results in a unified look to the campus and is easier to maintain and replace

damaged furnishings. Trash receptacles shall be provided in a location convenient to building points of entry as these spaces are frequently used for eating.

- Courtyards or open spaces that are adjacent to the public way should be at a grade elevation higher than the sidewalk. This asserts a measure of privacy and deters entry for those who do not belong there.
- Green Space - The master plan makes reference to the limited green space available and courtyards should be used to provide a respite from hardscape areas. Green space can take the form of planted landscape beds or open lawn areas. Ideally there is a mix of both. The landscape beds provide interest and accent to the architecture and the lawn areas give students the flexibility to sit on the grass or throw a Frisbee. Green spaces also have an environmental impact as they reduce the amount of impervious area on campus which reduces the storm water runoff.
- Sun Shade - The height of the buildings and the proportional size of the courtyards will produce shade and this should be considered in the design of these spaces. Lawn areas need sunlight daily to survive and plantings should be designed to respond to the amount of sunlight they will receive. Seating areas should be positioned to allow for both sun and shade as the seasons change.
- Hardscape Materials – Given the internal nature of most courtyards, these spaces are not readily visible from the street. Therefore there is flexibility in the design of the hardscape. The paving materials may vary from the standard brick paver and should be in harmony with the architecture of the building. The use of permeable pavers is also encouraged to reduce the percentage of impervious area. However, any variances from the standards must be approved by the University Architect or the University's Landscape Architect.
- Lighting – Lighting is an integral part of security and should be a part of all courtyard designs. As with the hardscape materials, variance from the Campus Amenity Standards is permissible to allow the courtyard to be an extension of the architecture. The lighting should be pedestrian scale and the fixtures should be an ornamental type head and not a shoe box style fixture. In other words if the light fixtures are going to deviate from the standard, they need to add aesthetic value to the courtyard. The use of LED as a light source is encouraged. However, any variances from the Campus Amenity Standards must be approved by the University Architect or the University's Landscape Architect
- Trees – Large shade trees shall be located in courtyards in sufficient quantities to produce an immediate impact. In the winter months when the sun angle is low, the courtyards tend to be shaded by the adjacent buildings. However in the warmer months, there is little shade in the middle of the day and the presence of large shade trees will make the courtyards more inviting. Another benefit of these trees is

to reduce the scale of the space and to provide a sense of privacy. The adjacent buildings are usually at least three stories tall and the trees help to make the space more human scale. The minimum size at the time of installation shall be three and one half inch caliper.

2.6 Site Furnishings

2.6.1 Benches

Benches are the most common form of seating used at VCU and the most common bench is the metal ribbon bench. These benches are to be used on all streetscapes and spaces visible from the street. They should also be used in Residential Life courtyards as they are durable and resistant to vandalism. The standard ribbon benches shall be shop painted steel and can be obtained from different manufacturers.

The benches shall be bolted to the pavement to prevent movement and theft. See Appendix C, figureS C-16 & C-17. Benches may also be used as a class gift. See Appendix C, figure C-15.

Manufacturer:	Victor Stanley
Catalog No:	RB-28 – 6 ft. length
Color:	Black

Manufacturer:	Timberform Renaissance
Catalog No:	2806-6 – 6 ft. length
Color:	Black

Manufacturer:	Keystone Ridge Designs
Catalog No:	P26C 6’ Pullman – 6 ft. length
Color:	Black

There are spaces on campus in which different styles of benches have been used. These spaces are smaller, more contemplative style gardens and courtyards, such as the School of Nursing garden. The use of non-standard benches is not encouraged and must be approved by the Director of Planning & Design.

2.6.2 Tables with Attached Seating

Tables with attached seating are used frequently at student housing facilities in courtyards and other public spaces. The seating is attached to prevent theft and the seats have backs to be comfortable for long stays. The table top is perforated which is easier to maintain and is more durable. When specifying these in a courtyard, a minimum of one table should be handicap accessible and those should have either 3 or 5 seats with an opening for a wheelchair. Four or Six seat models may be used and the umbrella hole shall be provided. If an umbrella is desired, the manufacturer offers a matching metal umbrella. These tables shall be anchored to the pavement. See Appendix C, figure C-18.

Manufacturer:	Landscape Forms
Model:	Carousel
Seat type:	Backed
No. of seats	3, 4, 5 or 6
Table top:	Perforated
Umbrella:	Optional metal umbrella, include umbrella hole
Color:	Black

Note: 3 and 5 seat models are handicap accessible and one handicap accessible table shall be provided when using this type of seating.

2.6.3 Trash and Recycling Receptacles

Trash and recycling receptacles shall be typically located within 50 feet of all building entrances and exits and in areas where seating is provided as students will often have food or drink with them when using these spaces. A trash receptacle located in these areas will help keep the campus clean which adds to the overall image of the school. Care should be taken in the placement of trash receptacles. Care should be taken in the placement of trash and recycling receptacles. See Appendix C, figures C-19, C-20 & C-21.

Trash and Recycling Receptacles:

Manufacturer:	Victor Stanley
Catalog No:	SD-242 w/ raised dome top over trash
Color:	Black
Manufacturer:	Keystone Ridge
Catalog No:	MT3-32DRT 32 Gallon w/ raised dome top over trash

Color:	Black

Trash Receptacles:

Manufacturer:	Victor Stanley
Catalog No:	ES-242 S-2A with raised dome top
Color:	Black
Manufacturer:	Keystone Ridge
Catalog No:	MT3-32E 32 Gallon w/ raised dome top
Color:	Black

2.6.4 Bicycle Racks

The availability of safe and convenient parking is as critical to bicyclists as it is for motorists and yet it is frequently overlooked in the design and operation of campus planning. Bicycle parking needs to be visible, accessible, easy to use, convenient, and plentiful.

Bicycle racks shall be “U” style racks constructed of 2 inch dia. Sch. 40 galvanized steel pipe. In new construction these shall be embedded mount. If used as a retrofit in an existing pavement, surface mount may be used. See Appendix C, figures C-23 & C-24.

2.6.5 Skateboard Racks

Skateboards are a mode of transportation students love. As such, providing a safe place for students to lock up skateboards with confidence is necessary. The use of racks such as this will help minimize skateboards in the classroom.

The product manufactured by Ground Control Systems allows for an installation that accommodate 10 boards and is expandable to accommodate 30 boards. These should be surface mount so as to be removable in the future without damage to the building. The Duraplas thermoplastic finish is standard. A galvanized finish is not acceptable.

These should be located near the entrance of buildings so as to be convenient. Aesthetics should be considered to these do not become the dominant architectural feature. Refer to manufacturer’s recommendations for spacing and clearances,

Manufacturer:	Ground Control Systems
Catalog No:	SM10X Skatedock Surface Mounted Skateboard Rack
Finish:	Duraplas Thermoplastic

2.6.6 Moped/Scooter Racks

The placement and design of such racks for increased use of mopeds/scooters should be provided to ensure the safety of pedestrians. Moped/scooters should not be driven on sidewalks any further then it takes to park at the racks. Moped/scooter parking on the VCU Campus is restricted as follows:

- Moped/scooters cannot be parked in the pedestrian or vehicle right of way - no parking on sidewalks.
- Moped/scooters cannot be parked in such a way as to obstruct vehicular entrances, exits, ramps, or breezeways.
- Moped/scooters must adhere to laws regulating the operation of vehicles.
- Moped/scooters are not permitted to park in a bicycle space.

The construction of moped racks shall be constructed of galvanized steel piping to match the bicycle racks. See Appendix C, figure C-25. All moped parking racks shall be embedded mount. Surface mount is not an option as the weight of mopeds and scooters will make the rack unstable.

2.6.7 Medallions/Donor Plaques

Paving Medallions - Paving Medallions shall be used to commemorate locations on campus such as the site of a building no longer in existence that was of historical significance or an important event in the history of the university. These medallions may also be used to recognize class gifts. There is a medallion in Kontos plaza and recognizes the St. Philip School of Nursing. The Shafer Court stage, Founders Hall and the Birthplace of Cardiac Transplantation near West Hospital have been commemorated with similar plaques. These plaques are made of bronze and can be located in a paved plaza such as Kontos Plaza or in a landscaped area such as in front of West Hospital. See Appendix C, figure C-22 for a typical installation detail.

Dedication / Donor Plaques - Acknowledges a building or item that has been donated by or dedicated to a person or group of persons. These can be used as a class gifts.

The plaque is treated in an individual manner. Specifications have been deliberately limited to provide guidance but not restrict creativity. Generally, some form of the university signature appears on each plaque. VCU Development and Alumni Relations administers the approval process for dedication and donor plaques. In general, the university is very selective in its policies regarding the naming of rooms or buildings constructed with donated funds. Any buildings or open space that is named requires approval of the Board of Visitors.

Location is dependent on the nature of the commemorative item. When acknowledging an architectural space, place plaque inside the area to be identified, not at the entrance.

Do not group plaques with other sign types. Follow standard heights listed for similar sizes of sign panels. Suit messages to the nature of the donated area or item; use dignity and good taste in wording.

See Appendix C, figure C-26.

2.7 Seat Walls, Fences & Bollards

Fencing is used on campus primarily as a means for controlling pedestrian traffic. It is used to separate parking areas from the sidewalk and to prevent people from walking on the grass in certain areas. Fencing is also used as a decorative element and to define the "front yards" in some cases throughout the Franklin Street district.

The 1996 Master Site Plan states "In the 1960's, however, a succession of large suburban type buildings began to erode the physical environment of the Campus and create discontinuities with the surrounding communities. This has created the impression of two academic campuses: one centered around Franklin and Shafer Streets; the other, the Academic Core, centered around Main and Linden Streets" These "suburban type" buildings have created the wrong kind of open space. The green spaces created by these buildings are often bordered by a row of shrubs and/or posts and chains. The lawn areas then are inaccessible but still require regular maintenance such as mowing, fertilizing and weed control.

Materials and design details for seat walls and fences within VCU shall be designed to complement the architectural character of the campus. Both quality design and materials are critical to this initiative. Similar to screen walls and fences, the materials and style of non- screening walls and fences shall match or compliment those of adjacent buildings.

Chain link, wood, stockade or corrugated metal fencing is not appropriate for the use on the campus.

2.7.1 Seat Walls

The use of seat walls is encouraged in courtyards, near building entrances and along pedestrian walkways. Seat walls shall be constructed of materials that are compatible with the adjacent architecture. Brick is the material used in most seat walls on campus and the cap treatment varies between architectural precast concrete, stone and brick. Concrete block segmental retaining walls may be used in landscape areas where deemed appropriate by the office of Planning and Design.

Height of seat walls may vary due to the slope of the adjacent pavement and should be designed to be on average 21 inches tall. They should not be taller than 24 inches or shorter than 15 inches. Deterrence of skateboarders should be considered in the location, shape and cap materials.

2.7.2 Metal Fences

Previous Master Plans list as a guideline “Buildings will occupy, or fill, the site to the sidewalk line” The ornamental metal fence can be used to define the street where existing buildings do not meet that standard. The grass areas between the building and the sidewalk should be converted to a lower maintenance evergreen groundcover or shrub mass. The metal fencing will have a decorative cast post at major intersections and building entrances. This type of post is used throughout the Franklin Street area and the Fan District. This post will be unique to VCU. See Appendix C, figure C-27. The metal fence itself will be a simple design of vertical pickets with two top rails and one bottom rail. See Appendix C, figure C-28.

This fencing should also continue to be used in conjunction with plantings to border on campus parking lots. Its use on the MCV campus will be limited as a means of defining an “edge” since most buildings are built to the property line and define the street edge in that manner. The decorative end post is only applicable for the Monroe Park Campus.

2.7.3 Bollards

Metal bollards shall be used to protect pedestrians from vehicles on wide pedestrian walkways such as Shafer Court and Linden Street. The standard metal bollard for the Monroe Park Campus is manufactured by Reliance Foundry and shall be permanently anchored. See Appendix C, figure C-29. Concrete bollards are not allowed on the Monroe Park Campus. Concrete pipe bollards may be used in areas such as loading docks and dumpster enclosures but should not be used where they will be prominent along pedestrian walkways or visible from the street.

For bollards located in vehicular areas, a continuous concrete footing combined with a steel pipe filled with concrete core may be required. Consult with the VCU project manager on the specific design requirements for each application. A structural engineer may be required.

2.8 Exterior Lighting

2.8.1 Street and Pedestrian Lighting

The safety of faculty, staff, students and visitors is important to VCU and exterior lighting is critical to maintaining campus safety and security. Its appearance is equally important when considering what elements will help unify the campuses and create a sense of identity.

Presently, the Monroe Park and MCV Campuses have different standard street and pedestrian light fixture. The Monroe Park Campus standard is one that is used by the City of Richmond along Monument Avenue and West Franklin Street as well as parts of the Fan District The LED version of this fixture on a 14 foot tapered aluminum pole with

a decorative base is the campus standard. See Appendix C, figure C-31. This fixture has three manufacturers which are approved as equals by the university so competitive pricing may be obtained. These fixtures shall be used in both streetscape designs as well as courtyards and plazas and other exterior spaces where people gather.

A different lighting standard exists on Broad Street between Bowe and Belvidere Streets. 400 watt “cobra head” fixtures exist along Broad Street and the city’s Broad Street Streetscape Design Guidelines (1992) specified switching the cobra head fixtures to 250 watts and adding a 100 watt ornamental “acorn” style fixture mounted to the existing pole at 13 feet above grade. See Appendix C, figure C-33. This provides for better lighting along the sidewalk and increased the overall uniformity between the street and the sidewalk. This approach does not increase the power demand from the city grid.

The MCV Campus standard was originally specified in A Streetscape Plan of Medical College of Virginia in 1988. This fixture is used by the city throughout the Court End area of downtown. There are two different manufacturers that have been approved as equals so the university may obtain competitive pricing. See Appendix C, figure C-32. See Appendix C, figure C-30 for the standard footing detail.

Monroe Park Campus

Light Source:	LED
Pole height:	14 ft., tapered shaft
Pole material:	Aluminum
Color:	Black

Manufacturer:	Beacon
Catalog No:	WIN40/AF/36NB-80/4K/UNV/DIR5/BBT
Pole:	HOLL/S/14/4M/TN/BBT
Color:	Black

Manufacturer:	Philips
Catalog No:	VX8911 80 A F 5 N N N
Pole:	316-14-BLK
Color:	Black

Manufacturer:	Sternberg
Catalog No:	PT-MS805BLED-4A1R40T5-MDL03-SV1/BKT
Pole:	3714T4-3/BKT
Color:	Black

Broad Street between Bowe St. and Belvidere Street

The fixtures listed below are to be attached to the city standard cobra head light fixtures. When implementing this fixture, the 400 watt cobra head should be changed to a 250 watt fixture to avoid an impact to the power demand on the city grid.

Wattage:	100 Watt
Light Source:	Metal Halide
Color:	Dark green
Mounting Height:	13 ft.

Manufacturer:	Holophane
Catalog No:	Granville GV1A 100 MH MT F A

Manufacturer:	Sternberg
Catalog No:	Boulevard D650/508, 100W MH

MCV Campus

Light Source:	LED
Pole height:	14 ft., tapered shaft
Pole material:	Aluminum
Color:	Black

Manufacturer:	Beacon

Catalog No:	BOS40/AC/36NB-80/4K/UNV/DIR3/PT/TRF/BBT with decorative chimney
Pole:	HOLL/S/14/4M/TN/BBT
Color:	Black

Manufacturer:	Philips
Catalog No:	VX681 80 A C 3 N N A N S
Pole:	316-14-BLK
Color:	Black

2.8.2 Accent Lighting

Accent lighting shall be used to accentuate buildings and architectural elements and shall be complimentary to the architecture. The use of flood lights to wash the entire façade of a building is not encouraged. It is more desirable for accent lights to be used to highlight architectural features of a building such as columns, porticos, towers etc. When located near pedestrian walkways, down lighting is preferable to up lighting to avoid glare in the eyes of pedestrians.

2.8.3 Fixtures

The use of LED fixtures is encouraged as it will reduce the energy usage and the long term maintenance costs associated with replacing lamps. When fixtures are located in grade, tempered glass lenses shall be used for vandalism resistance. Lenses shall be crowned for drainage. A common problem with in grade fixtures is moisture intrusion so fixtures shall be selected that

When possible, accent lights shall be connected to the adjacent buildings electrical system and incorporated in the lighting controls for that building. The use of a central photocell is preferable to a timer for on/off operation. Landscape lighting can be low voltage LED fixtures but wiring should be placed in conduits and fixtures shall be permanently anchored in concrete. This will help deter vandalism and theft.

2.8.4 Connection to the City Grid

Lights within the city right of way shall be connected to the city street lighting grid. The VCU contractor shall provide and install the fuse link and the city will make the final connection to city power.

2.9 Landscaping

This section recognizes the diversity of landscapes at VCU that present multiple "campus images" within the overall context of an "urban park". It outlines the features and elements which enhance both the "urban" and the "park" images of the campus. The intent of the section is not to create visual homogeneity, but to provide an overall conceptual framework for the development of landscape elements which will establish and maintain a high level of quality in the design of landscape treatments at the VCU campuses, an order and structure to the campus, and which contribute to a distinct campus identity.

Effective and attractive landscaping can greatly enhance and contribute to the overall impression of the VCU campus. Landscaping is also a recommended material for use as a screening element provided it does not present a security risk.

Shade within the campus is a priority and the use of large shade trees is encouraged. Pedestrian spaces such as courtyards and streetscapes can be intimidating given the height of the buildings and the use of large shade trees can create a more pedestrian friendly human scale. Small flowering trees have their use to accent intersections and entrances but large shade trees should be a priority.

Street tree plantings are encouraged along roadways and pedestrian corridors. Care should be taken to maintain existing mature vegetation with the campus. The existing planting within campus should be enhanced with additional materials to form a consistent appearance with the campus.

2.9.1 Street Trees

Another element of the streetscape design which helps to unify the campus are the street trees. There is not a standard street tree and diversity of species across the campus is encouraged. Green Vase Zelkova was used extensively in the 1990's as it was required by the city of Richmond. The Zelkova was required by the city as its root structure does not push up sidewalk paving and it tolerates urban conditions. However the widespread use of a single species creates a monoculture which leaves the campus vulnerable if a disease should strike the Zelkova. For that reason, the Zelkova is not recommended unless it is to replace dead Zelkovas or to complete streetscape plantings on a block which already has them.

It is recommended that street trees be large deciduous trees and of a consistent species be used in contiguous sections of streetscape to avoid a disjointed appearance. Due to the location of most street trees within the public right of way, species selection will involve the City of

Richmond Arborist. Size at time of installation shall be a minimum of 3" caliper balled and burlapped and have a minimum branching height of five feet above finished grade.

The use of tree grates is discouraged by the City and they shall not be used in sidewalks on either campus. The problems with tree grates are many. First, as the tree grows, the opening in the grate needs to be enlarged. This involves removing the grate and cutting the rings with a torch and then resetting the grate. This rarely happens and as a result, the grate girdles the tree which is not good for the tree's health. Second, the gap between the grate and the grade on top of the root ball will eventually fill with trash, dirt and other debris making them unsightly. Lastly, as the tree grows, the base of the tree will begin to lift up the grate causing a trip hazard.

A typical mature street tree will reach a height that will conflict with overhead utility lines. Along streets with overhead wires, Trident Maple (Acer Buergeranum) should be substituted. The Trident Maples mature at a height of approximately twenty five feet and will not substantially conflict with overhead wires. The Trident Maple shall be installed in the same tree wells as the larger street trees. Size at the time of installation shall be 2 1/2" caliper balled and burlapped. They shall be grown in the nursery as a tree rather than a shrub. Excessive pruning wounds on the trunk indicating a shrub like growth habit shall be cause for rejection in the field. Street trees shall have a straight, single trunk and be free pruning wounds below the five foot branching height.

It is important that street trees be planted in the center of the tree wells and that the trees be set plum. Since street trees are not typically irrigated, the use of "gator bags" is encouraged to help the trees survive the summer season. Their use can be discontinued once the tree is established.

2.9.2 Tree Wells

The design of tree wells is critically important to the long term growth and health of the street tree. A suspended slab design which allows for growth of tree roots under the sidewalk without those roots causing an upheaval of the pavement is the standard tree well for the university. The suspended slab detail uses a reinforced concrete sub slab under brick pavers to span over a lightly compacted planting soil fill.

The slab is turned down to bear on a compacted subgrade along the back of the curb and the back of the walk while the slab is turned up at the border of the tree well to provide a solid edge restraint for the brick pavers. The tree well will be mulched which will allow for water infiltration but will not collect trash or be trampled by pedestrians. See Appendix C, figures C-34, C-35 & C-36.

It is not always feasible to use the suspended slab detail due to sidewalk width or budget constraints or to maintain consistency with adjacent conditions. In those cases, consult with VCU Planning & Design on the appropriate detail.

2.9.3 Planting Beds

For new construction, planting beds shall contain a minimum of twenty four inches of planting soil. For renovation projects, the soil should be tilled to a depth of twelve inches and amended as necessary to meet the university standard for planting soil.

2.9.4 Plant Selection Guidelines

Select trees, shrubs, perennials and groundcovers that are well adapted to the conditions of the individual planting sites. Poorly sited plants will typically fail regardless of how carefully they are planted. Consideration should be given to exposure and the amount of sun and shade the plant will receive as well as the time of day the exposure occurs. Late afternoon sun will be hotter and more intense than early morning sun. In an urban setting such as VCU, the sun exposure may change within a planting bed along one face of a building so the selection of plants to implement a design concept is important.

Site drainage should also be considered as species that do not tolerate wet soils will die if subjected to those conditions. Raised beds with all new soil tend to drain better than excavated beds. Beds that are excavated as part of new construction should consider the quality of the surrounding soils as a factor in determining whether a site will retain water below the surface. For sites with poor drainage, consider using more water tolerant species such as Red Maple, Sycamore, Bald Cypress, Willow Oak or River Birch. For shrubs, try Inkberry, Red Twig Dogwood and Buttonbush. Avoid dogwoods, Azaleas, Boxwoods, Japanese Hollies and other plants that don't like "wet feet" where drainage is poor.

Urban conditions such as pollution and reflected heat should also be considered when selecting a plant palette. Exhaust from vehicles and the proximity of the plants to the street are an important consideration. Examine soil for compaction before planting. If soils are compacted, consider replacement with a good loam soil, or incorporation of several inches of an organic material such as composted yard waste to a depth of at least 8 inches over the entire planting area. Do not incorporate small quantities of sand - compaction will increase and drainage decrease.

2.9.5 Rain Gardens

Rain gardens are designed to capture and infiltrate rainwater in the landscape. These gardens are also called bio retention or bio filtration. Rainwater is routed to the garden and filtered naturally by the plants and soils in the garden. This filtration process removes nutrients and pollutants. In its simplest form, a rain garden is a relatively small area of plantings near the drain spout of a building or paved area. However, large highly engineered gardens employing engineered soils and under-drains of varying designs may be required for gardens that receive runoff from a larger impervious area.

The use of rain gardens is encouraged and should be implemented when they will eliminate the need for underground storm water retention. The design of rain gardens should include a variety of plant materials that are suited to wet soils as they may be inundated for a period of several hours to a day or more. Selection of species should consider year round interest and include a mix of deciduous and evergreen shrubs and ground covers, small trees and perennial flowers. Consult with the state Department of Conservation and Recreation guidelines for bio retention.

2.9.6 Community Gardens

VCU unveiled the first Community Garden on the East side of Larrick Student Center on the MCV Campus. The garden plots are open for rental by students, staff, faculty and community members that may not have a place at home to garden. There are also plots that will be tended to by volunteers that will donate all fresh produce to local food banks.

Locations for community gardens shall be submitted to the planning and design office prior to commencing any design work for approval. Raised beds are commonly used in community gardens as they allow for good drainage, prevent contamination of soils by mixing with bad native soil, and are easier to work as they require less bending over. As such, the design of the raised beds shall follow the standard set by this manual. Design of the raised beds shall be approved by Planning & Design.

Raised beds shall be designed such that accommodations are made to be wheelchair accessible.

2.10 Irrigation

All landscape beds and turf areas in new construction shall be irrigated. An urban environment such as VCU is by nature warmer than an undeveloped location and reflected heat and pollution will add a level of stress to plant material. Irrigation will help to reduce that stress and protect the university's investment in landscaping in periods of high temperature and drought.

Spray irrigation shall be used in all turf areas using six inch pop up heads. Planting beds shall use drip irrigation which is more efficient and reduces the amount of water used by eliminating overspray and evaporation losses.

Vegetative roofs shall be irrigated using spray irrigation. The soil in a vegetative roof drains very quickly and drip irrigation can be ineffective in distributing water to the plants.

The controller for irrigation systems shall be compatible with and connected to the university's central control system, which is the Baseline 3200 X Series smart controller.

The VCU Grounds Superintendent shall be consulted to confirm the controller prior to issuing bid drawings.

Irrigation equipment shall be:

- Hunter
- Rainbird
- Toro
- or equivalent.

Plans for all landscape and irrigation designs shall be reviewed and approved by VCU Facilities Management - Physical Plant Grounds Superintendent.

All commercial lawn irrigation systems shall require a pressure backflow preventer 12" above ground, and comply with water supply utility or authority requirements.

Install tracer wire per section 5.2.4 for all irrigation lines including main lines, lateral lines and supply lines.

2.10.1 Cisterns

The use of cisterns is allowed in new construction as a method of rainwater capture for irrigation use. When implemented on a project seeking LEED certification, this can allow you to capture LEED points for 100% reduction in the potable water used for irrigation.

Cisterns shall be of fiberglass construction with an access hatch to allow for maintenance. Sizing of the cistern shall be to accommodate three weeks supply. The pump shall be a shallow well jet pump with a cycle stop valve and located in a fiberglass enclosure.

2.11 Vegetative Roofs

The use of vegetative roofs is not encouraged. Use of them must be approved by the University Architect. If approved, extensive systems shall use a pre vegetated tray system. Pre vegetated systems are grown off site and delivered to the site 95% vegetated and once installed provide an instant result. There are many different types of pre vegetated systems and there is no standard manufacturer. The system should not compromise the warranty provided by the roofing membrane manufacturer.

Extensive systems planted with plugs are not allowed. Extensive systems that are planted on site such as this are vulnerable to the plugs being eaten by birds or blown by winds. They also would require significant maintenance to control weeds.

When used, vegetated roof plantings shall be composed of a mix of succulent plants that are drought tolerant and provide year round interest.

CHAPTER 3 – SAFETY AND SECURITY

3.1 Fire Detection

Fire Protection and Sprinkler shop drawings and submittal data shall be reviewed and approved by the A/E of record. When the submittal with any added notations is satisfactory to the A/E, the A/E shall so stamp and send one copy of such documents to the responsible State Fire Marshal Office, as appropriate, for final review before approval to begin installation.

Where a change of occupancy is intended for an existing building, full compliance is required. For consideration of seeking code modifications for an existing building the level of fire safety shall be factored into a request to the Code Official (DEB). A modification for a condition that decreases the level of fire safety shall be offset by modifications that increase the fire safety level.

3.1.1 Fire Detection and Alarm Systems:

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. Construction documents shall indicate that changes to the design during construction shall be considered substitutions in accord with Section 26 of the General Conditions for the Construction Contract. Changes shall be documented by Change Order and shall be submitted to the DEB for review. The A/E shall confirm that the fire detection and alarm systems are complete, functional and code compliant. Any design that goes beyond code minimum must be approved by the VCU Project Manager.

1. The University has four acceptable fire alarm manufactures:
    i. Siemens
    ii. Simplex
    iii. Notifier
    iv. Firelite
2. All fire alarm systems must be fully addressable.
3. All fire alarm systems must transmit alarm and trouble signals to the central monitoring station immediately.
4. All Fire Alarm Control Panels (FACP) must be located near the main entrance to the building.

5. Smoke detectors are not to be installed in mechanical rooms, electrical rooms, transformer rooms, telephone equipment rooms, or similar rooms that are protected by an approved sprinkler system, unless required by NFPA 72. Contact the VCU AHJ at DEB for specific questions. Unless otherwise specified by the code, all buildings will have partial coverage fire alarm systems. (ex: R use group).
6. When mounted above the ceiling, duct detectors must have a keyed remote indicator mounted below the ceiling.
7. Use ceiling mounted horn / strobes when code allows.
8. For complex applications, VCU may require the Contractor to mock-up the fire alarm system in their shop to verify ahead of time that the installation will meet VCU needs.
9. Do not mix old fire alarm systems with new fire alarm systems; only one FACP per building.

Drawings shall provide the following minimum information to demonstrate compliance with the requirements of the code:

1. Location and identification of all fire alarm system initiating and notification appliances, including protective covers where applicable. The same is required for an existing fire alarm system.
2. Location and identification of all fire alarm control and trouble signaling equipment. As related the same is required for existing fire alarm control and trouble signaling equipment.
3. Location and identification of interface requirements for all devices provided by other trades such as HVAC duct smoke detectors, kitchen hood fire suppression equipment, and fire sprinkler flow and tamper switches.
4. Location and identification of interface requirements for all devices whose operation is initiated by the fire alarm system such as door hold open devices, fire shutters, elevator recall, electronic door hardware, and smoke control systems.
5. Identify the primary and secondary power supplies and connections.
6. Identify clearly the candela output levels for all visual alarm notification appliances.
7. Matrix defining the interface of the fire safety control functions, including the alarm initiating device activated, the action of the control and signaling equipment, the resulting alarm notification appliance actions, and the resulting operation of interfaced equipment.

8. Fire alarm riser diagram showing all system components, including zones to be protected, location of constantly attended location supervising fire alarm system, and the interface between the fire alarm systems and the constantly attended location.

Specifications shall provide:

1. 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 Code Official (DEB).
2. Description of the acceptance testing requirements and which of the acceptance tests are to be witnessed by the responsible State Fire Marshal Office.

Shop drawings are to be reviewed by the A/E of record for compliance with the project contract documents and the code. The A/E shall:

1. Verify the Underwriters Laboratories (UL) listings and classifications for the materials, components, and equipment provided for the specific project resulting in a code compliant fire alarm system
2. Provide a “sealed” statement, attached to the reviewed shop drawings, indicating that the fire alarm shop drawings (working plans, product data, and calculations) satisfy the requirements of the contract documents and the code (citing applicable NFPA criteria).
3. Provide the responsible State Fire Marshal Office with copy(s) of the approved complete fire alarm shop drawings.
4. Provide the Code Official (DEB) a copy of the “sealed” statement and transmittal to the responsible State Fire Marshal Office.

Fire alarm systems are to be acceptance tested in accord to code requirements. The responsible State Fire Marshal Office, VCU Fire Safety personnel and the VCU Project Manager shall observe the installed fire alarm system and witness the fire alarm system performance tests. The A/E and Contractor shall certify that the fire alarm system is complete.

3.2 Fire Suppression

3.2.1 Fire Suppression Systems – Sprinklers

The University’s policy is to sprinkle all of its student residences.

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 in accord with Section 26 of the General Conditions for

the Construction Contract. Changes shall be documented by Change Order and shall be submitted to the Code Official (DEB) for review. The A/E shall confirm that the fire sprinkler system(s) is (are) complete functional and code compliant. Fire and Smoke Dampers

Drawings shall provide the following minimum information to demonstrate compliance with the requirements of the code:

1. Identification of the occupancy hazard classification and location of sprinklers for each of the spaces on each floor.
2. Location of fire department valves and risers (standpipe, combined standpipe and sprinkler, wet pipe) within the building.
3. Sprinkler piping and standpipe layout including sprinkler mains (including cross mains) within the building, and layout of branch lines for the most hydraulically demanding zone(s) on each floor of each sprinkler system. Indicate the size of pipes that are not shown.
4. Table summarizing the characteristics of the sprinkler system(s).
5. 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.
6. Identification of all existing sprinkler systems and standpipe systems, including any new connections to existing systems.
7. Sprinkle riser diagram with appropriate fittings, accessories, sizes, alarms, valves, etc. noted.
8. Location of all system drains, inspector's test station(s) and associated discharge/draining piping. AE team shall propose a project specific design solution for addressing the sprinkler test drainage. Coordinate design with the city of Richmond DPU and VCU.
9. Location of fire department connection(s) with all interconnecting piping to the sprinkler and standpipe systems.
10. Sprinkler head type, K-factor and temperature ratings.

Specifications shall provide the following minimum information to demonstrate compliance with code requirements:

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 Code Official (DEB).

2. Description of the acceptance testing requirements, and which of the acceptance tests are to be witnessed by the responsible State Fire Marshal Office.

Provide the following minimum calculations to demonstrate compliance with code requirements:

1. Final hydraulic calculations for each of the sprinkler systems and the standpipe system.
2. Demonstration of performance of the system with an automatic water supply for the most hydraulically demanding zone(s) on each floor of the building per NFPA 13 and NFPA 14.
3. Performance of the sprinkler and standpipe system as connected to the manual water supply (fire department pumper truck) by the fire department connection and interconnecting piping.

Shop drawings (working plans, product data, and calculations) are to be reviewed by the A/E of record for compliance with project contract documents and the code. At the conclusion of the shop drawing review the A/E shall:

1. Verify the Underwriters Laboratories (UL) listing and classifications for the materials, components and equipment provided for the project result in a code compliant fire suppression sprinkler system.
2. Provide a “sealed” statement, attached to the reviewed shop drawings, indicating that the fire suppression sprinkler shop drawings (working plans, product data, and calculations) satisfy the requirements of the contract documents and the code (citing applicable NFPA criteria).
3. Provide the responsible State Fire Marshal Office with copy(s) of the approved complete fire suppression sprinkler shop drawings.
4. Provide the Code Official (DEB) a copy of the “sealed” statement and transmittal to the responsible State Fire Marshal Office.

Fire suppression sprinkler systems are to be acceptance tested in accord to code requirements. The responsible State Fire Marshal 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.

Similar requirements to the above are required for fire suppression systems utilizing clean agents.

3.2.2 Fire and Smoke Dampers

The A/E shall provide project specific drawings and specifications that locate, identify and define code compliant fire and smoke dampers. Performance criteria do not meet the intent of this section. Construction documents shall indicate that changes to the design during construction shall be considered substitutions in accord with Section 26 of the General Conditions for the Construction Contract. Changes shall be documented by Change Order and shall be submitted to the Code Official (DEB) for review. The A/E shall confirm that the fire and smoke dampers are complete, functional and code compliant.

Drawings shall provide the following minimum information to demonstrate compliance with the requirements of the code:

1. Locate and identify the fire resistance rating of all fire and smoke dampers.
2. Locate and identify all ceiling radiation dampers in rated ceilings.
3. Typical fire damper detail(s) indicating damper, sleeve, method of support, fusible link, duct access door and a breakaway joint between the sleeve and the connecting duct.
4. Notation stating that each shall be installed in accordance with the conditions of their listing and the manufacturer's installation instructions.

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

1. Complete specifications respective of the project scope of work.
2. Description of the acceptance testing requirements with requirement that tests are to be witnessed by the responsible State Fire Marshal Office.

Validation of Fire and Smoke Dampers: Fire and smoke dampers are to be acceptance tested in accord with requirements of the VUSBC. The responsible State Fire Marshal Office shall observe the installed fire and smoke dampers and witness the fire alarm system performance tests. The A/E and Contractor shall certify that the fire alarm system is complete.

3.3 Fire Separation for Equipment

3.3.1 Equipment

Direct fired heating equipment and make-up air heating equipment shall be separated from other air handling equipment by a one hour fire-resistance rated wall. Exceptions:

1. Combination heating and cooling equipment need not comply with the above if the heating and cooling equipment is an approved single package or tandem unit.

2. Buildings of Use Group R-3.

3.3.2 Fire Pumps

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) as referenced in NFPA 13 to NFPA 20, and National Electric Code NFPA 70. Performance criteria do not meet this intent. Where the building characteristics are such that the water supply requirements of a fire sprinkler system/standpipe system cannot be reliably provided by a public water system then the incorporation of an automatically controlled fire pump into the fire suppression system.

Construction documents shall:

1. Indicate that changes to the design during construction shall be considered substitutions in accord with Section 26 of the General Conditions for the Construction Contract. Changes shall be documented by Change Order and shall be submitted to the Building Code Official for review.
2. The A/E shall confirm that the fire and smoke dampers are complete, functional and code compliant. The A/E shall perform shop drawing reviews, observe the progress and quality of the installation, and confirm that the fire pump installation is complete resulting in a code compliant fire sprinkler system.

Working drawings shall:

1. Show the location of the fire pump, pressure maintenance pump; pump controllers, piping, components, and piping specialties.
2. Provide details of the fire pump, pressure maintenance pumps, pump controllers, suction piping, discharge piping, components and piping specialties.
3. Provide a table summarizing the water supply characteristics for the most demanding part of each of the sprinkler systems supplied by the fire pump, and factors considered in the resulting safety factor in psig for each sprinkler system.
4. Provide information regarding locations of fire hydrants, test and flow hydrants, including underground pipe routing, water flow test results, the date and time tests taken, and who conducted the test.
5. Show and identify all existing sprinkler systems and standpipe systems in the vicinity of the fire pump(s).
6. Show and indicate all new connections to existing systems.
7. Show location of fire department connection(s) with all interconnecting piping back to the pump(s).
8. Show the location of the fire pump test header and all interconnecting pipe.

9. Show the location of electrical components of the fire pump, driver, fire pump controller, and ancillary electrical components, and provide details.
10. Show the location, size, and routing of the conduits and conductors serving the fire pump, driver, fire pump controller, and ancillary electrical components.
11. Provide details of the electrical components serving the fire pump, driver, fire pump controller, piping, components and piping specialties.
12. 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 to demonstrate compliance with the requirements of the code:

1. Complete specifications to reflect the systems that are defined on the drawings.
2. Provide calculations to demonstrate compliance with the most hydraulically demanding zone(s) of the fire sprinkler system(s) is satisfied by the water supply plus fire pump in compliances with NFPA 13, NFPA 14 and NFPA 20.
3. 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 Section F-516.6 of the Virginia Statewide Fire Prevention Code.
4. Shop drawings (product data, sketches and certified shop test pump curves) are to be reviewed by the A/E of record 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. A copy 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 responsible State Fire Marshal Office, and a copy of the transmittal to the University.
5. Fire pump(s) is (are) to be acceptance tested in accord with code requirements. The responsible State Fire Marshal 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.

3.3.3 Smoke Control Systems

The A/E shall provide project specific complete drawings and specifications that define a code compliant smoke control system(s), and assure that code compliant smoke control system(s) are provided through the review of shop drawings and the observation of the

progress and quality of the work. Performance criteria do not meet the intent of this section.

Construction documents shall indicate that changes to the design during construction shall be considered substitutions in accord with Section 26 of the General Conditions for the Construction Contract. Changes shall be documented by Change Order and shall be submitted to the Code Official for review. The A/E shall confirm that the smoke control system(s) is (are) complete, functional, and code compliant.

The VUSBC requires smoke control systems to be designed in accordance with the applicable sections of the VUSBC and the generally accepted and well-established principles of engineering relevant to the design. The “generally accepted and well-established principles of engineering” recognized by VCU for this purpose are the current editions of NFPA 92A.

Recommended Practice for Smoke Control, NFPA 92B Guide for Smoke Management Systems in Malls, Atria and Large Areas, and The Principles of Smoke Management (ASHRAE/SFPE).

The University and the A/E shall early in the design phase obtain the approval of the State Fire Marshal Office of the specific method of smoke control to be applicable to the project. The University and the A/E shall submit a narrative that compares and contrasts the three methods defined in the VUSBC (pressurization method, airflow design method, or exhaust method) to the project conditions that result in a recommended method. Provide conceptual floor plans that identify the locations of the major components, pertinent calculations, sequence of operations and any other information that may assist in the evaluation of the methods.

Drawings shall provide the following minimum to demonstrate compliance with code requirements:

1. Location and identification of all walls, floors, and ceilings that define the perimeter of the space(s) to be protected.
2. Location and identification of HVAC system components respective to the smoke control system(s).
3. Location and identification of all smoke dampers and/or motorized dampers respective to the smoke control system(s).
4. Location and identification of the interface requirements with the fire alarm system.
5. Location and identification of the interface requirements for all devices whose operation is required by the smoke control systems (such as door hold open

devices, smoke dampers, fire shutters, motorized ventilation dampers, fans, air handlers, and smoke detectors.

6. Identification of primary and secondary power supplies and connections where code required.

Specifications shall be project specific and provide a description of the acceptance testing requirements. Specifications shall state that components of and their locations that make up the smoke control system are not to be altered by the Contractor without prior written approval of the A/E and Code Official.

Provide calculations that:

1. Demonstrate compliance with requirements of the VUSBC.
2. Demonstrate the volume of the spaces respective of the smoke control system.
3. Are defined by the "generally accepted and well-establish principles of engineering" relevant to the design.

The University and the A/E shall provide the responsible State Fire Marshal Office with the approved shop drawings and a copy of the sealed statement. A copy of the sealed statement and transmittal to the responsible State Fire Marshal Office shall be on record with the office of the Code Official.

The smoke control system(s) are to be acceptance tested with the requirements of the VUSBC. The 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.

3.3.4 Sprinkler Head Database

The University shall compile information and maintain the Virginia Commonwealth University Sprinkler Head Database for all sprinkler heads installed in each University building. The database will be furnished to the Division of Engineering and Buildings (DEB) web based database. (URL is **http://deb.dgs.virginia.gov/brpm/sprinklersystem**).

To facilitate timely responses to a manufacturer's recall for repair or replacement due to malfunctions it is essential that State agencies maintain the DEB sprinkler head database for all sprinkler heads installed in its facilities, both existing and new. The database should 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.

Sprinkler head information shall be recorded and maintained by the University using the DEB web based application as the sole vehicle for compliance to the DEB database

mandate. Data on replacement heads shall be entered to update the inventory. The University shall maintain a record copy of the sprinkler head inventory for each of its buildings.

CHAPTER 4 - BUILDING

4.1 Structural

4.1.1 Minimum Design Loadings for Buildings

The minimum design loadings indicated in the current VUSBC shall be modified and/or supplemented as hereinafter indicated for the design of University buildings.

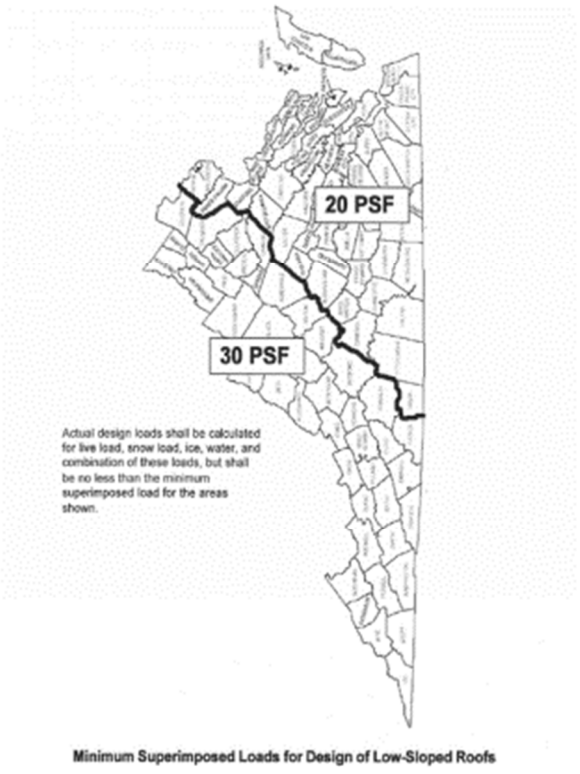


Figure 5.1.1.A

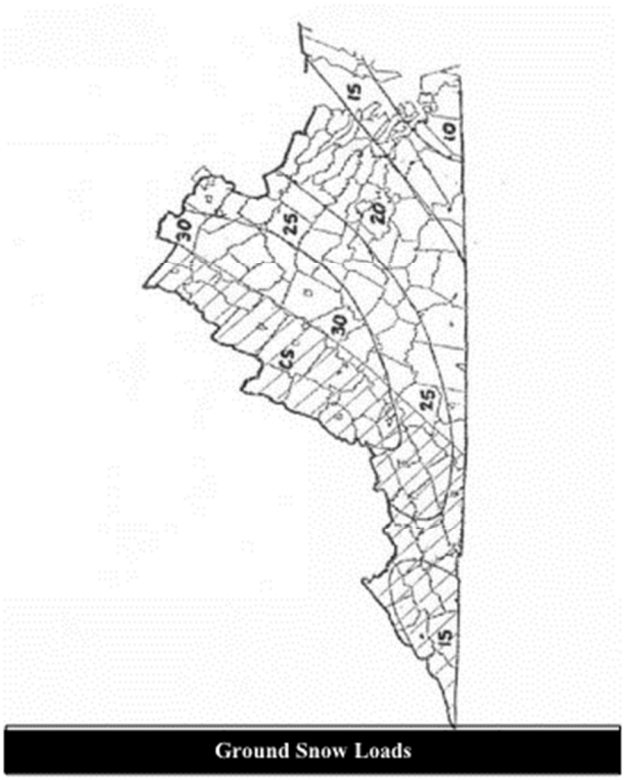


Figure 5.1.1.B

The minimum design roof live or snow load for flat roofs and roofs with a slope of less than four (4) inches per foot shall be as indicated on Figure 5.1.1.A, Minimum Superimposed Loads for Design of Low-Sloped Roofs and Figure 5.1.1.B, Ground Snow Loads, which supplements the Virginia Uniform Statewide Building Code (VUSBC) requirements for designing Virginia Commonwealth University buildings. Areas west of the Blue Ridge Mountains shall have a minimum design roof live load of 30 pounds per square foot. Areas east of the Blue Ridge Mountains shall have a minimum design roof live load of 20 pounds per square foot. Ground snow loads west of the Blue Ridge Mountains are determined by case studies and other VUSBC requirements.

4.1.2 Addition of Loads to Existing Structures

Prior to mounting any antennae, microwave dishes, solar panels, 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 and lateral loads shall be checked by a licensed structural engineer. Consideration must be given to deflection from the added load(s), to potential for vibration, to potential for ponding water, and to the consequences of overturning moments on stressed attachments and construction. Rooftops equipped as described above are subject to the approval of the University Architect and the Art and Architectural Review Board (as determined by the University Architect).

4.2 Concrete

4.2.1 Cast-in-Place Concrete

The specifications shall contain the following requirements in section 033000 – Cast-in-Place Concrete:

1. ACI 301, Specification for Structural Concrete for Buildings (current edition) shall be incorporated by references as the standard unless otherwise modified.
2. Field tests of fresh concrete shall include Sampling - ASTM C172, Slump - ASTM C143, Making and Curing Test Specimens - ASTM C3 1, Air Content - ASTM 231 or ASTM C173, and Unit Weight - ASTM C138.
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.

Individuals performing the field tests of fresh concrete shall have proper training, qualifications, and be certified as a Concrete Field Testing Technician-Grade I by the American Concrete Institute or other recognized certification conforming to the minimum requirements of the American Concrete Institute's certification which requires the successful completion of a written and performance examination on the applicable ASTM test methods of this section.

The CPSM contains requirements for cast-in-place concrete. These requirements must be incorporated into all projects. In case of a conflict between the standards herein and the CPSM, the CPSM shall take precedence.

- A comprehensive concrete placement specification should be use on all projects.
- Minimum concrete compressive strength shall be not less than 3,000 psi.
- Exposed aggregate surfaces shall not be used.

4.2.2 Concrete Reinforcement

Comply with Concrete Reinforcing Steel Institute's (CRSI) recommended practice for the placing of reinforcing bars.

Carbon fiber grid, also known as C-Grid, is not permitted in elevated slabs in parking decks.

To control surface cracking in exposed concrete slabs, the use of polypropylene fibrillated fiber is encouraged and is acceptable for other exposed concrete, when approved in writing by the Facilities Management Division.

Polypropylene fibrillated fiber is not a substitute for structural reinforcing and expansion and or contraction requirements.

4.2.3 Finish Quality

Even though finish quality is described in the specifications, it is critical that the project specifications require a pre-installation conference attended by the A/E, Project Manager, Project Inspector, Testing Firm, Contractor, and relevant Subcontractors review project requirements, and establish acceptable quality levels for all concrete surfaces prior to the placement of any concrete on the project.

Attention is required to assure that flatness and levelness requirements are specified for concrete floors scheduled to receive finishes. The concrete specification must match the requirements of the finish material and subsequent construction.

4.2.4 Curing

Wet – The use of wet curing is the preferred method.

Curing compound: The use of a curing compound is to be limited where application of moisture is impractical. Such compounds shall not jeopardize the appearance of concrete, or bond to additional concrete. Further, curing compounds shall be used where concrete surface is to be finished with paint, tiles, waterproofing, roofing, or chemical seal. Compatibility with proposed finishes must be confirmed. Curing compounds shall be used and applied with uniform thickness and other recommendations by manufacturers is type 1. When surfaces are exposed to sunlight, then type 2 curing compound shall be used.

4.2.5 Sidewalks

Design:

All sidewalks at VCU should be designed to accommodate vehicular traffic load. Since many of the sidewalks are installed on City of Richmond property, the specifications

must meet or exceed City of Richmond Standards. Otherwise, the minimum are as follows.

1. 4000 PSI, air-entrained
2. 6” minimum thickness
3. Reinforced with 6 x 6 – W 1.4 x W 1.4 sheet
4. Keyed contraction joints
5. Doweled expansion joints

Sub slabs for brick pavers to meet same specifications as above, with the exception that thickness can be reduced to 4”.

All sidewalks should have a perpendicular broom finish to the direction of travel after the edges have been framed. Tooled joints and edges.

4.2.6 Stair Treads and Landings

Ensure that the placement and or screening method for stairwells and landings is uniform, flat, and or properly sloped. Stair treads are to slope down 1/8” per ft. interior, 1/4” per foot exterior, riser to nose. A screed template is to be used for stair treads to assure consistency.

A/E should monitor and coordinate with the Project Manager to ensure that the requirements for floor finishes are acceptable on all concrete filled stairs. Bituminous paint is to be applied to concealed surfaces of nosings.

4.2.7 Strip Waterstops

All waterstops shall be 3/4” x 1” and shall contain bentonite material.

Strip waterstops shall be used where they are shown on drawings, and where new concrete pours meet existing concrete or masonry surfaces.

4.2.8 Maintenance, Cleaning & Tightening

Forms and adjacent surfaces that will receive the concrete shall be thoroughly cleaned. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

4.2.9 Penetrations and Openings

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

Waterproof curbs or sleeves and penetration seals to be added to all new openings and existing openings within the limits of construction. Curbs shall be made of a durable material and shall extend two inches minimum above the floor deck.

4.3 Masonry

4.3.1 General

Preliminary Design Phase: In context with the surrounding buildings, the A/E shall select an acceptable brick, mortar and joint tooling, approved by the University Architect as part of the agreed design criteria.

If fewer than three brick manufacturers and or mortars are selected, then performance specifications for size, type of brick, color, range, strength and permeability shall be used; citing as the basis of design one or more manufacturer's brick.

The specifications shall require the Contractor to erect at least one, but no more than three sample wall panels size 4'-0" x 4'-0".

The final selected and proposed bricks, mortar, masonry and or steel stud back-up, wall ties, insulation and limestone, and or precast stone trim, flashing, including termination bars, and drip edges, etc., applicable to the project, shall be displayed in a mock-up wall panel size 4'-0" x 4'- 0". This mock-up wall panel is separate from the sample panels, and is to be used to set standards for quality, along with final confirmation of exterior materials selection. A larger mock-up wall panel can be specified, however, variance from the standard size needs approval by the University Architect prior to incorporation into the contract document.

Recommendation is to vary mortar colors a shade lighter and a shade darker on the initial three sample wall panels, to verify initial selection. For large projects, consider an integrated wall mock-up that includes window openings, complete with framing and flashings.

The Architect of Record and University Architect shall review and approve the mock-up wall panel for workmanship and conformance prior to the materials order by the Contractor. The Architect of Record shall advise the University prior to approving or not approving a mock-up prior to notifying the Contractor.

Additions to existing buildings shall match the existing mortar and brick in size, color, texture, and compressive strength, unless otherwise approved by the University Architect. The A/E is to clearly delineate an existing 4-foot square or greater wall area containing a minimum of 100 existing bricks to be matched, and include that information in the bid documents. The wall area location selected by the A/E shall be approved by the University Architect prior to bidding.

4.3.2 Mortar

All brick types, shapes, colors, and mortar type and color, shall be approved by the University Architect.

Colored mortar shall be premixed; not jobsite mixed.

Mortar admixtures must have both A/E and Facilities Management approval prior to specification and or usage.

When the existing building has a historic significance as determined by the University, special attention shall be paid to the process of reviewing and approving the materials by the University and the Virginia Department of Historic Resources (DHR), because the masonry design must comprehensively consider unit size, texture, color, patterns, mortar, and striking.

4.3.3 Masonry Accessories

1. Concrete masonry control joints shall be built-in rubber type or grout keyed type, with face joint kept clear for installation of sealant.
2. Dovetail slots and anchors shall be used for masonry veneer over concrete walls.
3. Wire ties of pintle and eye-hook design shall be used for masonry veneer over concrete masonry or framed walls.
4. Where required by seismic or wind-loading criteria, provide continuous horizontal wire reinforcement to secure brick veneer to wall ties.
5. Weep holes for solid masonry shall be rope wicks.
6. Weep and vent holes for brick veneer shall be manufactured vents. Do not use open head joints.
7. Gauge and materials should be standard weight, hot-dip galvanized, or stainless steel.
8. Mortar cavity drainage mesh should be used.
9. Flashing should be 7-oz/ft^2. copper laminated flashing with hemmed metal drip edge, or sealant stop as approved by University Architect.

Miscellaneous steel lintels, shelf angles, attachments, etc. embedded or incorporated into masonry construction, shall be hot-dipped galvanized or stainless steel. Exposed to view, e.g., window lintels, items are to be finished to match adjacent construction. Unit Masonry

Clearly show locations and detailing of masonry control and expansion joints on drawings (elevations and floor plans). Reliance on specified location criteria is not recommended.

Clearly show locations and detailing of flashing on drawings. Show extent and alignment of flashing locations with other building elements, and openings on elevations. Indicate end dam locations.

Specify molten zinc galvanizing repair if necessary for cut or abraded miscellaneous steel embedded in masonry. Paint-type repairs or non-galvanized miscellaneous steel items are not acceptable

4.3.4 Unit Masonry

Comply with the American Concrete Institute (ACI) 530.1 / American Society of Civil Engineers (ASCE) 6 / The Masonry Society (TMS) 602, as referenced by the Virginia Construction Code (VCC) as the baseline standard. Specify additional requirements for installation and workmanship, such as tighter joint width tolerances as required.

Veneer Masonry - Face brick and other masonry veneers shall be backed for their full extent with masonry units, or steel stud back-up as is appropriate for the building design and selected structural system.

Veneer Anchors - Specify veneer anchors capable of transferring horizontal wind loads through continuous insulation and sheathing materials to back-up structure.

Parapet Walls - Parapet walls up to 3’ in height shall be flashed from coping to roofing. Parapet walls over 3’ in height shall be faced with brick masonry, or other approved exterior material other than exposed concrete masonry. Preference is for roofing membrane to extend up and over parapet, and to terminate to exterior face of wall.

4.3.5 Masonry Restoration & Cleaning

Water Repellant Coatings: Use of water repellant coatings on exposed above-grade masonry is prohibited. This includes not selecting new masonry materials that require a field-applied sealer or coating for proper long-term performance.

4.4 Thermal and Moisture Protection

4.4.1 Waterproofing & Drainage for Subsurface Structures

Generally, the University strongly discourages basements containing occupied space. However, it will consider them if there are extenuating circumstances. Varying degrees of subsurface water content require the following minimal waterproofing and drainage techniques:

Soils with little or no obvious water content:

1. Waterproof walls and provide any suitable waterproofing protection board.
2. Provide perforated type drainage pipe with gravel surrounding.

3. Backfill with porous suitable material.

4.4.2 Damp to wet soils with no obvious water source:

1. Waterproof walls and provide protection board. Note: If geotechnical type drainboard is used, protection board may not be required.
2. Provide perforated type drainage pipe and (if necessary) surround with full height gravel to the underside of the impervious soil or material. An approved geotechnical type drainage board may be used in lieu of the full height gravel at the contractor's option.
3. Provide impervious soil or material at finish grade.

4.4.3 Walls or floors below the groundwater table:

1. Delete the lowest floor or space below the highest calculated groundwater table possible, or
2. Raise the level of the lowest top of floor structure above the top of the highest calculated groundwater table possible.

The use of a geotechnical filter fabric is recommended for protection board and perforated pipe

4.4.4 Insulation

Multi-story wall assemblies utilizing combustible foam plastic insulation (either board or spray-applied), shall comply with requirements of NFPA 285 (National Fire Protection Association) when tested as an assembly.

Provide design and detailing to completely separate foam plastic insulations from the interior of the building, with appropriate thermal barriers.

Roof insulation shall achieve a minimum of an R-30 rating, for both flat and sloped roofs.

See VCC Chapter 13. Note: Constructed assemblies must not deviate from tested assemblies.

4.4.5 Sprayed on Fireproofing Design & Specification

The A/E shall determine which members are required to be fireproofed and indicate the minimum thickness of the sprayed-on fireproofing to be applied. The bid documents shall clearly show the scope of work for the sprayed-on fireproofing on the drawings, on typical and special details, and in the specifications. Shop drawings may be required to further clarify requirements for the Applicator and the Inspector, if necessary.

In order to assure that beams, decks and columns are properly fireproofed, include the requirements hereinafter indicated in all applicable specifications for capital outlay projects.

Where structural steel members having different thicknesses of sprayed-on fireproofing intersect or connect, provide sprayed-on fireproofing equal to the greater thickness on all members for a distance of two (2) feet minimum from the junction of the members.

Metal attachments such as miscellaneous angles, light gage framing, and hanger shall be covered in the areas of the attachment with the same thickness of sprayed-on fireproofing as the structural member.

Validation Testing Requirements: All sprayed-on fireproofing shall be tested after installation according to ASTM E-605 and ASTM E-736, latest editions. An independent testing laboratory shall make these tests. The University shall arrange and pay for laboratory 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.

The location and number of tests of the sprayed-on fireproofing shall conform to the requirements below:

1. For Thickness on Floor Sections: One out of every four bays or similar units shall be inspected, but in no case shall a bay or unit exceed 2,500 sq. ft. Each bay or unit selected shall be divided into quarters. In each quarter, a 12-inch square shall be selected for taking thickness measurements. The thickness shall be determined by taking the average of at least ten individual symmetrical thickness measurements within the 12-inch square. Where more than one thickness is required by design, a similar procedure shall be followed for each of the required thicknesses.
2. For Thickness on Beams and Columns: Beam and column thickness measurements shall be taken within each bay or similar unit in which floor insulation thickness measurements are made. Four sets of random measurements shall be taken for each bay or unit.
3. For Density: Samples for density determination shall be taken for each 10,000 sq. ft. of pre-selected floor area, but in no case shall there be less than two per floor.
4. For Bond Strength: Samples for cohesion / adhesion shall be taken on thoroughly dried material adjoining test sections used for thickness and density determinations. There shall be one test for beams and one test for decks for each 10,000 sq. ft. of pre-selected floor area, but in no case shall there be less than two tests per floor.

Removal and Replacement of Sprayed-on Material: University and/or A/E shall contact the State Fire Marshal early in the design phase to verify the original purpose of the fireproofing material to be removed or replaced and what, if anything, must be done to

restore the fire resistive characteristics. Plans and specifications shall be submitted as required in Chapter 8 to the Fire Marshal which will include any bidding documents, addenda or change orders which may relate to the fire resistive characteristics of the structure. Submission shall include the construction date, original and present uses, height in floors and feet, whether sprinkled and any other information that may assist the responsible State Fire Marshal Office in a determination of need.

The independent testing laboratory reports shall clearly show the location of the tests and test results. Copies of the reports shall be sent through the A/E to the University and State Fire Marshal.

4.5 Wood, Plastics and Composites

4.5.1 General

Refer to section 1.10 for specific target goals, project requirements, specific use VOC limits, and list of prohibited chemicals.

Specify that panel products shall not be manufactured with binder resins, or adhesives that contain urea formaldehyde. Specify that field-use adhesives shall not contain urea formaldehyde, or excess Volatile Organic Compounds (VOC), as indicated for specific purpose.

4.5.2 Rough Carpentry

Use the current (reduced) design values for Southern Yellow Pine as published by the Southern Pine Inspection Bureau.

This is an Interim requirement based upon 2012 updates of the building code standard referenced, and remains effective until the 2015 building code revision cycle incorporated the updated referenced standard.

4.5.3 Finish Carpentry

Do not use Polyvinyl Chloride (PVC) trim materials (i.e. Fypon). VCU has experienced material failures due to excessive thermal movement of these types of materials, especially when painted in traditional dark historic colors.

Provide chair rail systems in rooms and spaces with seating located against a wall. Specify chair rail systems that provide a cleanable surface. When appropriate for the design, provide appropriate wainscot materials that can be similarly cleaned. Typical examples include waiting rooms, conference rooms, and classrooms without fixed seating.

Provide corner guards on outside corners within areas subject to typical traffic. Examples include corridors, lobby spaces, classrooms, waiting rooms, and similar areas

subject to traffic. Private offices, dorm rooms, and similar spaces would not require these features.

4.5.4 Wood Treatment

Avoid use of treated wood materials to the greatest extent possible. If it must be used, comply with manufacturer's treatment recommendations regarding design value adjustment factors. Consider alternative detailing and other more appropriate materials.

Provide hot-dipped galvanized and or stainless steel fasteners and connectors, typical for any type of treated wood. Where preservative-treated wood is used, provide separation membrane between wood materials and metals. Typical recommendation is a .030 inch thick high-temperature "peel and stick" membrane or similar flashing type material. Polyethylene sheet is not recommended.

If fire-retardant materials must be used, confirm manufacturer's treatment requirements regarding appropriate use, detailing, and environmental limitations. Confirm specific structural uses with VCU Project Manager, and Authority-Having-Jurisdiction (AHJ).

4.5.5 Architectural Woodwork

All ornamental stair or other railing systems shall be specified using standard, easy to replace parts. Fabrications that can be easily replicated locally, or by on-site trade personnel are preferred. Custom fabricated components such as tempered glass used either as guard infill or to support rails, should not be used.

4.6 Roofing

4.6.1 Roofing Policy

The University requires that first priority be given to the roofs of its facilities. This section shall govern the design of all low-slope, flexible-membrane roofs.

Roofing Abbreviations:

BUR	Built-up Roofing
EPDM	Ethylene Propylene Diene Monomer
FM	Factory Mutual
KEE	Ketone Ethylene Ester
NBP	Acrylonitrile Butadiene Polymer
NDE	Non-Destructive Evaluation
NRCA	National Roofing Contractors Association NRCA Manual: The NRCA Roofing and Waterproofing Manual (latest edition)
PVC	Polyvinyl Chloride

RCI	Roof Consultants Institute
RIEI	Roofing Industry Educational Institute
SPM	Single-ply Membrane
SPRI	Single-ply Roofing Institute
TPO	Thermoplastic Polyolefin
UL	Underwriters Laboratories

4.6.2 Acceptable Roofing Membrane

The following types of membrane are acceptable on low-slope roofs for University owned facilities:

1. EPDM, Single-ply, 60-mil minimum thickness. Fully adhered system is preferred.
2. KEE, single-ply, 45 mil min. thickness
3. NBP, single-ply, 45 mil min. thickness
4. PVC, single-ply, ASTM D 4434 Type III and Type IV, 45 mil minimum thickness
5. TPO, single-ply, 60 mil minimum thickness

Other Roofing Membrane

The University will consider a request for the use of membranes other than those listed above. The request must be received and approved before working drawings are submitted for review and shall provide the following:

1. The reasons for using other membrane(s).
2. A description of the system(s) and membrane(s).
3. A summary of evaluated design criteria.
4. The A/E shall confirm in writing:
    i. That the roofing membrane and systems have been investigated and in the A/E's opinion are suitable for use on the proposed project roof(s);
    ii. That at least three installations have had at least five years of successful service in Virginia or contiguous states with project names, University, approximate roof sizes, locations, contact names and telephone numbers.
5. That the A/E has personally investigated at least three installations of the proposed system(s) and is satisfied that they will have a service life under existing conditions.

4.6.3 Existing Roofing Systems

Before reroofing a facility or making major repairs, the University must procure a roof survey performed by an experienced and qualified inspection service. The roof survey shall use infrared or nuclear NDE moisture detection methods. For roofs repairs or replacement, an asbestos survey shall be performed and the findings reported in writing.

Exception: For roofs that are very small or that have reached an advanced stage of deterioration and where a roof survey does not appear cost effective, the University may, after determining the conditions by visual inspection, waive of the roof condition survey. The request must be accompanied by a roof plan sketch with features noted, a written description of the problems cross referenced to the plan, an approximate area of the roof, and photographs showing the conditions which support the request. An asbestos assessment is required.

If the survey indicates a need for complete reroofing, the A/E shall specify new construction guarantees. If complete reproofing is required, then insulation for thermal resistance of the building shall be provided in the roof covering assembly in accord with the requirements of new construction.

University's Roofing Inspection: The University shall have a full-time inspector on the job while the roof is being applied. The inspector can be the project inspector or someone qualified to inspect a roof installation but, preferably, a RIEI Certified Quality Assurance Observer, RCI Registered Roof Observer or one who has attended Roof Consultants Institute Seminars.

The Roofing Inspector shall check all materials and application procedures and prepare a daily written report covering such items as: the weather conditions, the deck conditions, the materials stored, the materials installed, and the installation procedures used including bitumen temperature at kettle and point of applications, etc. A copy of the daily report shall be given to the Contractor. The inspector shall not permit installation of roofing materials without having first obtained from the Design Architect a copy of the manufacturers' certification confirming that the materials delivered for use on the project meet the specified ASTM Standards or other approved Standards. The University shall inspect the roof(s) semiannually, as a condition of the roofing guarantee and states maintenance policy. The University shall also inspect the roof(s) before the two-year guarantee expires. (See roof inspection form in Appendix F.)

Appendix F provides criteria and qualifications for selecting (1) full time roof inspectors and (2) roof consultants. It, also, provides (3) criteria for non-destructive evaluation (NDE) roofing surveys and (4) criteria for drawings to accompany NDE surveys. Forms used with (1), (2), and (3) are included in Appendix F.

Roofing Conferences: A pre-bid conference is not required but is strongly recommended for reroofing or roofing repair projects. A pre-roofing conference is required and shall be specified.

Pre-bid Conference: Unless otherwise specified, bidders shall not be required to attend. Those attending may question or comment on the specified roofing system, materials, details, and any other details thought to affect the roof. Response to comments shall be in writing or by addendum if bid documents need to be changed.

4.6.4 Pre Roofing Conference:

1. A conference shall be required and held before ordering roofing materials.
2. Representatives of the University (including the Roofing Inspector), Architect, General Contractor, Roofing Contractor, Deck Contractor, Mechanical Contractor, and Roofing Manufacturer will attend.
3. Review plans, specifications, flashing details, work scheduling, and workmanship standards required. Resolve problems and discrepancies.
4. Prepare a written record of proceedings and make it a part of the job record.

4.6.5 Guarantees

Specify guarantees and warranties for new construction or reroofing in the Special Conditions or General Requirements (Division 1) as follows:

1. For New Construction:

   The (General) Contractor shall submit a written guarantee in which he agrees to maintain the entire roof system(s) in a completely watertight condition at no cost to the University for two (2) years from date of final acceptance; except the water tightness guarantee shall not be enforced when the Contractor can prove water damage was caused by the University.

   The guarantee shall cover the roofing membrane and flashing, metal flashing, parapet coping, and all properly detailed penetrations of the roofing membrane for such things as stacks, curbs, expansion joints, etc., which exist when the work is performed.

   Provide the following Roofing contractors guarantee on the General Contractors guarantee form:

   “The roofing contractor shall guarantee its materials and workmanship associated with the roofing, flashings, and sheet metal work incidental to the work required under the roofing subcontract, against defect due to faulty materials or workmanship for a period of two (2) years from the date of completion of such work. It is understood and agreed by all parties hereto that

the responsibility of the roofing contractor under this guarantee form or any contract document shall be limited to the limited guarantee herein expressed by said roofing contractor."

Provide the following University's Agreement on the Contractors guarantee form:

"The undersigned named Virginia Commonwealth University agrees, from the date of acceptance of the project, to maintain the roof in accordance with the manufacturers written requirements and agrees to avoid damage to the roof surface by any parties under his control working or walking on the roof. The University recognizes his responsibility to inspect the roof semiannually."

Authorized agents of the General Contractor, Roofing Contractor, and University shall execute the guarantee form.

The General Contractor shall furnish, as a minimum, a manufacturers standard 15- year warranty/ guarantee.

2. For Reroofing:

   The Contractor shall guarantee the materials and workmanship associated with the roofing, flashings, and sheet metal work incidental to the reroofing project against defects due to faulty materials or workmanship for a period of two (2) years from the date of completion.

   Also, include wording in paragraph 7F.2.7.1 (3) on the contractors guarantee form.

   Authorized agents of the Contractor and University shall execute the guarantee form.

   The Contractor shall furnish, as a minimum, a manufacturers standard 20-year warranty/guaranty.

   NRCA Roofing and Waterproofing Manual: Use the latest edition of the NRCA Manual as a guide in preparing plans and specifications for all new roofing projects and for reroofing projects to the extent practicable unless:

   i. The NCRA Manual conflicts with provisions of this section, or

   ii. The A/E documents needs for and obtains University Roofing Project Manager approval to use different details and provisions.

4.6.6 Bidding Roofing Systems

Specifications shall include bids for only one type of roofing system either built-up roofing or fully adhered single-ply roofing, for example, but not both unless approved. If

more than one is approved, the systems shall be specified as options permitting the bidder to select the system he wishes to use. The systems shall not be bid as alternates.

4.6.7 Materials Certification

Specify that, at the pre-roofing conference, the Contractor shall give to the A/E the roofing manufacturers certification that the roofing materials being furnished comply with specified ASTM and approved standards.

Specify that, such certification shall be received with roofing materials delivered to the job site.

Specify that the A/E must receive a copy of the certification and give it to the University's full-time roof inspector before roofing materials may be installed.

The A/E shall give a copy of the certification to the University representative at the final inspection.

4.6.8 System Evaluation

The A/E responsible for roofing design shall evaluate and specify the roofing system(s) for:

1. Fire Resistance Rating
2. Wind Uplift Resistance
3. Warranty
4. Tear Resistance
5. Attachment
6. Resistance to harmful local chemicals
7. Membrane compatibility with insulation
8. Type of membrane seams and joints

4.6.9 Single-ply Membrane (SPM) Specifications

Specify SPM completely with latest listed ASTM and performance criteria.

1. SPM, if specified with either manufacturer or brand-name products, shall be specified with three manufacturers and three equivalent products. Use the latest edition of Roofing Materials Guide, published by National Roofing Contractors Association, to determine equivalent SPM.
2. Where ballast is permitted, the single-ply membrane manufacturer's representative shall check installation procedures at start-up and inspect the completed membrane installation before ballast is applied.

4.6.10 Roof Deck

Corrosion protection is critical to maintain the structural integrity of the roof deck from moisture leaks through the roofing membrane. NRCA Bulletin 15-9 1 provides guidance on protection. 'Primer paint' coated deck is not allowed on University projects. Require the steel roof deck to be Factory Galvanized, G-60 or G-90 (ASTM A924-94) or Factory coating with aluminum zinc alloy (ASTM A792).

4.6.11 Low Slope Roofing

General Requirements: The following requirements are generally applicable to all low-slope roofs. They shall be specified as indicated.

Roof Slope:

1. Specify that all new roofs shall slope 1/4" per foot, minimum, to drain.
2. If a 1/4" slope per foot is impractical on replacement roofs, the A/E may request authority to use a lesser slope from the University Project Manager.
3. Dead level valleys are unacceptable. Valleys shall slope a minimum of 1/8" per foot unless impractical. In such case a waiver may be requested by the A/E to the University Project Manager to allow a slope of 1/16" per foot.

Wind Uplift: Rating of complete roof assemblies shall be Class 1-60 (1-90 for open coastline locations) designed in accord with FM P7825; alternatively, loose laid, ballasted applications shall be designed to withstand wind uplift in accord with requirements in SPR1 RP-4 (or FM Technical Advisory Bulletin 1-29).

If the above design methods are not used, roof-covering assemblies shall be designed to withstanding an uplift pressure as determined by criteria in:

1. Factory Mutual (FM) Loss Prevention Data Sheets 1-7 and 1-28S or
2. Single-ply Roofing Institutes (SPRI) SPRI RP-4 Wind Design Guide

Vapor retarders shall have a perm rating of 0.5 or below, in accordance with ASTM E96 (American Society for Testing and Materials). Typically, two-ply organic membranes are recommended under hot applied system; a polyethylene sheet under single plies.

4.6.12 Insulation

Unless otherwise required to comply with a Manufacturers roofing system, specify as follows:

1. C or R (per inch) factor
2. Compatible Insulation: The A/E shall assure the University that the specified type of insulation has been investigated and is entirely compatible with contiguous, specified roofing materials system.

Maximize insulation value to conserve energy; avoid insulation containing formaldehyde, ammonium sulfate, or foams expanded with Hydrochlorofluorocarbons (HCFCs); consider insulation with recycled content.

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

Maximum single board thickness for flat insulation shall be 2”.

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

Chlorinated Fluorocarbons (CFCs) are permitted in insulation blowing agent only, with specific project approval by the Roofing Project Manager.

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

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

1. Phenolic foam insulation (board and spray-applied).
2. Organic fiberboard insulation, including use as tapered edges.
3. Non-structural glass mat face, non-combustible, water-resistant treated gypsum core panels in ballasted roof systems.

4.6.13 Rooftop Equipment

Avoid if possible.

Comply with NRCA Manual recommendations.

Design clearances and details for easy re-roofing.

Provide prefabricated walks to and around equipment that requires servicing; walks must not block roof drainage.

4.6.14 Approved Applicator

Specify that the roofing and base flashing applicator shall be approved by the materials manufacturer.

4.6.15 Roof Protection

All specifications must state that before moving equipment or materials over a roof, the University, General Contractor, Roofing Contractor, and any of their agents must protect the roof from damage during and following roofing work. Movement of equipment and materials without roof protection shall be cause for the University, General Contractor, Roofing Contractor or A/E to stop work until protection is provided and any damage is corrected. The University's roofing inspector shall record all such violations.

4.6.16 Pre-Final Inspection Survey

Unless the University, on advice of his A/E, requests a waiver of the survey for justifiable reasons given in writing and the Associate Vice President for Facilities Management approves the waiver, specifications shall include the following survey provisions:

1. The A/E shall notify the University, Contractor, and Roofing Contractor (in writing) that they have inspected the roof(s) and finds it (them) sufficiently complete to permit a roofing survey. In no case shall the survey be made earlier than forty days before the Substantial Completion Inspection.
2. The University shall engage the services of an experienced, independent roof survey inspection service or laboratory, to survey the roof(s). The service shall use infrared or nuclear moisture detection methods, except if the method used requires roof probes or cuts, it shall not void the Contractors two-year guarantee and the Manufacturers standard warranty/guarantee.
3. The Roofing Contractor shall cooperate and assist the inspection service by making and repairing any required cores, test cuts, or probes in such a way that Manufacturer's and Contractor's warranty/guarantees are not voided.
4. A copy of the survey report shall be delivered to the University Project Manager no later than ten days before the Substantial Completion Inspection. Also, copies of all survey reports shall be delivered to the A/E, Contractor, and Roofing Contractor.
5. The University shall pay for the service except that if the survey shows roofing deficiencies caused by improper materials, poor workmanship, or Contractor negligence, the Contractor, at his expense, shall repair or replace the roof(s) and provide additional surveys until the roofing work complies with the contract documents. All corrective work shall be completed before the final inspection.
6. Acceptance of the roofing system shall be contingent on a roofing survey report that indicates the presence of no detrimental amount of moisture; for example, moisture that would cause a significant lowering of the thermal resistance of the roof; separation of the roofing plies; blisters; etc.

7. Insulation that has lost more than 20% of its dry thermal resistance (R-value) and any materials covering the insulation shall be replaced by the Contractor at no cost to the University.

4.6.17 Final Inspection

The following items must be given to the University's representative at the Final Inspection:

1. A copy of the (general) contractors and roofing contractor's two-year guarantee.
2. A copy of the roofing manufacturers' standard warranty/guarantee.
3. A copy of the manufacturers' certification that roofing materials comply with specified ASTM standards.
4. Copies of the History of Roofing Installation, Sample Form A; Roof Information Worksheet - Built-Up Roofing, Sample Form B, or Roof Information. Worksheet - Single Membrane Roofing, Sample Form E. The A/E shall obtain forms from the University and complete all applicable items. (The Forms may be found in Appendix F.)

Representatives of the University and the A/E, the Contractor, the Roofing Subcontractor, and the Membrane Manufacturer shall inspect the roof(s) between nine months and one year before the closing of the General Contractors one-year guarantee. The University shall also have the roof inspected at least three months before the two-year guarantee expires and notify the Contractor in writing of any defects noted. The University shall require that any defects be corrected at least 30 days prior to expiration of the guarantee.

4.6.18 Steep Slope Roofing

Provide lead-coated copper or terne-coated stainless steel for counter flashing, cleats, drip edges, exposed metal trim, and or ridge cap, cant strips, and exposed metal valleys, typical. See 5.6.8 Flashing for roof drainage items.

Snow guards are required for all roofs with a slope of 6" - 12" or greater, and over all entrances regardless of slope. A minimum of three staggered rows is required. Snow guards shall be copper, stainless steel, or bronze butterfly type. Adhered plastic snow guards are not acceptable. Wire snow guards are acceptable only with specific project approval by the Roofing Project Manager. Confirm design and layout of snow guard system as appropriate for size and slope of roof. Larger roofs may require intermediate rows of snow guards.

4.6.19 Flashing

All buildings shall have a positive means of conducting rainwater from the roof to an underground storm water system. On sloped roofs, adequately sized and securely installed gutters and downspouts of minimum 16 oz. copper shall be specified, unless otherwise established by Facilities Management.

A minimum slope of 1/16” per foot for gutters shall be required. A minimum of two downspouts for each drain area shall be provided. Downspouts shall be securely fastened to the vertical plane, emptying into a cast iron boot at grade connected to a storm water system.

Down leader protective baskets shall be provided to keep leaves away from drain inlets in gutters. Built-in or concealed gutters are discouraged for new construction.

Built-in metal gutter liner shall be terne-coated stainless steel, non- magnetic, with both sides coated with a terne alloy. Minimum thickness shall be 0.015” (28 gage). Built-in gutter liners shall have 3/4” wide formed expansion folds spaced every two linear feet prior to fabrication of gutter profile.

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

Solder all non-expansion joints in metal work.

Exposed metal shall be:

1. Lead-coated copper, 16 oz. (0.216” thick) unless otherwise indicated.
2. Terne-coated stainless steel, non-magnetic sheet, both sides coated with terne alloy, minimum thickness of 0.015” (28 gage) unless otherwise indicated.

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

4.6.20 Joint Seals

Color and appearance of joint seals shall be approved by VCU as part of the overall design review. Specify preconstruction and field adhesion testing where appropriate.

Use high quality 30+ years warranted products where possible.

4.6.21 Roof Access

Roof access for buildings less than 3 stories: Provide a 48” roof hatch with a ships ladder and an A frame hoist sized to lift at least 300 lbs.

Roof hatches shall be insulated and feature thermally broken construction.

Ships ladder shall be fixed, or if portable, shall be located where it is accessible and available at all times.

Per OEHS Fire and Safety Department provide frangible (break away) type padlocks.

Roof access for buildings 4 or more stories: Provide a stair to the roof, with an oversize door (42") to the roof. Note: For service access also provide an oversize (42") door at the ground floor level as well.

An A-frame type hoist located near the alleyway, or other area shall be provided.

For roofs greater than 6 stories, an elevator that opens level with the roof surface shall be required.

Mechanical Penthouse Rooftop Enclosures — Refer to this subject on Page 161 of Section 23.0 to review additional rooftop guidelines.

4.7 Doors

4.7.1 General

Durability - Doors and frames must be sturdy enough to resist racking associated with the placement of magnetic locks at the upper corner of the frame. VCU has had trouble with the durability of some recently installed doors. This has been particularly problematic for tall storefront doors (over 7'-0") with magnetic locks. People will pull on the locked door and warp the door.

Possible solutions include:

1. Latching mechanism at the door handle.
2. Continuous hinges.
3. Latching at top and bottom.

For single doors, a possible solution is to install full length vertical housings, and locate two magnetic locks at the top and bottom corners on the lock edge. This would not work for a pair of doors. For severe use conditions consider specifying auxiliary overhead holders / stops and closers with enhanced back-check functionality.

Environmental Conditions - VCU has encountered several problems with doors being blown open and hinges being damaged by wind. Although not all wind conditions can be anticipated, there are some areas where we can reasonably assume these could be wind caused by a venturi effect. The Architect should take care to observe the microclimate and take into consideration the effects of wind pressures on door operations accordingly. All door closers must be equipped with a hydraulic back-check function or a brake.

Because of use of floor cleaning and ice-melting chemicals and difficulty of service and replacement, do not use floor mounted door closers or pivots.

Vestibules - To enhance energy efficiency the University requires that exterior doors be arranged as a vestibule or “airlock” to avoid excessive exchange of conditioned indoor and unconditioned outdoor air. For high-traffic locations adjoining occupied such as a lobby incorporating a waiting area, consider the use of an air curtain located within the vestibule to reduce infiltration.

Access Control & Security - Typical access controlled exterior doors are provided with electro-mechanical hardware (electric strikes, electric-latch retraction, etc.) locking system. For normal operation, the mechanical exit device is disabled (crash bar is dogged open) and building access and door locking are controlled by the electro-mechanical hardware. In the event the access control system is taken out of service, the exit device is enabled to provide building security.

All exterior doors must be equipped with a mechanical locking system to secure out-of-service and vacant facilities. Preference for access control and electronic locking systems, is to be equipped with uninterruptible power supply (UPS) battery back-up and connected to standby power system.

Preference for access control and electronic locking systems, is to be equipped with uninterruptible power supply (UPS) battery back-up and connected to standby power system.

The A/E shall be Responsible for:

1. Egress door operation code compliance
2. Hardware coordination
3. Specifying and indicating appropriate pathways / conduits for access control and Closed-Circuit Television CCTV systems.
4. Conducting one or more meetings with representatives from VCU and the AHJ, coordinating and resolving conflicting requirements and showing requirements on the construction documents.

See additional information under section 5.7 – Electronic Safety and Security

4.7.2 Metal Doors & Frames

Hollow metal door frames are preferred, unless existing building has wood frames. All hollow metal frames should be knock-down for interior renovations, and welded for new construction. Door frames fabricated from steel shapes shall not be used unless authorized. Specify A-40 (ZF 120) metallic coated steel sheet with factory primed finish after fabrication for standard interior door frames.

In general, comply with Steel Door Institute (SDI) or Hollow Metal Manufacturers Association (HMMA) standards as appropriate. VCU often wet-cleans flooring surfaces, and standard primed frames do not offer enough corrosion resistance. The A-40 (aluminized) finish has replaced G-60 galvanizing as the industry standard for light-weight metallic coatings.

Specify A-60 galvanized coating for high moisture interior and all exterior frames must be factory primed.

All steel frames shall be minimum 0.053", 1.3 mm, 16 ga. steel prior to application of metallic coating, reinforced for scheduled hardware. Reinforce all frames for door closers whether scheduled or not. Exterior metal frames shall be fully grouted. Specify shop-applied asphaltic frame undercoating for surfaces of frames that will be in contact with grout.

Hollow steel doors shall be insulated. Hollow metal exterior, stairwell, and other heavy use doors shall be minimum 0.053", 1.3 mm, 16 ga. face sheets. Other interior hollow metal doors shall be minimum 0.042", 1. mm, 18 ga. face sheets. Reinforce all doors for door closers whether scheduled or not. Stile reinforcement shall be at least 5" wide to accommodate standard mortise and cylindrical hardware. Specify standard 1 3/4" thick doors. Corresponds to SDI "Extra Heavy Duty" for exterior and heavy use application, and SDI "Heavy Duty" for all other applications. Expectation is that doors will be relocated and hardware will be replaced and or retrofitted over the useful life of the door.

Exterior hollow metal doors shall have sealed inverted top channels and weeps.

Exterior door heights shall not exceed 8'-0".

4.7.3 Wood & Plastic Doors

Addressed by VCU Project Manager as needed.

4.7.4 Access Doors

This standard provides general guidance concerning the specific preferences for access doors and frames for ceilings, floors, and walls.

General locations:

1. Access doors are to be provided for all maintenance points where immediate access is required.
2. A/E is to specify that contractor shall coordinate trades to locate items needing maintenance access in grouped locations to minimize access doors.

3. Contractor shall coordinate access door layout with VCU Project Representative in advance of constructing door(s).
4. Locking - Provide lockable access doors when they are located in public areas or where providing access to crawl spaces. Utilize Access Panels that will accept a mortise or rim cylinder. Cylinders and cores should be specified in accordance with the current lock standard, Section 4.10.
5. In wall, 20” x 20” square door: Plumbing valves, arrestors, hammers, reset buttons, controls manometers, clean-out ports, etc.
6. In wall, 24” x 24” square door: Plumbing fittings at toilets, mechanical filters banks, access hatches, areas requiring work access for unit replacement, etc.
7. In ceiling, 24” x 24” square door: Above ceiling cut-off valves, duct dampers, fire and/or smoke dampers, meters, registers, etc.
8. In ceiling, 24” x 30” square door: HVAC filter units, remote duct dampers, remote fire dampers, remote electrical J-boxes, access hatches, etc.

For concealed dampers, provide extended operators to be easily reachable from access door.

Provide metal access doors with a powder-coated finish for panels located in non-lab/research areas.

All access doors located in research areas to be stainless steel.

All access doors in Department of Animal Research spaces to be stainless steel and utilize rubber seals in the opening to provide a tight seal. The outside perimeter of the door frame is to be caulked to the ceiling or wall.

Wires for electrified hardware must be in conduit.

All access doors located in a space that is subject to corrosives or chlorides to be a grade of 316 stainless steel. Door should have a seal around the opening and be sealed along the outer perimeter to the finished surface.

4.7.5 Entrances & Storefronts

Preference for main exterior entrance doors is for rim mounted exit device with panic hardware, electric latch retraction and electrified exit device

Aluminum entrance doors should not exceed 7’-6” in height. Standard 7’-0” is preferred.

Aluminum entrance doors should have vertical stiles at least 6” wide, top and bottom rails at 8” wide, and center rail at least 8” wide.

Preference is for a door fabricated of standard extrusions capable of resisting racking and twisting.

Do not use full-glass ("Hurculite") doors. Full-glass doors are easily damaged and difficult to secure, repair, and replace.

Do not use concealed closers; use surface mounted heavy duty closers with auxiliary door stops. Traditional heavy duty surface mount closers are preferred for ease of service and repair.

Provide for coordination between storefront installers, and electronic access control installers. All cabling must be fully concealed within framing members of completed installation. Use concealed power transfers where necessary, to transfer power to door mounted hardware.

4.7.6 Automatic Sliding Entrance Doors

Use of automatic sliding entrance doors for high-traffic areas is not allowed.

4.7.7 Roof Windows & Skylights

The use of skylight structures, unit skylights, and clerestory windows, shall be approved as part of the Schematic or Preliminary design process. VCU approvals include the Director of Planning & Design and or the Associate Vice President for Facilities Management.

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

4.7.8 Glazing

Window glazing shall not be patterned, but instead be a continuous monochromatic sheet. There shall be a clear border surround with application. All windows shall have an energy star rating. Double glazing shall be required, with a vacuum seal and low E-glass.

Skylights shall be used sparingly.

For new construction, bird friendly glass is encouraged but not mandated.

4.8 Elevators

4.8.1 General

Comply with the following code requirements:

- Virginia Construction Code

- American Society of Mechanical Engineers – Safety Code for Elevators & Escalators (ASME A17.1)
- Assuring Dependability in Architecture-based Adaptive Systems (ADAAS)

VCU elevators tend to be very heavily used. Therefore, both public and freight elevators should be designed with durable, vandal resistant, low-maintenance finishes. Parts and components should be easy to replace in the event of damage.

For buildings with color-coded floors, such as parking decks, the elevator call buttons shall be colored to match the color of the floor.

All elevator shafts with glass shall be designed so that the glass can be cleaned safely and inexpensively.

Fire service key shall be standardized. Coordinate with VCU Project Manager for key required.

Call buttons in elevators and Ares of Refuge/Rescue Assistance shall be directed to the Operations Center unless the fire alarm system is activated in which case they should be directed to the fire command center. Coordinate with VCU Police and Fire Safety.

4.8.2 Warranties & Service Contracts

All new elevators will have a 1 year service contract, with at least 4 possible annual extensions to include 24/7 response within 4 hours.

4.8.3 Operation & Maintenance (O&M) Manuals & Non-proprietary Equipment Requirements

All elevator systems, including controllers, individual components, and software, shall be non-proprietary.

Provide 4 sets of O&M manuals, to include operating features and diagnostic information, and all other necessary data for elevator system diagnosis, interpretation, and modification. Include in each copy of the O&M manual “as-installed” straight line wiring diagrams, showing all electrical connections. Differentiate between factory-installed and field-installed wiring.

Provide all proprietary diagnostic tools to VCU upon Substantial Completion, so that the elevators may be maintained by appropriately qualified VCU staff or other contracted elevator service providers. Provide all passwords and other necessary accessory items, so that individuals servicing the elevators can perform all adjustments on-site.

Diagnostics, programming, adjustment tools, associated software, and information, must be non-expiring, fully functional, and usable throughout the life of the equipment. Upgrades and replacements for diagnostic tools, software, periodic update training, and

other information, shall be provided to VCU at no additional cost on a perpetual basis for the life of the equipment installation.

4.8.4 Elevator Types

Machine-room less elevators are acceptable.

4.8.5 Required Elevator Equipment

Provide hall lanterns with floor position indicators at all elevator lobbies.

Equip pits of hydraulic elevators with sumps for use of a portable sump pump during maintenance activities.

4.8.6 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. See the applicable VUSBC and VCU Design & Construction Guidelines Sections on elevators and conveying systems for additional requirements. Where existing elevators are being replaced, the above criteria shall be met where possible.

4.8.7 ANSI/ASME A17.1

Application of ANSI/ASME A17.1, Rule 102.2(c)(4): In order to prevent people from being trapped in an elevator when power is automatically disconnected in accord with the requirements of ASME/ANSI A17.1, Rule 102.2 (c)(4), the policy below shall be applicable for all new and remodeled state building elevator systems

Before power is automatically disconnected in accord with ASME/ANSI A17.1, Rule 102.2 (c)(4), provide controls necessary to accomplish the following:

1. Heat detectors required by Rule 102.2 (c)(4) shall provide a signal to initiate Phase I Fireman's Service Emergency Recall Operation Rule 211.3a. The activation sequence shall be similar to requirements for smoke detectors in Rule 211. 3b. No additional heat detectors are required other than those called for by Rule 102.2(c)(4).
2. 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 as required by Rule 102.2(c)(4). [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.]

4.8.8 Final Acceptance

Include the following statement in all Elevator Specifications: “As a part of final acceptance of the project and in accordance with the 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 University. VCU’s AHJ should accompany the QEI certified inspector during final testing.

The Contractor shall obtain from the elevator contractor and/or manufacturer and furnish to the University all data affecting the elevator installation or modification, including ‘as-installed’ circuit and control wiring diagrams and maintenance manuals.”

Elevator certificate shall be an engraved plaque. Coordinate with signage package.

4.9 Hardware, Locks and Access Control

Use the following standards on all projects. Do not match existing if it does not meet these standards.

All hardware shall be heavy-duty, commercial grade hardware. Include a Primus full size interchangeable core (FSIC) as part of the door hardware for any keyed trim. Primus cores can be used with Schlage B600, B700, L, and ND series locks. 626 satin chrome finish. See Appendix G for hardware standards.

Standard hinges are 5-knuckle ball bearing hinges, listed and labeled for fire door use. Do not use plain bearing hinges. Minimum size 4 1/2” x 4 1/2” with non-removable pin (NRP).

Use continuous geared hinges for high-traffic locations, and for doors equipped with low-power operators.

Operational Grade 1 hardware required.

VCU Physical Plant Lock shop does all keying.

4.9.1 Knox Box, First Responder Box & Key Center

See 5.7.3 Electronic Access Control & Intrusion Detection

4.9.2 Low Powered Operators

Although not required by the building code or by the Americans with Disabilities Act (ADA), VCU’s policy provides at least one automatic door opener at each major public entrance on the new facility. If there are a series of doors, both doors in the series must have automatic openers.

Recommend the Record 8100 series control and operator or equivalent.

Automatic Door openers must be connected to standby power.

4.9.3 Restroom Occupancy Indicators

For single use gender neutral restrooms with an auto operator, comply with the following:

1. Push button to open on the outside shall have a light that is occupied when lit.
2. Inside the restroom, there shall be two buttons, one to push to lock the door with a light that will be lit when the door is locked. A second button to push to exit the room. The faceplates may be furnished by VCU. Check with your project manager.

For single use gender neutral restrooms without an auto operator, a thumb turn lock and indicator are required.

4.10 Interior Finishes

4.10.1 General

All products selected on any project shall meet LEED certification requirements. The level of certification will be decided per project. The most environmentally compliant finishes should be provided when possible. Refer to section 1.10 for sustainability standards and project specific requirements.

All removed gypsum board partitions, acoustic ceiling systems, and carpet products shall be recycled to the greatest extent possible.

All products shall be readily available. Imported products may be used only with the approval of a VCU Project Manager. Conditions of approval include but are not limited to demonstrated compliance with VCC requirements, and continued available of products for maintenance purposes.

All products shall withstand heavy usage and be easy to maintain. Cleaning method specifications shall be provided to the VCU Project Manager.

The VCU Project Manager shall determine quantity of attic stock, and storage location.

4.10.2 Plaster & Gypsum Boards

Provide blocking and supplemental concealed supporting materials as required to adequately support suspended and supported items such as light fixtures, audio visual equipment, rails, grab bars, cabinets, and casework.

Verify noise isolation and acoustical privacy requirements, and show specific requirements on plans.

Fire rated construction shall comply with fire rated designs as indicated on plans, as approved by VCU and the designated building official.

Protect materials from moisture. Replace moisture or mold damaged materials.

Minimum acceptable finish for exposed to view and painted gypsum board is ASTM C840 Level 4. Provide Level 5 finish where required by manufacturer of high performance coatings and were directed by VCU Project Manager. Level 5 may be either provided as a skim coat, or as a heavy-based primer designed to impart a Level 5 finish.

4.10.3 Tiling

No grouted tile floors anywhere without prior approval by VCU Project Manager. If approved for use, ceramic floor tile grout must always be sealed. Do not select or use white or light colors. Epoxy grout is recommended for areas subject to staining, such as self-serve soda fountains and similar food service areas.

Specify appropriate installation materials for application in accordance with current Tile Council of North America (TCNA) installation methods, and associated American National Standards Institute (ANSI) standards. Specify mortars with shear strengths, sag-resistance, and working times appropriate for tile size, type, and installation location.

For restrooms, tile the wet walls only with minimal grout joints.

4.10.4 Ceilings

Design and construct bulkheads and soffits of gypsum board supported on appropriate framing. Do not fabricate bulkheads from ceiling grid and acoustic ceiling panel materials. Suspended ceiling grid module shall be 24” x 24”, typical.

Specify and provide standard 15/16” wide grid unless otherwise directed by the VCU Project Manager. If other grid types are provided, coordinate selection of lighting, HVAC diffusers, and other grid- mounted items for compatibility with specific grid provided.

Provide commercially available and locally stocked acoustic ceiling panels for standard use, per VCU stock items unless otherwise directed by VCU Project Manager. Match existing in-use products within each building whenever possible. Verify availability of attic stock prior to bidding.

Where new product is required, attic stock is not available and a need for regular individual panel replacement is ongoing, consider replacing an entire room or space to create a new supply of attic stock from existing salvageable panels and components.

New ceiling tiles to be comprised of rock wool, Basis of design is Rockfon.

Provide upgraded tegular panels, 24” x 24”, in upgrade use areas per direction of VCU Project Manager.

Provide hold-down clips near exterior entrances and operable windows to prevent panel displacement by wind.

4.10.5 Flooring

Require that installer verify concrete slabs for acceptable moisture content, and pH levels prior to flooring installation.

Specify replaceable carpet tile type entry mats at entrance vestibules. Do not specify recessed slat-type walk-off mats at vestibules. Where feasible, building entrances protected by canopies are preferred.

Provide vinyl or rubber wall base in continuous roll with job-formed corners fabricated from same lot of running material, installed in each space. Wood base is not to be used in high traffic areas. Use of wood base to be approved by the VCU project manager.

4.10.6 Acoustic Treatment

Bottom edge of acoustic wall panels shall be above seated head height, unless authorized by VCU Project Manager. At locations subject to passing traffic and potential standing and leaning against wall surfaces, locate bottom edge of acoustic wall panels above head height. A suggested location is a few inches above top of prevailing door frame height.

4.10.7 Painting & Coating

Require painting applicator to verify acceptability of surfaces to be prepared and painted. Specify appropriate preparation, including where necessary removal of existing finishes or coatings.

Provide high quality paint products with consideration of resins, binders, and pigments. Preferred products are Zolotone, Benjamin Moore and Sherwin Williams.

Provide a minimum of one primer coat and two finish coats on all rolled or brushed paint applications. Finishes (except in vivaria) to be as follows:

1. Ceilings: Flat
2. Walls: Eggshell
3. Trim: Semi-gloss

Do not use low VOC epoxy paint.

Provide one primer coat and three finish coats on sprayed paint applications.

Provide high performance paint at locations directed or specified by VCU Project Manager. Current preferred product is Scuffmaster.

Provide a minimum 100 square foot test sample of each type and color of paint specified per project, for review and approval by VCU Project Manager. Sample painting

should extend across a typical gypsum board wall joint to verify acceptability of substrate finish.

Provide 5% additional product rounding-up to nearest full gallon for each type and color of painting specified on the project, for touch-up painting after project completion. Label cans with finish designations and colors.

4.11 Furnishings

4.11.1 General

All furniture will meet LEED standards or other accepted standards that are designed for sustainability. VCU strives for 100% compliance in purchasing level-certified products.

The VCU Interior Designer or interior design consultant shall secure the following items, and turn them over to the Physical Plant Zone Leader upon occupancy:

1. Cleaning and maintenance information provided on all products purchased.
2. Furniture requiring operation shall be accompanied by operational standards.

All furnishings will meet respective fire and life safety codes, and proof of compliance is required.

Project costs will include removal and or disposal of any surplus items left in the space by the previous user.

Manufacturer warranties must be provided for all furnishings purchased, and related services provided. Warranties shall be for a minimum of 1 year.

4.11.2 Appliances

For major capital projects funded by the pool process, refrigerators and microwave ovens shall be architect specified and contractor furnished and installed. Power connections shall be designed by the AE and installed as part of the construction contract. Coffee makers may not be furnished as part of pool funded projects.

For user funded projects, appliances shall be furnished and installed by the user. The AE is responsible for designing the space to accommodate the appliances and the power and water connections required.

4.12 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 A/E, or the interior designer and or signage consultant, the established VCU interior signage standards. Signage criteria vary depending on location, such as Monroe Park Campus, MCV campus, etc.

CHAPTER 5 – BUILDING SYSTEMS

5.1 Building Automation Systems

5.1.1 General

This standard applies to all new construction, all mechanical / electrical infrastructure renovation and replacement projects. For renovation projects, the VCU Project Manager shall evaluate the feasibility of system change-over on a case-by-case basis with Engineering and Utilities. This standard is intended to establish the minimum acceptable standards of execution for all projects that impact the VCU Building Automation System (BAS). All new building control systems shall be capable of being integrated with the VCU Building Automation Central Hub (BACH) utilized by our Operations Center as the web-based system for 24-hour monitoring of our facilities. These guidelines apply:

1. The following are the only acceptable manufacturers:
    i. Johnson Controls (Metasys)
    ii. Siemens (Desigo)
    iii. Tridium Niagara
2. All BAS networks shall connect to their corresponding server over VCU's IT network and must comply with VCU Network Services policies. This includes that all supervisory devices connecting to VCU's ethernet network directly shall use a star topology in which all cables are home run to the switch and that any ethernet devices connected downstream of the directly connected supervisory devices must be on isolated ethernet subnets, i.e., only 1 MAC address shall communicate with any VCU network ethernet port.
3. All materials shall be new, the best of their respective kind, and shall consist of the manufacturer's latest technology at the time of equipment submittal. All materials shall be undamaged.
4. The supplier shall provide laminated control drawings, including system controls schematics, sequences of operation, and panel termination drawings for major pieces of equipment. Terminal unit drawings shall be located in the central plan equipment panel, or mechanical room panel. The drawings shall accurately record the actual controller programming and settings at the time of occupancy for the building.
5. For spaces that house animals, the BAS shall monitor and record at a minimum temperature, humidity, lights (on/off), and air pressure of space, to building reference point showing positive or negative.

6. All heat traces are to be set to alarm.

5.1.2 Uninterruptible Power Supply

An Uninterruptible Power Supply is required for each Network Area Controller with a minimum of 15 min. battery time. This UPS shall be powered by the building emergency power system with a dedicated circuit breaker.

This is not a life / fire safety issue, or even a comfort issue since heating and cooling will be off in a power outage, but it is difficult, complex, and time consuming for Physical Plant to reset a controller in the event of a power outage.

5.1.3 Network Connectivity

All building equipment that communicates with any building automation system shall use a BACnet interface that is hardwired to the building automation network. If the building automation network is BACnet/IP, all wiring must comply with standards set by VCU Network Services. Any exemption to this standard shall be submitted by the VCU project manager to FMD Review for review and approval by Facilities Operations and Engineering & Utilities.

5.2 Plumbing

5.2.1 General

Refer to section 1.10 - Sustainability for fixture GPM requirements.

Pipe sleeves at floors should extend 2” above adjoining finished floor. Natural gas (mass flow) meters are required for all boilers.

5.2.2 Accessible Restrooms

For new construction, provide one scooter accessible restroom stall with high impact finishes and a chair rail. If part of a larger restroom, provide one per gender. If for a single use restroom, one per building is sufficient.

Swing up grab bars may be requested by some building users. If one is requested, the standard installation shall be as shown in Appendix B. For new construction or major renovations, all ADA restroom stalls shall have blocking installed in the walls to accommodate the installation of a swing up grab bar similar to the installation shown in Appendix B.

5.2.3 Backflow Prevention

Comply with requirements of the City of Richmond or other water supply authority requirements.

Backflow assemblies shall meet the requirements of: United States Code (USC) American Society of Safety Engineers (ASSE) Std. 1013; American Water Works Association (AWWA) Std. C511; Canadian Standards Association (CSA) B64.4.

A reduced pressure zone assembly shall be installed at each potential health hazard location, to prevent backflow due to back-siphonage and or backpressure.

The assembly shall consist of an internal pressure differential relief valve, located in a zone between two positive seating check modules with captured springs and silicone seat discs.

Seats and seat discs shall be replaceable in both check modules, and the relief valve.

Valve body and check modules shall be brass.

There shall be no threads or screws in the waterway exposed to line fluids.

Service of all internal components shall be through a single access cover secured with stainless steel bolts.

The assembly shall also include two resilient seated isolation valves, four resilient seated test cocks, and an air-gap drain fitting.

Backflow preventers shall include flood control alarms that report to the BAS.

Provide access for backflow preventers that are installed in obscure places, to allow removal of the entire unit for service and replacement.

Floor drain pipe size to be determined and evaluated before installation of backflow preventer, to ensure that floor drain is capable of handling backflow to prevent flooding.

For all new construction and major renovation projects, provide a dedicated cold-water line for chemical feeds with a central RPZ backflow preventer to serve the janitors closets. This dedicated cold-water line is separate from and in addition to the domestic hot and cold water that serves the closets. This backflow preventer shall be clearly labeled so it is obvious that this serves the janitors closets only. This is to be located downstream from the main domestic backflow preventer.

5.2.4 Non Metallic Pipe Tracer Wire

For all non-metallic underground piping (i.e. PVC) install tracer wire as follows:

- 12 gage, solid copper, blue jacket wire, zip tied to lines every ten feet. Ten foot coil in a valve box where run starts.

5.2.5 Flush Valves & Toilets

For all restrooms in new construction and major renovation projects, provide solenoid-actuator flush valves, actuated by electronic sensor for toilets (water saver) and urinals (low consumption). Battery powered units may be provided where installation of hardwiring is not feasible. Flush valves shall be on emergency power or have a mechanical override.

VCU accepted manufacturers are Sloan, American Standard, and Toto, or approved equal.

Standard toilets – wall mount elongated flush valves hard wired with manual override.

5.2.6 Faucets

Provide solenoid-actuated touchless faucets. Faucets to be hardwired and on emergency power.

5.2.7 Floor Drains

Floor drain types to be generally as follows:

- Interior – Self priming
- Exterior/Freeze Area – Waterless

Confirm floor drain types with Physical Plant.

5.2.8 Water Cooler/Bottle Filling Station

For new construction and major renovation projects, provide one water cooler / bottle filling station on the first floor.

See section 1.10 Sustainability to reference specifications for the preferred product, Elkay EZH20 Cooler / Bottle filling station, but may provide equivalent product.

The specified product must include filters.

5.2.9 Emergency Plumbing Systems

Where research and teaching labs are required to have Emergency Eye / Face Wash and Emergency Showers, provide a recessed barrier-free swing-down eye / face wash with drain pan, and shower safety station with ceiling mounted exposed shower head combination unit. Reference the preferred product by Guardian Equipment, model GBF2150.

Where research and teaching labs are required to have Emergency Eye / Face Wash only, provide a recessed barrier-free swing-down eye /face wash with drain pan unit. Reference the preferred product, by Guardian Equipment, model GBF1735DP.

Where surface mounted Emergency Eyewash / Faucet combination units are required to supplement recessed swing-down emergency wash units, provide Faucet Eyewash Combo unit with the following features:

1. Combined gooseneck faucet with independently operated eye-wash
2. Twin aerated eyewash sprays, with flip-top dust covers
3. Eyewash activation by clearly delineated handle
4. Faucet handles shall have at minimum 4" wrist blade handles for hot and cold water supplies, operating quarter-turn ceramic cartridges (25 year cartridge warranty).
5. Eyewash faucet location shall be further identified by appropriate wall mounted or ceiling suspended signage.

Reference the preferred product, by Speakman, model SEF-1800-CA-8.

5.2.10 Compressed Air Systems

Air-cooled rotary screw compressors are preferred for system needs greater than 50 cfm. Preferred manufacturers include Quincy, Ingersoll-Rand, LeROI, and Sullair.

Ascertain that proper ventilation is available for compressor location. Provide liquid-cooled compressors when ventilation is inadequate.

Compressed air systems shall have refrigerated driers. The preferred manufacturer is Hankison.

Unless otherwise indicated, compressed air system shall be of "instrument" quality, as further modified by other requirements stated herein. Uses requiring "Process" quality and medical air "breathing" quality air, require further development of project-specific criteria.

Compressed air system shall have redundant P3 filtration, followed by redundant coalescing air filtration.

Compressed air dew point shall be reduced to 40° F.

Existing pneumatic instrument air system in existing buildings shall be used while providing upgrades as needed.

Piping for compressed air systems shall be Type L copper.

Provide a certificate issued by an appointed examiner, or recognized inspection body in respect to the air receiver certifying the inspection during construction of the air receiver and its' auxiliary equipment.

5.2.11 Acid Neutralization Systems

Passive neutralization systems are preferable. Active systems can be used only with approval from VCU Safety & Risk Management and Engineering & Utilities.

1. Connect to the BAS with 2 levels of alarms
2. Spill containment must be provided

System shall be reviewed and approved by Safety & Risk Management and Engineering & Utilities.

5.2.12 Condensing Boiler Drain Piping

Drain piping for condensing boilers shall be CPVC.

5.3 HVAC

5.3.1 Mechanical Design Standards

The criteria contained in this section supplements VUSBC to assure minimum standards as indicated and applies to all appropriate projects in the Capital Outlay Program. Its purpose is not to limit architectural and engineering freedom, but to create awareness that all designs must effectively minimize the use of energy. The development of these standards/guidelines has demonstrated that energy efficient designs provide very significant energy savings and reductions in life cycle costs. Compliance with these standards/ guidelines is mandatory.

Energy efficiency considerations are a function of building design. All projects financed by the state will be evaluated for energy conservation and life cycle costs.

Computerized energy budget analysis, forecasting energy consumption in BTU/GSF/year is mandatory for all projects with greater than 8,000 gross square feet which have heating and cooling and with greater than 20,000 gross square feet which have heating only.

Building Design: All construction shall be designed in conformance with ASHRAE 90.1.

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.
2. Cooling - Use 2-1/2% figures for outside Wet Bulb and 2-1/2% figures for Dry Bulb temperatures.
3. Methods of energy conservation, such as energy recovery from exhaust air shall be evaluated.

4. System shutdown and night setback or reduction of outside airflow shall be provided for all systems to reduce energy use during periods of non-use.
5. Ventilation rates and total air circulated shall be kept to the minimum as required by VUSBC, AS11RAE Standard 62-1989, or recognized special space requirements. Each mechanical ventilation system (supply and/or exhaust) shall be equipped with a readily accessible means for either shutoff or volume reduction when ventilation is not required, including morning warm-up. CO2 monitoring to control ventilation should be considered.
6. Use outdoor air for cooling as defined by the VUSBC.
7. Humidification for human comfort will not be allowed.
8. The use of electric resistance as the primary source of heat is not allowed without a waiver from the Associate Vice President of Facilities Management. If electric resistance heat is the only option for heating, documentation justifying the same shall be submitted to the Associate Vice President of Facilities for approval.
9. Use hot water temperature reset controls or variable volume pumping to minimize energy consumption.
10. Size pumps, fans, chillers etc. to design load; do not oversize.
11. Use variable speed drives on VAV fans.
12. Use electric ignition instead of pilots.
13. Provide means to shut-off 11VAC distribution to unoccupied areas. Exceptions will be granted to hospitals, health care facilities, and other specialized construction, i.e., labs, computer rooms etc.
14. Systems should be designed to minimize the use of rehear for final control.
15. Use primary/secondary pumping and/or variable volume pumping.
16. Avoid supplying simultaneous heating and cooling to a zone.
17. Evaluate the use of energy management control and/or direct digital control systems. See VCU Design & Construction Guidelines for types of systems compatible with the University wide system.
18. Evaluate thermal storage for electrical demand reduction, if current utility rates justify this technology.
19. Use chemical sterilization and/or booster heater systems for dishwashing needs instead of higher temperature supply hot water.

20. Maximum water use rates for showerheads, faucets, water closets and urinals shall meet the requirements of the VUSBC.
21. Provide temperature control devices and time clocks for domestic water heaters.
22. Consider instantaneous units for heating domestic hot water.
23. The use of domestic water for process cooling is prohibited.

Mechanical systems shall be designed for the following set points:

1. 75°F for cooling
2. 70°F for heating.

5.3.2 Mechanical Penthouse Rooftop Enclosures

The University wants to protect rooftop mechanical equipment from premature deteriorations caused by exposure from the elements, therefore, an enclosure is required. The enclosure need not be an extension of the building's architecture, what is traditionally called a "mechanical penthouse", but it needs to provide walls and a roof. The enclosure does not necessarily need to be fully enclosed, nor climate controlled. The size and construction of the enclosure should consider accessibility to the equipment, and the ease with which future equipment can be removed and replaced.

5.3.3 Heating Standards

Central plant steam shall be used to the exclusion of all other sources where available.

Humidifiers or autoclaves shall be used where central plant steam is not available, and total boiler horsepower installed, exceeds 40 bhp or where there is a single pass, 100% outside Air Handler Units (AHU).

Steam coils with face and by-pass dampers shall be used. The use of hot water for pre-heats in air handler units shall be strictly prohibited.

Hot water shall be the preferred medium, and shall be generated via a steam to water converter.

The use of steam in direct radiation such as cast iron or fin coil radiators is not prohibited. The use of steam for heating coils in terminal equipment shall be prohibited.

All freezestats shall be hard wired. Freezestats in the BAS programing logic shall not be acceptable.

Steam Piping: All welded joints on exterior steam lines shall be radio-graphed by a third party for at least 25% of the welds. When a streamline is under a street and expected to be under a future building or otherwise inaccessible, then 100% of the welds shall be

radio-graph tested. Due to the nature of the weld, socket welded pipes shall be tested using the dye penetrant method.

For projects in existing buildings requiring modifications to the HVAC system, the design engineer shall use a recent Test and Balance (TAB) report as the basis of design rather than using “As-Builts”, Record documents, design capacities shown on the faceplate of equipment, anecdotal information, or any other information as the basis of design. The TAB report shall be completed within 6 months of the start of the design.

Enthalpy Wheels are not to be used for hazardous exhaust or wet lab space. Any use of an enthalpy wheel shall be approved by Engineering & Utilities and Risk Management

5.3.4 Cooling Standards

Air handler units shall have economizer cycles to allow the use of outside for cooling, when the exterior temperature is low enough.

Where the load for the structure is 20 tons or less, air cooled Direct Expansion (DX) shall be used, provided that the lengths of refrigerant piping are short enough to ensure oil return.

Where the load for the structure is greater than 20 tons consult with Engineering & Utilities as to whether an air cooled or water cooled chiller is appropriate. Water cooled chilled water systems shall be considered if space for cooling towers is available.

Exceptions:

1. For Vivarium or critical laboratory units, DX cooling shall be provided as a secondary back-up where chilled water is the primary source. In this case, the chilled water coil must be ahead of the DX Coil to prevent the chilled water coil from freezing.
2. DX cooling shall not be used as the primary means of cooling for units over 5 tons, where the air handling units are 100% outside air (single pass).
3. Chilled water shall be preferred over any other source of cooling from a central plant.

5.3.5 Heat Exchangers

It is mandatory to use 316 stainless steel plate and frame heat exchangers.

5.3.6 Cooling Towers

Cooling towers shall be made of 316 stainless steel construction for the tower and basins, and provide meter on make-up water. Acceptable meter manufacturers by the City of Richmond are the following:

1. Sensus

2. International
3. Neptune Meter Company
4. Hersey Meter Company
5. Badger Meter Company

They shall provide access for safe, routine maintenance for the cooling towers. Cat walks should be provided around the entire perimeter if possible.

The impact of cooling tower fan noise on the surrounding area shall be considered in the selection of the fan and shroud. To minimize the noise impact on surrounding areas, a low noise type of fan and or fan shroud shall be specified when necessary.

The pipe and valve controlling the make-up of the cooling tower shall be sized by the engineer, and located at or within 5' of the cooling tower. Mechanical float type make-up control shall be preferred over electronic sensor types. This make-up to the cooling tower shall be in addition to hose bibs required for roof service. Cooling towers shall be selected using an 80° F wet bulb temperature. Towers using belt drives for their fans shall have provision for shielding the belt from the wet air stream.

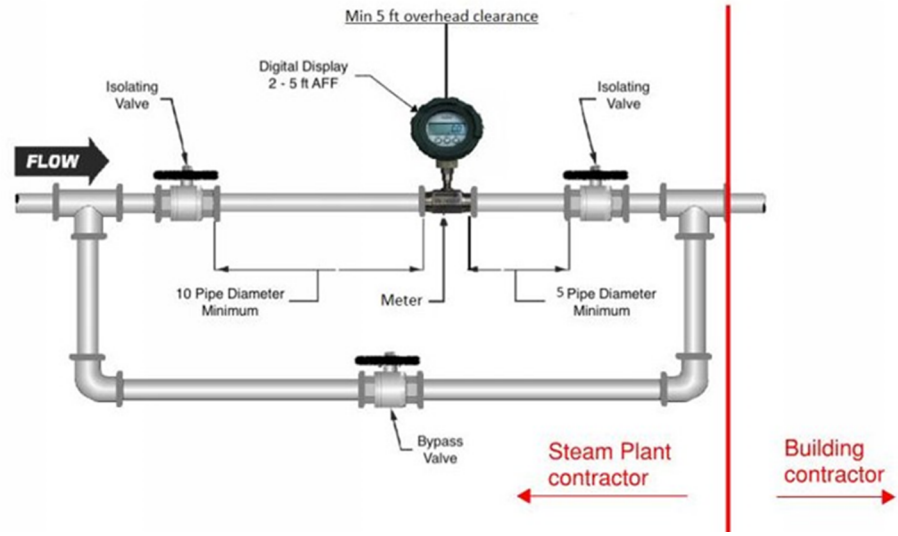
Electric motors shall be of the TEFC or Totally Enclosed Air Over (TEAO) types. ODP motors are not acceptable. All disconnecting means and electrical control cabinets and enclosures related to the cooling tower and located outdoors, shall be of type by National Electrical Manufacturers Association (NEMA) 4X. All outdoor wiring related to the cooling tower shall be in either rigid conduit, or liquid tight flexible conduit. All cooling tower sumps shall be equipped with sump heaters to prevent freezing. Exterior condenser water lines shall be insulated and heat traced as well.

Cooling Tower Sub-Meters: Please utilize the link below to the City of Richmond's Department of Public Utilities website to direct designers to the design requirements:

https://www.rva.gov/sites/default/files/2019-03/DPUForm_CoolingTowerSub-MeteringPermit.pdf

5.3.7 Steam Flow Meters

All new buildings shall have meters installed where steam enters the building. The meters shall be owner furnished and contractor installed. The following diagram is for reference purposes only.



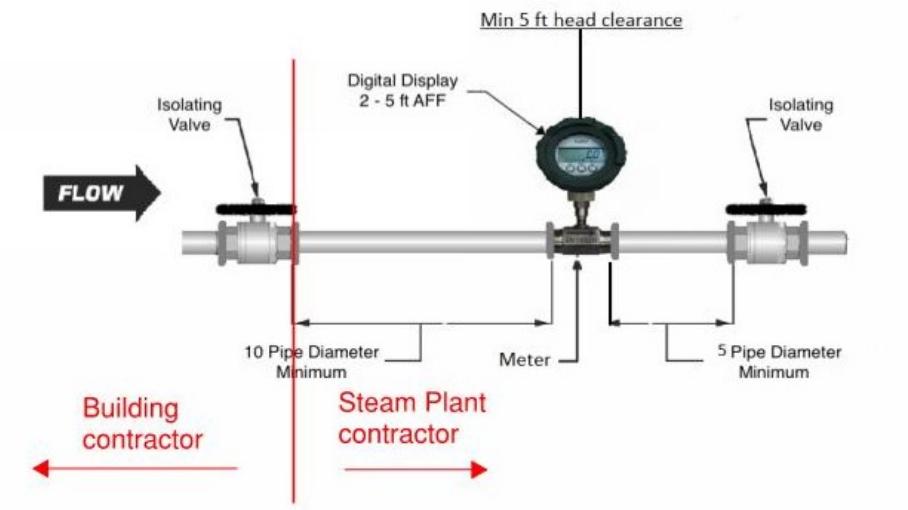
The following steam flow meter guidelines apply:

1. Meters shall be one of the below named products:
    i. ABB SR400 (Basis of design)
    ii. Onicon F-2600
    iii. Emerson Rosemount 8800
    iv. Spirax Sarco VLM10
2. Type: In-line Vortex or Swirl (Swirl preferred)
3. Wetted material shall be stainless steel 316
4. External pressure transmitter will supply flow sensor assembly downstream.
5. Internal temperature compensation will be ordered with meter.
6. VCU Steam Plant will supply, install, TAG, and commission the meter and its digital display
7. VCU Steam Plant shall terminate all wiring connections to the meter.
8. Meter shall be mounted horizontally with the lowest part of the meter body at 1 to 5 feet above finished floor, with a minimum of 5 feet overhead clearance, and sufficient clearance to allow for future replacement.
9. Steam meter shall be located on the high pressure side ahead of the PRV station.
10. Meter shall be mounted with a minimum of 10 straight pipe diameters upstream and a minimum of 5 straight pipe diameters downstream, with no other pressure affecting devices or other set up throughout the flow conditioning straight pipe run.

11. Meter shall have flanged mounting connections.
12. Meter and its display shall be located at least 5 feet away from EMF causing equipment.
13. A dedicated power supply 120 VAC J-Box shall be mounted on the nearest wall to the meter.
14. Steam meter body insulation will be provided by VCU Steam Plant.
15. A bypass steam pipe of the same diameter shall be installed with both end connections located outside of the flow conditioning straight pipe run, with two independent manual isolation valves, and one manual bypass valve.
16. Digital Communication output protocol shall be BACnet or FOUNDATION fieldbus. Highway Addressable Remote Transducer (HART) shall be used for device commissioning.
17. Output shall communicate directly with the BAS with integrators.
18. Meter output Liquid Crystal Display (LCD) display shall be mounted amount 5'-0" above finished floor, so it is readable from a standing position for most persons.
19. Meter shall be factory calibrated to National Institute of Standards and Technology (NIST) traceable standards, and shipped with applicable documentation.
20. All factory installation requirements must be followed without exception.
21. Each meter shall have a flanged sensor connection design with unit completely insulated.
22. Meters shall be suitable for 500° F superheated steam measurement process.

5.3.8 Steam Condensate Meters

All new buildings shall have steam condensate meters installed inside of the new building at the exit point of service. The following steam condensate flow meter guidelines apply. The following diagram is for reference purposes only.



1. VCU Steam Plant will supply, install, TAG, and commission the meter and its digital display.
2. VCU Steam Plant shall terminate all wiring connections to the meter.
3. Meter shall be mounted horizontally with the lowest part of the meter body at 1 to 5 feet above finished floor, with a minimum 5 feet overhead clearance.
4. Meter shall be mounted with a minimum of 10 straight pipe diameters upstream and a minimum of 5 straight pipe diameters downstream, with no other pressure affecting devices or other set up throughout the flow conditioning straight pipe run.
5. Condensate meter shall have flanged mounting connections.
6. Meter and its display shall be located at least 5 feet away from EMF causing equipment.
7. Meter shall be connected to the network, and shall be accessible thorough an IP address.
8. A dedicated power supply 120 VAC J-Box shall be mounted on the nearest wall to the meter.
9. A isolating valve and a strainer with manual blowdown valve shall be installed upstream of the flow meter, outside of the 10 D flow conditioning straight pipe run:
    i. Strainers with manual blowdown valve shall be line size specific as follows:
        1. Pipe size 2 to 3 inch: 33% open mesh area.
        2. Pipe size 4 to 16 inch: 43% open mesh area.

10. A check valve ad a ball valve shall be installed inside of the building downstream of the meter, but outside of the 5 D flow conditioning straight pipe run.
11. Condensate piping shall be designed so that the stem condensate flow meter is flooded as all times.

5.3.9 Chilled Water BTU (British Thermal Unit) Meters

All new buildings shall have meters installed. The following Chilled Water BTU Meter guidelines apply:

1. Meters shall be one of the below named products:
    i. Onicon F-3100
    ii. Approved equal (system 10 electromagnetic in-line flow meters, system with remote temperature detector)
2. Meter shall be factory calibrated to NIST traceable standards, and shipped with applicable documentation.
3. Digital Communication output protocol shall be BACnet or FOUNDATION fieldbus (HART for device commissioning).
4. Output shall communicate directly with the BAS with integrators.
5. Meter output LCD display shall be mounted amount 5’-0” above finished floor so it is readable from a standing position for most persons.
6. Meter accuracy shall be +/- 0.4% of reading from 3.3 to 33 ft/sec, +/- 0.8% of reading from 1 to 3.3 ft/sec and +/- 0.0075 ft/sec at flows less than 1 ft/sec.
7. Minimum installation clearance shall be no more than 3 pipe diameters.

5.3.10 Natural Gas Meters

The meter shall be mounted horizontally, and easily accessible for service and reading.

The meter shall be supplied by emergency power where available. The electrical disconnecting means shall be lockable. A 120V to 24V DC power supply rated at 50 watts per meter. The meter output shall be transmitted to and readable over the BAS.

Buildings with independent boilers shall have individual gas meters (mass flow) for each boiler, which shall transmit to and be readable over the BAS.

5.3.11 Facility Fuel Piping

Fuel oil piping for diesel-generators or boilers shall be carbon steel ASTM A106 Type S schedule 80. 2 1/2” or larger shall be welded.

Fittings for 2” threaded or less shall be Association of American Railroads (AAR) Malleable Iron Extra Heavy. 2 1/2” or larger shall use either ball valves conforming to

API 607, or gate Valves conforming to API 605. 2" or smaller shall use ball valves conforming to API 607. Threaded joints shall use joint compound especially made for fuel oil service equal to "Gasoila".

5.3.12 Steam & Hot Water Distribution Systems

The basic requirements for these systems are as follows:

1. Underground piping systems distributing steam, condensate, low and high temperature water and other heating media above 180 F shall be installed in box trenches or tunnels. A direct burial system shall not be permitted without approval of the CFO. Construction shall be designed to prevent the intrusion of water and other substances into box trenches or tunnels for a minimum of 25 years. Cost effectiveness of cathodic protection systems shall be evaluated.
2. Pipe shall be properly supported, anchored, and guided to allow for expansion/contraction. Expansion loops, slip joints, and/or ball joints may be applied (to be packed and lubricated under full line pressure). Bellows type joints are not acceptable. Systems must be ventable and drainable.
3. 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 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.
4. Materials of construction and fabrication must lie within allowable stress values specified by the ASME Code. Design life will be 30 years.
5. Pipe systems at elevated temperatures (greater than 150¡F.) will be designed to stay dry, be corrosion protected, and to have economic heat loss rates.
6. Above-ground steam and hot water distribution systems should be used where they are feasible.
7. Insulation materials must have high compressive strength, low permeability, and low conductivity; must be non-corrosive, and vermin-proof. Insulation must be dryable if wetted, and withstand repeated or extended boiling without damage or loss of insulating qualities. Pre-molded types are to be used; loose fill and blanket types are unacceptable.
8. The piping shall be hydrostatically tested before insulating and before field joints are backfilled.

5.3.13 Chemical Cleaning & Water Treatment of Boilers & HVAC Systems

The boilers, the HVAC systems, all system piping, and all system related equipment shall be thoroughly flushed out with pre-cleaning chemicals designed to remove construction related deposits such as pipe dope, oils, loose mill scale, and other extraneous material. Systems shall be cleaned and/or boiled-out in accordance with the manufacturer's instructions and the recommendations of the University's Water Treatment Consultant. The products used shall inhibit corrosion of the various metals in the system and shall be safe to handle and use.

The A/E shall consult with the University and its Water Treatment Consultant to determine the proper cleaning and water treatment requirements for boilers, piping, and other HVAC systems.

The A/E shall specify the standards and requirements applicable to the chemical cleaning and water treatment of the system. The following should be addressed:

The standards to be met by the Contractor in flushing, cleaning and treating the system;

1. That 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; and The chemicals to be used for the initial treatment of the system after flushing and cleaning have been completed;
2. That the chemical formulation used shall be compatible with system materials;
3. That the chemicals used shall conform to DEQ regulations and requirements; and
4. That the chemical mixtures do not exceed DEQ or local effluent limits.
5. The A/E must specify that the Contractor notify the University (approximately) 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.
6. The contract 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. The University shall continue monitoring and treating the water after initial treatment.

5.3.14 HVAC Piping & Pumps

For any service, butterfly valves 4" and larger, shall be fitted with hand wheel gear operators. Butterfly valves in horizontal lines shall be installed with the stem horizontal.

Steam condensate piping 4" or smaller, shall not be less than seamless ASTM A106, A53 or API 5L schedule 80 in thickness. Threaded steam condensate lines shall use cast iron fittings. The use of malleable iron fittings is prohibited for steam condensate.

The use of non-rising stem valves for any service shall be prohibited. All threaded gate or globe valves shall have union bonnets. The use of threaded class 125 valves for any service shall be prohibited. The minimum acceptable rating for threaded valves shall be class 150.

The service entrance valve that is 2 1/2" or larger, isolating the building from the central district steam system, shall be flanged cast steel Outside Screw and Yoke (OS&Y) gate valve class 150 where the pressure is 150 psig or less, and class 300 where higher.

All condensate pumping packages shall be equipped with drains and discharge check valves.

For underground piping, 100% of the welds to be tested. Above ground the percentage of welds to be tested is to be determined on a case by case basis by VCU Engineering and Utilities. Discuss the testing protocol with the VCU project manager prior to preparing project specifications.

5.3.15 Motors and Variable Speed Drives

Electric Motors - Integral horse power electric motors shall have TEFC premium efficiency. ODP motors are not acceptable

Variable Speed Drives (VSD) - Warranty period stating the dates and warranty service contract information shall be clearly labeled next to the VSD data plate.

Variable Speed Drive units shall have the following:

1. Alpha-numeric and replaceable displays
2. Non-proprietary fuses
3. Integral bypass feature that lets motor operate if drive is inoperable
4. Drives on all three contactor bypasses
5. Fused input line with disconnect means in door

6. Modbus / Lon Works communications interface
7. Direct Current (DC) inductor filter or line reactors

5.3.16 HVAC Insulation

Cellular Glass shall be used for chilled water lines 2" or larger. Chilled water lines less than 2" may be insulated with Closed Cell Elastomeric. Use of fiberglass on chilled water lines shall be specifically prohibited. Chilled water coil condensate lines and domestic cold water lines shall be insulated with Closed Cell Elastomeric.

Steam lines (any pressure) shall be insulated with Calcium Silicate.

Insulation outdoors or otherwise exposed to weathering, shall be protected with metal jacketing.

Fiberglass pipe insulation is acceptable for heating hot water service.

5.3.17 HVAC Air Distribution

Double wall insulated duct shall be used. The use of inside lined duct for any purpose shall be specifically prohibited.

Double wall insulated terminal boxes shall be preferred. Boxes used in humid environments like cage wash or autoclave rooms, shall be made of stainless steel inside and of epoxy or non-corrosive non-metallic exterior.

Terminal boxes shall have no exposed insulation inside, a foil liner is not acceptable. Terminal boxes in laboratories and vivaria shall allow exterior sanitizing by wet chemical compounds, or alcohol solutions.

HVAC Filters - Bag filters are preferred on air handling units. It is important that the same MERV rating be available. This should be evaluated at the design stage and discussed with VCU engineering & Utilities to get direction.

Ultraviolet C - A factory installed UV-C lighting system is required on all air handlers.

At large duct openings in mechanical rooms, include an angle iron water stop on the concrete slab around the opening to prevent water from running down the duct shaft.

5.4 Commissioning

5.4.1 General

Construction and renovation projects with a construction budget of $1 million dollars or greater will be commissioned. Projects with a value less than $1 million dollars, will be commissioned if they affect vivarium, scientific, or clinical laboratory spaces. Projects affecting patient care spaces, with a value less than the threshold, will be considered for commissioning. Additionally, projects of less than the designated threshold value, that

because of technical considerations or significant adverse effects on the University community, will be considered for commissioning.

Commissioning will normally be procured by utilization of the statewide open end contract for commissioning services, administered by the Department of General Services, Division of Engineering and Buildings (DEB).

For projects seeking some level of LEED certification, the minimum basic commissioning required as a prerequisite will be done. Enhanced commissioning is encouraged, and will be considered for the additional LEED point that it generates.

Details as to specific systems to be commissioned and the degree and depth of the required commissioning, will be provided in the Request for Quote for Services under the State Contract. Normally, the Commissioning Agent will develop and write the commissioning specification and plan for the project manual, subject to review by VCU.

Unless otherwise provided by the State Contract, the Project Manual, the Request for Quote for Service under the State Contract by VCU, the LEED requirements, or other specific direction by VCU, commissioning will be done in compliance with the most recent versions of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):

ASHRAE Guideline 0: The Commissioning Process
ASHRAE Guideline 1: The HVAC Commissioning Process
ASHRAE Guideline 4: Preparation of Operating and Maintenance

5.5 Electrical

5.5.1 General

Codes: Comply with requirements of the National Electrical Code (NEC), NFPA 70E, edition currently incorporated by reference into the VCC.

Basic Electrical Installation Requirements

1. No shared neutrals
2. No cut bushings
3. All conduits 4” and larger shall be bushed
4. Branch wiring, including neutral wires, shall be labeled on each end.
5. Parking Decks are considered exterior applications.

5.5.2 Outlet & Switch Labels

All electrical outlets are to be labeled with the panel and circuit numbers on the inside and outside of the cover plate. Junction boxes shall also be labeled with the same information

5.5.3 E Power Switches & Outlets

All outlets and switches which are connected to emergency backup power shall be red.

5.5.4 Temporary Electrical Service

The Architect/Engineer shall coordinate with the University as to the type of electric service available, location and who will pay for the electricity required for construction. The temporary service shall be metered.

5.5.5 Low Voltage Transmission

1. The preferred distribution voltage inside structures of 5000 square feet or larger shall be 480 / 277V Wye 3 phase.
2. Where 120 / 208V 3 phase or 120 / 240V single phase is required, it shall be supplied by means of step down transformers.
3. Installer shall properly torque all factory connections within panels, distribution panels, switchgear, and motor control centers.
4. Multiple single pole breakers shall not be used for multiple pole applications.
5. Engrave label attached with screws on each panel and disconnect shall be provided.
6. Information on label shall include the electrical feed origin of the panel / disconnect.
7. Distribution panels for lighting and power shall include a minimum of 30% spare capacity and spaces for future use.
8. Electrical distribution panel covers shall be of hinged type for access.
9. Service entrance switchboards shall have provision to attach an external generator of a size sufficient to power the entire building.

5.5.6 Wiring Devices

1. Ground pigtails shall be used to ground devices to equipment grounding conductor.
2. Devices shall not be used to continue circuit feed to other devices.
3. Pigtails and joints shall be used to continue circuits to feed other devices.
4. All receptacles shall be rated 20 amp minimum, and shall be commercial specification grade in commercial applications.
5. All receptacles shall be labeled with a panel number and a circuit number.

6. All switches shall be rated 20 amp 120V / 277V, and shall be commercial specification grade in commercial applications.
7. Enclosures for motor starters, control cabinets, or other device enclosures used where they may be subject to any overhead leaks, flooding, or infestation by vermin or wildlife, shall be a NEMA 4X enclosures at outdoor locations and NEMA 4 at indoor locations.

5.5.7 GFCI Protection

1. Where required by the latest version of the National Electrical Code in effect.
2. For all power outlets within six (6) feet of water sources.
3. Where the presence of water or grounded surfaces contributes to a hazardous environment.

5.5.8 Lighting

The levels of illumination (interior), as recommended in IESNA Lighting Handbook, current edition, shall be used as the basis for designing maintained foot-candle levels in applicable areas. Overall watts per gross square foot shall meet the provisions and requirements of ASHRAE 90.1 – 1989, section 401.3. The use of task lighting is to be maximized.

The recommendations of IESNA Lighting Handbook, current edition, shall be used as the basis for exterior lighting. Exterior lighting shall be controlled through the use of photocells or other programmable means.

Preferred voltage is 277V for lighting in structures larger than 5,000 ft^2.

LED shall be used for lighting. Any deviation from this standard shall be approved per the process for deviations included in chapter 1 of this manual.

Provide LED, fluorescent, or low mercury content lamps, typical. Other colors may be used with approval when necessary. Unless specifically required for a special purpose, do not use incandescent or halogen lamps.

Provide LED lighting for all exit signs

Arrange and locate fixtures for easy accessibility for maintenance purposes.

Exit lights containing radioactive material (tritium) shall not be used.

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.

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

Recessed light fixtures are to be supported from the structure and not solely from the ceiling suspension system.

The following energy conservation measures shall be used wherever possible:

1. Building designs shall take maximum advantage of natural light. Ambient light sensors, dimmers and programmable controllers are to be used where cost effective.
2. Occupancy sensors shall be used in rooms such as restrooms, single person offices, storage rooms, custodial rooms, etc.
3. Unless impractical, occupancy sensors shall be used in conference rooms and classrooms.
4. Multiple circuits/switching shall be provided in classrooms and other large rooms to permit reduced power consumption.
5. Fluorescent fixtures shall use T-8 or compact fluorescent lamps. All fluorescent ballasts shall be electronic except in areas where the usage requirements take precedence (i.e. vivarium).

Lighting Control Systems:

The lighting designer/electrical engineer shall consult with VCU Media Support Services to ensure compatibility between the Audio Visual Systems and the lighting control systems. VCU does not have a standard lighting control system.

5.5.9 Electrical Equipment

Dry-type Transformers:

- Transformers shall have copper windings.
- K-factor transformers shall be used where large quantities of harmonic producing loads are present.
- Transformers shall meet the requirements of NEMA TP 1 – 1996, Guide for Determining Energy Efficiency for Distribution Transformers.

Panels and Switchgear:

- Bussing shall be copper. Separate neutral and equipment-grounding busses shall be provided.
- Schedules shall be provided for all electrical construction involving panel boards and switchboards.

- The power monitoring meter must be commissioned when the switch gear is tested for proper operation upon initial energization. See appendix C, detail C-41 for power monitoring meter cut sheet.
- Contractor to provide a pathway from the meter through the switch gear outside of the sheet metal enclosure and to the nearest data closet. A patch cord of cat 6 cable needs to be included from the meter to the outside of the sheet metal enclosure.

Electric Motors

Integral horse power electric motors shall have TEFC premium efficiency. ODP motors are not acceptable.

Motors shall be high-efficiency type, and shall conform to the requirements of NEMA MG 1-1993, Table 12-10. All motors between 1 and 200 hp shall exceed these standards where possible.

5.5.10 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 bid documents, including approved shop drawings and/or manufacturer's instructions for this project."

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

5.5.11 Lightning Protection

Lighting protection shall be included in the design for all new buildings greater than 5,000 GSF in size in accordance with NFPA 780.

Surge suppression shall be installed at the service entrance and at each main panel.

5.5.12 Conductors and Cables

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. Installation shall be in accordance with NEC 725.

Conductors except grounding wires shall be stranded.

Branch circuits shall be a minimum size of #12 AWG (American Wire Gauge), unless used for control wiring.

Conductors shall be copper, typical. Aluminum conductors are not acceptable.

All branch circuits shall have a separate equipment grounding conductor.

Raceways used in lieu of separate grounding conductors are not acceptable.

5.5.13 Instrumentation and Controls for Electrical Systems

Lighting shall be controlled by and integrated with the BAS.

Provide occupancy sensor (motion sensor) control for classrooms and conference rooms, and similar shared space lighting.

Use of mechanical time clocks for lighting control is prohibited. See 6.5.6 B.

Fluorescent fixtures controlled by dimmer devices shall be burned in for a minimum of 100 hours at full capacity prior to being dimmed.

Communications Interfaces: Provide Modbus / LonWorks communication interfaces for the following:

1. Generators
2. Transfer Switches

Coordinate functions (points) required to be monitored and or controlled with the VCU Project Manager and A/E.

5.5.14 Generators and Transfer Switches

All new buildings shall have a standby generator with a fuel source approved by the VCU Project Manager. The following guidelines apply:

1. Emergency power systems shall have two sources of power.
    a. Normal
    b. Standby back-up connected with an automatic transfer switch
2. The list of items to be connected to the standby generator includes, but are not limited to:
    a. Fire alarm detection
    b. Alarm systems
    c. Emergency Egress and exit lighting
    d. Public safety and voice communication systems

e. Fire pumps

f. At least one elevator

If the building code requires other items to be connected, they shall be connected per Virginia Construction Code.

Standby power must be available within 10 seconds of failure of the normal power supply.

The standby power supply shall be available for operation of the rated loads for a minimum of 24 hours without refueling.

The standby power generator shall have programmable logic controller mounted on the unit, and shall interface with the Building Automation System using BacNet protocol.

Provide cam locking docking station per NEC 700.3F to allow for the connection of an external generator.

5.5.15 Diesel Generators:

1. Diesel generators may be acceptable, but VCU's air permit limits the amount of exhaust we can generate. Therefore, low or no emissions diesel generators must be used.
2. Shall be standby duty rated for the specified load including radiator fan and all parasitic loads. The generator should be sized to operate at the specified load at a max ambient of 77°F, and altitude of 500 feet.
3. A minimum warranty shall be five years from the date of acceptance by Owner against defective parts and or workmanship, and shall provide parts and labor to fulfill this warranty at no cost to the Owner. Preventive maintenance shall be required the first year of the warranty period. Warranty period starting dates and warranty contact service information shall be clearly labeled next to generator data plate.
4. Data plates should be engraved in metal and also:
    a. Shall be capable of power transfer within 10 seconds of power failure.
    b. Shall be tested at the factory and on-site, to ensure that all devices and auxiliary equipment work and that the automatic operation of the system is functional.
    c. The door to the room where the generator is located shall be labeled "Indoor Installations".
    d. The training date and the startup date should be the same date.

e. The generator should have a remote fill indicator for indoor installations 80%, and 90%.

5. Diesel generator units shall be provided with the following:
    a. Modbus / LonWorks communications interface
    b. Battery powered 24V / 12V lighting in walk-in units
    c. Access platforms for units higher than 24” above finished floor
    d. Sound attenuated enclosures on all enclosed machines
    e. Spare filters included with each machine
    f. “Algae-X” type recirculating fuel filter systems on all units
    g. External load bank / tap 4X cabinets for all installs that can connect to a temporary remote generator set, or a load bank to test the existing installed generator set.
    h. Sight glass on radiator
    i. Common fault from the generator must go to fire alarm panel.
    j. Generators must have shunt trip breakers.
    k. Global reset for annunciator panel.
    l. Annunciator panel must be located adjacent to fire alarm panel, and must mimic the generator panel (example: if the generator panel is alarming the annunciator panel, it must also be in the alarm).
    m. If annunciator panel lights are present, they must be in operation when there is an option to be connected.
    n. Generator must have sufficient flow from front to back for cooling. All normal automatic transfer switch breakers must be located in main switch gear room.
    o. If the generator has louvered openings with control dampers for intake and exhaust, they must be fail open and powered close.
    p. One spare set of fuel and air filters turnover.
    q. Pad lock latches must be on generators.
6. Provide sufficient on-site fuel capacity to operate diesel generators for a minimum of 24 hours at full rated load.
7. VCU uses a third party to monitor its’ generators, and report to the appropriate responsible parties when generators must come online in actual emergencies. To facilitate this monitoring, the generators must have two sets of contacts and the

automatic transfer switches must have a set of contacts dedicated to this cause. The two sets of contacts for the generator are for general fault status and run status. The set for the automatic transfer switches is to prove that it has transferred.

5.5.16 Natural Gas Generators

Gas fired standby generators may be acceptable, but must be on uninterruptable service. Care should be taken to verify that the City has adequate capacity to feed new buildings. In one instance, the start-up of one of VCU's generators depleted gas feeds to nearby residential customers.

5.5.17 Transfer Switches:

Provide units with the following features:

1. Full control display pads (start, stop, test)
2. Modbus / LonWorks communications interface
3. Maintenance bypasses for automatic transfer switches are greater than 200 amps.

5.6 Communications

5.6.1 Media Support Spaces:

Programming and Schematic design shall meet the requirements established through the Project Manager and VCUAIT (Virginia Commonwealth University Academic Information Technology). VCUAIT equipment rooms shall be dedicated for information technology, and telecommunications use (telephone, data, etc.).

Be within 295 feet of cable run distance from the most remote site.

Must have lockable doors.

HVAC capacity to maintain ambient room temperature over the range 50 - 85°F, 30 - 75% relative humidity (non-condensing), positive pressure with air exchange sufficient to dissipate heat generated by equipment.

5.6.2 Media Support Standards

1. Refer to Appendix E for space planning guidelines spaces that will include Audio Visual equipment.
2. All A/V conduit to be 1 ¼" EMT. Label as A/V conduit on drawings. Include pull strings in all A/V conduit.
3. Label conduit or pull string with source and destination.
4. For screen mounting use a double gang box, single gang box will not support 1 ¼" conduit.

5. Drop down screens in new construction shall be by the general contractor. All controls shall have access panels.
6. Contractor to include A/V install in the overall project schedule to avoid schedule compression at the end of projects.
7. VCU Media Support Services (MSS) to be included in page turn reviews.
8. A/E to coordinate with VCU Media Support Services on specifications and locations.
9. A/E to show all low voltage pathways (excluding fire alarm) on one drawing. The purpose of this is to ensure that pathways for audio visual are coordinated with other low voltage pathways.
10. All temporary data cables are to be removed prior to final completion.

5.6.3 Data Communications – Network Closet Requirements

1. One dedicated duplex NEMA 5-20R (for our UPS) in our MDF, IDF.
2. Two NEMA 5-20R convenience (quad) outlets on a dedicated circuit on opposite walls.
3. One wall covered with 4’ x 8’ x ¾” fire rated plywood. Consult with VCU Network Services as to which wall.
4. Conditioned air ducted into the space to maintain temperature and positive pressure. A dedicated system on emergency power is preferred.
5. One 4” x 12” x ¼” copper bus bar (min. #6 cu. AWG, green/bare, back to building steel) for grounding equipment, pre drilled/tapped with ¼” holes (for two hole lugs) and mounted to the wall with standoff isolators.
6. Code compliant lighting.
7. Minimum of three 4” sleeves out of the closet wall (horizontal), firestop around outside of sleeve.
8. Minimum of three 4” sleeves, floor-to-floor (riser), firestop around outside of sleeve.
9. Lay in ceilings are not allowed in the closet.
10. Floor tile is not required in closet. Sealed concrete is preferred. If tile is used, use non static tile.
11. 3’-0” minimum wide door.
12. Network closet shall be located as close as possible to the center of the floor and shall be accessible from the corridor.
13. Network closets shall not be shared with other trades, crafts or facilities.
14. Network closets shall be stacked floor to floor one over the other.

15. Network closets shall be a minimum of 6’-0” x 8’-0”.
16. Conduit pathways to field connection: No more than 100 feet between pull boxes. Install pull box every 180 degrees of bend. No right angle / 90 degree fittings.

5.6.4 Data Communications – Fiber Optic Duct Bank Requirements

VCU Net Fiber optic cable that is located outside of buildings shall be run in a concrete encased duct bank. The duct bank shall consist of two (2) four inch dia. Schedule 80 PVC conduits and encased in cast in place concrete.

5.6.5 Distributed Communications and Monitoring Devices

1. Alertus Devices
    A. Provide Alertus Devices strategically located on residence halls and, all classrooms with 20 or more seats, and other high volume areas throughout campus.
    B. Devices will be wall mounted at the front of the classroom area near the whiteboard, or other “front” location of the classroom.
    C. Devices require network and electric power connections. Network needs will be determined by Technology Services with Project Manager and coordinated with Physical Plant.
    D. Device must be installed with a “VCU Alert!” emergency sign.
    E. Reference Alertus Alert Beacon Unit Installation Instructions document in Appendix D
2. ERTS Emergency Response Phones
    A. ERTS phones are to be provided at parking areas and main entrances for each building. Each ERTS phone requires both electrical power and phone connections. These requirements should be planned as part of the project to avoid surface mounted conduit.
    B. Confirm type of phone connection, Voice over Internet Protocol (VoIP) or analog, required for installation location.

5.7 Electronic Safety, Security and Access Control

5.7.1 General

A/E shall be responsible for all the hardware coordination.

A/E shall be responsible for specifying all access control system pathways, conduit, access control and CCTV.

A/E shall be responsible for coordinating the requirements from the access control coordination with VCU, and specifying them on the construction documents.

5.7.2 Telecommunication Cabling Standard

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, Engineering Department, 2001 Pennsylvania Avenue NW, Washington, DC 20006 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

5.7.3 Electronic Access Control & Intrusion Detection

VCU Campus Card Services Access Control Responsibilities:

1. Campus Card Services will be responsible for all access control hardware coordination
2. Campus Card Services will coordinate with A/E to specify all access control system pathways and conduit.
3. Campus Card Services will be responsible for coordinating the requirements of access control with the FMD project manager, VCU Police Department, VCU Fire and Life Safety, and any other areas that need to be involved.

A/E Responsibilities:

1. A/E will be responsible for all other hardware coordination.
2. A/E will be responsible for specifying Fire and Life Safety and CCTV hardware and system pathways.
3. A/E will be responsible for specifying all access control system pathways and conduit.

5.7.4 Access Control Closet:

1. Provide an access control and security closet for all new construction projects, separate from other required communications and data closets. The closet shall be a minimum of 6’ x 4’. Full height 3/4” fire-rated Oriented Strand Board (OSB) shall be installed on all 3 walls. Conduit size shall be 3/4” minimum or larger, as required per the access control coordination.
2. HVAC capacity to maintain ambient room temperature over the range 50 - 85°F 30 - 75% relative humidity (non-condensing), positive pressure with air exchange sufficient to dissipate heat generated by equipment.
3. Access control panel network drop(s) to be provided by VCU Network Services.
4. Access control new panel locations will include a fire drop relay provided by fire alarm contractor.
5. Access control enclosures will require a fire-rated plywood backboard as designated by the A/E.
6. Dedicated 110VAC circuit to be provided as designated by the A/E. Dedicated circuit on emergency power if available.
7. Access control closet cabling entry pathways to be designated by the A/E.
8. All access control closets require a card reader.

5.7.5 Campus Standard Access Control Closets

Mechanical closets require a card reader.

Electrical closets require a card reader.

Plumbing closets require a card reader.

Network closets require a card reader.

Elevator control rooms require a card reader.

5.7.6 Access Control System:

1. An access control system will be included in each new construction project and designated renovation projects.
2. The access control system shall be powered by emergency power or standby generator, if available. The number of circuits will be determined based on equipment requirements provided by VCU. Sharing of neutral wires will not be allowed.
3. Campus Card Services is responsible for the administration of all access control servers and programming.

4. Campus Card Services is responsible for commissioning and testing of all access control components.
5. Campus Card Services will coordinate with VCU Network Services to install network connectivity to the Campus Card Services Network.
6. Campus Card Services will provide and install all access control cable.
7. Campus Card Services will provide and install all access control panels, enclosures, door boards, and input and output boards.
8. Web-based access control programs shall be password protected.
9. A/E shall specify electric strike and key unlock from the outside for all rooms requiring panic buttons.

5.7.7 Building Perimeter Security

1. Mag locks will not be designated or installed on perimeter doors.
    a. Mag locks will not be deployed at any space unless the physical characteristics of the opening preclude the installation of any other type of electronic locking device, i.e. QEL electrified mortise or electronic strike.
2. QEL devices, electrified mortise, and electronic strikes are the campus standard for all perimeter locking devices.
3. Perimeter emergency egress devices, as specified by the AHJ, may be designated as delayed egress devices.

5.7.8 Delayed Egress

Interior/exterior emergency egress devices, as specified by the AHJ, may be designated as delayed egress devices.

5.7.9 Access Control Gates

Electronic gate hardware will be coordinated with Campus Card Services.

5.7.10 Access Control Raceways for New Construction and Renovation Projects

All junction boxes and raceways will be designated by the A/E .

Access control raceway junction box (12x12x4) will be installed in the closest accessible ceiling on the secure side of the opening. This is inclusive of the following:

1. All raceways will be terminated and connected to the junction box.
2. Card reader raceway
3. Lock raceway
4. Door position raceway

5. Request to exit raceway
6. Emergency exit button
7. All other associated devices required for access control.

5.7.11 Card Readers

1. Wired readers will be HID Seos/Prox Bluetooth technology and will be provided, installed and maintained by Campus Card Services.
2. Wireless readers will be Allegion AD400 locks and will be provided, installed and maintained by Campus Card Services.
3. The standard for biometric (fingerprint) scanners will be MorphoAccess Sigma Lite. These scanners will be provided, installed and maintained by Campus Card Services.
4. The standard for biometric (IRIS) scanners will be IRIS EAC. These scanners will be provided, installed and maintained by Campus Card Services.

5.7.12 Access Control Peripheral Door Hardware

1. Door position switch provided and installed by Campus Card Services for all openings.
2. Request to exit devices will be included as part of the lock assembly with QEL and electrified mortise devices for renovation and new construction projects.
3. All request to exit devices not included as part of the lock assembly to be provided and installed by Campus Card Services.

5.7.13 Panic Button

1. Panic Button installations must be approved by VCU Police.
2. All panic button cabling and hardware will be provided and installed by Campus Card Services.

5.7.14 Intercom System

1. IP based AiPhone is the campus standard intercom system. These will be purchased by Campus Card Services.
2. All intercom cabling and hardware will be provided and installed by Campus Card Services.

5.7.15 Knox Box

1. The VCU standard is KNOX VAULT 4400 dual lock box with door position switch and rear tamper.

2. Installation of the Knox Box will be performed by the General Contractor/Construction Manager.
3. Connectivity of the Knox Box alarms will be performed by Campus Card Services.

5.7.16 First Responder Box

1. First Responder Box installations must be approved by VCU Police.
2. VCU Police will determine the location for each First Responder Box installation.
3. Campus Card Services will provide and install the First Responder Box.
4. The General Contractor/Construction Manager will provide all required pathways for the First Responder Box.

5.7.17 Classroom Emergency Lockdown

1. Classroom Emergency Lockdown installations must be approved by VCU Police.
2. VCU Police will determine the location for each Classroom Emergency Lockdown button based on occupancy in conjunction with the Alertus notification appliance.
3. Campus Card Services will provide and install the Classroom Emergency Lockdown device.
4. The general contractor will provide all required pathways for the Classroom Emergency Lockdown device.

5.7.18 Monitored Alarms

1. Monitored alarms must be approved by VCU Police.
2. Standard alarms for all delayed egress devices are monitored by VCU Police.

5.7.19 Campus Key Controlled Box

1. All new construction will have a Key Controlled Box provided and installed by Campus Card Services.
2. The location of the Key Controlled Box will be determined by the A/E.
3. The Key Controlled Box will be located behind no less than one failed secure door of access control.
4. The A/E will specify the appropriate 110VAC and all required pathways.
5. The Key Controlled Box shall be on ePower.

5.7.20 Electronic Surveillance

Closed Circuit Television (CCTV) System

1. VCU may provide a CCTV system in areas it deems appropriate.
2. A/E shall meet with the VCU Police and the VCU Access Control Shop to coordinate the CCTV system installation with the construction documents.
3. The access control system shall be powered by emergency power or standby generator, if available. The number of circuits will be determined based on equipment requirements provided by VCU. The sharing of neutral wires will not be allowed.

5.8 Equipment

5.8.1 General

All requests for audio visual equipment shall be coordinated with VCU Construction Management, Planning & Design, and Media Services. All Information Technology requests shall be coordinated with VCU Construction Management, Planning & Design, Technology Services, and the General Contractor.

5.8.2 Fall Protection

All new construction and major renovation projects are required to comply with certain standards in Occupational Health and Safety Administration's (OSHA) General Industry Standard 1910 Subpart D - Walking-Working Surfaces. This applies to employees on a walking-working surface with an unprotected side or edge that is 4 feet or more above a lower level. Note: The definition of a walking-working surface means any horizontal or vertical surface on or through which an employee walks, works, or gains access to a work area or workplace location. The required standards include:

- Duty to have fall protection - 1910.28
- Design requirements for fixed ladders - 1910.23(d) - In addition to the standard requirements, all VCU fixed ladders greater than 10 feet in height shall have a ladder safety system or personal fall arrest system installed. Cages are no longer considered an acceptable means of fall protection {1910.28(b)(9)}. Ladder safety system designs must comply with 1910.29(i). Glideloc Vertical Height Access Ladder System Kits.
- Design requirements for guardrail systems - 1910.29(b)
- Design requirements for skylights (holes) - 1910.29(e)
- General requirements for personal fall protection systems - 1910.140(c)

Additionally, all Fall Protection and Fall Arrest systems and components must meet the requirements found in the American National Standards Institute (ANSI) consensus standards: Z359-2007

5.8.3 Cold Rooms

Built in cold rooms to be on BAS and E-Power. For stand-alone units, consult with Engineering & Utilities on project specific requirements

5.8.4 Laboratory Equipment

Where research and teaching labs are required to have Emergency Eye / Face Wash and Emergency Showers, provide a recessed barrier-free swing-down eye / face wash with drain pan, and shower safety station with ceiling mounted exposed shower head combination unit. Reference the preferred product by Guardian Equipment, model GBF2150.

Where research and teaching labs are required to have Emergency Eye / Face Wash only, provide a recessed barrier-free swing-down eye /face wash with drain pan unit. Reference the preferred product, by Guardian Equipment, model GBF1735DP.

Where surface mounted Emergency Eyewash / Faucet combination units are required to supplement recessed swing-down emergency wash units, provide Faucet Eyewash Combo unit with the following features:

- Combined gooseneck faucet with independently operated eye-wash
- Twin aerated eyewash sprays, with flip-top dust covers
- Eyewash activation by clearly delineated handle
- Faucet handles shall have at minimum 4” wrist blade handles for hot and cold water supplies, operating quarter-turn ceramic cartridges (25 year cartridge warranty).
- Eyewash faucet location shall be further identified
- Reference the preferred product, by Speakman, model SEF-1800-CA-8.

5.8.5 Lockers

Lockers are departmental equipment and are not maintained by Physical Plant. Locker design will vary based on the user’s requirements. Below is a list of requirements for all lockers.

- Lockers shall be phenolic. Painted metal is not permitted.
- Lockers shall include an electrical outlet.
- Lockers shall include charging stations for portable electronics.
- Power for locker outlets and charging stations shall be on dedicated circuits.
- Lockers shall have electronic (digital) locking systems. Key based systems are not allowed unless specifically requested by the user.

CHAPTER 6 - CONSTRUCTION

6.1 Construction Site

6.1.1 Construction Sign

A construction sign will be posted at a location to be determined by the VCU Project Manager. The cost of mounting and disposing of the sign, shall be included in the Contractor's general condition's cost. Design and graphics for signs must be approved by the VCU Project Manager.

6.1.2 Staging & Lay-Down Areas

Staging and lay-down areas are very limited. The impact of this should be considered in the schedule and cost estimate, especially if off-site lay-down or staging areas are required.

6.1.3 Contractor Signage

The Contractor may mount or display company logo signage, after the proposed type, size, verbiage, and location is approved by VCU.

6.1.4 Temporary Construction Barriers

If construction barriers are needed, the type of barrier will be determined by both project scope, and length of use of the material. Caution tape may be used for a period not to exceed one day. Plastic safety fence may be used for a period not to exceed one week. Portable chain link fence panels are to be used for longer durations. Plywood barriers may be needed for closed sidewalks adjacent to construction sites.

6.1.5 Interior Temporary Partitions & Barriers

Interior temporary partitions are to be specified as part of the design documents. The Contractor shall provide spare keys to temporary locks for the construction phase Project Manager, in case emergency access is required. Temporary partition materials must comply with building code requirements for construction type and use of the existing facility.

6.2 Vermin Protection and Infection Control

6.2.1 Vermin Protection

All demolition and construction sites shall be pre-treated by a pest control contractor, to place bait stations and mechanical devices near the demolition site or the perimeter of

nearby occupied buildings, to curtail rodent activity from moving to nearby occupied buildings.

6.2.2 Infection Control

Due to the presence of Aspergilla spores present in soils, all ground disturbances on the VCUHS campus must comply with the hospital's Infection Control Policy, established for each project as directed by the Hospital Epidemiologist. The hospital's Epidemiologists should provide specific recommendations and protocols based on the risks presented by each project.

6.3 Underground and Aboveground Storage Tank Systems

Technical standards related to Underground Storage Tank Systems (USTS) and Above Ground Storage Tanks (AST) are contained in the Department of Environmental Quality, Water Division, Regulations: VR 680-13-02, Underground Storage Tanks: Technical Standards and Corrective Action Requirements; VR 680-14-12, Facility and Aboveground Storage Tank Registration Requirements; and VR 680-14-13, Above ground Storage Tank Pollution Prevention Requirements.

Pursuant to Section 36-98.1 of the Code of Virginia, the Director of the Department of General Services has delegated to local building departments inspection and enforcement authority for state-owned USTS and AST for the purpose of issuing permits, Certificates of Use and performing inspections required by VR 680-13-02; VR 680-14-12; and VR 680-14-13

The University shall request the services above from the nearest local building department on all USTS and AST projects/actions. The University will provide the local building department copies of the appropriate sections/sheets of the specifications/ drawings. The University shall pay to the local building department the same fees as would be paid by a private citizen for the services rendered.

Appendix A – Asbestos and Lead Paint

A1 General Asbestos Requirements

Buildings constructed prior to 1980 are presumed to have asbestos-containing materials (ACM) in materials including, but not limited to, asphalt and vinyl flooring, resilient floor covering, mastics, fibrous pipe insulations, caulking, roofing, flashings, bonding agents, coatings, and binders until such materials have been tested and found not to contain asbestos. Existing facilities constructed prior to January 1, 1985 must be inspected by a Virginia-licensed or properly certified asbestos inspector who must provide their signed (certified) report.

Refer to the most current edition of the Virginia Construction and Professional Services Manual (CPSM) together with any subsequent DEB notices or revisions, as currently posted on the Virginia Department of General Services'website.

https://dgs.virginia.gov/engineering-and-buildings/statewide-constructionproject-management/current-cpsm-edition/

The following VCU facilities have special asbestos alerts:

- West Hospital - It has asbestos throughout almost all aspects of the building's components
- Lyons - There is asbestos above the fourth floor ceilings, and in select areas on other floors.
- Harris Hall - Although it has been incrementally abated over the years, there are ceiling tiles in a few remaining rooms that contain asbestos, along with the auditorium.

If asbestos is found in floor tile or floor tile mastic, VCU policy states that the floor must be abated and removed, rather than covering over it with carpet or some other floor materials.

Specifically require abatement contractor(s) to comply with the 20 working day notice requirement to the Virginia Department of Labor and Industry in advance of beginning any asbestos abatement. Note the use of "working days." Contractor must add additional time for weekends and holidays as appropriate.

An estimated cost for asbestos abatement when suspected or predetermined, shall be included in the cost estimate supporting the construction budget or budget request. For renovation, demolition, or addition projects, including roofing materials, the University shall test for ACMs prior to submittal of the preliminary design. The asbestos survey and inspection report must be made available to the project A/E for information and use in preparing the project documents.

If ACMs are found, the University shall have a licensed asbestos designer in consultation with the A/E, shall prepare an asbestos abatement plan and prepare or update the University Asbestos Management Plan as required by the University, in compliance with §2.1-1164, Code

of Virginia. The asbestos abatement contractor shall be required to mark up the Asbestos Management Plan to show the "As-Built" conditions resulting from its work; to include areas where asbestos was abated, areas where asbestos was encapsulated, and areas where ACMs exist, but were left in place.

ACMs abatement designers and A/E's can coordinate with each other, but neither can legally be responsible for the other's work, since the licensing and insurance requirements for each discipline are very different.

Based on the report of the asbestos survey and inspection report and the Asbestos Management Plan, the construction drawings for renovation or addition projects shall indicate all locations where ACMs were found, where ACMs are to be disturbed, and where ACMs are to remain. The asbestos survey and inspection report and the Asbestos Management Plan, must be made available for their respective information to the contractor(s) for demolition and for construction.

The report and "As-built" documentation may be included as an appendix to the project manual (A/E specifications) when provided, otherwise they can be made available as standalone documents for bidder's reference. Be clear that these are provided for bidder's reference only and are not contract documents.

Include the appropriate Asbestos Disclosure Statement on the demolition plan sheets, and the floor plan sheets for all disciplines and for each floor. See the current edition of the CPSM for approved language.

The Demolition Plan sheets and the Architectural Floor Plan sheets for each floor shall also have an Asbestos Disclosure Statement indicating one of the following:

- "An asbestos inspection was performed and no ACM was found. The asbestos inspection report is included as an appendix to the project specifications."

- An asbestos inspection was performed and ACM was found generally in the areas indicated. However, the work in this project is not intended to disturb the existing ACM. The asbestos inspection report is included as an appendix to the project specifications.

- An asbestos inspection was performed and ACM was found generally in the area indicated. The asbestos inspection report is included as an appendix to the project specifications. The Owner shall submit an application for permit to have the asbestos-containing materials abated by a licensed asbestos contractor under a separate contract using approved procedures prior to issuing a Notice to Proceed to the General Contractor. Any ACM that is to remain and the new non-asbestos containing material shall be labeled accordingly. The asbestos abatement contractor shall mark up the As-Built Drawings resulting from its work to include areas where asbestos was abated, areas where asbestos was encapsulated, and areas where ACM exist but were left in

place. The General Contractor shall review and certify the locations where ACM was abated, areas where ACM was encapsulated and areas where ACM was left in place as marked on the As-Built Drawings and will provide the drawings to the Architect.

- An asbestos inspection was performed and ACM was found generally in the area indicated. The asbestos inspection report is included as an appendix to the project specifications. Asbestos-containing building materials shall not be disturbed in this work except where specifically indicated and required. Where such actions are required, the contractor shall have the ACM removed by a licensed asbestos contractor using approved procedures as specified. The work required for asbestos abatement is permitted within the overall building permit issued. The ACM that is to remain and the new non-asbestos containing material shall be labeled accordingly. The asbestos abatement contractor shall mark up the As-Built Drawings resulting from its work to include areas where asbestos was abated, areas where asbestos was encapsulated, and areas where ACM exist but were left in place. The General Contractor shall review and certify the locations where ACM was abated, areas where ACM was encapsulated and areas where ACM was left in place as marked on the As-Built Drawings and will provide the drawings to the Architect.
- An asbestos inspection was not performed because all portions of the existing building that may be affected by the work were originally constructed after January 1, 1985.

The A/E shall be responsible to the University for coordinating the design of the renovation / addition work with the asbestos abatement work in order to prevent conflicts, claims, and work stoppages.

The VCU Project Manager will verify that the A/E and the licensed asbestos designer have coordinated their design work with each other, and the licensed abatement contractor has coordinated and verified their work and project scope with other contractors.

Each design and construction entity is obligated to coordinate their work with others, and to bring conflicts and discrepancies to the Owner's attention for resolution.

A2 Asbestos Removal

All ACMs that will be disturbed as a result of a renovation, demolition, or addition project, must be removed. The University will have asbestos project specifications written by a Virginia licensed designer. The designer's license number, name, and signature must appear at the beginning of the asbestos specifications. Use of a Virginia licensed asbestos abatement designer is mandatory. The asbestos abatement designer must be under direct contract with the University.

The asbestos project specifications shall adhere to all current Federal and State regulations and policies.

The specifications shall include a copy of the project specific asbestos inspection report and Asbestos Management Plan, indicating the sampling of and analyses for all materials that will or may be disturbed or accessed by the project. The specifications shall include a section that covers project notification by the asbestos contractor to the United States Environmental Protection Agency (EPA), the Virginia Occupational Safety and Health (VOSH), and the Division of Air Pollution Control (DAPC), at least 20 calendar days prior to the actual start of the asbestos project.

Asbestos drawings and specifications shall be submitted to the University Department of Environmental Health and Safety with the Contract Documents for review and approval.

The University has two contracting options for use, in the removal of asbestos from a structure and option two is the preferred method:

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

The asbestos abatement contractor shall be required to mark-up the Asbestos Management Plan to show the "As-Built" conditions resulting from its' work, to include areas where asbestos was abated, areas where asbestos was encapsulated, and areas where ACMs exist, but were left in place.

A3 Use of Asbestos Containing Materials

The use of materials that contain asbestos is prohibited in any new construction or renovation.

A4 Removal & Replacement of Sprayed on Fireproofing Material

In consultation with the University, the A/E shall verify early in the design phase with the appropriate Fire Marshal, the original purpose of the fireproofing material to be removed or replaced and what, if anything, must be done to restore the fire resistive characteristics. Plans and specifications shall be submitted to the Fire Marshal, which will include any bidding documents, addenda, or change orders from the original construction, which may relate to the fire resistive characteristics of the structure. On a submittal to the Fire Marshal, indicate the original construction date, and any renovation or alteration dates, original and present uses, height of floors in feet, and whether sprinkler or any other information that may assist the Fire Marshal in his determination, be provided. If sprayed-on ACMs are to be replaced, the University or its' A/E shall also submit copies of the specifications for the intended replacement material, and the bridging encapsulate specified by the asbestos project designer for review by the Fire Marshal. Require that the spray-applied fireproofing applicator provides bridging encapsulate that is correctly matched with the replacement fireproofing material, to ensure

maximum bonding strength and intended fire rating integrity of the assembly, and acceptable flame spread ratings.

A5 Asbestos Related Work Insurance Requirements

Asbestos inspectors, project designers, project monitors, and their firms, are required to provide evidence of professional liability or errors and omissions insurance, with asbestos coverage in an amount not less than $1,000,000.00. VCU, its' officers, employees, agents, or any other persons acting in an official capacity, temporarily or permanently in the service of the Commonwealth, should also be named as additional insured persons.

Section 11 (e) of Virginia Commonwealth University General Conditions of the Contract for Capital Outlay Projects requires 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 is also a Virginia licensed asbestos designer, and prepares the asbestos project drawings and specifications, the requirement to name the A/E as an insured party is waived.

A6 Conflict of Interest Policies

The asbestos surveyor / inspector, the asbestos abatement designer, the University's asbestos management plan author and any other person or firm hired by the University to provide consulting or inspection services on the project shall not be associated by any business or financial relationship to the asbestos abatement contractor.

Asbestos abatement contractors are not eligible to bid on those particular projects for which the asbestos surveys, inspections, bulk sample analyses, project designs, or asbestos management plans were performed by individuals or firms employed by or financially affiliated with the contractors during the time period in which the inspections were conducted, samples analyzed or the project designs written.

Asbestos surveyors, asbestos abatement designers or asbestos abatement management plan authors shall not contract with the asbestos abatement contractor to provide services on the project. Asbestos project inspector (project monitors) are not eligible to contract for project inspection work on a project if they are financially affiliated with or employed by the asbestos abatement contractor on any project. These services are to be directly contracted for by the University, and the monitoring personnel shall be accountable only to University officials.

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.

A7 Resilient Floor Covering

Summary:

If the floor tile, when dry, can be crumpled in one's hand, it is considered "friable". All friable materials must be removed using the standards from the National Emission Standards for Hazardous Air Pollutants (NESHAP). If the floor tiles are friable and total less than 10SF of surface area, the Armstrong method may be used. If the floor tiles total more than 10SF of surface area, NESHAP abatement methods are required.

There is a wide variety of resilient floor covering applications that contain asbestos. The most common are linoleum flooring and Vinyl Asbestos Tile (VAT). VAT is most commonly found in either a 9" x 9" or a 12" x 12" square size. The 9" x 9" VAT's are normally found in older buildings, because they were manufactured earlier than the 12" x 12" VAT's; however, floor tile sizes and resilient floor covering applications vary greatly since many buildings have been re-tiled several times.

Floor coverings in poor condition can often be found near doorways or loading / staging areas where the floor has sustained a lot of stress and traffic.

In order to determine if a resilient floor covering is in poor condition, look for sections or tiles which are cracked or peeling to the extent that they are crumbled. If the floor covering is in poor condition, collect a small representative sample and seal it in a transparent, sample bag. Hand pressure should be applied to determine if the material can be crumbled, pulverized, or reduced to powder. If it can be crumbled, the resilient floor covering that will be or has been sanded, ground, or material is considered friable.

Resilient floor covering that will be or has been sanded, ground or abraded is subject to NESHAP standards.

If the floor tiles are friable, they are considered Regulated Asbestos- Containing Material (RACM), and must be handled in accordance with NESHAP standards.

Regulated Asbestos-Containing

Material (RACM) is (a) friable asbestos material, (b) Category I non- friable ACMs that has become friable, (c) Category I non-friable ACMs that will be or has been subjected to sanding, grinding, cutting or abrading, or (d) Category II non-friable ACMs that has a high probability of becoming, or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations.

If floor tiles are non-friable and specify compliance with the Resilient Floor Covering Institute’s (RFCI) “Recommended Work Practices for Removal of Resilient Floor Coverings” including removal of residual adhesives, underlayment materials (if required), and the packaging and labeling of waste materials.

See http://www.osha.gov/dcsp/osp/stateprogs/virginia.html and

http://www.doli.virginia.gov/leadasbestos/leadasbestos_intro.html for current summary information regarding the Virginia State Plan.

Reference the Virginia Department of Labor & Industry (DOLI) fact sheets, “Renovation & Demolition of a Building / Facility” and the “VA Department of Labor & Industry Asbestos FACT Sheet” at the end of “Division 2: Existing Conditions”.

The October 2011 edition of RSCI’s recommendations replace all prior editions and Armstrong Recommended Work Practices publications.

A8 Special Procedures for Lead Containing Materials

Effective June 3, 1993 the U. S. Department of Labor’s interim final rule amends the Federal OSHA standards for occupational health and environmental controls in subpart D of 29 CFR part 1926, adding a new Section1926.62 indicating protection requirements for construction workers exposed to lead. The entire rule is contained in the Federal Register Vol. 58, No. 84, May 4, 1993. The Virginia OSHA regulations have subsequently adopted the federal regulations in total.

The Virginia Department of Labor and Industry (DLI) established an emergency regulation in the May 27, 1996 Virginia Register requiring, among other things, that a permit be issued by DLI to the lead abatement contractor. This requirement is also stated in the General Conditions of the Construction Contract. When planning a renovation, demolition or addition project, the University shall have the facility to be renovated surveyed for lead based paint (LBP) contamination and document all quantities and locations found.

All facilities which may house children 6 years of age and younger that were constructed prior to 1978, must have a lead materials and lead paint inspection and risk assessment conducted by a Virginia-licensed lead inspector and or risk assessor prior to being occupied by children 6 years and younger. Where abatement or renovation is to be conducted in these facilities, a Virginia-licensed lead project designer shall develop lead project specifications that comply with all EPA and VOSH regulations. A Virginia-licensed risk assessor or lead project designer shall insure that the requirements of the project specifications are followed, including the collection and documentation of all clearance samples.

An estimated cost for lead paint abatement, when suspected or predetermined, shall be included in the cost estimate supporting the construction budget or budget request.

In addition to abatement, disposal budget estimates and requests shall include cost of Contractor compliance with Virginia DOLI requirements for the protection of construction workers for the specific project.

In areas to be renovated, the agency shall include a copy of the lead inspection report as an appendix to the project specifications. Where lead materials are found in structures to be demolished, the agency shall determine if the structure has the potential to be considered a

hazardous waste when demolished, and shall have a TCLP test conducted, if recommended by the lead inspector or risk assessor.

The construction drawings for renovation or addition projects shall indicate all locations where lead-based paint is to be disturbed or to remain and shall also have a lead-based paint disclosure statement indicating one of the following:

- A lead-based paint inspection was performed and no lead-based paint was found.
- A lead-based paint inspection was performed and lead-based paint was found in indicated areas. However, the work in this project is not intended to disturb existing lead-based paint.
- A lead-based paint inspection was performed and lead-based paint was found in the areas indicated. The lead-based paint shall be removed prior to any other work being performed in these areas.
- A lead-based paint inspection was performed and lead based paint was found in the areas indicated. Lead-based paint shall not be disturbed in this work except where specifically indicated and required for connections to utilities. Where such connections are required, Contractor shall have the obstructive and adjacent lead-based paint removed by a licensed lead- based paint abatement contractor using approved procedures as required by VOSHA. The lead-based paint that remains and new non lead-based paint areas shall be labeled accordingly.
- A lead-based paint inspection was performed and lead-based paint was found in the areas indicated. The contractor shall be responsible for compliance with all requirements of the Virginia Occupational and Health Administration regulations regarding lead-based paint protection for workers.

If abatement and encapsulation is to be done by the General Contractor, the A&E shall identify the type and location of all lead-based paint and notify the contractor that this work is part of the contract for construction. Lead-based paint must be identified and the contractors notified that they must be in compliance with VOSHA requirements for worker safety. It shall be the contractor's responsibility to comply with the requirements of VOSHA.

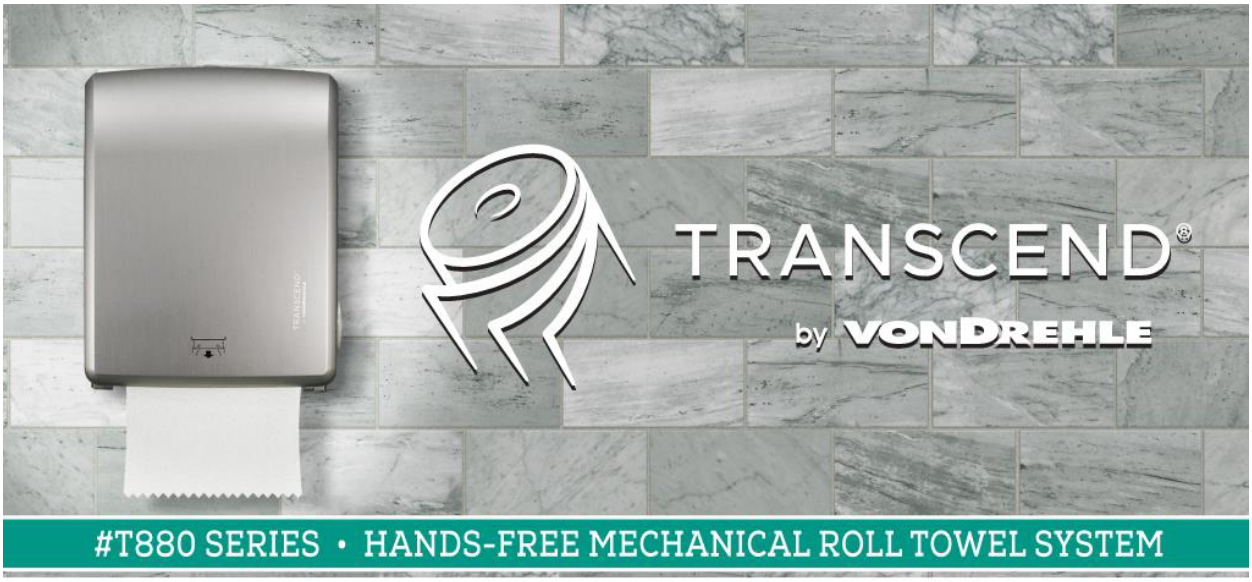
In facilities where children 6 years and under may be located, and if lead-containing materials will be encountered by the General Contractor (GC), the A/E shall identify the type and location of all lead-based paint and notify the GC that this work is part of the contract for construction. Lead-based paint must be identified and the contractors notified that they must be in compliance with all EPA requirements for lead control and abatement in target housing, and all VOSH requirements for worker safety. It shall be the Contractor's responsibility to comply with all EPA and VOSH requirements.

The contractor shall establish a schedule with the University for abatement and containment in buildings that are to remain occupied during construction.

Following removal of lead-based paint containing materials, additional TCLP tests in accordance with EPA guidelines shall be done on these materials to determine disposal requirements. TCLP tests of waste materials shall identify whether the material will be required to be disposed of as toxic waste or as ordinary construction debris. It shall be unlawful for materials identified as toxic waste to be disposed of with ordinary construction debris.

Appendix B – Restroom Accessories

Paper Towel Dispenser



- Transcend Your Expectations -



Performance / Reliability -
- Third-party, independent life-cycle testing
- Low pull force for reduced tabbing
- Auto-transfer stub roll feature



Consistency -
- A comprehensive dispenser family
- Consistent styling from "wall to stall"
- Matching finishes in black, white, or stainless finish



Appearance -
- Sleek lines and timeless styling
- Unique micro-texture resists fingerprints
- Dispensers stay cleaner and newer looking



Convenience -
- Same metal key for the entire family
- Dual-function locking mechanism
- Key required or keyless push-button


#T880-B


#T880-S


#T880-W



VONDREHLE CORPORATION

INTEGRITY IS OUR **MOST IMPORTANT** ASSET.

T. 800-438-3631
www.vondrehle.com

Paper Towel Dispenser (cont.)

TRANSCEND®

T880 Series

Controlled-Use
8-Inch Mechanical Roll Towel Dispenser







- **Hands-free**
  for sanitary, hygienic dispensing
- **No Batteries Required**
  for increased reliability and lower operating costs
- **High Capacity**
  holds up to 1,000 feet to reduce maintenance
- **Cuts 11" Towel**
  to control usage and reduce waste
- **Low Pull Force**
  to virtually eliminate mis-feeds and tabbing issues
- **Stub Roll Feature**
  to reduce waste and the possibility of run-outs

Item #:	T880-*
Brand:	Transcend®
Color Options:	■-B (black) ▨-S (stainless) □-W (white)
Finish:	Micro-Texture

Height:	15.21 inches
Width:	12.04 inches
Depth:	9.48 inches

Units per Case:	1
Cases per Pallet:	99
Case Cube:	1.01
Shipping Weight:	6.1 lbs.

For use with:

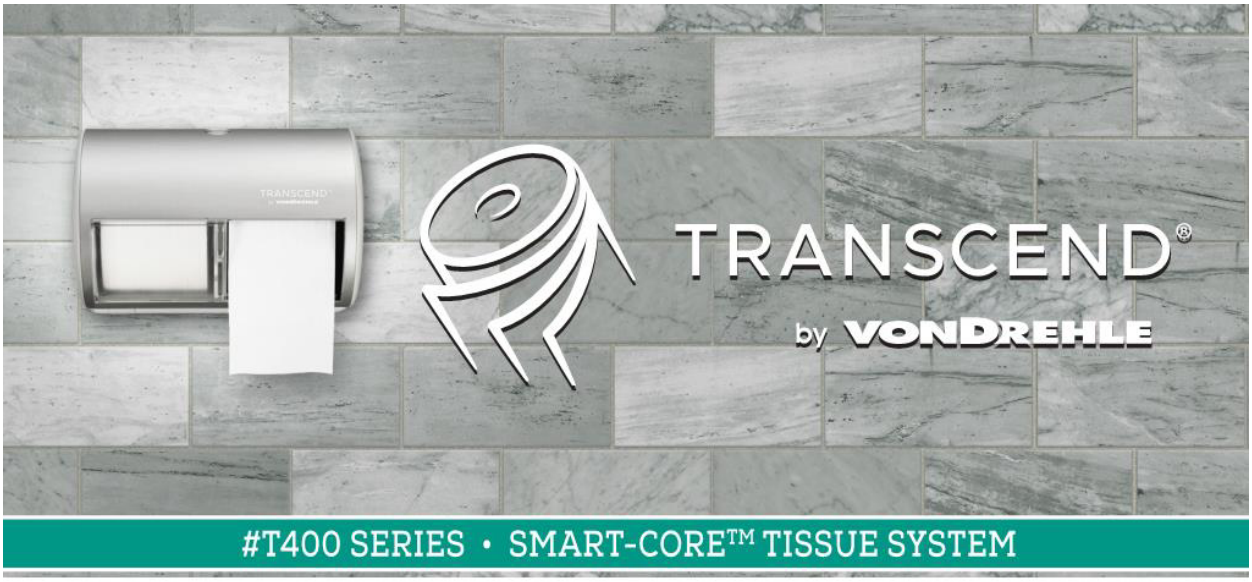
813-BP, 880-BP, 88012-BP, 813-NP, 880-NP, 88012-NP, 880-TP

VONDREHLE CORPORATION

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Toilet Paper Dispenser



- Transcend Your Expectations -



Performance / Reliability -
- Third-party, independent life-cycle testing
- Designed for years of trouble-free service
- Stub roll features to reduce waste



Consistency -
- A comprehensive dispenser family
- Consistent styling from "wall to stall"
- Matching finishes in black, white, or stainless finish



Appearance -
- Sleek lines and timeless styling
- Unique micro-texture resists fingerprints
- Dispensers stay cleaner and newer looking



Convenience -
- Same metal key for the entire family
- Dual-function locking mechanism
- Key required or keyless push-button



#T400-B



#T400-S



#T400-W



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Toilet Paper Dispenser – cont.

TRANSCEND®

T400 Series

Controlled-Use
Forward-Facing Smart-Core™ Tissue Dispenser







- **Small Footprint**
  perfect for small or limited space areas
- **High Capacity Smart-Core™**
  holds up to 1,880 feet to reduce maintenance
- **Enclosed Tissue Supply**
  for sanitary, hygienic dispensing
- **Stub Roll Feature**
  to reduce waste and ensure full use of tissue
- **Back-Up Tissue Roll**
  to eliminate the chance of run-outs
- **Reduced Packaging**
  for less storage demands

Item #:	T400-*
Brand:	Transcend™
Color Options:	■-B (black) ▨-S (stainless) □-W (white)
Finish:	Micro-Texture

Height:	7.25 inches
Width:	10.5 inches
Depth:	7.0 inches

Units per Case:	2
Cases per Pallet:	110
Case Cube:	0.72
Shipping Weight:	5.0 lbs.

For use with:
PR350, PR420, PR470, PR850, PR420VT

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Appendix B – Restroom Accessories

Soap Dispenser

DISPENSERS

SC Johnson PROFESSIONAL
A Family Company™

Manual Skincare Dispensers

PRODUCT DESCRIPTION
Unique range of 1 liter and 2 liter sealed cartridge dispensers that meet the distinct needs of any office or public facility environment.

WHERE TO USE
For exclusive use with SC Johnson Professional 2L Foam or 1L cartridge products.

METHOD OF USE
Large, 'easy-push' buttons dispense a controlled dose of product appropriate for the application required and empty cartridges are easily replaced in seconds.



FEATURES	BENEFITS
Warranted for Life	Proline, TF Ultra and CTF Ultra dispensers are warranted for their lifetime. Warranty applies only in the USA and to dispensers exclusively using SC Johnson Professional products. Other terms and conditions apply: warranty.scjp.com.
Robust Design	All SC Johnson Professional dispensers are manufactured from durable plastic components and rigorously tested for high usage environments, providing assurance of quality and longevity.
BioCote® Protected* BioCote®	Biocote silver ion technology effectively reduces bacteria, mold and fungi on the surface of Biocote® treated SC Johnson Professional* dispenser buttons within as little as 2 hours and achieves up to 99.99% reduction over a 24 hour period**. Biocote® maintains its antimicrobial protection for the lifetime of the dispenser button and will not wear off, wash off or leach out. Biocote® technology is not a substitute for good hand hygiene practices.
Large Push Buttons	Minimize the operation force required to allow easy use by hand or elbow; suitable in hygiene sensitive areas.
Fixed Product Dose	Delivers the exact amount required, controlling usage and reducing waste.
Unique Locking Mechanism	Helps prevent unauthorized access, pilferage and product contamination.
Simple Cartridge Replacement	Designed for exclusive use with SC Johnson Professional skin care system products to enable cartridges to be replaced in seconds, reducing maintenance time and costs.
Hygienic, Airless Cartridges	The ultrasonically sealed cartridge and pump mechanisms prevent the ingress of air into the cartridge during use to help prevent product contamination and ensure 'fresh' product is dispensed every time.
Minimal Waste	The air-tight cartridges are designed to collapse to minimize product waste.
Replacement Parts Available	In case of vandalism or accidental damage, replacements parts can be provided allowing for repairs without taking the dispenser off the wall.

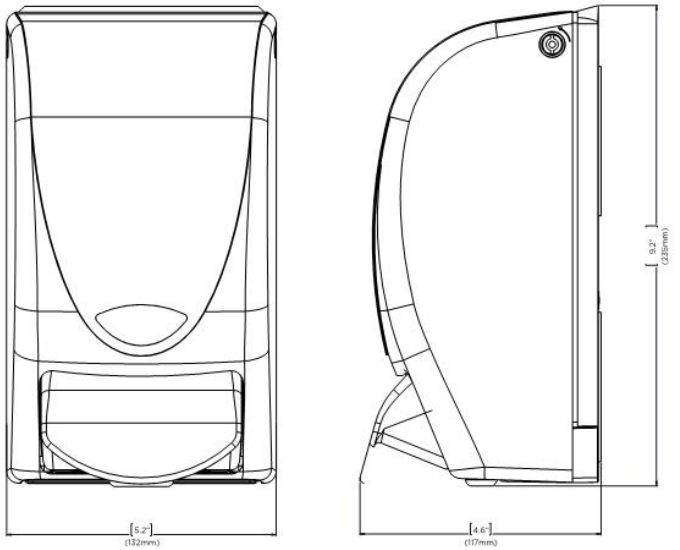
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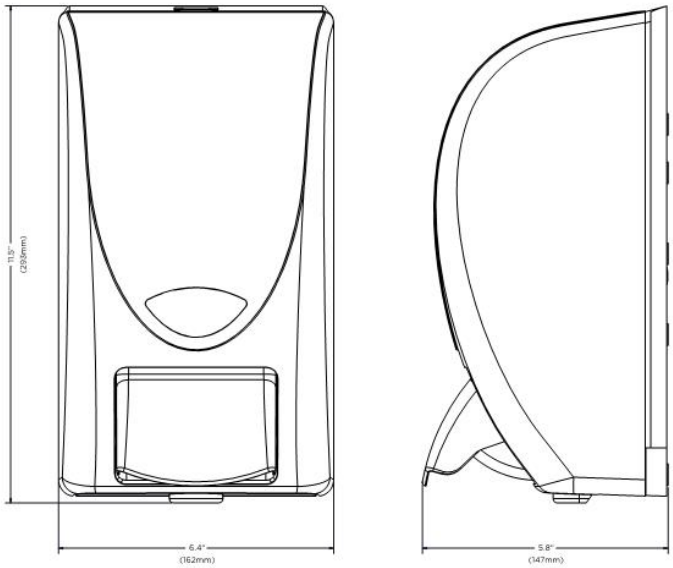
Soap Dispenser – cont.

Manual Skincare Dispensers

1 LITER MANUAL DISPENSER



2 LITER MANUAL DISPENSER



Manual Skincare Dispensers | Jan 2021 2/3

Soap Dispenser – cont.

Manual Skincare Dispensers

DISPENSER CARE

- DO clean with a damp cloth
- DO NOT use abrasive cleaners
- DO NOT use solvent-based cleaners
- DO NOT use caustic or acid-based cleaners
- DO NOT expose the unit to direct sunlight,UV can damage its high quality finish
- DO NOT expose the unit to extreme temperatures above 104°F or below 40°F

* BioCote® is a registered trademark of Biocote Limited ** Efficacy is independently validated by ISO methods

PACK SIZES

STOCK CODE	DISPENSER	COLOR	CARTRIDGE CAPACITY	CASE QTY	TO USE WITH
91128	Proline 1L Dispenser Black	Black	1 Liter	15	Universal for All 1 Liter Manual SC Johnson Professional Product Cartridges
WHB1LDS	Proline 1L Dispenser White	White	1 Liter	15	
TPW1LDS	Proline 1L Dispenser Transparent White w/Chrome	Transparent White w/ Chrome	1 Liter	15	
TPB1LDS	Proline 1L Dispenser Transparent Black w/Chrome	Transparent Black w/ Chrome	1 Liter	15	
WYH1LDS	Kid's Wash Dispenser	Green	1 Liter	15	
BLK2LDP	Proline 2L FOAM Dispenser Black	Black	2 Liter	8	For 2 Liter Foam SC Johnson Professional Product Cartridges

SC Johnson Professional USA, Inc.
2815 Coliseum Centre Dr.
Suite 600,
Charlotte, NC 28217
United States
Telephone: +1 800 248 7190
www.scjp.com

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SCJohnson PROFESSIONAL A Family Company™

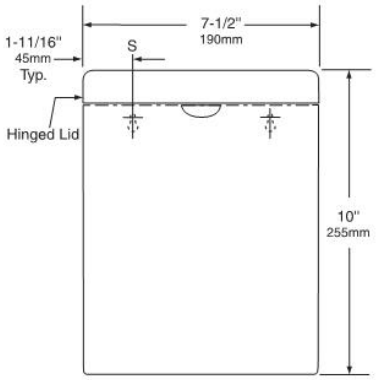
BOBRICK

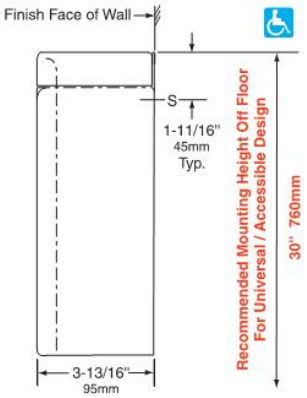
Technical Data

ConturaSeries® SURFACE-MOUNTED SANITARY NAPKIN DISPOSAL

B-270







MATERIALS:

Container — 18-8, type-304, 22-gauge (0.8mm) stainless steel. All-welded construction. Exposed surfaces have satin finish. Integral finger depression for opening cover. Front of container has same degree of arc as front of cover and other Bobrick ConturaSeries washroom accessories. Radius on side edges of container match corners and edges of cover and other ConturaSeries accessories.

Cover — 18-8, type-304, 22-gauge (0.8mm) stainless steel with satin finish. Drawn, one-piece, seamless construction. Front of cover has same degree of arc as front of container and other Bobrick Contura Series washroom accessories. Radius on corners and edges of cover match side edges of container and other Contura Series accessories. Secured to container with a full-length stainless steel piano-hinge.

OPERATION:

Cover flips up for disposal of sanitary napkins and for servicing container.

INSTALLATION:

For partitions with particle-board or other solid core, secure with two #8 x 3/4" (4.2 x 19mm) sheet-metal screws (not furnished) at all points indicated by an *S*, or provide through-bolts, nuts, and washers.

For hollow-core metal partitions, provide solid backing into which sheet-metal screws can be secured. If two units are installed back-to-back, then provide threaded sleeves and machine screws for the full thickness of partition.

For masonry walls, provide fiber plugs or expansion shields for use with sheet-metal screws, or provide 3/16" (5mm) toggle bolts or expansion bolts.

For plaster or dry wall construction, provide concealed backing to comply with local building codes, then secure unit with sheet-metal screws.

SPECIFICATION:

Surface-mounted sanitary napkin disposal shall be type-304 stainless steel with all-welded construction; exposed surfaces shall have satin finish. Front of sanitary napkin disposal shall have same degree of arc and match other Bobrick ConturaSeries accessories in the washroom. Radius on corners and edges of sanitary napkin disposal shall complement other Bobrick ConturaSeries washroom accessories. Cover shall be drawn, one-piece, seamless construction and secured to container with a full-length stainless steel piano-hinge. Container shall have integral finger depression for opening cover.

Surface-Mounted Sanitary Napkin Disposal shall be Model B-270 of Bobrick Washroom Equipment, Inc., Clifton Park, New York; Jackson, Tennessee; Los Angeles, California; Bobrick Washroom Equipment Company, Scarborough, Ontario; Bobrick Washroom Equipment Pty. Ltd., Australia; and Bobrick Washroom Equipment Limited, United Kingdom.

The illustrations and descriptions herein are applicable to production as of the date of this Technical Data Sheet.
The manufacturer reserves the right to, and does from time to time, make changes and improvements in designs and dimensions.

Revised 10/18/13 Printed in U.S.A.
© 2013 by Bobrick Washroom Equipment, Inc.

Hand Dryer

TECHNICAL DATA SHEET

XLERATOR® HAND DRYER

MODELS: **XL -** **BW** **W** **GR** **C** **SB** **SI** **SP** OPTIONS: **-H** (HEPA Filter) **-1.1N** (Noise Reduction Nozzle) **-VOLTAGE** (See Chart)



XL-BW
White Thermoset Resin (BMC)



XL-W
White Epoxy Painted



XL-GR
Graphite Textured Painted



XL-SP[4]
Custom Special Paint



XL-SI[5]
Custom Special Image



XL-C
Chrome Plated



XL-SB
Brushed Stainless Steel

TESTED TO PCR GUIDELINES

UL Environment published the first global Product Category Rules (PCR) for Hand Dryers. The PCR created evaluation methods through industry consensus that compare products' environmental impact and performance. Third-party testing results then allow for the creation of certified Environmental Product Declarations (EPDs).

CERTIFIED

An EPD is a comprehensive, internationally-harmonized report documenting a product's environmental impact over its lifecycle. They enable specifiers and buyers to make a true apples-to-apples comparison of products and make more informed product selections. Excel Dryer received the industry's first certified EPDs.

LIMITED WARRANTY

The dryer shall be guaranteed to be free from defects for a period of **seven (7) years**. Warranty shall include labor performed at factory as well as the repair or exchange of defective parts, at manufacturer's option.

QUANTITY RECOMMENDATIONS

One dryer for every two washbasins is sufficient for most applications. If restroom traffic is unusually heavy, we suggest one dryer per washbasin in small installations and two dryers for every three washbasins in larger installations. When a 54" washfountain is used, we suggest four to five dryers.

PERFORMANCE

TESTED TO PCR GUIDELINES **DRY TIME: 8 SECONDS**[1] **ENERGY PER USE: 3.7 Wh**[1]

DATA BASED ON ALL XL .8 NOZZLE DRYERS INCLUDING HEPA MODELS

SOUND: 62 - 75 dB(a) Average
VELOCITY: 12,000 - 20,000 LFM @ Air Outlet
FLOW RATE: 39 - 64 CFM
MOTOR RPM: Up to 24,000 RPM
HEAT RANGE: OFF to HIGH: 90°F - 145°F Average @ Air Outlet
WATTAGE: ~1,450 Watts (Heat On) ~510 Watts (Heat Off)
IP RATING: IP23B

CONSTRUCTION

A. All covers will be fastened to a base plate by two chrome plated tamper-proof bolts.
Cover shall be one of the following:
Die-cast zinc alloy – One-piece, heavy-duty, rib-reinforced, lightweight, unbreakable, rustproof and all exposed surfaces shall be bright chrome plated or finished with chip-proof, electrostatically applied epoxy paint.
Bulk Molding Compound (BMC) – White reinforced thermoset resin.
Stainless Steel – with a brushed finish.
Special Image – Digital image applied to die-cast or stainless steel covers using patented Kolorfusion Sublimation Decoration process.

B. Base plate shall be equipped with (3) 7/8" (22 mm) diameter holes, the bottom one is suitable for use with surface conduit.

C. All internal parts shall be coated according to Underwriters' Laboratories, Inc. requirements.

D. Entire mechanism shall be internally grounded.

E. Options
HEPA Filtration System: Removes 99.999% of viruses[2] and 99.97% of potentially present bacteria[3] at 0.3 microns from the airstream.
1.1" Noise Reduction Nozzle: Reduces the sound level by 9 decibels by significantly decreasing air deflection noise while only increasing dry time by approximately
3 seconds.

F. Accessories (optional)
Antimicrobial Wall Guards: 89W (Microban® White), 89B (Microban Black), 89S (Brushed Stainless Steel)
XChanger Paper Towel Dispenser Retrofit Kit: 40575, 40576 (ADA Height)
ADA-Compliant Recess Kit: 40502

MECHANISM

A. **New 50% longer life motor** shall be a thermally protected, series commutated, through-flow discharge vacuum motor/blower (5/8 hp / 24,000 rpm) which provides air velocity of up to 20,000 LFM (linear feet per minute). Includes a washable metal mesh filter for more reliable performance.

B. Heating element (970 W) is constructed of Nichrome wire and mounted inside the blower housing, thereby being vandal resistant. It shall be protected by an automatic resetting thermostat, which shall open whenever air flow is cut off and shall close when flow of air is resumed. It shall produce an average air temperature at the outlet of up to 145°F (63°C) at a 72°F (22°C) ambient room temperature.

C. Control assembly is activated by an infrared optical sensor located next to the air outlet. The dryer shall operate as long as hands are under the air outlet. Control includes a speed and sound control mechanism, adjustable heat control with High, Medium, Low and Off settings and a filter sensor which is activated should the filter become clogged. There is a 35-second lockout feature if hands are not removed. Sensor equipped with externally visible red LED that flashes error codes to assist in troubleshooting. t

EXCEL DRYER, Inc.
East Longmeadow, MA
Phone 1.800.255.9235
Fax 1.413.525.2853
sales@exceldryer.com
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20XLT0948

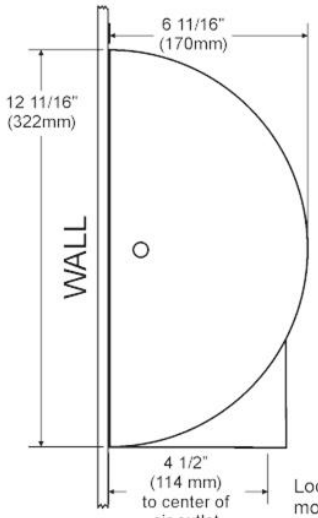
Hand Dryer – cont.

TECHNICAL DATA SHEET

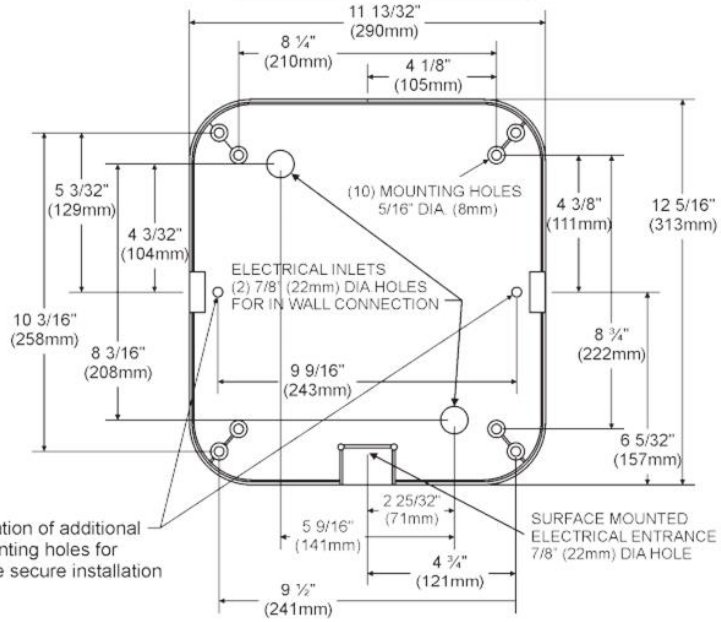
XLERATOR® HAND DRYER

MODELS: **XL -** **BW** **W** **GR** **C** **SB** **SI** **SP** OPTIONS: **-H** (HEPA Filter) **-1.1N** (Noise Reduction Nozzle) **-VOLTAGE** (See Chart)

SIDE VIEW



FRONT VIEW FACING WALL



DIMENSIONS

Width 11 3/4" (298 mm) **Height** 12 11/16" (322 mm) **Depth** 6 11/16" (170 mm)

ACTIVATION

Automatic Sensor Operated

MOUNTING

Surface-Mounted

WEIGHT

XL-BW: 15 lbs. (6.8 kgs.) **XL-SB**: 16 lbs. (7.26 kgs.) **XL-W, GR, C, SI, SP**: 17 lbs. (7.71 kgs.)

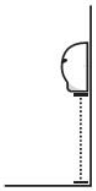
ELECTRICAL

VOLTS	AMPS	WATTS	AMPS (NO HEAT)	WATTS (NO HEAT)	HERTZ	LISTING
110-120V	11.3-12.2A	1,213-1,450W	4.3-4.5A	442-513W	50/60 Hz	c UL us
208-240V	5.6-6.2A	1,135-1,450W	2.0-2.2A	416-495W	50/60 Hz	c UL us
208-277V	5.6-6.2A	1,135-1,450W	2.0-2.2A	416-495W	50/60 Hz	UL
230V	6.1A	1,400W	2.1A	500W	50-60 Hz	CE

SUGGESTED MOUNTING HEIGHTS

from floor to bottom of dryer:

Men	45"	(114 cm)
Women	43"	(109 cm)
Teenagers	41"	(104 cm)
Small Children	35"	(89 cm)
Accessible	37"	(94 cm)



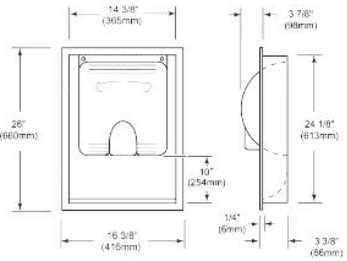
CERTIFICATIONS

RoHS

OPTIONAL ADA-COMPLIANT RECESS KIT



Part # 40502



DIMENSIONS

Width 16 3/8" (416 mm) **Height** 26" (660 mm) **Depth** 3 3/8" (86 mm)

Bottom of recessed wall box should be 10" (254 mm) below suggested mounting height for dryer.

[1]Dry time and energy use testing performed by SGS International on standard XLERATOR Hand Dryer with 0.8" nozzle to 0.25g or less of residual moisture, pursuant to the UL Environment Global Product Category Rules (PCR) for Hand Dryers. [2]Based on testing performed by LMS Technologies, 2020. [3]LMS Technologies, 2014. [4]Special Paint powder-coated covers are available in many colors and textures. [5]Exclusive digital image technology allows for the addition of company, school or team logos with any color, design or a "green message".

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20XLT0948

Appendix B – Restroom Accessories

Trash Receptacle

Rubbermaid Commercial Products

UNTOUCHABLE® 22 GAL ROUND GRAY

SKU: FG354600GRAY



CLICK TO VIEW PRODUCT DETAIL PAGE

UNTOUCHABLE® 22 GAL ROUND GRAY

The Rubbermaid Commercial Untouchable® Container is space-efficient and economical.

FEATURES & BENEFITS

- Durable and crack-resistant, even under tough indoor/outdoor conditions
- Contains Post Consumer Recycled Resin (PCR) meets EPA guidelines
- Recycling options available

SPECIFICATIONS

	U.S.	Metric
Product Length	15.75 in	40.01 cm
Product Width	15.75 in	40.01 cm
Product Height	30.13 in	76.53 cm
Product Weight	6.00 lb	2.72 kg
Case Pack Quantity	4	
Color	Gray	
UPC	00086876023480	

CERTIFICATIONS

Appendix B – Restroom Accessories

Trash Receptacle Top

Rubbermaid Commercial Products

UNTOUCHABLE® ROUND FUNNEL TOP GRAY

SKU: FG354800GRAY



CLICK TO VIEW PRODUCT DETAIL PAGE

UNTOUCHABLE® ROUND FUNNEL TOP GRAY

The Rubbermaid Commercial Untouchable® Tops help facilitate recycling sortation and waste disposal.

FEATURES & BENEFITS

- Durable and crack-resistant, even under tough indoor/outdoor conditions
- Post consumer recycled resin(PCR) content meets EPA guidelines
- Fits FG395806, FG395906 Untouchable® Round Containers

SPECIFICATIONS

	U.S.	Metric
Product Length	16.25 in	41.28 cm
Product Width	16.25 in	41.28 cm
Product Height	4.00 in	10.16 cm
Product Weight	1.20 lb	0.54 kg
Case Pack Quantity	4	
Color	Gray	
UPC	00086876023527	

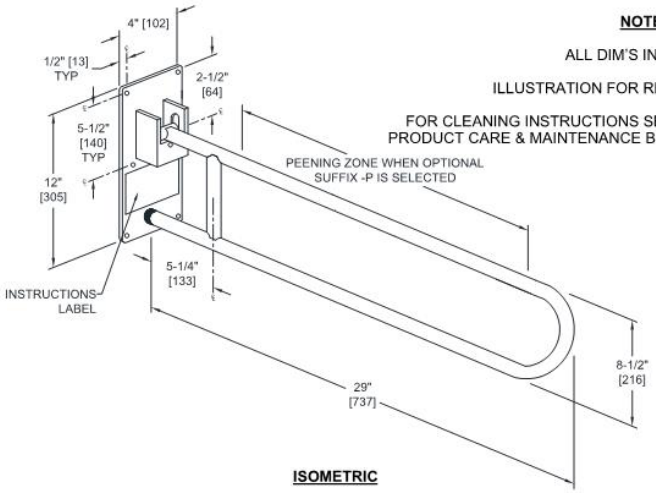
CERTIFICATIONS

Swing Up Grab Bar – Cut sheet

AMERICAN SPECIALTIES, INC.
441 Saw Mill River Road, Yonkers, NY 10701
(914) 476.9000 • (914) 476.0688
www.americanspecialties.com

MODEL №:	**3551**
ISSUED:	JAN 2016
REVISED:	3 SEP 2021

SWING-UP GRAB BAR



NOTE

ALL DIM'S INCH [MM]

ILLUSTRATION FOR REF ONLY AND NTS

FOR CLEANING INSTRUCTIONS SEE APPROPIATE SECTIONS IN PRODUCT CARE & MAINTENANCE BULLETIN (PCM) ON ASI WEBSITE

ISOMETRIC

SPECIFICATION

Swing-Up Grab Bar shall be stainless steel type 304 alloy 18-8. Grab bar tubing shall be 18 gage 1-1/2" Dia. [Ø38]. Mounting bracket shall be 7 gage (3/16" [5] thick) plate with six (6) 5/16" Dia. [Ø8] mounting holes provided and shall have 1-1/2" Dia. [Ø38] x 3/16" [5] wall tubing hinge riding on solid bar axle with twin torsion-spring counter balance. All exposed surfaces shall be satin finish. Structure shall be of welded construction. All exposed edges and corners shall be eased and burr free. Vertical position gravity lock with manual release shall be provided. Tamper resistant set screw shall be provided to allow owner to lock grab bar in vertical position. Internal mechanisms shall be captive and suitable for heavy duty service. Grab bar shall be operable with no more than 5 lbs_f (22.2 N) and only one hand. Grab bar tube shall have a plastic end cap to cushion contact with wall plate in use position.

Swing-Up Grab Bar shall be Model № 3551 as manufactured by American Specialties, Inc., 441 Saw Mill River Road, Yonkers, New York 10701- 4913

INSTALLATION

This unit is surface mounted. Installer/construction contractor must provide concealed anchor plate or blocking as specified in construction documents or as required by local building codes prior to wall finishing. Fasten wall plate to concealed anchor or blocking plate with appropriate hardware (by others). See "STRENGTH" section below. Note that concealed mounting plates or anchors and hardware are not supplied with this product and must be specified separately (for anchor plate add line item 3940). Ensure that mounting configuration complies with local building codes. For compliance with 2010 ADA Accessibility Standards, install unit so that top of horizontal bar is between 33" [838] and 36" [914] Above Finished floor (AFF) for use by adults. Other heights are appropriate for other age groups at lower levels.

STRENGTH

ASI grab bars are designed to meet and exceed 2010 ADA Accessibility Standards and ANSI A117.1 that fabricated product shall be of adequate strength to support a load of 250 pounds (113.4 kg). Mounting to the wall is a critical part of the system to meet this requirement. To withstand the shear, tension or pull-out, and torsion loads generated by the maximum loading, the fastener system must be adequately sized.

OPERATION

Swing-Up Grab Bar is manually lowered to horizontal position for support and raised for departure or arrival. Gravity lock prevents grab bar from dropping from the vertical position, and must be manually released to lower grab bar. Lock does not affect raising bar from horizontal and automatically locks bar when bar is returned to vertical storage position. Plastic tube cap closes end of bottom tube and provides smooth solid contact with back plate. It is the owner's responsibility to ensure continued safe operation by performing periodic inspection and effecting any repairs required by adverse environmental conditions.

OPTIONS AVAILABLE

For integral toilet tissue roll holder specify option -25. For non-slip gripping surface add suffix –**P** (peened).

THIS MANUFACTURER RESERVES THE RIGHT TO MAKE CHANGES IN DESIGN OR DIMENSIONS WITHOUT FORMAL NOTICE

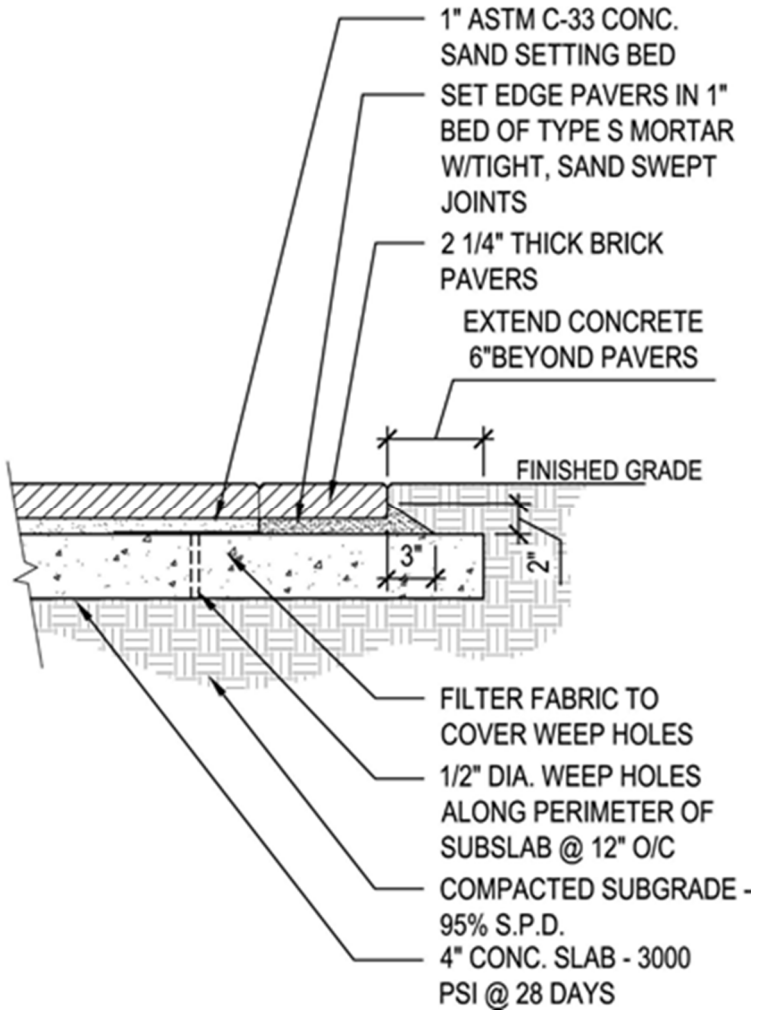
Appendix B – Restroom Accessories

Swing Up Grab Bar – Sample installation



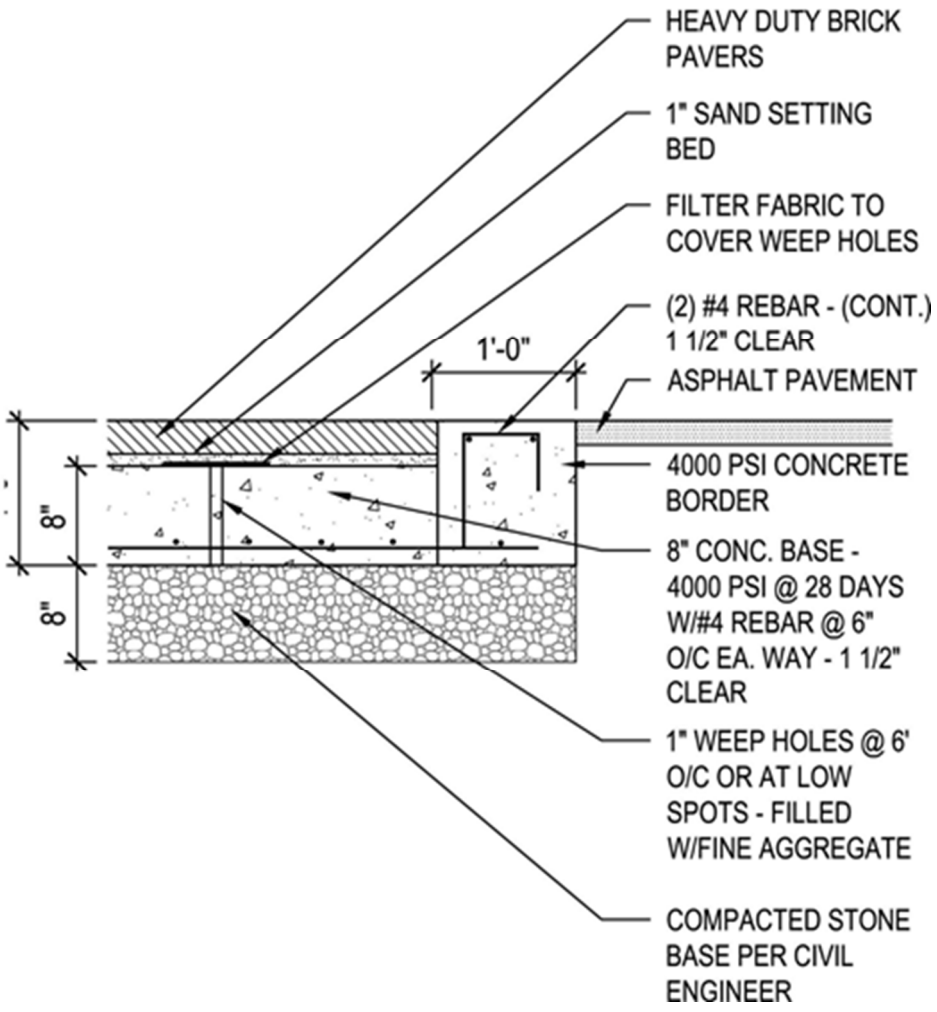
Appendix C – Details

Figure C-1 – Typical Brick Paver Section in Pedestrian Areas



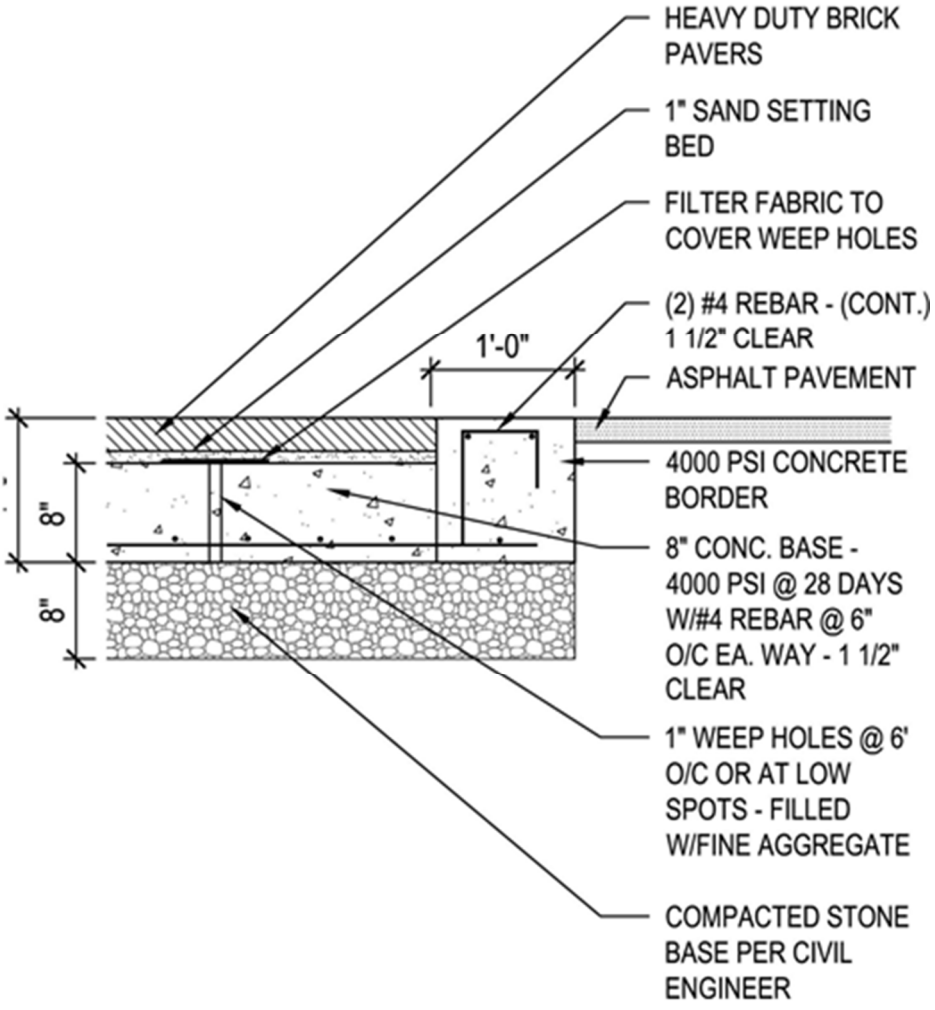
Scale: 1” = 1’-0”

Figure C-2 – Typical Brick Paver Section in Crosswalks



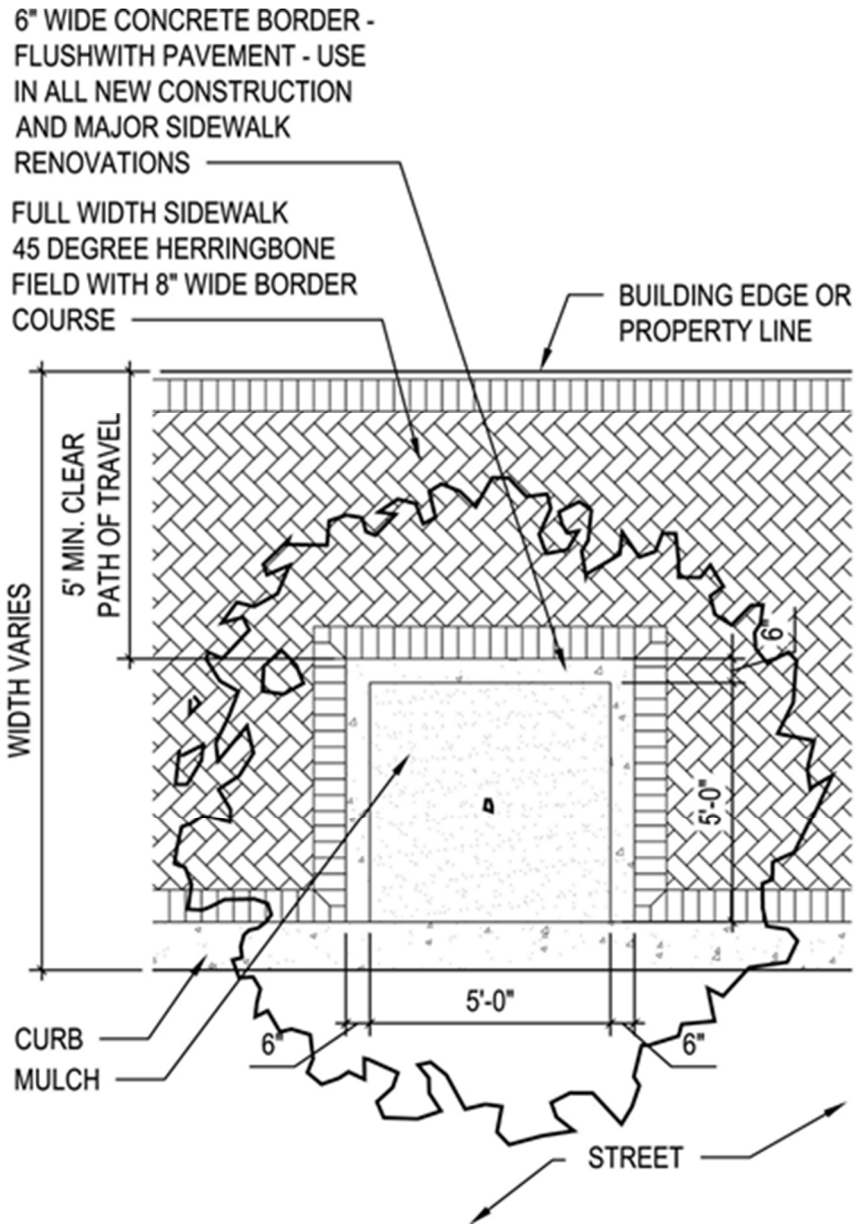
Scale: 1” = 1’-0”

Figure C-3 – Typical Brick Paver Section in Vehicular Areas



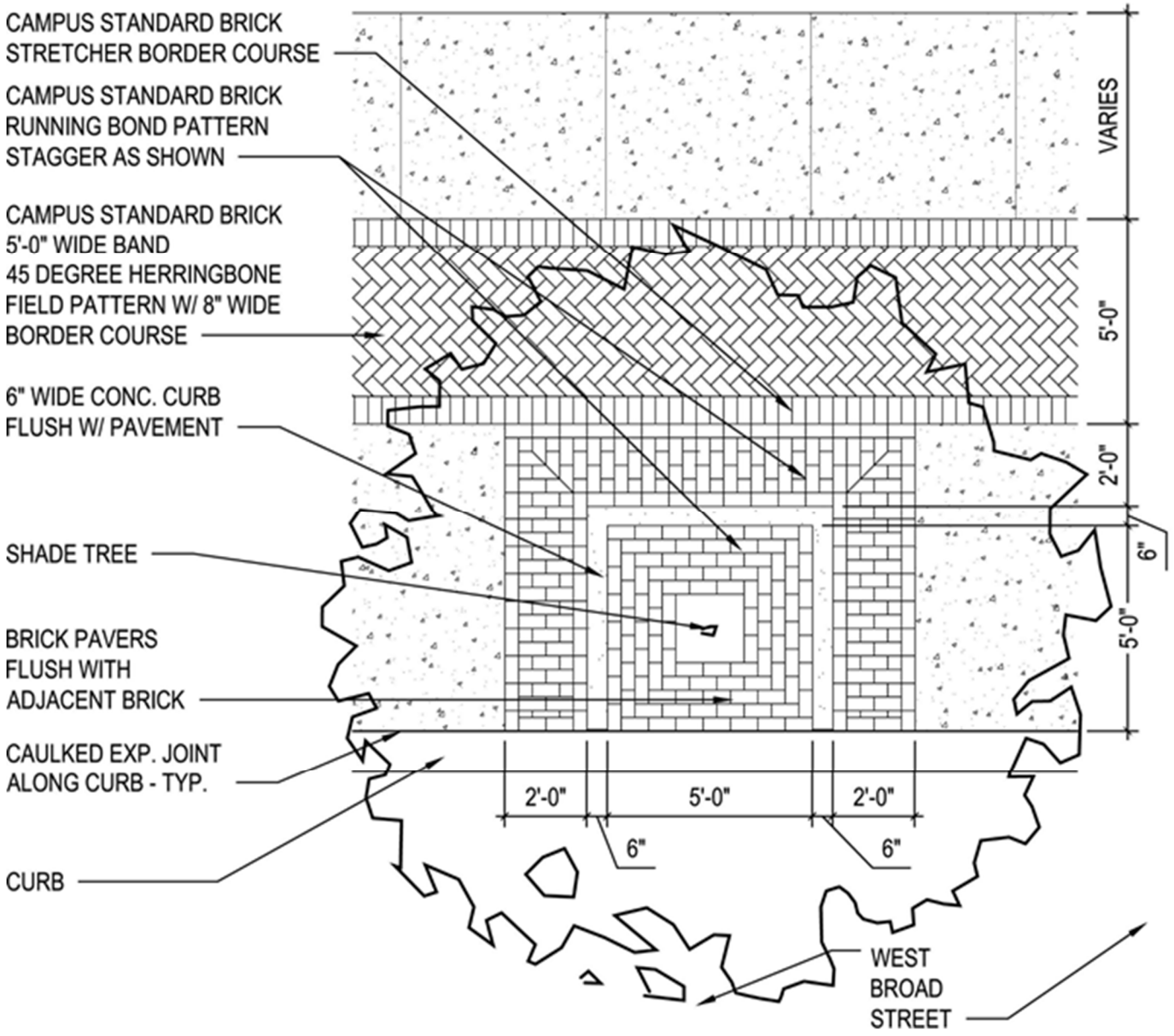
Scale: 1” = 1’-0”

Figure C-4 – Typical Brick Paver Sidewalk Paving Plan



Scale: 1/4” = 1’-0”

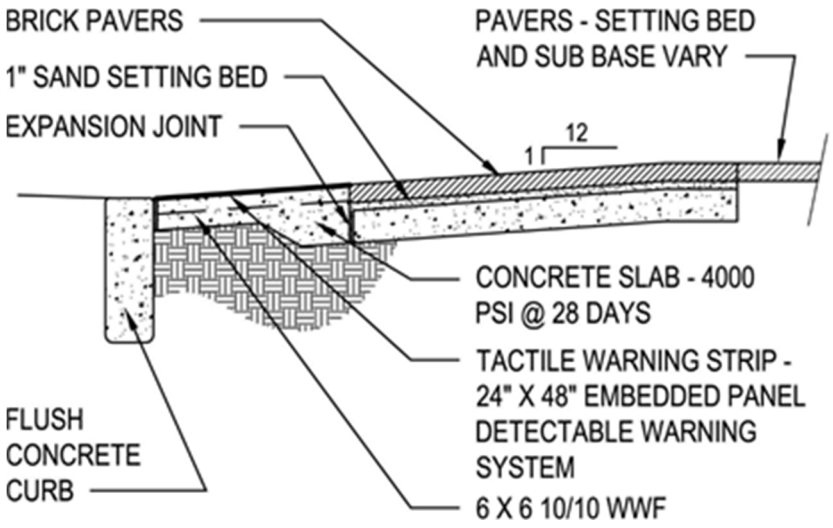
Figure C-5 – Typical Brick Paver Sidewalk Paving Plan – West Broad Street Corridor



Scale: 1/4” = 1’-0”

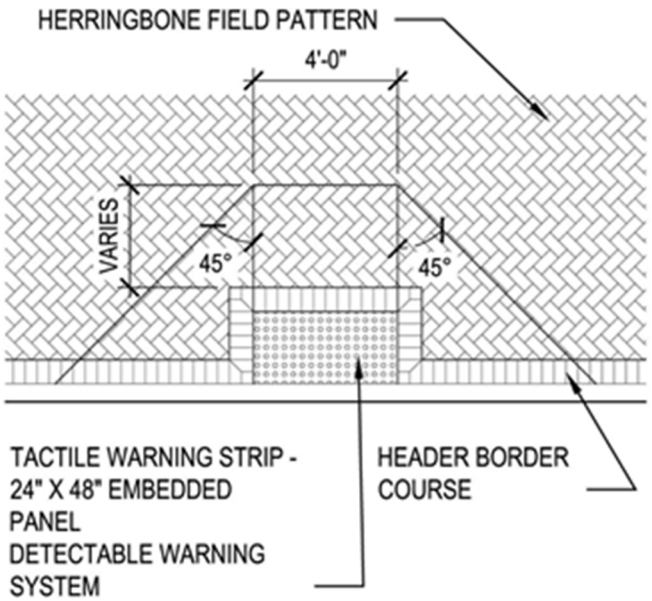
Appendix C – Details

Figure C-6 – Tactile Warning Section



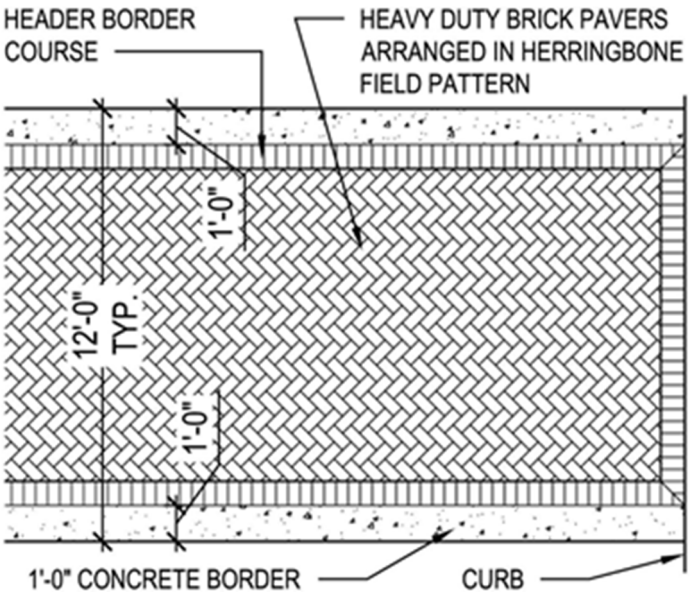
Scale: 1/2” = 1’-0”

Figure C-7 – ADA Paving Plan



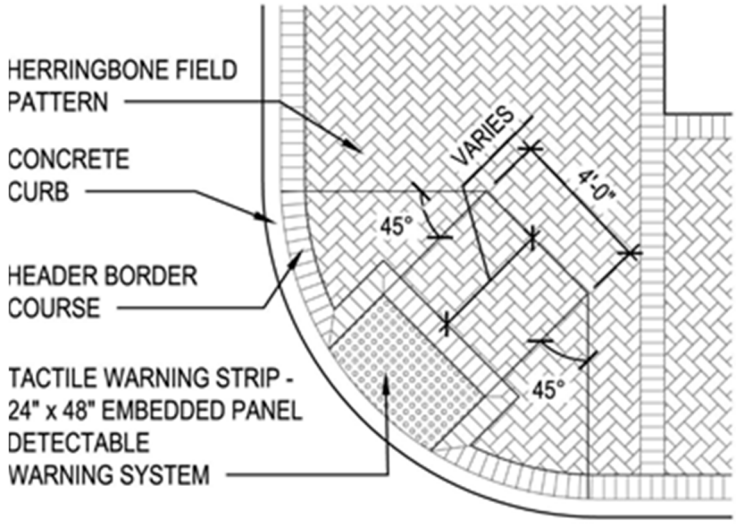
Scale: 3/16” = 1’-0”

Figure C-8 – Typical Brick Paving Plan



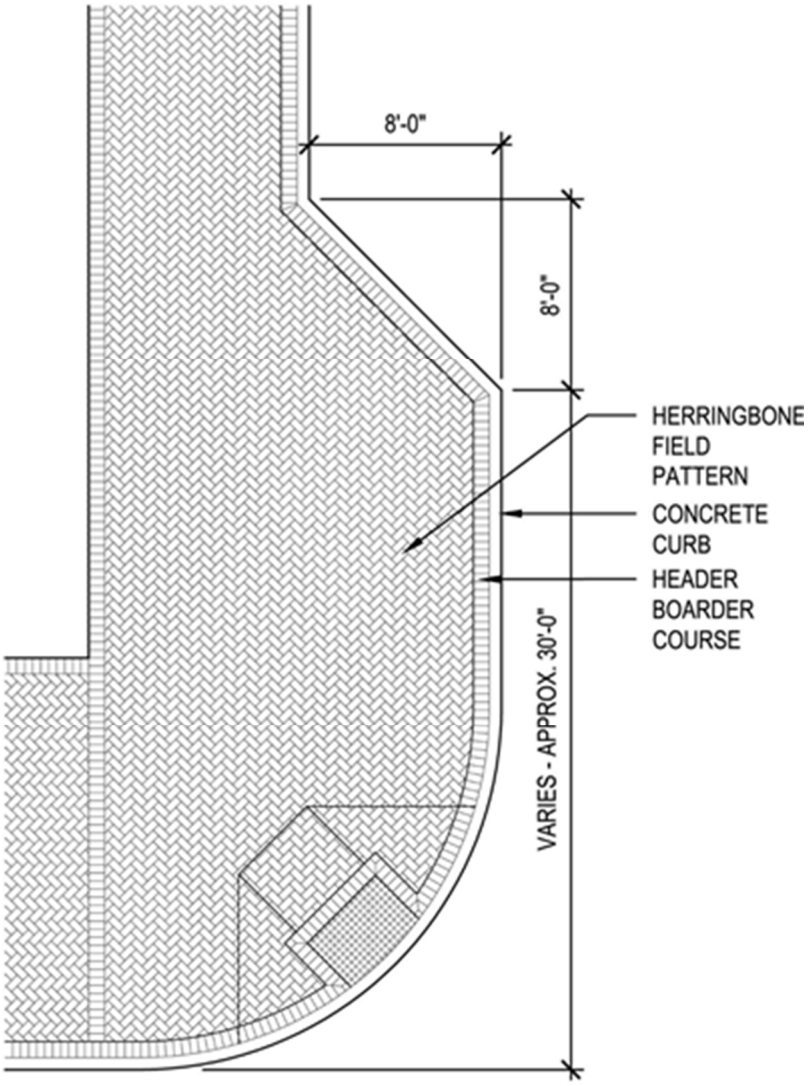
Scale: 3/16” = 1’-0”

Figure C-9 – ADA Corner Paving Plan



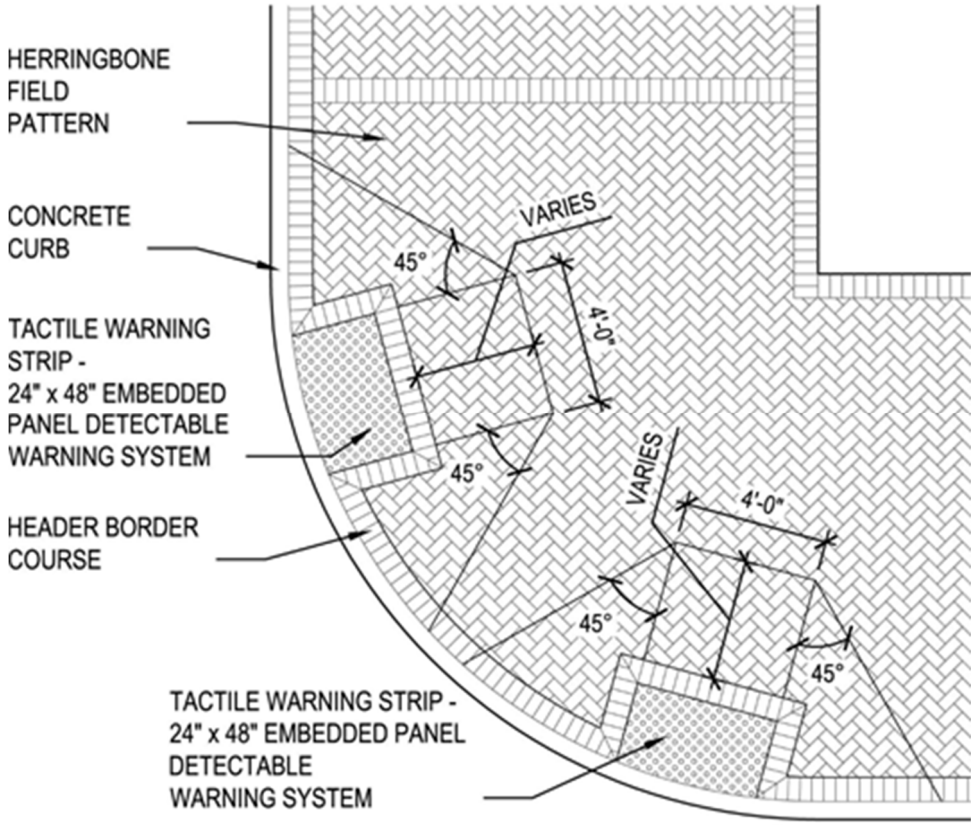
Scale: 3/16” = 1’-0”

Figure C-10 – Choker Plan



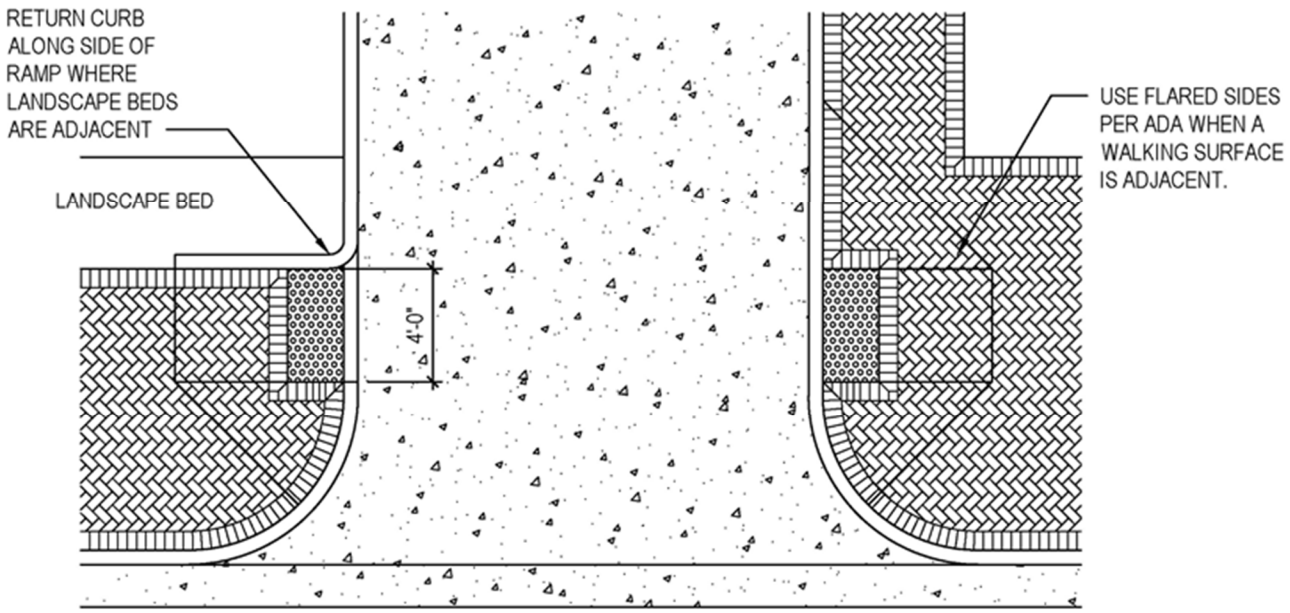
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Figure C-11 – Corner Paving Plan



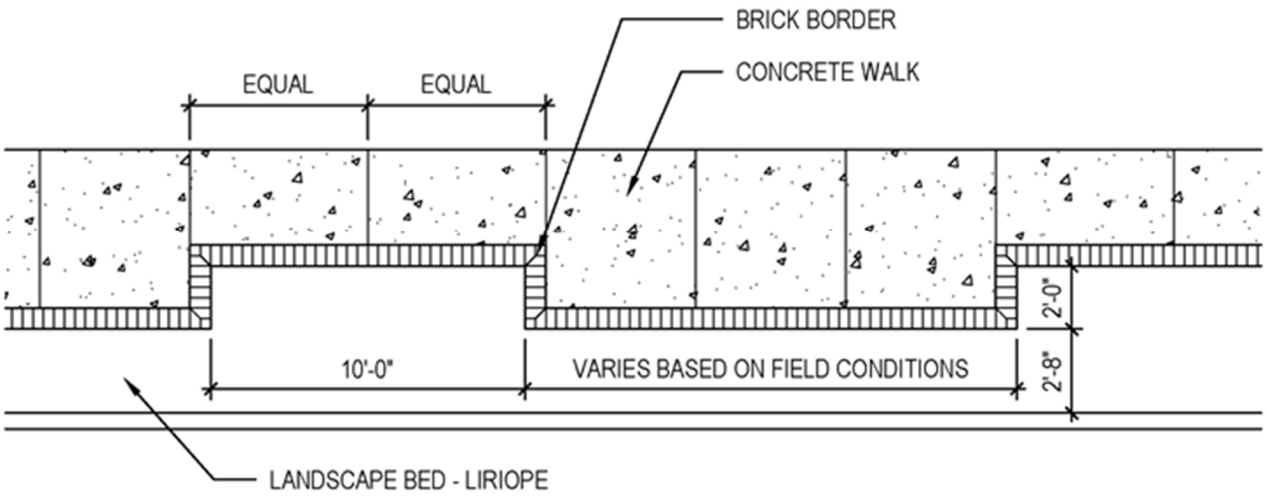
Scale: 3/16” = 1’-0”

Figure C-12 – ADA Ramps at Driveways



Scale: N.T.S.

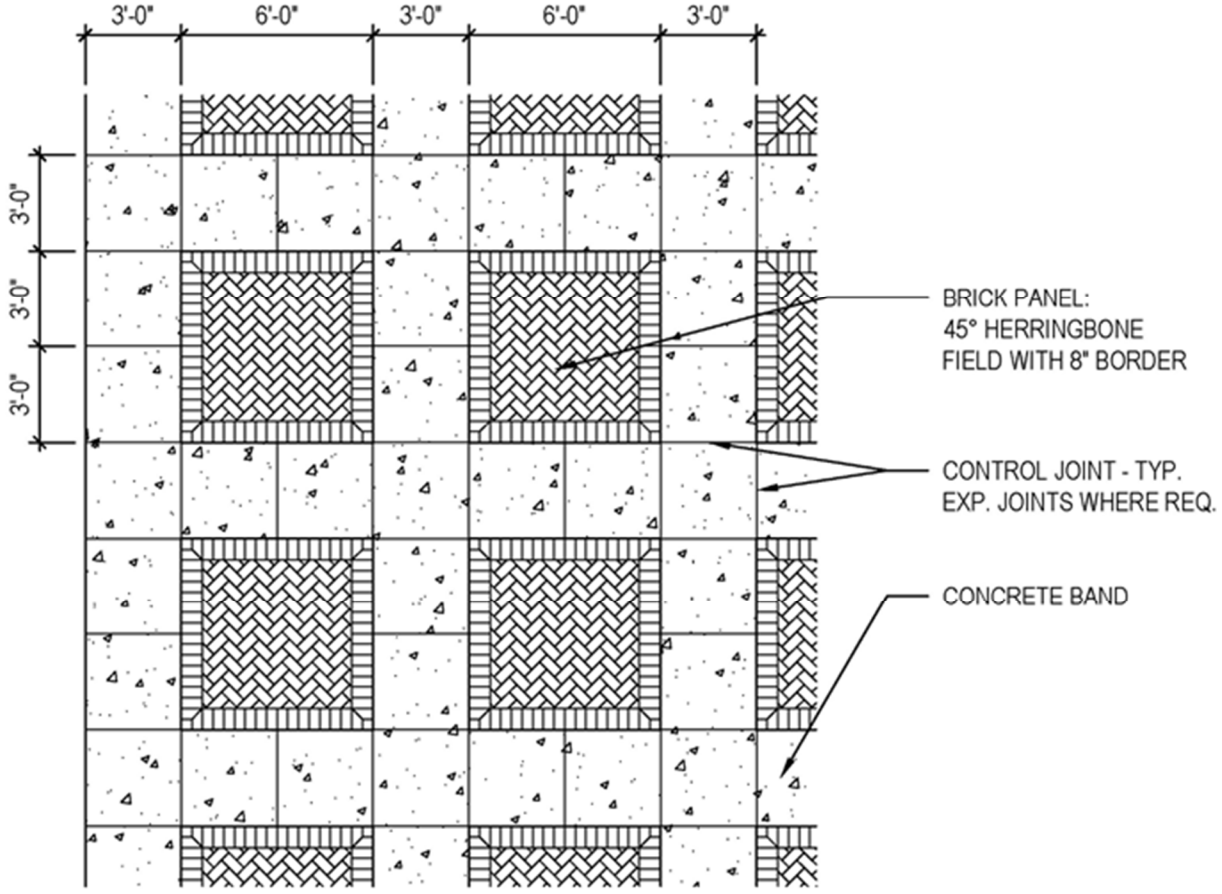
Figure C-13 – Belvidere Street Paving



Scale: N.T.S.

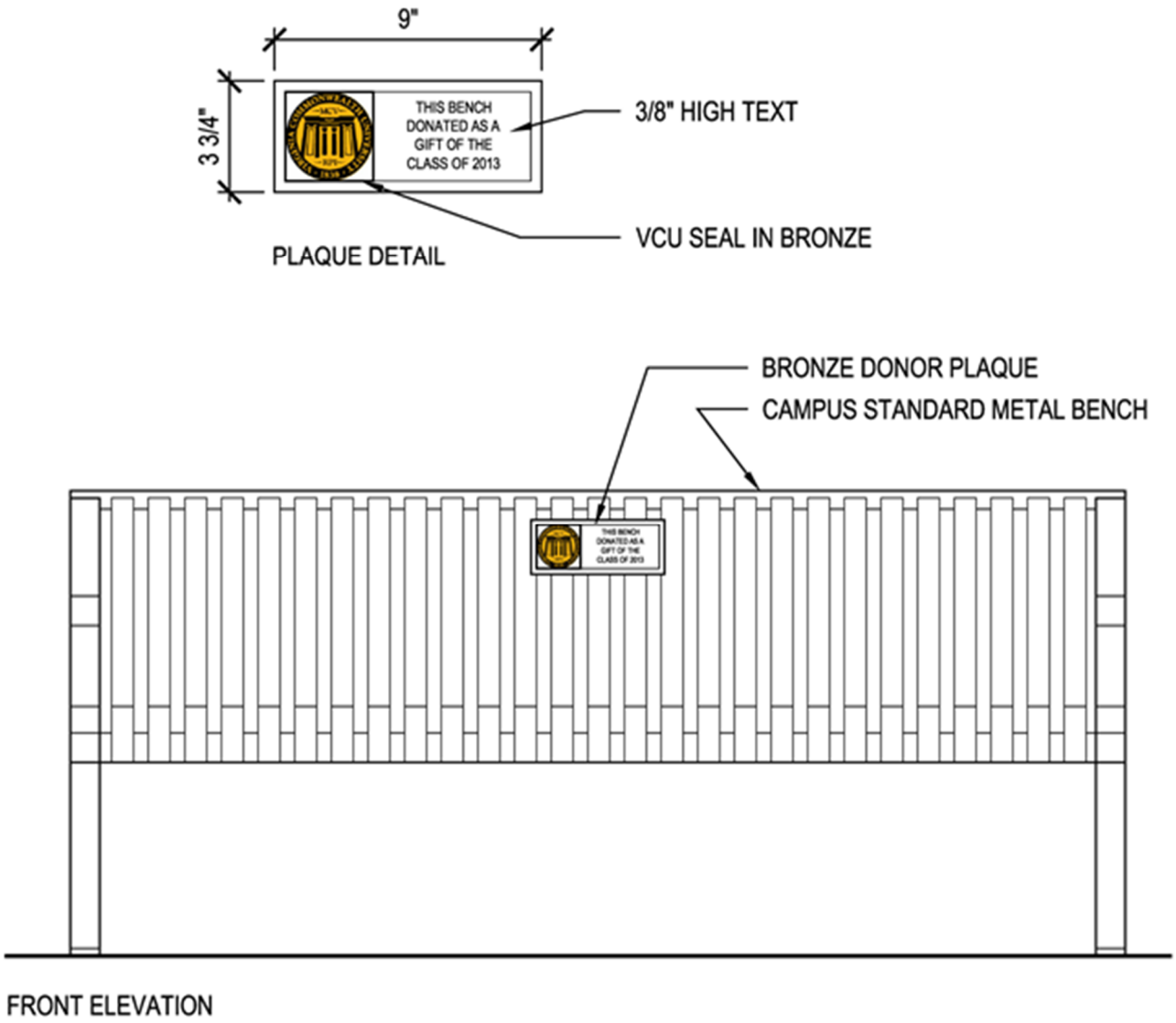
Note: This is for select locations only. Please discuss with VCU Planning & Design as to whether this details is applicable.

Figure C-14 – Shafer Court Paving



Scale: N.T.S.

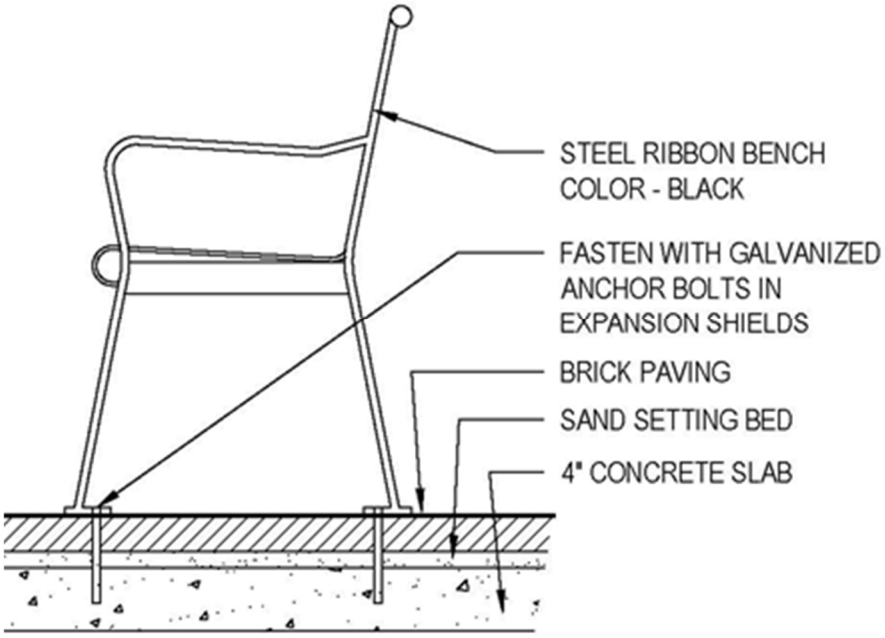
Figure C-15 – Typical Bench – Class Gift



Scale: 1” = 1’-0”

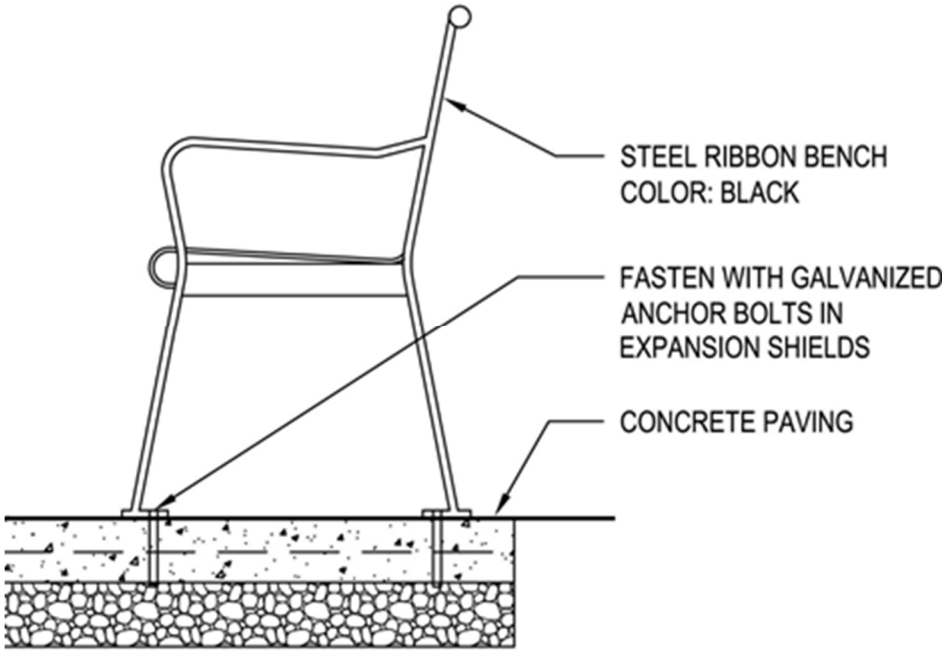
Appendix C – Details

Figure C-16 – Typical Bench on Brick Pavers



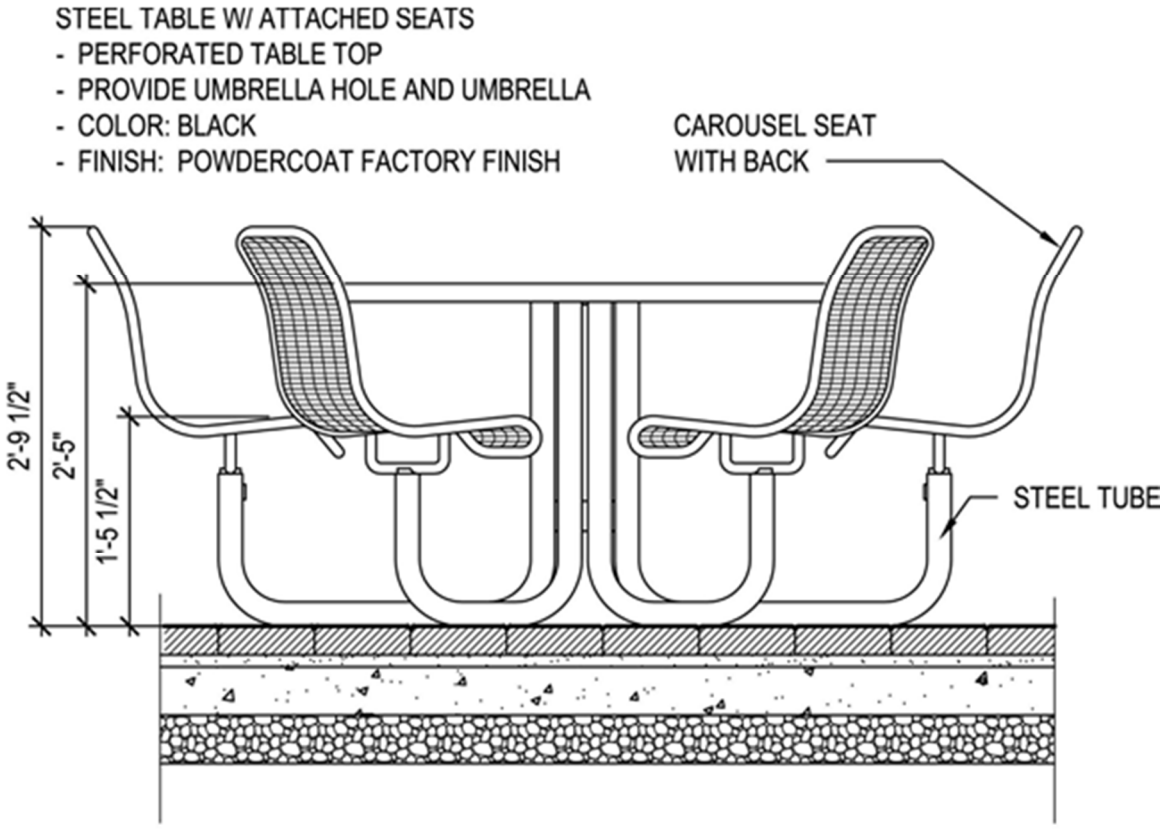
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Figure C17 – Typical Bench on Concrete Paving



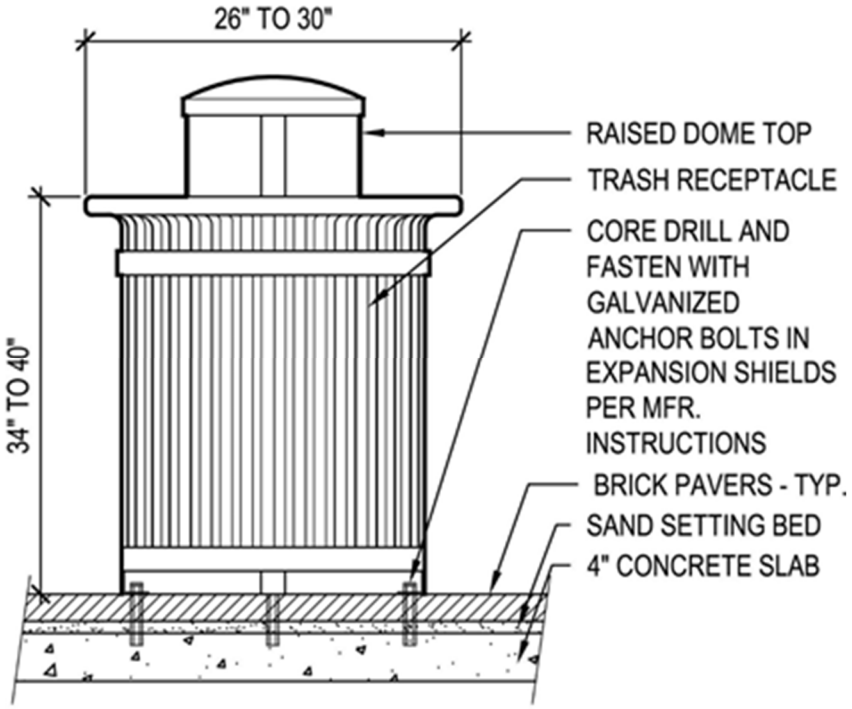
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Figure C-18 – Tables with Attached Seating on Brick Pavers



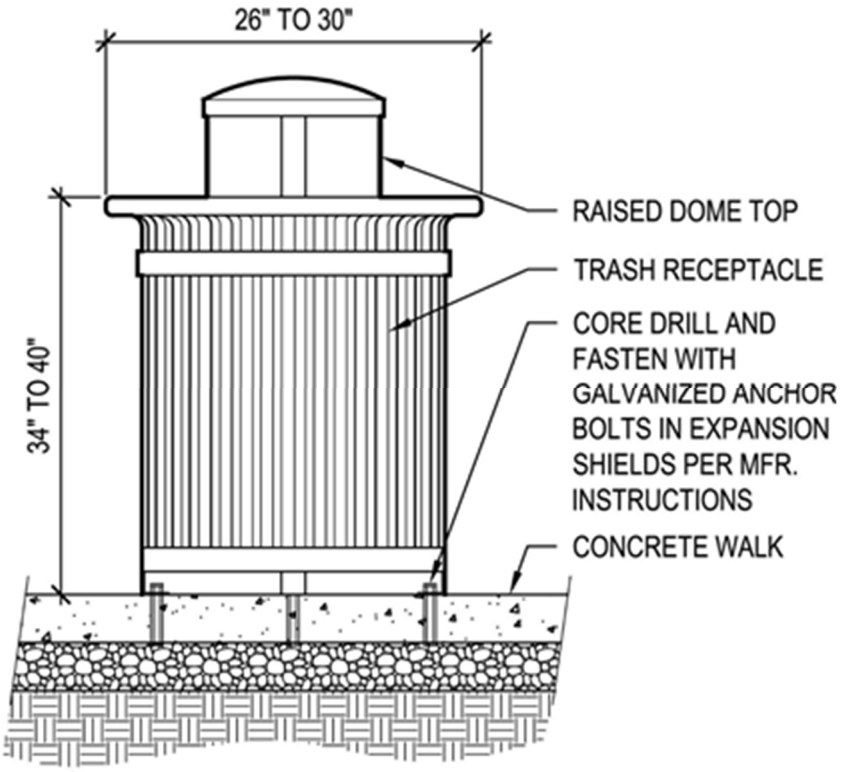
Scale: 3/4” = 1’-0”

Figure C-19 – Typical Trash Receptacle on Brick Pavers



Scale: 3/4” = 1’-0”

Figure C-20 – Typical Trash Receptacle on Concrete Paving



Scale: 3/4” = 1’-0”

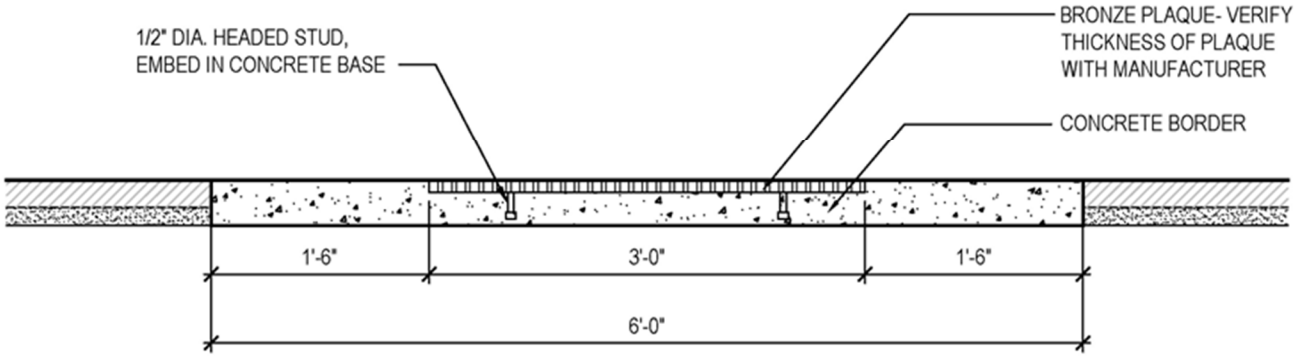
Figure C-21 – Typical Trash and Recycling Receptacle



Please note all VCU trash and recycling containers to be black.

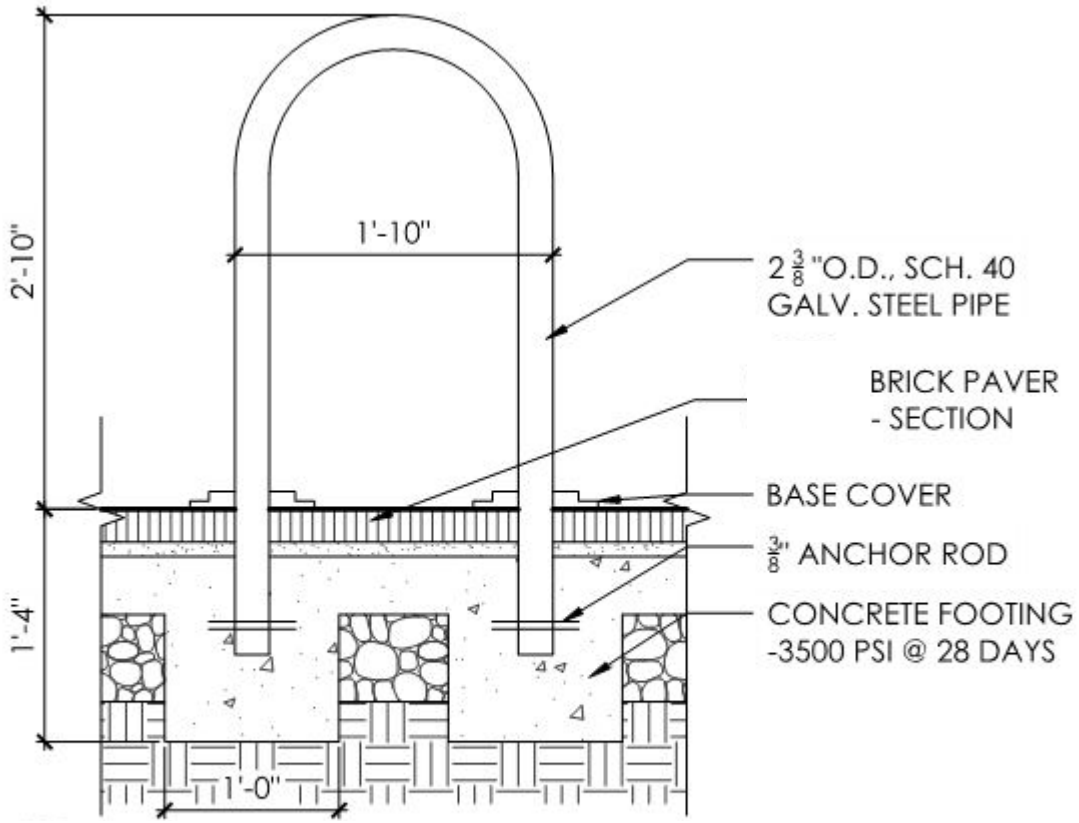
Figure C-22 – VCU Paving Medallion





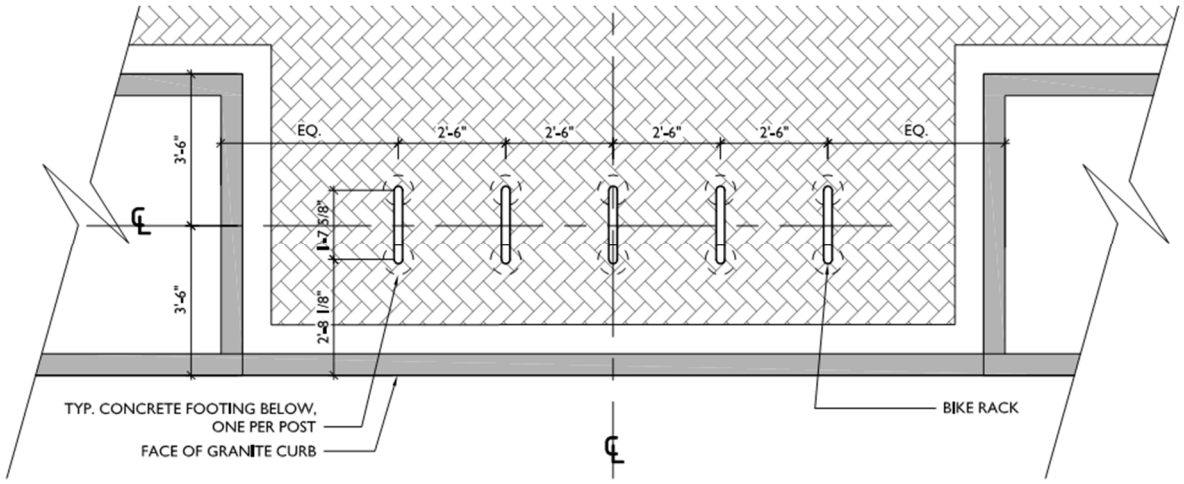
Scale: N.T.S.

Figure C-23 – Bike Rack



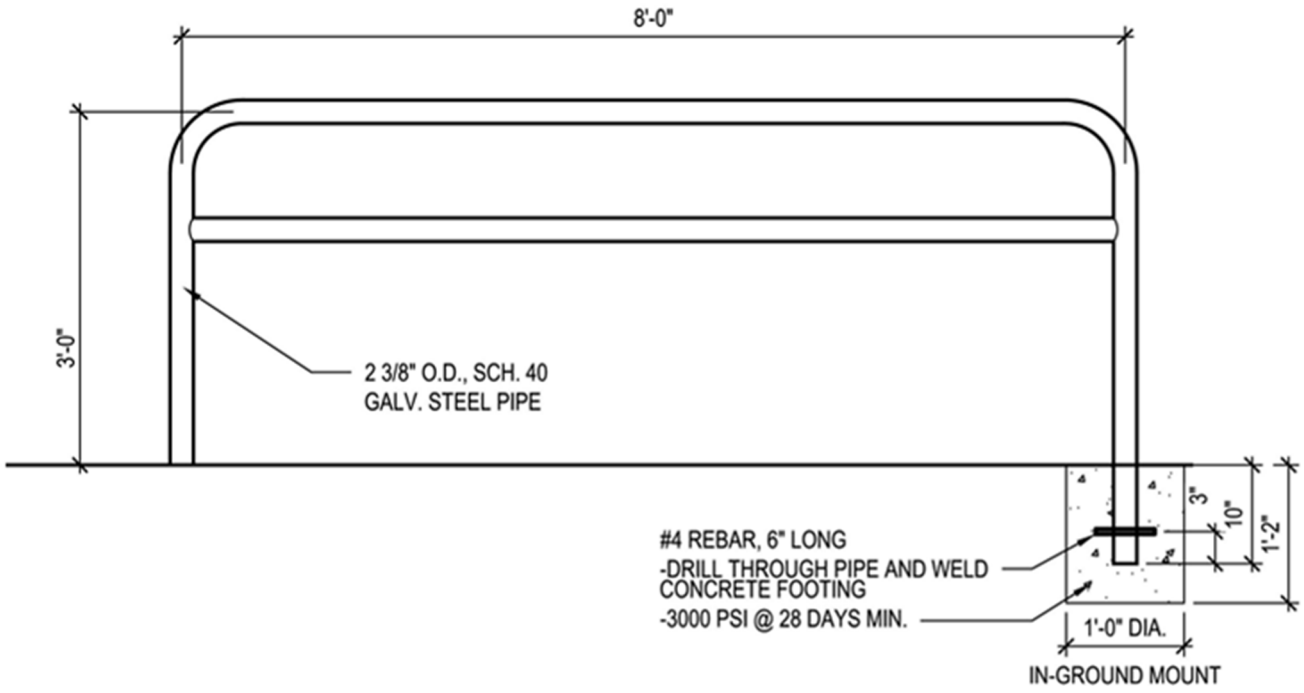
Scale: N.T.S.

Figure C-24 – Typical Bike Rack Plan



Scale: N.T.S.

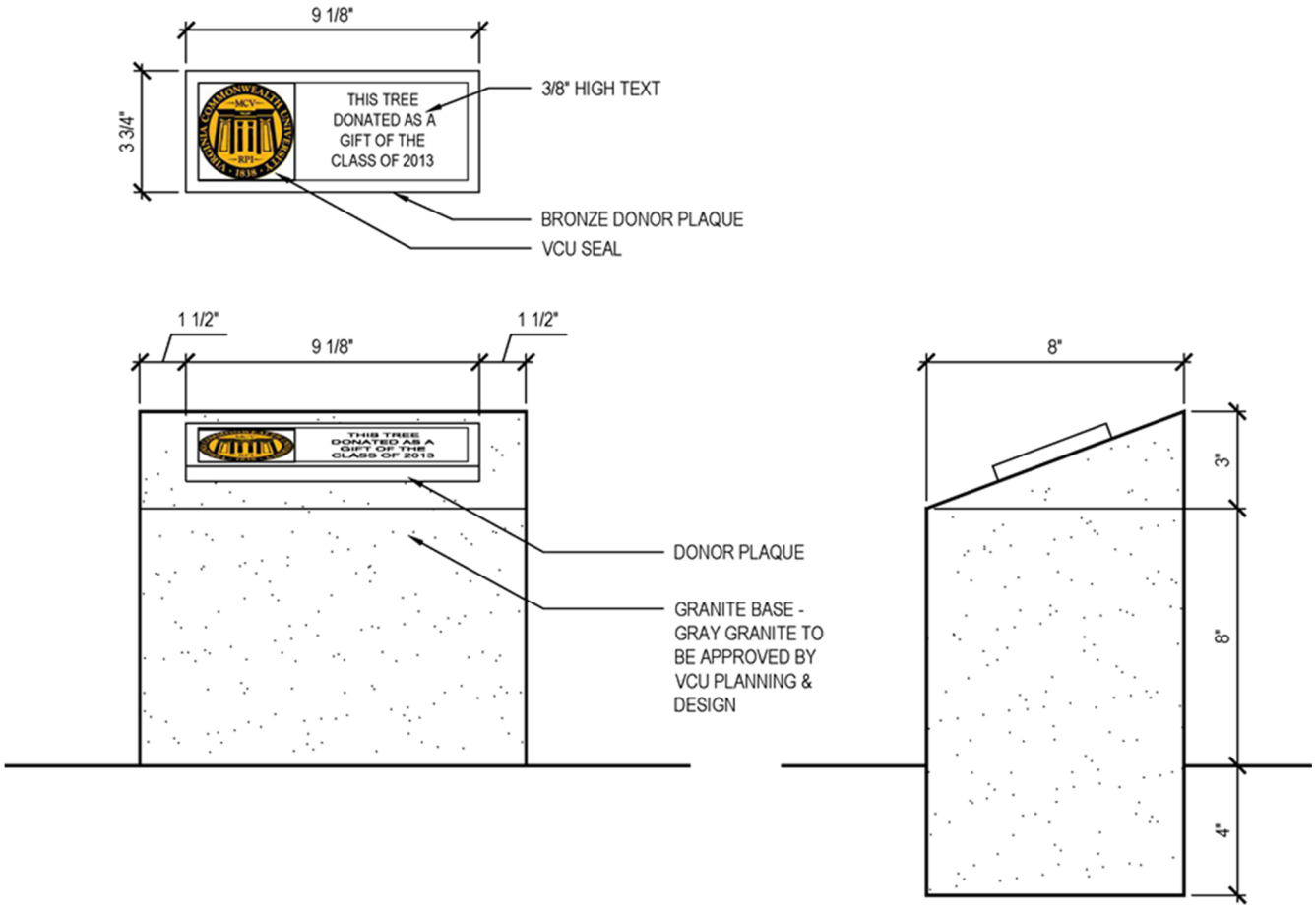
Figure C-25 – Moped Rack



Scale: N.T.S.

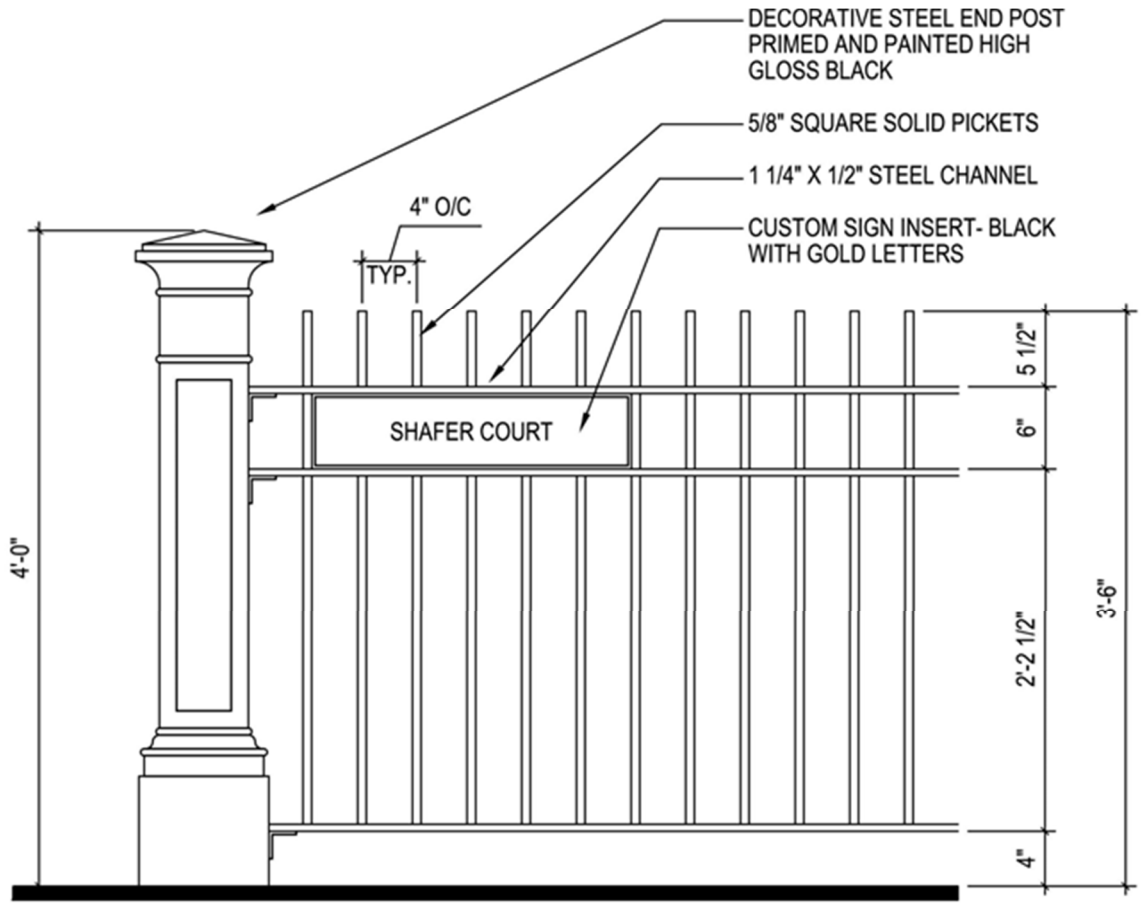
Appendix C – Details

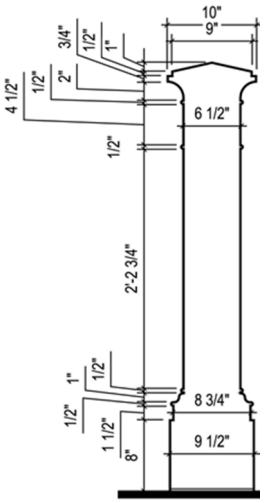
Figure C-26 – Tree Donor Marker



Scale: N.T.S.

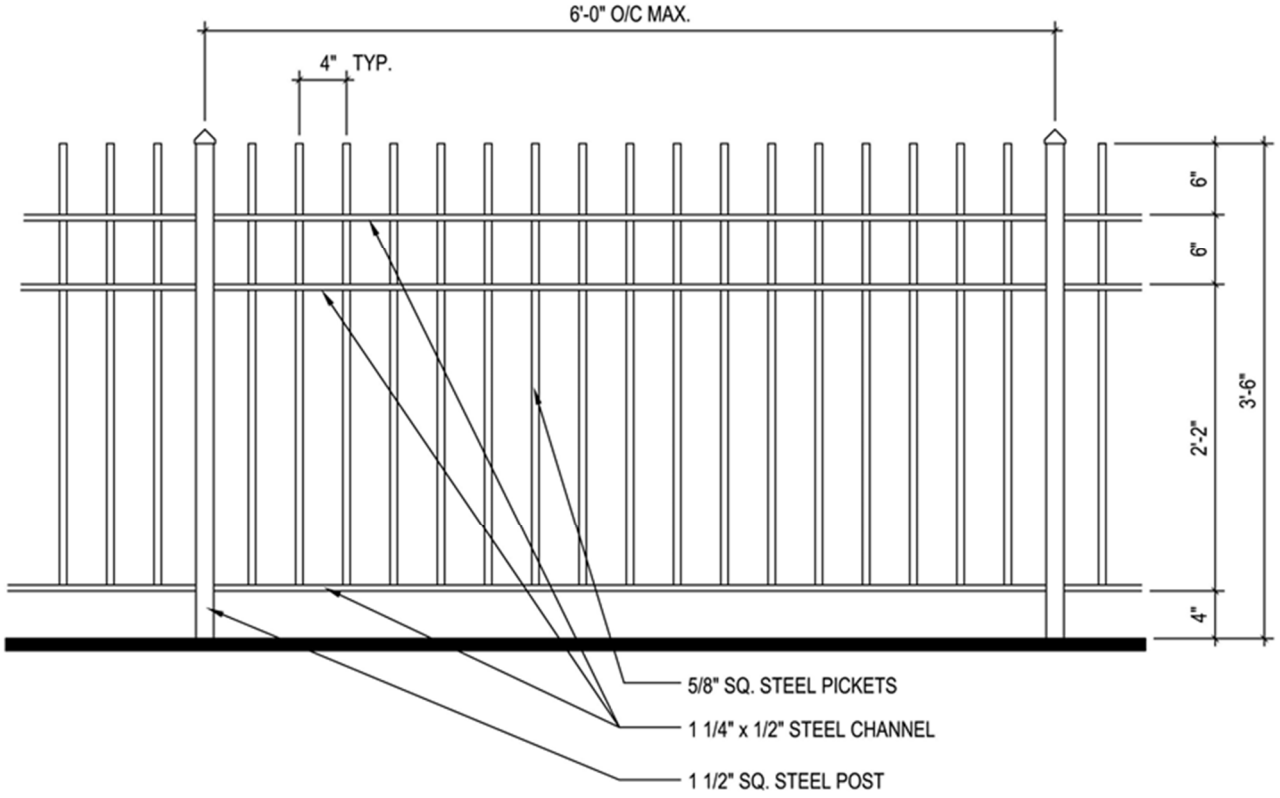
Figure C-27 – Metal Fences with Decorative End Post – Monroe Park Campus





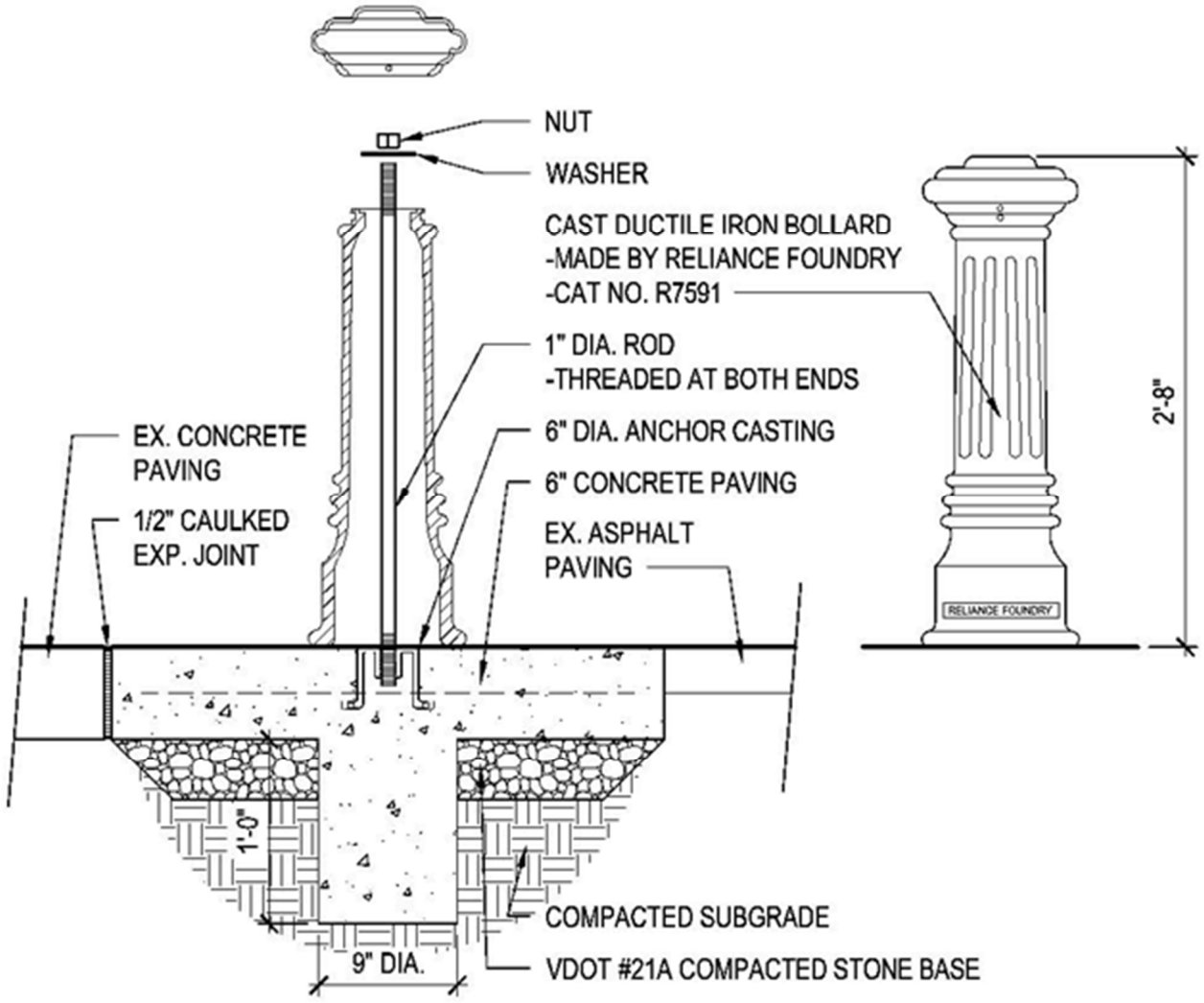
Scale: N.T.S.

Figure C-28 – Metal Fences



Scale: N.T.S.

Figure C-29 – Bollard – Monroe Park Campus

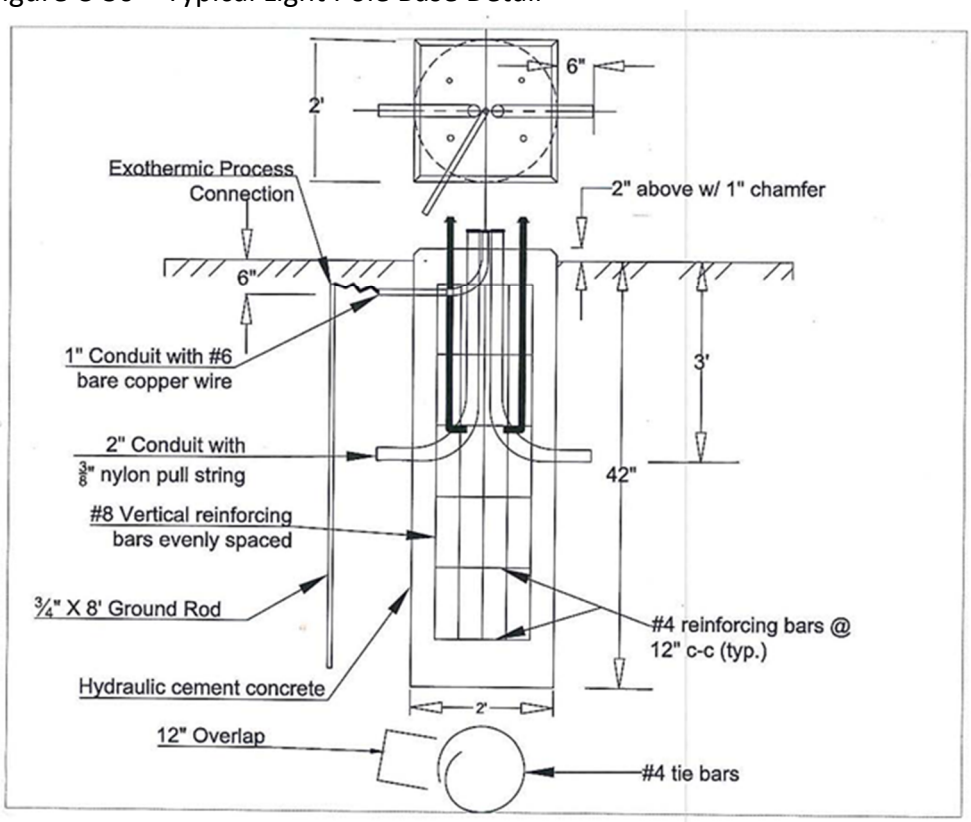


Scale: N.T.S.

Note: This detail is meant to depict the style of bollard only. The installation detail shall be appropriate for the application and may include the steel pipe bollard core filled with concrete. Coordinate with your VCU project manager for the appropriate detail.

Appendix C – Details

Figure C-30 – Typical Light Pole Base Detail

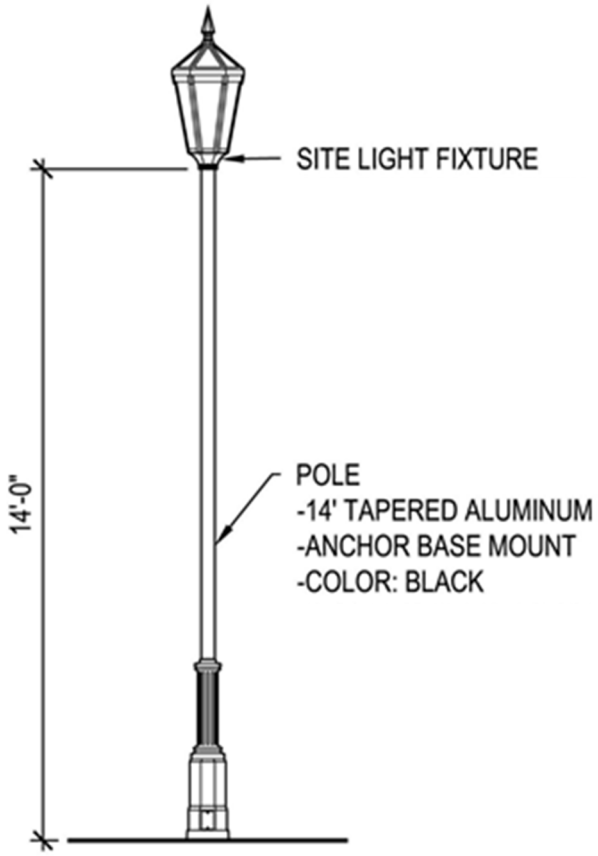


NOTES:
1. Conduit elbows shall have 90° bend. The bend radius shall be in accordance with the NEC.
2. The bolt circle template shall be furnished by the lighting pole manufacturer.
3. The number, orientation and size of conduits entering and exiting foundation shall be as shown on plans.
4. Concrete pour shall be continuous with 3000 psi concrete. No mortar, grout, or concrete shall be placed between bottom of base plate and top of pedestal.
5. The anchor bolts shall be dripped galvanized and "L" type with the orientation parallel to the street.
6. The horizontal reinforcing bars shall be 4"above the bottom of the hole and 4" below the surface.
7. The vertical reinforcing bars shall be 4" from wall of the hole.
8. The lighting pole manufacturer will specify the bolt projection requirements.
9. The pole base shall be 30" from back of curb to center of the pole base.

Hanover Pole Foundation

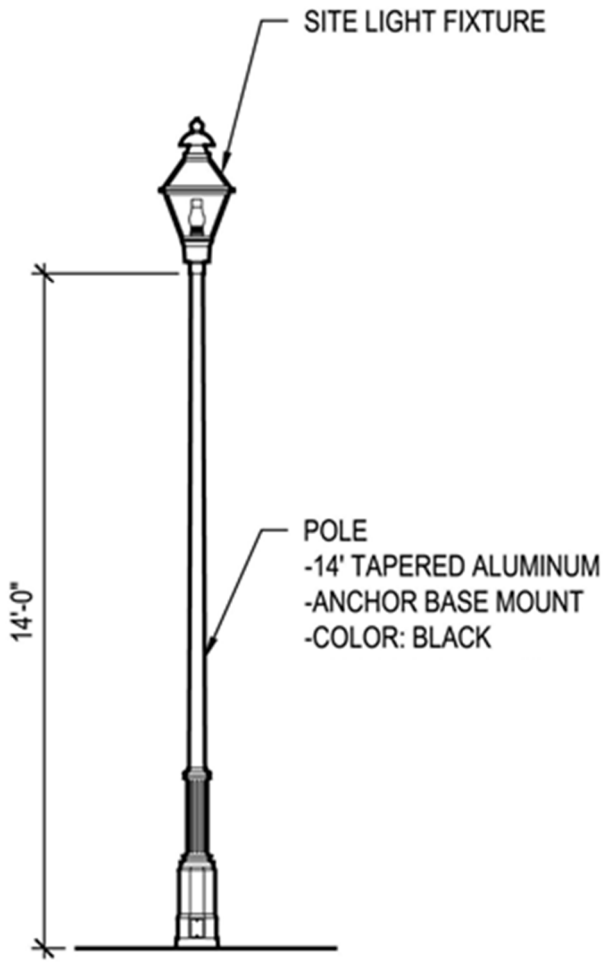
Scale: N.T.S.

Figure C-31 – Typical Monroe Park Campus Ornamental Site Light



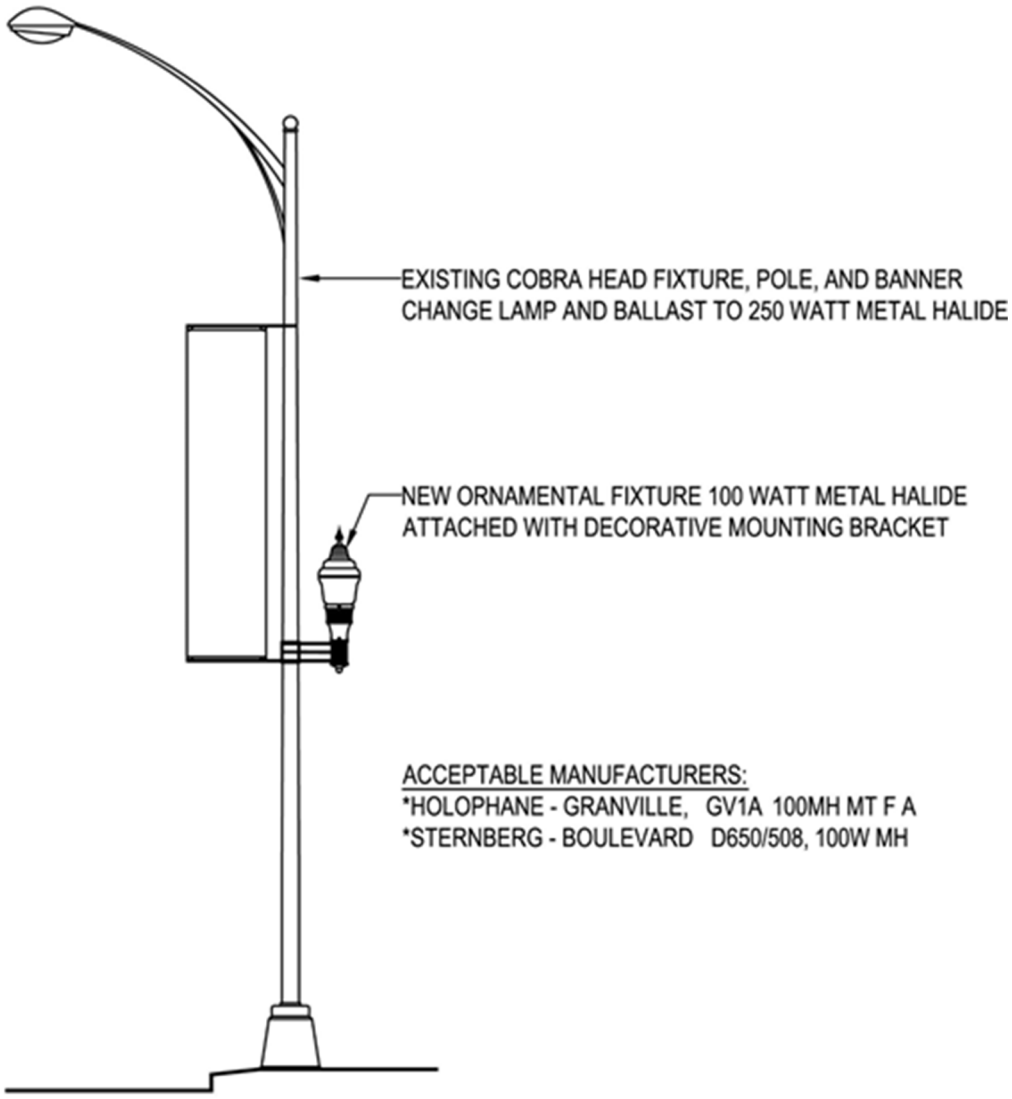
Scale: N.T.S.

Figure C-32 – Typical MCV Campus Ornamental Site Light



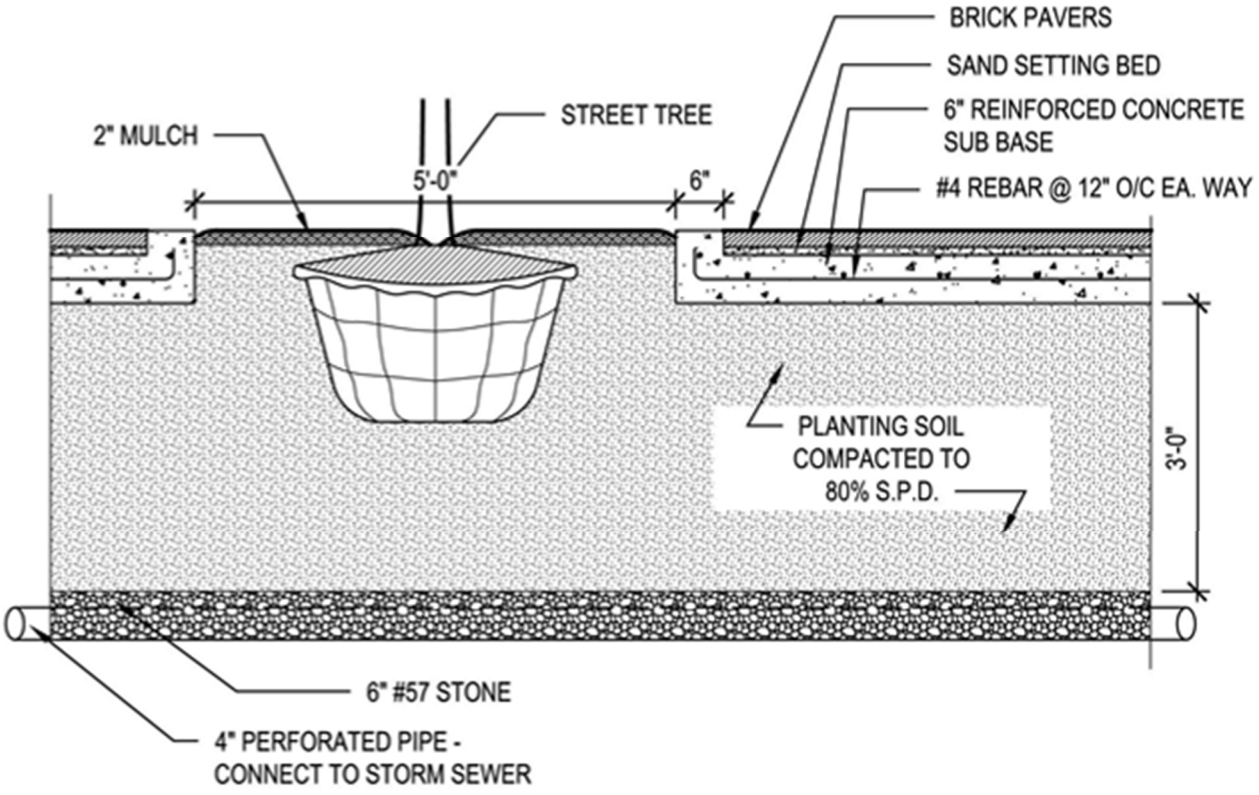
Scale: N.T.S.

Figure C-33 – Typical Broad Street Site Light



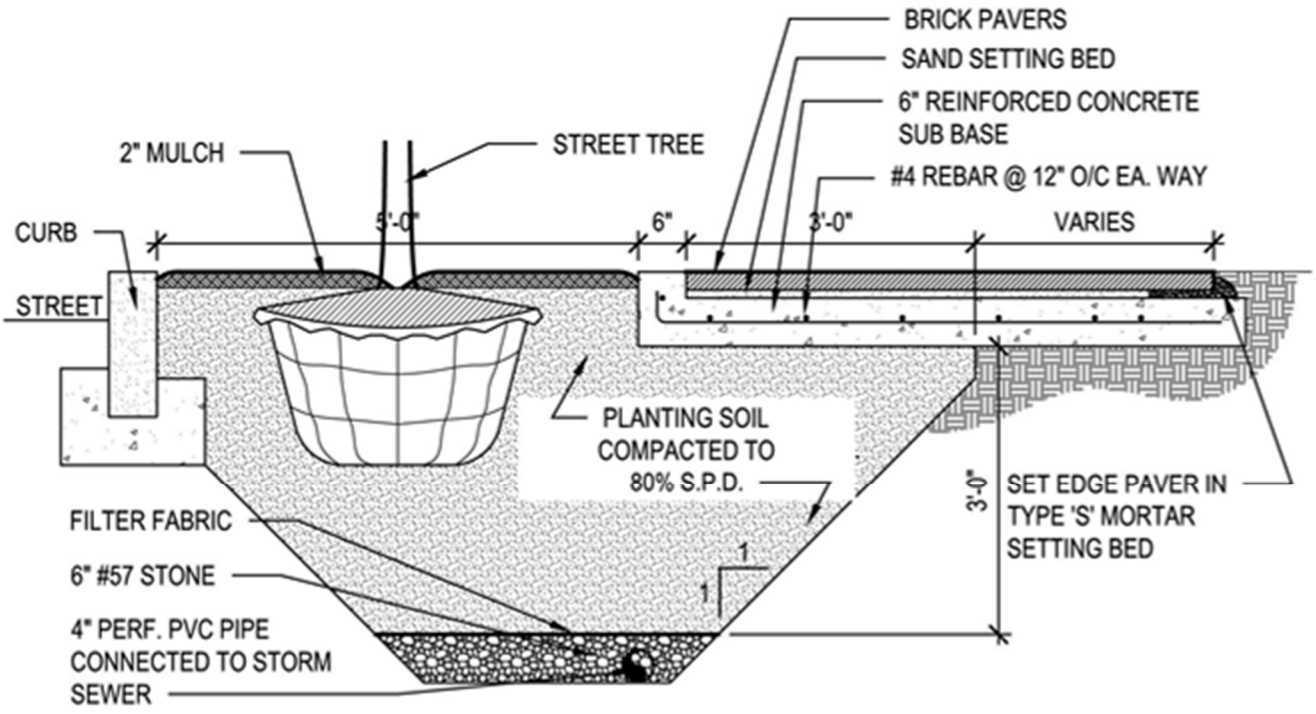
Scale: N.T.S.

Figure C-34 – Suspended Slab Tree Well Detail – Without Curb Condition



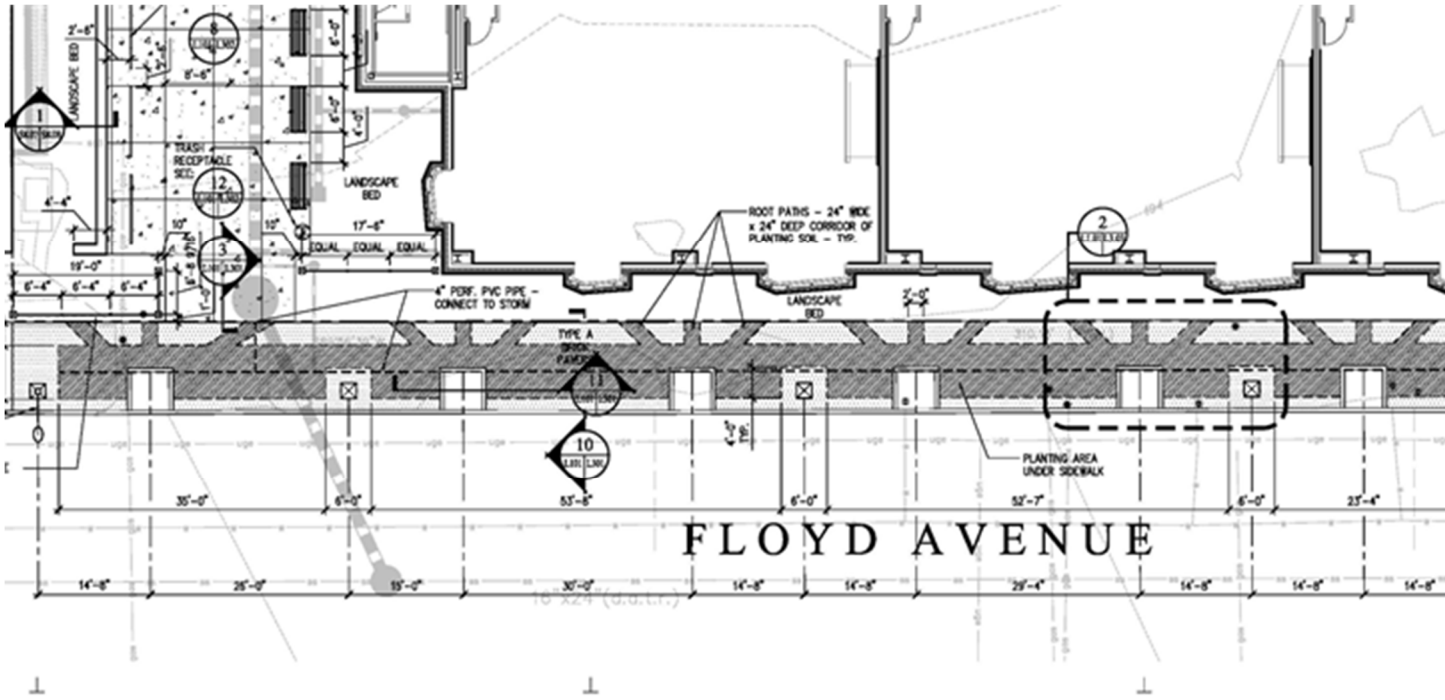
Scale: N.T.S.

Figure C-35 – Suspended Slab Tree Well Detail – With Curb Condition



Scale: N.T.S.

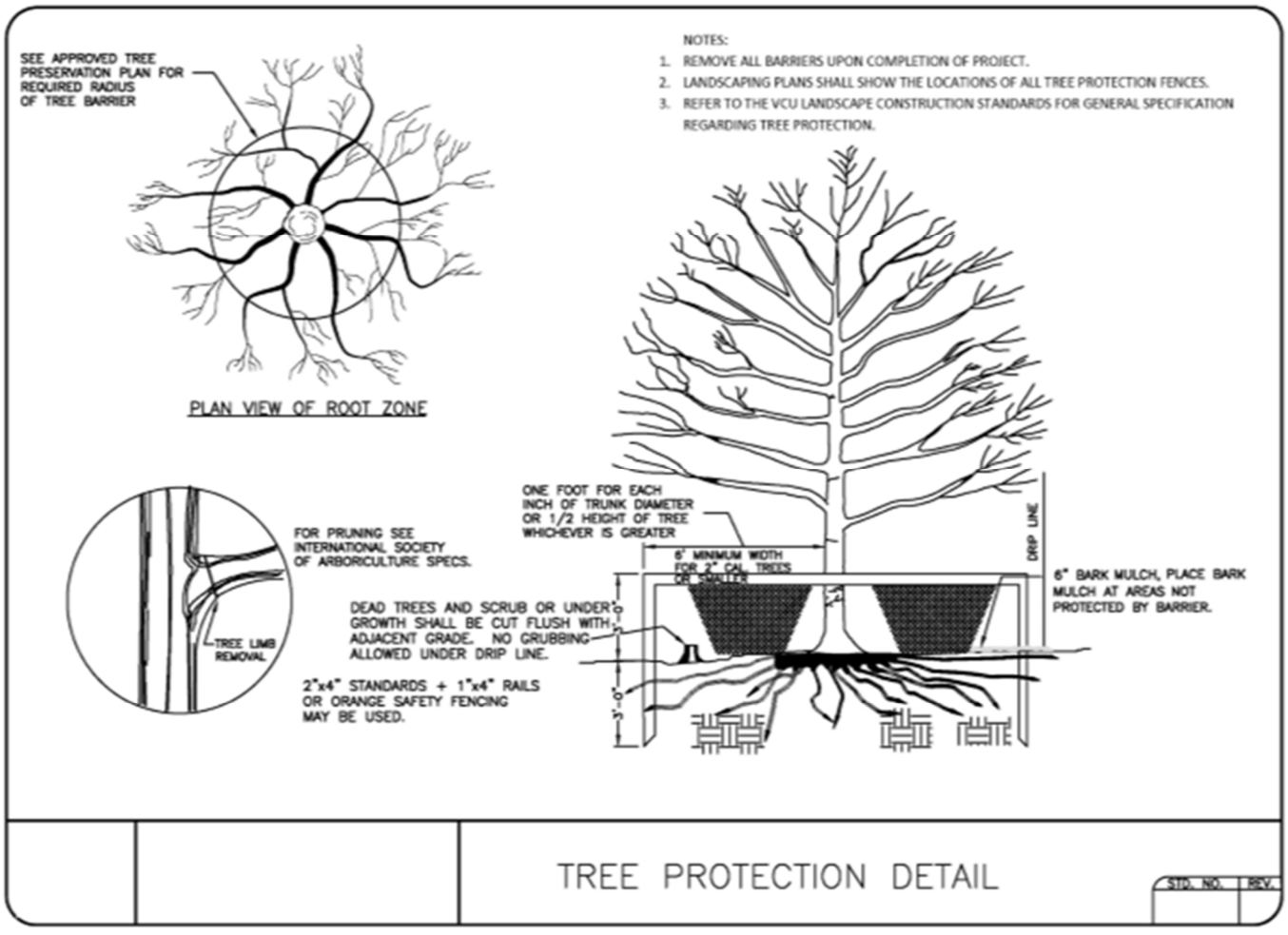
Figure C-36 – Typical Suspended Slab Tree Well Plan



Scale: N.T.S.

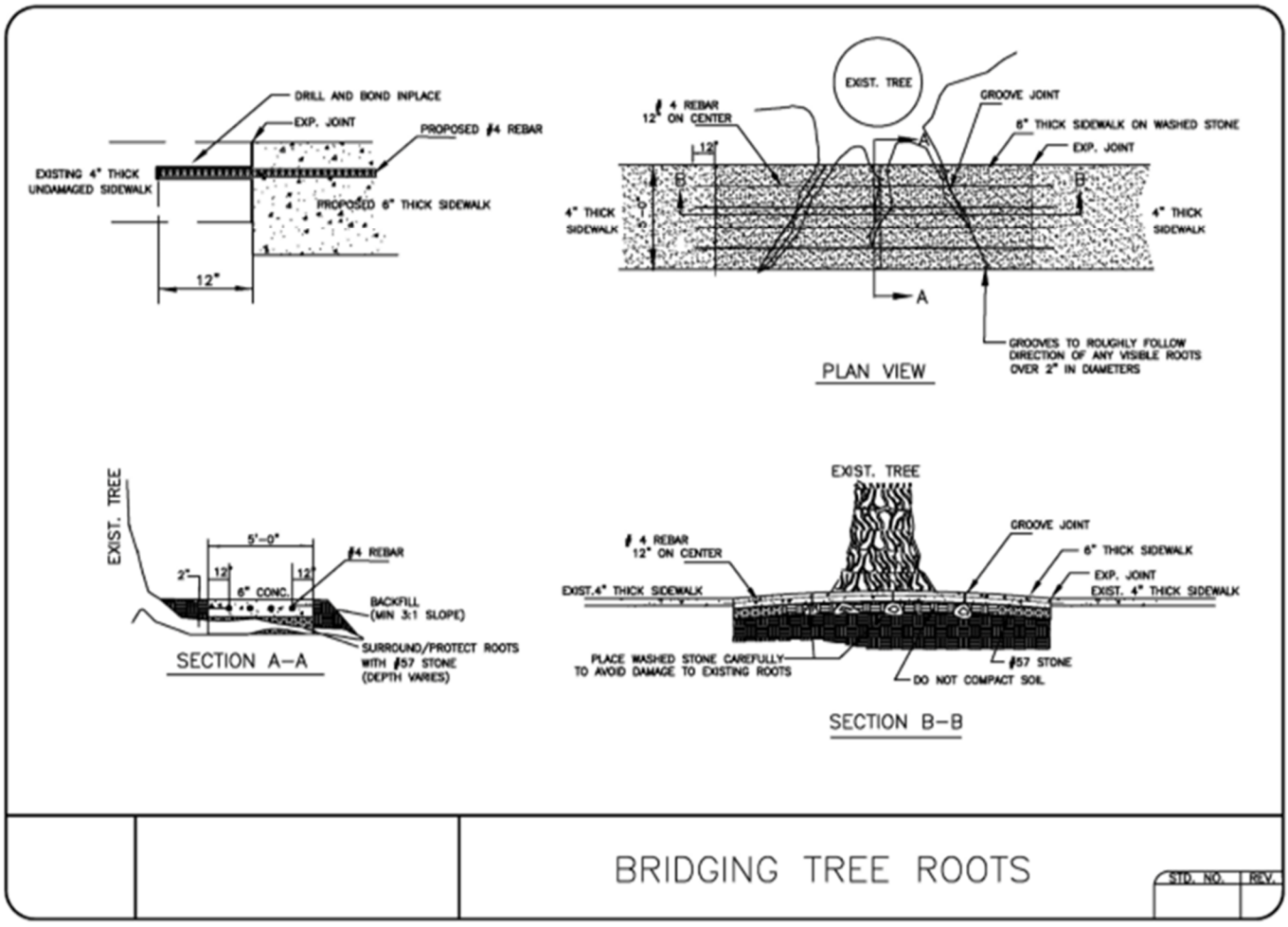
Appendix C – Details

Figure C-37 – Tree Protection Detail



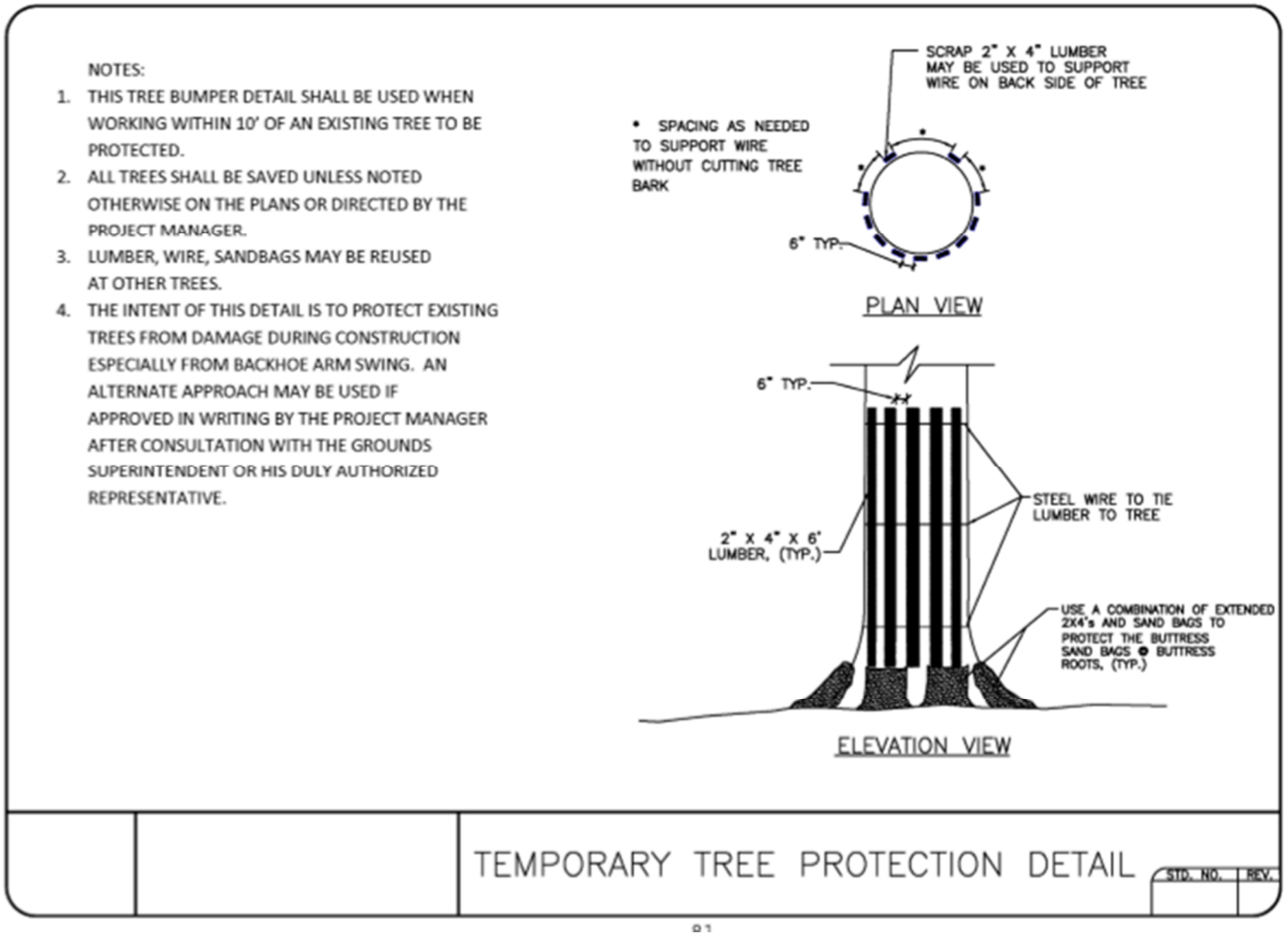
Not to scale

Figure C-38 – Typical Bridging Tree Roots Detail



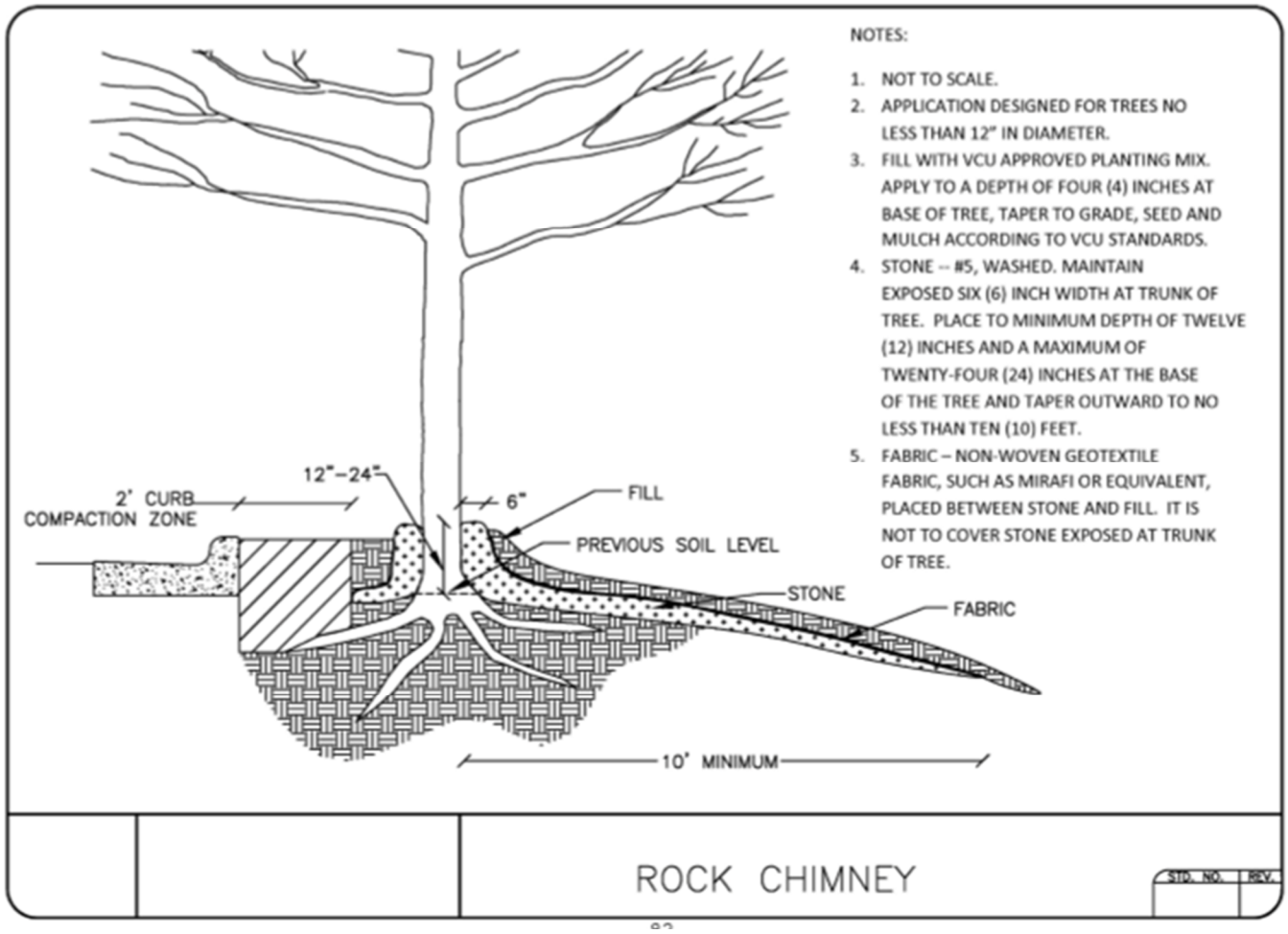
Not to scale

Figure C-39 – Temporary Tree Protection Detail



Not to scale

Figure C-40 – Rock Chimney Detail



Not to scale

Figure C-41 - Power Monitoring Meter Cut Sheet

PowerLogic™ PM8000 Series Technical Datasheet

The PowerLogic™ PM8000 series meters are compact, cost-effective multifunction power meters that will help you ensure reliability and efficiency of your power-critical facility.

Reveal and understand complex power quality conditions. Measure, understand and act on insightful data gathered from your entire power system. Designed for key metering points throughout your energy infrastructure, the PowerLogic™ PM8000 series meter has the versatility to perform nearly any job you need a meter to do, wherever you need it!

Applications

Ideal for low to high voltage applications in industrial facilities, data centers, infrastructure and other critical power environments.



METSEPM8240

PM8000 series

The solution for

Markets that can benefit from a solution that includes PowerLogic™ PM8000 series meters:

- Industry
- Data centers
- Infrastructure
- Healthcare
- Buildings

Benefits

- Makes understanding power quality simple to help operations personnel avoid downtime and helps ensure increased productivity and equipment life.
- Makes energy and power quality immediately relevant and actionable to support your operational and sustainability goals.

Competitive advantages

- Modular, flexible patented ION technology architecture enables a simple building block approach.
- Disturbance Direction Detection, modularity and compliance with latest power quality standards.
- Color screen.
- Multiple communication options.
- Excellent accuracy.

Power management solutions

Schneider Electric provides innovative power management solutions to increase your energy efficiency and cost savings, maximize electrical network reliability and availability, and optimise electrical asset performance.

Conformity of standards

- EN 50160
- EN 50470
- IEC 61000-4-30
- IEC 61010-1
- IEC 61326-1
- IEC 61557-12
- IEC 62052-11
- IEC 62053-11
- IEC 62053-22
- IEC 62053-23
- IEC 62053-24
- IEC 62586-2
- IEEE 519
- UL 61010-1



PowerLogic™ PM8000 DIN rail meter- underside



PowerLogic™ PM8000 series meter - rear view

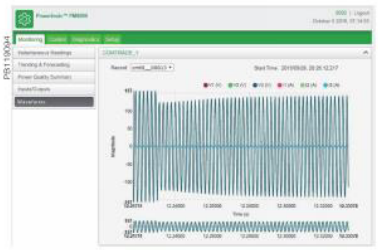


PowerLogic™ PM8000 DIN rail mounted meter

PM8000 series



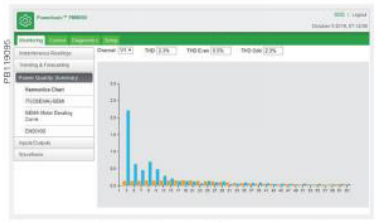
PowerLogic™ PM8000 series meter



PowerLogic™ PM8000 series waveform web page sample



PowerLogic™ PM8000 series CBEMA web page sample



PowerLogic™ PM8000 series PQ harmonics web page sample

Feature selection

Commercial reference number	PM8000 meters
PM81XX	Essential Feature Set
PM82XX	Standard Feature Set
PM83XX	Advanced Feature Set

Main characteristics

- Precision metering:
  - IEC 61557-12 PMD/SD/K70/0.2 and PMD/SS/K70/0.2 3000m (performance measuring and monitoring functions).
  - Class 0.2S accuracy IEC 62053-22, ANSI C12.20 Class 0.2 (active energy).
  - Industry leading Class 0.5S accuracy for reactive energy (IEC 62053-24).
  - Cycle-by-cycle RMS measurements updated every ½ cycle.
  - Full 'multi-utility' WAGES metering support.
  - Net metering.
  - Anti-tamper protection seals and hardware metrology lock.
- PQ compliance reporting and basic PQ analysis:
  - Monitors and logs parameters in support of international PQ standards,
    - IEC 61000-4-30 Class A/S (test methods as per IEC 62586-2).
  - Generates onboard PQ compliance reports accessible via onboard web pages:
    - Basic event summary and pass/fail reports, for EN 50160 for power frequency, supply voltage indication, supply voltage dips, short and long interruptions, temporary over voltages, voltage unbalance and harmonic voltage.
    - ITIC (CBEMA) and SEMI curves, with alarm categorization to support further analyses.
    - NEMA Motor Derating curve.
    - Pass/fail report for IEEE 519 for voltage and current harmonic limits.
  - Harmonic analysis:
    - THD on voltage and current, per phase, min/max, custom alarming.
    - Individual harmonic magnitudes and angles on voltage and current, up to the 63rd harmonic.
  - High resolution waveform capture: triggered manually or by alarm, captured waveforms available directly from the meter via SFTP in a COMTRADE format.
  - Disturbance detection and capture: sag/swell on any current and voltage channel, alarm on disturbance event, waveform capture with pre-event information.
  - Patented Disturbance Direction Detection: provides indication of the captured disturbance occurring upstream or downstream of the meter; timestamped results provided in the event log, with degree of certainty of disturbance direction.
- Used with Schneider Electric's sophisticated software tools, provides detailed PQ reporting across entire network:
  - EN 50160 report.
  - IEC 61000-4-30 report.
  - IEEE 519 harmonic compliance report.
  - PQ compliance summary.
  - Display of waveforms and PQ data from all connected meters.
  - Onboard web-based waveform viewer.
  - Energy reports for consumption analysis and cost management.
  - WAGES dashboards and reports.
  - EcoStruxure™ Power Events Analysis, including alarm management, sequence of events, and root cause analysis.
- Cybersecurity:
  - Security events logging with Syslog protocol support.
  - HTTPS secure protocol.
  - Ability to enable or disable any communication port and any protocol per port.
  - Anti-tamper protection seals and hardware metrology lock.
  - User accounts with strong passwords.
- Data and event logging:
  - Onboard data and event logging.
  - 512 MB storage.

PM8000 series



PowerLogic™ PM8000 series meter with remote display



PowerLogic™ PM8000 series meter with option modules



PowerLogic™ PM8000 series with RS-485 4-Wire module



PowerLogic™ PM8000 series with Fiber-Ethernet Module

Main characteristics (contd.)

- No data gaps due to network outages or server downtime.
- Min/Max log for standard values.
- Up to 64 user definable data logs, recording up to 16 parameters on a cycle-by-cycle or other user definable interval.
- Continuous logging or 'snapshot' triggered by setpoint and stopped after defined duration.
- Trend energy, demand and other measured parameters.
- Forecasting via web pages: average, minimum and maximum for the next four hours and next four days.
- Advanced time-of-use capability.
- Security / event log: alarm conditions, metering configuration changes, power outages, firmware download, and user login/logout all timestamped to ±1 millisecond.

- Alarming and control:
  - 50+ definable alarms to log critical event data, trigger waveform recording, or perform control function.
  - Trigger on any condition, with 1/2-cycle and 1-second response time.
  - Combine alarms using Boolean logic and to create alarm levels.
  - Alarm notification via email.
  - In conjunction with Schneider Electric's EcoStruxure™ software, alarms, software alarms, and alarm frequency are categorized and trended enabling sequence of events and root cause analyses.

Usability

- Easy installation and setup:
  - Panel and DIN rail mounting options, remote display option.
  - Pluggable connectors.
  - Free setup application simplifies meter configuration.
  - Auto-discovery using DPWS (Device Profile Web Services).
  - DHCP for automatic IP address configuration.

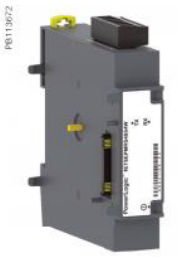
- Front panel:
  - Easy to read color graphic display.
  - Simple, intuitive menu navigation with multi-language (8) support.

- Flexible remote communications:
  - Multiple simultaneously operating communication ports and protocols allow interfacing with other automation systems; (e.g. waveforms, alarms, billing data, etc.) can be uploaded for viewing/analysis while other systems access real-time information.
  - Supports Modbus, ION, DNP3, IEC 61850.
  - Dual port Ethernet: 10/100BASE-TX; supports IPV4 and IPV6; daisy-chaining capability removes need for additional switches.
  - Fiber-Ethernet option module: Multi-mode 100Base-FX with SC duplex connector
  - Secure web interface with HTTPS and TLS 1.2 with support for user-provided certificates.
  - Create redundant network loop using Rapid Spanning Tree Protocol (RSTP) and managed Ethernet switches.
  - Customize TCP/IP port numbers and enable/disable individual ports.
  - RS-485 2-wire connection, up to 115,200 baud, Modbus RTU, ION and DNP3 protocols.
  - 4-Wire RS-485 option module: Up to 115,200 baud, Modbus RTU, ION and DNP3 protocols.
  - Ethernet to serial gateway with Modbus Master functionality, connecting to 31 downstream serial Modbus devices. Also supports Modbus Mastering over TCP/IP (Ethernet) network.
  - Full function web server with factory and customizable pages to access real-time and PQ compliance data.

PM8000 series



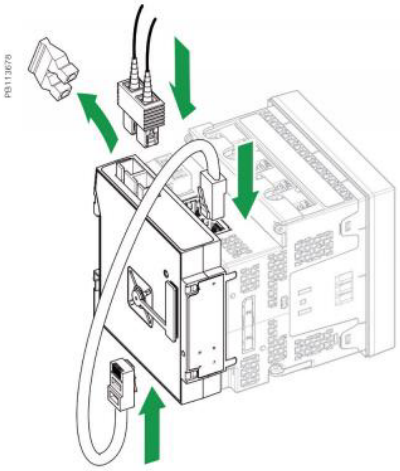
PowerLogic™ I/O module



4-Wire RS-485 Option Module



Fiber-Ethernet Option Module



PowerLogic™ PM8000 connection with Fiber-Ethernet module

- Time synchronization via:
  - GPS clock (RS-485) or IRIG-B (digital input) to ±1 millisecond.
  - Network Time Protocol (NTP/SNTP).
  - Precision Time Protocol (PTP - IEEE 1588 / IEC 61588).
  - Time set function from Schneider Electric software server.

Adaptability

- ION™ frameworks are customizable, scalable applications with object-oriented programming that compartmentalizes functions, and increases flexibility and adaptability.
- Applications include: accessing and aggregating data from downstream Modbus devices over serial or across the network (Modbus TCP/IP), logging and/or processing data through totalization, unit conversion or other calculations, applying complex logic for alarming or control operations, and visualization via webpages.

Standard meter I/O

- 3 digital status/counter inputs.
- 1 KY (form A) energy pulse output for interfacing with other systems.

Advanced Metering Option Modules

- Expanding meter's flexibility with communication and I/O option modules
- Powered from meter base

I/O Expansion Option Modules

Option modules include:

- Digital module:
  - 6 digital status/counter inputs.
  - 2 Form C relay outputs, 250 V, 8 A.
- Analog module:
  - 4 analog inputs (4-20 mA; 0-20 mA; 0-30 V).
  - 2 analog outputs (4-20 mA; 0-20 mA; 0-10 V) for interfacing with building management sensors and systems.

Communication Option Modules

Option modules include:

- 4-Wire RS-485 Module (+1):
  - Adds 4-wire support to the meter i.e. eliminating the cost and efforts of rewiring while replacing/retrofitting legacy 4-Wire RS-485 systems
  - Pluggable screw terminal connector
- Fiber-Ethernet Module (+2):
  - Provides isolated data transmission through fiber optics up to 2000 m length
  - Supports multi-mode 100Base-FX type
  - SC duplex connector

(+1) Onboard 2-Wire RS-485 port is disabled with the optional module.
(+2) Connected to the meter base using Ethernet patch cable (included with the module)

Maximum of 4 optional modules in total (Fiber-Ethernet, 4-Wires RS-485, I/O modules) can be connected to the meter. Only 1 Fiber-Ethernet and 1 4-Wire RS-485 option module is supported per meter.

*Please refer to the option module **Installation Guides** for more details.*

PM8000 series

Feature guide

		PM8000 Essential	PM8000 Standard	PM8000 Advanced
General				
Use on LV, MV, and HV systems		■	■	■
Current accuracy		0.1 % reading	0.1 % reading	0.1 % reading
Voltage accuracy		0.1 % reading	0.1 % reading	0.1 % reading
Active energy accuracy		0.2 Class	0.2 Class	0.2 Class
Number of samples/cycle or sample frequency		256 (+3)	256	512
ION programability		■	■	■
Instantaneous rms values				
Current, voltage, frequency		■	■	■
Active, reactive, apparent power	Total and per phase	■	■	■
Power factor	Total and per phase	■	■	■
Current measurement range (autoranging)		0.05 - 10 A	0.05 - 10 A	0.05 - 10 A
Energy values				
Active, reactive, apparent energy		■	■	■
Settable accumulation modes		■	■	■
Demand values				
Current	Present and max.values	■	■	■
Active, reactive, apparent power	Present and max.values	■	■	■
Predicted active, reactive, apparent power		■	■	■
Synchronization of the measurement window		■	■	■
Setting of calculation mode	Block, sliding	■	■	■
Power quality measurements				
Harmonic distortion	Current and voltage	■	■	■
Individual harmonics	Via front panel and web page	31	63	63
	Via EcoStruxure™ software	-	127	127
Waveform capture		■ (+3)	■	■
Detection of voltage swells and sags		■	■	■
Fast acquisition	1/2 cycle data	■	■	■
IEC 61000-4-30 Class A/S		-	S	A
EN 50160 Interharmonic		-	-	■
IEC 61000-4-15		-	-	■
EN 50160 compliance checking		-	■	■
IEEE 519 compliance checking		-	■	■
Disturbance Direction Detection		-	■	■
Rapid Voltage Change		-	■	■
Customizable data outputs (using logic and math functions)		■	■	■
Data recording				
Min/max of instantaneous values		■	■	■
Event logs		■	■	■
Trending/forecasting		-	■	■
SER (Sequence of event recording)		■	■	■
Time stamping		■	■	■
GPS synchronization (±1 ms)		■	■	■
Data Recorder		10	50	64
Memory Channels		160	800	1024
Storage (in Mbytes)		64	512	512

(+3) Waveform capture is limited to 128 Samples/cycle recording.

PM8000 series

Feature guide (Contd.)

	PM8000 Essential	PM8000 Standard	PM8000 Advanced
Display and I/O			
Front panel display	■	■	■
Wiring self-test	■	■	■
Pulse output	1	1	1
Digital or analog inputs (max)	27 digital 16 analog	27 digital 16 analog	27 digital 16 analog
Digital or analog outputs (max, including pulse output)	1 digital 8 relay 8 analog	1 digital 8 relay 8 analog	1 digital 8 relay 8 analog
Communication			
2-Wire RS-485 port	1	1	1
Ethernet port	2	2	2
Serial port (Modbus, ION, DNP3)	■	■	■
Ethernet port (Modbus/TCP, ION TCP, DNP3 TCP, DHCP, DNS, IPv4, IPv6, IEC 61850)	■	■	■
Ethernet gateway	■	■	■
Alarm notification via email	■	■	■
HTTP/HTTPs web server with waveform viewer	■	■	■
SNMP with custom MIB and traps for alarms	■	■	■
SMTP email	■	■	■
PTP and NTP time synchronization	■	■	■
FTP file transfer	■	■	■
Option module with 4-Wire RS-485 port	■	■	■
Option module with Fiber-Ethernet port	■	■	■

Commercial references

Essential	Standard	Advanced	Description
METSEPM8140	METSEPM8240	METSEPM8340	96 x 96 panel mount meter, AC/DC power
METSEPM8110	METSEPM8210	METSEPM8310	96 x 96 panel mount meter, LV DC power
METSEPM8143	METSEPM8243	METSEPM8343	DIN rail mount meter, AC/DC power
METSEPM8113	METSEPM8213	METSEPM8313	DIN rail mount meter, LV DC power
METSEPM8144	METSEPM8244	METSEPM8344	DIN rail mount meter with remote display, AC/DC power
METSEPM8114	METSEPM8214	METSEPM8314	DIN rail mount meter with remote display, LV DC power
METSEPM81401	METSEPM82401	METSEPM83401	MID approved panel mount meter (+4)
-	METSEPM82403	-	RMICAN approved panel mount meter (+5)
METSEPM81404	METSEPM82404	METSEPM83404	RMICAN sealed panel mount meter (+5)
Accessories	**Description**		
METSEPM89RD96	Remote display, 3 metre cable, mounting hardware for 30 mm hole (nut & centering pin), mounting hardware for DIN96 cutout (92 x 92 mm) adapter plate		
METSEPM89M2600	Digital I/O module (6 digital inputs & 2 relay outputs)		
METSEPM89M0024	Analog I/O module (4 analog inputs & 2 analog outputs)		
METSECAB10	Display Cable, 10 m		
METSEPM8HWK	Replacement hardware kit (connectors, screws, retainer clips, mounting template)		
METSEPMRS4854W	4-Wire RS 485 option module		
METSEPMFIBER	Fiber-Ethernet option module		
METSEPM8000SK	Sealing kit		

(+4) For UK + EU only.
(+5) For Canada only.

PM8000 series

Technical Specifications

Electrical characteristics		
Type of measurement		True rms to 512 samples per cycle
Measurement accuracy	Current & voltage	Class 0.2 as per IEC 61557-12
	Active Power	Class 0.2 as per IEC 61557-12
	Power factor	Class 0.5 as per IEC 61557-12
	Frequency	Class 0.02 as per IEC 61557-12
	Active energy	Class 0.2S IEC 62053-22 Class 0.2 IEC 61557-12, ANSI C12.20 Class 0.2
	Reactive Energy	Class 0.5S IEC 62053-24*
	MID Directive	EN 50470-1, EN 50470-1, AnnexB & AnnexD (optional model)
Display refresh rate		1/2 cycle or 1 second
Input-voltage characteristics	Specified accuracy voltage	57 - 400 V L-N / 100 - 690 V L-L
	Impedance	5 MΩ per phase
	Specified accuracy frequency - Frequency	42 to 69 Hz (50/60 Hz nominal)
	Limit range of operation - frequency	20 to 450 Hz
Input-current characteristics	Rated nominal current	1 A (0.2S), 5 A (0.2S) , 10 A (0.2 ANSI)
	Specified accuracy current range	Starting Current: 5 mA Accurate Range: 50 mA - 10 A
	Permissible overload	200 A rms for 0.5 s, non-recurring
	Impedance	0.0003 Ω per phase
	Burden	0.01 VA max at 5 A
Power supply AC/DC	AC	90-415 V AC ±10 % (50/60 Hz ±10 %) 90-120 V AC +/- 10% (400 Hz)
	DC	110-415 V DC ±15 % (20-60 V DC ±10 % for PM8210
	Ride-through time	100 ms (6 cycles at 60 Hz) min., any condition 200 ms (12 cycles at 60 Hz) typ., 120 V AC 500 ms (30 cycles at 60 Hz) typ., 415 V AC
	Burden	Typical: 7.7 W / 16 VA at 230 V (50/60 Hz) Fully optioned: max. 18 W / 40 VA at 415 V (50/60 Hz)
Power supply LV DC	DC	20 to 60 V DC ±10 %
	Burden	Fully optioned: max. 18 W at 18 to 60 V DC
Input/outputs	Meter Base Only	3 digital inputs (30 V AC/60 V DC) 1 form A (KY) solid state digital output (30 V AC/60 V DC, 75 mA)
	Optional	Digital - 6 digital inputs (30 V AC / 60 V DC) wetted + 2 form C relay outputs (250 V AC, 8 A)
		Analog - 4 analog inputs (4-20 mA, 0-30 V DC) + 2 analog outputs (4-20 mA, 0-10 V DC)
Mechanical characteristics		
Weight		Integrated Display Model 0.581 kg DIN rail mounted Model 0.528 kg IO modules 0.140 kg Remote display 0.300 kg
IP degree of protection		IP 54, UL type 12: Panel mount and Remote display, front IP 30: Panel mount rear, DIN rail mount, I/O modules
Excellent quality		ISO 9001 and ISO 14000 certified manufacturing
Dimensions	Panel mount model	96 x 96 x 77.5 mm
	DIN model	90.5 x 90.5 x 90.8 mm
	Remote display	96 x 96 x 27 mm
	IO modules	90.5 x 90.5 x 22 mm
Environmental conditions		
Operating temperature		-25 ☒C to 70 ☒C
Remote Display Unit		-25 ☒C to 60 ☒C
Storage temperature		-40 ☒C to 85 ☒C
Humidity rating		5 % to 95 % non-condensing
Installation category		III
Operating altitude (maximum)		3000 m above sea-level
Electromagnetic compatibility		
EMC standards		IEC 62052-11 and IEC 61326-1
Immunity to electrostatic discharge		IEC 61000-4-2
Immunity to radiated fields		IEC 61000-4-3
Immunity to fast transients		IEC 61000-4-4
Immunity to surges		IEC 61000-4-5
Immunity to conducted disturbances		IEC 61000-4-6
Immunity to power frequency magnetic fields		IEC 61000-4-8
Immunity to conducted disturbances, 2-150kHz		CLC/TR 50579
Immunity to voltage dips & interruptions		IEC 61000-4-11
Immunity to ring waves		IEC 61000-4-12
Conducted and radiated emissions		EN 55022, EN 55011, FCC part 15 Class B, EN55011, EN55022 Class B, ICES-003 Class B
Surge withstand Capability (SWC)		IEEE / ANSI C37.90.1

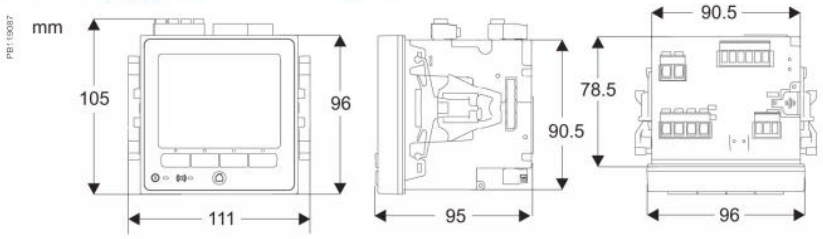
PM8000 series

Technical Specifications(Contd.)

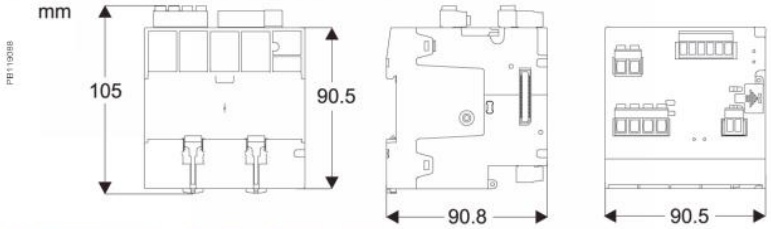
Safety	
Safety Construction	IEC/EN 61010-1 ed.3, CAT III, 400 V L-N / 690 V L-L UL 61010-1 ed.3 and CSA-C22.2 No. 61010-1 ed.3, CAT III, 347 V L-N / 600 V L-L IEC/EN 62052-11, protective class II
Communication	
Ethernet to serial line gateway	Communicates directly with up to 31 unit load devices
Web server	Customisable pages, new page creation capabilities, HTML/XML compatible
Serial port RS-485	Baud rates of 2400 to 115200, pluggable screw terminal connector
Ethernet port(s)	2x 10/100BASE-TX, RJ45 connector (UTP)
Protocol	Modbus, ION, DNP3, IEC 61850, HTTPS, FTP, SNMP, SMTP, DPWS, RSTP, NTP, PTP, NTP/SNTP, GPS, IPv4 /IPv6, DHCP, Syslog protocols
Communication Option Modules	
Optional 4-Wire RS-485 serial port	Baud rates of 2400 to 115200, pluggable screw terminal connector
Optional Fiber-Ethernet port	Ethernet patch cable from base meter, multi-mode 100Base-FX, SC duplex connector
Firmware characteristics	
High-speed data recording	Down to 1/2 cycle interval burst recording, stores detailed characteristics of disturbances or outages. Trigger recording by a user-defined setpoint, or from external equipment
Harmonic distortion	Up to 63rd harmonic (127th via Schneider Electric software) for all voltage and current inputs
Sag/swell detection	Analyse severity/potential impact of sags and swells: magnitude and duration data suitable for plotting on voltage tolerance curves per phase triggers for waveform recording, control
Disturbance direction detection	Determine the location of a disturbance more quickly and accurately by determining the direction of the disturbance relative to the meter. Analysis results are captured in the event log, along with a timestamp and confidence level indicating level of certainty
Instantaneous	High accuracy of standard speed (1s) and high-speed (1/2 cycle) measurements, including true rms per phase and total for: voltage, current, active power (kW),reactive power (kvar), apparent power (kVA), power factor, frequency, voltage and current unbalance, phase reversal
Load profiling	Channel assignments (Up to 1024 Channels via 64 data recorders) configurable for any measurable parameter, including historical trend recording of energy, demand, voltage, current, power quality, or any measured parameter. Trigger recorders based on time interval, calendar schedule, alarm/event condition, or manually
Trend curves	Historical trends and future forecasts to better manage demand, circuit loading, and other parameters. Provides average, min, max and standard deviation every hour for last 24 hours, every day for last month, every week for last 8 weeks and every month for last 12 months
Waveform captures	Simultaneous capture of all voltage and current channels, sub-cycle disturbance capture, ability to record from 320 cycles at 512 sample per cycle to over 2880 cycles at 16 points per cycle with user selectable sampling speed as well as pre- and post-trigger length
Alarms	Threshold alarms: adjustable pickup and dropout setpoints and time delays, numerous activation levels possible for a given type of alarm, user-defined or automatic alarm threshold settings, user-defined priority levels (optional automatic alarm setting)
Advanced Time of Use (TOU)	6 seasons; 3 different day types: weekend, weekday, and holiday; up to 8 tariffs per day type
Advanced security	Up to 50 users with unique access rights. Perform resets, time sync, or meter configurations based on user privileges
Storage	512 MB
Firmware update	Update via the communication ports
Display characteristics	
Integrated or Remote display	320 x 240 (1/4 VGA) Color LCD, configurable screens, 5 buttons and 2 LED indicators (alarm and meter status)
Languages	English, French, Spanish, Russian, Portugese, German, Italian, Chinese
Notations	IEC, IEEE
The HMI menu includes	
Alarms	Active alarms, historic alarms (50+ alarms)
Basic Reading	Voltage, current, frequency, power summary
Power	Power summary, demand, power factor
Energy	Energy total, delivered, received
Events	Timestamped verbose event log
Power Quality	EN 50160, IEEE 519, harmonics, phasor diagrams
Inputs/Outputs	Digital inputs, digital outputs, analog inputs, analog outputs
Nameplate	Model, serial and FW version
Custom Screens	Build your own metrics
Setup Menu	Meter setup, communications setup, display setup, date/time/clock setup, alarm setup, language setup, time of use setup, resets, password setup

PM8000 series

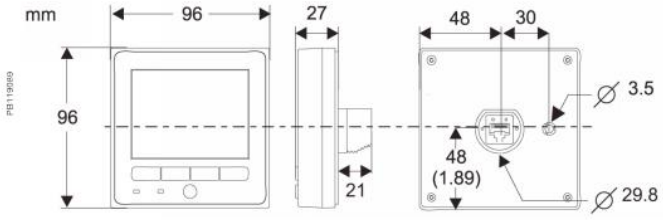
PM8000 panel mount meter dimensions



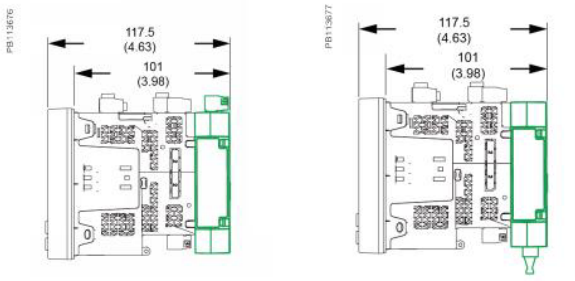
PM8000 DIN rail mount meter dimensions



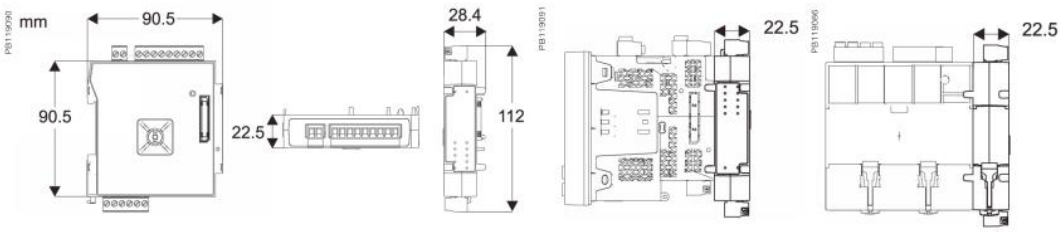
PM8000 remote display dimensions



PM8000 with communication option modules



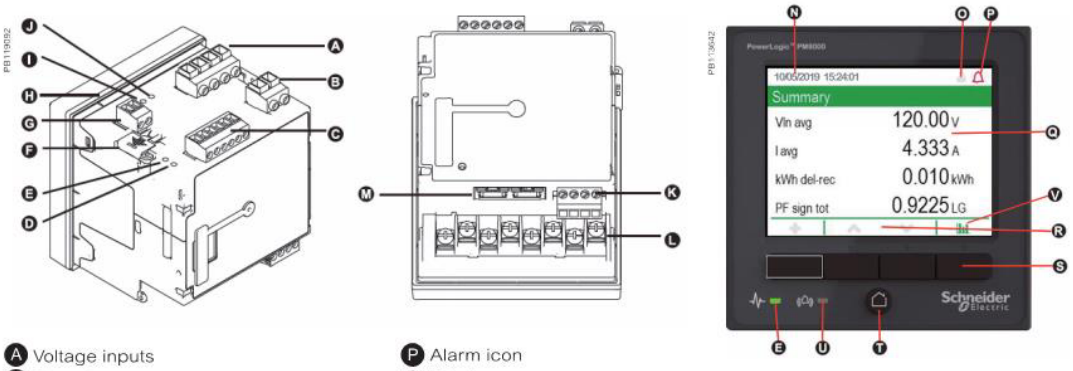
PM8000 with I/O modules dimensions



*Please see the appropriate **Installation Guide** for accurate and complete information on the installation of this product.*

PM8000 series

PM8000 series parts



- A Voltage inputs
- B Control power
- C Digital inputs
- D Revenue lock LED (green)
- E Status LED (green/red)
- F Revenue lock switch
- G Digital output
- H Sealing gasket
- I Infrared energy pulsing LED
- J Energy pulsing LED
- K RS-485
- L Current inputs
- M Ethernet (2)
- N Date/time
- O Revenue lock icon
- P Alarm icon
- Q Display
- R Navigation icons
  - Up
  - Down
  - Select
  - Cancel
  - Edit
  - More
- S Navigation buttons
- T Home button
- U Alarm LED (red)
- V Bar graph

ALERTUS®

Alert Beacon®

Familiarization

Short overview of the Alert Beacon.
Version number: 000001

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About Alertus
Alertus Technologies is a pioneer and market leader of emergency mass notification systems for large-area, high occupancy facilities. Since 2002, Alertus has engineered innovative solutions for unified mass notification, in-building notification, outdoor notification, and personal notification. Thousands of institutions and enterprise organizations worldwide trust and rely on Alertus to protect millions of people. To learn more, visit www.alertus.com.

Alert Beacon Overview

Front View

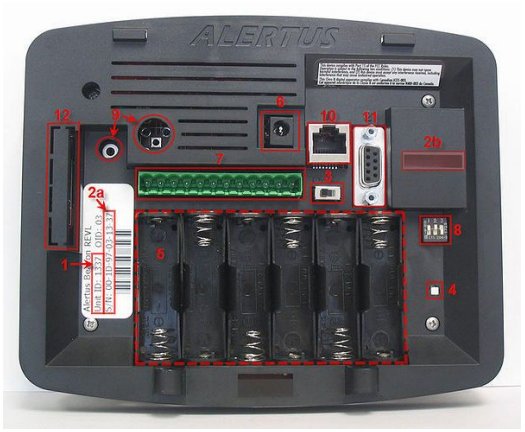
The image on the right shows the Alert Beacon installed on a Flush Mount bracket.



1. **Screen:** Displays Alert Message text. Device information and menu options are also shown here.
2. **Siren:** Grille for the internal Piezo Siren.
3. **Top Button:** Used for a variety of functions. Referred to as "TOP" or "UP" in this documentation.
4. **Bottom Button:** Used for a variety of functions. Referred to as "BOTTOM" or "DOWN" in this documentation.

Rear View

The image on the right shows the reverse side of the Alert Beacon. Points of interest are as follows:



1. **Unit ID (UID):** This is a 4-digit hexadecimal number used to refer to the specific Alert Beacon in the Alertus Server software. See Beacon Configuration for details on using the unit ID to change Alert Beacon settings. (Note: The characters A through F may appear in the UID, as these are valid hexadecimal digits.)
2. **Serial Number (S/N):** The 12-character string at location 2a uniquely identifies the unit, and is also the MAC address for the wired Ethernet connection. If the unit is equipped with a Wi-Fi module, the WLAN MAC address will be visible through the window at location 2b. Refer to Info for Network Administrators for more information about MAC addresses on the Alert Beacon.
3. **Power Switch:** Toggles the unit on and off. (Note: if the unit is not connected to an external power source, this switch alone will not turn on the power: see Reset Button for details.)
4. **Reset Button:** When external power is not present, but batteries are installed, turning on the unit requires toggling the power switch (3) to the 'On' position, then pressing this button to activate the unit. (This is by design. If external power is present, it is not necessary to press this button. Also, if the unit is running while externally powered, then disconnected, it will continue to operate using battery power without pressing the button.) When running in Hardcoded Demo Mode, press this switch to change siren intensity.
5. **Backup Batteries:** The Alert Beacon uses 6 standard 'AA'-sized batteries (not shown in this picture.) Alertus recommends the use of Nickel-Metal Hydride (NiMH) rechargeable batteries. IMPORTANT: DO NOT USE NON-RECHARGEABLE BATTERIES (i.e. alkaline batteries) as this may result in hazardous conditions, damage to the Alert Beacon hardware, and/or personal injury.
6. **DC Input**: 2.5mm barrel plug. Accepts 12-24 VDC, generally from a 'wall-wart' type AC adaptor.
7. Aux Connector: For hardwired connections to AC or DC power, or Auxiliary Input/Output devices. Refer to details below.

8. **DIP Switches:** Configure some elements of device behavior. See below for detailed instructions.
9. **FM Antennas (if applicable)**: #4-40 screw terminal and F-type connector for 50 ohm external FM antennas. (Connectors are not present in this picture.)
10. **Ethernet Connector:** RJ-45 jack for Ethernet connectivity.
11. **Serial Port:** For connection to external 'smart' peripherals (LED Marquee Displays, Video Switches, etc.) Also used for firmware upgrades (see below.)
12. **Pager Port:** (unused for most beacons)

Power Supply



The Alert Beacon can use DC, AC, or Power-over-Ethernet (PoE) (if so equipped.) The power connection method differs depending on the chosen power source.
NOTE: Due to the many power options, Alertus does not include power supplies with the Alert Beacons. However, links to compatible power supplies are included below.

DC Power

The Alert Beacon can run on DC power between 13.8V and 24VDC. Connect DC power using the DC Input Jack (Item 6 on the above diagram). The required barrel plug dimensions are 2.5mm inner diameter and 5.5mm outer diameter. Either polarity (center positive or negative) will work. The power supply should be capable of supplying 12 Watts. Therefore, if voltage is 13.8V it should have a current driving capacity of about 1A or more. If using a 24V supply, it should be able to supply at least 0.5A.
One example of a compatible DC power supply is the 271-2574-ND from Digi-Key.

AC Power

A step-down transformer can be used to supply the Alert Beacon with AC power. Either a plug-in type or hardwired type can be used; the secondary voltage should be between 13.8V and 24V. Connect AC power using the rightmost two pins of the Aux connector as detailed in the Auxiliary Connector section below.
Example Plug-In AC transformer #1: ACTX-2420 from All Electronics
Example Plug-In AC transformer #2: ELK-TRG2440 from Elk Products
Example Hardwired AC transformers: Foster Transformer Model 15343, or Grainger item #6WU91.
Power-over-Ethernet (PoE)
Prior to the approval of the IEEE 802.3af standard, Cisco developed a proprietary implementation of the PoE concept. This is properly called Cisco In-Line Power (ILP), but is sometimes referred to as PoE, which can be misleading. While some later Cisco devices do implement both standards, different hardware is required for a client device to make use of either standard. Therefore, it is important to note that **the Alertus Beacons ONLY SUPPORT the newer 802.3af IEEE standard - they DO NOT support the older Cisco ILP protocol.**
The Cisco ILP standard is commonly used with Cisco 7900-series phones (the 7940 and 7960, for example.) A PoE deployment that powers these phones MAY or MAY NOT work with the Alertus devices, depending on the exact model of switch used. For more information on which Cisco models use which standard, refer to this page on the Cisco web site.

PoE Injectors/Midspans

If you don't have PoE capable switches you can use a PoE Injector or a Midspan to "inject" power onto your existing LAN Cables. A PoE Injector/Midspan resides in series with your existing Ethernet switch and the data terminals. It combines the data along with power to give you the equivalent of a PoE enabled switch.

PoE injectors

Injectors are single port solutions.

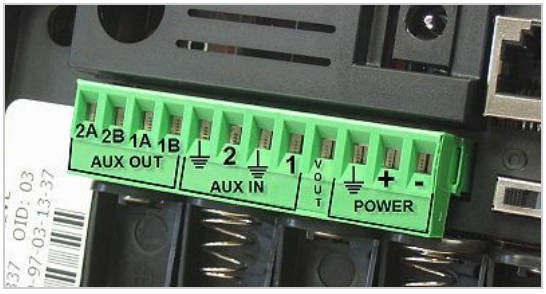
- Versa Tek VX-PI100 -

PoE Midspans

A midspan is usually a multi port solution that is rack mounted. Typically, they cost more per port but they're often a necessity to reduce the clutter in electrical closets.

- Power Dsine PD-3506G/AC on Provantage.com 6 Ports, 19" Rack Mnt - $308.22 as of 02/19/2014
- Power Dsine PD-3512G/AC on Provantage.com 12 Ports, 19" Rack Mnt - $417.07 as of 02/19/2014

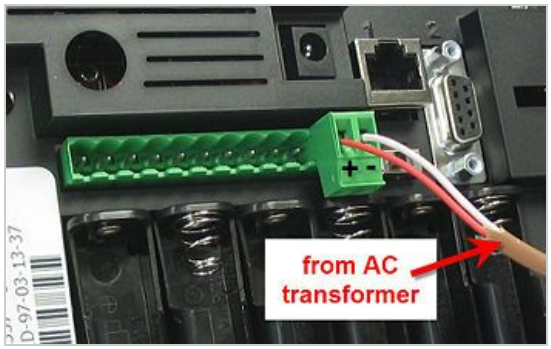
Full Pinout



Connections to the auxiliary terminals are as shown in the following diagram:

Power Input and VOut

The right-most three pins are for power input. These pins should be used when connecting the Alert Beacon to an AC step-down transformer. Only the + and - terminals should be connected to the transformer; leave the ground terminal unconnected. The supported voltage range is 12-24VAC.



The fourth pin from the right, "VOut", is intended to power small, low-power auxiliary devices such as sirens or strobe lights when the Alert Beacon is powered via an external transformer, not PoE. This pin presents approximately the same voltage being applied to the input pin, less 1-2V. When using an AC power supply, this voltage will be DC (the Alert Beacon converts it internally.) The maximum current draw from the VOut pin is 1 Amp. Repeatedly exceeding this current can cause the VOut pin to become inoperable.

Aux In

The Alert Beacon provides two inputs for connection to external signals, switches, or the like. See Alert Beacon Peripherals -> Aux In for full specifications and wiring diagrams. Since auxiliary input devices may require customized firmware, contact Alertus for details.

Aux Out

The auxiliary outputs can be used to trigger simple devices such as external strobe lights or sirens. Each of the two outputs is a normally-open contact closure. As such, they can be used to switch AC or DC current, to support a wide variety of devices. See Alert Beacon Peripherals -> Aux Out for specifications and application guidance.

Alert Beacon®

Installation Guide

This guide provides typical installation instructions. Please bear in mind that building codes vary and the technician installing the Alert Beacon is responsible for compliance with any relevant codes.

Version number: 000001

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About Alertus

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Alert Beacon® Installation

This guide provides typical installation instructions. Please bear in mind that building codes vary and the technician installing the Alert Beacon is responsible for compliance with any relevant codes.

Specifications

- Dimensions: 5.9 "H x 7.2 "W x 2.2 "D
- Weight: 2 lbs
- Colors: Yellow, White
- Power: 24VDC or AC or POE
- Data Input: TCP/IP port 80
- Temperature: 0-35C with batteries installed, 0-55C without batteries



Installation Kit

- Alert Beacon
- Flush Mount
- Surface Mount

Due to differences in installation styles and locations, it is the responsibility of the customer to supply a power cable in the appropriate length. If using DC: 18AWG, 2-conductor cable is suggested, if using AC: 18AWG 3-conductor cable is suggested, if using POE: CAT5e is suggested; please ensure compliance with applicable building codes.

Installation Overview

1. Determine desired mounting location
2. Determine power source
3. If necessary, install electrical box / wiremold to supply power to the Alert Beacon
4. Affix mounting bracket to the wall
5. Connect power / cables to the Alert Beacon
6. Set DIP switches, if applicable
7. Record the Unit ID and location description
8. Snap the unit into the mounting bracket
9. Test the unit

This guide provides typical installation instructions. Please bear in mind that building codes vary and the technician installing the Alert Beacon units is responsible for compliance with any relevant codes.

General Mounting Guidelines

Recommended locations for installing Alert Beacon units include:

1. Heavily trafficked building corridors
2. Lobbies and points of egress
3. Administrative desks

For optimal coverage, each hallway and common area should contain at least one unit. Suggested mounting height is 48” above finished floor, in accordance with accessibility recommendations.

Install location with a drop ceiling:

- The preferred method is to install an electrical outlet in the ceiling, and use a plug-in AC transformer (e.g. Mouser Part # 507-XT2420, or AllElectronics Part # ACTX-2420). This presents a number of advantages:
- Plug-in transformers include a locking screw to prevent accidental unplugging.
- Power can be disconnected without needing to turn off the mains; simplifies maintenance (i.e. if power supply needs to be replaced)
- The power supply for an external siren or strobe can be connected to the second outlet, providing for future expansion.
- AC plug-in transformers do not come pre-wired, so it is necessary to obtain crimp-on spade lugs for the transformer connection, a compatible “Euro-block” style connector (Digi-Key Part # ED2779-ND or ED1701-ND) for the Alert Beacon connection, wire strippers and an appropriate crimp tool. See the section on “Connecting Power”, below.

Install location without a drop ceiling:

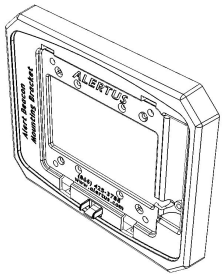
This typically requires a standalone step-down transformer. These are often slightly more expensive than the plug-in type, and are more complicated to install. However, this method is sometimes necessary if there is no place to install an outlet, or for aesthetic reasons. While a full install procedure for a hardwired transformer is beyond the scope of this document, the following are some UL-approved models known to function well with the Alertus Alert Beacons:

- Foster Transformer, Model 15343
- Grainger Item #6WU91 (fits inside a deep double-gang box)

The sample photos at the end of this document illustrate examples of installations using hardwired AC transformers.

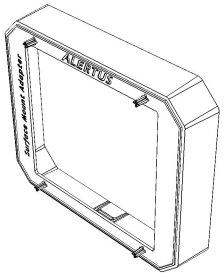
Mounting Options and Accessories

Select a suitable mounting option from the three options below. Installation examples of each mounting option are provided at the end of this manual.



Flush Mount Bracket

The low-profile flush mount bracket is included standard with every Alert Beacon. By itself, this bracket is suitable for mounting the unit on drywall, or anytime the power cables can be run inside the wall. It attaches directly to a double-gang electrical box using 2 to 4 #6-32 screws (1 ½” length suggested). Note that the box must be recessed into the wall; if this is not an option (i.e. on masonry walls) then the additional Surface Mount Adapter should also be used.



Surface Mount Adapter

If it is not feasible to recess the electrical box inside the wall, then a Surface Mount Adapter may be required. This extension combines with the standard Flush Mount Bracket to increase the total depth, allowing the Bracket to mount on a double-gang surface mount Wiremold box.

The inner rim of the Surface Mount Adapter has punchouts on the top and bottom to allow cable entry via Wiremold conduit.

If you have received a Surface-Mount Adapter as part of a first article kit, please note that while there is no additional charge for these parts, they are not included unless requested. If you have determined that your installation will require Surface Mount Adapters, please make your sales representative aware of the quantity you would like to receive.



Wire Desk Stand

The desk stand provides a simple and easy option for deploying Alert Beacons at administrative desks or in offices, as well as in temporary locations. Other stand options are also available; contact Alertus for details.



Optional Accessory: Wire Guard

To protect against theft, vandalism, or accidental damage (in locations such as a gymnasium) Alertus offers a wire guard cage as an optional accessory.

Mounting the Bracket

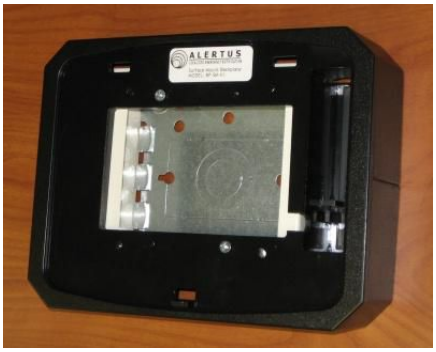
The procedure for attaching the bracket depends on the bracket type.



Flush Mount Bracket

The low-profile, “Flush Mount” bracket is designed to mount to a standard double-gang electrical box. The box should be installed as normal, i.e. recessed into the wall so that the mounting tabs are flush with the wall surface. All required wiring should be run into the box before proceeding.

Once the box is securely mounted to the wall, attach the flush mount bracket using 2 to 4 #6-32 screws (1 ½” length suggested.) The inner-most holes on the bracket should line up with the appropriate holes on the double-gang box. Figure 3 shows an installed Flush Mount bracket.



Surface Mount Bracket

The Surface Mount bracket mounts to a “shallow” surface-mount receptacle box such as Wiremold part #V5747-2, as shown in Figure 4. #6-32 screws (1 ½” long) are required. The inside of the bracket includes prefabricated punch-outs for a variety of wiring conduit sizes, allowing connections from the top or bottom.

Connecting Power to the Beacon

After determining the desired mounting option, the next step is to make the power connections. Select the procedure appropriate for the chosen power source.

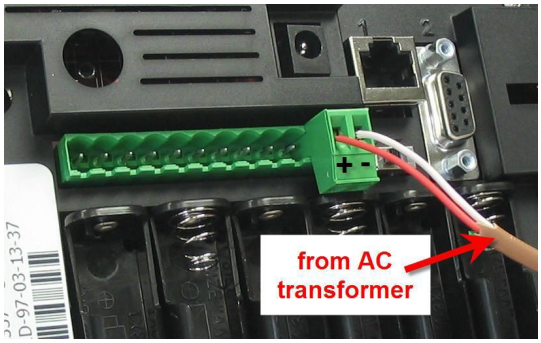
Connecting DC Power

The Alert Beacon can operate on DC power from 13.4V to 24V, and requires a maximum of approximately 15W. The required barrel plug dimensions are 2.5mm inner diameter and 5.5mm outer diameter. To use DC power, simply

connect the barrel plug to the appropriate jack on the Alert Beacon, as shown in Figure 2 (see page 2 of this guide.) After connecting power, proceed to the next section to select the appropriate DIP switch settings.

(Note: While it is possible to use a DC adapter for a wall-mount installation, this is not recommended. If 13.4V-24V DC is available, it can be connected using the Auxiliary Port connections similar to the AC power connection method described below, although care must be taken to observe the proper polarity.)

Connecting AC Power



AC power connections are made through the Alert Beacon's Auxiliary Port (green Euroblock connector.) Either a 12-position or 2-position plug can be used (typically, Alertus will ship a 2-position plug with the Alert Beacon when the customer is using AC power.) Make the connections according to the procedure below.

1. Attach one end of a two-conductor cable to the AC power source. Refer to the Power Options section on page 2 for a list of suitable AC transformers, if required.
2. Strip the wires carrying the low voltage AC power and insert them into the terminal block plug, as shown in Figure 5 (above.)
3. Insert the plug into the terminal block on the back of the Alert Beacon.

The Alert Beacon should now be receiving AC power. Proceed to the next section to select the appropriate DIP switch settings.

Connecting Power over Ethernet (PoE)



When using PoE, the only required connection is the data/power cable from the PoE data equipment. Use Category 5e or Category 6 cabling, with standard RJ-45 connectors. After connecting the cable as shown in Figure 6, proceed to the next section to select the appropriate DIP switch settings.

DIP Switches



Certain aspects of the Alert Beacon's behavior can be configured using DIP switches, located on the back of the unit as shown in Figure 7. The switches are numbered from 1-3, and function as follows:

- DIP1 – Set to ON for Low Power Siren mode. This limits the maximum siren intensity and should be set when the Alert Beacon is installed in small or enclosed areas.
- DIP2 – Set to ON to allow the siren to be muted by pressing both front buttons. This is NOT recommended when installing in public areas! It is intended for use when the unit is installed in an administrative office (such as a police dispatch center) where continued siren operation may interfere with emergency response operations.
- DIP3 – Reserved for future use. This switch should remain set to OFF.

Power Switch

The last step before attaching the Alert Beacon to a Mounting Bracket is to set the Power Switch to ‘ON’.

Attaching an Alert Beacon to the Mounting Bracket





Once all required connections have been made and the appropriate DIP switches have been set, attached the unit to the mounting bracket using the following procedure:

1. While tilting the Alert Beacon towards the bracket as shown, attach the clips on the top rear under the slots on the bracket.
2. Once the top clips are in place, rotate the bottom edge of the unit towards the bracket while continuing to apply slight upwards pressure.
3. After the Alert Beacon is fully aligned, apply firm pressure towards the wall until the unit is caught by the retaining clip. Ensure that the clip is holding the unit securely.

Security Screws

While the standard mounting bracket provides sufficient attachment for most locations, the bottom of the bracket also includes threaded inserts for security screws. These can be installed as a deterrent to accidental or malicious removal of the unit, or to provide additional tamper protection for units in isolated areas. These inserts require pan head #6-32 screws, ¾” long (screws over 1” long may interfere with the electrical box.) For additional security, use tamper-proof screws such as the #6 spanner head (Screws and driver available from McMaster-Carr: P/N 94066A151 (screws) and 94062A114 (driver).)

NOTE: Alertus does not include screws for this purpose due to the wide variety of tamper-proof screw designs on the market, and the fact that many organizations already have a preferred bit/driver type.

Post-Install Tasks



In order to properly configure the localized notification capabilities of the Alertus Notification system, administrators must have a record of the Unit ID and location of each Alert Beacon. Alertus provides Alert Beacon Install Logs for this purpose.

After completing an installation, record the 4-digit Unit ID (found on the white label on the rear of the unit, highlighted in Figure to the right) and a short description of the unit’s location, such as “Mathematics Building, East hallway near lobby” or “Smith Dorm, near main entrance”.

Removing an Alert Beacon

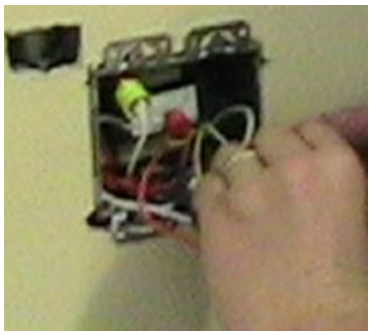
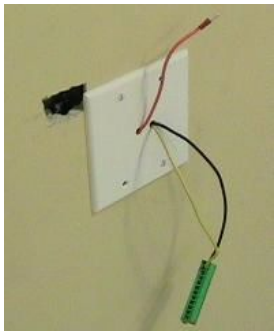




The release mechanism operates similar to a standard fire alarm. To remove an Alert Beacon, first remove the security screws (if applicable.) To release the retaining clip, insert a small flat-head screwdriver (or similar tool) into the slot on the bottom of the Alert Beacon housing. Press gently but firmly until the clip releases; continue to hold the clip while tilting the Alert Beacon upwards out of the mounting bracket. The stages of the release procedure are illustrated in the images below.

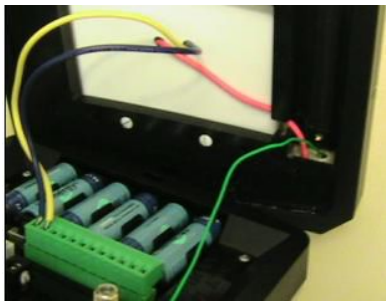
Example: Flush Mounting (Hardwired AC transformer, FM Datalink)

1. Hardwired a step down transformer in a double gang electrical box.
2. Drilled holes in faceplate for wires to come through. Two screws hold the face-plate and two screws secure the mounting bracket (next photo).

3. Installed mounting bracket onto double gang box with the transformer located inside.
4. Connected AC Power plug to Alert Beacon. (Note: The unit in this example received data over a wireless FM datalink; the green wire on the right was an antenna.)






Example: Surface Mounting (Hardwired AC transformer, FM Datalink)

1. 120VAC from a nearby emergency exit sign was brought into an electrical box installed above the drop ceiling.



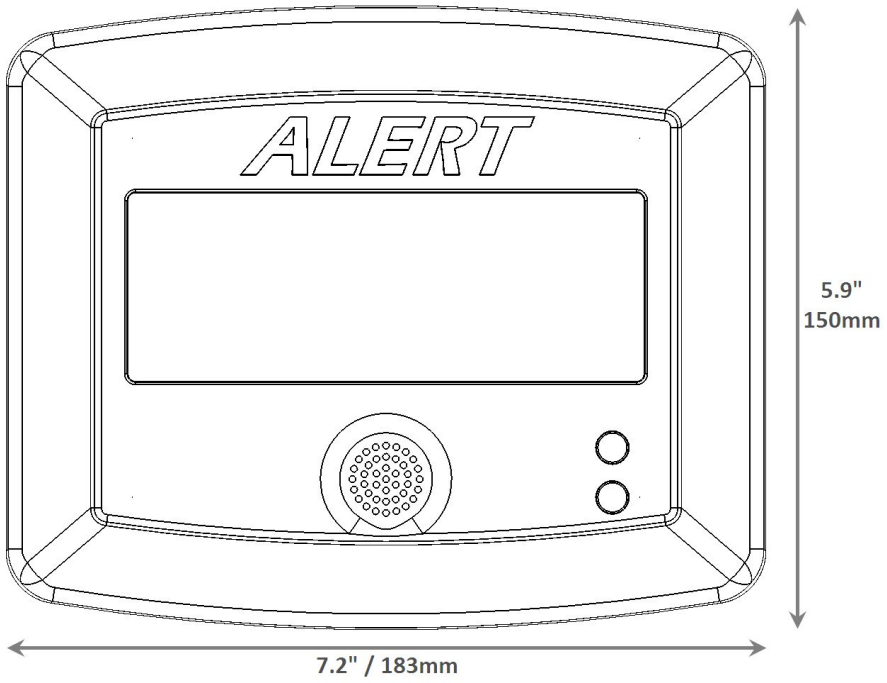

2. 500 Series Wiremold was brought down from the electrical box.
3. A Wiremold double-gang surface mount box was installed.
4. The Surface Mount Backplate screws into the Wiremold box.



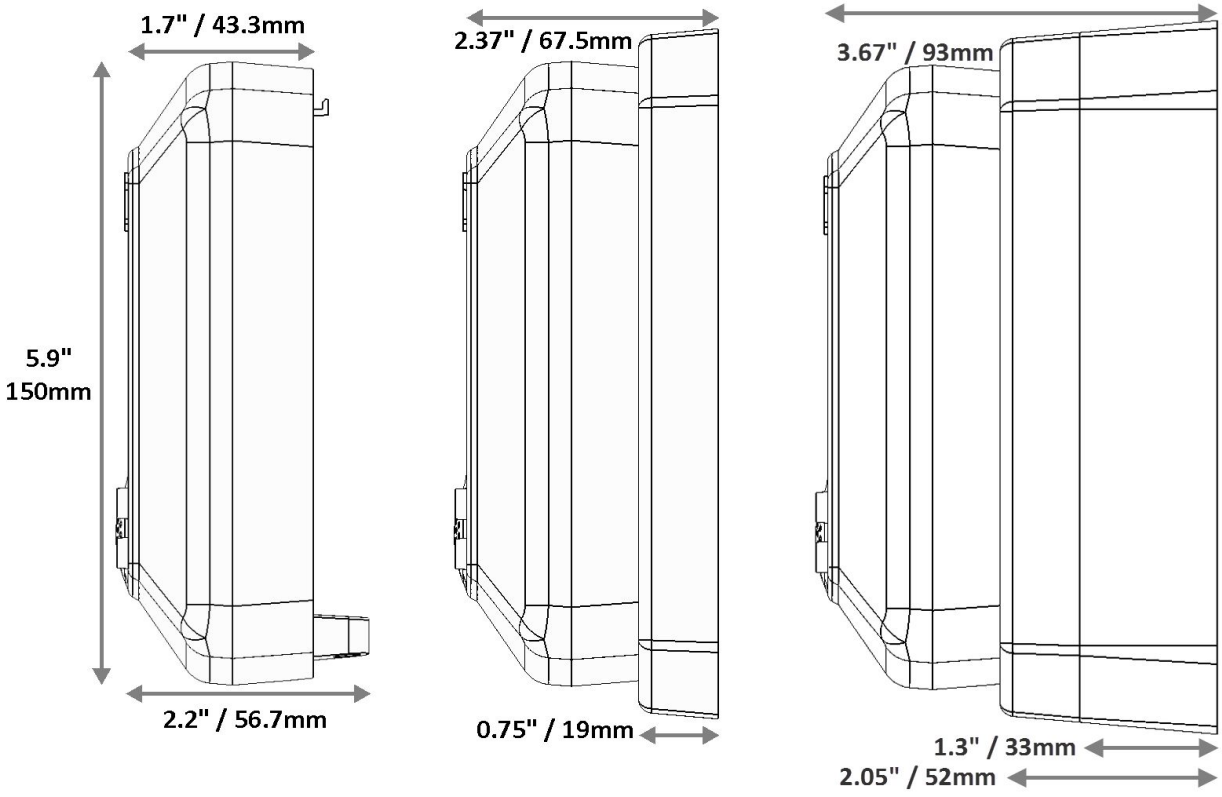


Appendix: Dimensional Drawings

Alert Beacon, front view (no mounting bracket)



Alert Beacon, side views



MSS Protocols for Construction

MSS requires the following standards be implemented by all architects, engineers, project managers, and installation personnel in areas containing audio visual systems where applicable. If an audio visual related requirement prevents one of the below standards from being implemented, is not applicable to an audio visual requirement, or if there are any questions regarding these requirements, please contact Drew Barker (804-628-1182) or the project's associated Media Support Services Project Manager.

Standards for Projectors and Screens

1. MSS AV Vendor will supply and install the projector mount and screen.
2. Electrical contractor to:
    a. Provide and Install all electrical hardware & accessories to provide 120v for:
        i. Flush mounted duplex outlet in the ceiling at the projector location
            1. (See Diagram 1).
        ii. An electrical box & switch above the ceiling and within 3' of the AV projection screen's Low Voltage Controller (LVC).
            1. (See Diagrams 2, 3).
            2. NOTE: LVC Provided by AV Contractor/MSS
            3. Screen cutoff switch CANNOT be mounted on a junction box
3. For spaces with projectors and screens, the ceiling height at the screen location requires a minimum of 4 feet + (1/5th the distance to the farthest person viewing).
4. For spaces with tiered seating, the ceiling height at the screen location requires, at minimum, a ceiling height 3 feet + (1/5th the distance to the farthest person viewing).
    a. Any height less than this could result in people in the back rows having difficulty reading small text due to reduced screen size.
5. Screens should be installed with the fabric 6 inches off the wall fully extended unless specified otherwise.
6. It is STRONGLY recommended that all ceilings in media areas be accessible drop tile.
7. All ceiling mounted devices such as screens, projectors, and cameras must have above-ceiling access by drop tiles or, at a minimum, large access doors at both ends of the screen for servicing.
8. All planned/existing fire and emergency systems need to be clear of proposed AV equipment locations.
9. Screen Power Cutoff Switch Installed at Location Identified During Site Survey
10. New Screen Wall Switch Installed at 48" to top, Near Lectern as Identified During Site Survey.
11. Secondary Safety System Installed on Screen Using Appropriate Gauge to Weight Aircraft Cable (MSS needs to specify exactly what we want/expect, ect.)

Appendix E – Media Support Standards

Displays

1. All 65” and larger wall mounted displays require wall backing (See Diagrams 4, 5, 6, 7). See MSS contact for specs, conduit, heights, etc.
2. Display locations, height and horizontal placement, should adhere to the appropriate diagram for pre/post construction (See Diagrams 4, 5, 6, 7) and be approved by the MSS project manager.
3. All planned/existing fire and emergency systems need to be clear of proposed Display locations.
4. AxisTV displays should be a minimum size of 32”.

Standards for Floor Boxes containing Media

1. Generally requires (2) to (4) 1.25" conduit going to behind rack location or stubbing out above accessible ceiling.
2. Floor boxes for podiums should be a minimum of 3’ 6” (A) away from side wall or any other obstruction and a minimum of 6’ 2” (B) from rear wall or any other obstruction. (See Diagram 8)
3. For concrete floors where there will be no connections in the floor but power and wiring will pass straight thru to the lectern use Wiremold floor box RFB4
4. For concrete floors where connections need to be made in the floor use Wiremold floor box RFB11
5. For wood floors where there will be no connections in the floor but power and wiring will pass thru straight to the lectern the floor, use Wiremold floor box RFB2
6. For wood floors where connections need to be made in the floor use Wiremold floor box RFB6
7. If a low capacity poke thru style floor box is desired that has the ability to make connections below the floor, use Wiremold Evolution Series floor box
8. As always, consult with your MSS PM before choosing the appropriate floor box/conduit as site conditions/functionality may dictate special needs.

Standards for Lighting & Shading

1. It is strongly suggested that in any room where there is projected media that the lighting fixtures be flush with the ceiling. NO PENDANT!
2. Lutron is the standard for low voltage lighting and shade control systems. The lighting shall be a stand-alone system provided by the electrical contractor unless specified otherwise. The electrical contractor shall also provide and install the Lutron low voltage RS-232 interface at the location designated by the MSS PM.
3. In multi-zone low voltage lighting control systems, it is recommended to have a simple on/off entry switch for the general seating area and independent control of zones/scenes through our AV control system.
4. To prevent the effect of sunlight on camera image and content projection, blackout shades are to be installed in spaces with excessive ambient light.

5. General zones for lighting shall include: “All Lights On”, “Lecture”, “Presentation”, “Movie”, and “All Lights Off”. The Lighting Contractor shall use the RFI process for any questions regarding lighting and shading zones/presets.
6. In general, lighting in classrooms is to provide 50 foot candles at desk height or 30".
7. Color temperature of the lamps should be at 3500k.

Podiums and Racks

1. Custom podiums and racks are provided by MSS unless specified otherwise.
2. Podiums require (2) dedicated 20a circuits, terminated into a quad outlet box.
3. Podiums should be at a strategic location as to view the screen and the audience. They should not be in the path of the projected image or audience view angles and not impede classroom traffic.
4. AV Rack locations require:
    a. (4) 1.25" conduits stubbing up into accessible ceiling.
    b. (2) dedicated 20a circuits, terminated into a quad outlet box, connected to the building’s technical ground at 16" AFF behind each rack.
    c. Average temperature in the rack room should be maintained at 68 degrees.
5. All AV equipment to be on the same electrical phase, including but not limited to podiums, racks, projectors, etc.

Room Schedulers

1. Install 2-Gang Metal Box at 3’8” at center.

Standards for Noise Intrusion

1. Spaces that are ≤ 20,000ft³ shall have a one hour A-weighted average maximum background noise level of 35dB.
2. Spaces that are >20,000ft³ shall have a one hour A-weighted average maximum background noise level of 40dB.
3. This shall be measured during normal business hours, under normal mechanical system operation.
4. Measurement shall be taken 3ft above the floor and no closer than 3ft from a wall, window, or fixed object.

General Items

1. All conduit shall have commercial grade pull string installed
2. It is strongly recommended that all buildings with integrated AV systems be equipped with lightning protection. Lightning can cause large scale equipment damage if not managed properly.

Reference Diagrams

Diagram 1 - Projector Power

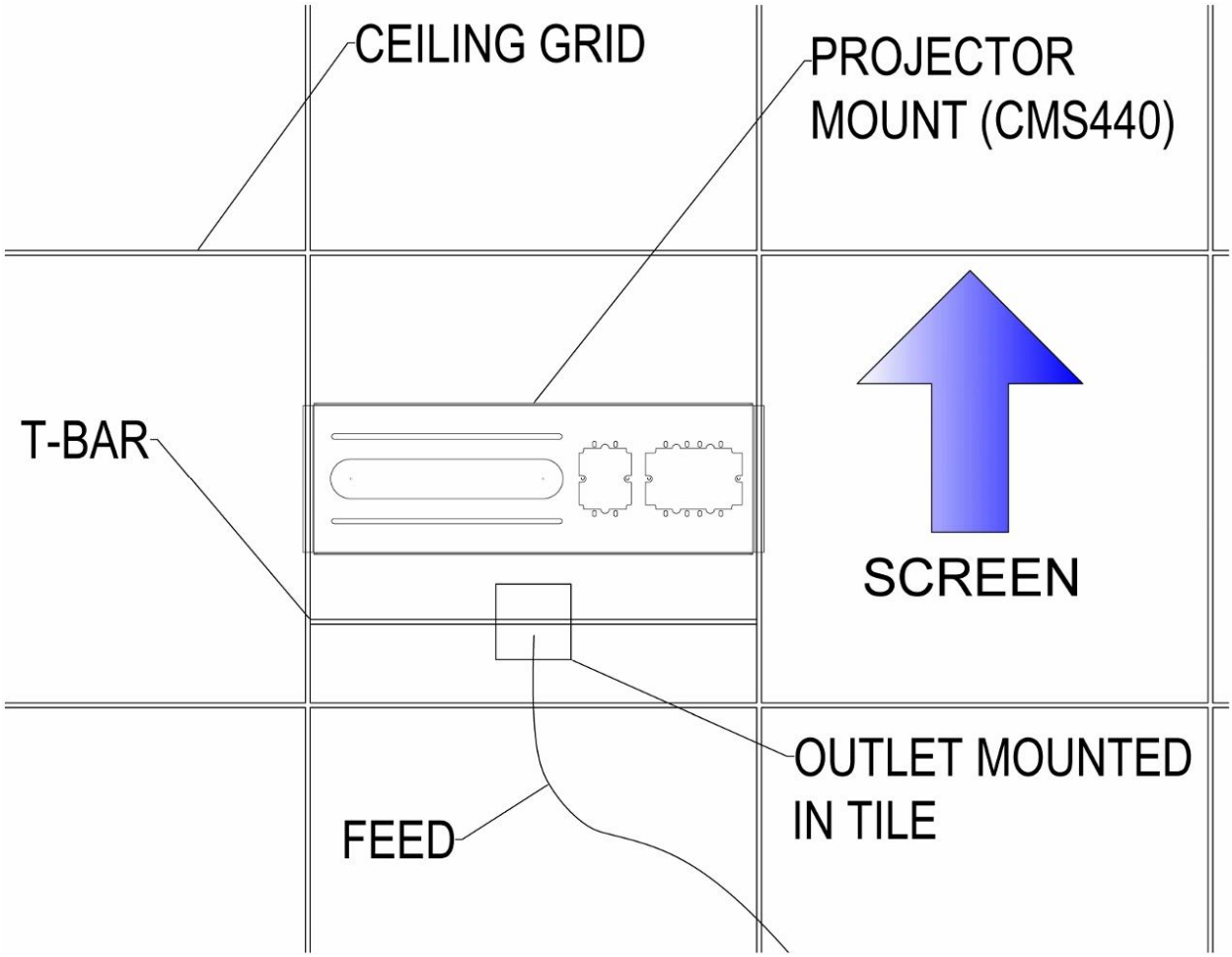


Diagram 2 - Screen Disconnect (Block Wall)

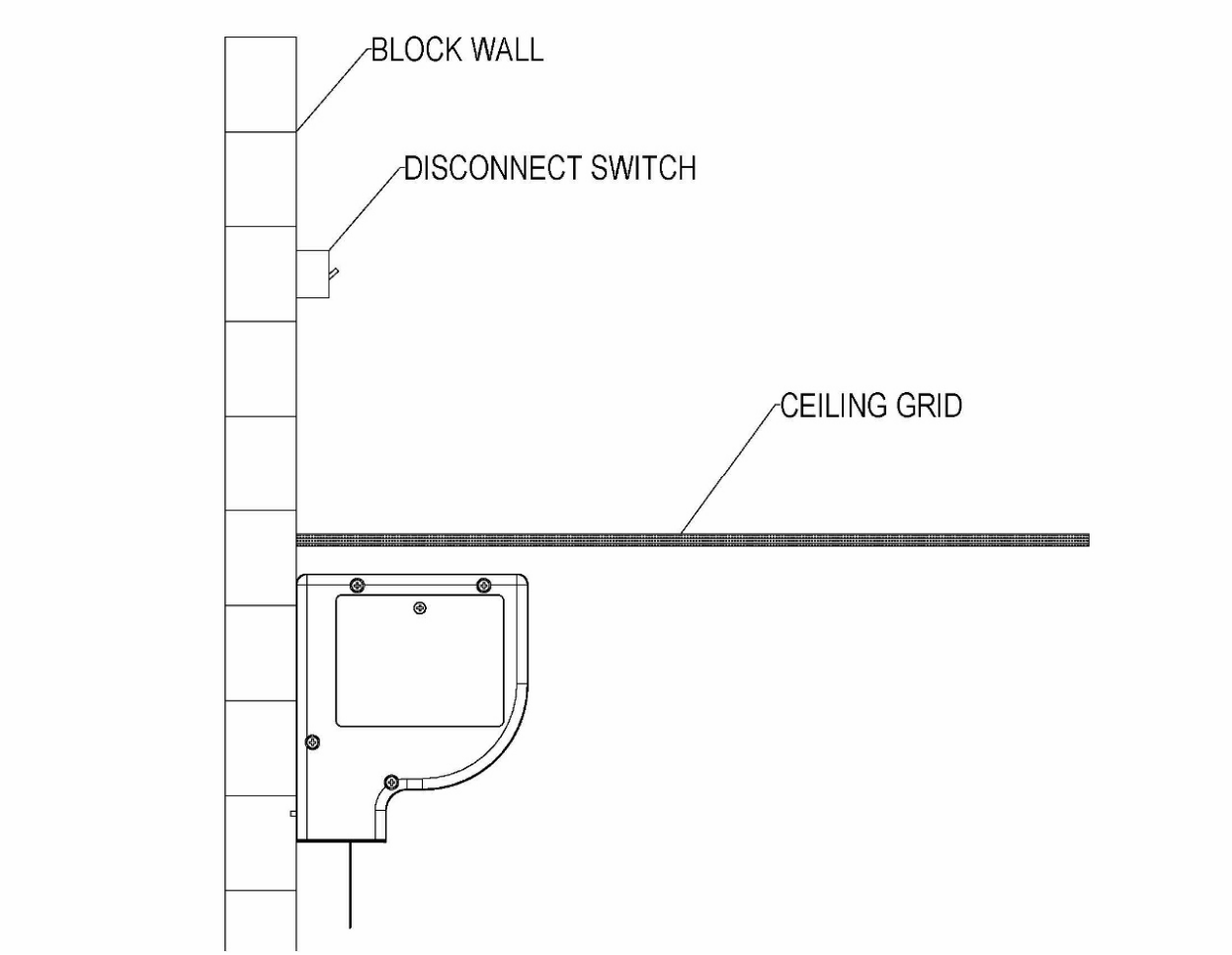


Diagram 3 - Screen Disconnect (Stud Wall)

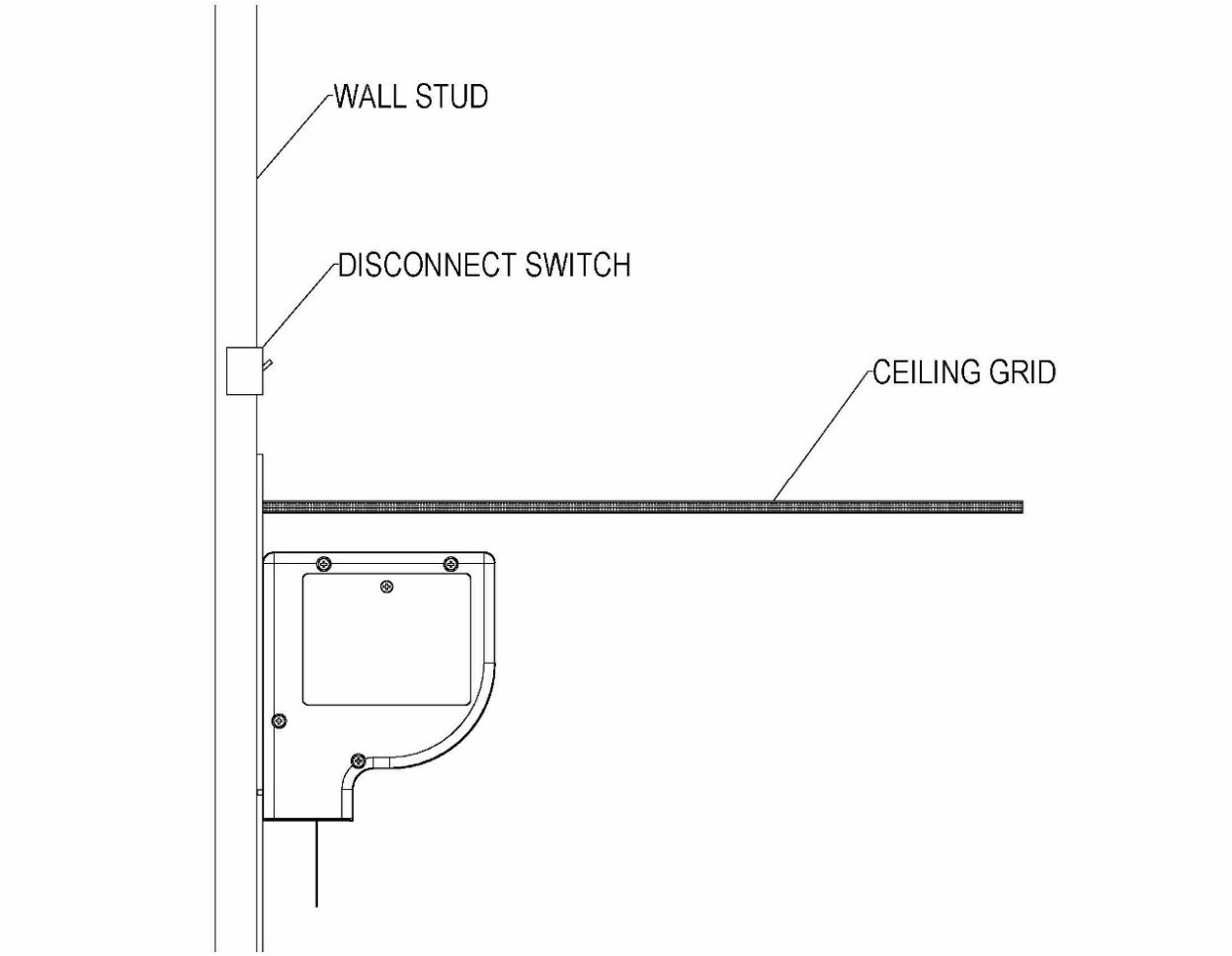


Diagram 4 - Display Backing (Pre Construction)

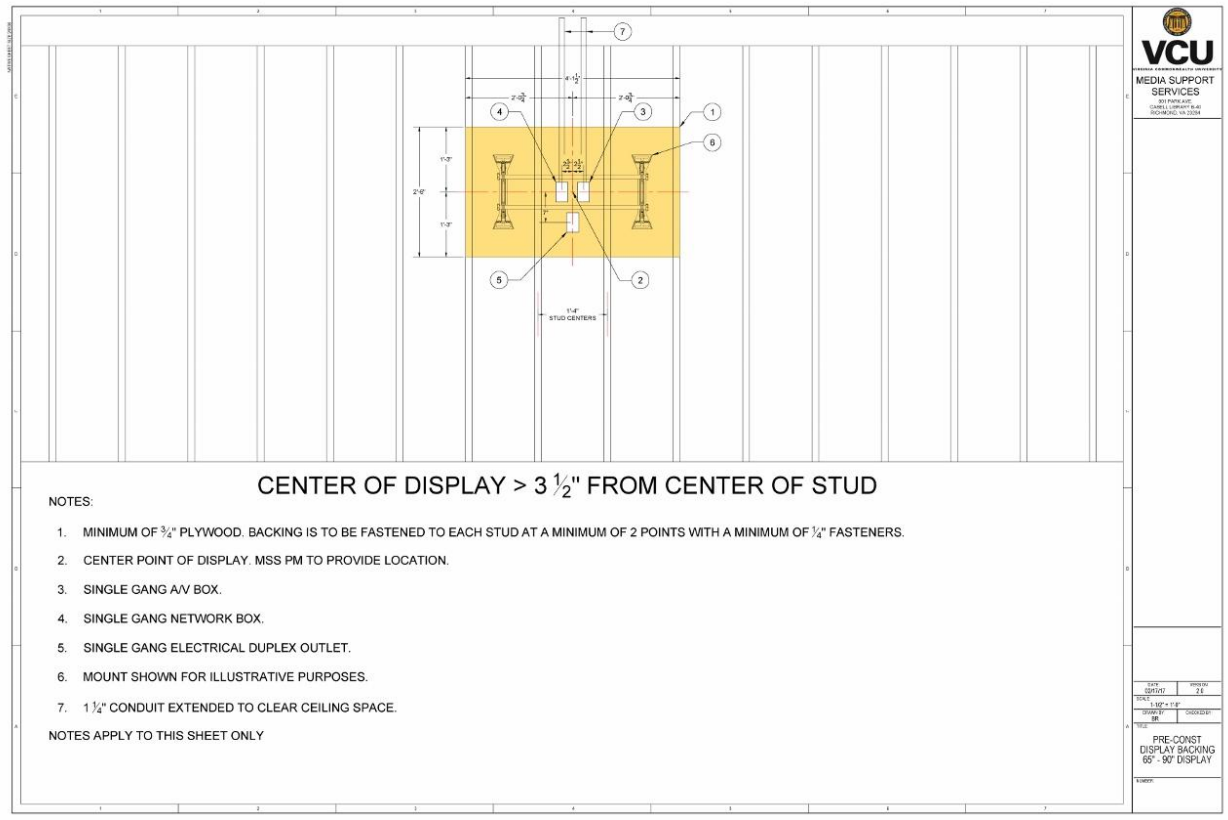


Diagram 5 - Display Backing (Pre Construction) Cont

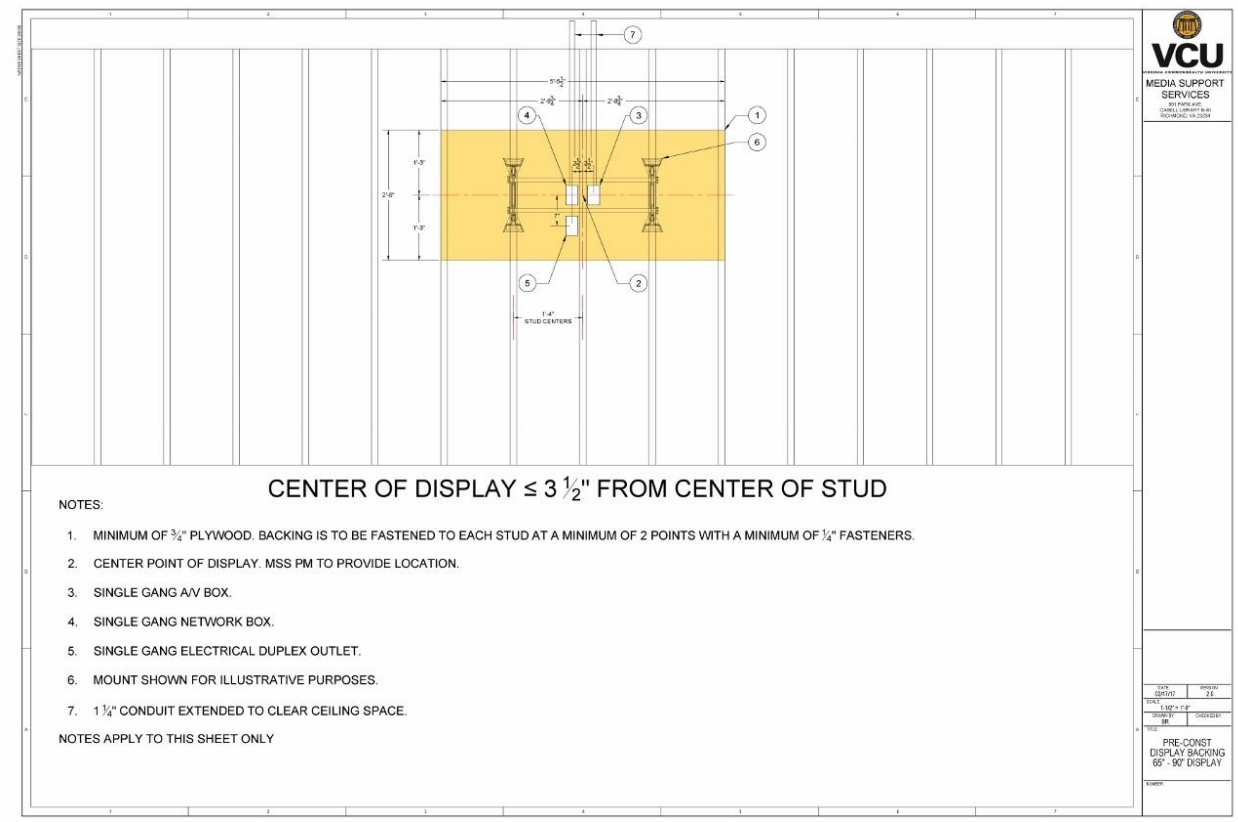


Diagram 6 - Display Backing (Post Construction)

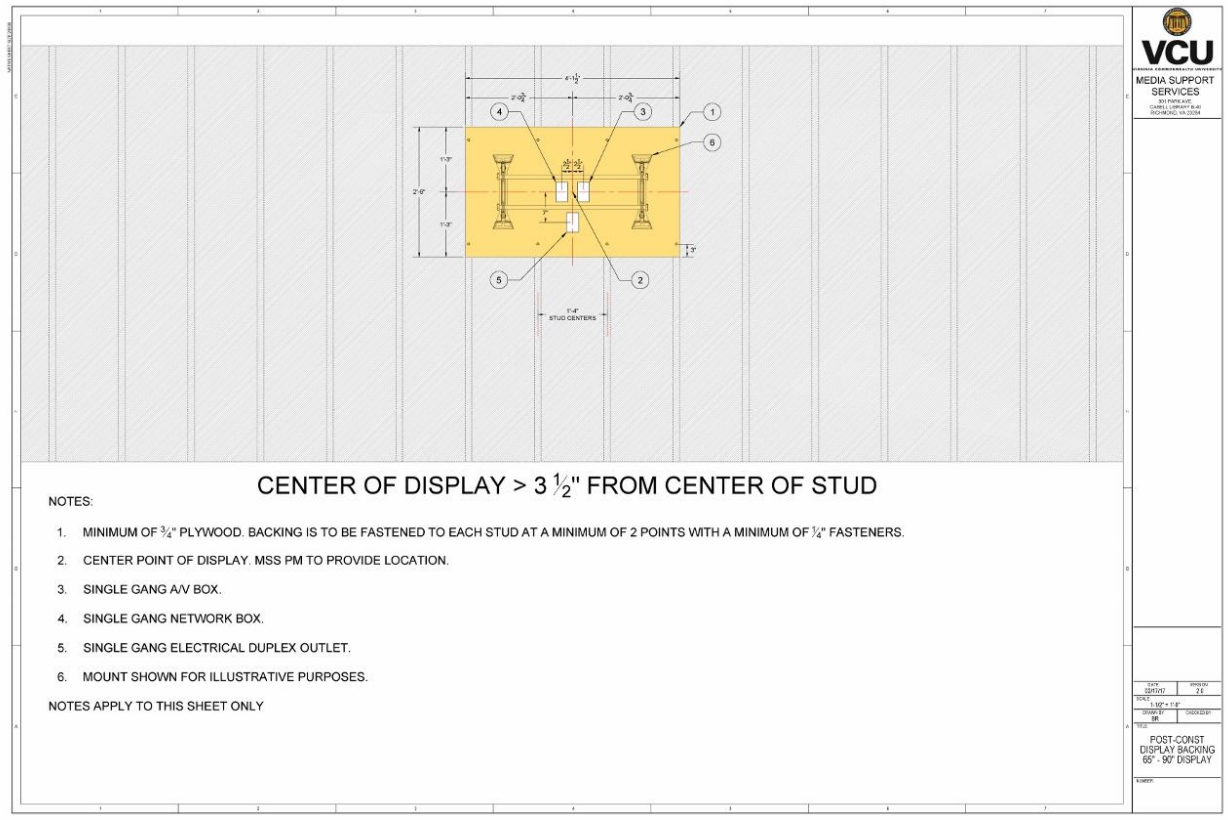


Diagram 7 - Display Backing (Post Construction) Cont

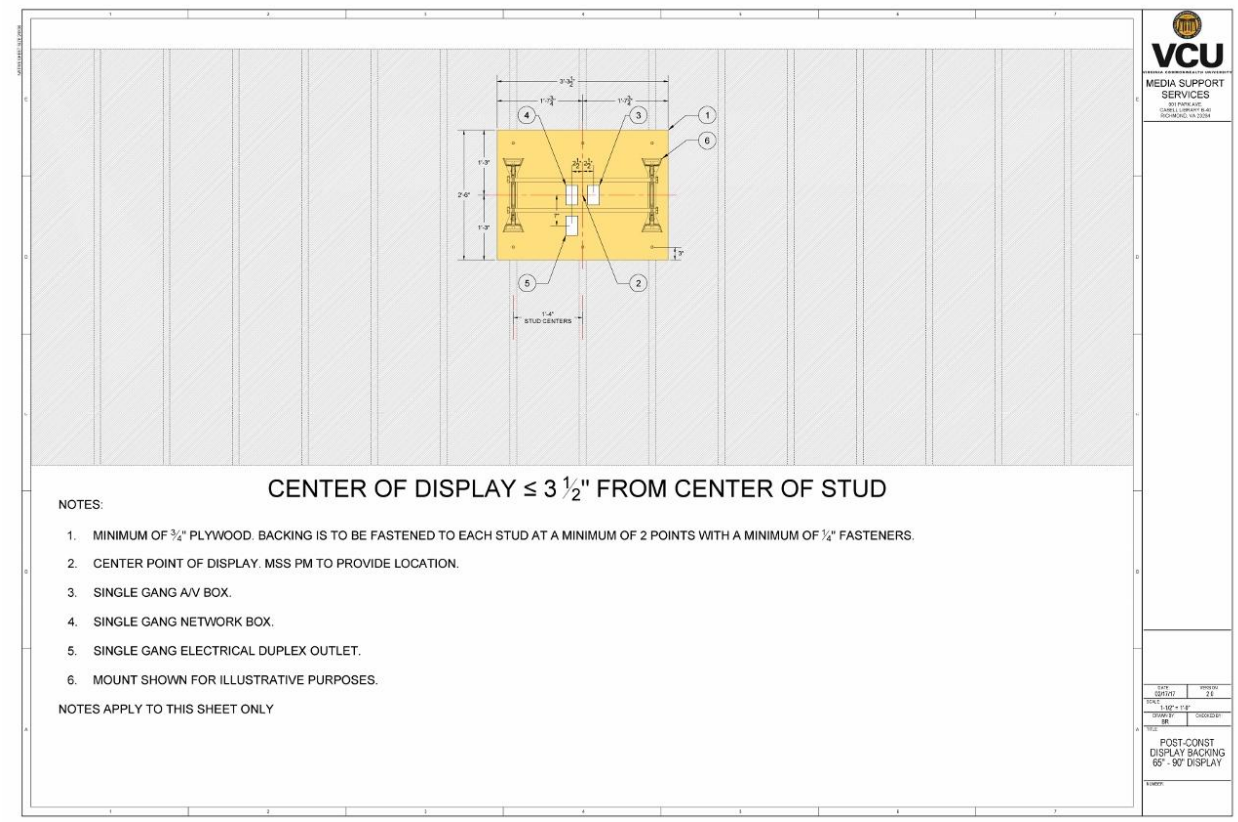
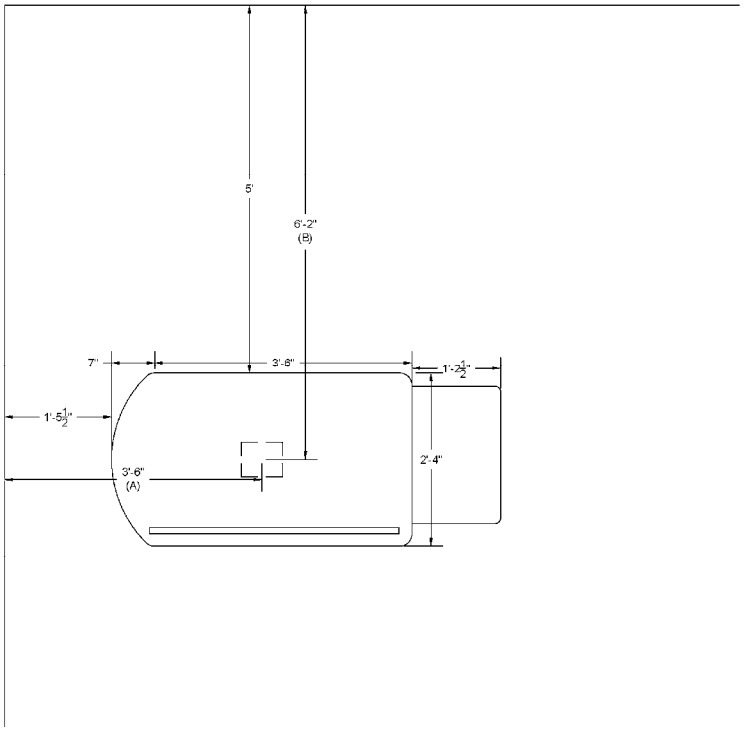
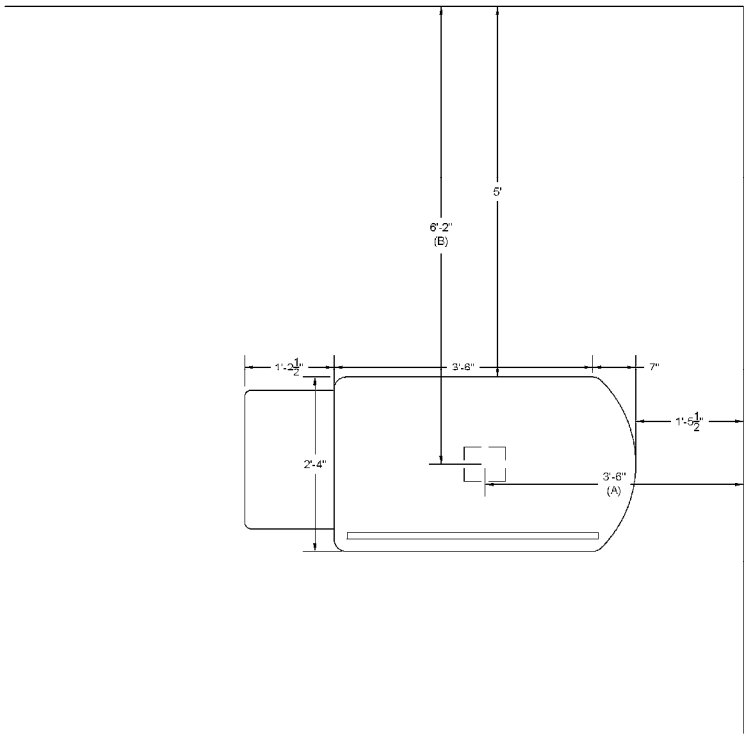


Diagram 8 - Floor Box for Podiums





Appendix F - Roof Inspection Forms & Procedures

1. The Roof Inspector

   The minimum qualifications below serve as criteria for the University if selecting an outside, full-time roofing inspector:

   A. The Inspector should have a thorough knowledge of roofing details, flashing, and systems employing single-ply, built-up, metal, shingle, slate, or other membranes as the main weatherproof barrier.

   B. The Inspector should have attended at least three formal schools / seminars (for example: AIA, BURSI, RCI, CSI, NRCA or RIEI seminars) providing no less than a total of four (4) continuing education units, have a registered roof observer registration from RCI (or a Quality Assurance Observer Certificate from RIEI for the roof system to be observed) or have equivalent training as approved by the University.

   C. He should be thoroughly familiar with the latest edition of the NRCA Roofing and Waterproofing Manual.

   D. The Inspector should have a minimum of five years of full-time, practical roofing experience or approved equivalent experience.

   E. He should identify, in writing, at least three projects where he has been the full-time roofing inspector. He should provide names, addresses, and telephone numbers of roof University's and Architects / Engineers for the roof projects.

   F. He should be trained and competent in the services he is providing.

   G. Roof Inspector's Scope of Work:

      (1) The Inspector shall monitor the work continuously during installation of the roof.

      (2) He shall monitor the work for compliance with the contract documents and the State's Roofing Policy of Chapter 7 of this Manual.

      (3) He shall immediately report any deviations from the contract documents, the University's Policy, or good roofing practice to the Architect and University. A written report shall follow an oral report.

      (4) The Inspector may recommend suspension of work or rejection of non-complying work to the A/E and University.

(5) He shall not:

(a) Allow roofing materials to be installed until the manufacturer's certification that the roofing materials comply with specified ASTM or other approved standards are received. He shall notify the University so that appropriate action can be taken.

(b) Authorize deviations from the contract documents.

(c) Enter the area of responsibility of the Contractor's superintendent.

(d) Issue orders on any aspect of construction means, methods, techniques, sequences, procedures, or safety in connection with the work.

(6) The Inspector shall keep a daily log (refer to the form at end of this appendix) for each project and shall give a copy of the log to the roofing contractor. The Inspector shall record all pertinent information such as weather, daily progress, workmen on the job, material storage, deck condition, bitumen temperature, installation procedures, quality of workmanship, job-related visitors, and so forth.

2. The Roof Consultant

The Consultant should have the following qualifications:

A. Roof consulting and testing services should be the Consultant's full-time occupation.

B. He should have a minimum of five years of field experience in providing the service.

C. He should have completed at least three service contracts in the recent past. Work for each of the completed contracts should be roughly equivalent in size and complexity to the proposed work.

D. He should be required to submit three complete surveys of roofs that were repaired, recovered, or replaced; names, addresses and telephone numbers of roof University's; and Architects or Engineers responsible for preparing the drawings and specifications.

E. He should have attended at least three formal roofing schools / seminars (RIEI, BURSI, RCI, NRCA, AIA, CSI Seminars, for example). The seminars should be the type that gives CEU (Continuing Education Unit) credits. A minimum total of four (4) CEU credits should have been received.

F. He should be trained, experienced and competent in performing required services.

G. If testing is required, he shall be appropriately trained, certified, licensed in the testing procedures (infrared, nuclear, electrical capacitance surveys; core sampling;

ASTM procedures; gravimetric analysis; and so forth) required for the service.

H. He should submit resumes of his firm and all employees participating in the service.

I. His resume should describe other related services and contributions, such as writing, lecturing, and serving as an expert witness that he has provided. He should list any professional qualifications or licenses.

J. The resume form must be submitted with the roof Consultant's response to the University's request for proposal. It will be used with other requested items to evaluate the applicant.

3. Non-Destructive (NDE) Roofing Surveys

A non-destructive (NDE) Survey uses infrared or nuclear and electric capacitance moisture detection equipment to locate unacceptable moisture within a roofing system. An infrared or nuclear survey may be used alone; electric capacitance is acceptable only if it issued with infrared or nuclear surveys.

An NDE survey is mandatory before a newly constructed roof may be accepted. Depending on the size and condition of an existing roof, a survey may or may not be required before an University may repair or replace the roof. The following outlines requirements for NDE surveys:

A. Equipment, subject to the University's approval, shall be equal to the following:

(1) Infrared: AGA 720 system or Inframetrics 520 system

(2) Nuclear: Seaman Troxler 3216 Roof Reader, Nuclear Model R-50 or later model

(3) Electrical Capacitance: As approved by the University

B. Surveys

(1) Infrared: Provide a complete survey of the roof or roofs. Outline all anomalies with spray paint. Provide a thermogram showing the outlines and daylight photographs of all anomalies. If video thermogram imaging is used, provide the University with the video tape of the survey. Roof markings, therogram, and photographs shall be numbered so that features can be readily identified and coordinated.

Walkover surveys shall be performed in a pattern of 20'-0" maximum (20 foot maximum distance between walk paths), however the distance between walk paths shall not exceed the sensitivity of the instrument being used. Instrument sensitivity shall permit recognition of areas of wet insulation as

small as 6 inches on a side. Surveys, inspection procedures, reports, etc. shall be conducted in accordance with the requirements and procedures in ASTM C1 153, "Standard Practice for the Location of Wet Insulation in Roofing Systems Using infrared Imaging", except of otherwise noted in this Appendix.

(2) Nuclear: Provide a grid, comprising 5'-0" on-a-side grid unit, to completely cover the roof or roofs. Mark each grid intersection with spray paint. Take readings at the inter-sections and record them on a roof plan. Provide daylight photographs of anomalies.

C. Core Samples

Since NDE surveys are not able to measure moisture in roofs directly – nuclear equipment responds to hydrogen emissions, infrared to heat changes – core samples to measure actual moisture content must be taken from surveyed roofs and correlated with NDE readings. The samples shall be taken as follows:

(1) One is required on roofs showing no anomalies. Additional cores are not required if the Consultant can show that moisture is not causing detected anomalies. The Consultant shall identify such anomalies and explain their cause in a written report to the University.

(2) On all other roofs a minimum of one dry and one wet core shall be taken from each roof surveyed.

(3) As many cores as needed should be taken to establish moisture counts and changes, but no more than five cores shall be taken from any roof.

D. Gravimetric Analysis

As soon as possible after samples are taken, cores should be sealed in air tight containers and taken to the laboratory for analysis.

(1) Analyze samples gravimetrically to determine percent of moisture in any required core sample taken from new roofs and, unless waived for justifiable reasons, from existing roofs.

(2) Identify all materials – surfacing, membrane (and number of plies), insulation, vapor barriers, adhesives, etc. – in the cores.

E. Moisture Conditions

The Surveyor shall correlate survey reading results with actual moisture conditions determined by core samples gravimetrically analyzed. The correlation shall be shown or tabulated on the drawings.

F. Report

The Consultant shall submit a written report explaining what the problems are, what to do about them, and what the costs are. Specifically, the report shall:

(1) Identify and describe all anomalies.

(2) Identify and describe any visual survey defects that may be harmful to the roof.

(3) Give the causes for each anomaly and defect.

(4) Recommend alternate courses of corrective action for defects and anomalies harmful to the roof.

(5) Provide the cost for correcting the defects and anomalies.

4. Drawings

The consultant hired to survey roofs shall provide plans complying with the following:

A. General Requirements are:

(1) Print size, preferably, should be 24" X 36"; but in no case larger than 36" X 46".

(2) Minimum drawing scale is 1/8" = 1'0" for roofs or portions of roofs surveyed.

(3) Provide one reproducible print (Mylar, etc.) and two non-reproducible prints, as a minimum, for each sheet of drawings.

(4) A legend defining all symbols and explaining abbreviations.

B. Drawings shall show the following as a minimum:

(1) All roofs surveyed

(2) State identification, title, and date

(3) An orientation north arrow and drawing scale

(4) The area of each roof and approximate overall dimensions.

(5) All existing features, equipment, and roof penetrations of whatever nature (such as vents, stacks, drains, hatches, skylights, screens, railings, mechanical equipment, etc.) shall be accurately indicated, identified, and drawn to scale.

(6) All roof slopes and valleys noted with drainage arrows. If there is no slope, state that the roof is dead level.

(7) Where flashing is carried to a vertical surface, identify the surface (roof vent, masonry parapet, etc.) and give its height from roof level.

(8) For a visual survey, show and explain all roofing defects and anomalies. Show interior damage (to the roof system) by dotted line.

(9) For an infrared survey, accurately delineate moisture anomalies with contour lines; for a nuclear survey, show all grid point readings and define areas having unacceptable moisture by contour lines. Show where core samples were taken. Correlate nuclear grid point readings and infrared contour changes to percent of moisture. Dimension areas recommended for removal and locate them with respect to fixed identifiable features (such as parapets).

(10) Provide at least one detail section (3/4" = 1'0" minimum) showing roof construction where core samples were taken; more if there are differences in construction from core to core. Identify surfacing material, membrane product, insulation type and thickness, vapor barrier if used, and deck construction.

ROOFING FORMS

Standard DGS forms and formats are available for download from the DGS Forms Center (http://forms.dgs.state.va.us).

For a listing of current DGS forms applicable to the design and construction process, download Form DGS-30-000 (Capital Outlay Management Forms Available for Download from the DGS Forms Center).

The following roofing forms are available for download from the Forms Center:

Form Number	Description	File Type
DGS-30-328	Roofing – Installation History	Word
DGS-30-332	Roofing – Built-up Roofing Data	Word
DGS-30-336	Roofing – Metal Roofing Data	Word
DGS-30-340	Roofing – Shingle Roofing Data	Word
DGS-30-344	Roofing – Single Ply Roofing Data	Word
DGS-30-348	Roofing – Inspection Checklist	Word
DGS-30-352	Roofing – Daily Inspection Log	Word
DGS-30-356	Roofing Consultant / Inspector Resume	Word

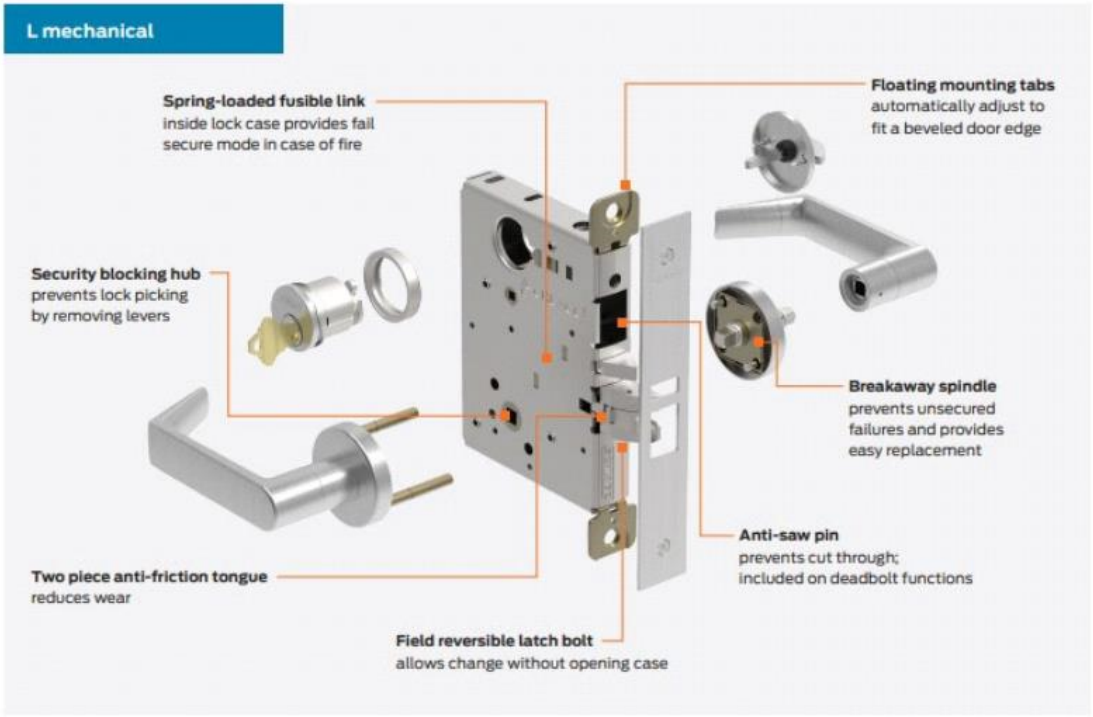
To view / download the latest version of a form, visit the website listed above and enter the Form Number (e.g., "DGS-30-328") in the search box on the Forms Center.

Additional instructions for viewing and downloading forms are available in the Help Guide on the DGS Forms Center.

Appendix G – Hardware Standards

Standard finish for door hardware will be BHMA 626 or equivalent.

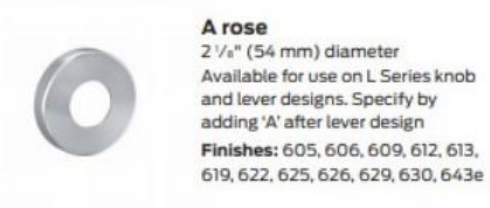
Unless an exit device is being used all new doors should come prepped for a Schlage L Series mortise lock.



With 06 trim



and A rose



Use this Design

06
Material: Forged brass, bronze and cast stainless steel



Roses

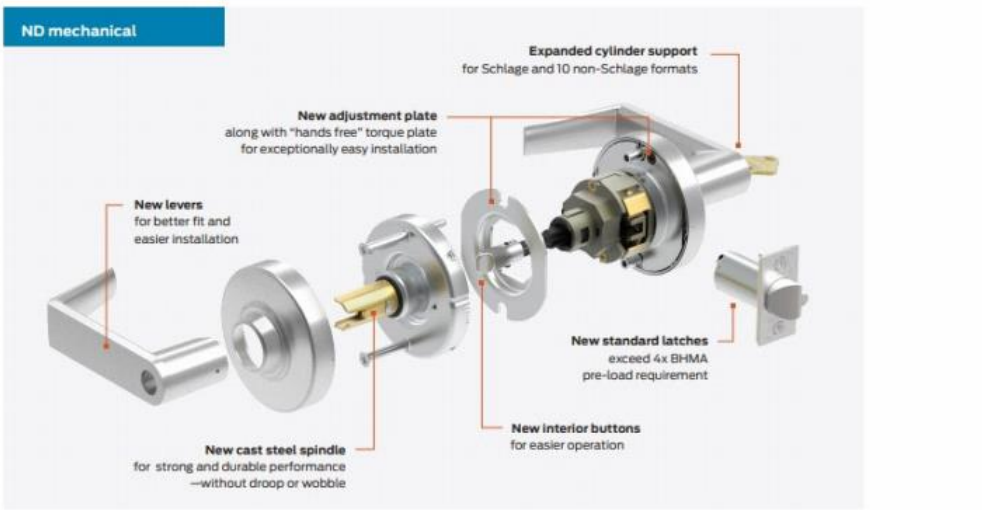


A Wrought Rose
2 1/8" (54 mm) diameter
Available for use on L-Series knob and lever designs.
Order by letter designation corresponding to the design and diameter desired.
Finishes: 605, 606, 609, 612, 613, 619, 625, 626, 629, 630, 643e

Appendix G – Hardware Standards

New doors should come prepped for mortise locks. Cylindrical locks should only be used to replace existing cylindrical locks.

If cylindrical locks are used then they need to be Schlage ND Series



Rhoades design



Standard finish should be BHMA 626

Appendix G – Hardware Standards

Exit devices should come Less Dogging. If there is a need for dogging then Cylinder Dogging must be used.

Consult with VCU Lockshop. Hex key dogging should never be used.

Cylinder dogging (CD)



Cylinder dogging is available on all 98/99 Panic exit devices to replace the standard hex key dogging. Unit requires a standard 1⅛" (32mm) mortise cylinder with an inverted straight cam. When ordering, reference Schlage cylinder 20-001, 1⅛", XQ11-949. This provides the L583-477 cam inverted at the factory.

To order, specify: Use prefix, CD, example CD99L

Less dogging (LD)

Less dogging is available in all 98/99 Panic exit devices to remove the dogging option.

To order, specify: Use prefix LD, example LD99L

All locks with key functions need to come prepped for Schlage Full Size Interchangeable Core (FSIC)



Full size (FSIC)

Mortise and Rim housings need to be provided for the appropriate hardware. Schlage cylindrical locks will need to come prepped for FSIC.

Appendix G – Hardware Standards

Exit Devices

Von Duprin 99 Rim mount is standard.

Fire rated as needed



with no trim for exit only doors

otherwise Von Duprin 996L Trim



LCN 4040 XP is the standard door closer

4040XP Series



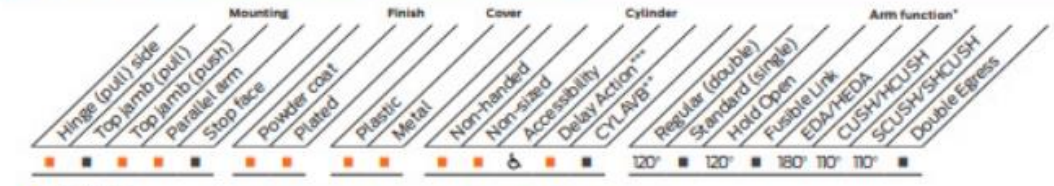
The 4040XP is LCN's most durable and flexible heavy duty closer designed for institutional and other demanding high traffic applications.

Features

Certifications	Grade 1 - ANSI A156.4, UL 10C, ADA, 100 hour salt spray, meets BAA - Buy American Act
Body construction	• Cast iron body • Full complement bearing • 1 ½" diameter piston • Double heat treated pinion journal
Fluid	All weather liquid X fluid
Handing	Non-handed
Templating	Peel-n-Stick templates - 2 ¾" x 5" mounting hole pattern
Size	Adjustable spring size 1-6, includes patented green dial
Warranty	30 years

Cover	• Plastic Cover (PC), standard • Metal Cover (MC), optional
Fasteners	Self reaming and tapping screws (SRT)
Mounting	Hinge (pull side), top jamb (push side), parallel arm (push side)
Arms	Regular arm
Finishes/colors/ powder coat	• 689 Aluminum • 690 Statuary bronze • 691 Light bronze • 693 Black • 695 Dark bronze • 696 Brass • Custom colors optional
	• Optional SRI primer - powder coat only • Optional plated finishes

Special templates	Customized installation templates or products may be available to solve non-standard applications. Contact LCN Product Support for assistance.



■ Available
■ Not available

♿ Closer available with less than 5.0 lbs. opening force on 36" door.
* Maximum opening/hold open point with standard template.
** Advanced Variable Back Check.
*** Delay feature incorporates standard 4040 cylinder (not XP).

Appendix G – Hardware Standards

Gender Neutral Restrooms:

For single use gender neutral restrooms with an auto operator:

- Light shall be lit when occupied.
- Button on the outside, push to lock, push to open.
- Locked when lit.
- Face plates may be supplied by the owner.
- When the power goes out, the lock shall open.

When an auto operator is not present, use a thumb turn mechanical occupied/vacant indicator.