

# Facility Design Manual

Appalachian State University







This Facility Design Manual was prepared for  
**Appalachian State University**  
**Office of Design & Construction**

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Stanford University Design Guidelines  
North Carolina State University Construction Guidelines  
North Carolina Department of Administration, State Construction Manual  
University of North Carolina at Charlotte Design and Construction Manual  
University of South Carolina Sustainable Design Guidelines  
US DOE & US Green Building Council (USGBC) Sustainable Building Technical Manual

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# POLICIES & PROCEDURES

1



## PP 1.1 | ADMINISTRATION

This section outlines the administration requirements which are unique to capital projects at Appalachian State University. These requirements supplement the most current addition of the State Construction Manual required by the North Carolina Department of Administration, State Construction Office.

### Procedures

#### 1.1.1 Designer's Relationship with the University

The Designer should understand that the University is the Owner and Client for the project, even though project planning and design for the University is a cooperative procedure involving many persons within the University, the State Construction Office (SCO) and other reviewing agencies.

The planning procedures related to design an construction of capital improvement projects are outlined in Chapter 200 of the State Construction Manual. For projects under \$2,000,000, the UNC Board of Governors has the authority to perform the duties and responsibilities of the Department of Administration and the Director of the State Construction Office.

#### 1.1.2 Contact With The University

The Director of Design & Construction is the primary contact for all correspondence and transfer of information during the initial design phases. After award of the construction contract, the point of contact is transferred to the University's Project Manager for the duration of the construction process and final closeout. All documents and correspondence from the Designer shall included the State Construction Office ID number.

#### 1.1.3 Design Contracts

Design Contracts or Letters of Agreement will be issued in accordance with the provisions set forth in Chapter 100 of the State Construction Manual and shall be coordinated with the Director of Design & Construction with the University.

#### 1.1.4 Project Delivery Schedule

The Designer shall prepare and submit a proposed Project Delivery Schedule to the University's Office of the Director of Design & Construction for approval. This schedule shall be submitted within twenty-one (21) calendar days of the date of the design contract, and it shall incorporate the end-of-phase milestone dates stipulated in the design contract. In addition, this schedule shall include:

1. The start dates and durations of each major phase of design:

Programming, Schematic Design, Design Development, Construction Documents and Bidding.

2. The durations and completion dates of each design review period required to maintain the project. For typical projects the normal review time for design submittals is approximately two (2) weeks and four (4) weeks for Construction Document reviews.
3. The projected durations and completions dates of other project-related activities, such as funding decisions, surveys, sub-surface investigations, and all regulatory including zoning approvals.
4. The estimated durations of the construction contract award process and the construction period.

The Project Development Schedule shall be up-dated and re-submitted with each end-of-phase submittal described in Section PP 13-Design Phases.

#### 1.1.5 Site & Existing Conditions Information

The University will, upon request, furnish available topographic surveys and other existing information for new construction or renovations, as well as, furnishing available record drawings for remodeling projects. The University does not in any way warrant that this information is accurate or correct. Verification shall be the responsibility of the Designer. The Designer shall supplement this information with field surveys and measurements. The Designer is responsible for the accuracy of all information shown on the construction contract drawings.





## PP 1.2 | PROJECT REVIEWS

This section outlines the review procedure requirements which are unique to capital projects at Appalachian State University. These requirements supplement the most current addition of the North Carolina State Construction Manual required by the North Carolina Department of Administration, State Construction Office.

### Procedures

#### 1.2.1 Initial Planning Conference

An initial planning conference will be scheduled by the Department of Business Affairs to include representatives of the using office or agency and other appropriate participants on the Architectural Program Development Committee to discuss general requirements of the program and procedures for facilitating the Designer's work. This conference will be held as soon as possible after selection of a Designer for the project. It is recommended the Designer's professional consultants for plumbing, HVAC, electrical and telecommunications design may attend this conference.

#### 1.2.2 Design Reviews

The Designer is required to make submittal and presentations, and to participate in review conferences at various stages of the project design process. It is recommended to the Designer, that the number of reviews required for the project be determined prior to executing a form of agreement.

The Designer will be expected to record the content of all conferences and, within seven days, to provide a memorandum containing a complete summary of the decisions and actions which affect the project. This memorandum will be submitted to the Director of Design & Construction who will distribute copies to all attendees.

Presentation and Review Conferences: During the design process, the Designer will be expected to make presentations to various groups who must review and approve the proposed project designs. These groups include the using department, various members of the Department of Business Affairs, the Board of Trustees and General Administration. All conferences and presentations will be scheduled by or with the approval of the Office of Design & Construction.

Schematic Design Conference: Normally several conferences precede the approval of the architectural program and sub-sequentially the Schematic Design documents. Conferences may be required to clarify the program of requirements, to review and discuss the Designer's design proposals, to discuss the Designer's evaluation of the achieve-ability of the program requirements within budget constraints, and to assist in the definition of

alternates which will become an important component of the Construction Documents.

**Presentations to the University Administration & Board of Trustees:** The Designer will be expected to make presentations of the project design to appropriate ASU Departments and to the Board of Trustees as necessary. The following exhibits are typically required for these presentations: floor plans, exterior elevations and renderings as necessary to communicate the extent of design. When required, these presentations may be scheduled to occur as early as possible in the Design Development Phase of the project.

**End-of-Phase Reviews:** At least one conference each will be devoted to the end-of-phase review of the Design Development and Construction Documents, and will be for the purpose of discussing any areas of concern that arise during the review process. The Designer and the Designer's primary consultants will be expected to attend these review conferences. It should be noted that the University reviews projects to insure that they are developed in conformance with its criteria and that they will be suitable for University purposes, but does not provide a checking or quality control service for the Designer.

### 1.2.3 Agency Reviews

The Designer will be responsible for the preparation and submittal of all local, state and federal agency review and approvals required for the project scope of work. See Chapter 200 of the State Construction Manual for additional information. The Designer will work with the Office of Design & Construction to coordinate each submittal to the governing organization which may include the following:

- Watauga County and the Town of Boone
- North Carolina Department of Administration (NCDOA)
- State Construction Office (SCO)
- North Carolina Department of Insurance (NCDOI)
- North Carolina Department of Labor (NCDL)
- North Carolina Department of Health & Human Resources (NCDHHR)
- State Historic Preservation Office (SHPO)
- North Carolina Department of Environmental Health & Natural Resources (NCDEHNR)
- North Carolina Department of Transportation (NCDOT)

### 1.2.4 University Reviews

In addition to the various State and local agencies reviews required for the project, design submittals may also be reviewed by various departments (user groups) within the University. The Office of Design & Construction will coordinate the End-of-Phase Reviews outlined in item 1.2.2. The Designer shall not proceed to the next phase before receiving written approval of the previous phase from the Director of Design and Construction.





## PP 1.3 | DESIGN PHASES

This section outlines the design phase requirements which are unique to capital projects at Appalachian State University. These requirements supplement the most current addition of the State Construction Manual required by the North Carolina Department of Administration, State Construction Office.

The Guidelines are developed based on two project types which include:

1. Design Phases for projects over \$2,000,000
2. Design Phases for projects under \$2,000,000

### Procedures (over \$2 million)

#### 1.3.1 General - Projects Over \$2 million

The Designer shall comply with Chapter 300 of the State Construction Manual regarding design phases and submittal requirements. The design phases outlined below describe supplementary requirements of the University for a “typical” project process.

#### 1.3.2 Programming / Advance Planning

The Designer shall facilitate an integrated design approach utilizing the designated representatives of the University and user group(s) to establish the design criteria for the project. The Designer shall define the program, space needs, site considerations and project budget in this phase.

The Designer shall comply with the University’s standards for space planning and furniture.

Programming/Advance Planning Submittals: At completion of this phase of the project the Designer will summarize all programmatic and advance planning criteria in written format to include:

- Project Budget
- Site Analysis
- Sustainable Design Criteria
- Detailed Space Program
- Code Summary
- Project Delivery Schedule
- Special Requirements

#### 1.3.3 Schematic Design

At the beginning of the Schematic Design Phase, the Designer shall finalize the program, budget and project scope with the designated user group(s) and the University’s Project Manager. A written summary shall be provided to the Office of Design & Construction.

Based on an approved summary of the project requirements, the Designer shall prepare a Schematic Design package illustrating the recommended

implementation of the program and project requirements.

The Designer is expected to involve the Director of Design & Construction, the using department (user group) and appropriate members of the University during the development of the schematic design. A number of studies may be required to satisfactorily explore the range of alternatives possible.

Schematic Design Submittals: In addition to those copies required by the various state agencies, the Schematic Design Phase Submittal to the University shall consist of one (1) hardcopy and one (1) electronic copy of the following documents:

1. A general description of the project indicating the construction materials, framing systems, and mechanical, electrical and plumbing systems.
2. A site plan showing the size of the facility, adjacent buildings, generalized topography, roads, walks, and utility service
3. Floor plans for all floor levels including mechanical, electrical, and telephone rooms and service areas. Identify each room or space by functional name.
4. A tabulation of floor areas and volume of floor area
5. A statement of probable construction cost. (Estimates shall include separate items for site work, utility extensions, and other items outside the structure.) Show estimated cost per square foot and per cubic foot. Indicate new construction costs, remodeling costs, including major and minor areas of remodeling, with approximate areas.
6. An updated Project Delivery Schedule.
7. Sustainable Design Criteria

#### 1.3.4 Design Development

Prior to proceeding to the Design Development Phase, the Designer shall obtain written approval from the Office of Design & Construction and SCO on the Schematic Design submittal. The Designer shall prepare the Design Development documents which set forth in detail all of the basic elements, systems, and materials to be used in the project.

During the Design Development process, the Designer is expected to involve the Director of Design & Construction, and through his representative, the using department and appropriate members of the University. A number of studies may be required to satisfactorily explore the range of alternatives possible; for example, two or more structural, electrical and mechanical systems that are feasible for the project shall be evaluated, and the Designer shall select the systems that are best suited to the project.

Design Development Submittals: The Design Development Phase





Submittal to the University shall consist of one (1) hardcopy and one (1) electronic copy of the following documents. Additional sets shall be submitted to the SCO and to the regulatory agencies having appropriate jurisdiction.

1. Site drawing(s) showing adjacent buildings, significant existing features, proposed limits of construction, proposed site improvements, existing and proposed contours, horizontal and vertical control points, general elements of drainage and sedimentation control, utility requirements, and other site data furnished on the previous submittal.
2. Scaled architectural plans of all floor levels. Identify each room or space by name and number.
3. Elevation drawings of every exterior side of each structure showing materials, features, openings, floor and roof lines, grade lines, footings, and everything exposed to view above eaves or parapets.
4. Section(s) through the entire building, selected to best show the relationships of architectural and engineering features.
5. A room finish schedule showing the type of material to be used for floors, walls and ceilings.
6. Equipment and furniture layouts for all rooms, when crucial in indicating the adequacy of the arrangement and configuration of such rooms.
7. The structural system design , including boring logs from the subsurface investigation report; the allowable soil bearing pressure; a foundation plan showing the basic elements of the foundation system; typical floor framing plan showing size, spacing, and type of principal members; a roof framing plan; and the locations of shear walls and/ or bracing with such additional information as may be necessary to describe the method of lateral load resistance. Structural drawings shall show the design floor loadings of all areas.
8. The plumbing design, showing the general development of the plumbing system, including source of supply and disposal of waste.
9. The mechanical design, showing the basic layout and location of HVAC equipment, piping, and duct-work; a schematic of the temperature control systems; diagrams of air, hot water, and/or steam systems, chilled water and condenser water systems; and major design calculations.
10. The electrical system design, showing an analysis of loads and the major design calculations; the basic fixtures and equipment; and location of the electrical power distribution components including primary service circuits, transformers, main switch-gear, motor control centers, power and branch circuits panels, lighting , and switching patterns.
11. Single line drawings showing the basic elements of the fire alarm, smoke/heat detection, Telecommunications (telephone and data),

Campus closed circuit TV, emergency lighting, paging, or other systems in the project.

12. An outline specification, indicating materials, types of construction, and equipment to be used. Include a description of each plumbing, HVAC, fire protection, telecommunications, and electrical system design concept. Include elevator characteristics, and include the names of proposed manufacturers of HVAC, plumbing, fire protection, special systems, data, electrical equipment, and fixed equipment.
13. The reports of the required Life Cycle Cost & Energy Consumption analysis.
14. The maximum steam and hot water demand, for the purpose of determining whether the existing steam systems will be adequate to meet anticipated demand or whether modifications to these systems will be required.
15. A tabulation of building data, including square feet of floor area, cubic content, roof deck "U" factor, heating load in BTUH, air conditioning in tons, plumbing load in drainage fixture units, water demand in peak GPM, electrical loads in KVA, the design live loads, and number of occupants.
16. A statement of probable construction cost using, as a minimum, the requirements expressed in appropriate units such as area, volume, linear feet, tons, BTUH, KW requirements, etc., taking into consideration the actual systems and materials proposed in the submittal. Site work, utility services, and other items outside of the structure shall be shown as separate items. A complete tabulation showing the breakdown of appropriated and/or authorized funds shall be included.
17. Updated Project Delivery Schedule
18. Updated Sustainable Design Criteria

### 1.3.5 Construction Documents

Prior to proceeding to the Construction Document Phase, the Designer shall obtain written approval from the Office of Design & Construction and SCO.

Based upon the approved Design Development submittal, the Designer shall prepare the Construction Documents and other materials required for the receipt of competitive bids on the project. These documents shall be prepared in compliance with the requirements outlined in the State Construction Manual.

The University fully supports and encourages minority business participation in projects on the campus, and the Designer should make sure that the latest guidelines from the SCO are followed during the preparation of the documents for bidding.





Construction Document Submittals: The Construction Document Submittal to the University shall consist of one (1) hardcopy and one (1) electronic copy of the following documents. Additional sets shall be submitted to the SCO and to the regulatory agencies having appropriate jurisdiction.

1. Drawings and specifications as outlined in the State Construction Manual.
2. The cover sheet of the construction drawings shall include the following summary:
  - Floor area (square feet) tabulation
  - Volume of floor area (cubic square feet) tabulation
  - Roof system “U” factor
  - Maximum steam demand tabulation
  - Heating load in BTUH
  - Air conditioning in tons
  - Plumbing load in drainage fixture units
  - Water demand in peak GPM
  - Electrical loads in KVA
  - Structural design live loads
  - Occupancy load summary
3. Where interior or exterior colors, materials, or finishes are specified, a “color board” (one copy only) shall be provided accurately depicting the materials, colors, and finishes to be used on the project and indicating their location within the project.
4. A list of “Owner Preferred Alternates” should be clearly defined in the submittal
5. Updated Project Delivery Schedule.
6. Provide one set of AutoCAD files and 11” x 17” drawings to the Physical Plant Director showing the architectural floor plan(s) with final approved room numbers as they will appear at the entrance of each space.
7. Provide one set of AutoCAD files showing the site plan, exterior elevations and roof plan. This drawing information will be used to update the Campus Map and for planning purposes.

After the initial submittal of completed Construction Document, the Designer shall revise the Construction Documents in accordance with the review comments. The Designer shall prepare a written response to the University’s comments and submit to the Director of Design & Construction within three (3) weeks of receipt of the review comments.

## Procedures (under \$2 million)

### 1.3.6 General - Projects Under \$2 million

The Designer shall comply with Chapter 300 of the North Carolina State Construction Manual regarding design phases and submittal requirements. The items outlined below describe supplementary requirements of the University for a process based on the anticipated project cost being less than \$2 million. These items may vary per project.

### 1.3.7 Programming

The criteria outlined in item 1.3.2 of this manual are applicable. If necessary, a review by the Office of Design & Construction will be performed to assure that the user's needs are being met for the project.

### 1.3.8 Design

The University will work with the Designer to consistently seek ways in which to improve the design/review process for projects less than \$2,000,000.

The Designer is responsible for obtaining review comments and agency approvals in accordance with the State Construction Manual.

The Office of Design & Construction will review plans and specifications for usability, maintenance, and compatibility with existing conditions. The University is not expected to perform a complete technical review. The Designer will be expected to produce a technically accurate set of plans and specifications that shall be bid without alteration by the University.

Design Submittals: At the beginning of the Design Phase, the Designer will meet with the Director of Design & Construction to establish an aggressive project delivery schedule and confirm which user group(s) will be involved in the project. Primary contacts shall be established to insure the Designer receives the necessary information and approvals in a timely manner. Review times by the University should be kept to a minimum in an effort to maintain the project delivery schedule.

The number of submittals required for the project shall be determined with the Designer prior to final negotiation of the design contract or letter of agreement. Submittal options may include:

1. Combine Schematic and Design Development submittal; or
2. Eliminate all but Construction Document review with sit-down review at 50% completion; or
3. Some projects may only require a Construction Document review.





## PP 1.4 | BIDDING

This section outlines the bidding requirements which are unique to capital projects at Appalachian State University. These requirements supplement the most current addition of the North Carolina State Construction Manual required by the North Carolina Department of Administration, State Construction Office.

### Procedures

Prior to proceeding to the Bidding Phase, the Designer shall obtain written approval from the Office of Design & Construction and the SCO.

The Designer shall comply with Chapter 400 of the State Construction Manual and applicable North Carolina General Statutes regarding bidding phase and submittal requirements.

The Designer shall coordinate all activities and information through the bidding process with the University's Project Manager.

The date for receipt of bids shall be established by the Designer in consultation with the University and the SCO. A period of four (4) weeks is the typical duration between the publication of the Advertisement for Bids and the receipt of bids.

**Bid Document Submittals:** The Bid Document Submittal to the University shall consist of two (2) hard copies and one (1) electronic copy of the final bid documents. These sets shall be in the possession of the Director of Design & Construction during bidding. Additional sets shall be submitted to the State Construction Office.

## PP 1.5 | CONSTRUCTION ADMINISTRATION

This section outlines the construction administration requirements which are unique to capital projects at Appalachian State University. These requirements supplement the most current addition of the North Carolina State Construction Manual required by the North Carolina Department of Administration, State Construction Office.



### Procedures

Prior to proceeding to the Construction Administration Phase, the Designer shall obtain written approval from the Office of Design & Construction and SCO.

The Designer shall comply with Chapter 500 of the State Construction Manual regarding the construction phase and submittal requirements.

The Designer shall coordinate all activities and information through the bidding process with the University's Project Manager.

The Construction Phase will begin with the Designer's receipt of the fully executed copy of the construction contract(s).

#### 1.5.1 Pre-Construction Conference

The Designer, in consultation with the University's Project Manager, and the State Construction Office shall arrange for a Pre-Construction Conference. The purpose of this meeting is to review the requirements of the project and to provide a framework for the coordination of all construction activities.

The Designer shall send copies of the minutes of this conference to all attending contractors, the University's Project Manager, the Director of Design & Construction, the State Construction Office, and any other interested parties.

#### 1.5.2 Notice to Proceed

Upon approval of all regulatory agencies, the Designer will coordinate with the SCO and the University's Construction Manager a date for each contract to proceed with work. The Designer will then issue a "Notice to Proceed" according to the type of construction contract for the project (single prime, multiple prime or CM at Risk). These letters shall establish the start date and completion date for each contract. Copies of each letter issued by the Designer shall be forwarded to the SCO and Office of Design & Construction.



### 1.5.3 Field Inspections

The Designer, where required by the design contract, shall provide liaison and necessary inspections of the project to ensure compliance with plans and specifications.

The ASU Physical Plant personnel will also observe work progress periodically and will provide comments to the Designer through the University's Project Manager. Included among these observations by the Physical Plant will be an above-the-ceiling inspection of all areas before suspended ceilings are installed.

### 1.5.4 Progress Meetings

The Designer shall establish a schedule of progress meetings at the job site in accordance with Chapter 500 of the State Construction Manual. The frequency of meetings will have been set in special conditions of contract and may be revised by the University depending on progress and nature of the work. Minutes of the meeting will be kept by the Designer and distributed to all parties.

### 1.5.5 Administration

The Designer, where required by the design contract, shall provide other construction administration services for the project which may include:

1. Prepare written copies of monthly construction progress reports, with copies of the weekly inspection reports attached.
2. Review shop drawing submittals. The Designer shall provide the University Project Manager with one copy of each approved submittal.
3. Provide general administration of the construction contract
4. Approve results of all field testing on the project.
5. Respond promptly to all Request for Information (RFI's).
6. Conduct final inspections and review of punch list.

### 1.5.6 Special Scheduling and Construction Constraints

When projects involve spaces in or contiguous to congested areas of the campus, research laboratories, or other critical activities, special steps may be required to avoid or minimize interference with on-going campus operations. The Designer should determine those areas where impact is critical or cannot be accepted. Dealing with utility outages is the most common consideration, while the problems of noise, vibration, dust, and circulation must also be explored.

## PP 1.6 | FINAL CLOSEOUT

This section outlines the final closeout requirements which are unique to capital projects at Appalachian State University. These requirements supplement the most current addition of the North Carolina State Construction Manual required by the North Carolina Department of Administration, State Construction Office.



### Procedures

The Designer shall comply with Chapter 600 of the State Construction Manual regarding the final report and closeout requirements. The Designer shall provide the following project close-out services upon completion of the project:

1. Assemble and forward all Final Report Documents for review by the Office of Design & Construction.
2. Prepare a written description of the HVAC system and operational requirements. The Designer shall also schedule and conduct a review of the HVAC plans and specifications with the Physical Plant personnel.
3. Provide copies of all Operations and Maintenance manuals to be supplied by the General Contractor or Project Manager.
4. At substantial completion of construction, the Designer shall provide a list of the mechanical and electrical equipment to be added to the University's preventive maintenance program.
5. Provide the results of the fire alarm tests and invite a representative of fire alarm contractor to the final inspection with the Department of Insurance. The Designer shall coordinate the delivery of as-built drawings of the fire system and spare parts (6% of installed stand alone smoke/heat detectors) to be handed over to the University within 30 days of the final inspection.
6. Computation and disposition of liquidated damages (if required).
7. Issue the Certificate of Final Completion & Compliance.
8. Provide record drawings and specifications within 30 days of substantial completion in accordance with the requirements outlined in Chapter 600 of the State Construction Manual. The digital format shall be compatible with the University's computing environment.
9. Provide an electronic copy of the Final Report in accordance with the requirements outlined in Chapter 600 of the State Construction Manual.



# DESIGN GUIDELINES 2





*“For our school I have an ideal: It is an Institution where friction is reduced to a minimum, and cooperation and congeniality are planted and successfully cultivated...where health is preserved, economy taught, honor developed, and morality and religion encouraged. We, and we alone, can make possible such a school.”*

*B.B Dougherty, 1922*

## INTRODUCTION

The purpose of the Design Guidelines section is convey guidance for planning, design and construction at Appalachian State University. The context for development of these guidelines is the main campus. However, many of these requirements should be considered applicable to all campus property. The guidelines offer direction for aesthetics and general design intent. The Designer should reference Section 3 - Campus Standards for detailed requirements.

The Campus Master Plan is the official document for continued growth and new development at Appalachian State University. It is expected that the Designer shall adhere to the design intent of the Master Plan and Guiding Principles.

## Parameters

Appalachian State University strives to protect the history and traditions of the University’s culturally rich mountain environment. These guidelines are intended to allow and encourage the campus to continue to evolve in such a way that each building contributes in a unique way to the context of the campus, while being respectful of its natural surroundings.

No written guideline can fully describe in detail all aspects of the required design criteria. These guidelines seek to portray a prescriptive approach for defining the parameters of a project and design outcome. Throughout the guidelines, there are examples of existing work on campus which illustrate responsive or preferred buildings on campus. These examples do not imply that the designer should consider direct imitations. These examples merely illustrate buildings that respond appropriately to programmatic requirements, the immediate context and physical conditions of the site.

For design and construction of new facilities (or renovation of existing buildings) the Designer should carefully consider the following parameters as ingredients for each new project on campus:

1. Responsive to use
2. Sustainable
3. Flexible
4. Technologically advanced
5. Considers weather & topography
6. Pedestrian oriented
7. Exhibits detail
8. Expresses physical harmony
9. A 50-year solution
10. Model for learning



## General Considerations

In addition to the parameters defined in the previous section, the University has defined several general considerations the Designer should address and/or integrate into each new project.

### Design Within Available Funds

Designers are directed and required to base their designs upon the budgeted funds available. The Designer shall continually monitor program requirements and cost estimates to assure that the project is designed within the available funds and does not deviate from the quality standards established herein. If at any time, the Designer believes that satisfying the stated program requirements, at the level of quality desired, will exceed the budgeted funds available, then he or she must inform the Office of Design & Construction without delay.

### Energy and Materials Conservation

The University is dedicated to the principle of conserving materials and energy. University personnel will examine proposed construction for means of reducing not only the initial cost of energy and non-renewable resources, but also long-range operating costs. In addition to basic conservation requirements, the Designer should consider the utilization of passive solar energy techniques, non-conventional and renewable energy resources, recycled materials content of specified materials, and non-conventional materials.





Constructed wetland to mitigate stormwater



Rain garden located in parking area



Permeable paving solutions can be durable and allow stormwater infiltration

## DG 2.1 | SUSTAINABLE DESIGN

The University shall uphold a sustainable doctrine by incorporation of new technologies for existing and future facilities, by providing efficiencies in energy, economic, and environmental performance that are substantially better than conventional practice as a model for the state and region. All new campus construction will be built to at least the U.S. Green Building Council's (USGBC) LEED Silver standard or equivalent.

### Guidelines

**2.1.1 Low Impact Design (LID)** *New development on campus (or as directed by the Office of Design & Construction) shall follow the guidelines for Low Impact Development (LID) by utilizing innovative storm water management techniques.*

Low Impact Development (LID) is an approach to land development that can be utilized at ASU as the campus continues to grow that works with nature to manage stormwater as close to its source as possible. LID employs principles such as preserving and recreating natural landscape features, minimizing effective imperviousness to create functional and appealing site drainage that treat stormwater as a resource rather than a waste product. There are many practices that have been used to adhere to these principles such as:

- Stormwater Wetlands
- Bioswales
- Riparian Buffers
- Cisterns
- Permeable Pavement
- Green Roofs
- Planted Filtering Strips
- Reduced Roadway Widths

By implementing LID principles and practices throughout the campus environment, water can be managed in a way that reduces the impact of built areas and promotes the natural movement of water within an ecosystem or watershed. Applied on a broad scale, LID can maintain or restore a watershed's hydrologic and ecological functions, creating a better environment for the ASU community.

1. **Stormwater wetlands** temporarily store rain runoff in shallow pools that support conditions suitable for the growth of wetland plants. These constructed wetland systems can be utilized as development occurs on campus, are designed to maximize the removal of pollutants

from stormwater runoff via several mechanisms; microbial breakdown of pollutants, plant uptake, retention, settling, and absorption. These structural practices are similar to wet ponds, but incorporate wetland plants in a shallow pool. As stormwater runoff flows through the wetland, pollutant removal is achieved by settling and biological uptake.

2. **Bioswales** are landscape elements designed to remove silt and pollution from surface runoff water. They consist of a swaled drainage course with gently sloped sides and filled with vegetation, compost and/or riprap. The water's flow path, along with the wide and shallow ditch, is designed to maximize the time water spends in the swale, which aids the trapping of pollutants and silt. Based on the topography of the mountain landscape, a bioswale likely will have a meandering channel alignment, which would enhance the storage time and lessen the effects of steep sloping elevation changes prevalent on campus. A simple application on campus could be around parking lots, where substantial automotive pollution is collected by the paving and then flushed by rain. The bioswale wraps around the parking lot and treats the runoff before releasing it to the watershed or storm sewer.
3. **Riparian buffers** are a vegetated area near a stream, which helps shade and partially protect a stream from the impact of adjacent land uses. They play a key role in increasing water quality in associated streams, rivers, and lakes in the mountain landscape, thus providing environmental benefits. These buffers are important natural biofilters, protecting aquatic environments from excessive sedimentation, polluted surface runoff and erosion. They supply shelter and food for many aquatic animals and shade that is an important part of stream temperature regulation. With development comes the decline of many aquatic ecosystems, riparian buffers can become a conservation choice aimed at increasing water quality and lessening pollution of ASU's water sources.
4. **Cisterns** are receptacles for holding liquids, usually water, often built to catch and store rainwater. Promoting the use of cisterns can provide an alternative source for irrigation, reducing the demand on local water sources within the campus area. To conserve groundwater, rainwater can be collected, stored and used for such things as watering gardens, washing cars or other non-potable water needs throughout the ASU campus.
5. **Permeable pavement** can be utilized throughout the campus for roads, parking lots and walkways that allow the movement of water and air around the paving material. These paving surfaces keep the pollutants in place in the soil and allow water seepage to groundwater recharge while preventing stream erosion problems. They capture the heavy metals that fall on them, preventing them from washing downstream and accumulating inadvertently in the environment. Porous pavement also gives campus trees the rooting space they need to grow to full size. This integrates healthy ecology and the thriving ASU campus, with the living tree canopy above, the campus traffic on the ground, and living tree roots below.
6. **Green roofs** are roofs of buildings that are partially or completely covered with vegetation and soil, or a growing medium, planted over



*Water quality swale (bioswale)*



*Small cistern or rain barrel collecting water for reuse on site*



*Green roof installation*



Riparian buffer along stream



Planted filter strip between creek and greenway



Reduced roadway width slows traffic and reduces runoff impacts

a waterproofing membrane. Numerous benefits can result from the adoption of green roof technologies; the recovery of green space, moderation of the urban heat island effect, improved stormwater management, water and air purification, and a reduction in energy consumption. The mitigation of stormwater runoff can be a great benefit to ASU because of the prevalence of impervious surfaces in the campus area. A major benefit of green roofs is their ability to absorb stormwater and release it slowly.

7. **Planted filtering strips** are land areas situated between a potential, pollutant-source area and a mountain landscape river, stream, or lake that receives runoff. A planted filter strip provides water-quality protection by reducing the amount of pollutants before the runoff enters the surface water body. Filter strips also provide localized erosion protection since the vegetation covers an area of soil that otherwise might have a high erosion potential.
8. **Reduced roadway widths** provides ASU with the opportunity to limit the impact runoff pollutants have on surrounding rivers, streams, and lakes. Campus roads, driveways and parking lots can exceed building rooftops as a percentage of the total impervious surface within the community. In addition to lessened stormwater runoff, reducing road width provides other benefits such as construction and maintenance savings, less required clearing and grading during initial construction, as well as slow traffic flow to help alleviate safety concerns.

### 2.1.2 Water Conservation *The University will strive to prove itself a leader in water management over time by enforcing the integration of water conservation practices throughout the campus.*

All evidence points to increasingly stressed water supplies in North Carolina and throughout the Southeast. Additionally, trends suggest that water management will be more heavily regulated in the future. By beginning to address these eventualities now, the campus will prove itself a leader in water management.

1. Reduce freshwater use 40% by implementing technology to enable water capture and reuse as part of the building design.
2. Reduce stormwater runoff impacts by implementing at least one Low Impact Development technology as described above.
3. Protect surface water by preventing culverts on any currently daylight surface water. Existing surface water enclosed in culverts will be daylight to the extent practical.
4. Utilize permeable surfaces as much as possible.
5. Select drought resistant plantings.

### 2.1.3 Energy Efficiency *The University will strive to reduce its carbon footprint over time by enforcing the integration of energy efficient practices throughout the campus.*

Whether it be for global concerns of climate change or national concerns of energy independence, the University can have a significant impact on

the consumption of energy through subtle and inexpensive changes to conventional design. All new construction on campus shall be designed in an energy efficient manner that complements the overall design intent and reduces total building energy consumption by addressing the following requirements:

1. Reduce overall building energy loads.
2. Provide efficient electrical systems to minimize consumption and optimize the use of natural daylighting.
3. Utilize occupancy sensor controls.
4. Incorporate exterior shading devices or extended roof overhangs to control heat gain.
5. Design high performance mechanical systems that minimize energy use while maintaining standards for indoor air quality and comfort.
6. Group similar building functions into the same mechanical zone.
7. Provide Energy Star rated equipment and appliances.
8. Eliminate the use of ozone-depleting materials.
9. Incorporated renewable or alternative energy sources.
10. Utilize energy modeling and analysis.
11. Utilize commissioning on all new projects.

#### 2.1.4 Material Conservation *The University will strive to conserve the use of natural materials and resources by enforcing the integration of material conservation practices on all new projects.*

The design and construction for new projects should include strategies that utilize materials with minimal environmental impact. Reusing building materials can greatly reduce the demand for virgin materials, which must be processed, transported and installed.

1. Reduce waste associated with construction and demolition by diverting materials from landfills for reuse or recycling.
2. Specify local materials as a first preference, then regional products to reduce shipping energy cost.
3. Specify materials with recycled content.
4. Plan for future growth and expansion.
5. Utilize flexible design and flexible spaces to provide a maximum lifespan for the use of the building.

#### 2.1.5 Indoor Environmental Quality *The University will maintain healthy and comfortable interior environments that promotes learning.*

Facilities should be designed and constructed with an appreciation of the importance of providing a high-quality interior environment for all users.





1. Utilize low-emitting materials.
2. Maximize daylighting for all occupied spaces when possible.
3. Maximize views to the exterior for all occupied spaces.
4. Provide operable windows for occupied spaces.
5. Provide acoustical privacy where appropriate.
6. Supply adequate levels of outside air to ensure indoor air quality.
7. Provide CO2 monitoring of common spaces such as classrooms.
8. Prevent the infiltration of moisture into buildings. Replace water damaged finishes immediately.
9. Specify low Volatile Organic Compounds (VOC) products for all interior spaces.

## DG 2.2 | FACILITY SITING CRITERIA

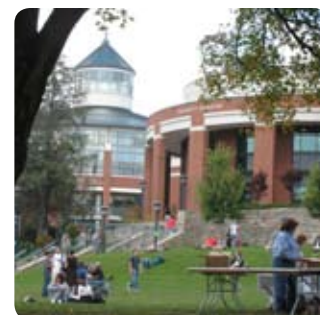
It is the intent of the facility siting criteria to emphasize continuity for the planning of new facilities on campus. Significant opportunities arise during the site planning stages of design and have a tremendous impact on the overall success of a project. The University requires that each new facility planned for the campus follow the Facility Siting Guidelines to insure a comprehensive approach to the site design.

### Guidelines

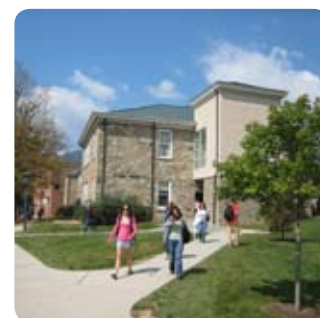
**2.2.1 Facility Siting** *The Designer shall visit the site and evaluate proposed locations of elements of the project. Site design alternatives must comply with the design intent of the approved campus master plan.*

For new construction or additions to existing buildings, site selection is generally indicated in the building program requirements. Designs should address the following criteria:

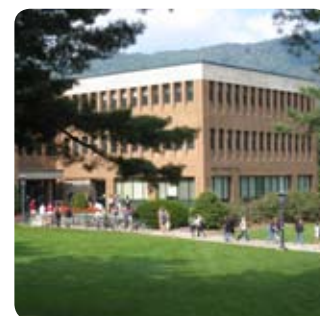
1. Reinforces the functional relationships of the building program.
2. Meets access requirements for pedestrian, bicycle and service
3. Works with the existing topography to minimize cut & fill material
4. Responds to existing sub-soil conditions
5. Avoids unnecessary environmental impacts
6. Maximizes sustainable design principles for solar orientation
7. Responds appropriately to the locations of existing utilities and infrastructure
8. Maximizes views to and from the building
9. Considers construct-ability issues for contractors access
10. Provides fire truck access
11. Minimizes on-campus surface parking
12. Maximizes open space areas
13. Preserves nature where possible
14. Considers extreme weather conditions of the region



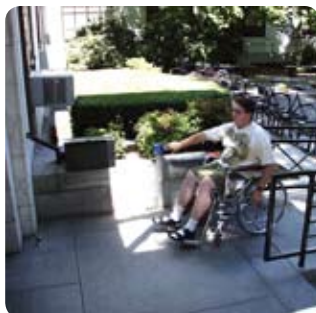
*Maximize views to and from buildings*



*Provide access for all user groups to buildings*



*Compact building design affords larger open space outside of building*



Accessibility to campus buildings and amenities through ramps



Terraced steps with stone wall



Hand rails provide stability for those users that require the extra support

## DG 2.3 | SITE DESIGN

A primary task of all campus architecture and landscape design is the physical definition of streets and public spaces as places of shared use. Streets lined by buildings or landscaping rather than parking lots are more interesting to move along, especially for pedestrians and provide a safer environment. The following guidelines serve to unify the campus through site design principles that will be applied to all projects.

### Guidelines

**2.3.1 Handicapped Accessibility** *It is the policy of the University to make all areas of the campus, and all buildings located within the campus, physically accessible to all students, faculty and staff, regardless of individual limitations which may effect mobility.*

The Designer is directed and required to consider in their designs, and to otherwise accommodate, the special requirements of all segments of the University population, including wheelchairs users, and others using walking aids, the hearing impaired, and those with sight limitations.

The Designer is required to meet all appropriate regulations as set forth by the current North Carolina Accessibility Code and adopted amendments.

**2.3.2 Walks, Ramps & Steps** *These elements shall provide safe routes for all user groups of the campus.*

#### Walkways:

1. Design consideration should be given to align walkways to connect to major destinations circulation paths and offer pedestrians a safe, interesting and relatively direct means of travel.
2. Walks should not dead-end into the middle of parking lots and other vehicular-oriented areas.
3. Special consideration should be given to locations where pedestrian pathways cross vehicular routes and shall be handicapped compliant.
4. Where primary pedestrian traffic intersects roadways, brick paving material should continue across the vehicular route.
5. Existing brick paving materials and patterns should be continued as a means of maintaining visual continuity across the campus.
6. Consistent walkway widths should be maintained across the campus and respond to pedestrian movement and emphasize a hierarchy for pedestrian circulation.

Standard walkway widths to be applied are:

|                             |                       |
|-----------------------------|-----------------------|
| Major pedestrian corridors: | 16 feet wide          |
| Major pedestrian walks:     | 8 feet wide           |
| Minor walks:                | 6 feet wide (minimum) |

### Ramps and Steps:

1. Siting and building design should minimize the need for steps or ramps when possible. Alternative grading measures should be considered.
2. Ramps should be installed for supply and service deliveries.
3. Ramps should be installed for handicapped accessibility for renovation projects.
4. Provide overhead exterior lighting for all steps and ramps. Recessed wall or step lights below 24" is discouraged due to maintainability issues.
5. All walking surfaces should have a surface providing traction. Carborundum or similar abrasive will NOT be permitted.
6. The building design shall take into account the need to protect steps and ramps from the fall of snow from roofs at entrances and along walkways.

### 2.3.3 Service & Utilities *Utilities and service areas should be screened or otherwise hidden from the view of the pedestrian.*

1. Locate trash storage, loading, and truck parking to minimize visibility from the street/sidewalk and building entrances. Avoid locating service and loading areas along important view corridors.
2. All exterior trash or dumpster areas should be screened from public view on three sides; and, on the fourth side, by a gate that also screens the receptacles from view. The enclosure should be made of materials and colors compatible to that of the principal structure.
3. Where feasible, screen loading docks and truck parking from public view using building mass, freestanding walls, and/or landscaping.
4. Consult with the utility companies early in the design process about the location of utility boxes and meters. Ensure that all utility equipment is located, sized, and designed to be as inconspicuous as possible. All utilities, both new and existing, should be placed underground in conduits and vaults. All utility services should be underground.
5. Do not locate HVAC equipment on the street-side of the building. In addition, locate all building-mounted utility meters and service equipment to the side or rear of the building. Screen all rooftop equipment from public view.



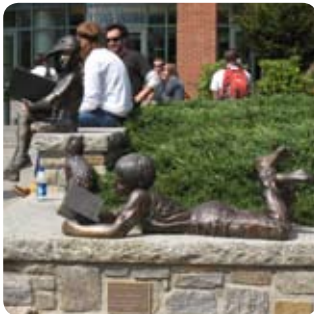
*Properly screened dumpster*



*HVAC equipment and meter boxes should not be located on the street side of a building*



*Decorative lighting fixtures found on campus*



*An example of informal public art*



*Example of public art telling a story*

**2.3.4 Environmental Protection** *All campus development should respect natural resources as an essential component of the human environment. The most sensitive landscape areas, both environmentally and visually, are steep slopes greater than 15%, watercourses, and floodplains. Any development in these areas should minimize intervention and maintain the natural condition except under extreme circumstances. Where practical, these features should be conserved as open space amenities and incorporated into the overall site design.*

1. Piping of creeks should be avoided and channelization should be minimized.
2. Where crossing of existing creeks is necessary, a bridge structure is superior to a culvert. Bridges permit the natural ecosystem of the stream to remain unimpeded under the crossing.
3. Existing vegetation and large specimen trees should be preserved and incorporated into the site design in order to create a natural landscape and the impression of a mature landscape.

**2.3.5 Outdoor Lighting** *Outdoor lighting should provide a safe and visible pedestrian realm for the University as well as perpetuate the character for the area.*

Lighting for outdoor conditions should comply with the design guidelines outlined by the IDA (International Dark-Sky Association).

1. Use a low intensity of high-quality white light, which will provide good, uniform visibility while avoiding light pollution.
2. Cut-off fixtures are required because they are more efficient than non-cutoff fixtures at casting light on the sidewalk and avoid light spillage and pollution.
3. Outdoor lighting should consider the illumination of sidewalks and other multiuse pathways using low intensity fixtures that provide an even distribution of light while avoiding areas of intense shadows.

**2.3.6 Public Art** *Works of art have contributed to the visual quality of ASU over a long period of time. This amenity adds a visual texture and character that should be continued as appropriate.*

1. Public art should be constructed and placed to add beauty and character to the campus. The piece of art should have meaning and give meaning to the campus and inspiration to those that have the opportunity to see it.
2. Artwork may be free-standing pieces (e.g. sculpture or water fountain) or it may be integrated into its surroundings as an architectural element (e.g. relief sculpture imbedded in pavement or a wall, a mosaic or mural on a wall, lighting or sound effects, or decorative railing or lighting).
3. All lighting of artwork should be in conformance with campus standards.

## DG 2.4 | CIRCULATION ELEMENTS

These Design Guidelines encourage the development of a network of interconnecting streets that work to disperse traffic while connecting and integrating various areas of the campus. Equally important, these guidelines encourage the development of a network of pedestrian paths, sidewalks and bicycle lanes that provide an attractive and safe mode of travel for pedestrians and cyclists.

### Guidelines

**2.4.1 Access Management** *The control of driveways, roadways and other curb cuts through a comprehensive access management program should be a high priority to maintain the efficient operation of the major campus corridors, thereby securing the long-term infrastructure investment.*

Street designs on the campus should permit the comfortable use of the street by cars, bicyclists, and pedestrians. Pavement widths, design speeds, and the number of vehicle lanes should be minimized without compromising safety. The specific design of any given street must consider the building which fronts on the street and the relationship of the street to the campus's street network.

The following standards are based upon NC DOT standards as well as best practices for corridors similar to those found throughout the campus.

1. Driveways shall be limited in accordance with the following standards. Where the NC DOT Driveway Manual conflicts, the stricter of the two standards should prevail.

| Frontage (feet) | Number of Driveways Allowed |
|-----------------|-----------------------------|
| < 500           | 1                           |
| 501-999         | 2                           |
| >1000           | 3                           |

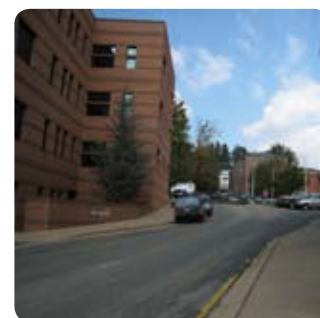
2. The minimum distance between a driveway and an intersection shall be as follows. Where the NC DOT Driveway Manual conflicts, the stricter of the two standards should prevail.

| Street Type              | Minimum Distance (feet) |
|--------------------------|-------------------------|
| Major/Minor Thoroughfare | 500                     |
| Local/Collector Street   | 200                     |

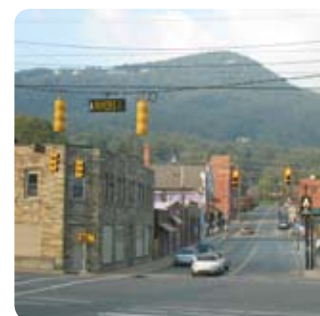
3. The Minimum Spacing between median openings shall be 1000 feet. Where the NC DOT Median Crossover Guidelines conflict, the stricter of the two standards should prevail.



*Minimize driveway cuts with shared use parking areas*



*Providing alternative routes for locals to navigate around campus*



*Connectivity to the Town of Boone will remain a key to the success of the campus*



*Pathways are made more interesting with seating and plantings*



*Bicycle parking*



*Pathways become ideal gathering places for conversation*

## 2.4.2 Connectivity *The campus should consist of a well connected street network that provides internal and external connections.*

Traffic studies have shown that highly connected street networks provide much greater mobility for a campus community at less cost. A high degree of connectivity should occur not only at the level of arterials, but also on collector, local and other secondary roads. Such connectivity vastly improves a street network's performance. The street pattern should not force short trips of one or two miles onto arterials; it should be possible to make trips of this sort by using collector or other secondary streets. With a highly connected street network, cross-campus trips should be possible using fairly direct secondary roads.

1. Good transportation design requires the development of a network of interconnecting streets that disperse traffic and support transit options while connecting and integrating the campus with the existing urban fabric of the surrounding area. A network of narrower streets with reduced curb radii slows and disperses traffic, and provides a pedestrian-friendly atmosphere.
2. Main campus roads should have a cross-section width of 48' and a speed limit of 25 MPH. Facility access roads should have a cross-section width of 36' and a speed limit of 25 MPH. Service roads should have a cross-section width of 24' and a speed limit of 20 MPH.
3. For good, clear visibility, intersections are to be perpendicular, have lighting arranged at 90 degrees to each street, and maintain a 50-foot landscape setback from each corner.

## 2.4.3 Pedestrian & Bicycle Circulation *Provide a complete network of paths that interconnect building entrances, parking, transit stops, sidewalks and crossings, adjacent properties, adjoining off-street paths, and other key destinations on or adjacent to the site.*

1. Pedestrian pathways should be provided from the street to the parking area between buildings, as necessary to ensure reasonably safe, direct and convenient access to building entrances and off-street parking. They should be clearly defined and enjoyable to use. To aid pedestrian navigation and comfort, provide the following elements along paths:
  - Landscaping, such as rows of trees and shrubs, flower beds, and planters
  - Campus standard outdoor lighting fixtures
  - Small way-finding signs
  - Vertical architectural elements, such as markers or arches
  - Seating and resting spots
  - Special paving
2. Whenever pathways cross internal drives and curb cuts, provide a highly-visible crosswalk, made of a material that provides strong contrast with the vehicular surface (imbedded elastomeric paint or unit pavers in concrete). Consider elevating the crosswalk to the level of

the connecting walk. Also use warning signs and light fixtures to alert drivers to crossings.

3. Pedestrian routes should be direct and should minimize potential conflicts with vehicles. For pedestrian safety and comfort, where a main pedestrian route must go along or across a parking lot or driveway, provide a separate path with buffer landscaping and other amenities.
4. Provide pedestrian and bicycle links to each adjacent property (in addition to the public sidewalk). They should be highly visible and conveniently located. Avoid steps; provide curb ramps to accommodate wheelchairs, bicyclists, and baby strollers. If the adjacent lot is undeveloped or under developed, provide part of the connection or maintain the potential for a future link.
5. No pedestrian paths should be less than five feet (5') in paved width. Multi-use paths (bicycle and pedestrian) should not be less than eight feet (8') in paved width, though ten feet (10') is preferred. Whenever parking abuts a walkway (head-in, diagonal or parallel), add one and one half feet (1.5') to the walkway width to accommodate car overhang or opening car doors. A wheel stop may be used to prevent car overhang instead.
6. Bike racks should be located close to the main building entrance so they are highly visible and convenient. To facilitate access, install a curb ramp in any drive near the bike parking.

#### 2.4.4 Transit *The regional transit system (APPALCART) should be maintained and enhanced as one of the greatest resources of the campus and surrounding area.*

1. Bus stations (bus stops) should be ½ to 1 mile apart, unless increased speed and/or higher ridership justifies closer placement. Stations shall be incorporated into new campus projects where appropriate.
2. Pedestrian access to the stations should be maximized.
3. Lighting and campus standard shelters should be provided. Station and shelter design shall be coordinated with AppalCart and University staff.
4. Where appropriate, park and ride facilities should be provided in close proximity to significant bus stations. Shared or joint use parking should be encouraged.
5. The impacts of cross traffic in relationship to transit should be minimized using grade separations, queue jumps or signal preemption.
6. Each station should have good access for other modes of travel including autos, pedestrians, bicycles, electric vehicles, buses and shuttles.



*Preferred bus shelter design*



*Users of the AppalCart*



*AppalCart signage*



*Parking lot located behind building*



*A shared parking lot*



*Rivers Street Parking Deck*

### 2.4.5 Parking *Parking lots (and decks) should not dominate the frontage of pedestrian oriented streets, interrupt pedestrian routes, or negatively impact surrounding developments.*

1. Parking lots or decks should be located behind buildings whenever possible. Parking lots should not occupy more than 1/3 of the frontage of the adjacent building or no more than 64 feet, whichever is less.
2. Shared parking is strongly encouraged.
3. Consider the feasibility of providing a parking structure rather than surface parking to conserve land and minimize the impacts on the environment.
4. Parking aisles should be separated from one another by planted medians with shade trees. When possible, it is recommended that parking aisles and their shade trees be aligned in a solar orientation to cast shade on parked cars during the summer months.
5. Large surface parking lots larger than 75,000 square feet of vehicular surface should be visually and functionally segmented into several smaller lots enclosed by landscaping.
6. Parking lots along the street must be screened from the adjacent street and sidewalk by low walls and/or landscaping.
7. Parking structure facades should be treated with approved building materials. The façade should be designed to visually screen cars.
8. Pedestrian entries should be clearly visible. The vertical circulation should not be located in the center of the structure so that it is difficult or circuitous to locate.
9. Bicycle racks and storage lockers are strongly encouraged inside new parking structure.
10. Alternative fuel stations should be considered for new parking structures as directed by the University.

## DG 2.5 | LANDSCAPE CHARACTER

The mountain landscape of ASU creates a sense of place for students, faculty, and visitors to the campus. This sense of place encourages social interaction which is a vital aspect of any pedestrian campus. Because the area is composed of diverse site and building elements, the landscape character is the integral component that serves to unify and create an attractive whole.

As ASU continues to grow, some landscapes will need to be preserved, while others will need to be expanded or created. Campus landscape should not inhibit creativity to proposed landscapes but provide an environment where creativity can flourish within parameters that are set to protect the overall campus unity.

The goal of the campus landscape is to achieve a comprehensive landscape fabric that is aesthetically attractive while also being practical and cost-effective to maintain. The overall philosophy of the guidelines is to foster a sense of community through the use of indigenous plant material that enhances the overriding sustainable approach to the campus environment.

As outlined in the Guiding Principles, it is important that the “University emphasize the quality of the natural environment” and “preserve the natural habitat”. For this reason, it is imperative that future growth consider the existing plant material and how this will be integrated into the overall concept of the landscape plan for a specific project.

*For specific material suggestions and size requirements, please refer to Section 3 – Campus Standards.*

### Guidelines

**2.5.1 Trees** *New tree plantings will be made on a regular basis and existing mature trees and quality tree stands should be protected as a valuable campus resource.*

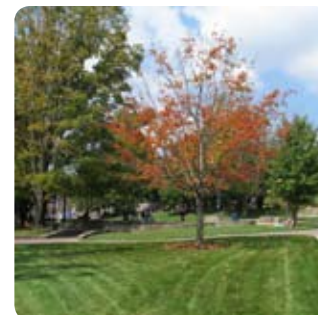
New construction on campus, whether it be expansion or infill-related, begins to put intense pressure on existing, mature trees and often results in the compaction of their critical root zone. All new projects should consider this fact and plan to enforce tree protection measures and enhance the site with new tree plantings.

Many of the older trees on campus will inevitably become less viable and will be lost to disease or other causes at some point in the future. The preservation, protection, and ongoing health of campus trees should never be a second priority for any proposed project.

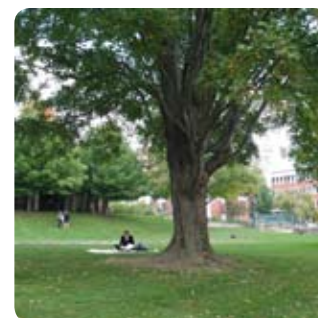
1. Existing trees shall be preserved whenever feasible.
2. When selecting which trees to preserve, the following shall be considered: existing and proposed grading, age and vigor, condition and type of tree, location of site improvements, utility connections, wildlife and environmental benefits.
3. Trenching, placing backfill in the critical root zone, driving or



*Promote active replacement program for trees on campus*



*Protect mature trees and maintain upkeep for continued longevity*



*Trees add a unifying element to the campus grounds*



parking equipment in the critical root zone, and dumping of materials detrimental to plant health in close proximity of a tree to be preserved is prohibited.

4. Should any tree designated for preservation die during or soon after a construction project, the contractor shall be responsible to replace it with a size and species type approved by the University.
5. Protective barricades shall be placed around all trees designated to be saved prior to grading.

### 2.5.2 Plantings *Campus plantings should create a unified design theme through the use of plant massings, native material, ease of maintenance, and simple, elegant designs that are scale appropriate for the area.*

Plantings truly enhance the quality of life for everyone at ASU. Shrubs, herbaceous plant material, and trees filter pollutants in the air and water help mitigate wind effects and solar heat gain, stabilize soil to reduce erosion, and provide beautiful aesthetics within the built environment.

The other critical ambition of plantings is to provide a human scale to the campus that makes people feel comfortable and safe. Safety in the landscape is a serious consideration that can be addressed by discouraging design that creates “hiding places”. Simple arrangements that are appropriate for the scale of a specific context should be encouraged throughout the campus while taking advantage of a landscape’s ability to create vistas, frame views, and provide visual termini. The creation of a healthy growing environment for plantings should be a joint effort of arborist, horticulturists, landscape architects, and native plant biologists.

The University encourages the maintenance and enhancement of habitat for various forms of wildlife and to create new woodlands through natural succession and reforestation where appropriate.

1. Site disturbance and erosion should be minimized through retention of existing vegetation and avoiding development in sensitive areas.
2. Plants to be selected for the campus should be native to the bio-region, long lived, relatively pest free and practical to maintain.
3. Establish new tree plantings along all major walkways and major campus streetscapes.
4. Define outdoor living spaces and quads with plantings to create informal gathering spaces with access to seating.
5. Expose the additional expanse of Boone Creek along Rivers Street and Hardin Creek along Hardin Street and embellish with rock and plant material appropriate to a mountain stream.
6. Provide landscape screening around exposed building equipment such as transformers or mechanical units.
7. The corners of street intersections, particularly gateways and site entries (from both street and sidewalk) should be distinguished by special



*Enhance entrances with annual color plantings*



*Enhance natural settings with low maintenance native plantings*



*Provide foundation plantings along buildings to soften approach*

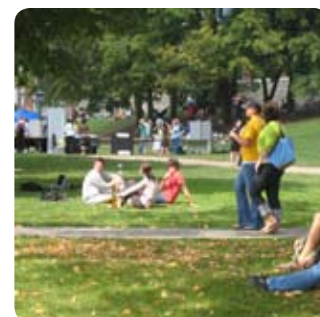
landscape treatments: flower displays, specimen trees and shrubs, accent rocks, low walls, signage, decorative lighting, sculpture, architectural elements, and brick paving. Features for vehicular entry points must meet NCDOT's sight triangle requirements.

8. The plantings (softscape) should be balanced with the special paved areas (hardscape). Whenever possible, pervious paving systems should be utilized to decrease stormwater runoff and its effects.

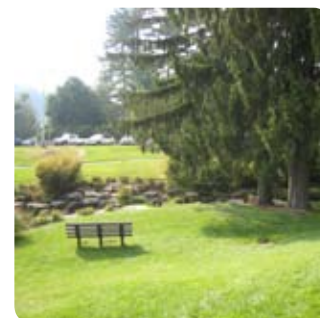
### 2.5.3 Open Space *As the campus continues to grow and evolve, dedicated open space should be protected, preserved, and enhanced as appropriate.*

Open space preservation and creation will be vital to the health, function, and beauty of the overall campus. The plan proposes a mix of formal and informal areas that recognize the existing conditions and build upon the inherent beauty of the campus.

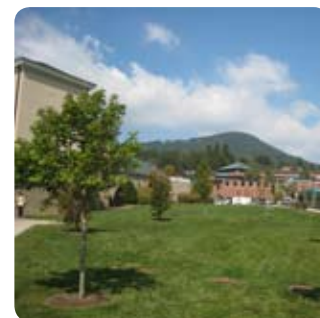
1. To ensure that open space is well used, it is essential to locate and design it carefully. The space should be located where it is visible and easily accessible from public areas (building entrances, sidewalks). Consider views and sun exposure into account as well.
2. New open spaces should contain direct access from the adjacent streets. They should be open along the adjacent sidewalks and allow for multiple points of entry. They should also be visually permeable from the sidewalk, allowing passersby to see directly into the space.
3. The space should be well-buffered from moving cars so that users can enjoy and relax in the space. The space may be visible from streets or internal drives but should not be wholly exposed to them. Partially enclose the space with building walls, freestanding walls, landscaping, raised planters, or on-street parking to help buffer it and create a comfortable "outdoor room".
4. Do not overlook general open spaces (not part of the dedicated open space). These areas help tie the campus together into a memorable experience thus giving them great value.
5. Utilize infill project whenever possible as the campus grows and expands. This will not only maintain the campus as a walkable environment by not extending the limits beyond a comfortable walking distance, but it will also protect open space from being pressured as new development is planned.
6. The design of these spaces can be enhanced with plazas, fountains or public art.
7. Maintaining open spaces at varying scales is also important and encourages both passive and active spaces within the campus setting.
8. Conserve open land, including those areas containing unique and sensitive features such as natural areas, wildlife habitat, streams or creeks, wetlands and floodways.
9. Promote compact building design accessible to open space amenities and with a strong campus identity.



*Provide areas of sun and shade for users*



*Provide seating and interesting vantage points within open space*



*Using open space as a foreground to a magnificent view*



*Open space includes sensitive features such as creeks*



*Students relax and study on a campus lawn*



*Open space can be enhanced with plazas where appropriate*

10. All lands within areas required to be maintained as open space shall be protected by a permanent conservation easement, prohibiting further development.
11. Lands to be preserved as open space should include wetlands, floodways, soils unsuitable for development, mature woodlands, significant wildlife habitat, historic archaeological and cultural features.
12. Create additional open grassed areas where possible, to provide an enjoyable place for relaxation and recreation.

## DG 2.6 | ARCHITECTURAL CHARACTER

While Appalachian State does not have a single consistent vocabulary of architecture on campus, there are a number of key elements and details found in many of the newer buildings on campus. In order for new buildings or additions to be integrated into the fabric of the campus, it is important for the Designer to be aware of such building attributes.

The architectural style on campus has been defined by the University as “American Gothic”. The intent of the guidelines is to loosely define the elements of a building in order to maintain a consistent vocabulary for each new project on campus.

### Guidelines

#### 2.6.1 Building Form & Massing *Building form and scale should be of human proportion.*

The massing of buildings on campus are generally four or five stories in height. This excludes some of the residence halls which require taller buildings to increase the density of occupants over a smaller footprint. The interface of interior and exterior space through the use of covered entries, arcades or courtyards should be considered in the initial form of the building. In addition, the massing should respond to the size of the adjacent context as well as the functional requirements of the program.



Some design elements to consider in designing proportionately scaled buildings include:

1. Recessed entries at ground level
2. Alter exterior walls in depth and dimension
3. Introduce a base or plinth to the lower level of the building
4. Vary the heights of the building to create distinct or separate massing
5. Articulate the building facade with humanly proportioned windows or openings



*Massing at Student Rec Center*



*Entrance at Plemmons Student  
University College of Education Rendering*



*Limited materials on Belk Library  
facade*



Entrance at Living Learning Center



Entrance at Plemmons Student Union



Colonnaded at Belk Library

### 2.6.2 Facades *Each building facade should be articulated in a simple consistent manner.*

1. Windows or openings should be spaced at regular intervals to create a horizontal pattern along the facade. This may vary depending on the function and scale of the structure.
2. The Designer should carefully consider the relationship between roof forms and massing when developing the design for the elevations of the building. Structural expression at the exterior may be included but should be incorporated in a thoughtful manner.
3. In general, design elements of the facade should appear to become “lighter” in the order from bottom to top of building (heavier base: lighter top).
4. The use of more than three (3) primary building materials is discouraged.
5. Accent details of precast or stone should be included to add design interest.

### 2.6.3 Entrances *Placing the main entrance is perhaps the single most important step the Designer takes during the evolution of a building plan.*

1. Placement of the main entrance should face primary pedestrian routes. The main entrance must be a bold, visible shape which is a significant feature of the design for the facility.
2. All entries must be easily identifiable and visually impressive for those entering the building. Covered entrances are preferred by the University to protect students, staff, faculty and visitors from snow or inclement weather upon entering the building.
3. Primary and secondary entries should be connected internally with a direct route to allow pedestrian passageway from building to building on campus.

### 2.6.4 Roofs *Special attention should be given by the Designer to the roof forms.*

1. Roof forms should be designed carefully with other massing elements of the building. Typical to American Gothic architecture, multiple gabled roof configurations are encouraged to be included in the design.
2. Flat roofs should be kept to a minimum and only used as a secondary roof form. When possible, mechanical equipment should not be located on the roof. In addition, penetrations of any roof system should be kept to a minimum.
3. Roof access must be as safe as possible. Ladders inside closets are not acceptable. Consideration should also be given for the need to access to multiple roof levels. Public access to any roof area is not acceptable.

**2.6.5 Fenestration** *Windows and doors located in exterior walls should be recessed to create shade and shadow along the building facade.*

1. Openings are another means for providing an appropriate human scale to the exterior appearance of a structure. Appropriately sized individual windows or openings, treated as penetrations of the wall surface, are preferred to large expanses of glass.
2. Larger openings may be used to express principle entries, gateways or as vertical separation of massing along a building facade.
3. Orientation and solar gain of openings should be a priority for the design of the exterior.
4. Appropriate overhangs or screening devices should be considered.
5. Operable windows with clear (Low-E) glass is recommended to be used where feasible.

**2.6.6 Arcades** *Arcades, archways or colonnades may be incorporated into the design of the exterior.*

1. These elements may freestanding or integrated into the building facade.
2. The height to length ratio should be expressed proportionate to human scale.



*Fenestration at Central Dining Hall*



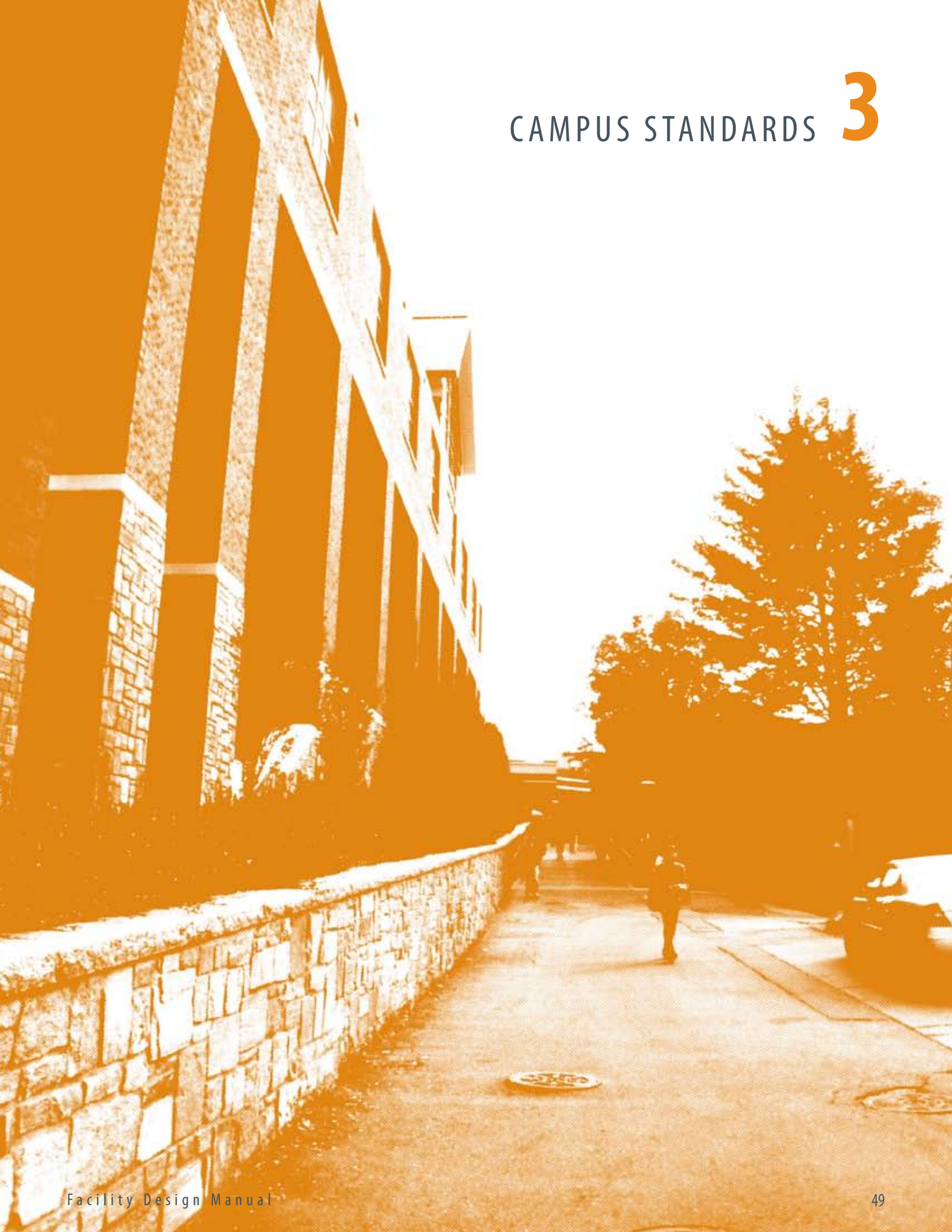
*Archway at the Living Learning Center*



*Overhang at the Bookstore*



# CAMPUS STANDARDS 3



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## GENERAL INFORMATION

### Energy Conservation

All projects constructed on University property shall comply with the energy performance requirements as outlined by the North Carolina Department of Administration, State Construction Office. Life cycle cost benefit and energy consumption analyses shall be provided, if required, for all new and renovation projects.

The Designer is encouraged to consider the utilization of passive solar energy techniques, non-conventional and renewable energy sources.

### Materials Conservation

The University is dedicated to the principle of conserving materials. In addition to basic conservation requirements, the Designer should consider the utilization recycled materials content of specified materials and non-conventional materials. Salvage of scrap materials shall be pursued to the maximum extent practical, especially with regard to scrap metals and lumber.

### Accessibility

It is the policy of the University to make all areas of the campus, and all buildings located within the campus, physically accessible to all students, faculty and staff, regardless of individual limitations which may effect mobility. Accessibility should relate to universal design principles when the approach involves “direct access”.

### Flexibility

Flexibility in the arrangement and use of a building is a fundamental requirement. In addition, the ability to accommodate growth and change should be a principle criteria in the selection of materials, and in the design of the structural, mechanical and electrical systems.

### Maintainability

Designers are required to consider long term durability and maintainability when designing and specifying equipment, materials and finishes. First cost should not be the over-riding consideration.

### Replacement of Equipment

All equipment must be accessible to service personnel without causing disruption to campus activities. Equipment rooms should be of ample size for maintenance, repair and easy removal of equipment. Equipment must be located so that service personnel can easily gain access; permanent ladders and platforms must be provided as required.

### Local Products

When it is possible, and where it is consistent with the desired quality and cost of the project, materials and equipment manufactured or distributed by local vendors should be incorporated into the design of the project.

### Standard Stock Items

Designers are directed and required to base their designs upon standard stock items whenever possible. Do not use end of run or items being taken out of stock. Where custom-built items are required, the Designer shall clearly indicate this information on the contract documents.

## CS 3.1 | GENERAL REQUIREMENTS

- Standard Materials & Equipment
- Alternates
- Temporary Facilities
- Temporary Tree Protection
- Cutting and Patching Pavement
- Site Limits



### Standards

1. **Standard Materials & Equipment:** Unless otherwise noted or as directed by Office of Design & Construction, all materials and equipment specified on University projects shall comply with the standards set forth by the State Construction Manual.
2. **Temporary Facilities:** Each Contractor, shall install, operate, protect and maintain temporary services. Where permanent utilities are available and can be tapped, the University may decide to allow use of these rather than having additional temporary services installed.
  - Temporary steam service will be provided to the Contractor only after an application for service has been filed with the ASU Physical Plant.
  - Temporary water service will be provided by connecting to the university water system. The Contractor shall contact the ASU Water Plant and Physical Plant to coordinate installation of the service.
  - Temporary electric service should be requested through the New River Light & Power Company.
3. **Temporary Tree Protection:** Prior to the start of construction any existing trees within the proposed construction site are to be evaluated by the ASU Physical Plant Landscape Services to determine the location of a safety barrier fence around the root zone of the trees. At no time is the area directly under the drip line of the tree to be used for storage or disturbed by machinery. Barrier fencing shall be installed on a radius of at least eighteen inches (18") for each inch of trunk diameter [12 inch trunk diameter = 18 feet tree protection zone radius].
4. **Cutting and Patching Pavement:** Where any paving is cut for placing new utility lines, the asphalt shall be neatly cut and removed with an asphalt cutter. Breaking the asphalt out with a backhoe or other means will not be acceptable. Boards or other suitable material shall be placed under the backhoe out-rigging to prevent damage to the asphalt.
  - In parking lots, pavement shall be replaced with a minimum of six inches (6") of course aggregate base course, followed by a minimum of three inches (3") of Type I-2 asphalt.
  - On streets and on parking lot travel lanes which experience frequent transit



bus traffic pavement shall be replaced with a minimum of five inches (5") of Type HB asphalt base, two inches (2") of Type H binder, and two inches (2") of Type I-2 asphalt surface course.

5. **Site Limits:** The limits of the construction site are to be established by the Designer in coordination with the University. These limits shall be shown on the construction drawings. The location of site fences, staging and parking, if required by the project, shall also be shown.
  - The construction area shall be enclosed with a six feet (6') chain link type fence with top rail.
  - Drawings shall also specify the area to be used for material storage during construction.

## CS 3.2 | EXISTING CONDITIONS

- Structure Removal
- Relocated Equipment
- Blasting



### Standards

1. **Structure Removal:** In open areas, foundations of structures shall be removed entirely. Where new structures will replace existing structures, indicate extent of foundation removal on the drawings.
2. **Relocated Equipment:** Special concern shall be taken with equipment to be reused. Establish schedule for removal and reinstallation through the University. Relocation of existing equipment shall include: Disconnection and Moving, Restoration and capping of utilities. Recording existing piping arrangements to facilitate reinstallation, and replacing utilities/extensions required to complete reinstallation.
3. **Blasting** is strongly discouraged. If blasting is authorized by the University, a blasting plan and schedule must be submitted by the contractor to the designer's geotechnical engineer for approval. Blasting plan will include at a minimum: seismograph monitoring locations, dust, traffic, and noise control contingencies. Contractor is responsible to document conditions of adjacent structures when collateral damage is possible. Contractor is responsible for collateral damage to existing conditions.



## CS 3.3 | CONCRETE

- Foundation Systems
- Walks, Ramps and Traffic Areas
- Sidewalks
- Dumpster Pads
- Recycle Container Pads
- Exterior Walls
- Interior Floors
- Walls, Columns and Ceilings

### Standards

1. **Foundation Systems** shall be designed to comply with the recommendations of a geotechnical engineer and/or licensed structural engineer. Driven steel pilings are not recommended.
2. **Walks, Ramps and Traffic Areas:** All exterior concrete ramps, walks, loading docks, aprons, and other such surfaces subject to wetting shall be finished with a non-slip broom finish. See Section CS 3.32 for additional information.
3. **Sidewalks** constructed with concrete will be a minimum of six inches (6") deep with a six inch (6") gravel base on compacted earth. Brick paver sidewalks are the standard for typical campus sidewalks. See Section CS 3.4 for brick paver requirements.
  - Pervious Concrete Mix for sidewalks and other paving conditions may be substituted as a slab or under-slab installation. The Designer should consult the University Project Manager for standard applications.
4. **Dumpster Pads** shall be constructed of a ten feet (10") wide by eighteen feet (18') long concrete pad with minimum reinforcing of 6 x 6 - 10/10 WWF for each refuse container. The pad shall be a minimum of six inches (6") deep with a six inch (6") gravel base on compacted earth.

If a loading dock is provided, the container pad shall be located at the dock. There shall be no bumpers on the dock at the pad location. A stop six inches (6") from the rear of the pad shall be provided for each dumpster, consisting of three (3) pipe bollards filled with concrete.

The bollards shall be finished with one (1) coat exterior metal primer, and two (2) coats exterior bronze "synthetic enamel". The bollards shall be six feet six inches (6'-6") in total length with three feet (3') set in concrete. If the bollards cannot be used, then a reinforced concrete stop shall be poured in place at the same location. This poured stop shall be six inches (6") deep by seven inches (7") high.

A clearance of seventeen feet (17') shall be provided above all dumpster pads for handling of refuse container by the trash truck. Refuse container shall be so positioned that it cannot be easily blocked. Turn-around space for the servicing truck shall be provided.

5. **Recycle Container Pads** shall be provided for recycle containers. This pad shall be located as near the refuse container pad and should be easily accessible. Slab construction shall be similar to dumpster pads. Overall size will vary depending on number of containers.
6. **Exterior Walls** should have drainage in the form of gravel and leech drain pipes properly pitched in the direction of flow.
7. **Interior Floors** constructed with concrete shall be level, without trowel marks, dirt, rust stains, and especially oil based paints (stains) or oil or grease spots. Floors shall be finished with an approved penetrating seal and hardener for concrete. Concrete floors not covered with a flooring material shall receive one smooth coat of membrane seal.
8. **Walls, Columns and Ceilings:** All exposed surfaces of concrete walls, columns, ceilings, and parapets shall be hand cleaned and rubbed to remove stains, foreign matter, burrs, fins, and any other surface irregularities after removal of form ties and after any repairs and patching work has been completed. Exposed surfaces shall be left true to line and plane, and free from form marks and other imperfections. Cosmetic coatings used to disguise underlying defects are not acceptable.

General Concrete Notes:

- Concrete floors with floor drains shall be sloped uniformly to the floor drain. The surface shall be tested at the earliest practical time to assure that water will flow to the drain.
- Roof decks for any built up roofing system must be standard weight concrete.
- All exterior concrete shall be designed with a minimum of 3000 PSI strength in 28 days, with fiber and six to eight percent (6-8%) entrained air. A maximum water to cement ratio shall be 0.45.
- All concrete should have wire or steel rods or both as a reinforcement properly suspended in the pour. All steel rods should be tied, with an overlap of one foot (1') in all linear runs and at intersections.





*Brick & precast*



*Stone wall*



*Brick pavers*

## CS 3.4 | MASONRY

- Unit Masonry
- Brick Pavers
- Precast or Natural Stone
- Mortar

### Standards

1. **Unit Masonry:** In most exterior conditions, face brick shall be “Old Guilford” manufactured by the Hanson Brick company. Alternate colors of brick and coursing patterns are acceptable but must be approved by Office of Design & Construction.



2. **Brick Pavers** shall be ten centimeter (10 cm) interlocking pavers, color “Harvest Blend”, traffic bearing, and constructed on a concrete base over compacted earth. Top dress brick pavers with carpenters sand. Pervious concrete mixtures for the base should be considered for most applications.



3. **Precast or Natural Stone** is recommended to be integrated into the design of the exterior for copings, stools and accents. Precast finishes should be selected from a range of natural colors.
4. **Mortar** colors shall be compatible with the color of brick, stone or precast concrete. It is recommended the Designer select from a range of natural colors.

#### General Masonry Notes:

- “Oversize” brick and brick in unusual colors is not appropriate.
- Glass block is not an approved material for exterior use on any facility on campus.

## DG 3.5 | METALS

- Structures
- Column Base Plates
- Lintels
- Exterior Ferrous Metals
- Shop Primer
- Exterior Railings
- Expansion Joint Covers

### Standards

1. **Structures** shall be designed with due regard for vibration, deflection, and avoidance of ponding. Consider expansion and contraction into account in the design and detailing.
2. **Column Base Plates** should be designed for ease of installation. Consider using anchor bolts with double nuts and one and one-half inch (1 ½") space to grout after leveling.
3. **Lintels** shall be hot-dip galvanized after fabrication.
4. **Exterior Ferrous Metals** shall be hot-dip galvanized after fabrication. Field welds shall be ground and have cold galvanizing applied.
5. **Shop Primer** for ferrous metal shall be manufacturer's or fabricator's standard, fast-curing, lead-free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats.
6. **Exterior Railings** including hand rails and guard rails shall be welded aluminum or steel; shop primed and powder-coated paint.  
  
Hand rail pockets, sleeves, or anchor plates shall be designed to shed water and prevent corrosion.
7. **Expansion Joint Covers** on interior floors shall be of color and texture that matches adjacent carpet or floor covering. Aluminum covered joints shall be avoided.

#### General Metals Notes:

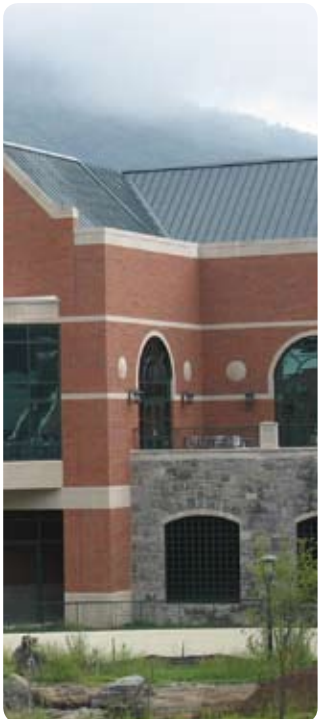
- Structural steel shall be stored in a manner that will prevent damage from falling objects and soiling from mud, concrete and debris.
- Handrails, stairs, and other items incorporated into the work in the early stages of construction shall be properly protected from weather, falling mortar, concrete, debris, water and other abuses.



*Metal hand railing*



*Metal guard railing*



*Metal roofing at Rivers Street Cafe*

## CS 3.7 | THERMAL AND MOISTURE PROTECTION

- Membrane Waterproofing
- Metal Roofing
- Snow Guards
- TPO Roofing
- EPDM Roofing
- Built-up Roofing
- Vapor Barriers
- Walkway Pads
- Downspouts

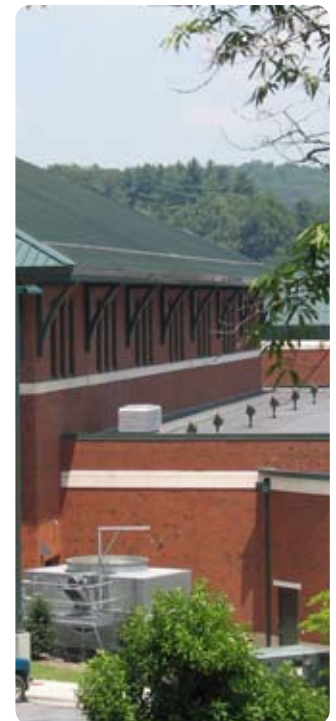
### Standards

1. **Membrane Waterproofing** shall be provided at the following locations:
  - All exterior walls below grade that enclose rooms and spaces.
  - Walls at below grade elevator pits.
  - Elevated toilet rooms, housekeeping closets and all floors containing floor drains.
  - Floors of all mechanical rooms above other areas.
2. **Metal Roofing** shall be required on all sloped roofs and should be a standing seam, twenty-four (24) gauge, metal roof system.  
  
 “Hartford Green” is the preferred color.  
  
 Install three inch (3”) stainless steel eyebolts or U-bar every twenty feet (20’) on or near the ridge line to meet OSHA’s standards for roof maintenance.
3. **Snow Guards** shall be required on all sloped roof structures along areas accessible to pedestrians below or where roofs or property can be damaged below.  
  
 Snow guards should be specified as the bar or pipe style application, mounted to the standing seam of the metal roof. Individual pad style guards are not acceptable.
4. **TPO Roofing** is the preferred system for low slope roofs. This system provides a heat-reflective and energy efficient roofing systems, which can help reduce cooling requirements. This single-ply roofing membrane also provides exceptional resistance to ultraviolet, ozone and chemical exposure.  
  
 The Designer should work with Office of Design & Construction for selection of the appropriate system, depending on the application. Colors are available in white, gray and tan.
5. **EPDM Roofing** systems are preferred to built-up systems. Single ply membrane should extend completely over parapet walls where feasible. Single ply systems shall be a minimum of sixty (60) mil thick.

6. **Built-Up Roofing** is the least desirable of roof systems. If a built-up system is used, design and construction shall be in accordance with the “Roofing Design Criteria” from the State Construction Office.
7. **Vapor Barriers** are required on all roofs, new or replacement.
8. **Walkways Pads** (prefabricated) from roof access to, and around, roof-mounted equipment shall be required for maintenance access.
9. **Downspouts** shall be sealed at the bottom with a cast iron boot and have a slip joint on the lower 10’ section to allow removal from the boot for cleaning. Screens shall protect the tops of all downspouts.
  - Downspouts or roof leader connections to the underground piping shall have a clean out located below the boot for the underground portion of the drain pipe. The underground pipe shall equal or exceed the capacity of all downspouts entering it. The clean out shall have a bolted or screw -on cover plate.

General Roofing Notes:

- Roof design will comply with the current version of “Roofing Design Criteria” from the North Carolina State Construction Office.
- Large, expansive areas of flat roofs are not acceptable and should be kept to a minimum.
- Multiple gabled roof configurations are recommended depending on the size and scale of the project.
- Avoid locating HVAC equipment or other equipment on a building roof if possible. If equipment is required on the roof, it shall be screened completely from ground view.



*Sloped and flat roof at Student Rec Center*



*Windows at Rivers Street Cafe*

## CS 3.8 | OPENINGS

- Interior Doors
- Exterior Doors
- Fire Rated Doors
- Aluminum-Framed Entrances and Storefronts
- Windows
- Door Hardware
- Automatic Door Operators
- Louvers and Vents

### Standards

1. **Interior Doors**, except in special situations, typical doors shall have a minimum width of three feet (3'-0") and a standard height of seven feet (7'-0").
  - Non-fire rated doors shall be solid-core wood doors similar and equal to Weyerhaeuser, Code DSC-1. Particle core doors are not acceptable.
  - Double doors should generally not be used because of the problems involved in securing these doors. Where double doors are required, a key-removable mullion with Von Duprin hardware will be used.
2. **Exterior Doors** shall have a minimum width of three feet (3'-0") and a standard height of seven feet (7'-0") to eight feet (8'-0"). Doors leading from the outside to vending equipment shall have a minimum door opening of three feet six inches (3'-6") wide.
  - Exterior doors shall have a maximum opening angle of one hundred twenty (120) degrees.
  - Entrance doors are to close against a full length jamb at the strike. Double doors are to have a center post mullion. Doors in gang sets are preferred and should swing in parallel to each other.
  - All exterior doors and jambs shall be hollow metal (steel) or an aluminum and glass (storefront system).
  - Due to high wind conditions, all exterior doors (unless an automatic entrance) shall require a lever handle and must latch.
  - Entrances to a building should never be designed as part of the smoke evacuation system.
  - An air lock or vestibule shall be provided at each entrance to the building for energy conservation purposes and to improve thermal comfort.
3. **Fire Rated Doors** shall be solid wood stave core doors similar and equal to Weyerhaeuser.
  - Doors which open to corridors and which contain glass, shall use either

one-quarter inch (1/4") UL fire-rated tempered glass or one-quarter inch (1/4") wire glass set in rated metal frames with wire strands running diagonally. Glass shall not exceed one hundred (100) square inches per door.

- Corridor and stairway doors, which are required to be fire doors or smoke doors, may be equipped with magnetic hold open devices connected to the fire alarm system.
4. **Aluminum-Framed Entrances and Storefronts** shall have wide stile with eight inch (8") mid-rail stile doors. Narrow stile doors are not acceptable. Aluminum entrances shall be a .125-inch wall-thickness, aluminum enclosed-tube frame with screw-applied door stops. Continuous hinges are to be used unless otherwise approved by Office of Design & Construction.
  5. **Curtain Wall Systems** are acceptable for design on larger scale projects. Parameters relating to solar gain should be considered. The Designer should include specifications for testing air and water infiltration of the system.
  6. **Windows** requirements are as follows:
    - Exterior window frames shall have baked-on enamel paint finish. Color is to match the University standard.
    - Operable window are preferred and should be included in habitable spaces where possible.
    - The orientation and solar gain potential of windows is always an important consideration. Installation of mirror or highly reflective glass is not encouraged.
    - Recessed window openings which emphasize depth and shadow lines are recommended. A minimum depth of two inches (2") is recommended from face of the exterior wall to face of window frame.
    - Window sections shall be so constructed as to enable outside glass surfaces to be cleaned from inside the building (in-swing, removable, or pivoted) except for those which can be reached from the ground and that are no higher than forty feet (40') above grade.
    - Window sections shall be equipped with concealed locks and removable keys. For certain buildings, fire department access and emergency escape windows are required to be operable from within, without the use of a special key. All keys shall be turned over to Physical Plant with a minimum of one key per each thirty (30) windows, or two (2) per floor, whichever is greater.
    - Glass areas shall be double-glazed with vacuum seal and shall be one-quarter inch (1/4") minimum, clear, polished glass.
    - Bathroom windows located on an exterior wall shall have obscure glass interior pane.
    - Windows that cannot be reached from the ground will have eye-bolts



*Windows at Belk Library*



anchored in the roof above the windows in accordance with the American National Standard Institute (ANSI) publication I-14.1 Window Cleaning Safety Standard.

- Ledges and openings which can become bird roosts shall be eliminated or bird roosting prevented by sheet metal installed at a forty-five (45) degree angle, by non-rusting wire or by other suitable means.

7. **Door Hardware** within each type of device, Hinges, Exit Devices, Locksets, and Closers shall be furnished totally by one manufacturer unless schedule indicates otherwise. Without exception doors shall be equipped with one of the following hardware selections: Sargent Series / Von Duprin Series / American Device

Finish shall match existing hardware in renovation projects, US26D (Satin Chrome) finish shall be used on all hardware since these are standard stock items. Other finishes (US3, US4, US10, US26) are special order items with long delivery times, and are generally discouraged.

Locksets (except Residence Halls) shall be mortise design Sargent 8200 Series Steel Case mortise lock. Cylinder shall be from Sargent.

- Cylinders for Residence Halls shall be Standard Sargent Key Cylinders.

Interior Door Closers shall be Medeco KeyMark 4 . Closer shall be heavy duty and have adjustments for back check, closing speed, latching speed, and delayed action cycle. Bracket type shall be specified.

Exterior Door Closers shall be Sargent series 281. Closer shall be heavy duty and have adjustments for back check, closing speed, latching speed, delayed action cycle and spring power adjustments. Rixson floor mounted, Model No. 27, with Q-series pivots, are acceptable for exterior doors only, with the approval of Office of Design & Construction. Cold Weather Fluid (CWF) shall be used in all exterior door closers.

Labeled Doors Closers shall be Sargent series 281 non-hold open type. Non-labeled doors shall have Sargent series 1431 and hold open feature at maximum degree of swing.

Magnetic Hold Open Devices for fire doors shall be provided at stairways and corridors.

Kickplates shall be US18 gauge 18-8 type, 302 stainless steel, satin finish. Size shall be eight inches (8") high by two inches (2") less than door width.

Hinges for aluminum storefront doors use: Continuous Gear Hinge, Select (SL-11HD) for non-electric doors. Continuous Gear Hinge, Select (SL-11HD) prepped for a Von Duprin Transfer Bar (EPT-2 Transfer Bar x SP28 Finish) for electric doors.

- Interior and corridor doors shall have heavy weight, premium quality ball bearing hinges. All interior and corridor doors wider than three feet (3'-0") shall have four (4) ball bearing hinges.

- Continuous hinges for fire doors shall be stainless steel.

Panic Hardware shall be provided for all doors serving fifty (50) or more persons. Exterior door panic hardware shall be Von Duprin 99 series. Center the bar on door 37" above the floor. Where possible, the bar shall be equipped with cylinder dogging in lieu of allen-wrench dogging.

- Interior door panic hardware shall be Von Duprin 99 series.
- Stairway and corridor doors shall be UL listed 99L-F series.

Thresholds for all exterior conditions shall be stainless steel. Due to the use of salt and the extreme weather conditions, aluminum thresholds and pivots are not acceptable for exterior applications.

Exterior Door Stops for all exterior conditions shall be stainless steel.

Sound Gaskets are required on mechanical room door off public corridors.

#### General Hardware Notes:

- Closers shall be mounted on the door rather than on the frame. Closers mounted on storefront systems require reinforcement at the frame and doors to be specified.
- Entrance doors shall require a conduit and cable from door strike and stub up to ceiling plenum for electronic card security system at each public entrance door group.
- Card Reader access should be provided at two (2) entrances when possible. If there is an entry vestibule, the card reader shall be placed inside the vestibule and control the second inside set of doors. This will provide additional protection from severe weather conditions.
- Overhead stops are preferred. Hold-open or select hold-open features on overhead stops are not desirable except where required for the function of the building.
- Stair doors leading to roofs are to be secured. Doors shall be equipped with closers, double cylinder dead bolt locks and a self locking lockset.
- Stair doors to the outside of the building shall have panic devices (as required by code). Doors shall be equipped with an overhead stop and a closer which is not exposed to the weather.
- Stair doors to the inside of the building shall have closers, latches and stops. Latches shall be activated by panic devices equipped with a thumb piece or lever handle function on the stair side of the door.
- All access doors to roof shall be lockable and keyed to the University mechanical equipment room key.





8. **Automatic Door Operators** shall be provided at all handicapped accessible entrances. Operators shall be completely protected from the weather. The housing for the push button shall have a weatherproof seal to prevent water from entering to prevent freezing during cold weather.

- Acceptable manufacturers for operators include Beason.

## CS 3.9 | FINISHES

- Gypsum Board
- Acoustical Tile Ceilings
- Tile Carpeting
- Sheet Carpeting
- Flooring
- Access Flooring
- Painting
- Color Coding & Identification
- Wall Coverings



### Standards

1. **Gypsum Board:** Any room that is subject to a high moisture content such as bathrooms and showers shall use waterproof gypsum board. Any rooms subject to high humidity such as mechanical rooms and locker rooms shall use water-resistant gypsum board for walls and ceilings.  
  
Areas subject to abuse (such as public corridors, loading docks, residence halls) shall use abuse-resistant gypsum wallboard.
2. **Acoustical Tile Ceilings** shall be exposed grid, lay-in system. Acoustical tiles shall be Armstrong Tundra, medium texture, two foot square (2'x2') lay-in tiles composed of non-combustible materials.
  - Class A "Fire Rated" materials shall be specified to complete a UL fire rated ceiling system for fire protection of structural components.
  - Extra boxes of ceiling tile and grid shall be furnished for future maintenance, consisting of not less than 5% for each type and size installed, but not less than one full box. Ceiling tile shall be of a standard type and size.
3. **Tile Carpeting** with a hard composition backing, but not containing PVC, is preferred for public spaces where floor access is desirable and for ease of repair. A mixed pattern with high soil and stain hiding capabilities is preferred.
4. **Sheet Carpeting**, if installed, should be selected based on durability. A mixed pattern with high soil and stain hiding capabilities is preferred.

#### Carpet Specification Requirements:

- Needle punch construction
- 100% Solution Dyed
- Polypropylene fiber
- Minimum 28 ounce face weight
- Natural and synthetic composite rubber backing
- Seams sealed against water penetration into adhesive
- Stain resistant against red dye, ink, coffee, mustard
- Manufactured with recycled content materials
- Purchased from a company that will recycle the carpet when time to replace



- Resistant to chemical damage from Bleach, Sodium Chloride, and Sodium Magnesium Acetate (Ice Melt).

General Carpet Notes:

- All carpet shall be selected from the North Carolina QPL (Qualified Products List) established by the State Purchasing Department.
- Light colors such as white, yellow or gold, and solid colors which immediately show all traffic pattern and any stain, must be avoided.
- All newly carpeted areas shall be appropriately covered with plastic or brown paper to protect the carpet from construction debris. Carpet shall be in clean, like new condition when turned over to the University.

5. **Flooring:** The following materials are preferred at the locations indicated:

- High traffic areas such as lobbies and corridors - terrazzo or non-slip porcelain tile.
- General purpose rooms - vinyl tile
- Offices, Conference Rooms, Auditorium aisles (with permanent seating), Lounges, Music or Language Listening Rooms - carpet
- Bathrooms and showers - ceramic tile
- Food service areas - quarry tile or anti-bacterial cement
- Laboratories - monolithic systems with no seams or cracks
- Mechanical, Storage, and Custodial - sealed concrete with steel trowel finish
- Computer Rooms - raised, removable panels supported on interconnecting grids and pedestals providing an under-floor plenum for air distribution and utilities
- Stairways - premium grade rubber treads and risers with vinyl tile landings

6. **Access Flooring** shall consist of twenty-four inch (24") square steel encapsulated wood core panels that are removable, interchangeable, and provide easy access to the plenum area beneath the floor panels.

The system shall be raised above the sub floor to a height sufficient to allow wiring, bus duct, and adequate air flow to all air outlets. The under structure system shall be supported in such a way as to provide a floor that is rigid, level and free of vibration.

The system shall have electrical continuity between the top of the floor panels and the base plates. The system shall a class 1-A fire rating when tested in accordance with ASTM-84-79.

The system shall have available accessories as follows: Cable cut outs with

grommets, ramps, steps, hand rails, fascia molding, plenum dividers, cove base, perforated air flow panels with adjustable air flow dampers and panel lifting devices.

7. **Painting:** All surfaces shall be prepared for painting by thoroughly filling, sanding, scraping, brushing or chemical cleaning following industry accepted standards and manufacturer's recommendations.

Exterior and interior paint shall be a top quality paint with maximum life and minimum shrinkage specifications. Acceptable manufacturers include Duron, Kyanize, Devoe, Pittsburg, Sherwin-Williams, Glidden, Benjamin Moore or any others approved by the Designer. Only first line premium paints shall be acceptable.

#### Exterior Painting Schedule:

|                        |   |
|------------------------|---|
| Ferrous Metal          |   |
| One (1) coat           | Rust Penetrating Metal Primer   |
| Two (2) coats          | Alkyd Enamel  |
| Galvanized Metal       |   |
| One (1) coat           | Galvanized Metal Primer   |
| Two (2) coats          | Acrylic Latex Flat  |
| Concrete Masonry Units |   |
| One (1) coat           | Block Filler Coat   |
| Two (2) coats          | Acrylic Masonry Coating   |
| Exterior Wood          |   |
| One (1) coat           | Vinyl Latex Primer  |
| Two (2) coats          | Latex Satin   |
| Exterior Handrail      |   |
| Two (2) coats          | Duron Alkyd Gloss Enamel, Woodland Green mix BY L24 <u>or</u><br>Powder Coat (color to match) |
| Exterior Stucco        |   |
| Two (2) coats          | Bondex Waterproof   |

#### Interior Painting Schedule:

|  |                               |
|--|-------------------------------|
| Concrete Masonry Units   |                               |
| One (1) coat   | Latex Masonry Block Filler    |
| Two (2) coats  | Semi-Gloss Alkyd Enamel       |
| Ferrous Metal Work   |                               |
| One (1) Coat   | Rust Penetrating Metal Primer |
| Two (2) coats  | Semi-Gloss Alkyd Enamel       |
| Gypsum Wallboard (Ceilings)                                      |                               |
| Spot prime all cemented and taped joints with Latex Vinyl Primer |                               |
| One (1) coat   | Latex Vinyl Primer            |
| Two (2) coats  | Latex Flat                    |





#### Wood Veneer Doors (Natural Finish)

Prior to application of stain thoroughly wash all faces of doors with mineral spirits or alcohol.

|               |                    |
|---------------|--------------------|
| One (1) coat  | Wood Sealer        |
| One (1) coat  | Gloss Spar Varnish |
| Two (2) coats | Satin Varnish      |

#### Wood Veneer Doors (Satin Finish)

Prior to application of stain thoroughly wash all faces of doors with mineral spirits or alcohol. Stain as selected

|               |                    |
|---------------|--------------------|
| One (1) coat  | Gloss Spar Varnish |
| Two (2) coats | Satin Varnish      |

#### Wood (Natural Finish)

|               |                    |
|---------------|--------------------|
| One (1) coat  | Wood Sealer        |
| One (1) coat  | Gloss Spar Varnish |
| Two (2) coats | Satin Varnish      |

#### Wood (Stain Finish)

Stain as selected

|               |                    |
|---------------|--------------------|
| One (1) coat  | Gloss Spar Varnish |
| Two (2) coats | Satin Varnish      |

#### Wood (Painted)

|               |                         |
|---------------|-------------------------|
| One (1) coat  | Enamel Undercoat        |
| Two (2) coats | Alkyd Semi-Gloss Enamel |

#### Epoxy Finish on Masonry

|               |                     |
|---------------|---------------------|
| One (1) coat  | Block Filler        |
| Two (2) coats | Epoxy Gloss Coating |

#### General Painting Notes:

- **Epoxy Paint:** In areas of extremely high traffic or potential abuse it is recommended that an epoxy paint similar and equal to Ford Paint Company "PolyCote", one part epoxy, be applied over a prime coat of recommended proportions. Washrooms not scheduled for wall tile should receive epoxy coating.
- **Elevator Pit & Equipment Rooms:** The elevator equipment room and the elevator pit floors shall be acid-etched, finished with one (1) coat thinned 50/50, and then one (1) coat of gray porch and synthetic enamel. Walls shall be sealed or primed and painted with two (2) coats of light finish alkyd semi-gloss enamel.

The hoistway equipment and the elevator pit equipment shall be painted with one coat of primer and two coats of alkyd resin, semi-gloss or gloss finish coat.

## 8. Color Coding & Identification:

- Piping systems in mechanical rooms should be completely painted with the applicable colors listed below and have appropriate self-sticking or strap-on identifications and arrows indicating direction of flow. Piping and ducts in chases above ceiling shall be color banded and have stencil markings at appropriate intervals.
- On straight runs of piping, markings should be no further than 30 feet apart; and stencil identifications, color bands, and direction arrows should be near each valve, pressure reducing valve, heat exchanger, etc. Where pipe passes through walls or floors, marking should be near the penetration on both sides. Markings should be at each directional change of all piping systems.
- The University recognizes OSHA Safety Color Designations for general safety color coding system for all items except pipe identification. Mechanical room pipe color and the color of bands are to be as follows:

| <u>System</u>                        | <u>Color</u>    | <u>ID.</u> |
|--------------------------------------|-----------------|------------|
| Condensate Return                    | Corrugate Brown | COND       |
| Steam - High Pressure (25-75 psi)    | Safety Orange   | HPS#___    |
| Steam - Low Pressure (0-25 psi)      | Safety Orange   | LPS#___    |
| Water - Chilled, Supply              | Dark Blue       | CWS        |
| Water - Chilled, Return              | Dark Blue       | CWR        |
| Water - Cold Domestic                | Safety Green    | DOM CW     |
| Water - Distilled                    | Safety Green    | DSTW       |
| Water - Condenser to Cooling Tower   | Light Gray      | CTW        |
| Water - Condenser to Condensers      | Light Gray      | CCW        |
| Water - Hot Domestic                 | Dark Yellow     | DHW        |
| Water - Hot Domestic - Recirculating | Dark Yellow     | DHWR       |
| Water - Hot - Heating                | Safety Orange   | HWS        |
| Gas                                  | Safety Yellow   | GAS        |
| Air                                  | Safety Green    | AIR        |
| Nitrogen                             | Safety Yellow   | Nitrogen   |
| Helium                               | Safety Yellow   | Helium     |
| Hydrogen                             | Safety Yellow   | Hydrogen   |
| Vacuum                               | Safety Green    | VAC        |
| Chemical                             | Safety Blue     | (labeled)  |
| Fire Protection                      | Safety Red      | (labeled)  |
| Sprinkler                            | Safety Red      | SPKR       |
| Fire Line                            | Safety Red      | FIRE       |
| Drains/Vents/Supports/Hangers        | Black           | -          |

- Pipe identification should contrast in color to the pipe colors and be easily readable. The width of color bands should be equal to the size of the stencil indicated below. For insulated or non-insulated pipe systems, stencil sizes should be sized according to the total outside diameter as follows:

For diameters up to 3/4 inch, use 3/8 inch letters.

For diameters from 3/4 inch to 1-1/4 inch use 1/2 inch letters.





For diameters from 1-1/2 inch to 2 inches, use 3/4 inch to 1 inch letters.  
 For diameters from 2-1/2 inches to 6 inches, use 1-1/4 to 3 inch letters.  
 For diameters greater than 6 inches, use 2-1/2 inch to 4 inch letters.

- At each floor level and at roof level each exhaust air duct from safety cabinets and fume hoods shall be identified by two-inch (2") wide painted black bands and lettering identifying the specific type of safety cabinet or hood. Abbreviations may be used but need to be itemized.
- Above Ceiling Controls/Equipment Marking: A colored dot shall be placed on the grid below items for easy locating, denoted on a plan drawing, and kept in a secure location such as the main mechanical room.

|        |  |
|--------|--|
| Green  | Domestic water and Chiller valves              |
| Orange | Hot water and steam valves & controls for heat |
| Red    | Fire related valves & controls                 |
| Black  | Clean-outs                                     |
| Yellow | Gas/Air valves                                 |
| Blue   | VAV Control boxes                              |
| White  | CATV Taps and Miscellaneous (label dot)        |

9. **Wall Coverings:** A patented multi-color paint that is not easily matched is not acceptable. No wallpaper shall be used and vinyl wall covering usage shall be kept to a minimum. The flame spread ratings of wall and ceiling coverings shall be in accordance with the North Carolina Building Code and with the NFPA-101-Life Safety Code.

#### General Finish Comments:

- Designers should program into the design of all projects, a designated area (storage room, accessible attic space, etc) for storage of attic stock finish items specified for the facility. This area should be accessible by representatives from the Physical Plant for repair, replacement and maintenance of building finishes. The percentage of attic stock required for each material shall be examined on a project basis and coordinated with Office of Design & Construction
- Designers should consider minimizing the number of "different" finishes specified for a building in order to limit the amount of storage space required for attic stock items.

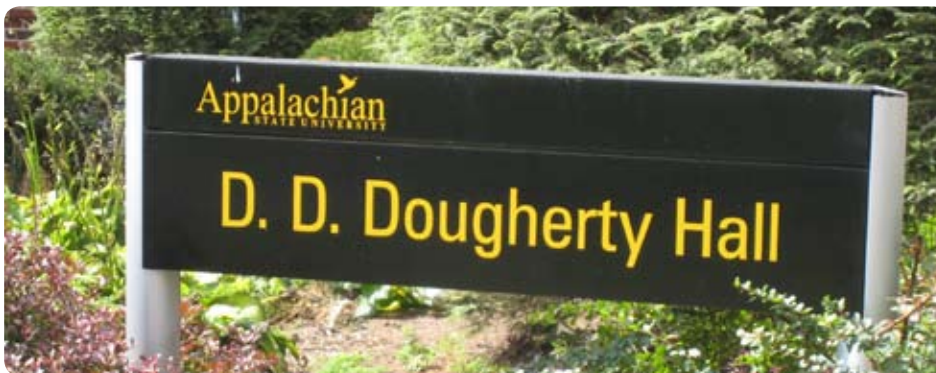
## CS 3.10 | SPECIALITIES

- Signage
- Building Plaque
- Room Numbering
- Toilet Compartments
- Toilet and Bath Accessories
- Fire Extinguishers
- Wall Protection



### Standards

1. **Signage:** The designer is responsible for incorporating into the design and graphics: room identification, directories, directional signage, exterior building identification and parking regulation signage. All should be handled in accordance with the University's campus standards. The designer is responsible for developing compatible graphics for any required applications not addressed by the signage program, such as "YOU ARE HERE" maps including emergency egress routes.
  - Exterior: All should be handled in accordance with the University's campus standard as shown below.



*Ground Mounted Building Sign*

- Building Interior: All spaces including custodial, mechanical, and closet spaces shall have assigned numbers and appropriate signage.
2. **Room Numbering:** It is desirable that the construction numbering system be retained throughout the life of the facility. Numbering systems will be coordinated with the Office of Design & Construction. The following are general guidelines for space numbering in all buildings:
    - Designers are to submit and receive written approval of the "Room Numbering Plan" from the Office of Design & Construction prior to establishing final base plans. It is desirable that the construction numbering system be retained throughout the life of the facility. The Designer therefore is to submit a numbering system no later than the Design Development Phase. Three separate numbering sequences will be used for each building; stairways, corridors and rooms. The Construction Documents for all



design disciplines shall display the approved, permanent room number assignments.

- The numbering system shall use three-digit numbers with alpha suffixes, if necessary; four-digit numbers are not acceptable. Suites can be numbered with nested letters such as 243-A, 243-B, 243-C . . .
  - Number sequence shall progress continuously in a corridor. Using odd or even numbers on either side of the corridor is neither required nor desired. Where corridor configurations make it impossible for a continuous numerical progression, the Designer shall strive to achieve a logical numerical progression.
  - The numbering system shall provide spare numbers in the sequencing, especially in areas where there are large rooms or open spaces where future renovations could sub-divide the space.
  - All spaces are to be assigned room numbers (closets, elevators, janitorial rooms, lobbies, rest rooms, stair landings, vestibules, etc.). Lobbies will not have signage.
  - The lowest floor with a primary entrance shall be assigned “100” series numbers. All other floors located below grade shall be assigned numbers with “B” prefix, (B02, B03, etc.).
3. **Toilet Compartments:** The preferred partition for toilet compartment is floor mounted, overhead braced type. Provide one (1) foot clearance from floor to partition for cleaning. Use stainless steel or plastic fiber partition material. Provide one (1) coat hooks for each stall.
  4. **Toilet and Bath Accessories** shall be provided as follows:
    - All toilet accessories shall be stainless steel with satin finish unless otherwise noted.

Framed Mirrors: One piece roll formed frame heavy gauge, stainless steel angle with satin finish. Frame shall be continuous integral stiffener on all sides for added strength. Corners shall be welded, ground and polished smooth. The mirror shall be one-quarter inch (1/4”) polished plate glass mirror, electrolytically copper plated.

Toilet Tissue Dispenser will be provided by the current vendor for the University. Provide one (1) unit per toilet stall.

Paper Towel Dispensers will be provided by the current vendor for the University. Provide one (1) dispenser per one and one half ( 1 1/2) sink in each toilet room.

Soap Dispenser will be provided the the current vendor for the University. Provide one (1) liquid soap dispenser per sink.

Trash Cans: Provide 20-32 gallon trash container with disposable trash liners.

5. **Fire Extinguishers & Cabinets:** Designers shall clearly identify locations for fire extinguishers and cabinets on the plans. Locations shall be planned with the intent to provide appropriate coverage, while having the least interference with the interior design.
  - Install 10-12 pound ABC type fire extinguishers in recessed fire extinguisher cabinets as required.
  - Install CO-2 fire extinguishers in hazardous areas and in mechanical room areas.
  - Install BC rated type fire extinguishers in cooking areas.
6. **Wall Protection:** Use corner guards fabricated of type 304 (18-8), 18 gauge stainless steel with exposed surfaces in architectural satin finish. Exposed edges and corners are rounded with adhesive strips for permanent installation. Use Bradley Corp. #BR991x48.





## CS 3.11 | EQUIPMENT

- Parking Control Equipment
- Trash Compactors
- Recycle Equipment
- Dumpster
- Vending Equipment

### Standards

1. **Parking Control Equipment** shall be provided to match the existing the campus standard equipment. See also Section CS 3.28 Gate Control System.
  - Entrance gates will have their own power supply and the opener will be provided with a contact that will open gate. The gate will close when it senses that the car has passed.
  - Exit gates will have their own power supply and a sensing device that will open the gate when a car approaches from the parking lot side and another sensing device that will close the gate once the car has passed.
  - At the gate island, provide a campus standard card reader ten to twelve feet (10-12') before the gate.
  - Provide 3/4" conduit at the gate island to run from the gate opener housing on a direct path to the control equipment. The length of the conduit should be less than one hundred feet (100').
  - Provide a 3/4" conduit from the gate opener housing to the edge of the curb for the entrance and exit gates. This conduit will be used for the sensor wire placed in the pavement so the curb will not be cut.
2. **Trash Compactors** shall have a six feet 6 inches (6'-6") by six feet 6 inches (6'-6") by six feet (6'-0") feet deep (8 yards/6.1 cubic meters) trash holder with compactor located on top, such as the VERT-I\_PACK unit by Marathon.
  - A ten feet (10'-0") wide by twelve feet (12'-0") high overhead coiling door shall be provided for truck access. Controls will be provided on the interior and exterior and should be equipped with a remote control. The control on the exterior of the building shall have a key control that can inactivate the push-buttons.
  - A ventilation fan shall be provided in the compactor area along with a hose bib and a place to store a hose, mop and broom. The floor shall slope to a twelve inch by twelve inch (12" x 12") drain with a minimum six to eight inch (6" to 8") drain pipe to the sanitary sewer system.
  - The temperature for the trash room shall be a minimum of 40 degrees F.

3. **Recycle Equipment:** Every building shall provide adequate space for recycling waste material. This space shall be exclusively for the storage of recycling equipment and recyclable material in addition to a container for general trash. Recycle closets are not recommended. The guidelines for content is as follows:

Exterior: Allocate space adjacent to exterior dumpster for an eight (8) cubic yard “cardboard only” dumpster.

Interior: Allocate space on each primary floor of the building for a grouping of five (5) recycle containers for office paper, newspaper, magazines, plastic bottles/aluminum cans and glass.

Public Sidewalks: Provide a plastic bottle/aluminum can container adjacent to general trash container (see Section CS 3.12 Site Furnishings).

#### 4. Dumpsters:



Dumpster - trash  
Baker Waste Equipment, Inc.  
8 cubic yard, notched front  
Color: Baker Green



Dumpster - cardboard recycle  
Baker Waste Equipment, Inc.  
8 cubic yard, notched front  
Color: Baker Green

5. **Vending Equipment:** If required by the building program, the Designer shall coordinate the requirements for all vending equipment with the ASU Food Services department.
- Vending machines should be located as to minimize noise transference to other areas of the facility. This may include placing machines in a room or alcove.
  - Vending machines produce heat which will damage the food products. Heat buildup in the area must be vented to the outside.





## CS 3.12 | FURNISHINGS

- Entrance Floor Mats and Frames
- Site Furnishings

### Standards

1. **Entrance Floor Mats and Frames** shall be provided inside each entrance to the building. These mats shall be of the type which is removable for cleaning and should be of exterior quality. Recesses shall be of even footage sizes to accommodate factory stocked mats.
  - Provide Cobblestone, Arrowhead, Kara Mat, or Protector heavy duty wiper/scraper 3/8" thickness pile. Constructed from fifty (50) ounces of 100% polypropylene per square yard, using a blend of heavy denier fibers double coated for superior mat performance, level loop pile or V-Loop double needed. Backing composed of a non-skid rubber, coated with a fire retardant latex for maximum safety and carry a three year wear warranty.
2. **Site Furnishings** are listed as follows:



#### Exterior Trash Receptacles

Victory Stanley, Inc., Ironsites Series

Model: SD-42 36

Description: 36 Gallon side opening with standard tapered formed lid

Color: Victor Stanley Green (typical). Note: Trash receptacles at Kidd Brewer Stadium require Victor Stanley Black



### Exterior Tables

DuMor Site Furnishings

Model: 76-44PLR

Description: 4' square, 4 seat pedestal table, 4"x4" redwood recycled plastic slats. Table can be ground mounted [S1] or surface mounted [S2].

Color: PC Green

### Exterior Benches

DuMor Site Furnishings

Model: 88-60PLR

Description: 6' bench, surface plates, recycled redwood slats. Table can be ground mounted [S1] or surface mounted [S2].

Color: PC Green



### Bike Racks

Madrax Trilary, Inc.

Model: HW238

Description: Loop heavy duty winder surface flange, powder coat finish.

Racks are available in 5 loop (7 bike), 7 loop (9 bike) and 11 loop (13 bike)

Color: Forest Green





## CS 3.14 | CONVEYING EQUIPMENT

- Elevators

### Standards

1. **Elevators** shall comply with all current state guidelines and regulations for university buildings and State-owned facilities.

The Otis Elevator Company is the current “Owner Preferred Alternate” for elevator equipment on campus.

#### Elevator Passenger Car

- Each passenger car shall be equipped with an exhaust fan (2-speed), emergency lighting supply, handrails on the wall and emergency telephone cabinet (see Section CS 3.27 Emergency Telephones). All equipment and finishes shall be vandal resistant.
- Size car and door for building equipment and furniture.
- Ceilings of the car shall not invite vandalism. Provide vandal-proof fixtures.
- Flooring shall be vinyl tile flooring for most applications.
- Walls shall be scratch-resistant laminate for heavy abuse areas and furnished with removable wall pads and hangers.
- All exposed trim shall be stainless steel.
- Braille plates and signage shall be high quality zinc die cast braille and shall meet all ADA and ANSI requirements.
- Each car shall contain a lighted floor indicator above the car door or in the return column; soffit mounting is not acceptable.
- Elevator door safety system shall protect passengers by setting up a harmless curtain of infrared beams.
- Each car control panel shall have a “keyed switch” to take the elevator out of service, keyed to the university keying system.

Elevator Fixtures & Equipment:

- Elevator Controls Modernization System shall be a microprocessor-based network with improved performance over relay-based or conventional dispatching systems. The system shall have the capability of real time management and advance information processing to analyze building traffic patterns and evaluates estimated times of arrival (ETA) based on car position and hall call assignments for each car in the building. The system shall dispatch the car with the shortest ETA so passenger wait time is minimal.
- Car Position Indicator An electrical position indicator shall be provided in the upper portion of the elevator cab. An audible signal shall sound prior to elevator arriving at or passing any landing.
- Car Riding Lantern shall be provided with a fixture mounted in the jamb, or soffit of the elevator cab entrance to notify waiting passengers by means of electrically illuminated direction arrows and audible gong as to which direction the elevator will be traveling.
- Door Hold-Open Timer shall be a modification to the elevator control circuitry combined with a solid state timer which is wired to the door open button in the elevator car.
- Corridor Hall Stations shall be surface mounted and have a modular design to allow for quick and easy installation of all components including key switches, etched instructions, and signage. Hall stations shall be made of anodized aluminum in stainless tones and mirror finished in frame.

Elevator Hoistway:

- Where the equipment is subject to loud or sudden vibrations, sound deadening material shall be provided to isolate sounds and vibrations from the supporting floor or wall.
- A hoist-way door unlocking device shall be installed at all landings. One emergency door key for each elevator shall be furnished to the Physical Plant.

Elevator Machine Rooms:

- Provide smoke detectors in all elevator machine rooms, using ionization detectors for the traction type and photoelectric detectors for the hydraulic type.
- Smoke detectors in the elevator machine room and each elevator lobby are on shall be on a separate zone.





## CS 3.21 | FIRE SUPPRESSION

- Automatic Sprinkler Systems

### Standards

1. **Automatic Sprinkler Systems** shall be provided as follows:
  - Fire protection systems shall be designed in accordance with the requirements of NFPA.
  - Fire protection systems shall comply with all current regulations for State-owned facilities.
  - Dry pipe systems shall be used anywhere that freezing conditions may occur. The minimum pipe size in a dry pipe system is one and one-quarter inch (1-1/4").
  - Ensure that factory built access doors are provided and installed for fire dampers to allow easy inspection and re-set.
  - Specify that sprinkler heads be centered in ceiling tiles.
  - Fire department connections shall be on the street side of buildings and shall be located and arranged so that hose lines can be readily and conveniently attached to the inlets.
  - Fire protection and domestic water lines should be designed with parallel lines and separate shut-off valves to each building.

## CS 3.22 | PLUMBING

- Domestic Water Piping
- Sanitary Sewer Waste & Vent Piping
- Backflow Prevention Devices
- Water Meters
- Plumbing Fixtures
- Drinking Fountains & Water Coolers



### Standards

1. **Domestic Water Piping** related items shall be provided as follows:
  - Water piping inside the building and above grade shall be type L hard drawn copper.
  - Water piping inside the building and below slab shall be type K soft annealed copper tubing with no joints below the slab. Water service shall be stubbed above floor as near the exterior wall as practical, rather than running below slab to an interior space.
  - Cold water and hot water plumbing piping is not permitted in exterior walls except to supply hose bibbs.
  - Hose bibbs shall be provided in all mechanical equipment rooms, kitchens, rooms that require wash down, and rooms with floor drains. All hose bibbs shall be provided with vacuum breakers. Frost-proof hose bibbs shall be used in the exterior walls of all buildings (the temperature in Boone may drop as low as -20 degree Fahrenheit).
2. **Sanitary Sewer Waste & Vent Piping** related items shall be provided as follows:
  - Sanitary sewer piping shall be cast iron. Joints for underground piping shall be bell and spigot with compression gaskets. Joints for piping above grade may be bell and spigot with compression gaskets or no-hub.
  - Vent piping shall be cast iron or galvanized steel except that galvanized steel shall not be used underground.
  - Drain, waste and vent piping for acid waste systems shall be of high silicon cast iron, borosilicate glass (above grade only) or polypropylene piping.
  - Roof drain leaders above grade shall be galvanized steel or cast iron piping with no-hub or bell and spigot joints with compression gaskets. All roof drain piping below grade shall be cast iron piping with bell and spigot joints with compression gaskets.
  - Undersides of roof drains, and horizontal storm water drains or roof leaders inside the building shall be insulated to prevent the formation of



condensation.

- Floor drains connected to the sanitary sewer shall be provided in all mechanical equipment rooms, custodial closets, toilet rooms and locker rooms.
- Infrequently used drains shall have traps resealed by a trap primer from clear water fixtures.
- Drain lines at exterior stairwells shall be a minimum of four inch (4") with a twelve inch (12") square drain well and grate-type cover.

#### General Piping Notes:

- All piping shall be routed as to remain clear of transformer vaults, refrigerated spaces, switch rooms, elevator shafts, or other critical areas, and vault spaces over same.
  - No piping except soil, waste or drain piping shall be installed in or below concrete slabs on grade.
  - All main piping shall have accessible shut-off valves for isolation purposes. All branch piping from main shall have shut-off valves.
3. **Back-Flow Prevention Devices** shall be installed in all buildings, sprinklers systems, and make-up water lines in accordance with the EPA Safe Water Act. They shall be installed in the mechanical rooms where they are accessible for testing and maintenance. Tank-type vehicles filling from the ASU water supply shall have back-flow prevention devices.
  4. **Water Meters** shall be installed for all buildings in accordance with the State of North Carolina and the Town of Boone regulations. Water meters shall be touch-read, have a 1000 gallon multiplier and be easily accessible for reading and maintenance.
  5. **Grease Traps** shall be installed in accordance with state and local regulation for food service facilities. Floor drains serving food service areas are required to flow into a grease trap.
  6. **Plumbing Fixtures** shall be designed to reduce water consumption. Designers should consider the following when specifying fixtures:
    - Automated controls in public spaces
    - Low flow toilets with a siphon jet
    - Dual flush water closets
    - Waterless urinals
    - Low flow faucets and shower heads
    - Energy Star rated fixtures and appliances
  7. **Drinking Fountains & Water Coolers** shall be wall hung, semi-recessed type and suitable for the handicapped.

## CS 3.23 | HEAT VENTILATION AND AIR CONDITIONING

- Mechanical Design Requirements
- Sound and Vibration Control
- Piping Insulation
- Piping & Valves
- Pumps & Pump Systems
- Chilled Water Systems
- Boilers
- Refrigeration Equipment
- Cooling Towers
- Air Handling Units
- Ductwork
- Building Automation Systems



### Standards

#### 1. Mechanical Design Requirements:

**Maintainability:** Mechanical systems and systems components shall be durable and easy to maintain. The Designer shall incorporate into equipment and system design sufficient access and clearance for maintenance, repairs, and replacement. Incorporate instrumentation necessary for balance and initial adjustment, as well as for service and monitoring.

**Reliability:** Systems shall have a high degree of reliability. If an entire building system will be affected by lesser reliability of a component (for example, a pump serving building chilled water system), then a redundant piece of equipment shall be provided to increase overall system reliability.

**Accessibility:** All serviceable equipment (fans, valves, reheat coils, VAV boxes, clean-outs, junctions, etc.) to be installed behind an inaccessible finished surface shall be made accessible by the installation of suitable access doors. All equipment provided shall be accessible either from the exterior or by elevator.

**Design Conditions:** All mechanical systems and equipment should be designed based on the ASHRAE Climate Recommendations - Zone 5A (Boone, NC). See Appendix for reference documents.

**Energy Conservation:** The energy efficiency of building systems and equipment is an essential part of the University design philosophy. Any new project shall be designed with state of the art energy efficiency. Design standards published by American Institute of Architecture (AIA), American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) and the State of North Carolina shall be met or exceeded.

- Major energy consuming systems and equipment shall be specified and purchased based on Life Cycle Cost Analysis. All projects ten thousand (10,000) square feet or larger shall require a Life Cycle Cost Analysis.
- Building functions that require twenty-four hour a day operation, such as libraries, laboratories, computer rooms, and others as defined by the University shall be served by a system separate from that of offices or classrooms, that are subject to different operating schedules.



- Economizer Cycle that allows the use of outdoor air for free cooling during the winter and intermediate seasons without the use of mechanical refrigeration equipment. The Designer shall provide heat recovery for all systems using one hundred percent (100%) outdoor air with both a supply and return air fan. In addition, careful attention should be given to designing a system in which the air stream is properly blended.
- All mechanical systems shall be controlled by a direct connection to the building automation system.
- Three phase electric motors for mechanical equipment shall be specified to be premium efficiency and a service factor of 1.0.
- The Designer shall use variable volume air handling systems and variable volume pumping to optimize energy efficiency. Fans and pumps shall be selected with the highest efficiency available. Wire to water efficiency shall be evaluated for pumps prior to making the final selection.
- The thickness of insulation for chilled water, hot water, steam, and condensate shall be geared toward conserving energy. Insulation thickness shall be selected for optimum cost versus efficiency.
- Cooling towers shall be selected with motors equipped with variable frequency drives to allow for energy efficient capacity control. Hydronic systems shall be designed with two-way valves to prevent energy waste.
- The Designer shall evaluate mechanical systems energy efficiency not only at full load, but also partial load conditions. The Designer shall submit a report indicating energy use for new facilities expressed in BTU's per square foot per year. The total energy consumption shall indicate monthly use of electricity, steam, water, cooling, heating and gas.

Commissioning will be provided by an independent, third-party consulting agency. The commissioning agent will be responsible for ensuring that building systems perform in accordance with the design intent and the University's operational needs. The University considers the following elements as a minimum requirement for building acceptance:

- Installation Verification
  - Startup and Checkout
  - Performance Testing and Demonstration
2. **Sound and Vibration Control** shall not produce noise levels that will be objectionable to facility occupants. The designer will specify the dB level required to meet this goal.
- HVAC equipment located in the building shall be carefully evaluated for sound level. If sound levels are expected to be higher than recommended in ASHRAE guidelines, sound control devices are required.
  - In general, all larger air-handling units will require sound attenuations in ductwork downstream from the fan for both the supply and return. Some mechanical equipment rooms might require lightweight acoustic materials

for walls to isolate equipment noise from the rest of the building.

- Acoustic lining is not an acceptable standard for duct systems.
- Air noise from a supply outlet is not acceptable.
- There shall be no objectionable transmission of vibration from equipment to the building structure.
- Mechanical Equipment Rooms shall be placed preferably at ground level and away from occupied spaces to minimize transmission of vibrations and noise into the building.

### 3. Piping Insulation:

- The designer shall evaluate thermal insulation properties and moisture migration to prevent surface condensation.
- Adequate protection for underground piping against ground water and electrolytic forces shall be provided.
- All valves and fittings shall be insulated with performed fitting insulation.
- Calcium silicate insulation shall be used for interior steam insulation on all high pressure steam services.
- Contact the Physical Plant for a detailed list of piping and insulation requirements.

### 4. Piping & Valves:

- Appropriate devices for piping expansion shall be provided.
- The Designer shall provide for a positive means of draining and venting piping systems. Valves shall be provided to allow for isolation of branch piping and risers.
- Balancing valves shall be provided to facilitate system testing and balancing.
- Pressure taps on each flow measuring device shall be extended outside of the insulation.
- Butterfly valves shall be of the positive shut-off type.

### 5. Pumps & Pump Systems

- Pumps shall have a minimum clearance of twenty four inches (24") on sides and end of pumps and motors to allow access for service and repair.
- Pumps shall have isolation valves to allow pumps to be removed and repaired.
- Pumps shall have bleed valves and gauge ports at accessible locations.





- All pumps shall be serviceable without removing the volute from piping connections.
- Pumps use considerable amounts of energy. Select pumps with the highest efficiency available for the particular application.
- Pumps shall be installed in mechanical equipment rooms.
- Outdoor pump installation shall be avoided. Pump packages should be avoided.

#### 6. Chilled Water Systems:

- The desired cooling medium for air conditioning systems is chilled water. The University currently has two regional utility plants. For new construction and renovation projects, the Consultant shall verify that the existing chilled water system will support the new load.
- The Designer shall consider using a water side economizer to meet winter cooling loads in applications where the use of 100 percent outdoor air for free cooling is not possible. Plate, frame, shell, or tube heat exchangers are strongly recommended for this application.

#### 7. Boilers: If connecting to either the ASU Steam Distribution System or the Regional Utility Plants hot water system is not feasible, individual boilers may be considered. Where individual boilers are required:

- Gas fired, forced draft boilers will be utilized.
- Electric boilers are not acceptable.
- Temperature reset controls will be utilized on hot water systems.
- Provide sensors on hot water supply and return

#### 8. Refrigeration Equipment: Preference shall be given to chilled water production based on water-cooled centrifugal chillers. Trane is the current “Owner Preferred Alternate” for chiller equipment on campus. Other options may be considered if circumstances warrant and are approved by the University.

Generally, the Designer shall select water-cooled reciprocating or rotary chillers for cooling loads up to 190 tons. For cooling loads 200 tons and up, centrifugal chillers shall be specified.

- Air-cooled equipment shall be used for small renovation projects where physical limitations preclude the use of chilled water.
- Provide environmentally safe refrigerants that conform to the latest Environmental Protection Agency and OSHA requirements.
- Ventilation of all mechanical rooms with refrigeration equipment shall be provided. Ventilation shall be accessible for activation from an emergency switch located outside any of the mechanical room access doors. Mechanical

room ventilation shall be negative to corridor or any other adjacent spaces.

## 9. Cooling Towers:

- Cooling towers shall be located in such a way as to have sufficient unobstructed space to allow for adequate air supply for tower fans. Care shall be taken to prevent possible air recirculation.
- Cooling tower location shall be as near as practical to level conditions and as close as possible to the chillers and pumps to minimize pumping costs.
- Tower locations shall be as far as possible from trees and other foliage. Screens shall be provided on tower intakes to keep debris and leaves out of tower sump.
- Balancing valves at hot water basins, extended lube lines and stainless steel cold water basins are required.
- Noise level shall be an important consideration in the selection of cooling towers. Cooling towers shall be selected with two-speed fan motors or motors equipped with variable frequency drives to allow for energy efficient capacity control.
- A hose bib shall be provided at each cooling tower for cleaning.
- Chemical testing shall be provided by a third-party consulting agency.

## 10. Air Handling Units:

- The use of multi-zone air handling units, spray coil systems, and ceiling-mounted fan coil units is not acceptable in new construction. For small renovation projects, an exception can be made if the need is substantiated.
- Air-handling units that use one hundred percent (100%) percent outdoor air shall be equipped with preheat, cooling and reheat coils with individual sensors to allow dehumidification control. Return air shall be ducted.
- Supply air for the building should be designed for control by duct static pressure. Return air for the building should be controlled by the building static pressure.

## 11. Ductwork:

- Ductwork for air distribution shall be designed to yield minimum owning and operating costs by keeping the static and dynamic pressure levels of a duct as low as possible given the building's normal physical constraints.
- The Designer shall provide ductwork that is free of heat gains or losses and excessive sound levels, has fire and smoke control, and in which air leakage does not exceed two to five percent (2-5%).
- To allow for proper system balancing, all branch ducts shall be equipped with balancing dampers.





- Variable air volume (VAV) boxes should be provided to adjust temperature demands on a space. Reheat coils should be located downstream of VAV boxes. Sensors should be provided where air is discharged.
- Parallel fans are preferred for fan powered boxes.
- The use of flexible ductwork should be avoided. The maximum length of a flexible duct shall not exceed five feet (5'). Avoid offsets and curves in flexible duct connections to diffusers and other terminal devices.
- Provide access doors large enough to allow service and inspection of control dampers, reheat coils, humidifiers, fire dampers, and all applicable system components. The minimum width for access doors will be twenty-four inches (24").
- All spaces should include both cooling and heating. Cooling only is not acceptable due to causing humidity issues.
- All ductwork in unconditioned spaces shall be provided with vapor-retarding finish.

## 12. Building Automation System:

Johnson Controls is the "Owner Preferred Alternate" for Building Automation Systems (BAS).

- The Designer shall provide building automation system drawings with the construction drawings. Copies shall be provided to the ASU Physical Plant, with no exception. The drawings shall clearly indicate the design and sequence of operation.
- If humidity is a specific issue to be controlled in the design of a space, this information should be clearly communicated on the BAS drawings.
- The control system shall be fully compatible with the existing campus facilities automated controls system.
- The new system shall have full control capability through the existing server. All systems must be programmable.
- Space Temperatures - In order to maintain reasonable comfort and lower energy expenditures, the University has established the following standards for comfort heating and cooling:
 

|                  | <u>Summer (air conditioning)</u> | <u>Winter (heating)</u> |
|------------------|----------------------------------|-------------------------|
| Occupied Space   | 74-76 degrees F                  | 69-71 degrees F         |
| Unoccupied Space | 85 degrees F                     | 55 degrees F            |
- All chiller rooms require audio and visual monitoring of the refrigerant lines.

## CS 3.26 | ELECTRICAL

- Campus Primary Distribution System
- Transformers
- Emergency Generators
- Electrical Device Manufacturers
- Interior Lighting
- Occupancy Sensors
- Day Lighting
- Exterior Lighting



### Standards

All electrical work shall be in complete compliance with the North Carolina State Construction Office guidelines and policies.

#### 1. Campus Primary Electric Distribution

The Electric Distribution System serving the Appalachian State University Campus is maintained by New River Light and Power, and this department is in effect the “power company” for all University projects. The primary campus distribution system is rated 12KV, 470Y/7200 volts, grounded neutral, and is installed in an underground conduit system with above ground transformers and switches. The electrical designer shall contact New River Light and Power for information regarding availability of service, location of nearest transformer, and available KVA.

The design of the electrical system for the project should begin at the manhole designated by the Electric Distribution Office. The incoming service (but not transformer size) shall be designed to have sufficient capacity for full design connected load plus 25% additional capacity for future growth

#### 2. Transformers

Transformers should be sized based on diversified KW demand. Pad mounted transformers are preferred to transformers located in vaults of any kind. Building surge protection should be a design consideration.

Locate pad mounted transformers at a suitable point outside the building, accessible to maintenance personnel and to truck-mounted crane. Provide a minimum of eight feet (8'-0") clearance in front of the transformer to permit hot-stick operation in the primary section. No other equipment or structures may be installed above or adjacent to the transformer, which may impede its installation or removal.

Locate transformers at least thirty feet (30'-0") from the nearest building. Any transformer that must be located nearer to the building shall be insulated with a listed “less flammable” material.

Where the use of a pad mounted transformer is not feasible, underground vaults are discouraged. Every effort should be made to provide adequate space for a vault in the building, located where it is readily accessible and where there is no danger of flooding. The vault should not be located under or opposite the building entrance. In addition to the necessary maintenance access



*Transformer*



requirements, provisions should be made for possible removal of equipment from the vault. Doors, window openings, or removable panels in walls should be considered so that large equipment can be removed without structural, piping, or lighting changes. Water, steam, vent, or drain pipes of any kind are not permitted in the transformer vault, switch-gear, or switch-board room. Switch-gear should be located in a separate room so that it is not subject to the high ventilation rates in vaults.

3. **Emergency Generators** should be located in weather-protected space contiguous with the building which the generator serves. Generator exhaust should be routed to discharge above the roof and remote from any air intake for the building. Standard clearances shall be provided to access panels for maintenance.
4. **Electrical Device Manufacturers** preferred due to compatibility with existing materials:

Panelboards: Westinghouse, GE, I-T-E (Gould), Square D, Siemens-Allis. All equipment and devices shall be labeled on the panel.

Conduit (Steel): Armco Steel, National Steel, Republic Steel, Triangle, Wheeling Steel, Youngstown Sheet & Tube, Allied Tube & Conduit, Wheatland

Liquidtight Conduit: American Brass, Columbia Cable & Electric, International Metal Hose

Outlet Boxes: Appleton Electric, General Electric, National Electric Products, Steel City, Thomas and Betts

Cable Supports: OZ Electric

Insulating Bushings: OZ Electric

Conduit Bodies and Fittings: Appleton Electric, Crouse-Hinds, Thomas & Betts, Steel City. Only compression type couplings should be provided.

Wire & Cable: Anaconda, Cerro de Pasco, General Cable, GE, Kerite, Phelps Dodge, Rome Cable, Triangle Conduit & Wire, Okonite

Solderless Connectors and Lugs: Burndy, Thomas & Betts, Dosert, OZ Electric

Wiring Devices: Arrow-Hart, Leviton, Pass & Seymour, Hubbel

Safety Switches: S & C (for high voltage), I-T-E, GE, Square D, Westinghouse

Lamps: Westinghouse, GE, Sylvania, Phillips

Life Safety Systems: Simplex, Pyrotronics, Fenwal

Heating Cable: Nelson, Chromalux

Circuit Breakers: Westinghouse, GE, I-T-E, Square D

Fuses: S&C (for high voltage), Bussmann, Chase-Shawmut, CEFECO

Motor Starters and Protective Devices: Allen Bradley, Westinghouse, Cutler Hammer, Seimens-Allis, Square D, GE

Generators: Onan, Katolight, Kohler, Caterpillar, Cummins

5. **Interior Lighting** levels should comply with recommendations of the EPA GreenLights and Illuminating Engineering Society Lighting (IESL) Handbook.

- Emergency lighting systems shall comply with the Electrical Guidelines & Policies of the State Construction Office.

Interior Lighting Level Guidelines: Unless safety and security requirements dictate greater illumination or specific visual tasks require either more or less illumination, lighting designs shall conform to the following guidelines shown in foot candles (fc):

|   |                           |
|---|---------------------------|
| Lobbies and Lounges                           | 20-30 fc                  |
| Offices and Classrooms, general use           | 50 fc                     |
| Offices and Classrooms, special use           | 60-75 fc                  |
| Conference Rooms                              | 30 fc                     |
| Laboratories and Libraries (close task areas) | 75-100 fc                 |
| Toilet Rooms                                  | 20 fc                     |
| Corridors and Stairways                       | 10 fc                     |
| Storage and Janitor Closets                   | 20 fc                     |
| Mechanical Equipment Rooms                    | 30 fc                     |
| Shop Areas, general use                       | 30 fc                     |
| Shop Areas, special use                       | Task lighting as required |
| Gymnasium (general recreation)                | 50 fc                     |
| Gymnasium (competition level)                 | 75 fc                     |
| Gymnasium (televised athletic events)         | 100 fc                    |

Interior Lighting Sources Fluorescent lighting should be used in most indoor building applications, especially where dimming is not required. Because of its poor efficiency and poor lamp life, incandescent lighting should only be used where other more efficient sources are unsuitable. In these cases, use improved efficiency sources such as halogen and reflective lamps. Interior lighting sources should conform to the following guidelines:

|                                     |                         |
|-------------------------------------|-------------------------|
| Offices, Classrooms and general use | Fluorescent or LED      |
| Corridors and Stairways             | Fluorescent or LED      |
| Storage and Janitor Closets         | Fluorescent or LED      |
| Mechanical Equipment Rooms          | Fluorescent, LED or HID |
| Shop Areas                          | Fluorescent, LED or HID |
| Gymnasium                           | Fluorescent, LED or HID |





*Exterior light fixture*

Warehouse or Large Storage

Metal Halide, HPS,  
Fluorescent or LED

6. **Occupancy Sensors** shall be provided to control ceiling light fixtures when room is not occupied, unless room function dictate otherwise. Detectors shall have manual override with sensor types as listed:

Classrooms and Conference Rooms

Dual technology

Laboratories

Dual technology

Offices

Ultrasonic

Toilet Rooms

Ultrasonic

Corridors and Stairways

Ultrasonic

Storage and Janitor Closets

Digital Timed

Equipment and Mechanical Rooms

Switches only

7. **Day Lighting** shall be considered in the design of new construction. Day lighting is the use of direct, diffuse or reflected sunlight to provide full or supplementary lighting. Day lighting systems combine technology and architecture to increase building energy efficiency and occupant well-being. Some keys to successful day lighting include:

- Maximize southern exposure (orient building on an east-west axis).
- Concentrate on the most heavily used spaces.
- Use roof monitors and light baffles to increase winter radiation, reduce summer radiation and eliminate glare from direct sunlight.
- Use glass on the roof equal to ten to twelve percent (10-12%) of the building floor area.
- Consider using photocells and dimmable ballasts in perimeter rooms to turn off lights when the available daylight augments lighting.

8. **Exterior Lighting:** Unless safety and security requirements dictate greater illumination, campus lighting shall avoid light pollution and light trespass in order to reduce inefficiency, sources of glare, and light that may be harmful to the nighttime environment and shall conform to the International Dark-Sky Association. Lighting designs shall conform to the following guidelines shown in foot candles (fc):

Campus Courtyards

2.5 fc (not  $\leq$  1)

Campus Walkways

2.5 fc (not  $\leq$  1)

Campus Streets

3 fc (not  $\leq$  1)

Campus Parking Lots

2 fc (not  $\leq$  1)

Campus Parking Decks

2 fc (not  $\leq$  1)

Exterior Lighting Sources sources should conform to the following guidelines:

|                      |  |
|----------------------|--|
| Campus Courtyards    | Metal Halide, HPS,<br>Fluorescent or LED |
| Campus Walkways      | Metal Halide, HPS,<br>Fluorescent or LED |
| Campus Streets       | HPS, Fluorescent or LED                  |
| Campus Parking Lots  | HPS, Fluorescent or LED                  |
| Campus Parking Decks | Metal Halide, Fluorescent<br>or LED      |



9. **Exterior Light Pole:** Use the “Sternberg Prairie Lantern”, model # 1230/5S9P/150HPS-MT/LO5/VG with CSA Lens, manufactured by Sternberg Vintage Lighting [Local distributor: Carolina Lighting & Systems, Charlotte, NC]



- Run one inch (1”) schedule 40 PVC from the appropriate size lighting circuit breakers to each base in series. Stub the conduit up eighteen inches (18”) above grade at each location. Center the conduits in the concrete base.
- Install a concrete base sixteen inches by sixteen inches by twenty-four inches (16” x 16” x 24”) minimum, below grade and six inches (6”) above grade with a one inch (1”) chamfer top edge and hand rub the above ground area to sand finish. Install one half inch by twelve inch (½” x 12”) minimum, galvanized anchor bolts in base to fit the Sternberg Prairie Lantern base.

#### Lighting General Notes:

- The lighting design and layout should address accessibility for re-lamping, cleaning and other maintenance procedures.
- Do not locate fixtures directly over hazardous chemicals, mechanical equipment and/or laboratory benches. Install fixtures on the perimeter of such equipment.
- Exterior recessed light fixtures (sometimes used for exterior stairs, ramps or walkways) are not recommended due to problems associated with winter weather conditions. If required, do not locate exterior recessed light fixture below twenty-four inches (24”) from walking surface.
- Stairway light fixtures should be mounted so that maintenance personnel can reach them safely from an eight foot (8’) ladder.
- All electrical installations shall be reviewed and approved by the ASU Electrical Department.



## CS 3.27 | COMMUNICATIONS

- Clock & Bell System
- Emergency Telephones

### Standards

1. **Clock & Bell System** shall be designed using the University's Simplex Time Recorder System equipped with a Simplex Electronic Master clock and a signal generator with a tone at 8775 Hz which uses a carrier current pulse superimposed on the main power distribution system.
  - Contractors shall install Simplex clocks with a 12" face or two sided clock which stands out from the wall and a Simplex #8562-299 Electronic Clock Receiver board (8775 Hz) in each clock.
2. **Emergency Telephones** shall be RAMTEL Corp. model (or current campus standard equipment). The emergency phone will be programmed and connected with the ASU Police Office to include:
  - **Bluelight Emergency Phones [ID number 000 - 099]:** The phone will have a blue light connected to it that will come on at night and will flash anytime that the emergency button is pressed to make an automatic call to the ASU Police. These Emergency Phones will not have a keypad.
  - **Dormitory Emergency Phones [ID number 100 - 199]:** The phone will have a blue light mounted on the outside wall next to the entrance that will come on at night and will flash anytime that the emergency button is pressed to make a call. Phones located in Dormitory Entrances will have a keypad to allow local calls into the building.
  - **Academic Building Emergency Phones [ID number 200 - 299]:** The phone has a red push button with auto-dial to the ASU Police and a red to green LED light to indicate the call has been answered.
  - **Elevator Emergency Phones [ID number 500 - 599]:** The phone has a red push button with auto-dial to the ASU Police and a red to green LED light to indicate the call has been answered



*Emergency call station*

## CS 3.28 | ELECTRONIC SAFETY AND SECURITY

- Alarm & Detection System
- Fire Alarm System
- Card Reader System
- Gate Control System



### Standards

1. **Alarm & Detection System:** The University has a Central Alarm Receiving System located in the ASU Police Office capable of supervising fire, burglar or other trouble signals from any campus location. All fire and security alarms shall transmit an alarm signal to this location by means of digital communication.
  - All burglar alarm systems, fire detection and alarm systems, and any special monitoring system shall be programmed to report to ASU Police Office.
  - The communicator shall be equipped with a locking cabinet, battery back up system and surge protection for the data and AC lines. The report shall contain alarm, trouble, sprinkler, reset and test conditions. The communicator shall be wired to the nearest building telephone closet with ten feet (10') of excess at the closet end, terminated in the communicator, and identified at both ends. The University shall connect the telephone lines.
2. **Fire Alarm System:** The fire alarm systems presently installed on campus is by Simplex. All new buildings shall be installed with 24-hour addressable monitor systems, including connection devices at the ASU Police Office.
  - The design and layout shall comply with all current state guidelines and regulations relating to university buildings.
  - Horns and strobes shall be placed no more than 30 to 40 feet apart so that they can be heard from any location. Horns shall be heard clearly, 15dBA above the normal ambient level, in bedrooms, living areas and bathrooms for residence halls.
  - New systems shall be fully compatible with the master panel.
  - The University shall provide dedicated telephone lines.
3. **Card Reader System:** The MR-5 card access reader device (or current campus standard device) and outside phone shall be placed on the same side and directly outside of the door it is opening.
  - When possible the right hand door shall be the controlled door.
  - If there is an entry vestibule, the card reader shall be placed inside the



vestibule and control the second inside set of doors. This will provide additional protection from severe weather conditions.

- Locate the power supply for the exit device and the access controller in the nearest electrical or telecommunications room, so it is accessible for maintenance.
  - The controller shall be placed within one hundred feet (100') of the card access reader.
4. **Gate Control System:** The Squadron Access Controller (or current campus standard controller) for the gate opener card reader device shall be located in an enclosed area where the temperature shall be within thirty-two (32) to one hundred (100) degrees Fahrenheit and the humidity shall be within thirty to ninety percent (30-90%).
- The card access reader shall be located ten to twelve feet (10-12') in front of the gate so that it is easily accessible from the driver's side of an automobile window.
  - Locate the power supply for the exit device and the access controller in the nearest electrical or telecommunications room, so it is accessible for maintenance.
  - The controller shall be placed within one hundred feet (100') of the card access reader.

## CS 3.31 | EARTHWORK

- Earth Moving
- Termite Control
- Site Drainage



### Standards

#### 1. Earth Moving:

Excavation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break up sloped surfaces steeper twenty-five percent (25%) so that fill material will bond with existing surface.

Backfill: To avoid subsurface problems during the life of a new building, particular emphasis must be placed upon the selection of backfill material around the walls of buildings.

- Place backfill and fill materials in layers not more than six inches (6") in loose depth for material compacted by heavy compaction, and not more than four inches (4") in loose depth for material compacted by hand-operated tampers.
- Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

Compaction: Control soil and fill compaction, providing minimum percentages of maximum density, accordance with ASTM D 1557, specified for each area classification indicated below:

- Under structures, building slabs and steps, and pavements, compact top twelve inches (12") of sub-grade and each layer of backfill or fill material at ninety-five (95%) maximum density.
- Under lawn or unpaved areas, compact top 6 inches of sub-grade and each layer of backfill or fill material at ninety percent (90%) maximum density.
- Under walkways, compact top six inches (6") of sub-grade and each layer of backfill or fill material at ninety-five (95%) maximum density.

Excavation and Backfilling of Utilities Trenches: All trenching and backfilling work shall conform to the North Carolina Department of Labor, OSHA Trenching and other Safety Standards.

- All trenches four feet (4') and deeper require shoring.



- Trenches shall be excavated to a depth that will provide a minimum cover of three feet (3') above the top of the pipe, and which will avoid interference with other utilities.
- The width of the trench at and below the top of the pipe shall be such that the clear space between the pipe barrel and the trench wall shall not exceed eight inches (8") on either side of the pipe.
- Prior to any digging below eighteen inches (18") utility lines in the area must be marked on site.
- Trenches shall not be backfilled until all required pressure tests have been performed and until the installed system conforms to the requirements of the specifications. Materials shall be deposited in six inch (6") layers and rammed carefully and thoroughly until the top of the pipe has a cover of one foot (1').
- Marking tape shall be placed twelve to eighteen inches (12"-18") below ground level directly above the underground facilities. The marking tape shall correspond to the following color code:

|                                 |        |
|---------------------------------|--------|
| Electric Power lines            | Red    |
| Gas, Oil or Steam               | Yellow |
| Telephone, Data, Cable TV lines | Orange |
| Water, Slurry lines             | Blue   |
| Sewer Lines                     | Green  |

- All backfilling under streets, sidewalks and drives shall be compacted above and allowed to settle for three days. The asphalt shall conform to the N.C. State Highway Commission requirements. The concrete shall be rated at three thousand (3000) psi and shall conform to the general construction portion of the specification for concrete.
2. **Termite Control:** The soil in the entire building area shall be poisoned or termite treated with a five year guarantee provided. Do not use any chemical which has been banned in any state.
  3. **Site Drainage** is to be designed with minimal visual impact. The storm drainage system shall be designed for an assumed minimum rainfall intensity of two inches (2") per hour for a five hour storm. In addition, the minimum runoff value to be used in the storm drainage design shall be two (2) cubic feet per second per acre.

#### Surface Drainage:

- The site, including paved areas, loading docks, maneuvering areas adjacent to docks, and landscaped areas, shall be graded in such a manner that gravity runoff occurs at all points, and all areas shall slope away from the building on a minimum gradient of one quarter inch (1/4") per foot. All terrain surrounding the building, including loading and parking areas shall be graded in such a manner that if storm drains serving the area become stopped up, water will flow away from the building.

- The maximum permissible horizontal distance that storm water shall be permitted to flow over the site before entering a catch basin or other inlet shall be seventy-five feet (75'). This applies to grassed areas, paved areas and elevated parking areas.
- Lawns and mulch areas are encouraged when possible around new building areas to increase natural percolation and decrease impervious run-off.
- Surface drainage shall be directed away from planting areas when possible. Subsurface drainage may be required in new planting areas with poor soils.

#### Natural Drainage:

- Natural drainage shall be utilized and maintained where ever possible.
- The vegetative area fifty feet (50') from each side the center line of the swale or stream shall be maintained when ever possible to provide for greater natural percolation and pollutant filtering. When a natural drainage course is required to be diverted due to site improvements the following shall be considered,
- The vegetative area adjacent to the new drainage course shall be re-planted to its original condition or improved with lawn and/or tree plantings.

#### Sub-surface Drainage:

- An underground storm sewer system shall be provided to accommodate the roof drainage system.
- The minimum size grate acceptable shall be eight inches (8") square.
- Drainage grates in lawn areas within twenty-five feet (25') of a walkway shall be designed to have a two percent (2%) slope from the edge of the walk to the storm drainage rim.
- Bee-Hive type drainage grates shall be used in mulched planting areas.

#### Headwalls:

- Headwalls shall be veneered stone.
- Slope and creek bed stabilization methods other than riprap should be considered.

#### Drain Opening Protection:

- Install removable bars or grills at open end of culverts, drains, and pipes ten inch (10") diameter and larger.
- In exterior stairwells, areaways and similar locations where leaf clogging of conventional drains would be expected, provide scupper or dome type drains.



*Boone Creek*



## CS 3.32 | EXTERIOR IMPROVEMENTS

- Walks, Steps & Ramps
- Asphalt Paving
- Landscaping
- Xeriscaping
- Large Trees
- Medium Trees
- Small Trees
- Shrubs
- Herbaceous Perennials
- Ground Cover

### Standards

#### 1. Walks, Steps & Ramps:

- Walks shall be constructed identical to existing walks and of equal widths as appropriate. Walk surfaces shall be left one inch (1") above finish grade.
- Steps should be minimized where possible and replaced with ramps. Steps shall ideally have a six inch (6") rise and twelve inch (12") tread with one quarter inch (1/4") wash across the tread.
- Ramps shall be constructed on a gradient not to exceed one foot (1') in twelve feet (12') and a minimum of six feet (6') wide for removal of snow.
- See Section CS 3.3 for concrete requirements and Section CS 3.4 for brick paver requirements.

#### 2. Asphalt Paving:

Streets and Driveways with Bus Traffic: Paving shall consist of a minimum of five inches (5") of Type HB asphalt base or six inches (6") of compacted coarse aggregate, two inches (2") of Type H asphalt binder, and two inches (2") of Type I-2 asphalt surface course properly crowned to allow for drainage.

Parking Lots: Paving shall consist of a minimum of six inches (6") of coarse aggregate stone base fully compacted. The surface course shall be Type I-2 asphalt concrete placed in a minimum thickness of two inches (2") and properly crowned to allow for drainage.

Curbs and Gutters: All curbs and gutters shall be Portland cement concrete and shall conform to North Carolina Department of Transportation standards - six inch (6") curb and twenty-four inch (24") gutter.

- #### 3. Landscaping:
- The campus landscape environment consists of plant materials that from a canopy layer, a focus layer and a floor layer. The canopy is an outdoor ceiling that provides unobstructed visual movement throughout the campus. Collectively, the layers give structure and order of the campus. The established landscape pattern of canopy trees and lawn should be reinforced and maintained.

Plant materials are used to:

- Add visual interest to the outdoor environment.

- Accentuate building and campus entrances at eye level.
- Enclose special areas such as plazas and courtyards
- Screen unappealing elements such as dumpsters, service areas and parking.
- Control access and circulation.

**Tree Protection:** Prior to the start of construction any existing trees within the proposed construction site are to be evaluated by the ASU Physical Plant Landscape Services to determine the location of a safety barrier fence around the root zone of the trees. At no time is the area directly under the drip line of the tree to be used for storage or disturbed by machinery. Barrier fencing shall be installed on a radius of at least eighteen inches (18") for each inch of trunk diameter [12 inch trunk diameter = 18 feet tree protection zone radius].

**Subsoil** shall be permeable and shall be brought to a friable condition by harrowing or otherwise loosening and mixing with mulch (40 bales per acre) to a depth of at least four inches (4"). Lumps and clods are to be thoroughly broken and stones larger than four inches (4") are to be removed.

**Topsoil** shall be stripped from all areas to be graded (either excavated or filled) and shall be stockpiled during construction. Topsoil shall not be stockpiled under trees. At the completion of the job, the topsoil shall be spread on the ground around the building to establish the finish grade. The areas shall be scarified one and a half foot (1.5') deep and all construction debris picked out and hauled off before spreading the topsoil.

- Topsoil shall be placed in six inch (6") layers and compacted by normal movement of equipment over area to a final depth of four inches (4). After the topsoil is spread the entire area shall be left smooth. All debris, roots, and rocks measuring 1" and larger shall be removed.
- Topsoil should not exceed the grade which existed prior to construction.

**Mulching & Weeding:** New planting beds should be weed free and mulched with two to four inches (2-4") of hardwood mulch. Individual trees should have a minimum five foot (5') diameter circle of hardwood mulch. All mulched areas should be treated with pre-emergent herbicide at the rate of one hundred fifty pounds (150 lb.) per acre of actual material or three (3) pounds of active ingredient per acre.

- The finish grade of any shrubbery beds not planted or mulched, should be three inches (3") lower than the existing finish grade of sidewalks.
4. **Xeriscaping** promotes water conservation by using drought-tolerant plant materials that thrive in the environment, within a landscape carefully designed for maximum use of rainfall runoff and minimum care. Xeriscaping principles can significantly reduce water use and save money.

Xeriscaping principles also stress the aesthetics of using native vegetation, reduction in turf, water harvesting techniques, the use of mulches and proper maintenance practices.

Buildings shall be landscaped for energy efficiency and water conservation. Bushes and large trees provide shading and act as a wind breaks.



*Landscaping on the Mall*



*Landscaping at Durham Park*



*Landscaping at Boone Creek*

## 5. Large Trees recommended for campus:

| Species   | Common Name              | Salt Tolerance | Remarks  |
|---|--------------------------|----------------|--|
| <i>Acer Saccharum</i>                           | Sugar Maple              | Not            | Wonderful fall color is one of the main trees in the local forest, but does not perform in urban settings. This species should be used sparingly throughout campus |
| <i>Aesculus Hippocastanum</i>                   | Horsechestnut            | Tolerant       | Fruit may be considered messy  |
| <i>Betula Alleghaniensis</i>                    | Yellow Birch             | Not            | Nice tree for a park setting, beautiful yellow fall color  |
| <i>Carya Aquatica</i>                           | Water Hickory            | Not            | Does well in wet areas, nuts eaten by wild life  |
| <i>Fraxinus Americana 'Skycole' P.P4256</i>     | White Ash                | Tolerant       | Borers may become an issue   |
| <i>Fraxinus Pennsylvanica</i>                   | Green Ash                | Tolerant       | Borers may become an issue   |
| <i>Ginkgo Biloba</i>                            | Maidenhair Tree          | Tolerant       | Select male clones   |
| <i>Gleditsia Triacanthos 'Inermis'</i>          | Thornless Honey Locust   | Moderate       | Tolerates urban soils. May require pesticide applications to control pest. (Plant bugs, mites, and webworms)   |
| <i>Gymnocladus Dioicus</i>                      | Kentucky Coffee Tree     | Tolerant       | This tree needs adequate room, fruit may be messy, list cultivar   |
| <i>Liquidambar Styraciflua</i>                  | Sweet Gum                | Not            | Fruit may be considered messy  |
| <i>Liriodendron Tulipifera</i>                  | Tulip Tree               | Not            | Sooty mold may be an issue   |
| <i>Metasequoia Glyptostrobooides</i>            | Dawn Redwood             | Not            | Tolerates urban soils  |
| <i>Nyssa Sylvatica 'Wildfire'</i>               | Black Gum                | Not            | Great fall color, tolerates acid soils   |
| <i>Picea Abies</i>                              | Norway Spruce            | Not            | Give plenty of room  |
| <i>Picea Pungens 'Royal Blue', 'Fat Albert'</i> | Colorado Blue Spruce     | Not            | Give plenty of room  |
| <i>Platanus x Acerifolia</i>                    | London Plane Tree        | Tolerant       | Needs adequate space; Anthracnose may be an issue  |
| <i>Quercus Alba</i>                             | White Oak                | Moderate       | Needs adequate space   |
| <i>Quercus Lyrata 'QLFTB' P.P 13470</i>         | Overcup Oak              | Not            | Tolerates wet soils  |
| <i>Quercus Palustris</i>                        | Pin Oak                  | Not            | Tolerates urban soils well, give adequate room to grow   |
| <i>Quercus Phellos 'QPSTA'</i>                  | Hightower Willow Oak     | Not            | Tolerates urban soils well   |
| <i>Quercus Rubra</i>                            | Red Oak                  | Tolerant       | Needs adequate space   |
| <i>Quercus Shumardii 'QSFTC'</i>                | Panache Shumard Oak      | Tolerant       | Urban tolerant   |
| <i>Quercus Nuttallii</i>                        | Highpoint Nuttall Oak    | Not            | Good winter leaf drop  |
| <i>Sophora Japonica</i>                         | Japanese Pagodatree      | Tolerant       | Tolerates urban soils, may be considered a messy tree  |
| <i>Taxodium Distichum 'Sofine'</i>              | Autumn Gold Bald Cypress | Moderate       | Tolerates urban soils, will produce knees if roots are kept wet  |

|  |                               |          |  |
|--|-------------------------------|----------|--|
| <i>Tilia cordata</i> 'Corzam'                                | Corinthian little leaf linden | Moderate | Tolerates urban soils: other Gen-<br>era of <i>Tilia</i> may be used |
| <i>Ulmus parvifolia</i> 'EmerII', 'Allee',<br>'Emerald Vase' | Allee lacebark elm            | Not      | Tolerant of urban soils  |

6. **Medium Trees** recommended for campus:

| Species   | Common Name                 | Salt Tolerance | Remarks  |
|---|-----------------------------|----------------|--|
| <i>Acer Rubrum</i>  | Red Maple                   | Not            | Tolerates wet compacted soils, needs regular pruning until mature  |
| <i>Betula Nigra</i> 'Heritage'                                    | River Birch                 | Not            | Bark makes a nice winter interest. Aphids may make this tree a little messy (shedding)   |
| <i>Carpinus Betulus</i> 'Fastigiata'                              | Fastigate European Hornbeam | Moderate       | Is not considered salt tolerant but has worked well for ASU. Nice street tree. Only issues susceptible to Calico scale and is grafted. |
| <i>Carpinus Caroliniana</i>                                       | American Hornbeam           | Not            | Prefers moist well drained soils   |
| <i>Koelreuteria Paniculata</i>                                    | Golden Raintree             | Tolerant       | Very urban tolerant  |
| <i>Larix Decidua</i>  | Common Larch                | Moderate       | Nice yellow fall color   |
| <i>Magnolia Grandiflora</i> 'TMGH'                                | Alta Southern Magnolia      | Moderate       | One of the most cold hearty varieties, worth a try in a protected spot   |
| <i>Magnolia Virginiana</i>  | Sweetbay                    | Moderate       | Protect from winter winds  |
| <i>Pinus Nigra</i>  | Austrian Pine               | Moderate       | Nice specimen plant needs room to grow   |
| <i>Pinus Thunbergii</i>   | Japanese Black Pine         | Tolerant       | Nice specimen plant needs room to grow; however, does well in containers especially 'Nishiki'  |
| <i>Robinia Pseudoacacia</i> 'Purple robe'                         | Black Locust                | Tolerant       | Considered messy only select thornless cultivars   |
| <i>Salix Babylonica</i>   | Willow                      | Tolerant       | Aggressive shallow roots, messy tree, nice around natural water  |
| <i>Salix Pentandra</i>  | Laurel Willow               | Not            | Great lustrous green leaves, almost look fake, may be hard to find but worth planting  |
| <i>Sciadopitys Verticillata</i>                                   | Japanese Umbrella Pine      | Not            | Protect from winter winds  |
| <i>Sophora Japonica</i> 'Princeton Upright'                       | Japanese Pagoda Tree        | Tolerant       | Good street tree   |
| <i>Sorbus aucuparia</i>   | European Mountain Ash       | Tolerant       | Showy fruit, grows best on northern exposures, keep away from sidewalks fruit is messy   |
| <i>Thuja</i> ( <i>Standishii</i> x <i>Plicata</i> ) 'Green Giant' | Green Giant Arborvitae      | Not            | Select good central leader   |

## 7. Small Trees recommended for campus:

| Species  | Common Name                  | Salt Tolerance | Remarks   |
|--|------------------------------|----------------|---|
| <i>Acer Griseum</i>                                  | Paperbark Maple              | Not            | The bark is a great winter interest   |
| <i>Acer Palmatum</i>                                 | Japanese Maple               | Not            | Great specimen plants, protect from early spring freezes  |
| <i>Amelanchier x Grandiflora 'Autmun Brilliance'</i> | Serviceberry                 | Tolerant       | Check for good branch structure, minimal crossing limbs   |
| <i>Cedrus Atlantica 'Glaucua'</i>                    | Blue Atlas Cedar             | Moderate       | Nice specimen tree with good winter interest  |
| <i>Cedrus Atlantica 'Glaucua Pendula'</i>            | Weeping Blue Atlas Cedar     | Moderate       | Nice specimen tree  |
| <i>Cercis Canadensis</i>                             | Eastern Redbud               | Not            | Can tolerate a wide PH range  |
| <i>Chamaecyparis Obtusa</i>                          | Hinoki Cypress               | Not            | Nice specimen plant, does well in containers  |
| <i>Chamaecyparis Pisifera 'Filifera Aurea'</i>       | Gold Mop                     | Moderate       | Nice winter interest  |
| <i>Chionanthus Retusus</i>                           | Chinese Fringetree           | Moderate       | Standards are preferred   |
| <i>Chionanthus Virginicus 'CVSTF'</i>                | Prodigy Fringetree           | Moderate       | Foliage darker more lustrous, than the Chinese fringe tree  |
| <i>Cornus Kousa</i>                                  | Kousa Dogwood                | Not            | More tolerant to Urban Soils than the Cornus florida  |
| <i>Cornus Mas</i>                                    | Cornelian Cherry             | Not            | Early bloomer   |
| <i>Corylus Avellana 'Contorta'</i>                   | Harry Lauder's Walking Stick | Not            | Great specimen plant especially in the winter   |
| <i>Crataegus Crus-Galli 'Inermis'</i>                | Thornless Hawthorne          | Tolerant       | Beautiful spring flowers  |
| <i>Crataegus Phaenopyrum</i>                         | Washington Hawthorne         | Tolerant       | Beautiful spring flowers  |
| <i>Hamamelis x Intermedia 'Arnold Promise'</i>       | Witch Hazel                  | Tolerant       | Early bloomer   |
| <i>Ilex Opaca 'Judy Evans'</i>                       | Judy Evans American Holly    | Moderate       | Outstanding fruit production  |
| <i>Ilex x 'Nellie R. Stevens'</i>                    | Nellie Stevens Holly         | Not            | Good performer protect from winter winds  |
| <i>Juniperus Chinensis 'Hetzii Columnaris'</i>       | Hetzii Columnaris Juniper    | Moderate       | Nice specimen plant   |
| <i>Juniperus Virginiana 'Idyllwild'</i>              | Idyllwild Red Cedar          | Moderate       | Excellent screening plant   |
| <i>Lagerstromia Indica 'Centennial Spirit'</i>       | Crapemyrtle                  | Not            | Tolerates wet soils. May be killed to the ground during harsh winters. Protect from drying winter winds. Only plant on southern exposures. Other species may be chosen. Crape myrtles grown in colder nurseries perform |

|                           |                     |          |   |
|---------------------------|---------------------|----------|---|
| <i>Malus</i>              | Flowering Crabapple | Tolerant | Tolerates urban Soils. fungal diseases; Japanese beetles may be an issue. Don't plant near patios fruit may be a house keeping issue. Plant resistant varieties |
| <i>Prunus Serrulata</i>   | Kwanzan Cherry      | Not      | Beautiful spring flowers  |
| <i>Prunus x Cistena</i>   | Sand Cherry         | Tolerant | Red leaves are nice   |
| <i>Prunus x Yedoensis</i> | Yoshino Cherry      | Not      | Bores may infect this species don't over plant  |
| <i>Rhus Typhina</i>       | Staghorn Sumac      | Tolerant | Nice specimen plant   |

8. **Shrubs** recommended for campus:

| Species  | Common Name          | Salt Tolerance | Remarks   |
|--|----------------------|----------------|---|
| <i>Berberis Julianae</i>                                 | Wintergreen Barberry | Not            | Makes a nice ten foot hedge with nice yellow flowers in the early spring  |
| <i>Berberis Thunbergii</i>                               | Japanese Barberry    | Not            | Makes a nice hedge, list cultivar   |
| <i>Clethra Alnifolia</i>                                 | Summersweet Clethra  | Moderate       | Beautiful fragrant white flowers  |
| <i>Hibiscus Syriacus</i>                                 | Rose of Sharon       | Not            | Nice plant some varieties seed profusely, list cultivar   |
| <i>Hydrangea Arborescens 'Annabelle'</i>                 | Hydrangea            | Tolerant       | Flowers great in dried arrangements   |
| <i>Hydrangea Macrophylla</i>                             | Hydrangea            | Tolerant       | Does not bloom consistently here  |
| <i>Hydrangea Quercifolia</i>                             | Oak leaf hydrangea   | Moderate       | Beautiful fall color, does best in a part shade exposure  |
| <i>Ilex Crenata 'Helleri'</i>                            | Helleri holly        | Not            | Protect from winter winds and salt  |
| <i>Ilex Decidua</i>                                      | Possum Haw           | Not            | Birds love the red berries, remember plants are monoecious  |
| <i>Ilex Verticillata</i>                                 | Winterberry          | Tolerant       | Tolerates wet conditions, wildlife love the fruit   |
| <i>Ilex x Meserveae 'Blue Prince' or 'Blue Princess'</i> | Holly                | Not            | Make a nice hedge   |
| <i>Itea Virginica</i>                                    | Virginia Sweetspire  | Not            | Nice red fall color performs well in wet areas  |
| <i>Juniperus</i>   | Juniper              | Moderate       | Many species and cultivars grow well here, List species and cultivar; however, make sure the plant is zone 6 or below |
| <i>Kalmia Latifolia</i>                                  | Mountain Laurel      | Not            | Looks nice as an understory plant   |
| <i>Kerria Japonica 'Zabelii'</i>                         | Japanese Kerria      | Not            | Lovely yellow flowers in the spring   |
| <i>Lonicera Tatarica 'Zabelli'</i>                       | Zabelis Honeysuckle  | Tolerant       | Early summer the plant is covered with flowers  |

|   |                       |          |   |
|---|-----------------------|----------|---|
| <i>Lonicera Xylosteum</i>                 | Fly Honeysuckle       | Tolerant | Red berries make a nice fall display  |
| <i>Myrica Pensylvanica</i>                | Northern Bayberry     | Tolerant | Makes a nice hedge, use caution when spraying herbicides, spreads very slowly by suckers                |
| <i>Philadelphus x Lemoinei</i>            | Mock Orange           | Tolerant | Very fragrant white flowers   |
| <i>Pieris Japonica</i>                    | Pieris                | Not      | Lace bugs love this plant, don't mass plant   |
| <i>Poncirus Trifoliata</i>                | Trifoliate Orange     | Moderate | Nice plant makes an impenetrable hedge  |
| <i>Prunus Laurocerasus 'Otto Luyken'</i>  | Otto Luyken Laurel    | Not      | Do not plant too close together or shot hole will infest this species; need plenty of air flow          |
| <i>Prunus Laurocerasus 'Schipkaensis'</i> | Skip Laurel           | Not      | Nice upright form   |
| <i>Rhodeodendron, Hybrids</i>             | Hybrid Azeleas        | Not      | Many of the hybrid varieties grow very well here, just make sure they are zoned for here; list cultivar |
| <i>Rhododendron Carolinianum</i>          | Rhododendron          | Not      | Nice flower show in the spring, nice hedge; list variety used   |
| <i>Rhododendron Catawbiense</i>           | Rhododendron          | Not      | Nice flower show in the spring, nice hedge; list variety used   |
| <i>Rhododendron 'PJM'</i>                 | PJM                   | Not      | Nice compact form   |
| <i>Rhododendron, Exbury</i>               | Deciduous Azalea      | Not      | Nice flowers in the spring, best planted with evergreen material  |
| <i>Ribes Alpinum</i>                      | Alpine Currant        | Tolerant | Good for woodland gardens   |
| <i>Rosa Rugosa</i>                        | Rugosa Rose           | Tolerant | Large tomato-like hips are as nice as the flowers   |
| <i>Spiraea Japonica</i>                   | Spiraea Japonica      | Not      | Many varieties grow very well here, just make sure they are zoned for here; list cultivar               |
| <i>Spirea Nipponica 'Snow Mound'</i>      | Snow Mound Spirea     | Not      | Mass of white flowers a vigorous grower   |
| <i>Symphoricarpos Albus</i>               | Snowberry             | Tolerant | Showy fruit as well, good city gardens  |
| <i>Tamarix Ramosissima</i>                | Salt Cedar            | Tolerant | Does not like wet feet  |
| <i>Taxus Cuspidata 'Densifomis'</i>       | Japanese Yew          | Not      | Forms a dense three foot evergreen mound  |
| <i>Taxus X Media 'Hicksii'</i>            | Japanese Yew          | Not      | Upright form to eight feet nice hedge   |
| <i>Viburnum Dentatum</i>                  | Arrowwood Viburnum    | Tolerant | Nice black fruit after white flowers  |
| <i>Viburnum Plicatum</i>                  | Viburnum Tomentosum   | Moderate | This plant many grow 15'X15' give room to grow  |
| <i>Viburnum Rhytidophyllum</i>            | Leather Leaf viburnum | Not      | Great screening plant, winter winds may burn some of the foliage  |

|                           |       |          |  |
|---------------------------|-------|----------|--|
| <i>Vitex Angus-Castus</i> | Vitex | Moderate | May be killed to the ground during harsh winters |
| <i>Yucca Filamentosa</i>  | Yucca | Tolerant | Nice flower stalks                               |

9. **Herbaceous Perennials** recommended for campus:

| Species   | Common Name                  | Salt Tolerance | Remarks   |
|---|------------------------------|----------------|---|
| <i>Achillea Millefolium 'Summer Pastels'</i>    | Yarrow                       | Moderate       | Note: other Yarrow varieties may be used, most do well here with nice fall flowers that persist into the early winter |
| <i>Adiantum Pedatum</i>                         | Northern Maidenhair Fern     | Not            | Tolerates many soil types, but prefers moist well drained soils, but will tolerate drought conditions                 |
| <i>Asclepias Tuberosa</i>                       | Butterfly Weed               | Not            | Butterflies love this plant must have well drained soil to perform well   |
| <i>Aster Nova-Angliae</i>                       | Purple Dome Aster            | Moderate       | 12"-18" Purple flowers in late summer early fall  |
| <i>Aster x dumosus 'Prof. Anton Kippenberg'</i> | Blue Aster                   | Moderate       | 12"-15" Lavender blue flowers in mid summer to fall   |
| <i>Aster x Dumosus 'Woods Pink'</i>             | Pink Aster                   | Moderate       | 8"-12" Tall Pink flowers in early to mid fall   |
| <i>Astilbe 'Arendsii Hybrids'</i>               | False Spirea                 | Not            | Showy flowers in early summer, needs well drained moist soil  |
| <i>Athyrium Nipponicum</i>                      | Japanese Painted Fern        | Not            | Tolerates many soil types, but prefers moist well drained soils   |
| <i>Baptisia Australis</i>                       | False Indigo                 | Not            | Beautiful blue flowers in mid summer.   |
| <i>Bergenia Cordiflora 'Pupurea'</i>            | Heartleaf Saxifrage          | Not            | Leaves turn purple in the winter then decline, flowers are a magenta-pink in the spring                               |
| <i>Brunnera Macrophylla</i>                     | Siberian Bugloss             | Not            | Naturalizes well in a woodland setting  |
| <i>Campanula Carpatia 'Deep Blue Chips'</i>     | Bellflower                   | Moderate       | 6"-10" Tall Beautiful blue flowers early to late summer   |
| <i>Chrysanthemum x Superbum</i>                 | Snow Lady Dwarf Shasta Daisy | Moderate       | 12"-15" tall white flowers  |
| <i>Coreopsis Verticillata 'Moonbeam'</i>        | Moonbeam Coreopsis           | Moderate       | 18"-24" Tall yellow flowers in summer through late fall   |
| <i>Crocasmia x Crocosmiflora 'Lucifer'</i>      | Crocasmia                    | Not            | Nice Orchid like red flowers in mid summer, plant must have well drained soil   |
| <i>Delphinium, Elatum Group</i>                 | Delphinium                   | Not            | Plant in full sun in well drained soil, shelter from strong winds if possible   |

|  |                          |          |  |
|--|--------------------------|----------|--|
| <i>Deschampsia Caespitosa</i>  | Tufted Hair Grass        | Not      | Nice planted in a woodland setting, needs moist well drained soil  |
| <i>Dryopteris Erythrosora</i>  | Autumn Fern              | Not      | Requires moist rich soils  |
| <i>Dryopteris Goldiana</i>   | Giant Wood Fern          | Not      | Prefers moist soils hard to transplant once established  |
| <i>Echinacea Purpurea 'Magnus'</i>   | Purple Cone Flower       | Moderate | 24"-36" tall nice fall interest  |
| <i>Eryngium Alpinum</i>  | Sea Holly                | Not      | Nice blue flowers, required sandy well drained soils   |
| <i>Eupatorium Purpureum</i>  | Joe Pye Weed             | Moderate | Likes moist soil to attain full growth   |
| <i>Geranium 'Johnson Blue'</i>   | Blue Geranium            | Moderate | 15"-18" tall blue flowers in early summer  |
| <i>Helleborus Niger</i>  | Hellebore                | Not      | Other species not listed will grow well here. These plants all require steady moisture but well drained loamy soil |
| <i>Hemerocallis</i>  | Daylily                  | Tolerant | Select variety   |
| <i>Heuchera</i>  | Coral bells              | Not      | Many of these species do well in woodland gardens. These plants also have a long flowering season                  |
| <i>Hosta</i>   | Hosta                    | Tolerant | List cultivar  |
| <i>Hypericum Frondosum</i>   | St. John's Wort          | Not      | Nice on steep banks  |
| <i>Iris Cristata</i>   | Dwarf Crested Iris       | Tolerant | List cultivar  |
| <i>Kmiphofia Uvaria</i>  | Red Hot Poker            | Not      | May seed throughout the garden   |
| <i>Lavandula x Intermedia</i>  | Lavender                 | Moderate | Needs to be grown on a southern exposure in full sun well drained soil   |
| <i>Leucanthemumx Superbum 'Becky'</i>  | White Aster              | Not      | White flowers put on a nice show in early summer   |
| <i>Liatris Spicata</i>   | Gayfeather, Blazing Star | Tolerant | 12"-24" Tall purple flower spikes in mid summer through fall   |
| <i>Lupinus L.</i>  | Lupine                   | Moderate | 20" Colorful flower spikes early to mid summer   |
| <i>Miscanthus Sinensis 'Gracillimus', 'Morning Light', 'Zebrinus', Gold Bar'</i> | Maiden Grass             | Not      | Is pretty urban tolerant, prefers moist well drained soil  |
| <i>Monarda</i>   | Beebalm                  | Moderate | 36"-48" Flowers are red to pink, blooms in mid to late summer  |
| <i>Osmunda Cinnamomea</i>  | Cinnamon Fern            | Not      | Prefers moist soil, takes a while to establish but long lived, will go dormant in dry soils                        |
| <i>Osmunda Regallis</i>  | Royal Fern               | Not      | Likes marshy situations, must have wet feet  |

|  |                        |          |   |
|--|------------------------|----------|---|
| <i>Panicum Virgatum 'Heavy Metal', 'Shenandoah'</i>      | Switch Grass           | Not      | Is pretty urban tolerant, prefers moist well drained soil, makes a nice perennial border                                |
| <i>Pennisetum Alopecuroides 'Hameln', 'Little Bunny'</i> | Chinese Fountain Grass | Not      | Is pretty urban tolerant, prefers moist well drained soil, looks nice in mass   |
| <i>Perovskia Atriplicifolia 'Little Spire'</i>           | Russian Sage           | Moderate | 20"-24" Tall beautiful blue flowers in mid summer to early fall   |
| <i>Polystichum Acrostichoides</i>                        | Christmas Fern         | Not      | Tolerates many soil types, but prefers moist well drained soils   |
| <i>Potentilla</i>  | Cinquefoil             | Tolerant | Many species grow well here, list cultivar  |
| <i>Pulmonaria</i>  | Lungwort               | Not      | Need to be planted in a woodland setting to preform well  |
| <i>Rudbeckia Fulgida</i>                                 | Black-Eyed Susan       | Not      | School colors   |
| <i>Salvia nemorosa 'Blue Hill'</i>                       | Sage                   | Moderate | 12"-14" Tall blue flowers in early to later summer  |
| <i>Schizachyrium Scoparium 'The Blues'</i>               | Little Bluestem        | Not      | Very urban tolerant, some uses include; borders, cottage gardens, wild gardens or prairie-like settings, group or mass. |
| <i>Sedum</i>   | Sedum                  | Moderate | Nice winter interests, most species grow well; list cultivar  |
| <i>Viola</i>   | Violet                 | Not      | The perennial species need constant moisture, and some shelter from the drying winds in the winter to perform well      |
| <i>Woodwardia Virginica</i>                              | Virginia Chain Fern    | Not      | Prefers moist soil, fairly aggressive spreader  |

#### 10. Ground Cover recommended for campus:

| Species                      | Common Name    | Salt Tolerance | Remarks  |
|------------------------------|----------------|----------------|--|
| <i>Aegopodium Podagraria</i> | Goutweed       | Not            | Good ground cover in difficult areas but need to be contained  |
| <i>Ajuga Reptans</i>         | Ajuga          | Not            | Brilliant blue flowers in early summer, browns out during sever winters but recovers nicely the next spring; list cultivar |
| <i>Euonymus Fortunei</i>     | Winter Creeper | Moderate       | Aggressive evergreen ground cover will climb masonry walls, scale may be a problem   |
| <i>Euphorbia Myrsinites</i>  | Donkey Spurge  | Not            | Needs well drained soil, self-seeds readily  |

|                        |                    |          |   |
|------------------------|--------------------|----------|---|
| Hedera Helix 'Baltica' | English Ivy        | Moderate | Nice ground cover once established, many other cultivars may be used  |
| Hypericum Calycinum    | St. John's Wort    | Not      | Flowers profusely given full sun  |
| Juniperus              | Juniper            | Moderate | Many species and cultivars grow well here, List species and cultivar; make sure the plant is zone 6 or below                  |
| Laminum                | Dead Nettle        | Not      | Is an aggressive ground cover prefers moist well drained soil. Flower color determines planting season and light requirements |
| Liriope Muscari        | Liriope            | Not      | This is the clump forming species has nice lilac flowers in the summer.   |
| Liriope Spicata        | Lilly Turf         | Not      | This is the creeping species also has nice lilac flowers in the summer  |
| Microbiota Decussata   | Russian Arborvitae | Not      | Great performer may be hard to fine   |
| Sedum                  | Sedum              | Moderate | Nice winter interests, Most species grow well here please list cultivar   |
| Vinca Minor            | Periwinkle         | Not      | Nice ground cover once established  |
| Pachysandra Terminalis | Pachysandra        | Not      | Great ground cover for shady locations  |

#### 11. Lawn Mix:

The establishment or renovation of permanent turf areas can be done between April 1st and November 1st.

The following lawn mixture for the establishment of permanent turf areas shall be used:

80% Kentucky Bluegrass

20% Blend of two (2) turf type tall fescues

For areas that are to be seeded for the first time the rate of application should be 6 pounds per 1000 square feet.

## CS 3.33 | UTILITIES

- Steam Systems



### Standards

#### 1. Steam Systems:

Appalachian State University operates a Steam Plant which provides nominal 100 psig steam to the campus. Steam Plant is operational September 15 through May 20 of each year. May 20 to September 15 is reserved for scheduled maintenance and repairs of the steam system. Satellite boilers are operated during the Steam Plant shutdown to provide the minimum steam support required by the campus.

- For detailed specifications of steam distribution systems, contact the ASU Physical Plant for information.





# REFERENCE DOCUMENTS APPENDIX

# APPENDIX | ASHRAE CLIMATE RECOMMENDATIONS-ZONE 5

|          | Item                                       | Component  | Recommendation   |
|----------|--|--|--|
| Envelope | Roofs                                      | Insulation entirely above deck                                       | R-25 c.i.  |
|          |  | Attic and other  | R-38   |
|          |  | Metal building   | R-13 + R-19  |
|          |  | SRI  | Comply with Standard 90.1*   |
|          | Walls                                      | Mass (HC > 7 Btu/ft <sup>2</sup> ·°F)                                | R-11.4 c.i.  |
|          |  | Steel framed   | R-13 + R-7.5 c.i.  |
|          |  | Wood framed and other  | R-13 + R-3.8 c.i.  |
|          |  | Metal building   | R-19 + R-5.6 c.i.  |
|          |  | Below-grade walls  | R-7.5 c.i.   |
|          | Floors                                     | Mass   | R-10.4 c.i.  |
|          |  | Steel framed   | R-30   |
|          |  | Wood framed and other  | R-30   |
|          | Slabs                                      | Unheated   | Comply with Standard 90.1*   |
|          |  | Heated   | R-15 for 24 in.  |
|          | Doors                                      | Swinging   | U-0.70   |
|          |  | Nonswinging  | U-0.50   |
|          | Vertical Fenestration                      | Total fenestration to gross wall area ratio                          | 35% Max  |
|          |  | Thermal transmittance—all types and orientations                     | U-0.42   |
|          |  | SHGC—all types and orientations                                      | SHGC-0.40  |
|          |  | Exterior sun control (S, E, W only)                                  | Projection factor > 0.5  |
| Lighting | Interior Finishes                          | Interior room surface average reflectance                            | 70%+ on ceilings and walls above 7 ft<br>50%+ on walls below 7 ft  |
|          | Interior Lighting—Daylighted Option        | Classroom daylighting (daylighting fenestration to floor area ratio) | Toplighted—<br>South-facing roof monitors: 8%–11%<br>North-facing roof monitors: 12%–15%   |
|          |  |  | Sidelighted—<br>South-facing: 8%–11%<br>North-facing: 15%–20%  |
|          |  |  | Combined toplitghted and sidelighted—<br>South-facing sidelighted: 6%–8%<br>Toplighted: 2%–3%<br>North-facing sidelighted: 9%–13%<br>Toplighted: 3%–5% |
|          |  |  |  |
|          |  | Gym toplitghting (daylighting fenestration to floor area ratio)      | South-facing roof monitors: 5%–8%<br>North-facing roof monitors 7%–10%   |
|          |  | LPD  | 1.2 W/ft <sup>2</sup> maximum  |
|          |  | Light source system efficacy (linear fluorescent)                    | 75 mean lm/W minimum   |
|          |  | Light source system efficacy (all other sources)                     | 50 mean lm/W minimum   |
|          | Interior Lighting—Nondaylighted Option     | Occupancy controls   | Manual on, auto off all zones  |
|          |  | Dimming controls daylight harvesting                                 | Dim all fixtures in classrooms and gym and other fixtures within 15 ft of sidelighting edge and within 10 ft of toplitghting edge                      |
|          |  | LPD  | 1.1 W/ft <sup>2</sup>  |
|          |  | Light source system efficacy (linear fluorescent)                    | 85 mean lm/W minimum   |
|          |  | Light source system efficacy (all other sources)                     | 50 mean lm/W minimum   |
|          |  | Occupancy controls—general   | Manual on, auto off all zones  |
| HVAC     | Packaged DX Rooftops (or DX Split Systems) | Air conditioner (<65 kBtu/h)   | 13.0 SEER  |
|          |  | Air conditioner (≥65 and <135 kBtu/h)                                | 11.0 EER   |
|          |  | Air conditioner (≥135 and <240 kBtu/h)                               | 10.8 EER   |
|          |  | Air conditioner (≥240 kBtu/h)  | 10.0 EER and 10.4 IPLV   |
|          |  | Heat pump (<65 kBtu/h)   | 13.0 SEER/7.7 HPSF   |
|          |  |  |  |

# APPENDIX | ASHRAE CLIMATE RECOMMENDATIONS-ZONE 5

|      | Item                                       | Component   | Recommendation   |
|------|--|---|--|
| HVAC | Packaged DX Rooftops (or DX Split Systems) | Heat pump ( $\geq 65$ and $< 135$ kBtu/h)           | 10.6 EER/3.2 COP   |
|      |  | Heat pump ( $\geq 135$ kBtu/h)                      | 10.1 EER and 11.0 IPLV/3.1 COP   |
|      |  | Gas furnace ( $< 225$ kBtu/h)                       | 80% AFUE or $E_f$  |
|      |  | Gas furnace ( $\geq 225$ kBtu/h)                    | 80% $E_g$  |
|      |  | Economizer  | $> 54$ kBtu/h  |
|      |  | Ventilation   | Energy recovery or demand control  |
|      |  | Fans  | Constant volume: 1 hp/1000 cfm<br>Variable volume: 1.3 hp/1000 cfm                             |
|      | WSHP System                                | Water-source heat pump ( $< 65$ kBtu/h)             | Cooling: 12.0 EER at 86°F<br>Heating: 4.5 COP at 68°F  |
|      |  | Water-source heat pump ( $\geq 65$ kBtu/h)          | Cooling: 12.0 EER at 86°F<br>Heating: 4.2 COP at 68°F  |
|      |  | GSHP ( $< 65$ kBtu/h)                               | Cooling: 14.1 EER at 77°F and 17.0 EER at 59°F<br>Heating: 3.5 COP at 32°F and 4.0 COP at 50°F |
|      |  | GSHP ( $\geq 65$ kBtu/h)                            | Cooling: 13.0 EER at 77°F and 16.0 EER at 59°F<br>Heating: 3.1 COP at 32°F and 3.5 COP at 50°F |
|      |  | Gas boiler  | 85% $E_g$  |
|      |  | Economizer  | Comply with Standard 90.1*   |
|      |  | Ventilation   | DOAS with either energy recovery or demand control   |
|      |  | WSHP duct pressure drop                             | Total ESP $< 0.2$ in. $H_2O$   |
|      | Unit Ventilator and Chiller System         | Air-cooled chiller efficiency                       | 9.6 EER and 11.5 IPLV  |
|      |  | Water-cooled chiller efficiency                     | Comply with Standard 90.1*   |
|      |  | Gas boiler  | 85% $E_g$  |
|      |  | Economizer  | $> 54$ kBtu/h  |
|      |  | Ventilation   | Energy recovery or demand control  |
|      |  | Pressure drop                                       | Total ESP $< 0.2$ in. $H_2O$   |
|      | Fan Coil and Chiller System                | Air-cooled chiller efficiency                       | 9.6 EER and 11.5 IPLV  |
|      |  | Water-cooled chiller efficiency                     | Comply with Standard 90.1*   |
|      |  | Gas boiler  | 85% $E_g$  |
|      |  | Economizer  | Comply with Standard 90.1*   |
|      |  | Ventilation   | DOAS with either energy recovery or demand control   |
|      |  | Pressure drop                                       | Total ESP $< 0.2$ in. $H_2O$   |
|      | Packaged Rooftop VAV System                | Rooftop air conditioner ( $\geq 240$ kBtu/h)        | 10.0 EER and 10.4 IPLV   |
|      |  | Gas furnace ( $\geq 225$ kBtu/h)                    | 80% $E_g$  |
|      |  | Gas boiler  | 85% $E_g$  |
|      |  | Economizer  | $> 54$ kBtu/h  |
|      |  | Ventilation   | Energy recovery or demand control  |
|      |  | Fans  | 1.3 hp/1000 cfm  |
|      | VAV and Chiller System                     | Air-cooled chiller efficiency                       | 9.6 EER and 11.5 IPLV  |
|      |  | Water-cooled chiller efficiency                     | Comply with Standard 90.1*   |
|      |  | Gas boiler  | 85% $E_g$  |
|      |  | Economizer  | $> 54$ kBtu/h  |
|      |  | Ventilation   | Energy recovery or demand control  |
|      |  | Fans  | 1.3 hp/1000 cfm  |
|      | Ducts and Dampers                          | Outdoor air damper                                  | Motorized  |
|      |  | Friction rate                                       | 0.08 in. w.c./100 ft   |
|      |  | Sealing   | Seal Class B   |
|      |  | Location  | Interior only  |
|      |  | Insulation level                                    | R-6  |
| SWH  | SWH  | Gas storage ( $> 75$ kBtu/h)                        | 90% $E_f$  |
|      |  | Gas instantaneous                                   | 0.81 EF or 81% $E_f$   |
|      |  | Electric (storage or instantaneous)                 | EF $> 0.99 - 0.0012 \times \text{volume}$  |
|      |  | Pipe insulation ( $d < 1.5$ in. / $d \geq 1.5$ in.) | 1 in./1.5 in.  |