Appalachian
STATE UNIVERSITY

Facility Design Guidelines 2022

Appalachian State University
Office of Planning, Design & Construction

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POLICIES & PROCEDURES 1

PP 1. 1 | ADMINISTR ATION

This section outlines the procedures that are unique to the capital improvement projects at Appalachian State University. These requirements supplement the planning, design and construction procedures required by regulatory agencies, including but not limited to the North Carolina Building Code, the North Carolina Department of Administration's Office of State Construction (SCO) as outlined in the State Construction Manual and the University of North Carolina General Administration Design and Construction Guidelines. The SCO manual can be accessed at http:www.nc-sco.com/scomanual.aspx. The UNC Design and Construction Guidelines can be found at: https://www.northcarolina.edu/wp-content/uploads/2013/10/designconstruction_guidelines_rev_2-1-08.pdf

Designers should refer to Appalachian State University's current Master Plan for specific information on the intentional campus character of the buildings, landscape, and open space on campus. Capital improvement projects shall be designed in such a way as to enhance the campus environment and character.

The current Appalachian State University Master Plan can be accessed at the following website: http://pdc.appstate.edu

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. Furthermore, the Designer should understand that Facilities Operations and, specifically, the Office of Planning, Design and Construction oversee all capital improvement projects and serve as the project client.

1.1.2 Contact with the University

The University Project Manager (PM) is the primary contact for all correspondence and transfer of information during all phases of the project.

1.1.3 Design Contracts

- The Designer shall designate a project manager, who shall represent the Designer and their design consultant team throughout all phases of the project. As with the University PM, the Designer's project representative shall be the single point of contact for communications and decisions. Any change in the Designer's project representative during the life of the design agreement shall be made only after written request and subsequent approval by the Designer and the University respectively. The Designer shall provide an experienced project manager capable of effectively coordinating a multi-disciplined architectural/engineering team.

- As per the requirements set forth on the SCO website, the University uses the "Standard Form of Agreement between Owner and Design Professional" as found on the SCO website at www.nc-sco.com for most projects. Letter agreements are used on smaller and informal projects and are administered through the University of North Carolina General Administration or directly through the University, depending on the total project cost.

- The Designer shall provide all basic services for the project except survey and environmental, unless specifically included. On major projects, the University may engage quality assurance professional services such as for code review, commissioning, document coordination, Construction Manager at Risk, and other services to ensure compliance with project goals.

- The Designer may provide additional consultant services as determined by the scope of the project. When the Designer contracts with other professional consultants for these services, the owner must approve the consultants. A change of professional consultants during the term of the design agreement must be approved by the owner. All contractual obligations and changes must be formally amended, including fee and schedule modifications.

- The employment of professional consultants does not relieve the Designer from the responsibility for the entire project and for the full coordination of services required under the design agreement, whether the work is performed by the Designer or their consultants.

- On occasions, the University shall request the Designer hire a specialty consultant, and/or a specialty consultant specifically selected by the University, to support and/or supplement the work of the Designer. In such cases, the Designer shall be responsible for the performance of the specialty consultant per the terms of the original design agreement or as amended.

- Fee proposals should include the Designer's perception of the project scope of work, budgeted construction cost of work, and recommended scope of services. The Designer shall include a proposed fee, deliverables based on the scope and fee, project schedule, and any other University-requested information. The University shall generally negotiate a fixed fee or percentage of the construction cost fee for major projects. Fees must include all miscellaneous expenses such as, but not limited to, meals, mileage, and printing expenses. There will not be reimbursable fees added to the Fixed Fee.

- No payments to the Designer will be made without an executed agreement on file.

- The Designer must submit requests for amendments to the agreement, or requests for additional fees, prior to proceeding with the services. All design phase requests for additional services will not be considered once the construction contract has been executed. (Fix bullet margin)

- All invoices and contractors pay applications shall be submitted to the University project manager via email and ASU project Pay at asu-projectpay@appstate.edu and will only be approved for services performed to date. The invoices must be delivered as a PDF document and clearly marked as "Invoice" and include the project name, the SCO ID number, the project Code and Item numbers, the Appalachian State project number and the ASU Project Managers name (PM). Invoices must include the total fee for the project with a breakdown of amounts of each phase: Advanced Planning, Schematic Design, Design Development, Construction Documents, Bid and Award, Construction Administration and Close Out, as appropriate. The percentage complete and the amount currently requested for each phase must be clearly noted and totaled for a total paid to date and a current total due represented.

1.1.4 Project Delivery Schedule

The Project Development Schedule shall be up-dated and re-submitted with each end-of-phase submittal described in Section PP 1.3 Design Phases

In the proposal, the Designer shall identify project milestones, including design review submittals, document revision periods, and re-review periods. These milestones shall include start dates and durations of each major phase of pre-design, design phases, bidding and award, construction contract award, and the construction period. Also included where appropriate shall be the start dates and durations for funding decisions, surveys, hazardous materials design and abatement, zoning and environmental approvals and permits, other permits and approvals, commissioning, move-in times, etc.

1.1.5 Site & Existing Conditions Information

Projects within existing facilities shall include an appropriate review of the existing conditions as a part of the basic services. The University shall make existing documentation available to the Designer upon request and the Designer shall verify all information. The University cannot warrant the accuracy of any record documents or as-builts, including surface or sub-surface features. The Designer shall have the responsibility to verify the existing conditions to the greatest extents possible.

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

The University's PM will schedule an initial planning conference with the Designer and other University stakeholders as appropriate. This meeting is held as soon as possible after the professional is selected for the project. The intent of this meeting is to review the project goals, scope, budget and schedule, and special conditions unique to the University or the project. It is recommended that the Designer's consultants attend this meeting. It is usually appropriate for mechanical, plumbing, electrical controls, and telecommunications consultants to attend to ensure project scope is clear to all parties.

Following the initial planning conference, the Designer will provide a preliminary design proposal and project schedule including the milestone dates through close-out. If acceptable, the PM forwards the proposal to the State Construction Office for review and approval. See the SCO manual for contract limits and regulatory requirements. Based on these requirements, a contract or letter agreement is prepared and subsequently executed.

1.2.2 Design Reviews

Planning and Design Process

A. Project Management

- The University's PM is the Owner's representative throughout the project. All correspondence, instructions, and approvals come to the Designer from the PM. Services rendered by the Designer, but not requested or approved in advance by the PM, shall not be compensated.
- The University manages the total project budget and requires the Designer to design to the Construction Cost of Work (COW) budget. This should be clearly documented as the basis of design. The Designer shall design the Base Bid and 85%-90% of the COW, with the remaining 10%-15% as alternates. The alternates must be structured such that if the alternate is not accepted, the facility is fully functional without that / those components. Alternates must be created such that potential bidders are not discouraged from bidding and that the bids are not inflated (i.e., complex alternates, which are difficult to define clearly on the construction documents, are not acceptable).
- The PM shall manage internal University reviews and approvals and shall instruct the Designer accordingly.
- The Designer must notify the PM of decisions that are critical to the project budget, schedule, and quality so as not to delay the project. These critical decisions must be highlighted during the design process and milestone dates included in the project schedule.

- If the Designer believes additional services are required by the University beyond the scope of services defined by the agreement, the Designer must notify the PM and seek approval before proceeding with the services. Additional fees must be negotiated and an amendment to the original agreement processed immediately. This also applies to terminated or suspended work.

- University projects normally involve many academic, student, and facilities service groups as stakeholders. The PM arranges for and coordinates the Designer contact with these groups.

- Meeting minutes shall be kept by the Designer and be issued to the PM within five (5) working days of the meeting for review. The Designer shall distribute the minutes to all participants or others required to be copied.

- At each phase, the design team should review the project budget and scope. At this time, the team should establish a list of pending critical decisions and a timeline for their resolution by the University.

- The Designer shall work with the University Interior Designer through the PM for all interior materials selections, interior and exterior signage, wayfinding, directories, furniture layouts and selections and room numbering systems. The University Interiors Designer must be involved at the initial design phases and throughout construction.

B. Coordination of Consultants

- On projects where a Construction Manager at Risk (CMR) is retained by the owner, the Designer may assist the owner with shortlisting and interviewing of the potential firms. At the project outset, the Designer and the CMR shall develop an agreed upon format for reconciliation of the scope and cost estimates and fully reconcile both for each phase of design. It is the responsibility of the Designer to invite the CMR to all project meetings during design. The Designer shall assist the CMR with structuring bid packages to foster the greatest HUB participation possible. Although the CMR is responsible for leading the pre-bid conference and the bid opening, the Designer is required to attend.

- On projects where a commissioning agent (CxA) is retained by the owner, the Designer shall develop the basis of design. The CxA will assist the owner with establishing the owner's project requirements (OPR). The Designer will integrate specifications provided by the CxA into the construction documents. The Designer shall assist in the coordination of and attend the pre-functional and functional tests and start up testing.

- On projects where asbestos and lead materials are suspected to be present, the Designer shall notify the owner and assist with identifying the necessary testing locations based on the project scope. Working with the hazardous materials consultant, the Designer shall incorporate into the construction documents the abatement design as required for the project. The hazardous materials consultant may be retained separately by the owner or be a consultant to the design team.

C. Testing

On projects where geotechnical exploration, seismic site classifications and special inspections are required, the Designer will develop the criteria for these studies and all testing for analysis during design or as required during construction shall be coordinated through the University PM.

Fire hydrant flows will be coordinated with the University project manager in conjunction with the Town of Boone Fire Marshall.

D. Design Phase Submittals

- The Designer should provide timely and complete submittals. The University shall review the Designer's work for program and constructability prior to issuance to other reviewing agencies. Incomplete submittals may be rejected by the PM.
- The Designer is responsible for the management and performance of their professional consultants. Delay of a consultant's part of a submittal is considered an incomplete submittal from the Designer. The Designer is responsible for quality assurance reviews prior to the submittal to the University.
- Submittal requirements are described in detail in Section II: Planning Standards.
- The Designer shall include the agency review times in the project schedule, following the review durations established by the State Construction Office.
- The University requires electronic files of CAD documents at each end of phase submittal. These must interface with the software requirements of Facilities Operations. The Designer should coordinate the format and the media at the project initiation meeting with the PM.
- The Designer is required to participate in plan review conferences at completion of each phase submittal to review the project goals and scope. This is typically a group review, whereby University stakeholders and the Designer discuss the programmatic requirements and how the proposed documents meet the stated goals. These help to clarify design intent, conflicts constructability and to assist in definition of alternates.

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 to accomplish the project scope of work. The Designer should work with the Office of Planning, Design & Construction to coordinate each submittal to the governing organization. Some of these may include:

- Ashe County Planning Department
- Watauga County Planning and Inspections
- Town of Boone Planning and Inspections
- North Carolina Department of Administration (NCDOA)
- State Construction Office (SCO)
- North Carolina Department of Insurance, Childcare Division (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)
- Appalachian Regional Health Department

  https://www.apphealthcare.com/environmental-health/food-protection-and-facilities-section/

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.

Procedures

Design Submittal
With each submittal phase, provide up to three (3) sets of printed documents, and an electronic file in AutoCAD and .pdf format or as determined by the University PM. The University shall review and approve the documents for completeness prior to submittal to other agencies. Coordinate size of plan sheets and if electronic plans instead of printed sets are preferred with the PM.

1.3.1 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 will define the program, space needs, and site considerations for development of a project budget in this phase.

The Designer shall comply with the University's Standards and Guidelines

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

1.3.2 Schematic Design (SD) Submittal

- General Requirements

  In addition to the requirements of the North Carolina State Construction Manual, the following requirements apply to the Schematic Design submittal:

  - All drawings submitted shall be dated, show scale and orientation of drawing, and include the official title of the project, as well as the University's project number, the SCO identification project number, and the name of the design professional.

  - Floor plans shall have rooms identified by the program room numbers and program room names. Net and gross area of each floor and total gross area of each floor and the

building shall be noted.

- Where applicable, site plans are required and shall note zoning district and indicate building setback requirements, as well as existing pedestrian/vehicular/ bicycle circulation, and those proposed during and following construction, access for disabled patrons, and fire and service access.
- LEED checklist indicating realistic project goals.
- The University Project Manager (PM), facilities, and other University stakeholders will create initial inventory of valuable and/or reusable building materials available for reuse in the project or other projects or for recycling.
- Owner's Project Requirements (OPR) documents as facilitated by the commissioning agent (CxA).
- Stormwater conceptual plan, which includes an existing conditions assessment, estimate of proposed impervious cover, and estimated size and location of proposed stormwater infrastructure and best management practices. Project location will determine if the Town of Boone Unified Development Ordinance or if the Watauga County Ordinance standards will be in effect for Stormwater Management requirements.
- If applicable, a geotechnical and seismic investigation, along with a hazardous materials analysis, will be commissioned by the owner in consultation with the design team and executed early in this phase for proper design and budget considerations.

- Project Cost Estimate

  Submit a written quantitative estimate of construction developed from complete schematic plans and outline specifications, per the SCO manual. Include estimated cost per square foot. Indicate the design professional's contingency as applicable.

- Building Systems & Description of Construction

  - Provide a project description using the following outline as a guide. This shall include a brief summary of building systems and materials proposed in the schematic design and a building code summary establishing occupancy group, construction type, building height, etc.
  - Construction systems including structural members, wall system, roof design, water proofing, vertical conveying system, exterior and interior finishes.
  - Life Cycle Cost Analysis using  software and sustainable design strategies as required by the Office of State Construction.
  - Plumbing, air conditioning, heating and ventilating systems, ducts, filtration and piping, and building controls. Include appropriate Code references to be followed in design.
  - Electrical services, including voltage and number of feeders. Provide specific description of items to be served by emergency power and describe consideration for any special areas.
  - Fire detection and fire protection systems required for intended occupancy for the building.
  - Site work and exterior utilities.
  - Scope of communication systems and audiovisual equipment
  - Scope of access control and security.

- Schedule
    - Provide updated project development schedule.
    - The Designer shall not proceed to the Design Development Phase without written notice of approval from the PM for the Schematic Design Phase.

1.3.3 Design Development (DD) Submittal

In addition to the required deliverables noted within the Schematic Design Section, the Design Development submittal should also include the following items:

a. General requirements

- Drawings submitted electronically must be in AutoCAD format. Each file shall be complete with any x-ref drawing files or shape files to be bound to the drawing file. Fonts supplied with current version of AutoCAD shall be used. The purge command shall be invoked to delete any unreferenced blocks, layers and line types. Provide polylines around each room on a separate layer.
- Drawings shall show room and space uses, including location of items of fixed equipment, furniture layouts, and major pieces of movable equipment whether owner or contractor supplied or installed. Room numbers shall be finalized and approved by the University on the Design Development set of documents.
- Program document showing net and gross square feet and comparison to the program requirements in previous phases of design. Program documents shall show how the proposed areas compare to the University of North Carolina Space Planning Standards also referred to as the "Eva Klein Study." The document can be found at:

  https://facilities.uncc.edu/sites/facilities.uncc.edu/files/media/Policy%20Statements/UP-601.4-SupplementalProcedures%20SPACE%20GUIDELINES.pdf
- Where applicable, site plans are required and, in addition to the items required for the Schematic Design, the plans are also to include limits of construction, fences, construction access, laydown and staging areas. Also include proposed location of transformer, generator, waste and recycling collection, and all utilities that serve the building.
- Landscape plan and other site improvements including exterior pedestrian and parking lot lighting, tree protection plan and details, roadways, walks, parking lots and any other hard surfaces, reflecting natural tendencies of pedestrian pathways as opposed to forced angles in hardscape routing.
- Ceiling plans shall show all devices to be located in the ceiling, which must be coordinated with all disciplines.
- Provide a review of interior finishes for approval.
- Review and coordinate placement of exterior and interior building code required and wayfinding signage with University Interior Designer. Signage package to be procured by the University.
- Outline proposed construction phasing needed to accomplish the project goals.
- At the direction of the PM, identify any University-preferred brand items to be included in the project documents.

- Include anticipated generator capacity if one is required for the project.
- An updated LEED checklist identifying realistic, budget conscience measures to meet the projected goals.
- Include Owner's Project Requirements (OPR) documents as facilitated by the commissioning agent (CxA).
- Include statement from Designer verifying documents comply with the University standards, guidelines, and Codes.
- Provide written responses to all review agency comments and indicate specifically how the comments have been resolved.

b. Description of Construction & Building Systems

- Energy efficiency analysis as required by the NC SCO manual.
- Structural
    - Include a building code analysis, including all design dead and live loads, material specifications, and design stresses assumed during the design, including any assembly stresses where applicable.
    - Specify the special mountain region wind category for Watauga County. Consult with the local AHJ for more information. Specify site specific snow load category.
    - When structures employ a beam-column framework, a grid reference system using alphabetic and numeric symbols shall be utilized. When additions are made to existing structures, the original reference system shall be extended where practical.
    - Include structural elements on floor plans to accurately show impact on spaces.
- Thermal and Moisture Protection

    • Continuity of water tightness and the thermal envelope is of special importance in this climate. Drawings should include how these elements are achieved.

    • Specify roofing system with guidance from the SCO Roofing Design Criteria & consultation with the University PM & Facilities Operation Roofing Maintenance Staff

c. Mechanical

- For existing building renovations, evaluate the exterior envelope to properly size new heating and cooling systems load requirements.
- Indicate all required demolition and associated capping of piping and duct runs.
- Indicate waste, vent, and service mains, including water, air, gas, vacuum, steam, condensate, compressed air, hot water, chilled water, etc.
- Indicate pieces of equipment and double line duct runs. Include locations and connections of piping, tanks, pumps supply and exhaust fans, fume hoods, etc.
- Show pump layout and piping runs
- Provide equipment scheduled indicating sizes, capacity, operating characteristics, etc. Indicate adequate vehicular access to equipment and space required for maintenance of equipment. Review access to all equipment with the University.

- Provide air and water flow diagrams for supply and exhaust air, and water distribution systems. Indicate flow rates in mains and branches.
- Include BAS control schematics and sequence of operations. **The University will provide sequence of operations for each project.**
- Include large scale drawings and room section cuts of mechanical rooms to include:

  Layout of equipment to scale

  Elevations of built-up fan units showing air flow and access to components

d. Plumbing

Provide isometrics for water, sanitary, and gas piping.

e. Fire Protection

In addition to requirements of the NC State Construction Manual, fire protection drawings shall include:

- Pipe runs, standpipes, fire pump (if required), pumper connections, and test connections.
- Indicate if system will be wet, dry, or a combination of both. Carefully consider areas that are vulnerable to freezing, such as awnings, attics, and vestibules that are not properly protected from the cold, and whether a dry system is required.
- Indicate any special requirements or equipment.

f. Electrical & Telecommunications

In addition to requirements of the NC State Construction Manual, electrical drawings shall include:

- All required demolition, if applicable
- Show power, data, telecom and electrical room layouts on one drawing and lighting and fire alarm device layouts on a separate drawing. Include electrical, data, and casework on one sheet. Coordinate loose furniture layout with electrical and data plan in those areas where coordination in necessary with proper height of devices identified.
- Include emergency power plan, identifying special program needs in addition to life safety requirements.
- Provide single line electrical distribution diagrams showing primary service to substations and secondary service to distribution switchboards, motor control center, and panel boards for power and lighting.
- Indicate the point of connection to external utilities.
- Indicate and provide utilization schedule for each load center unit substation, motor control center, distribution and switchboards, telephone equipment rooms, and closets. Indicate minimum panel clearances required on plans.

g. Schedule

Provide updated project development schedule.

The Designer shall not proceed to the Construction Document Phase without written notice of approval from the PM for the Design Development Phase.

h. Project Cost Estimate

Follow all requirements as outlined and detailed for the Schematic Design Project Cost Estimate. Submit a written quantitative estimate of construction developed from complete Design Development plans and specifications.

1.3.4 Construction Documents (CD) Submittal

a. General Requirements

In addition to the requirements of the North Carolina State Construction Manual, the Construction Document submittal shall include:

- All corrections to drawings and specifications identified during previous design phase reviews and subsequent reviews shall be completed and incorporated into the construction documents. These include agency comments, CxA, CMR, and special construction circumstances (i.e., phasing, utility outages, access, etc.).

- The Designer is responsible for obtaining, incorporating and responding to Owner review comments. The Designer is also responsible for obtaining agency approvals in accordance with the North Carolina State Construction Manual.

- The Designer shall perform their own drawing quality control check to ensure that all disciplines have been coordinated throughout the documents. It is the Designer's responsibility to perform quality control of the contract documents.

- Where interior or exterior colors, materials, or finishes are specified, a color board of approved finishes shall be provided accurately depicting the materials, colors, and finishes to be used on the project and indicating their location within the project.

- Drawings, not specifications, shall include all schedules for plumbing mechanical and electrical, lighting equipment, doors and windows, room finishes, etc. All design details, sketches and drawings shall be shown on the drawings, not in the specifications.

- All symbols and abbreviations used on the drawings shall be identified in a legend or key.

- Drawings shall clearly dimension and accurately describe non-standard details and construction requirements including, but not limited to:

  - Construction and expansion joint details
  - Construction sequencing made necessary for specific conditions and protection of work in place.
  - Concrete reinforcing details, including type placement and location of rebar splices.
  - Connection capacity
  - Water stops, etc.

- If contractors are to be prequalified, during the CD phase, the University will begin this process. The designer shall assist in the pre-qualification process by reviewing the list of contractors. The University will complete the pre-qualification process based on the submittals and the feedback from the designer.

b. Approved Erosion Control Plan

Storm drainage plan with table showing structures, pipe system, rim elevations and invert elevations.

c. Roofing

- Special design consideration shall be given and documented for roofing design requirements for the region including, but not limited to, wind uplift, snow loads, snow guards, impact of falling ice sheets from roofs. Approval of design criteria shall be obtained from the University PM. Follow the SCO Roofing Guidelines Manual, latest edition.

- Roof plans shall be fully developed and include all features and elements of the roof design in the construction document submittal, including roof slope and drainage, penetrations, and equipment. Refer to the Roofing Design Standard section for the complete list of roofing elements that are to be included and coordinated as part of the system.

d. Structural

- Construction drawings shall include a statement of special inspections, structural loadings, and details (i.e. floor, roof, cross-sectional, etc.)

- The geotechnical report shall be included as part of the contract documents

e. Mechanical and Electrical

- All ductwork plans are to be shown double lined, ¼" scale minimum. Provide an enlarged plan for all mechanical rooms. All ductwork and piping 3" and larger shall be shown double lined. Clearly identify locations of valves and dampers on drawing plans, sections, and installation details.

- General commissioning requirements, including Owner's project requirements and specific commissioning requirements for each discipline shall be included.

- Final LEED Checklist & Evaluation

- Owner Training Requirements

- A utility load summary sheet

- Air and water flow diagrams (for balancing purposed)

- Fully developed sequence of operations for HVAC controls that is provided by the University

- List of owner preferred alternates

- Designers shall confirm that all materials are identified in the specifications, thoroughly defined with a basis of design that is available and on the market. List all submittals, shop drawings, operations and maintenance manuals, warranties and

certifications that shall be required for each product.

- As part of the beneficial occupancy, a sealed survey, performed by a professional land surveyor licensed in the State of NC, will be provided in pdf and AutoCAD formats of the accessible building entrance and routes, including all steps into the facility, to confirm they meet requirements of the building code. In addition, a site survey will also be provided, prepared by a licensed professional land surveyor, as part of the closeout documents of all above and below ground as-built improvements. This will require the contractor to engage a surveyor during the installation of underground improvements such as utilities.

1.3.5 PROCEDURES (under $2 million)

The Designer shall comply with Chapter 300 of the North Carolina State Construction Manual regarding design phases and submittal requirements. Reference: https://www.northcarolina.edu/wp-content/uploads/2013/10/designconstruction_guidelines_rev_2-1-08.pdf for further guidance.

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.

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 like the formal process.
- 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:
  - Combine Schematic and Design Development submittal; or
  - Based on the complexity of the projects, only a Construction Document review may be required.

PP 1.4 | BIDDING

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

This outline is specific to the Single Prime Contracting method that is most common and preferred project delivery method.

Procedures

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

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

The date for the preferred alternate open meeting, pre-bid meetings and receipt of bids shall be established by the Designer in consultation with the University and SCO. A period of four (4) weeks is the typical duration between the publication of the Advertisement for Bids and the receipt of bids.

During the time of Construction Document development, the University will have identified pre-qualified contractors. Bid documents shall be made available to the prequalified contractors by the Designer.

It is the responsibility of the Designer to be aware of the Universities commitment to the State's Historically Underutilized Business (HUB) guidelines. The Designer will participate in this process to meet these goals. The ASU University HUB Coordinator can assist in this effort. As noted in the 2002 Guidelines for recruitment and Selection of Minority Businesses for Participation on State Construction Contracts, the Designer will:

- Attend the scheduled pre-bid conference to explain minority business requirements to the prospective bidders.
- Assist the Owner to identify and notify prospective minority business prime and subcontractors of potential contracting opportunities.
- Maintain documentation of any contact, correspondence, or conservation with minority business firms made in an attempt to meet the goals.
- Review jointly with the Owner, all requirements of G.S. 143-128.2(c) and G.S. 143-128.2(f) – (i.e., bidders' proposals for identification of the minority businesses that will be utilized with the corresponding total dollar value of the bid and affidavit listing Good Faith Efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) – prior to recommendation of award.

Note that MBE requirements and 10% goal also apply on informal contracts. Documentation and data on MBE participation is required. The Owner has the responsibility to make a good faith effort to solicit minority bids and to attain the goal.

1.4.1 Bid Opening, Evaluation of Bids and Awards

Projects where Construction is $2 million and greater:

Follow the State Construction Guidelines
https://ncadmin.nc.gov/documents/construction-manual

- **No AIA Bid Bonds!!!!!**

Projects where the construction is $500,000 to $2 Million:

Follow the UNC General Administration guidelines and procedures.
https://www.northcarolina.edu/offices-and-services/finance-and-administration/capital-design-and-construction/

- **No AIA Bid Bonds!!!!!**

Projects where the construction cost is less than $500,000:

Public advertisement, bid bonds, performance bonds and payment bonds are not required but may be included. Consult with the University Project Manager if these requirements are required. The receipt of three (3) bids is not required to open bids, but at least three (3) bids should be solicited. Bids may be faxed or sent electronically to the Owner.

Typically bids should be received on Tuesday through Thursday at 2:00 PM or 3:00 PM to maintain consistency and for the availability of contractors. Unless a larger venue is required, it is preferred that the bid opening be held in the University's Planning Design and Construction conference room, with shall be coordinated with the PM.

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, and the North Carolina General Administration. This outline is specific to the Single Prime Contracting method that is the most common preferred project delivery method.

Procedures

1.5.1 Construction Contract

The Designer is required to thoroughly review the construction contract for completeness. Special attention shall be given to the accuracy of the SCO identification number, Appalachian State Project Number, and accurate complete Certificates of Insurance.

Specific to the Certificates of Insurance, this clause (or its full intent) must be included in the Endorsement Form:

> Notwithstanding, the preprinted cancellation provisions on this form, coverages afforded under these policies will not be cancelled, reduced on amount nor will any coverages be eliminated until at least thirty (30) days after mailing the written notice, by certified mail return receipt requested to the insured and the State of North Carolina (at the address of the Certificate Holder), of such alteration or cancellation.

Designers shall refer to the SCO Construction Contract Checklist for items required.

1.5.2 Pre-Construction Conference

During construction, the Designer and their appropriate consultants are expected to attend all project meetings.

Items to review as part of the Pre-Construction Meeting Agenda that are in addition to the SCO requirement:

- Electronic vendor payment information.
- Material testing and special inspections. Some projects may require the testing agency to be present at the pre-construction meeting.
- Requirement for a NC registered land surveyor to locate uncovered existing and new utility installations to record horizontal and vertical locations (prior to covering up the work). This information will be turned over as part of the closeout documentation.
- Review utility location services are through University Facility Operations, the Town of Boone, and the New River Light and Power which are above and beyond other utility location services.

- Noise, Dust Mitigation.
- Utility outages.
- Pedestrian safety and traffic control signage requirements.
- Campus No Smoking policy
- Employee decorum on campus.

1.5.3 Notice to Proceed

Upon approval of all regulatory agencies, the Designer will coordinate with the SCO and the University's PM 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. This letter shall establish the start date and completion date for each contract.

1.5.4 Progress Meetings & Site Inspections

The Designer shall establish a schedule for progress meetings at the job site in accordance with the State Construction Manual. Minutes of the meeting will be kept by the Designer and distributed to all parties.

As required per the SCO Manual, inspections shall be qualified representatives of the Designer's firm and their consultants and shall be as often as necessary to ensure compliance with the contract documents, but in no case less than once per week while work is in progress.

The ASU Facilities Operations personnel will also observe work in progress and will provide comments to the Designer through the University's Project Manager.

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 the State Construction Manual regarding the closeout requirements. The Designer shall provide the following project close-out services upon completion of the project:

1. Provide all record drawings and specifications in pdf and AutoCAD format per the Universities most up to date requirements upon full review of as-built documents from the contractor for accuracy and completeness confirming that all Addenda, ASI Change Orders and Field Order revisions have been incorporated.

2. Provide review of Operating and Maintenance Manuals for accuracy and completeness.

3. Review in coordination with the Commissioning Agent, Owner's training requirements, additions to the preventative maintenance program, contractor's proposed training agenda and proposed training personnel qualifications. Verify contractor completes training requirements.

4. Provide review of Warranty Manual confirming manufacturer warranties are included in addition to those specifically required by the contract documents. Confirm warranty start dates are the project acceptance date. Verify extended warranties are included.

Review Attic Stock Inventory for accuracy, completeness and handoff to Owner is verified with signature receipt.

DESIGN GUIDELINES 2

INTRODUCTION

The purpose of the Design Guidelines section is to 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. The Designer shall solicit from the University preferred examples of existing design elements and building models that have successfully achieved these goals. 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:

- Responsive to use
- Sustainable
- Flexible
- Technologically advanced
- Considers weather & topography
- Pedestrian oriented
- Exhibits detail
- Expresses physical harmony
- A 50-year solution
- 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 University Project Manager 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 prioritize efficient building envelopes and consider the utilization of passive solar energy techniques, non-conventional and renewable energy resources, recycled materials content of specified materials, and non-conventional materials.

DG 2.1 | SUSTAINABLE DESIGN

Appalachian State University is committed to climate neutrality and has adopted a Climate Action Plan that outlines strategies to reduce building-related emissions and other environmental impacts. The University's design guidelines outline considerations that strike a balance between more efficient building practices and reliable technologies that reduce operations and maintenance costs.

Standards

All new construction and major renovations shall be built to at least the U.S. Green Building Council's (USGBC) LEED Silver standard or equivalent. LEED Silver is the minimum design criteria. When pursuing LEED certification, point priority should be given towards designing energy efficient buildings rather than offsets or other non-project specific point opportunities.

To the extent possible, new buildings and major renovations should go beyond LEED standards. If an equivalent green building standard is used, the standard must be appropriate for the building's intended use and strive to be at least 30% more efficient than code. Potential building standards that support regenerative design should be consulted and considered include:

- WELL Health-Safety Building Certification
- Living Future's Core Green Building Certification
- Green Built Multifamily Certification (Residence Halls only)
- ENERGY STAR Certification for Buildings
- PHIUS+ Passive House Certification
- Living Building Challenge

Appalachian State University requests that the following criteria be considered and prioritized in all new construction and major renovation projects:

- Energy Efficiency
- Water Efficiency
- Indoor Air Quality
- Indoor Environmental Quality
- Low Impact Development
- Material Selection
- Waste Management
- Diversity, Equity, and Inclusion

Guidelines

2.1.1 Energy Efficiency

Appalachian State intends to reduce its carbon footprint by integrating energy efficient practices and technologies throughout the campus. To the extent possible, all new construction and major renovation projects on campus shall be designed in an energy efficient manner by addressing the following criteria:

Reduce overall building energy loads by 30% as compared to the current NC Energy Code.

- Maximize the thermal efficiency of the building envelope.
- Designers shall work with a building envelope consultant for each project. All envelope designs should be internally reviewed by Facilities Operations.
- Utilize energy modeling and analysis. Thermal calculations are to use aged R-values.
- Utilize commissioning on all new projects to ensure systems are functioning as intended.
- Utilize LED lighting and dual-technology or ultrasonic occupancy sensor controls.
- Consider high efficiency mechanical systems that utilize proven technologies with successful operations and maintenance records. *See "Incorporating High Efficiency HVAC Technologies" for more information.*
- All equipment and appliances shall be ENERGY STAR rated.
- Incorporate Demand Controlled Ventilation. Each individual HVAC zone must have networked sensors that monitor dry bulb temperature, carbon dioxide, and relative humidity.
- Incorporate exterior shading devices or extended roof overhangs to control heat gain.
- Consider renewable energy sources.

2.1.2 Incorporating High Efficiency HVAC Technologies

Appalachian State University intends to incorporate proven technologies that reduce energy use, operation and maintenance costs, and environmental impacts. Balancing reliability with efficiency requires that the university takes advantage of newer efficiency technologies while also supporting the Facilities Operations staff that are responsible for maintaining and operating university systems. Facilities Operations requires the following two conditions when considering new, higher efficiency technologies such as magnetic bearing chillers, condensing boilers (off campus locations only), or similar:

- **10-year extended warranty** on all parts, labor, and refrigerants (if applicable) on all new, high-efficiency HVAC systems.

- **Life Cycle Analysis –** The university requires a Life Cycle Analysis using the university-approved LCA software platform that considers energy savings, maintenance costs over the life of the system, and any other potential operational issues. A copy of the completed analysis must be provided to the university in the original source format so that the LCA can be vetted by university staff.

2.1.3 Water Conservation

Appalachian State University has made significant progress in reducing the amount of water consumed on campus. To continue this trend, the university, the extent possible, seeks to maximize water efficiency in new construction and major renovation projects. The Designer should consider water efficiency measures such as:

- All water products (toilets, urinals, faucets, shower heads, irrigation controllers, etc.) shall be WATER SENSE rated (or equivalent).
- In renovation projects, ensure existing plumbing will successfully remove waste when considering low-flow technologies.

- Minimize freshwater use for landscaping by implementing technology to enable water capture and reuse as part of the building design.
- Protect surface water by preventing culverts from flowing into daylit surface water. Existing surface water enclosed in culverts will be daylit to the extent practical.
- Utilize permeable surfaces as much as possible.
- Select drought resistant plantings

2.1.4 Indoor Air Quality (IAQ)

The University will maintain healthy and comfortable interior environments that promote learning and increase the safety of occupants. Facilities should be designed and constructed to:

- Meet current ASHRAE ventilation standards.
- Incorporate or pursue WELL Health-Safety Building certification standards.
- Include networked sensors that monitor dry bulb temperature, carbon dioxide, and relative humidity in each individual HVAC zone.
- Prevent the infiltration of moisture into buildings.
- Supply adequate levels of outside air to ensure indoor air quality.
- Eliminate the use of ozone-depleting materials.
- Utilize low Volatile Organic Compounds (VOC) products for all interior spaces.

2.1.5 Indoor Environmental Quality (IEQ)

When designing new construction and major renovation projects, the health and well-being of occupants shall be prioritized. IEQ considers the conditions inside a building and the impact those have on occupants. To the extent possible, lighting levels, air quality, thermal conditions, and ergonomics should enhance the quality of life of the people occupying the building. Strategies to consider include:

- Ensure ventilation systems are capable of reducing indoor air pollutants under any outside weather condition experienced in Boone, NC.
- Maximize daylighting for occupied spaces.
- Maximize views to the exterior for all occupied spaces.
- Install operable windows.
- Utilize low-emitting materials.
- Provide acoustical privacy as appropriate.
- Specify ergonomic furniture.
- Explore Biophilic Design opportunities

2.1.6 Low Impact Design (LID)

New building developments should utilize storm water management techniques to reduce the impact of built areas on the natural movement of water. LID principles prioritize 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. Examples of specific LID practices include:

- Stormwater Wetlands
- Bioswales
- Riparian Buffers

- Cisterns
- Underground Pipe Storage
- Planted Filtering Strips

2.1.7 Material Selection

The design and construction for new buildings and major renovation projects should include strategies that utilize materials with minimal environmental impact. Projects that require the demolition of a buildings should consider if reusing building materials is feasible.

- Purchasing practices should consider the embodied carbon of materials.
- When selecting materials, the Designer should consult the environmental profile of specific products.
- Demonstrated carbon footprint – If a certain products costs less, performs as well, and meets aesthetic requirements, the Designer is required to go with products with the smallest carbon footprint.
- Specify local materials as a first preference, then regional products to reduce shipping energy cost.
- The carbon sequestering properties of building materials (i.e., big timber frames vs steel for smaller buildings) should be considered to the extent possible.
- Utilize flexible design and flexible spaces to provide a maximum lifespan for the use of the building.
- Maximize the recycled content of building materials.

2.1.8 Waste Management

The amount of waste created both during construction and during occupancy is affected by design considerations. Appalachian State University requests that Designers consider how the design of new buildings and major renovation projects will impact waste management. Considerations of effective waste management diversion include:

- During design, create a solid waste management plan that is included in the specifications.
- To the extent possible, specify construction materials that are recyclable and design to minimize waste.
- During construction, waste is to either be separated into separate containers and sorted onsite or sent to a material recovery facility.
- Include strategies for occupant generated waste.
- Designers to consult with the University's Zero Waste Leadership Team to ensure campus standards are met.
- Review Solid Waste Management Plan with Facilities Operations and the Office of Sustainability prior to the end of the design process.

2.1.9 Diversity, Equity, and Inclusion

Appalachian State University is committed to developing and supporting a diverse campus culture. The University requests that Designers consider the following on new and major renovation projects:

- Does this project support the UNC system's requirement to prioritize contracting with minority and women owned businesses?
- Will this project marginalize or displace people in Boone or elsewhere?
- Are health and safety prioritized not only for future occupants but also for the people designing and constructing the project?
- Can this project exceed requirements from the Americans with Disabilities Act to support and engage all occupants?

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:

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

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 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 affect 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:

- 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.
- Walks should not dead-end into the middle of parking lots and other vehicular-oriented areas.
- Special consideration should be given to locations where pedestrian pathways cross vehicular routes and shall be ADA compliant.
- Where primary pedestrian traffic intersects roadways, brick paving material should continue across the vehicular route.
- Existing brick paving materials and patterns should be continued as a means of maintaining visual continuity across the campus.
- 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:

- Siting and building design should minimize the need for steps or ramps when possible. Alternative grading measures should be considered.
- Ramps should be installed for supply and service deliveries.
- Ramps should be installed for universal accessibility for renovation projects.
- Provide overhead exterior lighting for all steps and ramps. Recessed wall or step lights below 24" is discouraged due to salt and water degradation.
- All walking surfaces should have a surface providing traction. Carborundum or similar abrasive will NOT be permitted.
- The building design shall consider the need to protect steps and ramps from the fall of snow from roofs at entrances and along walkways.

  See handrail requirements in section 3.5 for specifications.

2.3.3 Service & Utilities

Utilities and service areas should be screened or otherwise hidden from the view of the pedestrian. 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.

- All exterior trash or dumpster areas should be screened. The enclosure should be made of materials and colors compatible to that of the principal structure.
- Where feasible, screen loading docks and truck parking from public view using building mass, freestanding walls, and/or landscaping.
- 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. Vaults shall not be located in streets, parking areas, or sidewalk areas where subject to road salt application. All utility services should be underground.
- 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.

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.

- Piping of creeks should be avoided, and channelization should be minimized.

- 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.
- 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).

- All lighting shall be light emitting diode (LED) unless there is a more efficient alternative.
- Use a low intensity of high-quality white light, which will provide good, uniform visibility while avoiding light pollution.
- 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.
- 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.

- Public art should be constructed and placed to add beauty and character to the campus. The piece of art should be meaningful, give meaning to the campus, and contribute to the academic mission of the University.
- 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).
- 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. Driveway standards based upon NC DOT standards as well as best practices for corridors similar to those found throughout the campus.

- 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.

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.

- 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.

- 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.

- 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. 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

- 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 connecting walk. Also use warning signs and light fixtures to alert drivers to crossings
- 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.
- 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 underdeveloped, provide part of the connection or maintain the potential for a future link.
- No pedestrian paths should be less than six feet (6') 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.
- 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.

- 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.

- Pedestrian access to the stations should be maximized. Evaluate ridership and staging areas with the AppalCart Director to ensure it is sufficient.
- Lighting and campus standard shelters should be provided. Station and shelter design shall also be coordinated with AppalCart and University staff.
- Where appropriate, park and ride facilities should be provided in close proximity to significant bus stations. Shared or joint use parking should be encouraged.
- The impacts of cross traffic in relationship to transit should be minimized using grade separations, queue jumps or signal preemption.
- Each station should have good access for other modes of travel including autos, pedestrians, bicycles, electric vehicles, buses, and shuttles.

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.

- 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.
- Shared parking is strongly encouraged.
- Consider the feasibility of providing a parking structure rather than surface parking to conserve land and minimize the impacts on the environment.
- 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.
- 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.
- Parking lots along the street must be screened from the adjacent street and sidewalk by low walls and/or landscaping.
- Parking structure facades should be treated with approved building materials. The façade should be designed to visually screen cars.
- 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.
- Bicycle racks and storage lockers are strongly encouraged inside new parking structure.
- Alternative fuel stations (electric vehicle chargers) should be considered for new parking structures as directed by the University.

DG 2.5 | LANDSCAPE C HARACTER

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.

- Existing trees shall be preserved whenever feasible.
- 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.
- Trenching, placing backfill in the critical root zone, driving or 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.
- 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.
- 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 massing's, 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.

- Site disturbance and erosion should be minimized through retention of existing vegetation and avoiding development in sensitive areas.
- Plants to be selected for the campus should be native to the bioregion, long lived, relatively pest free and practical to maintain.
- Establish new tree plantings along all major walkways and major campus streetscapes.
- Define outdoor living spaces and quads with plantings to create informal gathering spaces with access to seating.
- 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 following proper stream restoration design.
- Provide landscape screening around exposed building equipment such as transformers or mechanical units.
- The corners of street intersections, particularly gateways and site entries (from both street and sidewalk) should be distinguished by special 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.
- The plantings (softscape) should be balanced with the special paved areas (hardscape).

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.

- 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.

- 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.
- 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".
- 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.
- 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.
- The design of these spaces can be enhanced with plazas, fountains, or public art.
- Maintaining open spaces at varying scales is also important and encourages both passive and active spaces within the campus setting.
- Conserve open land, including those areas containing unique and sensitive features such as natural areas, wildlife habitat, streams or creeks, wetlands, and floodways.
- Promote compact building design accessible to open space amenities and with a strong campus identity.
- All lands within areas required to be maintained as open space shall be protected by a permanent conservation easement, prohibiting further development.
- 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.
- 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 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

2.5.1 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:

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

2.5.2 Facades

Each building facade should be articulated in a simple consistent manner.

- 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.
- 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.
- 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).
- The use of more than three (3) primary building materials is discouraged.
- Accent details of precast or stone should be included to add design interest.
- Avoid tight internal corners, usually north facing that is in shade year-round.
- Exterior Insulation & Finish Systems (EIFS), stucco or plaster shall not be used.

2.5.3 Entrances

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

- 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.
- All entries must be easily identifiable and visually impressive for those entering the building. Covered entrances are preferred for protection from snow or inclement weather upon entering the building.
- Primary and secondary entries should be connected internally with a direct route to allow pedestrian passageway from building to building on campus.

2.5.4 Roofs

Special attention should be given by the Designer to the roof forms.

- Sloped metal roofs are preferred. Roof forms should be designed carefully with other massing elements of the building. Multiple gabled roof configurations are encouraged to be included in the design.
- 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.
- 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.

2.5.5 Fenestration

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

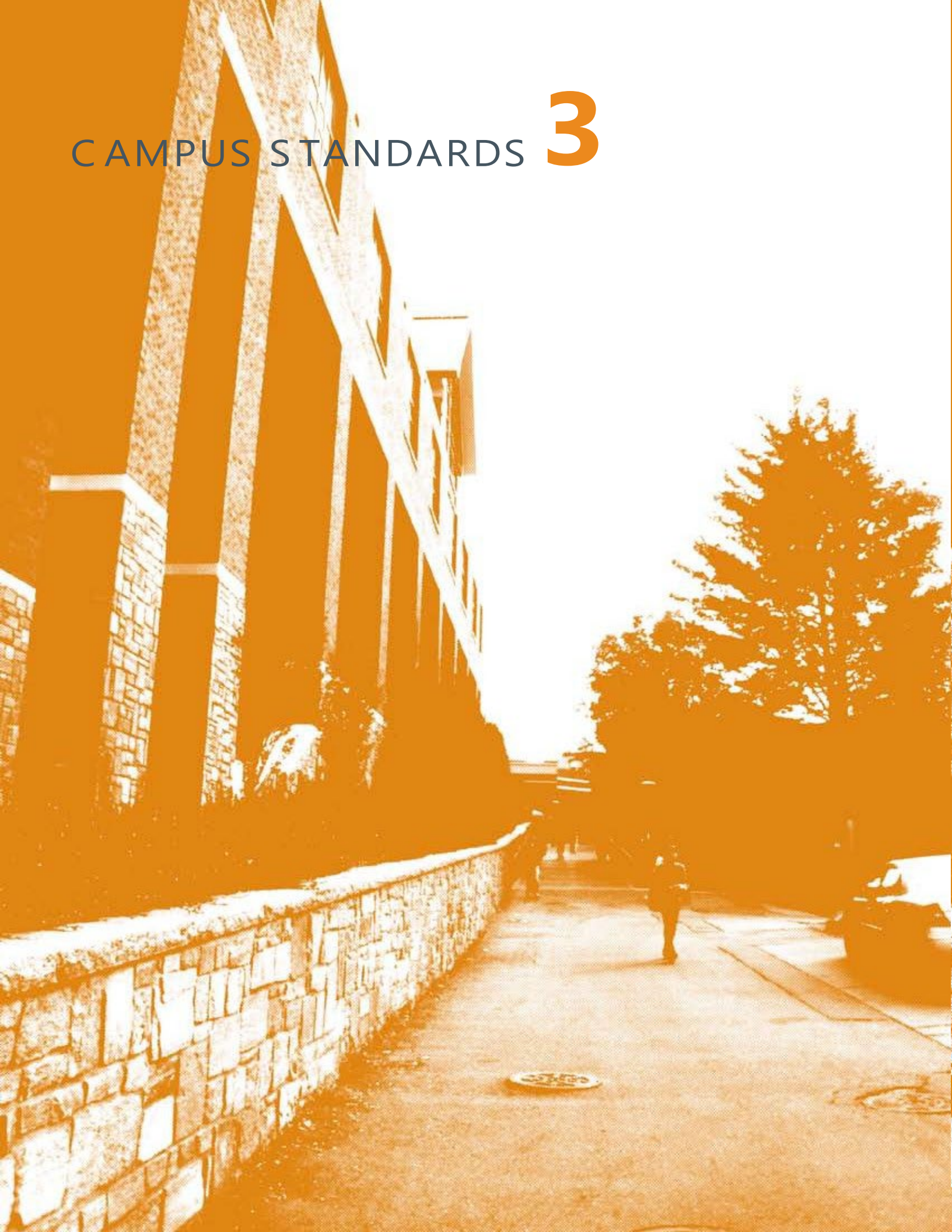
- Openings are another means for providing an appropriate human scale to the exterior appearance of a structure. Appropriately sized individual windows or openings, treated as penetrations of the wall surface, are preferred to large expanses of glass.
- Larger openings may be used to express principal entries, gateways, or as vertical separation of massing along a building facade.
- Orientation and solar gain of openings should be a priority for the design of the exterior.
- Appropriate overhangs or screening devices should be considered.
- Appropriately sized operable windows with screens and clear (Low-E) glass are recommended to be used where feasible.
- The efficiency of windows should be a major consideration when selecting windows. Associated U-factor shall not be higher than 0.28.

2.5.6 Arcades

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

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

CAMPUS STANDARDS 3



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 for all new and renovation projects.

The Designer is encouraged to maximize building envelope efficiency and consider the utilization of efficient mechanical and electrical systems (please see extended warranty and Life Cycle requirements), 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 of 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 affect mobility. Accessibility should relate to universal design principles when the approach involves “direct access”.
This also includes delivery of goods and services to the facility. If a loading dock is provided, there should also be a ramp with at least 4 feet of clearance or at grade access for the service entrance to accommodate mail delivery, courier services, etc.

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 principal criterion 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 overriding 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

3.1.1 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.

3.1.2 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.

3.1.3 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].

3.1.4 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.

2. 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.

3.1.5 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 six feet (6’) chain link type fence with top rail.
- Drawings shall also specify the area to be used for material storage during construction.

C S 3.2 | EXISTING CONDITIONS

Standards

3.2.1 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.

3.2.2 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
- Moving
- Restoration
- Capping of utilities

Recording existing piping arrangements to facilitate reinstallation and replacing utilities/extensions required to complete reinstallation.

3.2.3 Blasting

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.

C S 3.3 | CONCRETE

General Concrete Notes:

- Include cold weather requirements addressing materials and procedures for concrete placement.
- 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. The slope requirement shall be detailed on the structural drawings so that the slopes are installed where pours are made.
- Roof decks for any built-up roofing system must be standard weight concrete.
- All exterior concrete shall be designed with a minimum of 4000 PSI strength in 28 days, 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.

Standards

3.3.1 Foundation Systems

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.

3.3.2 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. Exterior caulked expansion joints shall be provided where needed along buildings, walls, curb and gutter, etc.

3.3.3 Sidewalks

Sidewalks will be constructed with concrete and will be a minimum of six inches (6") deep with a six inch (6") gravel base on compacted earth. Concrete walkways, minimum 4000 psi (because of amount of service trucks), with non-slip broom finish are the standard for typical campus sidewalks. Walkway elevations shall be 1" higher than the adjacent finish grade. Brick pavers should only be considered for accent areas and not main travel areas.

- 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.

3.3.4 Dumpster Pads

Dumpster pads shall be constructed of twelve feet (12') wide by eighteen feet (18') long concrete pad (5000 psi minimum) with minimum reinforcing of #4 rebar at 12" on center each way. The pad shall be a minimum of eight inches (8") deep with a six-inch (6") gravel base on compacted earth and be provided with positive slope away from the building or towards a storm drain to avoid standing water.

- If a loading dock is provided, the container pad shall be located at the dock. Provide laminated tread dock bumpers for truck delivery lanes. There shall be no bumpers on the dock at the pad location. Instead, provide a stop six inches (6") from the rear of the pad 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 (1) 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.

3.3.5 Recycle Container Pads

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.

3.3.6 Exterior Site Walls

Exterior site walls shall be erected using Elkstone Veneer, the campus standard in an ashlar pattern. Walls should have drainage in the form of gravel and leech drainpipes properly pitched in the direction of flow. Include top and bottom of wall elevations. Consideration should be given to the maximum slope above and below walls, required drainage swales and if guard railing is required for fall hazard conditions. The Elkstone is quarried from Western Carolina Stone in Morganton, NC. The University standard wall caps are "Kenoran Sage" or equal. Cold Springs Quarry in Cold Springs, Minnesota is one source for this material.

- Exterior site walls constructed from segmental blocks shall be the campus standard VERSO_LOK retaining wall system. For this type of system, geotechnical information may be required. In addition, provide top and bottom of wall elevations, location of wall relative to other features such as catch basins, parking lots, curb and gutter and fencing, maximum slopes allowed above and below walls, required drainage swales and if guard railing is required for fall hazard conditions
- If retaining walls can be integrated in such a way in public spaces to serve as seat walls, they must be 16" to 18" high and 18" wide built with Elk Stone or masonry, with tops including slight positive slope for drainage.

3.3.7 Interior Floors

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 not be finished with a penetrating seal and hardener for concrete that is receiving floor coverings. Concrete floors not covered with a flooring material shall receive one smooth coat of membrane seal. Prior to the installation of floor coverings over concrete floors, the concrete shall be tested for the unsuitable moisture levels utilizing the ASTM F2170 test to validate that the concrete floor will meet the recommended installation parameters from each specific flooring material manufacturer.

3.3.8 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.

C S 3.4 | MASONRY

General Masonry Notes:

- Include cold weather requirements addressing materials and procedures for each masonry division.
- Evaluation of the building enclosure system must be performed to determine direction of vapor flow, risk for condensation and proper design of vapor retarder location. The Boone climate is unique for the State so details cannot be replicated from projects outside of this climate zone. Follow ASHRAE guidelines.

Standards

3.4.1 Unit Masonry

In most exterior conditions, face brick with precast and stone are preferred. shall be "Guilford Blend" manufactured by the Hanson Brick company. Alternate colors of brick and coursing patterns are acceptable but must be approved by university. Use of oversize brick and glass block is not acceptable.

3.4.2 Precast or Natural Stone

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. Campus standard natural stone is Elkstone.

3.4.3 Mortar

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.

3.4.4 Brick Pavers

Brick Pavers shall be 60 mm interlocking pavers, color "Harvest Blend", traffic bearing, and constructed on a concrete base over compacted earth. Top dress brick pavers with polymeric sand.

C S 3.5 | METALS

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.
- On-site mockup panels including all major materials of the building envelope shall be included in the design documents and constructed to allow for evaluation of the materials and quality of construction prior to finalizing any material orders. These panels shall be constructed with adequate time to allow the decision-making process to take place, usually several weeks.

Standards

3.5.1 Structures

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.

3.5.2 Column Base Plates

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. Exterior galvanized metals that are to be painted shall follow proper preparation, cleaning, and etching procedures to receive exterior primers and high-performance paint.

3.5.3 Lintels

Lintels shall be hot dip galvanized after fabrication.

3.5.4 Exterior Ferrous Metals

Exterior ferrous metals shall be hot dip galvanized after fabrication. Field welds shall be ground and have cold galvanizing applied.

3.5.5 Shop Primer

Shop primer for ferrous metal shall be manufacturers 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.

3.5.6 Exterior Railings

Exterior railings including handrails and guard rails shall be welded 1 ¼" schedule 80 steel pipe. Railings for ramps and steps shall be core drilled and grouted into the concrete step or sla. Grout pockets or sleeves shall be installed to prevent collection of water at the attachment points. Railings shall be ropery cleaned, primed, and painted with Sherwin Williams (preferred, see Paint Specifications for acceptable alternatives) Acrolon 100 in Hartford Green. Handrail pockets, or sleeves, shall be designed to shed water and prevent corrosion.

3.5.7 Cold Formed Metal Framing

Cold formed metal framing shall be heavier than 25 gauge.

3.5.8 Expansion Joint Covers

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.

C S 3.6 | THERMAL AND MOISTURE PROTECTION

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

Standards

1. Building envelope and roof design shall be designed by a qualified building envelope and roofing designer/consultant.
2. The designer shall select roof systems which are suitable for the facility and comply with the latest version of the "Roofing Design Criteria" from the NC State Construction Office. To evaluate possible systems, the designer must consider the following design parameters:

    - Life of roof system
    - Initial cost of roof system and additional building costs required for proposed roof system
    - Maintenance costs and requirements
    - Energy costs associated with proposed roof system
    - Building height, roof slope, wind resistance, etc. **Wind uplift design loads shall be for a 120-mph zone.**
    - Present and future use of building, including specific uses on the building that could affect the roof system.
    - Environmental contaminants and pollutants that could affect the system
    - Life expectancy of the building
    - Structural properties of the roof superstructure
    - Type of roof deck: metal decking is preferred.
    - If structural concrete deck is required, metal decking shall be perforated to prevent moisture issues. **Architect shall coordinate with structural designer.**
    - Slope and drainage of the roof
    - Vapor retarder requirements

- Roof traffic, access requirements and penetrations
- Code and insurance requirements or restrictions
- Aesthetics
- HVAC internal pressures
- On reroofing projects, University preference is to update insulation levels to current NC Energy Code regardless of whether or not existing insulation levels are allowed under grandfathered clause.
- Coverboard under membrane are preferred to protect integrity of insulation.

3. Once design parameters have been established, the systems shall be evaluated by the designer based on:
    - Minimum requirements established by the University
    - Roof system that is best suited to the project considering all factors.

4. **Requirements for a Total System Warranty –** Warranty (membrane and system) shall be for a minimum of 20-years by the manufacturer and 5 years for the installation. **Warranty shall be provided for wind uplifts loads of 120 mph.** After two-years contractor shall return for onsite inspection.

    - On all new and re-roof projects, thermal imaging analysis shall be performed at 18 months following completion of the project. Imaging shall be performed by a third-party firm that specializes in this type of work. The firm shall be hired by the Owner. Costs incurred by the imaging company will be by the Owner if the roof system performs at an acceptable level. However, if the roof fails, the costs borne by the consultant and all repairs will be required to be paid by the roofing contractor (or general contractor)..

5. Sloped metal roof is the preferred design method by the University.
6. Large, expansive areas of flat roofs are not acceptable and should be kept to a minimum.
7. Multiple gabled roof configurations are recommended depending on the size and scale of the project.
8. 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. If required to locate HVAC systems on a roof, a fully enclosed penthouse is preferred.
9. **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. Included in the specifications will be requirements for waterproofing system flood testing to be observed and documented by the University PM. The system will be repaired and tested until it is proven to be leak-proof.
    - Avoid-placement of mechanical rooms over finished spaces. If this condition cannot be avoided, consider using resinous epoxy flooring in the mechanical rooms to waterproof floors and curbs to protect openings around ducts and piping between floors.

10. **Metal Roofing** shall be required on all sloped roofs and should be a 0standing seam, twenty-four (24) gauge, metal roofsystem.

    - The color will be determined based on the surrounding context and in association with all other building materials although “Hartford Green” is typically preferred color.
    - New buildings shall have a minimum roof slope of ¼” per foot accomplished by sloping structure.
    - Existing roofs with less than ¼” per foot will be evaluated individually for the appropriate result. If additional slope is required, tapered insulation may be used to accomplish the ¼” per foot slope.
    - **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. (**Requires annual inspection.)

11. **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. Quantity determined per manufacturer's guidelines for numbers of rows and anchoring.

12. Roof systems subject to grease laden exhaust shall be PVC.

13. **PVC 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. Single ply membrane should extend completely over parapet walls where feasible. This single-ply roofing membrane also provides exceptional resistance to ultraviolet, ozone and chemical exposure. Minimum thickness shall be sixty (60) mil thick unless otherwise approved by the University.

PVC Roofing must be fully adhered. Mechanically fastened is not preferred because of thermal bridging and may only be considered on a case-by-case basis. Solvent-based adhesives are currently preferred over water-based adhesives that may breakdown with exposure to water.

The Designer should work with Office of Design & Construction and Facilities Operations for selection of the appropriate system, depending on the application including color.

14. **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.

15. **Modified Bitumen can be considered on a case-by-case basis.**

16. Single ply ballasted roofs built up roofs and spray foam roofing systems are not allowed.

17. Single-ply roofing shall be a minimum of 60 ml thick and extend completely over parapet walls. Metal cap shall be provided at all parapet locations Metal coping caps shall have standing seam joints or Drive Seam.

18. Light weight concrete shall not be used to create slope on new buildings.

19. Use crickets, saddles, and edge strips to direct water flow away from parapets and penetrations. Backslope is to be confirmed during detailing in the design phase.

20. Overflow drains are required and shall not be tied into the primary roof drainage system. Highly visible systems such as scuppers or daylighted drains are required for overflow drains.

21. **Vapor Barriers** are required on all roofs, new or replacement. Vapor barriers shall be either torch applied or self-adhering and installed per manufacturer's instructions. Adhesion tests are required.

22. **Walkways Pads** (prefabricated) from roof access to, and around, roof-mounted equipment shall be required for maintenance access.

23. **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. Angled turns shall be fully open inside the downspout to prevent clogging.

    - Downspouts or roof leader connections to the underground piping shall have a clean out located below the boot for the underground portion of the drainpipe. 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.

24. Use crickets, saddles, and edge strips to direct water flow away from parapets and penetrations. Backslope is to be confirmed during detailing in the design phase.

25. **Drip Edges –** All coping caps or other capping methods shall have a minimum one-half-inch (1/2") drip edge.

26. **HVAC equipment** located on roof must not impede the flow of water. HVAC contractors must use a manufacture certified roofing contractor for all penetrations.

27. Overflow drains are required and shall not be tied into the primary roof drainage system. Highly visible systems such as scuppers or daylighted drains are required for overflow drains.

28. Dedicated roof walkways shall be provided to and around all rooftop equipment and other areas as directed by the PM.

29. The designer shall evaluate existing roof conditions for roof replacements or repair projects to include vapor retarder requirements, deck type, expansion joint locations and details, roof insulation conditions, drainage, roof access, roof contaminants, fire rating, and wind uplift factors, and all other applicable parameters.

30. Existing roof decks shall be analyzed by a registered structural engineer if roof loads are in question.

31. For re-roof projects, an evaluation shall be undertaken by the designer to determine if a roof survey by nuclear meter or other means may be necessary.

32. For re-roof projects, drains should be inspected either by flood test (3/4" garden hose for at least 15 minutes). If draining impaired, camera must be used.

33. **Protection for Work in Place –** All roofing projects shall provide adequate protection for roofing systems that are either not part of the project or have already been completed. All roof drains shall be protected both from damage and construction debris that could clog roof leaders.

34. Domestic hot water frost-free hydrants should be located on roof for maintenance. Hydrant shall be accessible from the interior and should have a ¼ turn valve for isolation. Quantity to be determined for each specific project.

35. **Roof access** shall be evaluated and insulated roof hatches, ladders, means of fall protection and other components may be required as determined by the University.
    - All roofs must be accessed by means of a hatch or doorway without disturbing any occupied spaced.
    - All roof access must meet NC Energy Code with adequate insulation and weather stripping.
    - See HVAC guidelines for additional information for roofs with significant equipment located on roof.

36. Avoid complex flashing details. Minimize use of pitch pans or sealant pockets. Maintain a minimum 18" flashing height above finished roof.

37. Minimize roof penetrations. If structural penetrations are unavoidable, use round structural steel shapes to facilitate flashing. University prefers boot flashing and secondary umbrella flashing. Provide for thermal breaks. Equipment supports for rooftop mounting shall be a minimum 18" in height. Use prefabricated equipment supports where possible. Equipment support frames or stands shall provide the following working clearances:

Width of Equipment	**Ht. of Legs Above Finished Roof**
Up to 25"	18"
25-37"	24"
37-49"	30"
49-61"	40"
Over 61"	50"

38. All sheet metal flashings and trim shall be fabricated and installed by an experienced sheet metal contractor.

39. All sealants used in conjunction with roof related sheet metal shall receive a sealant primer and the sealant color shall match the adjacent sheet metal.

40. On re-roofs, evaluate conditions of existing construction at flashing terminations and address deficiencies that would allow water to bypass flashing terminations.

41. On re-roofs, evaluate existing conditions with design criteria to eliminate damage by fastener penetration.

42. On re-roofing projects, all abandoned or unused equipment shall be removed, unless otherwise directed by PM.

43. Where lightning protection is provided, run above the roof membrane and attached with fasteners set in adhesive. In locations where cables contact membrane, sacrificial membrane layers shall be provided. If membrane penetrations occur, gooseneck style flashing shall be installed.

44. On re-roofs, existing lightning protection shall be removed, reinstalled and re-certified. Costs associated with this work shall be included in the project budget, with work being performed by the contractor.

45. Special design consideration shall be given and documented for roofing design requirements for the region including, but not limited to, wind uplift, snow loads, snow guards, impact of falling ice sheets from roofs. Approval of design criteria shall be obtained from the University PM. Follow the SCO Roofing Guidelines Manual, latest edition.

46. **Roof plans** shall be fully developed and include all features and elements of the roof design in the construction document submittal including roof slope and drainage, penetrations, and equipment. Refer to the Roofing Design Standard section for the complete list of elements that are to be included and coordinated as part of the system. Roof plans should identify the R-value and thickness of installed insulation (tapered plan, as built of insulation).
    - Mechanical units, exhaust fans, vents
    - Piping, conduit, and related supports
    - Roof walkways, screens, hatches, and ladders
    - Roof drains, overflow drains, and scuppers
    - All penetrations
    - Expansion joints and curbs
    - Gutters and downspouts
    - Valley ridges, saddles, and crickets

47. The drawings shall include as a minimum complete details of roof system and components including:
    - Each perimeter roof condition
    - Each penetration condition, including vent flashing
    - Each roof-related sheet metal fabrication
    - Equipment curbs, skylight curbs (if existing, no new skylights), and roof hatches
    - Roof expansion joints and area dividers
    - Piping and equipment support
    - Typical roof drain and overflow drain including sumps and flashings
    - Scuppers

48. Roof flashing details shall indicate as a minimum the following components:
    - Roof deck and wall substrate and other adjacent materials. Insulation including separate layers and vapor retarders.
    - Roof flashing membrane
    - Cant Strips
    - Flashing attachment
    - Counterflashing, through wall flashing, and reglets
    - Sealants
    - Wood nailers and blocking, including adequate attachment

Building Envelope

In addition to the previously mentioned roofing requirements, Appalachian State University requires that all new buildings and major renovation projects strive to exceed the latest North Carolina Energy Codes. The Designer should prioritize energy efficient buildings that minimize utility costs and maximize occupant comfort. Considerations to minimize energy consumption at the building envelope include:

- Consider the climate and thermal zone of Boone, NC.
- Optimize thermal insulation
- Incorporate high performance glazing
- When appropriate, consider effective solar shading devices
- Analyze envelope performance with energy modeling
- Commission envelope and consult with a building envelope specialist

Roof / Wall Systems

- Building envelopes shall have continuous air and thermal barriers. Provide proper detailing to ensure continuing at roof to wall transitions and penetrations through the air barrier assembly.
- Air leakage of building envelope assemblies shall meet or exceed Section C402.5 of the NC Energy Code.
- Air Barrier systems should minimize infiltration and exfiltration
- Building insulation thermal calculations must include the use of aged R-values to ensure actual performance equals designed thermal properties.
- Roof solar reflectance and thermal emittance shall meet or exceed Section C402.3 of the NC Energy Code.
- Roof insulation should incorporate multiple layers (2 or more) with staggered insulation joints.

Fenestration Systems – The University's goal is to achieve the best possible daylight transmission while minimizing thermal heat transmission.

- Fenestration in building envelope assemblies shall meet or exceed Section C402.4 of the NC Energy Code.
    - Windows shall have a maximum U-value of 0.28.
- **Glazing** size limitations (prevent excessive sized windows). Insulated Glazing Units should typically not exceed 50 SF. Generally speaking, the most available (and economical) width is 60" or less, because it can be heat-treated on a high-speed furnace. Widths of 60" to 84" are available from a number of fabricators, a few of which can handle widths up to 96". As the size increases, the cost is likely to be higher.
- Glazing specifics should be considered at each specific site to minimize energy consumption.
    - Low-emissivity (low-E) shall be selected when appropriate to improve thermal performance.
    - Ceramic window films should be considered for large sections of glazing with large solar exposure.
- **Window Testing -** AAMA 503 be included in specifications for window testing. This is the "Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems". This voluntary specification requires both the ASTM E 783 (air leakage resistance) and ASTM E 1105 (Procedure A) Uniform Static Air Pressure Difference. Where a chamber is built on the interior or exterior of the window, a static air pressure is provided in conjunction with water from a calibrated spray rack.
- Refer to ASTM E 122 for further information on calculating sample size of windows to be tested. The recommended testing schedule is at least 1 test per 100 SF of installed product. For larger projects, recommend testing at intervals of at 5% completion of window installation, 50 % completion and 90% completion. Number of tests at each interval shall be determined based one the rule of thumb of 1 test location per 100 SF of installed product. It is advantageous to all parties for an initial test to be conducted as soon as possible for each different type of window system installed.
- If any window fails, the attributing factors to the failure should be identified and corrections documented. The corrections shall be carried forward to all successive window installation. The failed window shall be restested and an additional window of similar type should also be tested at no additional cost to the Owner.
- **Exterior Doors** (Thermal Performance Requirements) – Designer
- **Exterior Doors** (Thermal Performance Requirements) – Designer should consider strategies to minimize heat

loss from air movement during operation, heat loss from air movement through perimeter detail, and radiant heat loss through the door materials

- Durable and sufficient weather stripping between operable sash and the door frame.

HVAC Integration

- An integrated and efficient building envelope should reduce operating costs as well as the size of the HVAC needed to maintain adequate building pressure, healthy indoor air quality, and adequate thermal comfort.
- Ensure HVAC system is balanced, and review need for dedicated dehumidification process, depending on interior conditions.

General Hardware Notes:

- Provide a Knox Bix with dual cylinders at entrances where emergency responders would access. This may be where the fire alarm control panel or closest annunciator panel is to the street. Coordinate location with the local fire marshal. Recessed boxes are preferred.
- Closers shall be mounted on the door rather than on the frame. Closers mounted on storefront systems require reinforcement at the frame and doors.
- Card Reader access should be provided at a minimum of two (2) entrances when possible. Power transfer shall be provided at hinge for door access control. ADA operation must work in conjunction with card reader feature.
- 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. Walls stops are acceptable. Do not use floor stops.
- 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 hatches to roof shall be lockable and keyed to the University mechanical equipment room key.

Standards

3.7.1 Interior Doors

Interior Doors, except in special situations, shall have a minimum width of three feet (3'-0") and a standard height of seven feet (7'-0"). No doors greater than eight feet (8' 0") in height.

- Non-fire rated doors shall be solid-core wood doors similar and equal to Weyerhauser, Code DSC-1. Particle core doors are not acceptable.
- Wood doors shall be specified as transparent, prefinished stain.
- Wood door veneers shall be birch, oak, maple, or cherry.
- 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.

3.7.2 Exterior Doors

Exterior Doors shall have a minimum width of three feet (3'-0") and a standard height of seven feet (7'-0"). No doors greater than eight feet (8' 0") in height. 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). For exterior openings, use of hollow metal doors and frames should be reserved for mechanical and service areas due to the effect of salt corrosion.
- 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. Avoid design of air lock vestibules that also house the elevator access for the entire building.

3.7.3 Fire Rated Doors

Fire rated doors shall be hollow metal in high use areas. Solid wood stave core doors specified with 2" wide stiles can be used where traffic is not extreme. Chalk core doors should not be used.

- Doors which open to corridors, and which contain glass, shall use one-quarter inch (1/4") UL fire-rated tempered glass. 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.
- Hollow metal frames shall be welded, minimum 16-gauge steel. No knock down frames allowed.
- Hollow metal doors shall be reinforced at the top of door for closer attachment.
- Exterior hollow metal doors shall be polyurethane, insulated, minimum 18-gauge steel, unless a heavier door is required. For exterior openings, use of hollow metal doors and frames should be reserved for mechanical and service areas due to the effect of salt corrosion.

3.7.4 Aluminum-Framed Entrances and Storefronts

Aluminum-framed entrances and storefronts shall have wide stile with eight inch (8") (minimum 6") 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.

3.7.5 Curtain Wall Systems

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.

3.7.6 Windows

Requirements are as follows:

- Energy efficiency windows shall be selected with a maximum U-value of 0.28
- Exterior curtain wall, storefront and window systems will have integral thermal break frame construction, shall be double-glazed as a minimum and shall have baked-on enamel paint finish. Color is to match the University standard.
- Windowsills shall be held off the ground and floor a minimum of 12”
- Operable windows with insect screens are preferred and should be included in habitable spaces such as offices where possible.
- The orientation and solar gain potential of windows is always an important consideration of low E-glass is required. Installation of mirror or highly reflective glass is not allowed. Integrated exterior sunshades should be considered as a sustainable solution to allow daylighting and temper solar heat and glair.
- 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 may be equipped with concealed locks and removable keys for roof access. 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.
- Replacement windows will be aluminum with baked enamel paint finish.
- Generally wood door frames and wood windows are not allowed. Use of these materials must be approved by the University PM.
- 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.
- 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.

3.7.7 Door Hardware

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.

- 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 stainless steel ball bearing hinges. All interior and corridor doors wider than three feet (3'-0") and/or taller than seven feet (7' 0") shall have four (4) ball bearing hinges.
    - All reverse wing doors shall have heave weight, premium quality stainless steel non removable pin 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 leu 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 thermally broke aluminum.

- Sound Gaskets are required on mechanical room door off public

  corridors.

3.7.8 Automatic Door Operators

Automatic door openers shall be provided at all handicapped accessible entrances and work in conjunction with the University card reader system. 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 LCN.

C S 3.8 | FINISHES

Standards

3.8.1 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.

3.8.2 Acoustical Tile Ceilings

Acoustical tile ceilings shall be exposed grid, lay-in system. Acoustical tiles shall be Armstrong Tundra: 301 or Armstrong Tundra: 303, 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.
- Ceiling grid shall be Armstrong (Prelude or Suprafine) or USG (Donn DX/DL or Donn Centrictee DXT/DXLT
- 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.

3.8.3 Carpeting

<u>Carpet Specification Requirements:</u>

- 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.
- Adhesive shall be troweled as opposed to rolled (unless otherwise noted by manufacturer specifications)
- 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.

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.

Broadloom Carpeting, if installed, should be selected based on durability. A mixed pattern with high soil and stain hiding capabilities is preferred.

3.8.4 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

3.8.5 Access Flooring

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, handrails, fascia molding, plenum dividers, cove base, perforated air flow panels with adjustable air flow dampers and panel lifting devices.

3.8.6 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. Only first line premium paints shall be acceptable. Manufacturers include:

- Sherwin Williams (preferred)
- Pittsburgh
- Benjamin Moore

<u>Exterior Painting Schedule:</u>

Ferrous Metal

- One (1) coat - Pro-Cryl Universal Acrylic Primer or Kemkromik Universal Primer
- Two (2) coats – DTM Acylic or Sher Cryl HPA or Water Based urethane alkyd

Galvanized Metal

- One (1) coat - DTM wash primer or Pro Cryl Galvanized Metal Primer
- Two (2) coats - DTM Eggshell or Multi Surface Acrylic Latex Flat

Concrete Masonry Units

- One (1) coat (Unfinished masonry) Loxon Block Surface
- Two (2) coats - Superpaint, Duration or Loxon XP Acrylic Masonry Coating

Exterior Wood

- One (1) coat – Exterior Latex Wood Primer or Probloack latex
- Two (2) coats – Superpaint Exterior (Satin)

Exterior Stucco

- Two (2) coats – Loxon XP Bondex Waterproof

Exterior Handrail

- One (1) coat – Pro-Cryl or Kemkriomik Universal Primer
- Two (2) coats – Acrylon 100 in Hartford Green (Color detailed below)

SHERWIN-WILLIAMS 702537 03/05/21
828-264-9133 Order# 0222334

WB AC 100 U DEEP A
STANDALONE
ASU HARTFORD GREEN
CUSTOM MANUAL MATCH

CCE*COLORANT	OZ	32	64	128
W1-White	-	9	-	-
B1-Black	4	12	-	-
G2-New Green	4	37	1	1
Y3-Deep Gold	-	37	-	-

ONE GALLON
B65T00724 65002569
DOOR
NOT RECOMMENDED FOR USE ON VINYL

Interior Painting Schedule:

Concrete Masonry Units
- One (1) coat - Latex Masonry Block Filler
- Two (2) coats – Precast Semi-Gloss (precatalized latex epoxy)

Ferrous Metal Work
- One (1) Coat – Pro-cryl or Kemkromik Universal Primer
- Two (2) coats – DTM or Multisurface Acrylic or Water Based Alkyd Urethane

Gypsum Wallboard
- One (1) coat – Promar 200 Primer or PVA drywall primer
- Two (2) coats – Promar 200 (Eggshell) or Precatalized latex epoxy in eggshell

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.

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. Pipe identification should contrast in color to the pipe colors and be easily readable. Mechanical room pipe color and the color of bands are to be as follows:

System	Color	ID.
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 DOM CW	Safety Green	
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	-

- 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)

3.8.7 Wall Coverings

A patented multi-color wallcovering that is not easily matched is **not** acceptable. No wallpaper shall be used, and vinyl wallcovering 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 Facilities Operations 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.

Standards

3.9.1 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.
- Building Interior: All spaces including custodial, mechanical, and closet spaces shall have assigned numbers and appropriate signage.

3.9.2 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.).

3.9.3 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.

3.9.4 Toilet and Bath Accessories

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 by 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.

3.9.5 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.

3.9.6 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.

Standards

3.10.1 Parking Control Equipment

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.

3.10.2 Trash Compactors

Trash compactors shall have a six feet 6 inches (6'-6") by six feet 6 inches (6'-6") by six feet (6'-0") deep (8 yards/6.1 cubic meters) trash holder with compactor located on top, such as the VERT-I_PACK unit by Marathon.

- 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 pushbuttons.
- 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") drainpipe to the sanitary sewer system.
- The temperature for the trash room shall be a minimum of 40 degrees F.

3.10.3 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 guideline 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).

3.10.4 Dumpsters

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

3.10.5 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.

Standards

3.11.1 Entrance Floor Mats and Frames

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 needled. Backing composed of a non-skid rubber, coated with a fire-retardant latex for maximum safety and carry a minimum three-year wear warranty.

3.11.2 Site Furnishings

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

Standards

3.12.1 Elevators

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 Facilities Operations.

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.

C S 3.13 | FIRE SUPPRESSION

Standards

3.13.1 Automatic Sprinkler Systems

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. (HVAC guideline)
- Specify that sprinkler heads be centered in ceiling tiles.
- Flexible sprinkler heads are preferred.
- 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.
- *Please see attached word document “CS 3.21 (21 00 00) - Fire Suppression - Revised March 2021 CS 3.21 (21 00 00) - Fire Suppression - Revised March 2021” for additional specific guidelines*

C S 3.14 | PLUMBING

General Piping Notes:

- All piping shall be routed so 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 the main shall have shut-off valves.

Standards

3.14.1 Domestic Water Piping

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 bibs.
- Hose bibs shall be provided in all mechanical equipment rooms, kitchens, rooms that require wash down, and rooms with floor drains. All hose bibs shall be provided with vacuum breakers. Frost-proof hose bibs shall be used in the exterior walls of all buildings (the temperature in Boone may drop as low as -20 ° Fahrenheit).

3.14.2 Sanitary Sewer Waste & Vent Piping

Sanitary sewer waste and 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.

3.14.3 Back-Flow Prevention Devices

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 with a minimum twelve-inch (12") clearance on all sides. Tank-type vehicles filling from the ASU water supply shall have back-flow prevention devices or air gap.

3.14.4 Water Meters

Water meters shall be installed for all buildings in accordance with the State of North Carolina and the Town of Boone regulations. The Town of Boone Currently stipulates that water meters must be Sensus Brand meters. Water meters shall be touch-read, have a 1000-gallon multiplier and be easily accessible for reading and maintenance.

3.14.5 Grease Traps

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.

3.14.6 Plumbing Fixtures

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
- Low flow faucets and shower heads
- Energy Star rated fixtures and appliances

3.14.7 Drinking Fountains & Water Coolers

Drinking fountains and water coolers shall be wall hung, semi-recessed type and suitable for accessibility.

- Please see the following attached controls guidelines for more detailed specification requirements 3.22 (22 00 00) - Plumbing - March 2020

Standards

3.15.1 Mechanical Design Requirements

At the beginning of each HVAC design phase, the designer shall meet with the Project Manager, Energy Manager, and HVAC & Controls Shop to discuss project specifics.

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 6 (-10 deg to 0 deg F minimum temperature) (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.

Incorporating High Efficiency Technologies – Appreciating the sustainability that many new technologies offer, Appalachian State University intends to incorporate proven technologies that reduce energy use, operation and maintenance costs, and the environmental impact of the university.

Balancing reliability with efficiency requires a delicate approach to ensure that the university is both taking advantage of newer efficiency opportunities while also supporting the Facilities Operations staff that are responsible for maintaining and operating university systems.

As such, the university requires the following two conditions when considering new, higher efficiency technologies:

- **10-year warranty** on all parts, labor, and refrigerants (if applicable) on all new, high-efficiency HVAC equipment.
- **Life Cycle Analysis –** The university requires a thorough Life Cycle Analysis using _____ software

platform that considers energy savings, maintenance costs over the life of the system, and any other potential operational issues. A copy of the completed analysis is to be provided to the university in the original source format so that the LCA can be vetted by university staff.

Additionally,

- 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, which 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. **This requires adequate pre-heat on incoming outside air and appropriately sized mixing chambers in the air handler during cold temperature when operating with 100% air (i.e., COVID operations).**
- Design minimum temperature for makeup air units should be -15 deg F.

- All mechanical systems shall be controlled by a direct connection to the building automation system.

- Three phase electric motors for mechanical equipment are specified in 3. __**Motor Guidelines.** 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.

    - Fan array preferred with a separate VFD controlling each fan.

- 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 savings. (See HVAC specifications for more details)

- 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 BTUs per square foot per year. The total energy consumption shall indicate monthly use of electricity, steam, water, cooling, heating, and gas.

- Individual zones shall have JCI networked sensors that measure dry bulb temperature, relative humidity, and carbon dioxide. (i.e., JCI NS8000 or equivalent)

Commissioning will be provided by an independent, third-party (no prior relationship with the Designer) 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
- Percentage of equipment commissioned
    - 100% of larger equipment such as air handlers and chillers.
    - At least 25% of smaller equipment such as VAV units.

3.15.2 Sound and Vibration Control

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
- Only ducted returns shall be considered. Ducted returns eliminate, noise concerns. Open returns should only be used with prior University approval.
- For spaces with sensitive noise and privacy constraints, noise dampening devices on open returns are required to ensure privacy with a maximum audible dB level.
- 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. 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.

3.15.3 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 Facilities Operations for a detailed list of piping and insulation requirements.
- Insulation on pumps and service valves needs to be removable and capable of being reinstalled.

3.15.4 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.
- All pumps, coils, VAV bocks need isolation valves for service. (Copper brass ball valves, no DU's needed)

3.15.5 Pumps & Pump Systems

- Pumps shall have a minimum clearance of thirty-six inches (36") 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.

3.15.6 Chilled Water Systems

- The desired cooling medium for air conditioning systems is chilled water. The University currently has several regional utility plants. For new construction and renovation projects, the Consultant shall verify that the existing chilled water system will support the new load.
- **Buildings should be designed to incorporate 100% OA during winter months to a design temperature of negative (-) 15 degrees Fahrenheit. If 100% OA cannot be incorporated, A/E shall discuss alternative options for cooling with university (both Facilities Operations and Planning, Design and Construction).**

3.15.7 Boilers

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

- Natural 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
- Boilers shall all be stainless steel, no aluminum.
- Life Cycled Analysis using university approved software is required for all high efficiency, condensing boilers.

3.15.8 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.

3.15.9 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.

3.15.10 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. AHU re-heat coils not necessary if VAV boxes have reheat.

- All units need preheat coils with faced-bypass arrangement.

- 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.

3.15.11 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 balancing dampers shall be at main trunks and be accessible for future service.

- Variable air volume (VAV) boxes should be provided to adjust temperature demands on a space. Reheat coils should be located on downstream side of VAV boxes to be able to heat without fan motor. Sensors should be provided where air is discharged.

- Parallel fans are preferred for fan powered boxes.

- Discharge air temperature sensor shall be at least 5 feet downstream of reheat coil.

- There shall be 6ft of hard duct after VAV.

- 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. Cooling only is only permitted in mechanical rooms or electrical rooms with constant heat load.

- All ductwork in unconditioned spaces shall be provided with vapor- retarding finish.

3.15.12 Building Automation System

Johnson Controls is the only "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 Facilities Operations, with no exception.The drawings shall clearly indicate the design and sequence of operation.
- **Sequence of Operations will be provided to the Designer by the Facilities Operations Controls shop for each specific project.**
- 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:

	Summer (air conditioning)	Winter (heating)
Occupied Space	74degrees F	68 degrees F
Unoccupied Space	85 degrees F	55 degrees F

- All chiller rooms require audio and visual monitoring of the refrigerant lines.
- Each controller output device requires a single analog output except for mechanically linked components.

"Frequently Missed" BAS list of items

- **Functional Intent** (23 09 00 – Section 1.08) – If submitting products that differ from what is detailed in guidelines, Contractor must receive signed approval by the project manager, controls shop supervisor, energy manager, and facilities operations director.
- **Electronic Drawings** (23 09 00 – Section 1.09) – Control submittals and schematics must be submitted in original source format and Adobe PDF format.
- **Product Data** (23 09 00 – Section 1.09) - Submit manufacturer's technical product data for each control device, panel, and accessory furnished, indicating dimensions, capacities, performance and electrical characteristics, and material finishes.
- **Control Drawings** (23 09 00- Section 1.09) – When submitting detailed shop drawings for each controls system, including a complete drawing for each air handling unit, system, pump, device, etc. with all point descriptors, the designer shall also include:
    - **General panel locations**
    - **Floor plans locating all control units, LAN interface devices, getaways, etc.**
    - **Laminated control drawings**
    - **Indicate cable numbers and termination points**
- **Control Logic Documentation** (23 09 00 – Section 1.09) – After functional testing, a **check-off sheet/commissioning report for each unique control program to make sure SOO works as intended,**

inputs/outputs have been calibrated, etc.

- **Systems Conversion Plan** (23 09 00- Section 1.09) –For renovation projects, a scope of work with schedule needs to be provided to and approved by the Controls Shop prior to the project beginning.

- **System Architecture** (23 09 00 – Section 1.11) – Pay special attention to capacity of functional requirements of network engines and controllers. **There should be as additional 25% additional input/output availability and memory capacity for future expansion.**

- **Control Valves** (23 09 01 – 2.08) - Control valve sizing and selection is the responsibility of the design engineer and not left to the controls subcontractor.

- **For Steam Service** (23 09 01 -2.08) - Valve Trim, Plug, Seat and Stem should all be polished stainless steel unless approved otherwise.

- **Name Plates** (23 09 01 – 2.20) – Provide phenolic labels for all equipment, sensors, components, and field devices furnished. Name plate shall identify function for each device.

- **All setpoints and commandable outputs shall be capable of being operator overridden** (23 09 03 – 2.03)

Please see the following attached controls guidelines for more detailed specification requirements:

- CS 3.23 (23 00 00) – Heating, Ventilation & Air Conditioning
- CS 3.23 (23 00 01_ - HVAC Chemical Contract
- CS 3.23 (23 09 00) - BAS General
- CS 3.23 (23 09 01) - BAS Materials Sensors
- CS 3.23 (23 09 03) – BAS Field Panels
- CS 3.23 (23 09 04) – BAS Comm Devices
- CS 3.23 (23 09 05) – BAS Software
- CS 3.23 (23 09 93) – Sequences of Operation (General)

C S 3.16 | ELECTRICAL

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

Standards

3.16.1 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

3.16.2 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 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 drainpipes of any kind are not permitted in the transformer vault, switchgear, 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.

3.16.3 Emergency Generators

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.

3.16.4 Electrical Device Manufacturers

Electrical device manufacturers preferred due to compatibility with existing materials:

Panelboards: Siemens, Square D, Cutler Hammer, and GE.

Life Safety Systems: Simplex, Pyrotronics, Fenwal Heating Cable: Nelson, Chromalux

Fuses: S&C (for high voltage)

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

Generators: Cummins (Preferred), Kohler, and Caterpillar

3.16.5 Interior Lighting

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

a. 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) and lux (lx):

Lobbies and Lounges	20-30 fc/ 200 – 300 lx
Offices and Classrooms, general use	50 fc/ 500 lx
Offices and Classrooms, special use	60-75 fc/ 600-750 lx
Conference Rooms	30 fc/ 300 lx
Laboratories and Libraries (close task areas)	75-100 fc/ 750 – 1000 lx
Toilet Rooms	20 fc/ 200 lx
Corridors and Stairways	10 fc/ 100 lx
Storage and Janitor Closets	20 fc/ 200lx
Mechanical Equipment Rooms	30 fc/ 300 lx
Shop Areas, general use	30 fc/ 300 lx
Shop Areas, special use	Task lighting as required
Gymnasium (general recreation)	50 fc/ 500 lx
Gymnasium (competition level)	75 fc/ 750 lx
Gymnasium (televised athletic events)	100 fc/ 1000 lx

Interior Lighting—LED lighting shall be used unless approved by the University for interior lighting

3.16.6 Occupancy Sensors

Occupancy sensors shall be provided to control ceiling light fixtures when room is not occupied unless room function dictates 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

3.16.7 Day Lighting

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.

3.16.8 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- Exterior lighting shall be LED.

Exterior Light Pole:

Use the “Sternberg Prairie Lantern” Model-1230
Led/S5/4AIR/45/T3/MDL03/CSA/FMC/VG
[Local distributor: SL Bagby Company]

Lighting General Notes: 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.

- The lighting design and layout should address accessibility forre-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.

Standards

3.17.1 Clock & Bell System

Clock and 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.

3.17.2 Emergency Telephones

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 autodial 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 autodial to the ASU Police and a red to green LED light to indicate the call has been answered

C S 3.18 | ELECTRONIC SAFETY AND SECURITY

Standards

3.18.1 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 backup 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.

3.18.2 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.

3.18.3 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.

- Please see the attached document for additional information

    - CS 3. - Access Control

3.18.4 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.

Standards

3.19.1 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, in 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.

3.19.2 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.

3.19.3 Site Drainage

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.
- 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 soil.

Natural Drainage:

- Natural drainage shall be utilized and maintained wherever possible.
- The vegetative area fifty feet (50') from each side the center line of the swale or stream shall be maintained whenever 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.

C S 3.20 | EXTERIOR IMPROVEMENTS

Standards

3.20.1 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.

3.20.2 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.

3.20.3 Landscaping

The campus landscape environment consists of plant materials that form 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 Facilities Operations 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.

3.20.4 Xeriscaping

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.

3.20.5 Large Trees recommended for campus:

Species	Common Name	Salt Tolerance	Remarks
Acer Saccharum	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. Use at least 50 feet from any salted area.
Aesculus Hippocastanum	Horsechestnut	Tolerant	Fruit may be considered messy
Betula Alleghaniensis	Yellow Birch	Not	Nice tree for a park setting beautiful yellow fall color
Carya Aquatica	Water Hickory	Not	Does well in wet areas, nuts eaten by wildlife
Fraxinus Americana 'Skycole' P.P4256	White Ash	Tolerant	Borers may become an issue
Fraxinus Pennsylvanica	Green Ash	Tolerant	Borers may become an issue
Ginkgo Biloba	Maidenhair Tree	Tolerant	Select male clones
Gleditsia Triacanthos 'Inermis'	Thornless Honey Locust	Moderate	Tolerates urban soils. May require pesticide applications to control pest. (Plant bugs, mites, and webworms)
Gymnocladus Dioicus	Kentucky Coffee Tree	Tolerant	This tree needs adequate room, fruit may be messy, list cultivar
Liquidambar Styraciflua	Sweet Gum	Not	Fruit may be considered messy. Consider 'rotundiloba' for fruitless option.
Liriodendron Tulipifera	Tulip Tree	Not	Sooty mold may be an issue
Metasequoia Glyptostroboides	Dawn Redwood	Not	Tolerates urban soils
Nyssa Sylvatica'Wildfire'	Black Gum	Not	Great fall color, tolerates acid soils
Picea Abies	Norway Spruce	Not	Give plenty of room
Picea Pungens 'Royal Blue', 'Fat Albert'	Colorado Blue Spruce	Not	Give plenty of room
Platanus x Acerifolia	London Plane Tree	Tolerant	Needs adequate space; Anthracnose may be an issue
Quercus Alba	White Oak	Moderate	Needs adequate space
Quercus Lyrata 'QLFTB' P.P 13470	Overcup Oak	Not	Tolerates wet soils
Quercus Palustris	Pin Oak	Not	Tolerates urban soils well, give adequate room to grow
Quercus Phellos 'QPSTA'	Willow Oak	Not	Tolerates urban soils well. Do not use Hightower variety.
Quercus Rubra	Red Oak	Tolerant	Needs adequate space
Quercus Shumardii 'QSFTC'	Panache Shumard Oak	Tolerant	Urban tolerant
Quercus Nuttallii	Highpoint Nuttall Oak	Not	Good winter leaf drop
Sophora Japonica	Japanese Pagodatree	Tolerant	Tolerates urban soils, may be considered a messy tree

Taxodium Distichum 'Sofine'	Autumn Gold Bald Cypress	Moderate	Tolerates urban soils, will produce knees if roots are kept wet
Tilia cordata 'Corzam'	Corinthian little leaf linden	Moderate	Tolerates urban soils: another Gen- era of Tilia may be used
Tilia Americana	American Basswood	Not	Good native choice for areas away from paved/hardscape areas.
Ulmus parvifolia 'EmerII', 'Allee', 'Emerald Vase'	Allee lacebark elm	Not	Tolerant of urban soils

3.20.6 Medium Trees recommended for campus:

Species	Common Name	Salt Tolerance	Remarks
Acer Rubrum	Red Maple	Not	Tolerates wet compacted soils, needs regular pruning until mature
Betula Nigra 'Heritage'	River Birch	Not	Bark makes a nice winter interest. Aphids may make this tree a little messy (shedding)
Carpinus Betulus 'Fastigiata'	Fastigiate 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.
Carpinus Caroliniana	American Hornbean	Not	Prefers moist well drained soils
Chamacyparis Nootkatensis 'pendula'	Nootka Cypress	Not	Not Salt tolerant, but architectural value should be considered. It's a seldom used tree on campus but could be used more often.
Koelreuteria Paniculata	Golden Raintree	Tolerant	Very urban tolerant
Larix Decidua	Common Larch	Moderate	Nice yellow fall color
Magnolia Grandiflora 'TMGH'	Alta Southern Magnolia	Moderate	One of the coldest hearty varieties, worth a try in a protected spot
Magnolia Virginiana	Sweetbay	Moderate	Protect from winter winds
Pinus Nigra	Austrian Pine	Moderate	Nice specimen plant needs room to grow
Pinus Thunbergii	Japanese Black Pine	Tolerant	Nice specimen plant needs room to grow; however, does well in containers especially 'Nishiki'
Robinia Pseudoacacia 'Purple robe'	Black Locust	Tolerant	Considered messy only select thornless cultivars
Salix Babylonica	Willow	Tolerant	Aggressive shallow roots, messy tree, nice around natural water
Salix Pentamdra	Laurel Willow	Not	Great lustrous green leaves, almost look fake, may be hard to find but worth planting
Sophora Japonica 'Princeton Upright'	Japanese Pagoda Tree	Tolerant	Good street tree

Sorbus aucuparia	European Mountain Ash	Tolerant	Showy fruit, grows best on northern exposures, keep away from sidewalks fruit is messy
Thuja (Standishii x Plicata) 'Green Giant'	Green Giant Arborvitae	Not	Select good central leader

3.20.7 Small Trees recommended for campus:

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

Lagerstromia Indica 'Centennial Spirit'	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
Malus	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
Prunus Serrulata	Kwanzan Cherry	Not	Beautiful spring flowers
Prunus x Cistena	Sand Cherry	Tolerant	Red leaves are nice
Prunus x Yedoesis	Yoshino Cherry	Not	Bores may infect this species don't over plant
Rhus Typhina	Staghorn Sumac	Tolerant	Nice specimen plant

3.20.8 Shrubs recommended for campus:

Species	Common Name	Salt Tolerance	Remarks
Clethra Alnifolia	Summersweet Clethra	Moderate	Beautiful fragrant white flowers
Hibiscus Syriacus	Rose of Sharon	Not	Nice plant some varieties seed profusely, list cultivar
Hydrangea Arborescens 'Annabelle'	Hydrangea	Tolerant	Flowers great in dried arrangements
Hydrangea Macrophylla	Hydrangea	Tolerant	Does not bloom consistently here
Hydrangea Quercifolia	Oak leaf hydrangea	Moderate	Beautiful fall color, does best in a part shade exposure
Ilex Crenata 'Helleri'	Helleri holly	Not	Protect from winter winds and salt
Ilex Decidua	Possum Haw	Not	Birds love the red berries, remember plants are monoecious
Ilex Verticillata	Winterberry	Tolerant	Tolerates wet conditions, wildlife love the fruit
Ilex x Meserveae 'Blue Prince' or 'Blue Princess'	Holly	Not	Make a nice hedge
Itea Virginica	Virginia Sweetspire	Not	Nice red fall color performs will in wet areas
Juniperus	Juniper	Moderate	Many species and cultivars grow well here, List species and cultivar; however, make sure the plant is zone 6 or below
Kalmia Latifolia	Mountain Laural	Not	Looks nice as an understory plant

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

Viburnum Rhytidophyllum	Leather Leaf viburnum	Not	Great screening plant, winter winds may burn some of the foliage
Vitex Angus-Castus	Vitex	Moderate	May be killed to the ground during harsh winters
Yucca Filamentosa	Yucca	Tolerant	Nice flower stalks

3.20.9 Herbaceous Perennials recommended for campus:

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

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

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

3.20.10 Ground Cover recommended for campus:

Species	Common Name	Salt Tolerance	Remarks
Aegopodium Podagraria	Goutweed	Not	Good ground cover in difficult areas but need to be contained
Ajuga Reptans	Ajuga	Not	Brilliant blue flowers in early summer, browns out during sever winters but recovers nicely the next spring; list cultivar
Euonymus Fortunei	Winter Creeper	Moderate	Aggressive evergreen ground cover will climb masonry walls, scale may be a problem
Euphorbia Myrsinites	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

3.20.11 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:

20% Kentucky Bluegrass
80% Blend of three (3) 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.

Standards

3.21.1 Steam Systems

Appalachian State University operates a Steam Plant which provides a nominal 100 psig steam to the campus. Steam Plant is operational year-round with scheduled maintenance typically for a few days in May. 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, please see

- CS 3.33 (33 00 00) Thermal Distribution

APPENDIX-REFERENCE DOCUMENTS A

APPENDIX | ASHRAE CLIMATE RECOMMENDATION S-ZONE 5a

	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/ft²·°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 50%+ on walls below 7 ft
	Interior Lighting—Daylighted Option	Classroom daylighting (daylighting fenestration to floor area ratio)	Toplighted— South-facing roof monitors: 8%–11% North-facing roof monitors: 12%–15%
			Sidelighted— South-facing: 8%–11% North-facing: 15%–20%
			Combined toplighted and sidelighted— South-facing sidelighted: 6%–8% Toplighted: 2%–3% North-facing sidelighted: 9%–13% Toplighted: 3%–5%
		Gym toplighting (daylighting fenestration to floor area ratio)	South-facing roof monitors: 5%–8% North-facing roof monitors 7%–10%
		LPD	1.2 W/ft² maximum
		Light source system efficacy (linear fluorescent)	75 mean lm/W minimum
		Light source system efficacy (all other sources)	50 mean lm/W minimum
		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 toplighting edge
	Interior Lighting—Nondaylighted Option	LPD	1.1 W/ft²
		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
		Dimming controls daylight harvesting	Dim fixtures within 15 ft of sidelighting edge and within 10 ft of toplighting edge
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 RECOMMENDATION S-ZONE 5a

	Item	Component	Recommendation
HVAC	Packaged DX Rooftops (or DX Split Systems)	Heat pump (≥65 and <135 kBtu/h)	10.6 EER/3.2 COP
		Heat pump (≥135 kBtu/h)	10.1 EER and 11.0 IPLV/3.1 COP
		Gas furnace (<225 kBtu/h)	80% AFUE or E_t
		Gas furnace (≥225 kBtu/h)	80% E_c
		Economizer	>54 kBtu/h
		Ventilation	Energy recovery or demand control
		Fans	Constant volume: 1 hp/1000 cfm Variable volume: 1.3 hp/1000 cfm
	WSHP System	Water-source heat pump (<65 kBtu/h)	Cooling: 12.0 EER at 86F Heating: 4.5 COP at 68F
		Water-source heat pump (≥65 kBtu/h)	Cooling: 12.0 EER at 86F Heating: 4.2 COP at 68F
		GSHP (<65 kBtu/h)	Cooling: 14.1 EER at 77°F and 17.0 EER at 59°F Heating: 3.5 COP at 32°F and 4.0 COP at 50°F
		GSHP (≥65 kBtu/h)	Cooling: 13.0 EER at 77°F and 16.0 EER at 59°F Heating: 3.1 COP at 32°F and 3.5 COP at 50°F
		Gas boiler	85% E_c
		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_c
		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_c
		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 (≥240 kBtu/h)	10.0 EER and 10.4 IPLV
		Gas furnace (≥225 kBtu/h)	80% E_c
		Gas boiler	85% E_c
		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_c
		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_t
		Gas instantaneous	0.81 EF or 81% E_t
		Electric (storage or instantaneous)	EF > 0.99 – 0.0012 x volume
		Pipe insulation (d < 1.5 in. /d ≥ 1.5 in.)	1 in./1.5 in.